EMEP Report 1/2009
Date: July 2009

METEOROLOGISK INSTITUTT
Norwegian Meteorological Institute

# Transboundary Acidification, Eutrophication and Ground Level Ozone in Europe in 2007

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## EMEP Status Report 2009; July 16, 2009

ISSN 1504-6109 (print)
ISSN 1504-6192 (on-line)

# Executive Summary

This report has been prepared for the thirty-third session of the Steering Body to EMEP. It presents the progress of activities on acidification, eutrophication and ground level ozone within EMEP during 2008-2009. The status of transboundary depositions in Europe in 2007 is presented and main features with respect to other years are discussed. The main focus in this year's report is on source-receptor relationships, regarding trends, emission sector contributions and the effect of the meteorological driver and resolution on the calculation of blame matrices.

**Main issues on transboundary air pollution in Europe in 2007**

The changes in the total antrophogenic emissions of main pollutants within the extended EMEP area from 2006 to 2007 were generally small, with averaged reductions of -2.6% for $SO_x$, -0.1% for $NH_3$, -6.4% for NMVOCs, while for $NO_x$ there was an increase of 1%. However, individual countries have reported much larger changes. In general, changes in air concentrations and depositions from year to year are driven by changes in emissions and by meteorological variability. For most countries, the reported change in emissions was smaller than the meteorological variability, and the changes in concentrations and depositions from 2006 to 2007 are to a large extent driven by meteorological variability.

The high temperatures in January 2007 together with large amounts of precipitation in central and eastern Europe and western Russia resulted in rather low particulate matter values for the same area. By contrast, in March, high particulate matter values were observed in central Europe related to dry conditions. For ozone, the levels in 2007 compared to 2006 were lower in central Europe and northern Europe, and the summer ozone levels of 2007 were among the lowest in the past decade. However, during the heat wave period over south eastern Europe in July the ozone air pollution was more severe than in the same period in 2006.

A direct comparison of the source-receptor calculations for 2007 with those made for earlier years is not straightforward as the meteorological driver for the Unified EMEP model has been changed from PARLAM-PS to HIRLAM. Selected source-receptor relationships were recalculated for 2006 with the same meteorological driver as is used for 2007. These results show that for some countries the source-receptor calculations for 2007 differ greatly from those for 2006. In particular, the high amount of precipitation over the North Sea areas has likely contributed to the pronounced reduction in imported nitrogen and sulphur deposited in Scandinavia in 2007.

**EECCA countries: status and developments**

The reporting of emission inventories by EECCA countries to the Convention is rather limited. In recent years only Belarus, Moldova, Russian Federation and Ukraine reported (more or less regularly) emission inventories to the Convention. Georgia has submitted inventories of main pollutants in 2008 and 2009, Kyrgyzstan provided main pollutant emissions from stationary sources (except $NH_3$), and Azerbaijan submitted some information on emissions for stationary sources in 2009. No data have been provided by Armenia and Kazakhstan. In general the reported inventories are not complete, and informative inventory reports are not provided. No consistent sets of historical data have been reported by these countries. The Russian Federation reports emissions only for "EMEP Russia", but not for the whole country or the extended EMEP area.

At present, the number of monitoring stations in EECCA countries is limited, but efforts are underway to improve this. Russia and Belarus are the only EECCA countries that have had regular monitoring in EMEP for several years. However, the measurement program is far from complete. During the last couple of years, EMEP level 1 sites have been established in Kazakhstan, Moldova, Armenia and Georgia with external support. Furthermore, Ukraine has for several years planned to establish a site as a contribution in kind to UNECE. However, so far very little data has been reported to CCC from these new sites. Some preliminary results from Moldova, Georgia and Armenia have been submitted, and it is expected that these three sites will report 2008 data at the official reporting deadline this year. It is evident that further training, especially in laboratory practice, is needed for those new EMEP sites to improve the data quality and reporting, and a training course especially devoted to these laboratories is planned for the winter 2009/2010.

Concerning the modelling capabilities of EMEP, calculations on the origin of transboundary air pollution to EECCA countries for all 12 EECCA countries are for the first time this year presented with exactly the same methodology as for the other countries. In order to achieve this, the meteorological model used to drive the Unified EMEP model has been changed from PARLAM-PS to HIRLAM (with an extended EMEP domain). The Russian Federation is still not fully covered by the EMEP calculations, but efforts are underway to extend the EMEP domain even further.

It should be noted that there are large uncertainties associated with the model results in EECCA countries, primarily associated with the emission and critical load data. Especially for those countries and areas which were first included in the modelling last year, there is very little background information available on emission sources.

**Trends and variability in source-receptor relationships**

In order to have a consistent set of country-to-country blame matrices that makes a trend study possible, source-receptor calculations for 10 years (1997-2006) have been performed this year. The same model version and meteorological driver have been used in all the calculations. A long term series of meteorological data for the extended EMEP domain was not accessible, thus these results are only available for the 'old' EMEP domain.

In general, over the whole of Europe, the trends in total deposition of sulphur, oxidized and reduced nitrogen follow the emission trend. However, due to transboundary contributions and some non-linearities, this is less true for individual countries.

The main contributors to deposition of sulphur for countries like Armenia, Belarus, Denmark and Latvia are transboundary fluxes. Even though these countries have reduced their emissions considerably over the years, the depositions resulting from the emissions of their largest contributors remain at an almost constant level, and thus the total deposition in these countries has not decreased much over the years. Oxidized nitrogen deposition shows similar trends to those of sulphur, but with weaker signals (since the emission reductions for $NO_x$ are relatively small compared to those of $SO_x$). The deposition trends of reduced nitrogen follow the emission for most countries. This is due to the faster deposition rate of reduced nitrogen, which causes larger indigenous contributions to deposition, and thus the country's own emission trends are reflected.

The largest contributors to deposition of sulphur and oxidized nitrogen over sea areas are land sources, where emissions decreased over the years. However, $SO_x$ and $NO_x$ emissions (and hence depositions) from ship traffic have increased over the years. These two trends counterbalance each other to a large extent, and therefore the total deposition of $SO_x$ and oxidized nitrogen to sea areas has remained almost constant over these ten years.

The interannual variations in transboundary contributions is about 10-30% and the variability is largest for smaller countries. This is slightly higher than the interannual variability caused by meteorology alone (10-20%). The interannual variability in transboundary contributions to depositions was found to be larger for sulphur than for oxidized and reduced nitrogen. This is due to the larger emission reduction in the case of $SO_x$ (-28%) than those compared to $NO_x$ (-7%) and $NH_3$ (-8%) over the 10 years of this study.

### Contributions from different emission sectors to depositions and air concentrations

Traditionally the source-receptor relationships are calculated applying the same percentage reductions for all emission sectors in a given country. This year, the 2006 'traditional' source-receptor matrices are accompanied by source-receptor matrices per emission sector.

Stationary combustion sources are shown to be the dominant source of oxidised sulphur deposition, both indigenous and transboundary. They also contribute significantly to the deposition of oxidised nitrogen in a number of countries and to the concentrations of secondary inorganic aerosols (SIA) and $PM_{2.5}$. Emissions from road traffic and other mobile sources (including shipping) make the largest contribution to the deposition of oxidised nitrogen and have the largest effect on ozone formation. They also make a significant (though not the major) contribution to SIA and $PM_{2.5}$ concentrations. Ammonia emissions from agriculture are a prerequisite for the formation of ammonium nitrate. They are the major source of reduced nitrogen depositions and an important source of SIA in many countries. In general, the contributions from agriculture ($NH_3$) to SIA concentrations are larger compared to other sources when considering only the sources from the country itself because of the higher long range transport potential of $NO_x$ and $SO_x$.

### Impact of resolution and the meteorological driver on source-receptor relationships

As a part of an uncertainty analysis of country-to-country blame matrices, this report presents an evaluation of the effect of using different meteorological drivers for the Unified EMEP model as well as a preliminary analysis of the effect of model resolution on source-receptor relationships.

The evaluation of the effect of the meteorological driver was based on data from three different numerical weather prediction models for 2006; PARLAM-PS, ECMWF and HIRLAM. The relative uncertainty was found to be larger for the small contributions from one country to another, while the results for the large contributions, both in terms of export and import of pollutants, are rather robust. In general, the uncertainty due to the meteorological driver is smaller or comparable in magnitude to the changes related to interannual variability in meteorology. Therefore, trend studies should be based on model runs that use the same numerical weather prediction model input.

A preliminary analysis shows that increasing the resolution of the Unified EMEP model (excluding the effect of changing the resolution of emissions) from 50 km to 25 km has only a minor impact on the results, at least for the largest contributions from one country to another. So far, the analysis has only been done for $\mathrm{SO_x}$, $\mathrm{PPM_{2.5}}$ and $\mathrm{PPM_{co}}$, and this conclusion might change for components for which chemical non-linearities are important (e.g. $\mathrm{O_3}$ and $\mathrm{NO_x}$). In general, the effect of resolution on source-receptor calculations is significantly smaller than the effect of using different meteorological drivers or of meteorological variability.

The effect of improving the resolution of emissions could not be judged directly from this study as the aggregated fine scale emission (to 50 km) does not equal the EMEP 50 km emissions. Obviously, a different spatial distribution of emissions (as in the two emission data sets used in this study) can lead to large differences in the calculated contributions from one country to another.

# Acknowledgments

The results presented here benefit largely from the work carried out under the four EMEP Task Forces and in particular under the Task Force on Measurements and Modelling.

The Working Group on Effects and its ICPs and Task Forces are gratefully acknowledged for their assistance in determining the risk of damage from air pollution. As in previous years, the Coordination Center for Effects (CCE) and Jean Paul Hettelingh have provided us with the latest information data on critical loads.

Special thanks are due to Maximilian Posch for helping in the calculation of exceedances to critical loads and providing data on land use to support model calculations with finer scale resolution. Special thanks are also due to Hugo Denier van der Gon for granting permission to use the finer scale information on the spatial distribution of emissions as developed by TNO Built Environment and Geoscience under the GEMS project.

We thank the following persons for contributing data on the nitrogen concentration in mosses for the 2005/6 European survey: Renate Alber (Italy - Bolzano region), Mahmut Cokun (Turkey), Ludwig De Temmerman (Belgium), José Angel Fernández Escribano (Spain - Galicia), Marina Frolova (Latvia), Zvonka Jeran (Slovenia), Eero Kubin (Finland), Sébastien Leblond (France), Siiri Liiv (Estonia), Blanka Maňkovská (Slovakia), Jesús Santamaría (Spain - Navarra), Ivan Suchara (Czech Republic), Lotti Thöni (Switzerland), Lilyana Yurukova (Bulgaria), Harald G. Zechmeister (Austria).

This work has been funded by the EMEP Trust Fund and it is a free contribution to the ACCENT Network of Excellence. The development of the EMEP Unified model has also been partly supported by the EU 6FP projects, NitroEurope and EUCAARI. This work has also received support from the Research Council of Norway (Programme for Supercomputing) through computing time granted at the IBM p575+ computer at the Norwegian University of Science and Technology (NTNU) in Trondheim and at the HP rx4640 computer at the University of Tromsø, Norway.

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# CHAPTER 1

# Introduction

## 1.1 Purpose and structure of this report

The mandate of EMEP is to provide sound scientific support for the Convention on Long-range Transboundary Air Pollution (LRTAP), in particular in the areas of atmospheric monitoring and modelling, emission inventories and emission projections and integrated assessment.

Each year EMEP provides information on transboundary pollution fluxes inside the EMEP area, relying on information on emission sources and monitoring results provided by the Parties to the LRTAP Convention. The purpose of the annual EMEP status reports is to provide an overview of the status of transboundary air pollution in Europe, tracing progress towards existing emission control Protocols and supporting the design of new protocols, when necessary. An additional purpose of these reports is to identify problem areas and new findings of relevance to the Convention.

In order to better fulfill its purpose the present report has been divided in four parts. Part I presents the status of transboundary air pollution with respect to acidification, eutrophication and ground level ozone in Europe in 2007 as well as a summary of the status and developments in the EECCA countries. Part II presents information on source-receptor relationships. Part III summarizes ongoing work of relevance to the EMEP programme. Part IV contains basic information on emissions and transboundary fluxes in table form.

The first chapter in this report presents the status of transboundary air pollution for acidification, eutrophication and ground level ozone in Europe in 2007 and identifies the main differences with respect to previous years. Further, integrated observations and model results are presented to characterize air pollution in Europe in 2007.

As recommended by the Steering Body to EMEP on its 31st session, 4 new countries in EECCA are now included in the operational EMEP model domain. The new countries are Kyrgyzstan (or the Kyrgyz Republic), Tajikistan, Turkmenistan and Uzbekistan. In addition, the model domain covers the whole area of Kazakhstan and a larger part of the Russian Federation, although still not its full domain.

To achieve an implementation of the extended domain into the operational EMEP model runs, the meteorological driver has been changed from PARLAM-PS to HIRLAM. For the first time this year we present calculations of all the countries, including the 4 new countries in EECCA, with model runs using the same meteorological driver.

Although the EMEP model now has the capability to provide results for all the EECCA countries, the quality of the model results depends heavily on the quality of the emission inventories. Further, the low availability of measurements in this region prevents a proper evaluation of the model results. The second chapter discusses these issues and the developments in the EECCA region both with respect to emissions, measurements and modelling.

Part II evaluates country-to-country blame matrices. In chapter 4 we present source-receptor calculations for 10 years (1997-2006) using the same model version (rv3.1) and meteorological driver (PARLAM-PS). This consistent set of country-to-country blame matrices has allowed for a study of trends in transboundary air pollution. The blame matrices themselves are not presented in this report, but they are provided for each country in the country reports and the data is available on www.emep.int.

The long-term timeseries of country-to-country blame matrices are accompanied by source-receptor matrices per emission sector, as discussed in chapter 5. Both the contribution from emissions sectors on a European scale and the contributions from groups of emission sectors in individual countries are presented for the year 2006.

In order to assess the implications of the change of the meteorological driver (from PARLAM-PS to HIRLAM) on the transboundary fluxes, a comparison between country-to-country blame matrices with different meteorological drivers is presented in chapter 6.

During the last years, the modelling capabilities of EMEP have been strengthened to allow a consistent description of pollution dispersion in the atmosphere occuring on local, regional and global scales. While the development of the hemispheric and global versions of the Unified EMEP model has been documented in separate technical reports (Travnikov et al. 2009, Gusev et al. 2008, Jonson et al. 2007, 2006), chapter 7 in this report presents finer resolution calculations with the Unified model ($25\times25$ km$^2$ and $10\times10$ km$^2$). The technical effort associated with the development of capability to run the EMEP model on different scales has also led to additional flexibility in the EMEP modelling such as the possibility of running the EMEP model on other projections than the polar stereographic projection used in the operational model runs. For the first time, results from fine resolution ($0.2°\times0.2°$) model runs on a rotated spherical grid are presented.

Running the EMEP model on fine resolution increases the CPU requirements considerably. In order to assess whether it is necessary to produce country-to-country matrices on fine resolution, a first assessment of the effect of resolution on source-receptor matrices has been provided in chapter 7.

Chapter 8 summarizes the first results of a collaboration between EMEP/MSC-W and ICP Vegetation. The European moss biomonitoring network, coordinated by the ICP Vegetation, attempted for the first time in 2005/6 to establish whether mosses can be used as biomonitors of atmospheric nitrogen deposition at the European scale. These data on nitrogen concentrations in mosses have been compared with the results from the EMEP model in a cross validation study.

The last chapter in part III of this report presents preliminary results for a comparison between the co-located satellite data, hourly observations of $NO_2$ surface concentrations and model result.

Other new developments within EMEP have also taken place. Although they are not documented here, they have been made available during the last year, either as peer-reviewed publications, technical reports or data notes. These are presented in section 1.5.

The last part of this report contains emission trends and country-to-country blame matrices with calculations of the transboundary contributions to pollution in different countries for 2007. This information is complemented by numerical fields and data on the EMEP website. The reader is encouraged to visit the website, http:/www.emep.int, to access this additional information.

## 1.2 Definitions, statistics used

For sulphur and nitrogen compounds, the basic units used throughout this report are $\mu$g (S or N)/m$^3$ for air concentrations and mg (S or N)/m$^2$ for depositions. Emission data, in particular in some of the Appendixes is given in Gg ($SO_2$) and Gg ($NO_2$) in order to keep consistency with reported values.

For ozone, the basic units used throughout this report are ppb (1 ppb = 1 part per billion by volume) or ppm (1 ppm = 1000 ppb). At 20°C and 1013 mb pressure, 1 ppb ozone is equivalent to 2.00 $\mu$g m$^{-3}$.

A number of statistics have been used to describe the distribution of ozone within each grid square:

**Mean of Daily Max. Ozone** - First we evaluate the maximum modelled concentration for each day, then we take the 6-monthly mean of these values, over the 6-month period 1 April - 30 September.

**SOMO35** - The Sum of Ozone Means Over 35 ppb is the indicator for health impact assessment recommended by WHO. It is defined as the yearly sum of the daily maximum of 8-hour running average over 35 ppb. For each day the maximum of the running 8-hours average for $O_3$ is selected and the values over 35 ppb are summed over the whole year.

If we let $A_8^d$ denote the maximum 8-hourly average ozone on day $d$, during a year with $N_y$ days ($N_y$ = 365 or 366), then SOMO35 can be defined as:

$SOMO35 = \sum_{d=1}^{d=N_y} \max\big(A_8^d - 35 \text{ ppb}, 0.0\big)$

where the `max` function ensures that only $A_8^d$ values exceeding 35 ppb are included. The corresponding unit is ppb.days.

**AFstY** - is the accumulated stomatal ozone flux over a threshold Y nmol $m^{-2}$ $s^{-1}$, i.e.:

$$\text{AFstY}_{gen} = \int \max(F_{st} - Y, 0)\, dt \qquad (1.1)$$

where stomatal flux $F_{st}$, and threshold, $Y$, are in nmol $m^{-2}$ $s^{-1}$, and the `max` function evaluates $\max(A - B, 0)$ to $A - B$ for $A > B$, or zero if $A \leq B$. This integral is evaluated over time, from the start of the growing season (SGS), to the end (EGS).

For the generic crop and forest species, the suffix $gen$ is usually applied, e.g. $AF_{st}1.6_{gen}$ is used for forests.

**AOT40** - is the accumulated amount of ozone over the threshold value of 40 ppb, i.e..

$AOT40 = \int \max(O_3 - 40 \text{ ppb}, 0.0)\, dt$

where the `max` function ensures that only ozone values exceeding 40 ppb are included. The integral is taken over time, namely the relevant growing season for the vegetation concerned. The corresponding unit are ppb.hours (abbreviated to ppb.h). The usage and definitions of AOT40 have changed over the years though, and also differ between UNECE and the EU. Mills (2004) give the latest definitions for UNECE work, and describes carefully how AOT40 values are best estimated for local conditions (using information on real growing seasons for example), and specific types of vegetation. Further, since $O_3$ concentrations can have strong vertical gradients, it is important to specify the height of the $O_3$ concentrations used. In previous EMEP work we have made use of modelled $O_3$ from 1 m or 3 m height, the former being assumed close to the top of the vegetation, and the latter being closer to the height of $O_3$ observations. In the Mapping Manual (Mills 2004) there is an increased emphasis on estimating AOT40 using ozone levels at the top of the vegetation canopy.

Although the EMEP model now generates a number of AOT-related outputs, in accordance with the recommendations of Mills (2004) we will concentrate in this report on two definitions:

**AOT40$_f^{uc}$** - AOT40 calculated for forests using estimates of $O_3$ at forest-top ($uc$: upper-canopy). This AOT40 is that defined for forests by Mills (2004), but using a default growing season of April-September.

**AOT40$_c^{uc}$** - AOT40 calculated for agricultural crops using estimates of $O_3$ at the top of the crop. This AOT40 is close to that defined for agricultural crops by Mills (2004), but using a default growing season of May-July, and a default crop-height of 1 m.

In all cases only daylight hours are included, and for practical reasons we define daylight for the model outputs as the time when the solar zenith angle is equal to or less than 89°. (The proper UNECE definition uses clear-sky global radiation exceeding 50 W $m^{-2}$ to define daylight, whereas the EU AOT definitions use day hours from 08:00-20:00. Model outputs are also available using the EU definition, but not presented here).

The AOT40 levels reflect interest in long-term ozone exposure which is considered important for vegetation - critical levels of 3 000 ppb.h have been suggested for agricultural crops and natural vegetation, and 5 000 ppb.h for forests (Mills 2004). Note that recent UNECE workshops have recommended that AOT40 concepts are replaced by ozone flux estimates for crops and forests.

This report includes also concentrations of particulate matter (PM). The basic units throughout this report are $\mu$g/m$^3$ for PM concentrations and the following acronyms are used for different components to PM:

**SIA** - are secondary inorganic aerosols and are defined as the sum of sulphate ($SO_4$), nitrate ($NO_3$) and ammonium ($NH_4$). In the Unified EMEP model SIA is calculated as the sum: SIA= $SO_4$ + $NO_3$(fine) + $NO_3$(coarse) + $NH_4$

**PPM** - denotes primary particulate matter, originating directly from anthropogenic emissions. It is usually distinguished between fine primary particulate matter, $PPM_{2.5}$, with dry aerosol diameters below 2.5 $\mu$m and coarse primary particulate matter, $PPM_{co}$, with dry aerosol diameters between 2.5$\mu$m and 10$\mu$m.

**PM$_{2.5}$** - denotes fine particulate matter, defined as the integrated mass of aerosol with dry diameter up to 2.5 $\mu$m. In the Unified EMEP model $PM_{2.5}$ is calculated as the sum: $PM_{2.5}$ = $SO_4$ + $NO_3$(fine) + $NH_4$ + SS(fine) + $PPM_{2.5}$

**PM$_{coarse}$** - denotes coarse particulate matter, defined as the integrated mass of aerosol with dry diameter between 2.5$\mu$m and 10$\mu$m. In the Unified EMEP model $PM_{coarse}$ is calculated as the sum: $PM_{coarse}$ = $NO_3$(coarse)+ SS(coarse) + $PPM_{co}$

**$PM_{10}$** - denotes particulate matter, defined as the integrated mass of aerosol with dry diameter up to 10 $\mu$m. In the Unified EMEP model $PM_{10}$ is calculated as the sum: $PM_{10}$ = $SO_4$ + $NO_3$(fine) + $NH_4$ + SS(fine) + $PPM_{2.5}$+$NO_3$(coarse)+ SS(coarse) + $PPM_{co}$

## 1.3 The EMEP extended domain

The EMEP domain defines the area where information on long-range transboundary air pollution is available from the EMEP centres. The information available concerns emissions, observations and modelling results. Last year, the Steering Body adopted an extension of the official EMEP domain to facilitate the inclusion of countries in Eastern Europe, Caucasus and Central Asia (EECCA) in the EMEP calculations (ref. ECE/EB.AIR/GE.1/2007/9). Thus, from 2008, the official 50×50 $km^2$ polar stereographic EMEP grid has been extended from 132×111 to 132×159 grid cells, following Stage 1 in ECE/EB.AIR/GE.1/2007/9. In geographical projection it leads to an extension eastward. The extended EMEP domain is presented in Figure 1.1.

The present extension of the EMEP modelling area has recognized drawbacks. One of the drawbacks is that the current extended EMEP domain only partly covers the Russian Federation. It is also recognized that results on air pollution in central Asian countries are highly dependent on sources outside the calculation domain. Countries in Central Asia are contiguous with other Asian countries, like China, India, Pakistan and Iran, that significantly affect pollution levels over the EECCA territories but are not included directly in the calculations. Consequently, the current EMEP modelling capacity for EECCA countries and the related grid domain is only an interim solution up to 2011. After that, a new EMEP official domain covering adequately transport of pollution to all 12 EECCA countries is expected to be adopted.

The extension of the official EMEP domain made it necessary to introduce new codes for the new countries and areas now included in the extended EMEP domain. The new country codes and their rationale are explained below.

Kyrgyzstan and Tajikistan were not included in the official EMEP domain in any part. These two countries are now included with their full area inside the extended EMEP domain. For these two countries, following UNECE nomenclature, ISO2 country codes are used. The codes are 'KG' for Kyrgyzstan and 'TJ' for Tajikistan.

In the case of the Russian Federation and Kazakhstan, their respective ISO2 codes, 'RU' and 'KZ', have previously referred to the parts of their territories inside the official EMEP domain. To keep new model results consistent and comparable with the previous ones, we keep these ISO2 country codes and use them to define the same areas as before in the official EMEP domain. Additional codes are used to identify parts of these countries' territories outside the official EMEP grid.

For Kazakhstan, the area of the country in the extension of the EMEP domain is denoted by 'KZE', as shown in Figure 1.1 (a). The total territory of Kazakhstan in the extended EMEP domain is then the sum of ‘KZ’ and ‘KZE’, and is denoted as ‘KZT’ in this report (see Figure 1.1 (b)).

For the Russian Federation, the territory in the extension of the domain is divided into two parts, ‘RUX’ and ‘RFE’, as shown in Figure 1.1 (a). The reason for this division is that the area called ‘RUX’ (‘EMEP external part of Russian Federation’) has been used in the modelling domain previously, although it was not included in the official EMEP domain. The combined territory of the Russian Federation inside the extended EMEP domain is denoted by ‘RUE’ that stands for ’Russian Federation in the extended EMEP domain’ and is presented in Figure 1.1 (b).

Until this year, 2008, Turkmenistan and Uzbekistan were not included in the official EMEP domain as individual countries. However, parts of their territories were inside the official EMEP grid and included in the region called ‘Remaining Asian Areas’, denoted by country code ‘ASI’. As indicated in Figure 1.1 (a),‘ASI’ also includes Syria, Lebanon, Israel, parts of Iran, Iraq and Jordan. In the extended EMEP domain, the ‘ASI’ area has been redefined, so the areas of Turkmenistan and Uzbekistan inside the old ‘ASI’ have now been extracted.

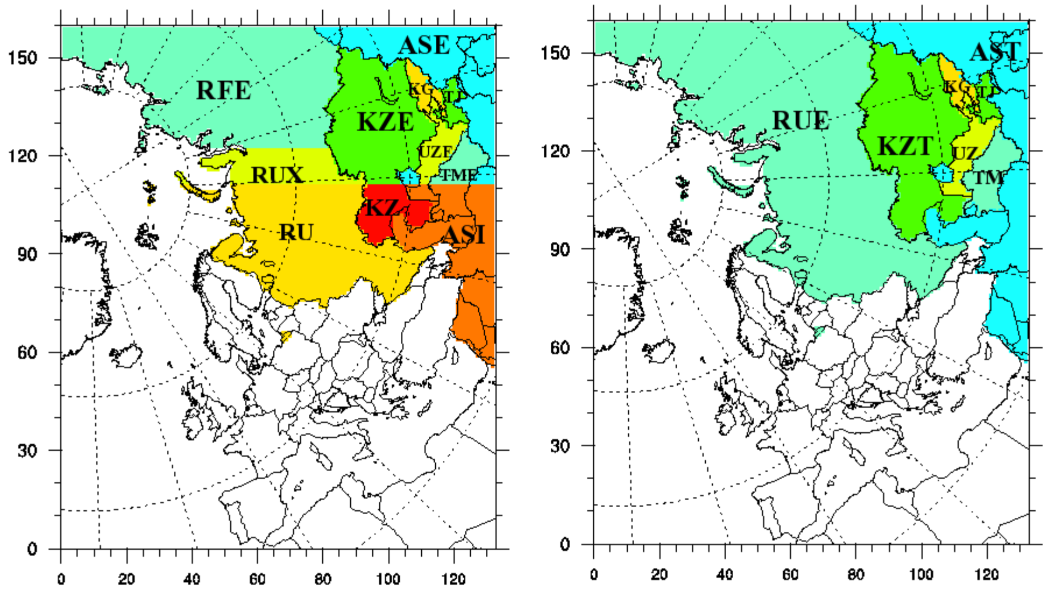
The territories of Turkmenistan and Uzbekistan in the domain extension are denoted by ‘TME’ and ‘UZE’, respectively, as in Figure 1.1 (a). The whole territories of Turkmenistan and Uzbekistan in the extended EMEP domain are the sum of the ‘extended’ and ‘official’ parts of the countries, namely the sum of ‘TME’ and ‘TMO’, and ‘UZE’ and ‘UZO’. The respective ISO2 codes are ‘TM’ for Turkmenistan and ‘UZ’ for Uzbekistan.

The region code ‘ASE’ in Figure 1.1 (a) denotes Asian countries in the extension of the EMEP domain and includes parts of Afghanistan, India, Pakistan, China and Mongolia. The ‘ASE’ area together with those parts of ‘ASI’ which are left after the exclusion of the Turkmen and Uzbek territories forms ‘AST’ in Figure 1.1 (b) referring to all Asian areas in the extended EMEP domain.

## 1.4 Country Codes

Many tables and graphs in this report make use of codes to denote countries and regions in the EMEP area. Results are presented for both the official and the extended EMEP domains. All through the report an effort is made to distinguish results from these two different domains. Table 1.1 provides an overview of these codes and lists the countries and regions included, with explicit mention whether the code refers to the official or the extended EMEP domain.

The most noteworthy difference between the official and the extended EMEP domains is the definition of the EECCA countries. Within the official EMEP domain, there are only 8 EECCA countries included or partially included. These are: Azerbaijan, Armenia, Belarus, parts of Kazakhstan, Georgia, Republic of Moldova, parts of the Russian Federation and Ukraine. In the extended EMEP domain, all the 12 EECCA countries are included. The new domain includes Azerbaijan, Armenia, Belarus, Geor-




(a) (b)

Figure 1.1: Overview of the country/area codes in the extended EMEP domain. Figure (a) shows the previously defined areas in the official EMEP grid ('RU', 'KZ', 'ASI') together with the new areas in the grid extension ('RUX', 'RFE', 'KZE', 'UZE', 'TME', 'TJ', 'KG', 'ASE'). Figure (b) shows the countries/areas with their codes in the extended EMEP grid ('RUE', 'KZT', 'UZ', 'TM', 'TJ', 'KG', 'AST').

gia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Tajikistan, Turkmenistan, Ukraine and Uzbekistan, and covers a larger part of the Russian Federation.

All 51 Parties to the LRTAP Convention, except four, are included in the analysis presented in this report. The Parties that are excluded of the analysis are: Canada and the United States of America, Monaco and Liechtenstein. The first two countries are not included because they lie outside the EMEP domains, both the official and the extended domains. Monaco and Liechtenstein are not included because their emissions and geographical extents are below the accuracy of the present source-receptor calculations in $50 \times 50 km^2$.
Malta is introduced as a receptor country. The estimated emissions from Malta are below the accuracy limits of the source-receptor calculations and do not justify a separate study of Malta as an emitter country.

## 1.5 Other Publications

This report is complemented with EMEP Status Report 4/2009 on Transboundary Particulate Matter in Europe and by country specific reports on the 2009 status of transboundary acidification, eutrophication, ground level ozone and PM. This year, Russian

| Code | Country/Region |
|---|---|
| AL | Albania |
| AM | Armenia |
| ASI | Remaining Asian areas (official) |
| AST | Remaining Asian areas (extended) |
| AT | Austria |
| ATL | Remaining N.-E. Atlantic Ocean |
| AZ | Azerbaijan |
| BA | Bosnia and Herzegovina |
| BAS | Baltic Sea |
| BLS | Black Sea |
| BE | Belgium |
| BG | Bulgaria |
| BIC | Boundary and Initial Conditions |
| BY | Belarus |
| CH | Switzerland |
| CY | Cyprus |
| CZ | Czech Republic |
| DE | Germany |
| DK | Denmark |
| EE | Estonia |
| EMC | EMEP land areas (official) |
| EXC | EMEP land areas (extended) |
| ES | Spain |
| EU | European Community |
| FI | Finland |
| FR | France |
| GB | United Kingdom |
| GE | Georgia |
| GL | Greenland |
| GR | Greece |
| HR | Croatia |
| HU | Hungary |

| Code | Country/Region |
|---|---|
| IE | Ireland |
| IS | Iceland |
| IT | Italy |
| KG | Kyrgyzstan |
| KZ | Kazakhstan (official) |
| KZT | Kazakhstan (extended) |
| LT | Lithuania |
| LU | Luxembourg |
| LV | Latvia |
| MD | Republic of Moldova |
| ME | Montenegro |
| MED | Mediterranean Sea |
| MK | The FYR of Macedonia |
| MT | Malta |
| NL | Netherlands |
| NO | Norway |
| NOA | North Africa |
| NOS | North Sea |
| PL | Poland |
| PT | Portugal |
| RO | Romania |
| RS | Serbia |
| RU | Russian Federation (official) |
| RUE | Russian Federation (extended) |
| SE | Sweden |
| SI | Slovenia |
| SK | Slovakia |
| TJ | Tajikistan |
| TM | Turkmenistan |
| TR | Turkey |
| UA | Ukraine |
| UZ | Uzbekistan |

Table 1.1: Country/region codes used throughout this report:'official' refers to the area of the country/region which is inside the official EMEP grid domain, while 'extended' refers to the area of the country/region inside the extended EMEP grid domain.

*The 'European Community' or EU27 includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, Sweden, United Kingdom, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia, Bulgaria and Romania.*

*'EECCA12' includes Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgystan, Republic of Moldova, Tajikistan, Turkmenistan, Ukraine and Uzbekistan and covers a large part of the Russian Federation.*

versions of the country reports are available for all 12 EECCA countries.

A list over all associated technical reports and notes by the EMEP centres in 2009 follows at the end of this section. In addition, the following scientific papers of relevance to transboundary air pollution and involving EMEP/MSC-W and CCC staff have become available in 2008/2009:

## Peer-reviewed publications

Aas, W., L. A. Alleman, E. Bieber, D. Gladtke, J. L. Houdret, V. Karlsson and C. Monies. Comparison of methods for measuring atmospheric deposition of arsenic, cadmium, nickel and lead. *J. Environ. Monit.*, 11:1276–1283, 2009. doi:10.1039/B822330K.

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## Associated EMEP reports and notes in 2009

### Joint reports

Transboundary acidification, eutrophication and ground level ozone in Europe in 2007. Joint MSC-W & CCC & CEIP Report. EMEP Status Report 1/2009.

Heavy Metals: Transboundary Pollution of the Environment. Joint MSC-E & CCC & CCE Report. EMEP Status Report 2/2009.

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**CCC Technical and Data reports**

A.-G. Hjellbrekke. Data Report 2007 Acidifying and eutrophying compounds and particulate matter. EMEP/CCC-Report 1/2009.

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**CEIP Technical and Data reports**

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**MSC-E Technical and Data reports**

V. Shatalov, N. Vulykh and O. Rozovskaya. Model Assessment of Potential for Long-range Transboundary Atmospheric Transport and Persistence of Hexabromocyclododecane (HBCD). EMEP/MSC-E Information Note 4/2009

V. Shatalov, N. Vulykh and O. Rozovskaya. Model Assessment of Potential for Long-range Transboundary Atmospheric Transport and Persistence of Trifluralin. EMEP/MSC-E Information Note 5/2009

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# Part I

# Status in 2007

# CHAPTER 2

# Status of transboundary pollution in 2007

**Ágnes Nyíri, Michael Gauss, Anna Benedictow, Anne-Gunn Hjelbrekke, Katarina Mareckova and Robert Wankmüller**

This chapter presents an overview on the status of transboundary air pollution for acidification, eutrophication and ground level ozone in Europe in 2007. It identifies the main differences in meteorological conditions, emissions and model results with respect to previous years. Combined model results and observations for acidifying and eutrophying compounds and photo-oxidants are also presented.

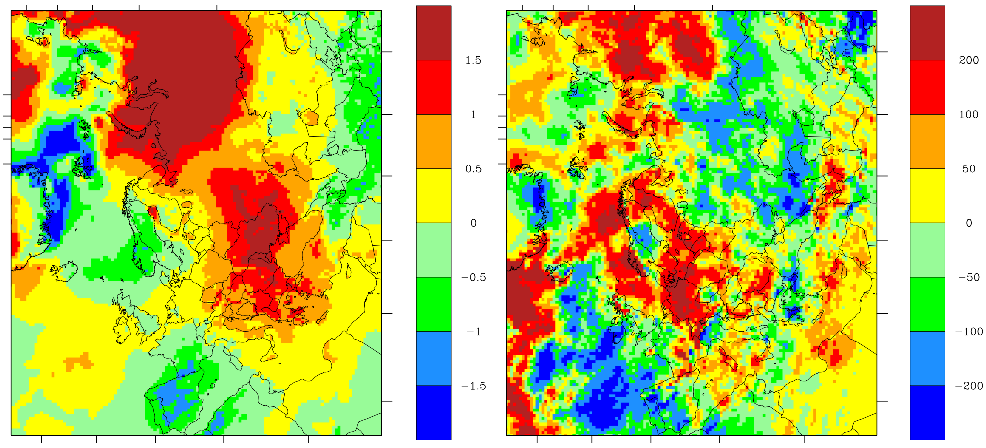
Evaluations of the Unified EMEP model performance have been presented in numerous EMEP reports (e.g. Fagerli and Hjellbrekke 2008, Simpson and Hjellbrekke 2008, Simpson 2006, Fagerli 2005, 2004, Fagerli et al. 2003, Simpson et al. 2003) and articles (e.g. Simpson et al. 2006a,b, Fagerli and Aas 2008, Jonson et al. 2006). There are only minor updates of the Unified EMEP model this year compared to last year and the performance is rather similar for 2007 as for 2006. Therefore, we do not discuss the Unified EMEP model performance for 2007 here. However, an evaluation for 2007 is available on the EMEP website.

All model calculations presented in this chapter are carried out with the Unified EMEP Model version rv3.1 in the extended EMEP domain (See Chapter 1.3), using HIRLAM as meteorological driver.

## 2.1 Meteorological conditions in 2007

The meteorological characteristics of 2007 are described based on the data that have been generated to drive the Unified EMEP model (HIRLAM).

As meteorological variability has a significant effect on the interannual changes of air concentrations and depositions, a comparison between 2007 and 2006 with respect to meteorological fields and selected results from the Unified EMEP model is presented here.




(a) ΔT2m, 2007-2006 (b) Δprecipitation, 2007-2006

Figure 2.1: Differences between 2007 and 2006. Left: Annual mean temperature at 2m [K], right: Annual precipitation [mm].

Figure 2.1(a) shows the change in annual mean temperatures from 2006 to 2007. 2007 was colder than 2006 in Scandinavia and large parts of Western Europe. It was warmer than 2006 in Eastern Europe, southeastern Europe, and the central and eastern parts of the Mediterranean. The figure is also consistent with the high temperatures over Russia reported by the Russian Institute of Hydro-Meteorological Information (meteo.ru, Bulygina et al. (2008)) and the heat in southeastern Europe manifesting itself in monthly mean temperatures from January to October 2007 being more than 1-2° higher compared to same period in the year before.

In January a strong winterstorm hit northern Europe and continued along a wide path from Northeast to Southwest across central Europe (Fink et al. 2009). In about the same area, according to NOAA (van Lanen 2007), the temperature was more than 3° above normal during January-March 2007 and continued to be relatively high in April-June. Whereas opposite temperature anomalies were observed in the same area later that year, in southeastern Europe temperatures remained relatively high until August. In particular, two extreme heat waves occurred in southeastern Europe in June and July, breaking earlier records with daily maximum temperatures exceeding 40°C in some areas. This caused numerous forest fires, especially in Greece during August. In addition to the heat, the months prior to the forest fires were extremely dry in southeastern Europe (Founda and Giannakopoulos 2009).

Figure 2.1(b) shows the difference between the yearly accumulated precipitation in 2007 compared to 2006. Germany, Switzerland, southern France, western Austria, southern Romania, northern Bulgaria, southern Bosnia, Poland, Slovakia, the Baltic countries, Finland, northern and southern Sweden, western and northern Norway, and southern Denmark received a lot more rain in 2007 than in 2006. In comparison to 2006, western and central Europe received more precipitation in winter and summer, while southeastern Europe received larger amounts of precipitation from September onwards.

Temperature and precipitation have a strong influence on photochemistry and deposition and thus on pollution levels both in the air and on ground. Therefore, they are good indicators of interannual variability in meteorology that can explain parts of the changes in air pollution levels and transboundary transport of pollutants from year to year.

## 2.2 Emission data in 2007

In addition to meteorological variability, the other factors affecting the interannual variability of transboundary transport are changes in the emissions. The main changes in emissions in 2007 with respect to previous years are documented in the following sections.

### 2.2.1 Emission reporting under the LRTAP Convention in 2009

Parties to the LRTAP Convention submit air pollution emission data ($SO_x$, $NO_x$, $NH_3$, CO, NMVOCs, HMs, POPs and PM) annually to the EMEP Centre on Emission Inventories and Projections (CEIP) and notify the LRTAP Convention secretariat thereof. The deadline for submission of 2007 data was 15 February 2009. Parties are requested to report emission inventory data using standard formats in accordance with the EMEP Reporting guidelines (UNECE (2009)).

41 of the 50 Parties (EC is not included in this statistics) to the Convention submitted inventories in 2009. Thereof 26 Parties reported emission data by the due date of 15 February 2009. Figure 2.2 indicates that 52% of the Parties reported in time and fifteen Parties submitted data after the deadline, increasing the number of submissions to 82%. This is an increase by one Party as compared to last year (Figure 2.2). 39 countries submitted main pollutants, however only 32 Parties provided PM emissions. A few Parties reported only national total emissions. Completeness and consistency of submitted data is analyzed in the EEA/CEIP Inventory review report 2009 (Mareckova et al. (2009)). Data as submitted by Parties can be accessed via the CEIP homepage at http://www.ceip.at/emission-data-webdab/2008-submissions-under-clrtap/.

Gridded data are part of the five-year reporting obligation and as such were not due in 2009. However, five Parties (Finland, Spain, Denmark, Greece and Slovakia) submitted gridded sectoral and national total emissions. Finland and Spain submitted gridded data for 2007 in the new GNFR sectors, Finland only for 2007 and Spain for the whole time series from 1990 to 2007. Denmark submitted gridded data for 2005,

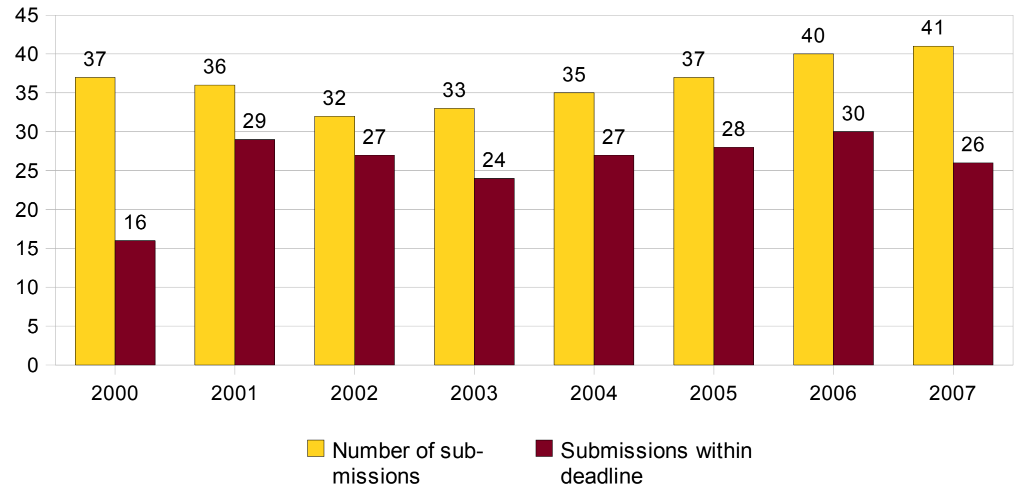



Figure 2.2: Number of Parties reporting emission data to EMEP since 2000 as of 30 June 2009.

Greece and Slovakia submitted only gridded national totals, Greece for 2000 and 2005 and Slovakia for 1990, 1995, 2000 and 2005.

Independent of the reporting year, out of the 48 countries which are considered in the extended EMEP area, only 15 countries reported sectoral gridded data for year 2000 (5.4% of the extended grid area) and only 19 countries reported sectoral gridded emissions for 2005 (5.5% of the extended grid area).

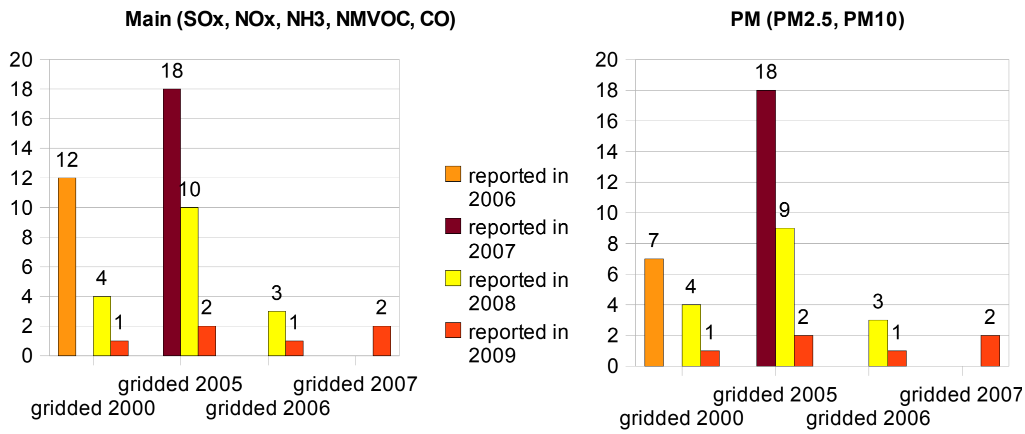



Figure 2.3: Number of Parties reporting gridded sector data to EMEP as of 30 June 2009.

26 countries have not reported gridded sectoral data, neither for 2000 nor for 2005 (Belgium, Bulgaria, Czech Republic, Greece, Luxembourg, Malta, Poland, Romania, Slovakia, Slovenia, United Kingdom, Albania, Armenia, Azerbaijan, Bosnia and

Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, Liechtenstein, Monaco, Montenegro, Republic of Moldova, TFY Republic of Macedonia, Russian Federation, Serbia and Turkey). However some of these countries reported gridded national total emissions. Cyprus, Hungary, Lithuania, Netherlands, Belarus, Croatia and Ukraine have not provided gridded sectoral emissions for 2000, and France, Italy and Iceland have not provided gridded sectoral data for 2005.

### 2.2.2 Emission data used for modelling in 2009

The emissions used for this years transboundary transport calculations with the Unified model are those provided by CEIP. These data are derived, as far as possible, from the official submissions for sectoral 2007 emissions as reported by the Parties. However, the official emission data are far from complete. Before emission data can be used by modellers, missing information has to be filled in. To gap-fill missing data CEIP applies two basic methods: a) linear extrapolation of the last five years (three as a minimum) and b) copy of previous year's emissions (data from 2006, 2005, 2003 or 2000). Gap-filled sectoral emissions are distributed over the extended EMEP grid by a base grid. The base grid defines the distribution of emissions in the extended EMEP area and was calculated by using gridded emissions if reported by countries and/or proxy data as large point sources (LPS), population data and different models if no or incomplete data had been reported by countries.

The overview information on gap-filled sectors can be found in Table 2.1. The gap-filled data are published on WebDab as ”Emissions used in EMEP models”: http://www.ceip.at/emission-data-webdab/emissions-used-in-emep-models/.

Emissions from international ship traffic are not included in the officially reported data. For 2007, the shipping emissions were linearly interpolated with ENTEC estimates for 2010.

This year CEIP considered for the first time the extended EMEP domain in the gap-filling and gridding process. Because of missing emissions from a number of countries in this area, MSC-W estimates from last year were used and gridded with current population data in particular countries. The population data CEIP used were compiled by IIASA.

Because of late resubmissions of corrected data from Bulgaria and Finland it was not possible to take into account the updated data in the model runs by MSC-W.

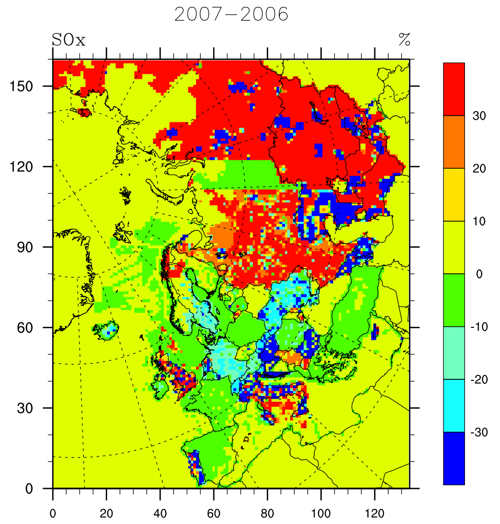
The national emission totals for 2007 in the extended EMEP domain (132$\times$159 grid cells), as used for the modelling, are listed in Appendix B for each individual country and area.

### 2.2.3 Differences between 2007 and 2006 emissions

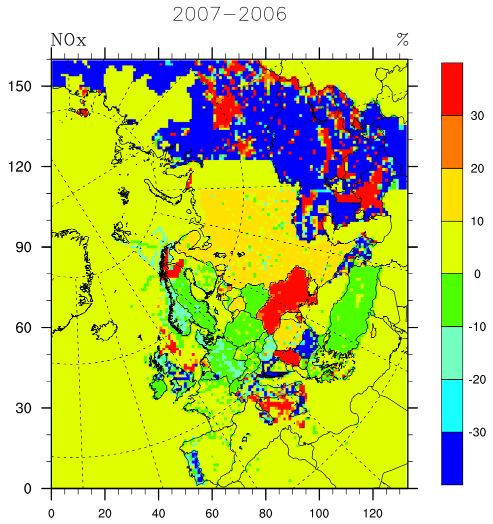
Changes in the total antrophogenic emissions of main pollutants within the extended EMEP area from 2006 to 2007 are generally small, with averaged reductions of -2.6%

Table 2.1: Overview of gap-filling in the EMEP 2007 inventory. Cross in the table indicates that emissions in at least one sector were gap filled in the data used for EMEP/MSC-W modelling in 2007.

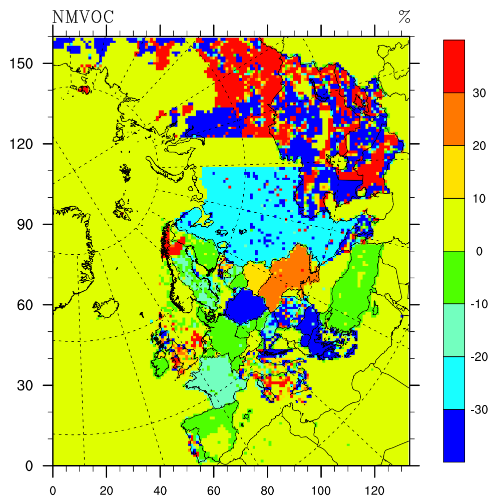
| Parties | NOx | NMVOC | SOx | $NH_3$ | $PM_{2.5}$ | PMcoarse | CO |
|---|---|---|---|---|---|---|---|
| Albania | x | x | x | x | x | x | x |
| Armenia | x | x | x | x | x | x | x |
| Azerbaijan | x | x | x | x | x | x | x |
| Belarus | | x | x | | x | x | |
| Bosnia and Herzegovina | x | x | x | x | x | x | x |
| Bulgaria | | | | | x | x | |
| Croatia | | | | | x | x | |
| Georgia | x | x | x | | x | x | x |
| Germany | | | | | x | x | |
| Greece | | | x | | x | x | |
| Hungary | | x | | | | x | |
| Iceland | x | x | x | x | x | x | x |
| Ireland | | | | | x | x | |
| Kazakhstan | x | x | x | x | x | x | x |
| Kyrgyzstan | x | x | x | x | x | x | x |
| Lithuania | | | | | x | x | |
| Luxembourg | | | | | x | x | x |
| TFYR of Macedonia | x | x | | | x | x | |
| Malta | | | x | | x | x | |
| Republic of Moldova | x | x | x | x | x | x | x |
| Montenegro | x | x | x | x | x | x | x |
| Poland | | x | | | | | |
| Romania | | | | | x | x | |
| Russian Federation | x | x | x | | x | x | x |
| Serbia | x | x | x | x | x | x | x |
| Slovakia | | | | | x | x | |
| Tajikistan | x | x | x | x | x | x | x |
| Turkey | x | x | x | x | x | x | x |
| Ukraine | | | | | x | x | |
| **Other Areas** | **NOx** | **NMVOC** | **SOx** | **$NH_3$** | **$PM_{2.5}$** | **PMcoarse** | **CO** |
| Arctic Ocean in the extended EMEP domain | x | x | x | x | x | x | x |
| Rest of Aral Lake in the extended EMEP domain | x | x | x | x | x | x | x |
| Aral Lake in the former official EMEP domain | x | x | x | x | x | x | x |
| Remaining Asian Areas in the extended EMEP domain | x | x | x | x | x | x | x |
| Remaining Asian Areas | x | x | x | x | x | x | x |
| Modified Remaining Asian Areas in the former official EMEP domain | x | x | x | x | x | x | x |
| Remaining N/E Atlantic Ocean | x | x | x | | x | x | x |
| EMEP-external Remaining North-East Atlantic | x | x | x | | x | x | x |
| Baltic Sea | x | x | x | | x | x | x |
| Black Sea | x | x | x | | x | x | x |
| Caspian Sea | x | x | x | x | x | x | x |
| Rest of Kazakhstan in the extended EMEP domain | x | x | x | x | x | x | x |
| Mediterranean Sea | x | x | x | | x | x | x |
| North Sea | x | x | x | | x | x | x |
| North Africa | x | x | x | x | x | x | x |
| Rest of Russian Federation in the extended EMEP domain | x | x | x | x | x | x | x |
| EMEP-external part of Russian Federation | x | x | x | x | x | x | x |
| Rest of Turkmenistan in the extended EMEP domain | x | x | x | x | x | x | x |
| Turkmenistan in the former official EMEP domain | x | x | x | x | x | x | x |
| Rest of Uzbekistan in the extended EMEP domain | x | x | x | x | x | x | x |
| Uzbekistan in the former official EMEP domain | x | x | x | x | x | x | x |



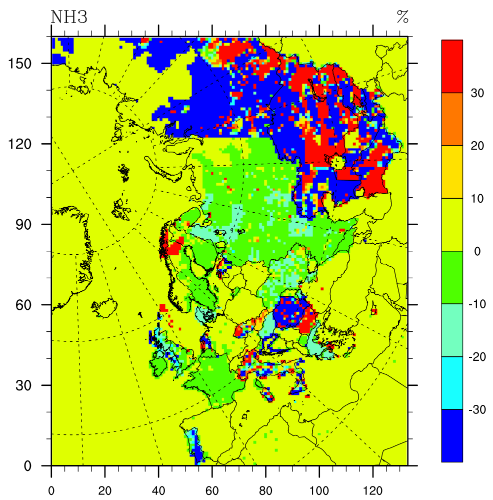

(a) $SO_2$ emissions



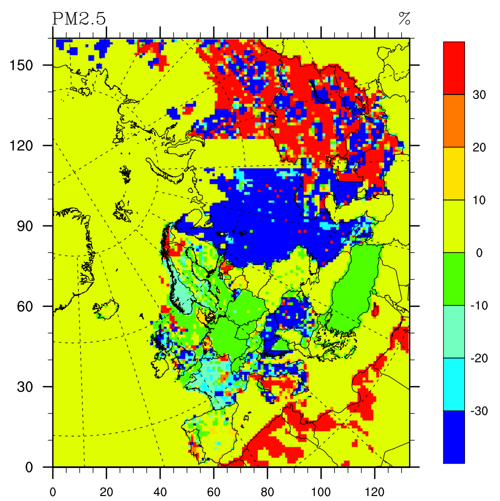

(b) $NO_x$ emissions



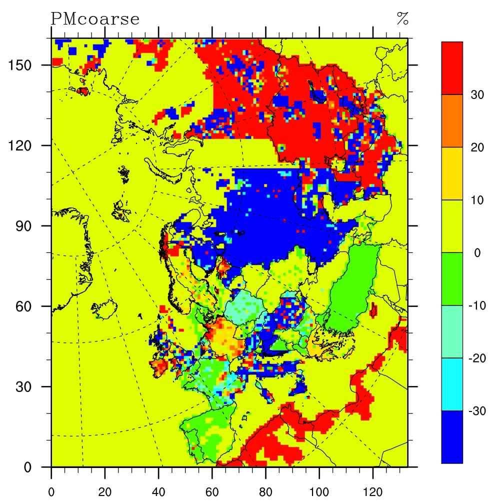

(c) NMVOC emissions




(d) $NH_3$ emissions




(e) $PM_{2.5}$ emissions




(f) $PM_{coarse}$ emissions

Figure 2.4: Percentage differences in the spatial distribution of emissions between 2007 and 2006.

for $SO_x$, -0.1% for $NH_3$, -6.4% for NMVOCs, while for $NO_x$, there is an increase of 1%.

In the case of particulate matter the changes are more significant, the averaged reductions are -9.1% for $PM_{2.5}$ and -11% for $PM_{coarse}$. The spatial variability of these changes is illustrated in Figure 2.4, which shows the changes as percentage of 2006 emissions.

For $SO_x$ the largest reductions in national total emissions occurred in Cyprus (-11%), Germany (-12%), Hungary (-29%), Luxembourg (-63%), Romania (-13%), Slovakia (-20%), Slovenia (-20%), Sweden (-15%), Switzerland (-22%) and the United Kingdom (-13%). $SO_x$ emissions increase significantly in Estonia (25%) and the Former Yugoslav Republic of Macedonia (15%).

For $NO_x$ the largest reductions occurred in Bulgaria (-24%), Luxembourg (-51%) and Portugal (-13%). $NO_x$ emissions increased in Cyprus (12%), Estonia (13%), Greece (18%), Lithuania (13%), Serbia (156%), the Former Yugoslav Republic of Macedonia (16%) and Ukraine (50%).

$NH_3$ emissions decreased most in Denmark (-16%), Greece (-11%), Hungary (-13%), Luxembourg (-24%), Portugal (-20%). Increases of 105% and 22% occurred in Malta and Slovakia, respectively.

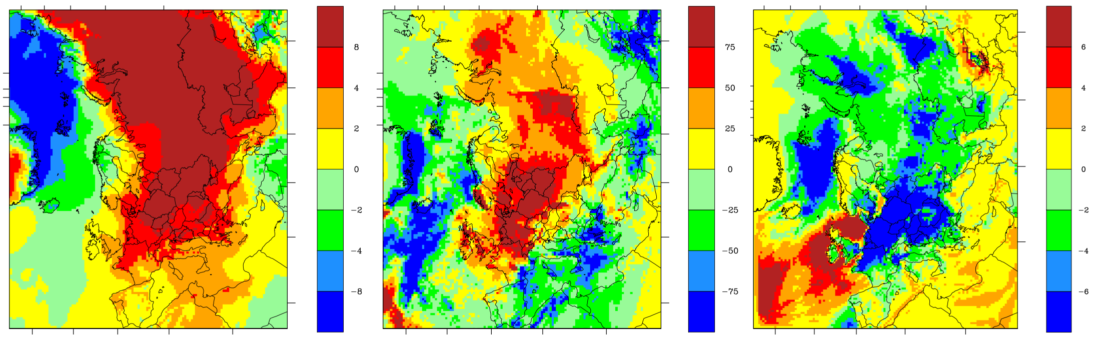
Significant reductions in NMVOC emissions occurred in Bulgaria (-48%), Greece (-30%), Hungary (-16%), Malta (-43%), Poland (-35%), Russian Federation (-14%), the Former Yugoslav Republic of Macedonia (-41%), while NMVOC emissions increased in Belarus (23%), Georgia (64%) and Ukraine (38%).

For $PM_{2.5}$ and $PM_{coarse}$ the largest reductions occurred in Belgium (-16% and -12%, respectively), Croatia (-47% and -58%), Hungary (-27% and -24%), Italy (-10% and -33%), Russian Federation (-27% and -34%) and Slovakia (-11% and -37%). Only $PM_{2.5}$ was significantly reduced in Sweden (11%) and the United Kingdom (-14%). Both $PM_{2.5}$ and $PM_{coarse}$ increased in Cyprus (320% and 293%, respectively), Estonia (33% and 74%) and Malta (28% and 248%). $PM_{2.5}$ increased significantly in Denmark (18%) and Portugal (11%), while $PM_{coarse}$ emissions doubled in Ireland.

As mentioned above, because of missing reported emissions from the new EECCA countries, the 2006 estimates for sectoral emissions from anthropogenic sources were used also this year. These emissions were, however, regridded using current population data compiled by IIASA. As Figure 2.4 shows, the new gridding led to significant changes in the spatial distribution of emissions, which are also reflected in the model results.

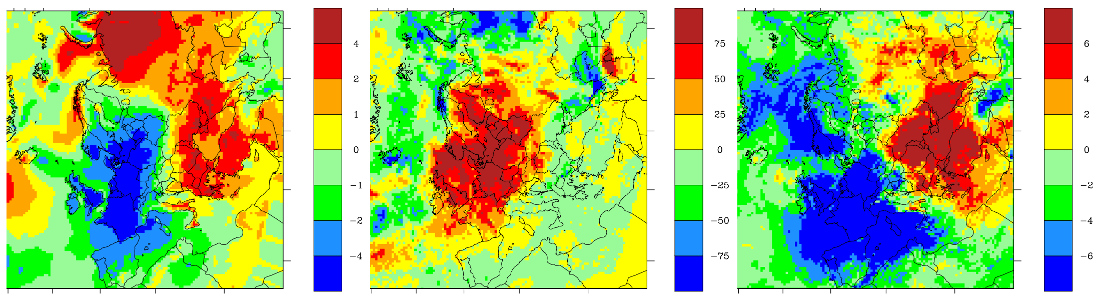
## 2.3 Main changes in concentrations, depositions and transboundary fluxes in 2007

The unusually high temperatures in January 2007 (Figure 2.5(a)) together with large amounts of precipitation in central and eastern Europe (Figure 2.5(b)) and western



(a) ΔT2m, January (b) Δprecipitation, January (c) $\Delta \mathrm{PM}_{10}$, January

Figure 2.5: Differences between 2007 and 2006 for January. Left: Monthly mean temperature at 2m [K], middle: Monthly precipitation [mm], right: Monthly mean $\mathrm{PM}_{10}$ concentration [$\mu$g m$^{-3}$].



(a) ΔT2m, July (b) Δprecipitation, July (c) ΔmaxO3, July

Figure 2.6: Differences between 2007 and 2006 for July. Left: Monthly mean temperature at 2m [K], middle: Monthly precipitation [mm], right: Monthly mean of daily maximum ozone [ppb].

Russia resulted in, e.g., rather low $\mathrm{PM}_{10}$ values for the same area as visible from the Unified EMEP model results shown in Figure 2.5(c). This finding is also supported by observations (EMEP CCC & MSC-W 2009).

By contrast, in March, high PM values were observed in central Europe related to dry conditions, and in late March a dust event was identified that originated from extremely dry areas in southern Ukraine and the northern shore of the Black Sea (Birmili et al. 2008).

For ozone, the levels in 2007 compared to 2006 are lower in central Europe and northern Europe. According to the European Environment Agency (EEA 2008) the summer ozone levels of 2007 were among the lowest in the past decade. However, during the heat wave period over eastern Europe in July the ozone air pollution was more severe than in the same period in 2006. This is shown in Figure 2.6 visualizing monthly mean temperatures and total precipitation for July 2007 along with Unified

EMEP model results for surface ozone.

Changes in transboundary fluxes, air concentrations and depositions from year to year are driven by changes in emissions and by meteorological variability. Generally, over the last decade the interannual variability in emissions has been small, and changes in air quality from year to year are mostly driven by meteorological variability.

A direct comparison of the source-receptor calculation for 2007 with those made for earlier years is not straightforward as the meteorological driver has changed from PARLAM-PS to HIRLAM. The change from 2006 to 2007 values (as reported last year and this year, respectively), is thus a result of changes in emissions, changes in meteorology, and of changing the numerical weather prediction model chosen to drive the Unified EMEP Model.

Selected source-receptor relationships have been recalculated for 2006 with the same meteorological driver as is used for 2007, in order to isolate the combined effect of emission changes and meterorological variability (see Chapter 6 for discussion) .

The relatively large differences between 2006 and 2007 regarding key meteorological parameters such as temperature and precipitation do have a bearing on long-range transport of pollutants and thus the source-receptor analyses presented in this report. As will be shown in Chapter 6, the differences seen in the source-receptor calculations are rather large for some countries. For example, the high amount of precipitation over the North Sea areas has likely contributed to the pronounced reduction in imported oxidized sulphur deposited in Scandinavia in 2007.

The differences in meteorology also explain why changes in deposition differ from changes in emissions. For instance, in the EU27 area total sulphur emissions decreased by 4.9% from 2006 to 2007, while the deposition of oxidized sulphur was only 3.3% smaller in 2007 compared to 2006, indicating that a smaller fraction of the total emission was exported. This may be connected to more precipitation inside the area in 2007, but also to chemical effects. The somewhat cooler summer conditions over large parts of Europe (with a notable exception in southeastern Europe) contributed to the large change in area-averaged SOMO35 in the EU27 area, amounting to -12.4%. By comparison, NOx emissions and VOC emissions decreased by 3.2% and 8.2%, respectively, in the same area. In this context it has to be noted, however, that the relation between ozone and its precursors is highly non-linear.

When considering the entire (extended) EMEP area, changes in meteorology average out to a larger extent. The deposition of oxidized sulphur decreased from 8307 Gg in 2006 to 8069 Gg in 2007, or by 2.9%, which is almost equal to the emission change. The total deposition of oxidized nitrogen decreased from 3752 Gg to 3714 Gg (-1.0%) and that of reduced nitrogen from 4618 Gg to 4521 Gg (-2.1%). The area-averaged SOMO35 decreased by 4.3% from 2006 to 2007.

## 2.4 Combined model results and observations

This year, for the first time, the operational Unified EMEP model calculations are based on meteorology from the HIRLAM model. The meteorological fields have been interpolated from spherical coordinates with a resolution of $0.2^\circ \times 0.2^\circ$ to the polar-stereographic $50 \times 50$ km$^2$ grid of EMEP. The model domain was extended to include 4 new EECCA countries last year, and they are now included as a part of the operational model runs.

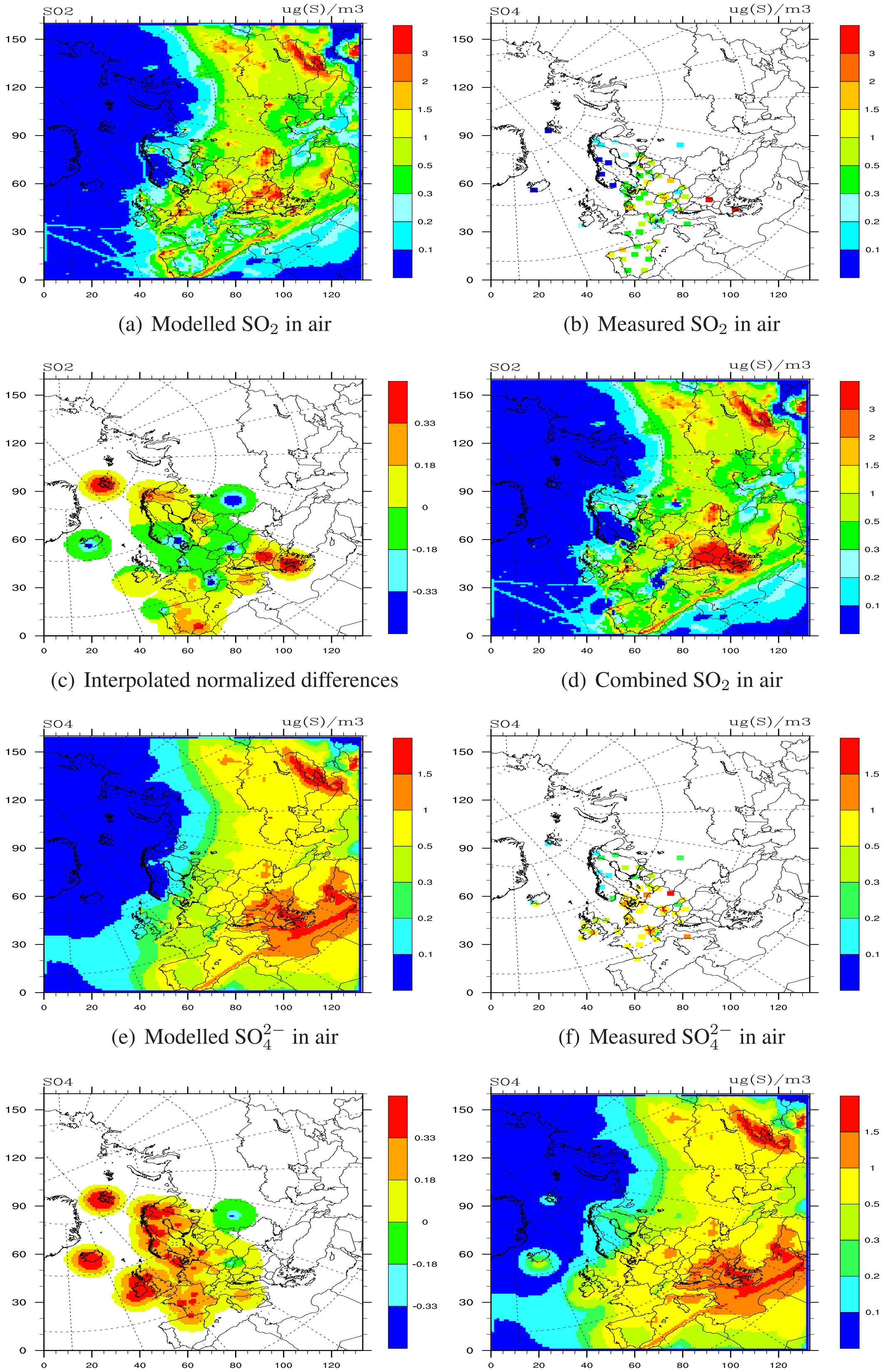
Test runs with HIRLAM meteorology and the evaluation of results for 2006 were presented in last year's EMEP Report 1/2008 (Fagerli et al. 2008). Results from model runs using different meteorological drivers were evaluated against measurements and the performances of the different model setups were compared. In general it was found that model results using the HIRLAM meteorological driver compared better to observations than model results using the PARLAM-PS meteorology.

### 2.4.1 Acidification and eutrophication

In this section, we present the 'best estimates' for air concentrations of $\mathrm{SO_2}$, $\mathrm{SO_4^{2-}}$, $\mathrm{NH_3}$+$\mathrm{NH_4^+}$ and $\mathrm{HNO_3}$+$\mathrm{NO_3^-}$ as well as concentrations of oxidized sulphur, oxidized nitrogen and reduced nitrogen in precipitation. The 'best estimates' have been created by using a combination of model results and observations from the EMEP network for 2007. For all measurement points, the difference between the measured value at that point and the modelled value in the corresponding grid cell is calculated. This difference is interpolated spatially using radial basis functions, giving a continuous two-dimensional function describing the difference at any point within the modelled grid. For the interpolated normalized differences (observations-model/(observations+model)), positive values show where the model underpredict the values, whilst negative values show where the model overpredict values. The combined maps are derived by adjusting the model results with the interpolated differences, giving large weight to the observed values close to stations, and using the modelled values in areas with no observations. The range of influence of the measured values depends on the component, and has been set to 300 km for $\mathrm{NH_3}$+$\mathrm{NH_4^+}$ and $\mathrm{HNO_3}$+$\mathrm{NO_3^-}$ in air, and 500 km for all other components. For each of the components, we present four different figures, visualizing the different steps of the procedure (Figures 2.7 to 2.9). In general, there is good agreement between model results and measurements for 2007 as for previous years. Thus, the combined results are rather similar to the model results. Please note that the evaluation of the performance of the EMEP Unified model for 2007 is not included in this chapter, but is available on the EMEP website.

### 2.4.2 Ozone and $\mathrm{NO_2}$

'Best estimates' have also been calculated for air concentrations of ozone and $\mathrm{NO_2}$, using a combination of model results and observations from the EMEP network for




(a) Modelled $SO_2$ in air

(b) Measured $SO_2$ in air

(c) Interpolated normalized differences

(d) Combined $SO_2$ in air

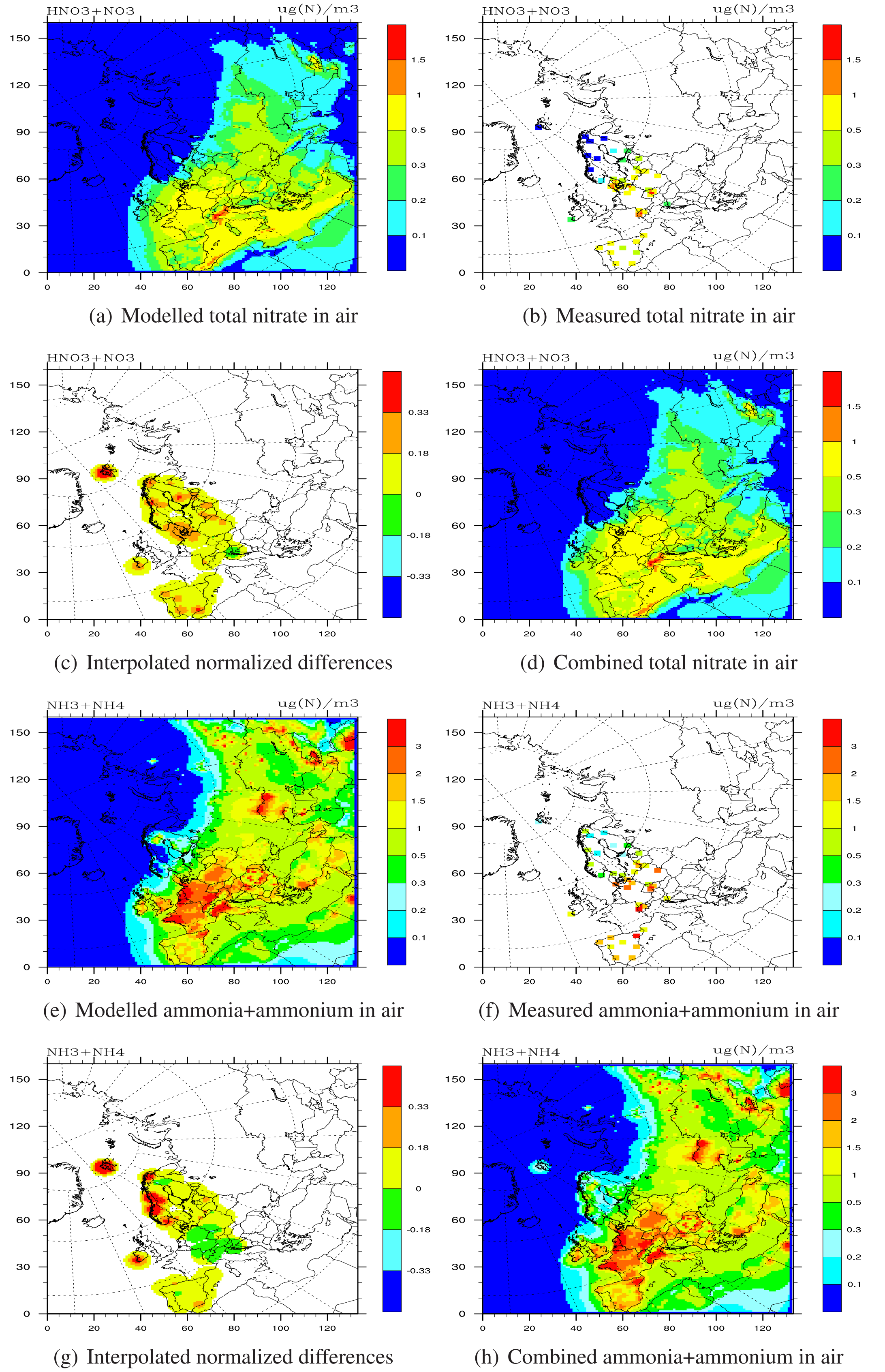
(e) Modelled $SO_4^{2-}$ in air

(f) Measured $SO_4^{2-}$ in air

(g) Interpolated normalized differences

(h) Combined $SO_4^{2-}$ in air

Figure 2.7: Yearly averaged $SO_2$ (a)-(d) and $SO_4^{2-}$ (e)-(h) concentrations in air [$\mu$g(S) m$^{-3}$] for 2007.




(a) Modelled total nitrate in air

(b) Measured total nitrate in air

(c) Interpolated normalized differences

(d) Combined total nitrate in air

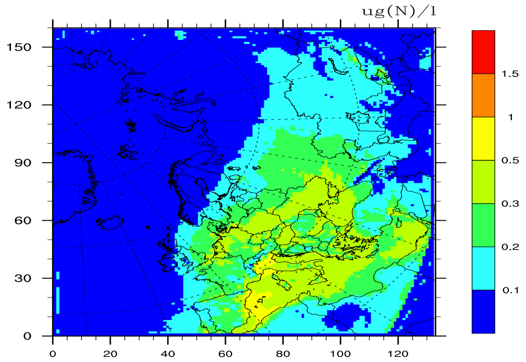
(e) Modelled ammonia+ammonium in air

(f) Measured ammonia+ammonium in air

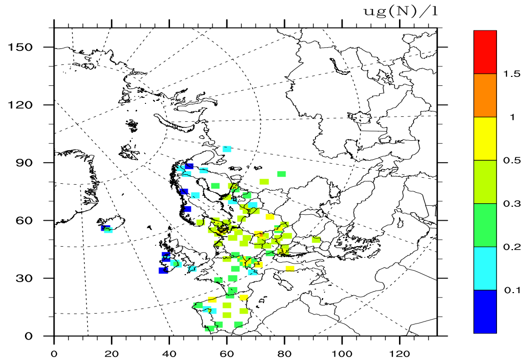
(g) Interpolated normalized differences

(h) Combined ammonia+ammonium in air

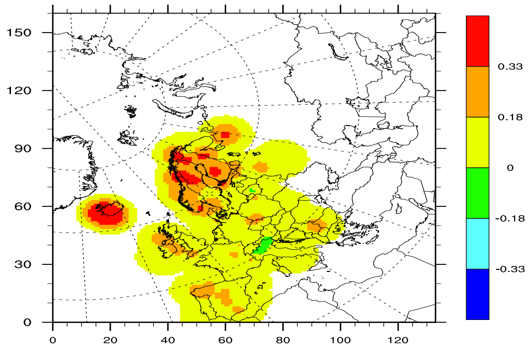
Figure 2.8: Yearly averaged $HNO_3$+$NO_3^{-1}$ (a)-(d) and $NH_3$+$NH_4^+$ (e)-(h) concentrations in air [$\mu$g(N) m$^{-3}$] for 2007.



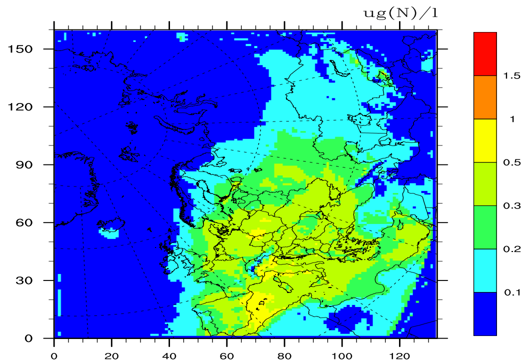

(a) Modelled nitrate in precipitation



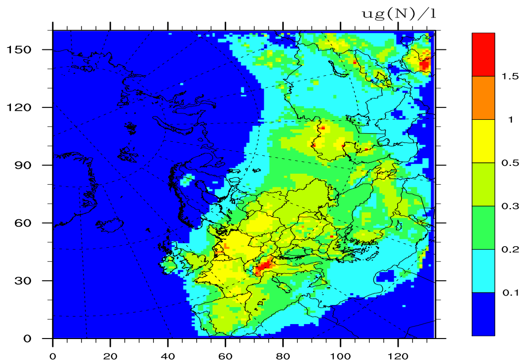

(b) Measured nitrate in precipitation



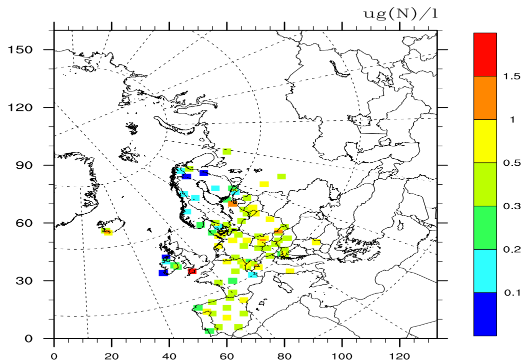

(c) Interpolated normalized differences



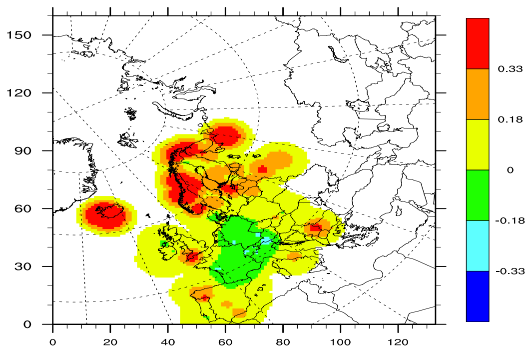

(d) Combined nitrate in precipitation



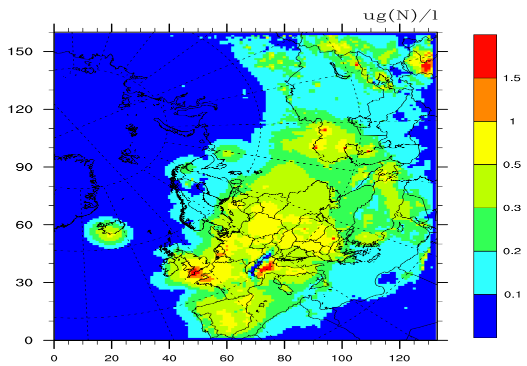

(e) Modelled ammonium in precipitation




(f) Measured ammonium in precipitation

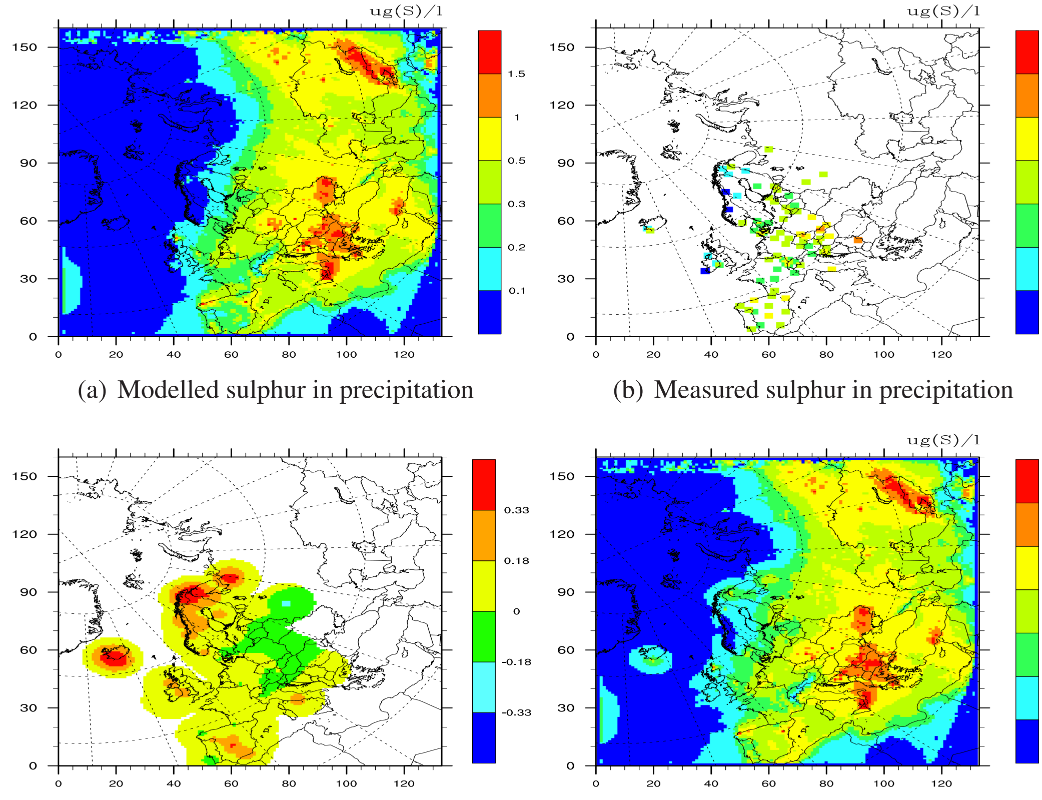



(g) Interpolated normalized differences




(h) Combined ammonium in precipitation

Figure 2.9: Yearly averaged oxidized nitrogen (a)-(d) and reduced nitrogen (e)-(h) concentrations in precipitation [$\mu$g(N)l$^{-1}$] for 2007.




(a) Modelled sulphur in precipitation

(b) Measured sulphur in precipitation

(c) Interpolated normalized differences

(d) Combined sulphur in precipitation

Figure 2.10: Yearly averaged sulphur concentrations in precipitation [$\mu$g(S)l$^{-1}$] for 2007.

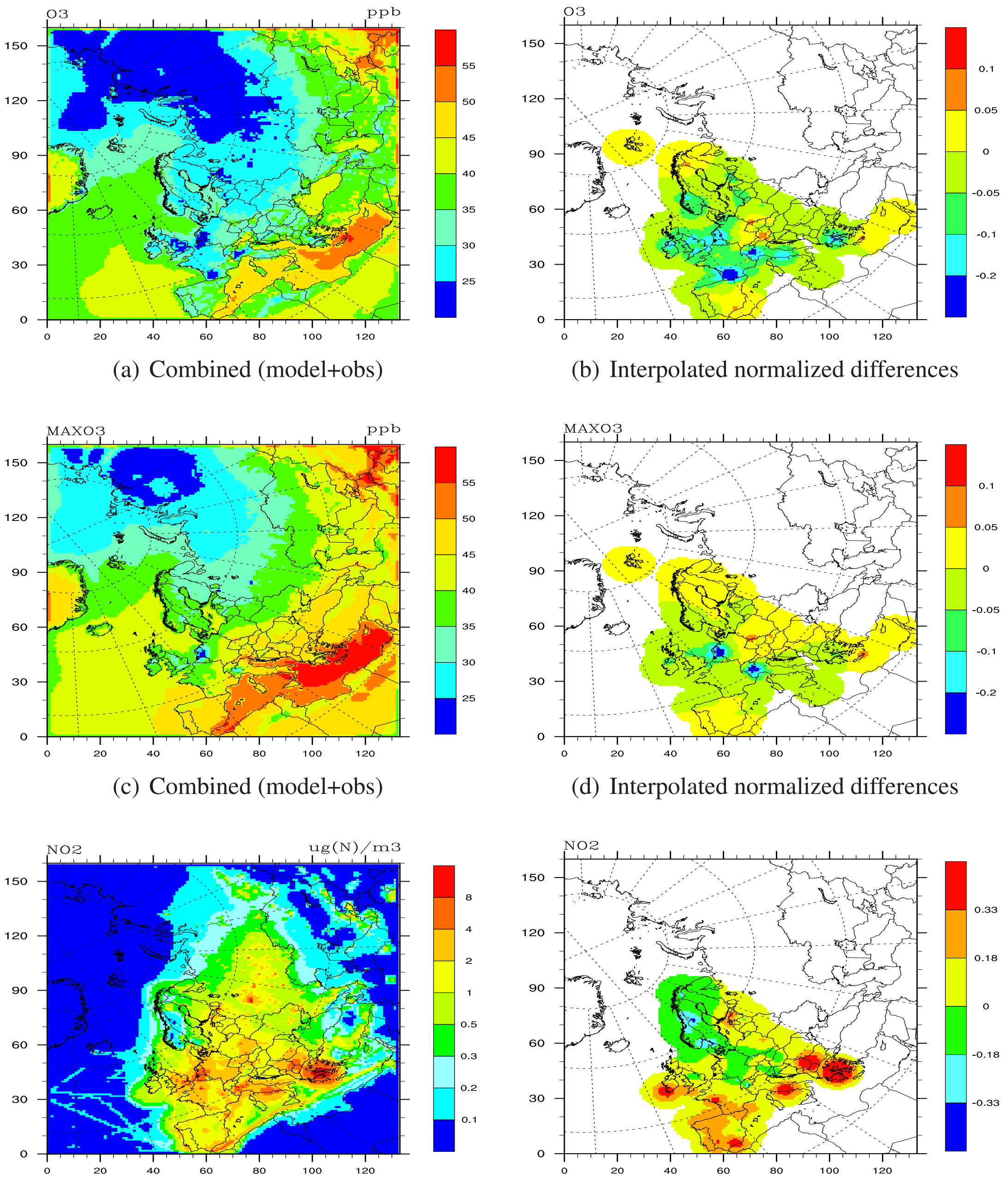
2007. The technique is the same as described in section 2.4.1.

In general, there is very good agreement regarding ozone between model results and measurements for 2007. Thus, the maps of combined results look very similar to those of the model results. We thus show only the combined results and the normalized error in Figure 2.11. For the maps of normalized error, positive values denote model underprediction, and negative values model overprediction. While the error is somewhat larger for $NO_2$ (bottom panels of Figure 2.11 the overall agreement is still satisfactory. The model tends to underestimate $NO_2$ in the south, especially over Spain, Italy, and Greece, and overestimate it in the north, e.g. Scandinavia.

A detailed evaluation of the EMEP Unified Model in terms of ozone and $NO_2$ for 2007 is available on the EMEP website.

## 2.5 Exceedances of critical loads

The calculated exceedances of critical loads and the ecosystem areas at risk in 2007 are presented in Figure 2.12 both for Europe in the old EMEP domain (a)-(d) and




(a) Combined (model+obs)

(b) Interpolated normalized differences

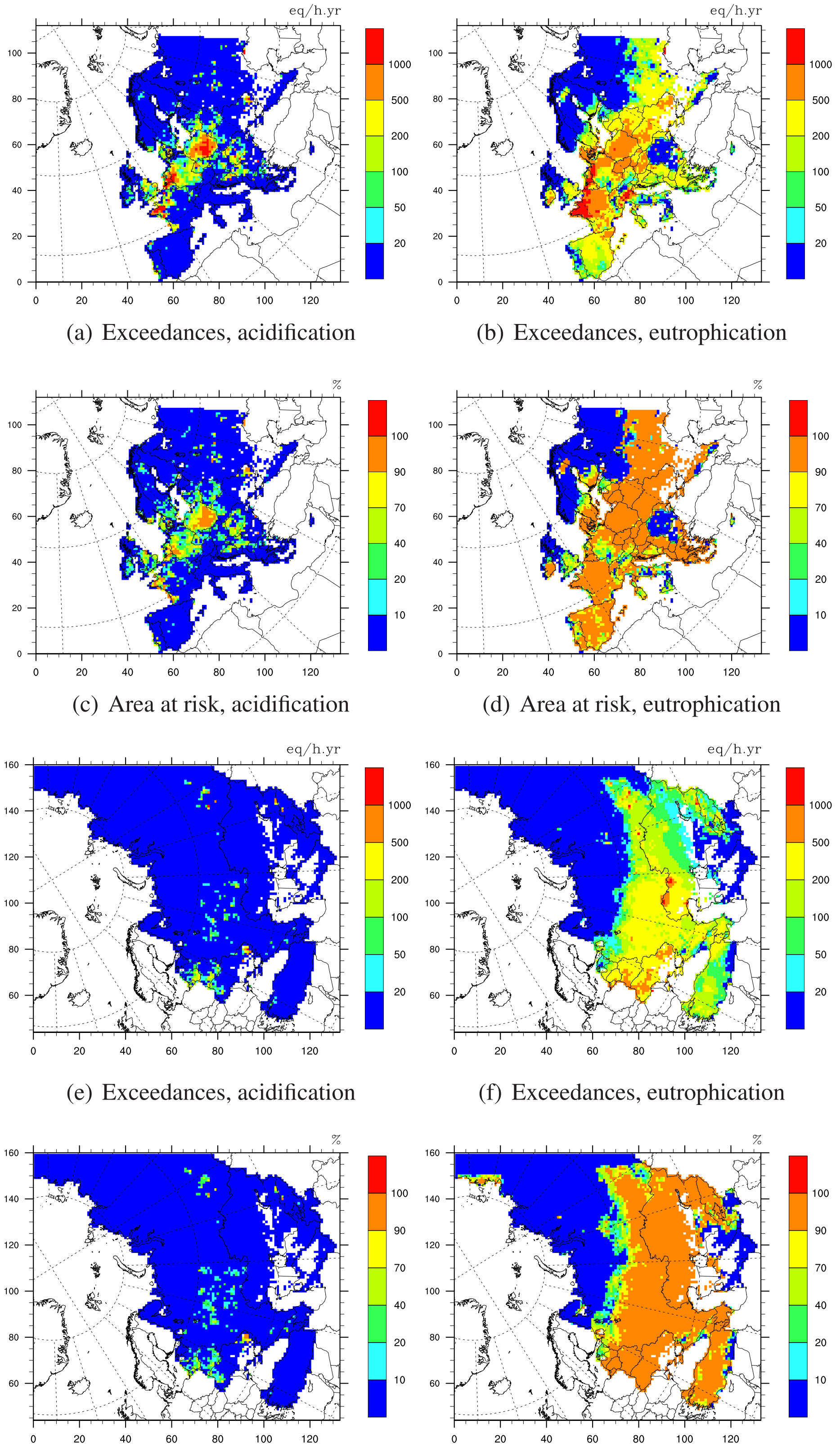
(c) Combined (model+obs)

(d) Interpolated normalized differences

(e) Combined (model+obs)

(f) Interpolated normalized differences

Figure 2.11: Yearly averaged Ozone and $NO_2$ for 2007. (a)+(b): daily mean ozone [ppb], (c)+(d): daily maximum ozone [ppb], (e)+(f): daily mean $NO_2$ [$\mu$g(N) m$^{-3}$].




(a) Exceedances, acidification

(b) Exceedances, eutrophication

(c) Area at risk, acidification

(d) Area at risk, eutrophication

(e) Exceedances, acidification

(f) Exceedances, eutrophication

(g) Area at risk, acidification

(h) Area at risk, eutrophication

Figure 2.12: Exceedances of critical loads [eq $h^{-1}$ $yr^{-1}$] and % ecosystem areas at risk for 2007 in Europe (a)-(d) and in EECCA countries (e)-(h).

for EECCA countries in the extended EMEP domain (e)-(h). The calculations for Europe in the old EMEP domain are based on official critical load data as decribed in Hettelingh et al. (2008), while those for EECCA countries are based on non-official critical load data by CCE's background database (Reinds et al. 2008).

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# CHAPTER 3

## Status and new development in the EECCA region

**Wenche Aas, Katarina Mareckova and Ágnes Nyíri**

Most of the twelve EECCA (Eastern Europe, Caucasus and Central Asia) countries are Parties to the Convention (CLRTAP), but only few of these Parties have yet signed the protocols thereunder, though many are in process to do so. There is a strong need to improve the official reporting on emissions as well as measurements from the EECCA countries, and this has been a priority area for EMEP the last years. This is also reflected in the EMEP work plan (ECE/EB.AIR/GE.1/2008/2), which clearly specifies the need for capacity-building and guidance to develop national actions needed for implementing the protocol obligations.

## 3.1 Emission inventories and emission reporting in EECCA countries

### 3.1.1 Status of reporting

The reporting of CLRTAP inventories by EECCA countries to the Convention is rather limited. In recent years only Belarus, Moldova, Russian Federation and Ukraine, reported more or less regularly emission inventories to the Convention. Georgia has submitted inventories of main pollutants, Total Suspended Particles (TSP) and Persistent Organic Pollutants (POPs) in 2008 and 2009, Kyrgyzstan provided main pollutant emissions from stationary sources (except $NH_3$), and Azerbaijan submitted some information on emissions for stationary sources in 2009. No data have been provided by Armenia and Kazakhstan. In general the reported inventories are not complete and informative inventory reports (IIRs) are not provided either. There are historical data in WebDab reported by these countries between 1990-2000, but it seems to be no link between the historical data and emissions reported in the last 2 years (Table 3.1).

| PARTY | SO2 NOx CO NH3 NMVOC | Cd,Hg, Pb | additional HM | PM2.5, PM10 | TSP | POPs (PAH DIOX HCB) | Projections | comments |
|---|---|---|---|---|---|---|---|---|
| Armenia | | | | | | | | SO2, CO, NO2, national totals only from stationary sources |
| Azerbaijan | 2000-2007 | | | | | | | Reported only National Totals of stationary sources in Word-file; |
| Belarus | 2006, 2007 | 1990-1995, 2006, 2007 | 2006, 2007 | 2006, 2007 | 2006, 2007 | 2006, 2007; DIOX 2004-2005 | | HM 1990-1995 are not in NFR |
| Georgia | 2000 - 2007 | | | | 2000 - 2007 | 2000 - 2007 | | National totals from 2000 to 2007 in Notification form; Resubmission of 2006 and 2007 data in new format, but without national totals; HCB is not reported |
| Kazakhstan | | | | | | | | |
| Kyrgyzstan | 1990, 1995-2005 | | | | | | | Energy sector only, without NH3 |
| Moldova | | 2006 | | | | | 2010, 2015, 2020 | |
| Russian Federation | 2006, 2007 | 2006, 2007 | | 2006, 2007 | 2006, 2007 | | | Projections in russian Word file; |
| Ukraine | 2006, 2007 | 2006, 2007 | 2006, 2007 | | 2006, 2007 | | | |

Table 3.1: Overview of inventories submitted to CEIP by EECCA countries during 2008 and 2009.

Kazakhstan has experienced inventory experts which would be able to compile and report the CLRTAP inventory, but legal framework in the country is not provided. In Kyrgyzstan, Georgia, Azerbaijan and Armenia experts do not seem to be familiar with emission reporting under CLRTAP. In Belarus and Ukraine inventories are reported, but a QA/QC system seem not to be in place. The Russian Federation reports emissions only for "EMEP Russia" but not for the whole country or the extended EMEP area. In previous years Belarus, the Russian Federation and Ukraine have reported sectoral gridded emissions (Belarus for 2005, the Russian Federation for 1990, 1995, 1996 and 2000 and Ukraine 2002 and 2005). Armenia and Moldova reported large point source (LPS) emissions (Armenia 1997 and Moldova 1996). However, in 2008 and 2009 no gridded emissions or LPS data has been provided by the EECCA countries.

### 3.1.2 TF HTAP Regional workshop in St. Petersburg

The Task Force on Hemispheric Transport of Air Pollution (TF HTAP) organized a regional workshop "Focusing on Eastern Europe, Central Asia, and the Arctic" from 1–3 April 2009 in St. Petersburg, Russia. The agenda of the workshop is available at `http://www.htap.org/meetings/2009/2009_04/agenda.htm`. Two days of the workshop were planned to deal with emission inventories and projections in the EECCA and SEE (South-East Europe) regions. The workshop was organized side to side with the "12th All-Russian Conference on Regulatory-methodological, Technical and Information Support of the Air Protection Activity" as part of the "Atmosphere 2009" conference. Up to 90 experts from the former Soviet Union countries participated. CEIP was invited to provide training to the Parties on reporting obligations, reporting formats and requirements for national inventory systems. CEIP individually consulted experts at the meeting using this opportunity to obtain additional information on the situation in individual EECCA countries.

Although the main problem in EECCA region seems to be awareness of policy-makers (followed by lack of legal and institutional framework and limited budget), the provision of emission data and quality of reported data could be partly improved by regular capacity building of EECCA inventory experts and small projects focusing on; a) establish institutional and procedural arrangements and b) assistance with inventory compilation for selected years (e.g. 2000, 2005, 2010). The experience shows, through UNDP, UNEP programmes (`http://ncsp.undp.org/index.cfm`, `http://www.rec.org/REC/Programs/UNDP-GHGInventories/`), that these countries will hardly develop national inventory systems and start with regular reporting of emission inventories without external support. Parts of the problems listed above are to be managed on the country level, however, national experts might welcome external support as well. EECCA experts expressed interest in regional capacity building workshops and in country focused support (e.g. country visits and/or bilateral projects).

### 3.1.3 Areas for improvement

Areas for improvement where EMEP might consider to provide assistance:

- Awareness of national stakeholders.
- Legal, institutional and procedural framework in the countries.
- Identification of data providers.
- Developing cadastre of emission sources.
- Environmental statistics and guidance on how to use national statistical data in inventory compilation.
- Missing inventory software tools (e.g. like Collecter, Copert).
- Technical capacity of inventory experts, transition of technical knowledge in areas; implementation of EMEP/EEA inventory guidebook (EMEP/EEA 2009), selection of methods and emission factors (EFs), uncertainty assessment of activity data (AD) and EFs, sensitivity analysis, Key Category Analyses (KCA) and methods for filling data gaps.

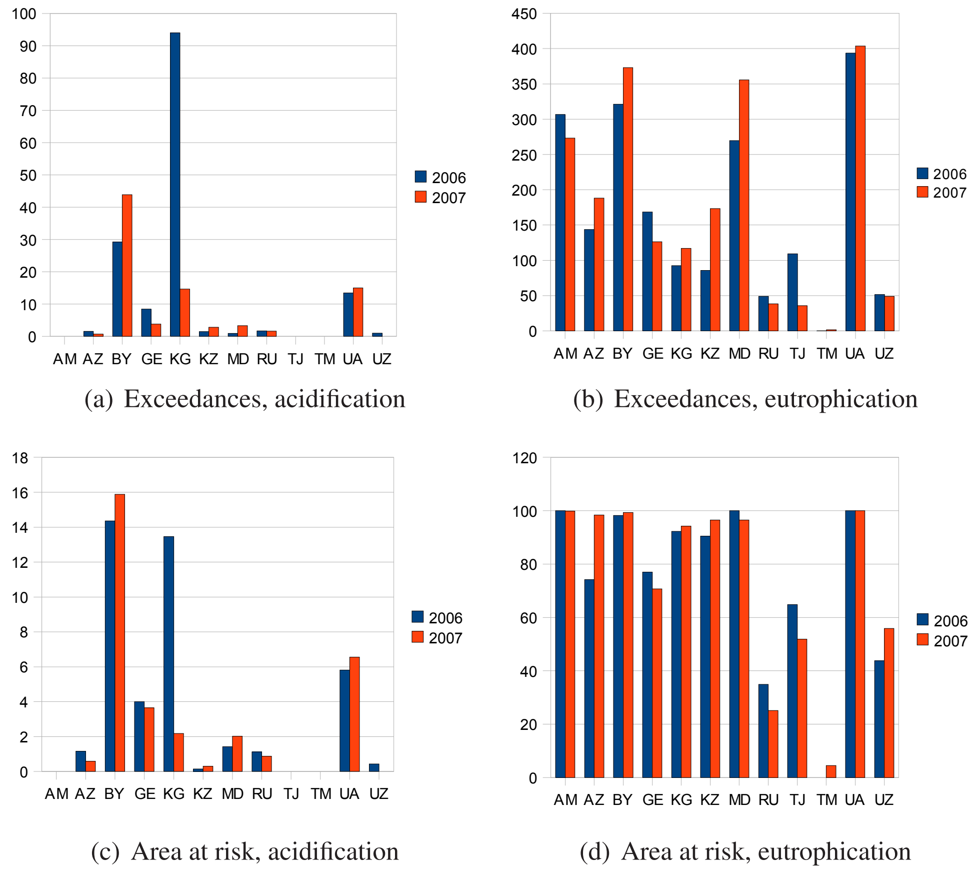
## 3.2 Status and progress regarding measurements

Russia and Belarus are the only EECCA countries that have had regular monitoring in EMEP for several years. However, the measurement program is far from complete. At the four Russian sites that reported data for 2007, only one site has air measurements in addition to precipitation, and none of them measure ozone or particulate matter. The one site in Belarus has only measurements of main components in precipitation. The last couple of years, EMEP level 1 sites have been established in Kazakhstan, Moldova, Armenia and Georgia with support from the Norwegian Ministry of Foreign Affairs and from the UNECE project CAPACT (`http://www.unece.org/energy/capact/`). Furthermore, Ukraine has for several years planned to establish a site as a contribution in kind to UNECE. There are also sites established that are not formally connected to EMEP, e.g. there is one site established in Kyrgyzstan (Teplokluchenka) measuring aerosol properties with support from the Atmospheric Brown Cloud (ABC) programme (Ramanathan and Crutzen (2003)). The Tiksi site in the Russian Arctic is being reestablished with an extensive measurement program in cooperation with research groups in Finland and Canada and the AMAP (Arctic Monitoring and Assessment) programme. Presently very little data has been reported to CCC from these new sites. Some preliminary results from Moldova, Georgia and Armenia have been submitted, and it is expected that these three sites will report 2008 data at the official reporting deadline 31th of July 2009. For Kazakhstan the measurement at the EMEP site at Borovoye did not start as planned in autumn 2007 due to various practical and financial problems. CCC revisited the site and laboratory in spring 2009 for further training and necessary reparations and calibrations, thus the measurements are now up and running. It is evident that further training in especially laboratory practice is needed for those new EMEP sites to improve the data quality and reporting. CCC will therefore conduct a training course especially devoted to these laboratories during the winter 2009/2010.

The UNECE Working Group on Environmental Monitoring and Assessment (WGEMA) has developed a guideline for developing national strategies for air quality monitoring (ECE/CEP/AC.10/2009/6). This includes all the different levels of air quality monitoring needed - urban, rural and global (i.e. EU, EMEP, WMO and WHO guidelines), though a special focus is on urban monitoring. To ensure that the national monitoring networks are cost efficient and scientifically sound, it is important to see this WGEMA guideline together with the new EMEP strategy for 2010-2019 since these complement each other.

## 3.3 Modelled pollution levels in EECCA countries

For the first time this year, pollution levels for all the countries, including the 4 new countries in EECCA (Kyrgyzstan or the Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan), are calculated in one consistent model run. The model version and




(a) Exceedances, acidification

(b) Exceedances, eutrophication

(c) Area at risk, acidification

(d) Area at risk, eutrophication

Figure 3.1: Exceedances of critical loads [eq $h^{-1}$ $yr^{-1}$] and percentage of ecosystem areas at risk [%] in 2006 and 2007 in EECCA countries.

meteorological driver is thus the same as described in Chapter 2, and modelled concentrations and depositions for the full (extended) model domain are presented there.

There are still large uncertainties associated to the model results in EECCA countries, primarily because of the emission data. Especially for those countries and areas which were first included in the modelling last year, there is very little background information available on emission sources.

The calculated exceedances of critical loads and the percentage of ecosystem areas at risk in 2006 and 2007 for EECCA countries are presented in Figure 3.1. The 2006 results are the ones presented last year in Tarrasón et al. (2008). Map plots of exceedances and areas at risk for 2007 are presented in Figure 2.12 in Chapter 2. The calculations of exceedances for EECCA countries are based on non-official critical load data from CCE's background database (Reinds et al. 2008) for both years.

The model results for both 2006 and 2007 indicate that acidification in the EECCA countries is a problem only in identified hot spots in the vicinity of large power emissions, while eutrophication is a widespread problem and considerable exceedances are estimated for the critical loads of eutrophication in this area.

As indicated in Figure 3.1, for most EECCA countries the calculated exceedances do not vary much between 2006 and 2007. An exception is Kyrgyzstan, where exceedances of critical loads and the percentage of area at risk of acidification decrease significantly from 2006 to 2007. It was discussed in Section 2.2.3 that estimated emission totals in Kyrgyzstan and its neighbouring countries are kept basically unchanged from 2006 to 2007, while the spatial distribution of emissions has been improved by regridding with available proxy data. It is primarily the new spatial distribution that led to the above change in the calculated exceedances for Kyrgyzstan. This illustrates the importance of the improvements in emission data inventories for the EECCA countries in order to decrease uncertainties in modelled pollution levels in this area. In lack of observational data from EECCA countries it is also difficult to evaluate the performance of the EMEP model in the extended domain.

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Tarrasón, L., Fagerli, H., Gauss, M., Nyíri, A., Simpson, D., Tsyro, S., and Aas, W.: S, N and O3 in EECCA countries, in Transboundary Acidification, Eutrophication and Ground Level Ozone in Europe in 2006. EMEP Status Report 1/2008, pp. 67–86, The Norwegian Meteorological Institute, Oslo, Norway, 2008.

# Part II

# Source receptor matrices

# CHAPTER 4

## Trends in source allocation of pollutants

**Valiyaveetil S. Semeena, Ágnes Nyíri, Alvaro Valdebenito, David Simpson and Hilde Fagerli**

EMEP has been calculating source-receptor (SR) matrices almost since its inception with the Lagrangian model. An investigation of SR matrices from the Unified Eulerian model was conducted by Wind et al. (2004). Source-receptor runs were carried out to study the trends in source allocation of pollutants and transboundary fluxes for the period 1996-2000 (van Loon et al. 2005) as part of the EU CAFE-BASELINE project (Amann et al. 2004). van Loon et al. (2005) used the projected emission of CLE2010 for their study of the entire period 1996-2000. The effect of meteorology for source allocation of pollutants was the main aim of that study and it was found that transboundary contributions depended on the pollutant considered. Interannual variability was found to be 10-20%, which implied that meteorological variability cannot be neglected in integrated assessment modelling.

This chapter discusses the trends carried out for ten meteorological years, 1997 to 2006, using the emissions of corresponding years. An overview of the average indigenous and transboundary fluxes, the trends in deposition versus emission and the meteorological variability in deposition of nitrogen and sulphur compounds are analysed here.

This study will provide information about the trends in source allocation of pollutants, as well as insight into the trends in the ratio of deposition to emissions for different pollutants. Information about the transboundary contribution of pollutants is very important in the context of reduction in emissions, so special effort is made in this study to understand this transboundary versus indigenous contribution of pollutants and their interannual variability.

## 4.1 Introduction and methodology

Source-receptor matrices give the change in various pollution levels in each receptor country resulting from a change in anthropogenic emissions from each emitter country. These matrices are generated by reducing the emissions for each emitter of one or more precursors by a given percentage. A 15% reduction is assumed in this study. The resulting output fields are then compared with the base simulation, i.e., a simulation without any emission reduction. The 15% reduction is sufficient to give a clear signal, but small enough that the chemical conditions are kept as close to the base-case as possible, as seen in Wind et al. (2004). This study also showed that the consequences of an emission change around 15% by several countries can be obtained by simply adding the changes caused by the individual countries. The differences due to the effect of nonlinear chemical climate are very small and can be neglected at this level.

SR calculations presented here involve changes in emissions of $\mathrm{SO_x}$, $\mathrm{NH_3}$, $\mathrm{NMVOC}$, $\mathrm{NO_x}$ and $\mathrm{PPM}$. Since the emitted substances undergo chemical reactions when released to the atmosphere, SR matrices are in principal required for each pollutant separately. Since primary particulate matter (PPM) are assumed chemically inert, they will not interact with any of the other components in the model, thus the effect of reduction in emissions of PPM can be computed together with a change in the emissions of any of the other pollutants. The number of simulations per emitter country is then four. For one set of SR matrices (i.e., one meteorological year and set of emissions for Europe) more than 200 different simulations are needed (four set of pollutants per emitter country for 53 countries plus the 5 seas, and natural marine emissions, volcanic sources and boundary and initial components). For this report ten such SR sets have been produced for the years 1997 to 2006 with emissions of respective years. On the fastest available platform, each simulation takes between 6 and 7 hours using 32 processors.

For all the computations discussed in this chapter, model version rv3.1 was used. PARLAM-PS (Parallel version of HIRLAM) meteorology with $50\times50$ km$^2$ horizontal resolution and 20 terrain following levels in sigma coordinate is used as the meteorological driver for all the years. The PARLAM-PS meteorological data are archived over many years and are carefully checked and documented (Benedictow 2003).

An analysis of the general trend of depositions of oxidised sulphur, oxidised nitrogen and reduced nitrogen for these 10 years are explained in the section 4.3. Transboundary contribution to each country is analysed in section 4.3.1. The chapter is concluded with main findings of this study.

## 4.2 Emissions used in SR trend runs

The emission data used for the SR runs which are discussed in this chapter are somewhat different to those which were applied for modelling in previous years. A consistent emission data set was produced for the period of 1997-2005, which combined

EMEP expert estimates for national and sector total emissions with a common spatial ($50\times50$ km$^2$ ) distribution from the 2005 emission database. The latter was chosen as the spatial allocation data for 2005 are based on more reliable and more complete proxy data than those available in previous years. 2006 emissions were not re-gridded, as the spatial distribution of the official gridded data for 2006 is the same as that of 2005 over most of the EMEP domain, except for a few countries (Tarrasón et al. (2008)).

Beside regridding of emissions, a few more modifications were also necessary. The first year when emission data were given separately for Serbia and Montenegro as independent countries was in 2005. In order to study the trends of SR relationships for these two countries, we allocated emissions separately to both of them for the years previous to 2005 by sharing the emissions given for Serbia-Montenegro between the two countries in the same ratio as in 2005.

Until the year 2000, particulate matter (PM) emissions were not included in the EMEP emission database. Emissions of fine and coarse particulate matter were thus estimated for this SR trend study. We have derived $\mathrm{PM}_{2.5}$ and $\mathrm{PM}_{\mathrm{coarse}}$ emissions for the years 1997-1999 for each country based on the available emission data for other pollutants. For each country we used the 2005 emissions to calculate the ratio of $\mathrm{SO}_{\mathrm{x}}$ and $\mathrm{PM}_{2.5}$ emissions from SNAP sector S1, the ratios of $\mathrm{NO}_{\mathrm{x}}$ and $\mathrm{PM}_{2.5}$ emissions from sectors S2-S9, and the ratio of $\mathrm{NH}_3$ and $\mathrm{PM}_{2.5}$ emissions from SNAP sector S10. In addition, the ratios of $\mathrm{PM}_{2.5}$ and $\mathrm{PM}_{10}$ emissions were calculated in each sector. These ratios together with the sectoral emission data for the other pollutants, such as $\mathrm{SO}_{\mathrm{x}}$ from S1, $\mathrm{NO}_{\mathrm{x}}$ from S2-S9 and $\mathrm{NH}_3$ from S10, were used to estimate the unavailable emissions of fine and coarse particulate matter.

The most restrictive assumption in the above described method is that the relative magnitudes of sectoral emissions of PM and the three main pollutants which are used in the estimation are the same in years 1997-1999 as in 2005. This approach might not be correct for each country, hence results for particulate matter SR relationships in 1997-1999 should be treated with caution. As mentioned before, primary particles are assumed inert and they do not interact with any other components in the model. Therefore, SR relationships for other components than PM will not be influenced by this assumption.

Similar methods were used to allocate PM emissions in the Asian areas (ASI) and North Africa (NOA), where emission estimates of particulate matter were not available for any years. Therefore, we applied the ratios calculated for the Russian Federation in the estimation of PM emissions from ASI and NOA.

Overview tables of the annual national emissions used for the SR trend studies are presented in Appendix A. Normally, the national total emissions do not vary much between adjoining years. However, there were significant changes in official estimates of national emissions for some countries between 2005 and 2006, which are also reflected in the SR trend results. The most significant differences were pointed out and explained in Tarrasón et al. (2008).

The first year for which emission data were compiled under the responsibility of the EMEP Centre on Emission Inventories and Projections (CEIP) was 2006. For previous years the reported emission data from EECCA and South-Eastern European countries went through several replacements based on estimates in Cofala et al. (2006) which in many cases led to changes in national totals (Tarrasón et al. 2007). Such replacements were not applied for the 2006 reported data. For that year CEIP only gap-filled sector data where reported emissions were incomplete.

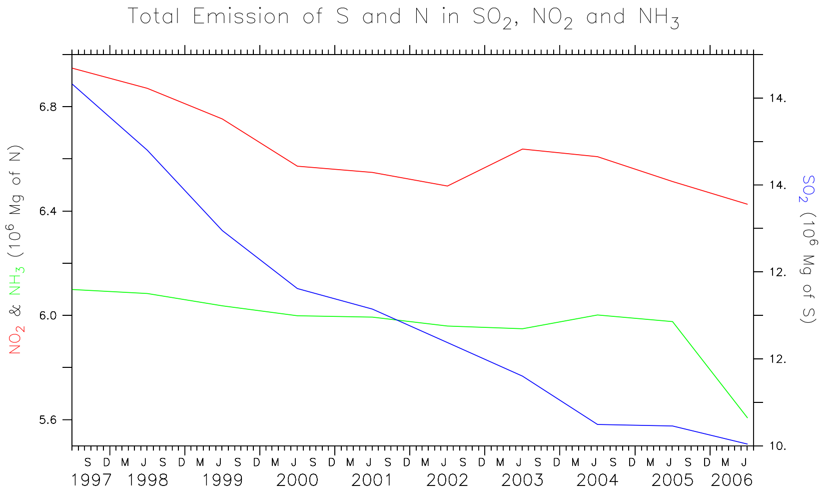
Emissions from international ship traffic are not included in the officially reported data. Prior to 2006 these were estimated using ENTEC ship emission data for 2000 with an increase of approximately 2.5% every year for each pollutant over each sea area (Cofala et al. 2007). For 2006, however, a linear interpolation with ENTEC estimates for 2010 was applied in order to derive the emissions for shipping. For the Baltic Sea and North Sea this resulted in 8% lower emission levels for $SO_x$ in 2006 than in 2005. For the North-East Atlantic Ocean, Mediterranean Sea and Black Sea $SO_x$ emissions increased from 2005 to 2006, but with lower percentage than in previous years. Also $NO_x$ and $PM$ emission estimates increased less from 2005 to 2006 than previously.

## 4.3 Trends in source allocation of pollutants

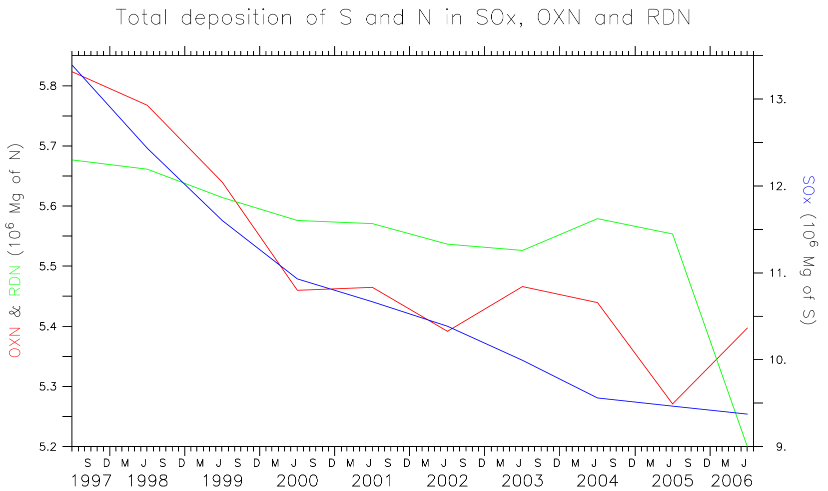
In this section an analysis of the trends in deposition of oxidised sulphur ($SO_x$), oxidised nitrogen (OXN) and reduced nitrogen (RDN) for individual countries are given with respect to the emissions. Since the PM emission data is not consistent over the years, such an exercise for PMs is not considered in this section.

Reported upward trends in emissions were mostly in Eastern European countries. Austria ($NO_x$), Portugal and Spain (both $NH_3$) were the only ones in Western Europe. There is a large reduction in emission of $SO_x$, $NO_x$ and $NH_3$ from the largest emitters in the western Europe: France, Germany, Italy and United Kingdom. The largest percentage reduction in $SO_x$ emissions is in Latvia (92%). For Georgia there is a 123% increase in $SO_x$ emission in the year 2006 compared to 1997. The largest reduction (52%) in reported $NH_3$ emissions has taken place in Ukraine (see table in Appendix A), although this may be due to the discrepancy in the reported emission data (see section 4.2). In general, whilst the land emissions have been reduced considerably, the sea emissions increased with $\sim 20\%$ (see section 4.2).

In general, the total emission of $SO_x$ from Europe has decreased by 28%, $NO_x$ by 7.5% and $NH_3$ by 8% (Figure 4.1) from 1997 to 2006. On a global scale, emission and deposition changes should balance one another, but due to non-linearities (e.g. Fagerli and Aas 2008) or due to transboundary contributions, this often is not the case for individual countries. One might expect this notion to be most valid for large countries with large emissions and low emitting neighbouring countries. Similarly, smaller countries with lower emissions can have direct or opposite relations for deposition to emissions, depending on their neighbours as well as the meteorological conditions. The steep reduction in deposition of RDN from 2005 to 2006 (Figure 4.1) is a reflection of $NH_3$ emission reduction mainly from Ukraine in this period (see table in Appendix A), which can be due to the discrepancy in the reported emission data (see section 4.2).




(a) Total Emission




(b) Total Deposition

Figure 4.1: Total (a) Emissions of $SO_2$, $NO_2$, $NH_3$ and (b) Depositions of $SO_x$, OXN and RDN for the whole of Europe for the period 1997-2006. The left axis is for $NO_2$ (OXN), $NH_3$ (RDN) and the right axis is for $SO_2$ ($SO_x$) respectively in both (a) and (b).

The ratios of total deposition to total emissions for $SO_x$, OXN and RDN of the respective years for each country/area are shown in Figures 4.2–4.4. The slope of the curves are calculated in order to illustrate trends. Slopes close to zero indicate that deposition trends generally follow emissions. A positive value for the slope indicates that deposition is increasing relative to emissions. This can happen for several reasons: (a) deposition is increasing while emission remains about the same, (b) deposition remains constant when emission decreases, or in an extreme case, (c) deposition increases while emission are reduced. A negative slope indicates the converse effects.

In order to illustrate some characteristics of these trends, we present more detailed

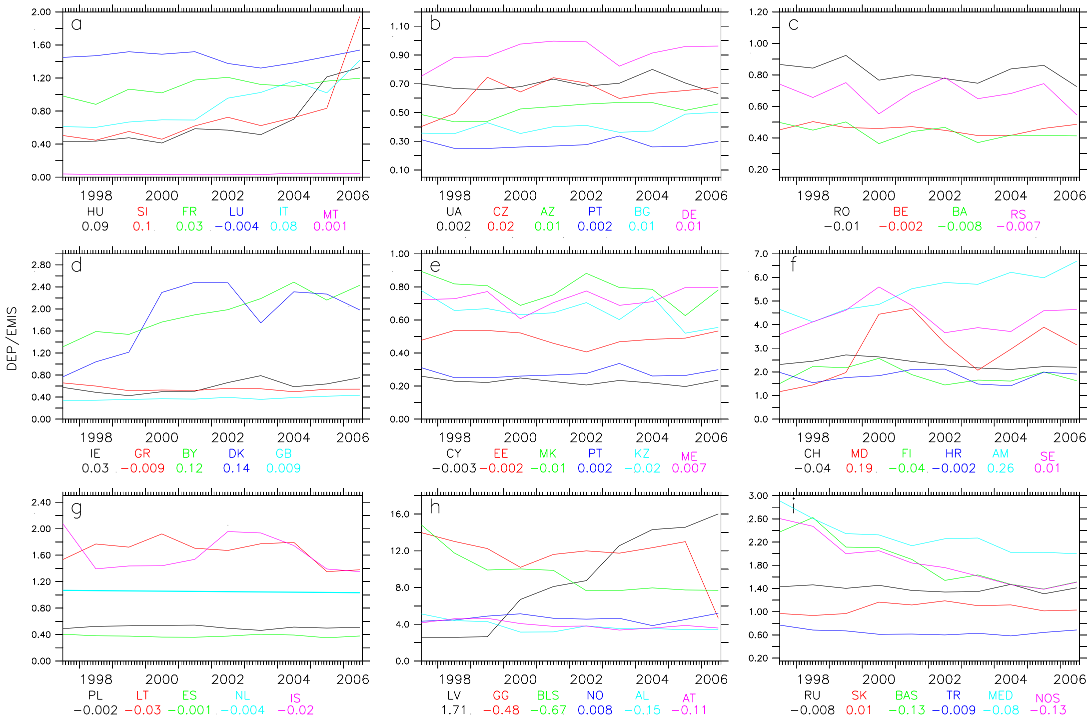



Figure 4.2: Ratio of $SO_x$ depositions to emissions for each country/area for the period 1997-2006. The ratios are on Y-axis and years on X-axis. Countries with similar trends are grouped together and those with negligible trend (i.e.,having deposition to emission trend close to zero) are not shown in the figure. The numbers under the country codes give the slopes of the curves.

data for a selection of countries/areas. Figures 4.5–4.7 show the five major contributors to the deposition of $SO_x$, OXN, and RDN into those countries/areas for the 10 years. The total contribution from the rest of the countries/areas together (represented as ’others’) are also shown.

The slope of deposition to emission ratio of $SO_x$ for most of the countries/areas are very weak (Figure 4.2), which means that the trends are more or less flat, but with some interannual variabilities. The weakness of the slopes is likely due to the meteorological variability since emissions are in general decreasing. Large negative slopes are seen for all seas considered. The reason for this is the large reduction in emission from the land sources, since those were the main contributors to deposition in the earlier years. Thus even though the emission from international ship traffic is increased over the years, it is not yet reflected in the deposition pattern. A steep increase in deposition to emission ratio is calculated for the countries Armenia (Figure 4.2f, AM), Belarus (Figure 4.2d, BY), Denmark (Figure 4.2d, DK), and Latvia (Figure 4.2h, LV). For all of these countries case (b) applies, the deposition remained more or less constant, while national emissions were decreasing. This implies that the transboundary contribution to deposition of $SO_x$ to all these countries have not changed much over the years.

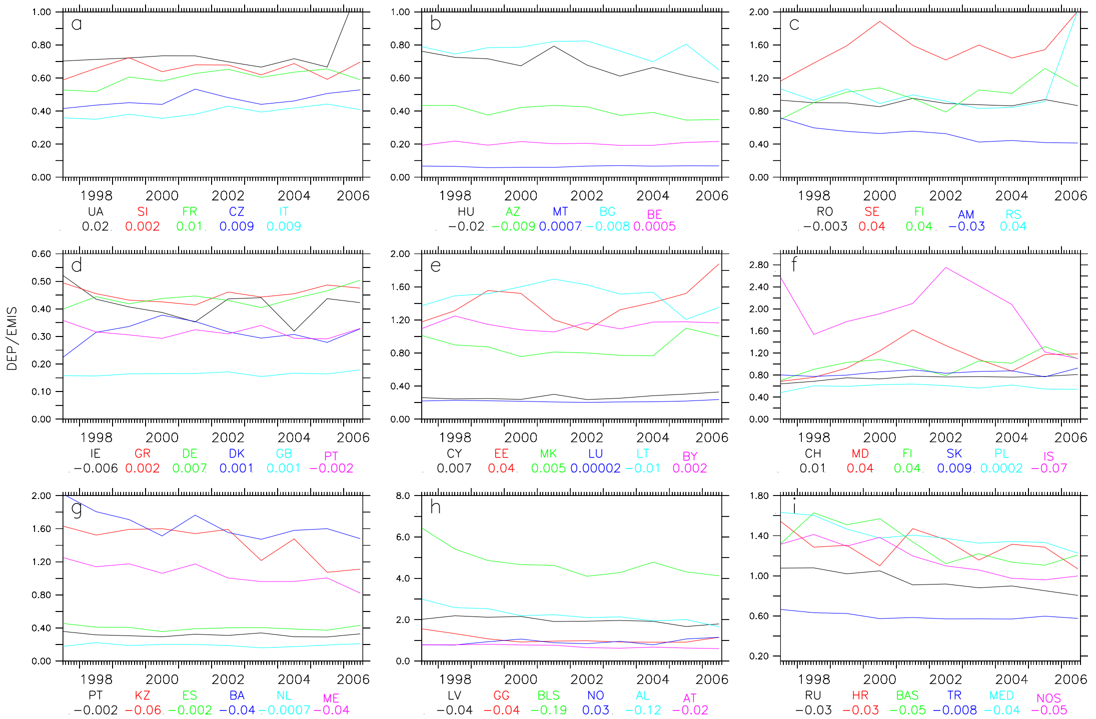



Figure 4.3: Ratio of OXN depositions to emissions for each country/area for the period 1997-2006. The ratios are on Y-axis and years on X-axis. Countries with similar trends are grouped together and those with negligible trend (i.e., having deposition to emission trend close to zero) are not shown in the figure. The numbers under the country codes give the slopes of the curves.

For example in case of Latvia, where the slope of emission/deposition for $SO_x$ is the steepest positive (Figure 4.2h, LV), national emissions have been reduced by 92% in 2006 compared to 1997, but the deposition from the five major contributors remain approximately at the same level as in 1999 (Figure 4.5c).

As another example, the steepest negative slopes are seen for the Baltic Sea (Figure 4.2h, BAS) and the Black Sea (Figure 4.2i, BLS) (the same value for North Sea also). The main contributors to $SO_x$ deposition over the Baltic Sea were Poland, Germany, the United Kingdom and Russia in the earlier years and these countries have reduced their emission considerably over time (Figure 4.5e). The deposition contribution from these countries have reduced over time due to emissions reduction, but deposition from ship traffic has increased. However the contribution to deposition from increased ship traffic is not larger than or equal to the land contribution of earlier years. Thus the total deposition to the Baltic Sea does not increase. Similarly for the Black Sea, where the largest contributors to $SO_x$ deposition are always land emitters (Figure 4.5f). The five major contributors to deposition of $SO_x$ over Black Sea are Ukraine, Turkey, Bulgaria, Romania and Russia. Thus, even though the increase in emission of $SO_x$ from the Black Sea is 23% over the years, the absolute values are

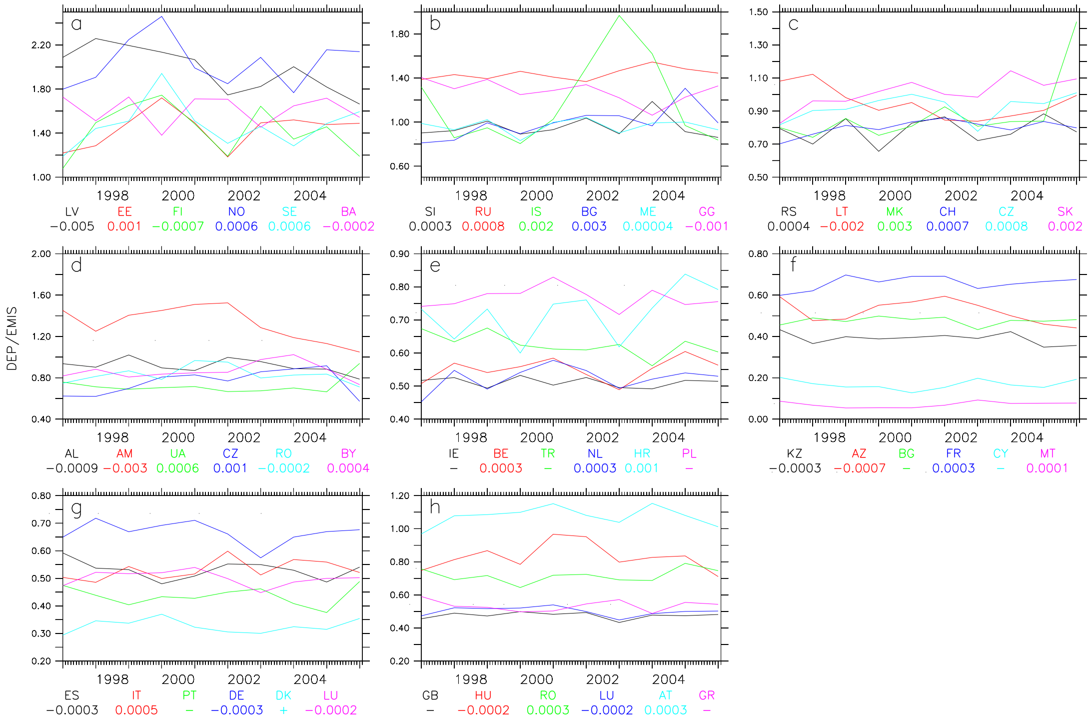
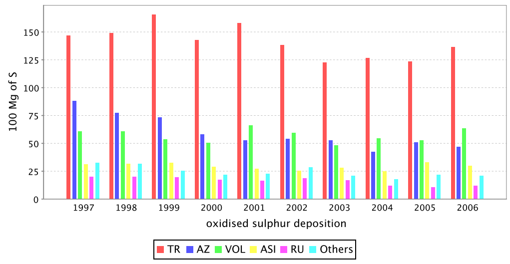


Figure 4.4: Ratio of RDN depositions to emissions for each country for the period 1997-2006. The ratios are on Y-axis and years on X-axis. Countries with similar trends are grouped together and those with negligible trend (i.e., having deposition to emission trend close to zero), and seas (no emissions of $NH_3$) are not shown in the figure. The numbers under the country codes give the slopes of the curves.

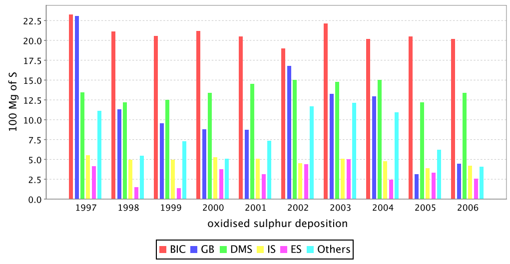
negligible compared to the neighbouring land emitters or other seas and as a result the total deposition to the Black Sea remains almost unchanged.

For the largest emitters like Bulgaria, France, Germany, Italy, Poland, Russian Federation, Spain, Turkey, Ukraine and United Kingdom, the major contribution to deposition is from the country itself (e.g. Figure 4.5d for UK). The import into Great Britain remains almost on the same level throughout the simulated period and thus the ratio between indigenous to transboundary contribution gets larger for the latest years of simulation and this is reflected in the deposition to emission ratio of the country (see Figure 4.2d, GB). For smaller countries like Armenia and Georgia, more than 99% of the deposition is transboundary contribution (see e.g., Figure 4.5a for Georgia).

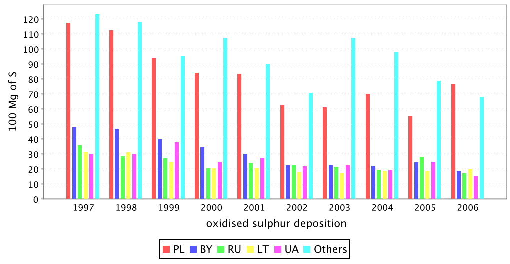
Figure 4.3 shows that the slopes of deposition to emission ratio of OXN are more or less flat but with some interannual variabilities similar to $SO_x$: i.e., the trends in deposition of OXN into most of the countries to a large extend follow the emission trends. Except for Portugal (Figure 4.3d, PT), Ireland (Figure 4.3d, IE), Iceland (Figure 4.3f, IS) and Austria (Figure 4.3h, AT), all other countries with negative slope values are Eastern European countries and the seas. Model results showed that for all these countries except for Russia, Turkey and Ukraine, more than 70% of the deposi-



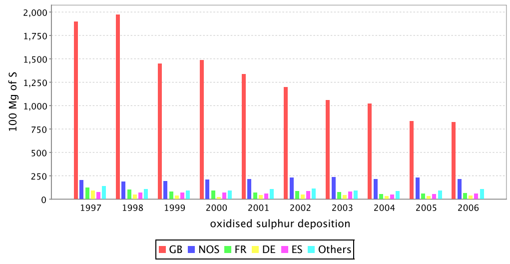

(a) GE



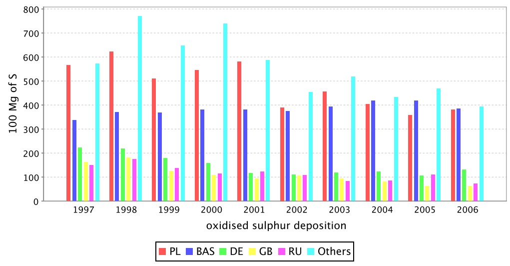

(b) IS



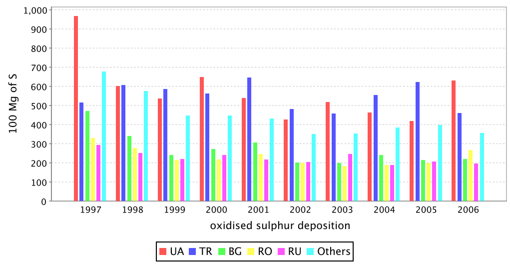

(c) LV




(d) GB




(e) BAS



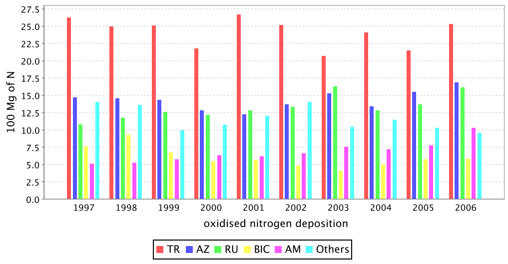

(f) BLS

Figure 4.5: Contribution of deposition of $\mathrm{SO_x}$ into the countries/areas Georgia, Iceland, Latvia, United Kingdom, Baltic Sea and the Black Sea. The five major contributors to deposition into each country plus the contribution from rest of the countries together (represented as 'others') for the period 1997-2006 are shown.

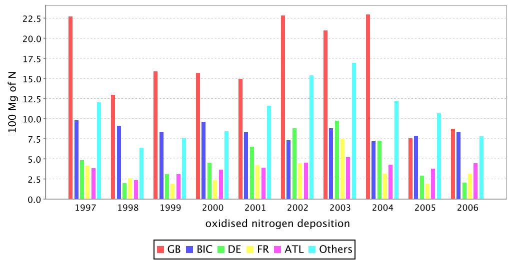
tion contribution is from transboundary fluxes.

For all sea-areas, the slopes of deposition to emission ratio of OXN are smaller compared to those of $\mathrm{SO_x}$. This reflects smaller difference in reduction of $\mathrm{NO_x}$ emissions: the major contributors to total deposition over seas are land sources which have decreasing emissions, but these are balanced by increases in $\mathrm{NO_x}$ emissions from the ship traffic. Thus, there is no clear increase in the deposition to emission ratio of OXN.

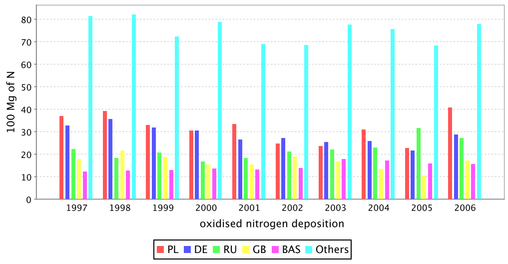
The ammonia emissions can have a negative impact on the deposition of OXN. Ammonia and $\mathrm{HNO_3}$ forms ammonium nitrate in an equilibrium reaction. $\mathrm{HNO_3}$ dry deposits much faster than ammonium nitrate. Thus, an increase in ammonia emissions will give less national depositions of OXN but subsequently more long range transport. Similar to $\mathrm{SO_x}$, the OXN deposited into all seas originates mostly from land sources and since these have been reduced considerably over the years, the increase in ship



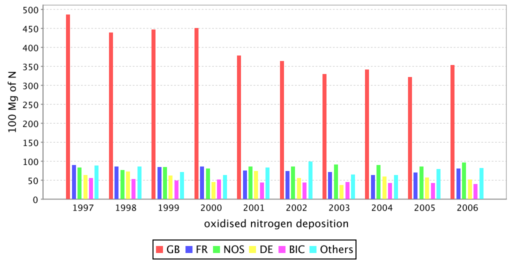

(a) GE



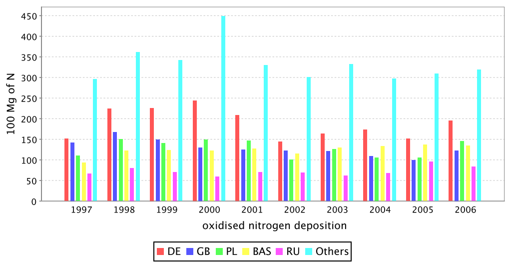

(b) IS



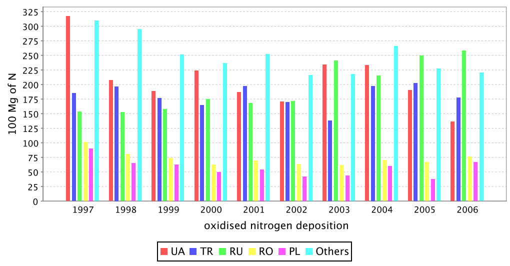

(c) LV




(d) GB




(e) BAS



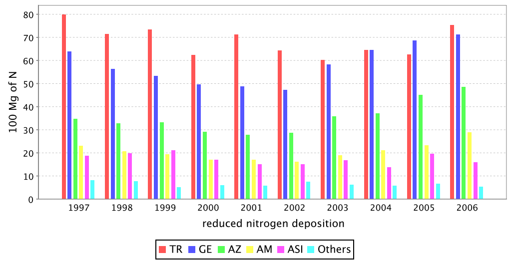

(f) BLS

Figure 4.6: Contribution of deposition of OXN into the countries/areas Georgia, Iceland, Latvia, United Kingdom, Baltic Sea and the Black Sea. The five major contributors to deposition into each country plus the contribution from rest of the countries together (represented as ’others’) for the period 1997-2006 are shown.

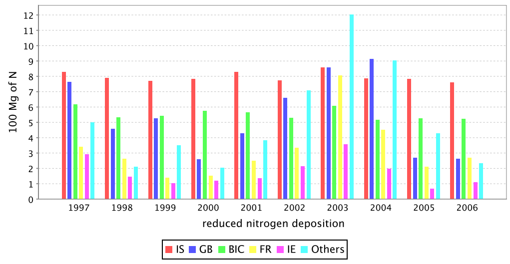
emissions have not lead to an increase in deposition over sea areas.

Similar to $SO_x$, major part of OXN deposited into the largest emitters are from the country itself (see Figure 4.6d for GB), while smaller countries with lower emissions import a lot of OXN. For example, Georgia imports more than 99% of its OXN deposition and Russia is one of the largest contributors to OXN deposition in Georgia (Figure 4.6b). This shows the long range transport potential of OXN under favourable meteorological conditions. Similar to Georgia, Iceland is also receiving more than 99% of its OXN deposition via transboundary contributions (Figure 4.6b) while it has a major indigenous contribution of $SO_x$ deposition (Figure 4.5b).

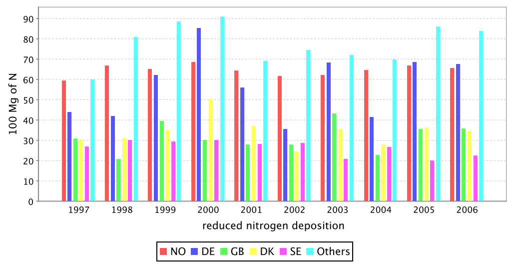
RDN depositions show a more or less flat trend in deposition to emission for almost all the countries (Figure 4.4). Much larger interannual variability in deposition is calculated for smaller countries with low emission compared to larger countries with



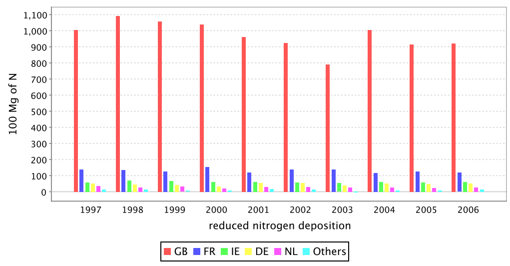

(a) GE



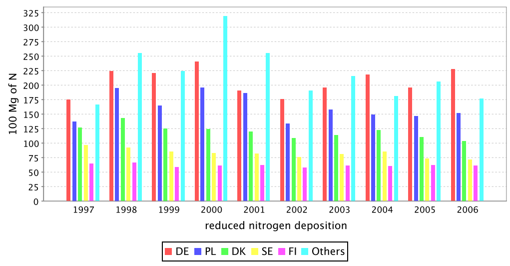

(b) IS



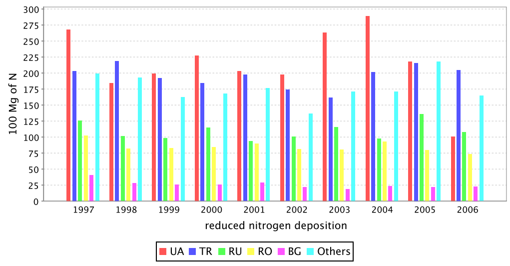

(c) NO




(d) GB




(e) BAS




(f) BLS

Figure 4.7: Contribution of deposition of RDN into the countries/areas Georgia, Iceland, Norway, United Kingdom, Baltic Sea and the Black Sea. The five major contributors to deposition into each country plus the contribution from rest of the countries together (represented as 'others') for the period 1997-2006 are shown.

comparatively higher emissions. The sea areas are 100% receptors for RDN and hence are not shown in the figure. Figure 4.4 shows that the trends are rather weak. An overall picture is that the long range transport potential of RDN is much smaller compared to that of OXN or $SO_x$ and hence the indigenous contribution is considerably larger or even dominating over transboundary contributions even in the case of small or remote countries, like Armenia, Latvia, Georgia, Iceland, and the Scandinavian countries (Figure 4.7a, b and c for Georgia, Iceland and Norway). This is because RDN results from $NH_3$ emissions and $NH_3$ has a shorter life time compared to $NO_x$ and $SO_x$, with rapid dry deposition close to sources.

### 4.3.1 Transboundary versus indigenous contributions

Figure 4.8 shows the transboundary contributions to all receptor areas for a number of pollutants expressed as percent of the total computed contributions (which we will denote FTB = fraction of trans-boundary). The countries are sorted in ascending order of FTB. Only yearly averages are considered here, but variations on shorter time scales (e.g. monthly) can of course be larger. There are large differences in the FTB for the different compounds. Compounds with long life time (e.g. particulates) have large transport potential and hence can have larger transboundary contributions than compounds with short life time. Precursors (e.g. $NO_x$) with low deposition velocities might in some circumstances have greater transboundary contributions than species (e.g. $SO_2$) with high deposition rates, although such tendencies depend heavily on the oxidation rates and fates of secondary compounds (e.g. on whether $NO_x$ is transformed to fine particles or $HNO_3$).

As discussed in the beginning of this chapter, there is a general relationship between the size of the country and the size of the transboundary contributions. The location of the country and the source strength are the other factors that can influence the transboundary contributions. The latter is obvious: as an extreme case, if a country is not emitting at all, all pollution will be transboundary, regardless the size of this country. This is clearly visible in the case of Georgia (Figure 4.5a). A small country with comparatively low emissions (6 Gg $SO_x$ in 1997- 14 Gg $SO_x$ in 2006), more than 99% of the $SO_x$ deposited into Georgia is from transboundary sources. The location of a country also plays role. A country that has no direct emitting neighbours will have a lower transboundary share than a country of the same size and with similar emission strengths that has direct emitting neighbours. Also the meteorological conditions influence the ratio between indigenous and transboundary contributions. For instance, on the Iberian peninsula, flow patterns often occur that cause the pollution to circulate in the area. This explains for example, why Spain has relatively low transboundary contributions.

In general the variability in transboundary fluxes for all countries is around 10-30% for the period 1997-2006. These values are larger than those found by van Loon et al. (2005). However, the interannual variability results from meteorological variability, emission changes and also chemical climate (e.g. life time of the pollutants). van Loon et al. (2005) considered constant emissions for the entire period of their simulations, so their calculated variability is smaller than in our study.

Different pollutants show different levels of variability in Fig. 4.8. Since all these pollutants are subject to the same meteorological conditions, other factors must control the difference between pollutants, namely the variability in their emissions and in their chemical properties and life time. The largest interannual variability is found for $SO_x$. The large reduction in $SO_x$ emissions is the main reason for larger interannual variability in transboundary contribution of deposition of $SO_x$ to each country. $PPM_{2.5}$ shows interannual variability as large as $SO_x$. But $PPM_{2.5}$ results have to be treated with caution, due to the adjustments made with emission data, however the longer life time

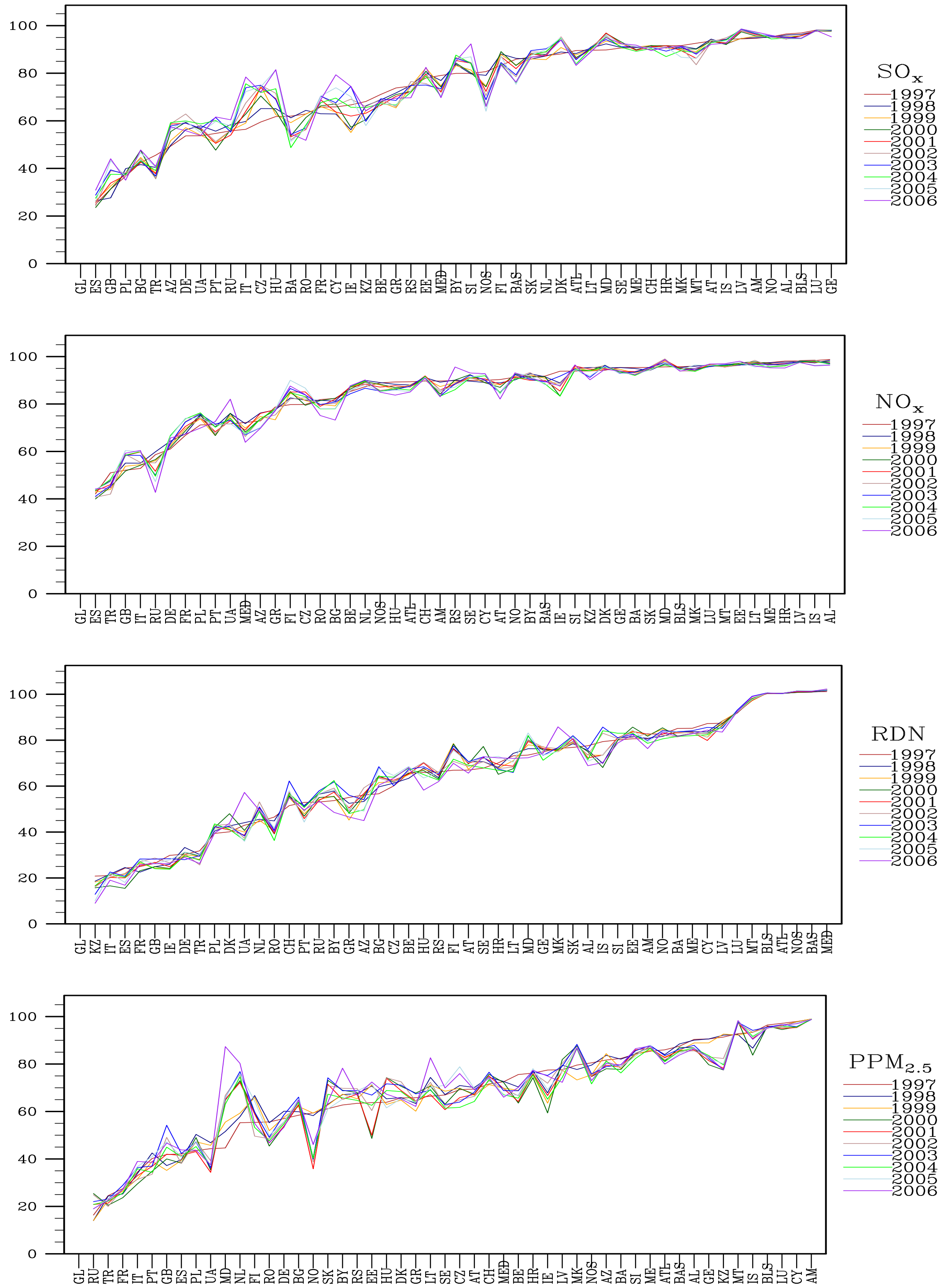
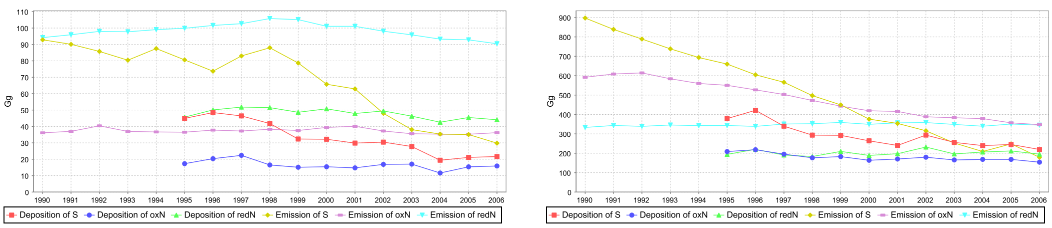



Figure 4.8: Transboundary contributions to deposition for $SO_x$, OXN, RDN, and $PPM_{2.5}$ to each country expressed as percent of the total calculated contributions. Data shown for the years 1997-2006.

of $PPM_{2.5}$ is a factor promoting larger variability. OXN shows the least interannual variability. This can be primarily due to much smaller emission reductions of $NO_x$ and secondarily due to its chemical properties and life time. Once emitted, it takes time to transform into $HNO_3$ and within this period, in the absence of rain they can be transported to longer distances. $HNO_3$ dry deposits much faster and then precipitation does not have large role in deposition. Hence, in the case of OXN, the weaker emission reductions in $NO_x$ could have been the main reason for smaller interannual variabilities. The reduced lifetime of RDN together with the weak emission reductions of $NH_3$ explains the reason for comparatively smaller interannual variabilities in transboundary contribution of depositions.

Generally larger countries or densely populated countries or countries with less emission regulations lies on the lower end of the transboundary contribution to deposition Figure 4.8, which means the indigenous contribution is dominating in case of these countries. Changes in emissions of individual countries are reflected in the indigenous contributions of these countries, but not in deposition totals to each country (Figures 4.5–4.7).

The main reason why no large interannual variations in the transboundary contributions are observed is that most countries have upwind neighbours in many wind directions, though with different emission densities. Interannual variations in flow patterns will therefore not lead to major changes in the transboundary contributions. The largest variability between the years was calculated for Cyprus, Ireland, Italy and Hungary in the case of $SO_x$ deposition. This variability is likely a reflection of emission trends as similar variability is not seen for nitrogen compounds or PPMs where the emission reduction are not as strong as in the case of $SO_x$ (Figure 4.9a and Figure 4.9b for Ireland and Italy). The Republic of Moldova has about 40% variability between the years 1997 and 2006 for the deposition of $PPM_{2.5}$ and it is seen that the year 2006 is contributing highly to this larger percentage in variability. Considering only the years 1997-2005, the variability in transboundary fluxes of $PPM_{2.5}$ deposition into Moldova is within the range of 20%. Generally the year 2006 shows an anomalous behaviour compared to other years in case of all components and this likely originates from the emission data (see the discrepancies in emission data for the year 2006 in section 4.2).




(a) IE (b) IT

Figure 4.9: Emissions and Depositions of $SO_x$, oxidised and reduced nitrogen for Ireland and Italy for the period 1990-2006

## 4.4 SR results for the Appendix

SR matrices for the year 2007 is given in Appendix C. For each country, reductions in five different pollutants have been calculated separately with an emission reduction of 15% for $SO_x$, $NO_x$, $NH_3$, and $PPMs$. These tables should be read as receptors in columns and emitters in the rows. A more detailed explanation of the these tables are given in the introduction of the Appendix C. Similar tables for all meteorological years of 1997-2006 is available on the web (`www.emep.int`).

The deposition tables in the appendix show the results of these (15% reduced emission) model runs after scaling with a factor 100/15, giving the equivalent of 100% emissions. Although introducing small errors due to non-linearity (Wind et al. 2004), this procedure allows an estimate of the complete deposition budget over each country. The deposition tables can thus be interpreted as the contributions from one country to another, at least within the limitations discussed in Wind et al. (2004).

## 4.5 Conclusions

This study focused on the trends in emission and deposition of pollutants over Europe for the period 1997-2006. From the results presented in this chapter, the following conclusions are drawn:

- In general, over the whole of Europe, the trends in total deposition of $SO_x$, OXN and RDN follow the emission trend. However, due to transboundary contributions and some non-linearities, this is less true for individual countries. The main contributors to deposition of $SO_x$ for countries like Armenia, Belarus, Denmark and Latvia are transboundary fluxes. Even though these countries have reduced their emissions considerably over the years, the depositions resulting from the emissions of their largest contributors remain at an almost constant level, and thus the total deposition to these countries have not reduced much over the years. OXN deposition shows similar trends to those of $SO_x$, but with weaker signals (since the emission reductions for $NO_x$ are relatively small compared to those of $SO_x$). The deposition trends of RDN follow the emission in most cases. This is due to the faster deposition rate of RDN, which causes larger indigenous contributions to deposition and thus the country's own emission trends are reflected.

- The deposition of pollutants into more than 50% of the countries follow the emission trends. Smaller countries with relatively lower emissions receive more than 99% of their deposition via transboundary contributions in the case of $SO_x$ and OXN (e.g., Georgia, Armenia, Iceland etc.).

- The largest contributors to deposition of $SO_x$ and OXN over sea areas are land sources, which have had decreasing emissions over the years. However, $SO_x$ and $NO_x$ emissions (and hence depositions) from ship traffic have increased over the years. These two trend counterbalance each other to a large extent, and so the total deposition of $SO_x$ and OXN to sea areas has remained almost constant over these ten years.

- For most countries, indigenous ('own') deposition, together with deposition from the five largest transboundary contributors, makes up 90% or more of the total contribution. This is true for all pollutants considered.

- The interannual variations in pollutant levels is about 10-30% and the variability in transboundary contributions are larger for smaller countries. This is slightly higher than what was found by van Loon et al. (2005) (10-20%). This difference originates from the use of yearly varying emission data used in this study, whereas van Loon et al. (2005) used constant emissions throughout their 4 years period. Larger interannual variability in transboundary contributions to depositions were found for $SO_x$ compared to that of OXN or RDN. This is due to the larger emission reduction in case of $SO_x$ (28%) than those of $NO_x$ (7%) and $NH_3$ (8%) over the 10 years of this study).

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# CHAPTER 5

# Contributions from different emission sectors to depositions and air concentrations

**Jan Eiof Jonson, Svetlana Tsyro, Hilde Fagerli and Alvaro Valdebenito**

This chapter summarizes the analysis of the contributions from emissions in different sectors to the depositions and concentrations in countries within the (non extended) EMEP area for 2006. First, we present the contributions from the pan-European emissions in 10 anthropogenic SNAP sectors. Secondly, for a number of countries, we discuss the contributions from national emissions from defined sector groups.

All model calculations are carried out with the Unified EMEP model version rv3.1 in the official grid and using PARLAM-PS (Paralell version of HIRLAM) as the meteorological driver. It should be noted that the results below are based on 15% reductions in the emissions in the sectors. Because of non-linear effects in the chemistry larger (or smaller) perturbations in the emissions could, for some pollutants, result in different source-receptor relationships, potentially affecting the conclusions.

## 5.1 Contributions from different sectors on European scale

The contributions from emissions in different sectors to deposition or concentration in a country depend both on the distribution of emissions between different sectors within the country itself and its neighbouring countries. In a country where most of the deposition originates from sources inside the country, the contribution will resemble the distribution of emissions between sectors, whilst countries where transboundary air pollution dominates will be more affected by the sector distribution in the contributing countries. Furthermore, emissions in different sectors have somewhat different potentials to be transported over longer distances (see next section). Sector-specific calculations have been presented previously with the EMEP model (Simpson et al. 1999), including a rather detailed study of different road-traffic contributions (Reis et al. 2000), but here we focus on the transboundary contributions.

The contributions from each sector have been estimated by reducing 15% of the emissions in sector by sector for all countries at the same time (see Table 5.1 for an overview of the different sectors). Below we present the contributions from each emission sector relative to the total contribution from anthropogenic emissions.

Emissions from sectors 1, 2 and 3 are related to combustion processes and constitute the major contribution to $SO_x$ deposition for all countries. However, in the sea areas and countries with a coastline, $SO_x$ emissions in sector 8 contribute substantially (Figure 5.1 a), mainly because of ship traffic emissions. For instance, the contribution from sector 8 to deposition of $SO_x$ in Denmark is around 40% of the total contributions from anthropogenic emissions.

For oxidized nitrogen deposition, road traffic emissions (sector 7) play an important role. For most countries, emissions in sector 7 are the largest contributor to oxidized nitrogen deposition (Figure 5.1 b) with contributions ranging from 20% to 50%. However, in the sea areas and for many countries with coastlines (e.g. Denmark, Norway, Portugal and Iceland) sector 8 is as important as sector 7, mainly because of ship traffic emissions. Emissions from stationary combustion sources contribute around 20-40% of the total deposition of oxidized nitrogen from anthropogenic sources.

Agricultural emissions ($NH_3$, sector 10) give a slightly negative contribution to oxidized nitrogen deposition for some countries, and positive for others. Ammonia reacts with nitric acid to form aerosol ammonium nitrate which has a less efficient dry deposition and therefore a longer lifetime than nitric acid. Consequently, a decrease of ammonia in the country leads to less transport of oxidized nitrogen (as ammonium nitrate) out of the country and more deposition of oxidized nitrogen (as nitric acid) inside the country. Thus, the reduction of ammonia emissions leads to an increase of oxidized nitrogen deposition in the country-emitter. On the other hand, oxidized nitrogen deposition increases in the country affected by the transboundary pollution by ammonium nitrate.

Agricultural activities (sector 10, ammonia) are the most important source of reduced nitrogen deposition (Figure 5.1 c). Small negative contributions from other sectors (mainly related to $NO_x$ emissions) can be seen in countries were the indigenous contribution is important, whilst for countries where long range transport is more important (e.g. Norway, Sweden, Iceland and the sea areas), the contributions from other sectors are positive. The $NO_x$ emissions in the other sectors contribute to ammonium nitrate aerosol formation, and thus result in less deposition of reduced nitrogen in the countries where they are formed, but more in the areas to which they are transported.

Both combustion sources (for $SO_x$ and $NO_x$), traffic emissions (road, off road and shipping; mainly $NO_x$ and to some extent $SO_x$) and agriculture ($NH_3$) contribute to

Table 5.1: Overview of the different emission sectors (SNAP) used in modelling.

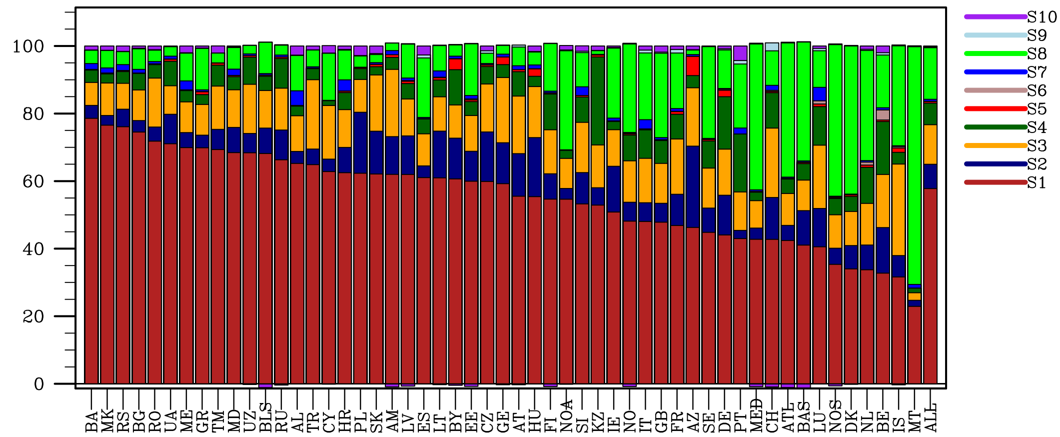
| No. | Sources |
|---|---|
| 1 | Combustion in energy and transformation industries |
| 2 | Non-industrial combustion plants |
| 3 | Combustion in manufacturing industry |
| 4 | Production processes |
| 5 | Extraction and distribution of fossil fuels and geothermal energy |
| 6 | Solvents and other product use |
| 7 | Road transport |
| 8 | Other mobile sources and machinery (including ship traffic emissions) |
| 9 | Waste treatment and disposal |
| 10 | Agriculture |

secondary inorganic aerosol (SIA) formation (Figure 5.2 a). Overall, sector 1 is the most important, but in many countries the contributions from traffic emissions and/or emissions from agriculture are comparable. SIA constitute a large part of $\mathrm{PM}_{2.5}$ (30% to 55% in most of Europe, EMEP CCC & MSC-W (2009)). Here, only dry $\mathrm{PM}_{2.5}$ (excluding secondary organic aerosols) from antropohenic sources is considered (e.g. dust and sea salt is not included). In that case, modelled SIA constitute around 60% to 90% of $\mathrm{PM}_{2.5}$. Therefore, contributions from different sectors to $\mathrm{PM}_{2.5}$ are similar to SIA. However, sectors 2 and 4 are relatively more important, as a large part of primary PM emissions are emitted from those sectors, whilst agricultural sources are less important.

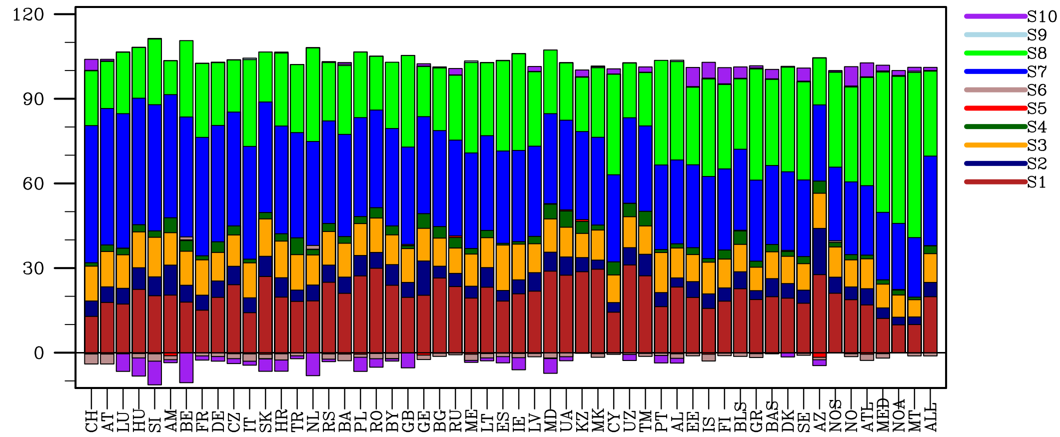
## 5.2 National sector contributions to concentrations and depositions

In this section, we look at the importance of different emission sectors focusing mainly on their national contributions to pollutant depositions and concentrations. In general, the national contributions to pollution levels are determined by factors such as: 1. The amount of emissions in the national sectors of interest; 2. the size of the country (i.e. for larger countries the pollutants in general have to be advected further to get outside the national borders, and subsequently they are expected to play a larger role in domestic pollution); 3. the location of the emission sources within the country; 4. emission height (e.g. emissions from high stacks will be advected further than if emitted at the surface; 5. sources in neighbouring countries that will affect the chemical regime; and 6. non-linearities in the chemistry.

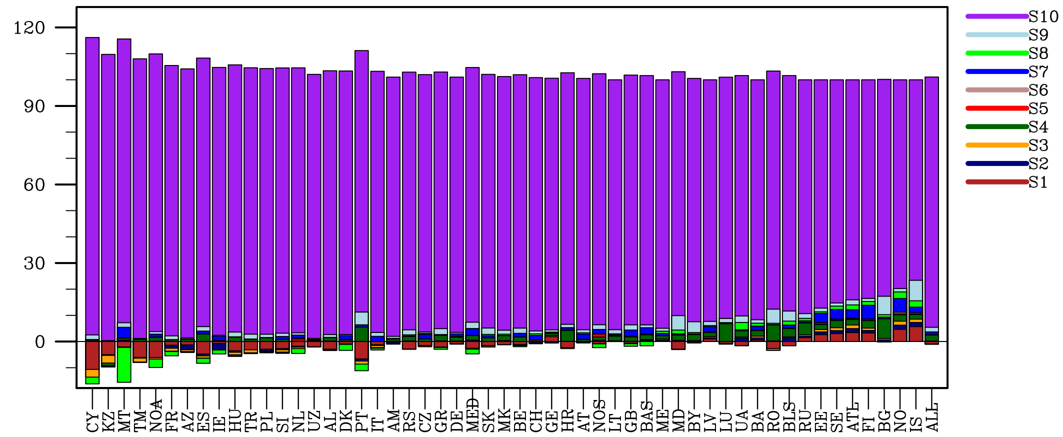
Thunis et al. (2008) sought to assess differences in the effects when emission changes were applied to single sectors compared to equal emission changes for all sec-



(a) Oxidized sulphur deposition

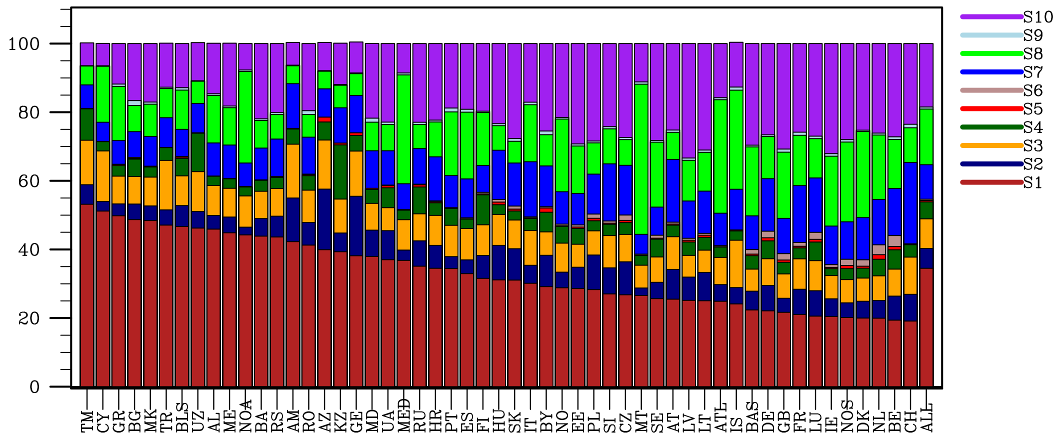


(b) Oxidized nitrogen deposition

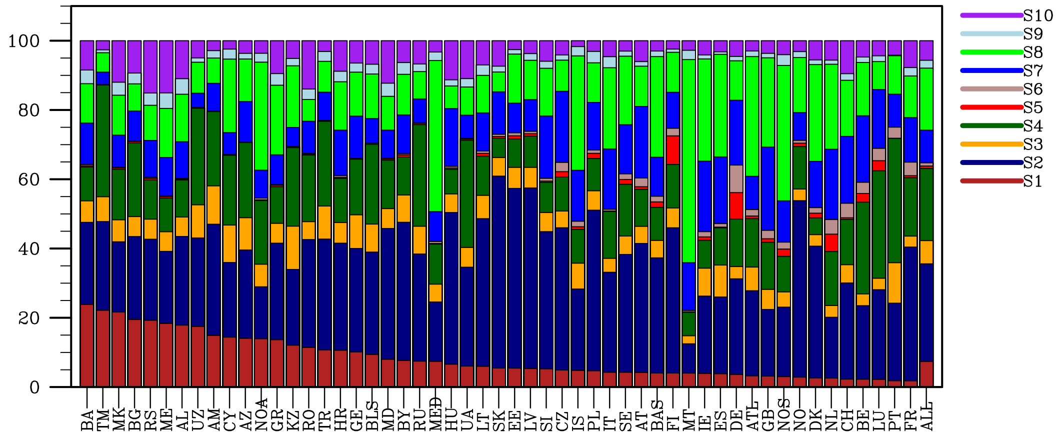


(c) Reduced nitrogen deposition

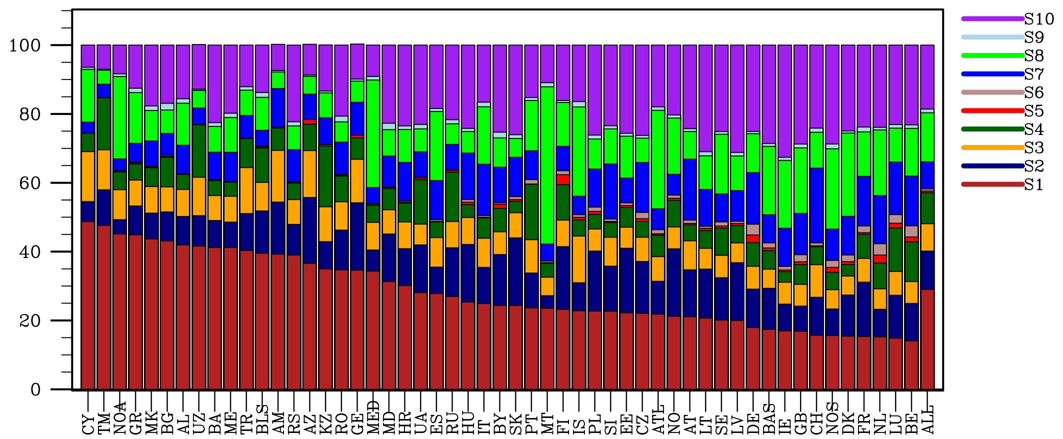
Figure 5.1: Contributions [%] from different emission sectors (relative to contributions from all anthropogenic emissions) to deposition of oxidized sulphur, oxidized nitrogen and reduced nitrogen in 2006 (sorted by S1, S7 and S10, respectively).




(a) SIA




(b) $PPM_{2.5}$




(c) $PM_{2.5}$

Figure 5.2: Contributions [%] from different emission sectors (relative to the contribution from all anthropogenic emissions) to secondary inorganic aerosols (SIA), $\mathrm{PPM}_{2.5}$ and $\mathrm{PM}_{2.5}$ in 2006 (sorted by S1).

tors. In general, they found that abating emissions which are released at low heights was more efficient in reducing the surface aerosol concentrations than abating emissions injected from high stacks. This finding has important implications for deciding on the measures in order to reduce the population exposure, as low height emissions (e.g. traffic, residential combustion) are often correlated with high population density.

In order to study the effect of national emissions from different source types on pollutant depositions and concentrations, a set of source-receptor runs for three subsets of sectors have been made for a number of countries. The three selected sub-sets are:

$S_{123}$ - Sectors 1, 2 and 3 (see Table 5.1). These sectors are the main sources of $SO_x$, they also emit significant portions of $NO_x$ and $PPM_{2.5}$. Emissions from these sources are predominantly released from high stacks.

$S_{78}$ - Sectors 7 and 8 (see Table 5.1). These sectors are the major sources of $NO_x$ and $PM_{2.5}$. Emissions from these sources are released at or near the surface.

$S_{10}$ - Sector 10, agriculture. The dominant pollutant is ammonia, which is emitted at the surface.

Below we discuss the calculations where the domestic contributions from the individual countries have been grouped as described above.

We will only briefly discuss the effects on reduced nitrogen from emissions of ammonia, as virtually all emissions are from $S_{10}$, and of sulphur, where virtually all emissions are from $S_{123}$. In such cases, when almost all emissions are in the same set of sectors, the sector calculations will not differ substantially from the regular source-receptor calculations. Such calculations are described in Chapter 4. Here we will focus on $NO_x$, where emissions are relatively evenly distributed between the aggregated sets of $S_{123}$ and $S_{78}$. Along with VOC (Volatile Organic Compounds) and CO, $NO_x$ is also important for controlling boundary layer ozone. We will also discuss the contribution of the sector aggregated national emissions to $PM_{2.5}$ and SIA (secondary inorganic aerosols) concentrations in the countries. The gaseous precursors of SIA, namely $SO_x$, $NO_x$ and $NH_3$, are emitted from all three sector-groups. In addition, primary $PM_{2.5}$ is emitted from $S_{123}$ and somewhat less from $S_{78}$.

### 5.2.1 Sector contributions to depositions of oxidised nitrogen

Figure 5.3(a) shows the contributions from national sources to the depositions from national sources of oxidised nitrogen. Figure 5.3(b) highlights the national contributions to the depositions of oxidised nitrogen from the three aggregated sectors relative to the total deposition in the same country. The countries are ranked from left to right according to the national contributions from sectors $S_{123}$. Notice that the ranking differs between Figure 5.3(a) and (b). As also discussed in section 5.1 the largest portion of the depositions in most of the countries is attributed to emissions in $S_{78}$ and partially in $S_{123}$.

The ranking of the domestic contribution to the countries in Figure 5.3 to a large extent reflects the geographical size and location of the country. For large countries as Russia, Spain and Poland, a greater portion of the emitted nitrogen will be deposited before crossing the national borders. Furthermore, countries facing the Atlantic, with prevailing winds from the west, such as Portugal, Great Britain and Ireland, will in general be less affected by transboundary pollution from other countries (even though there are large contributions from shipping for these countries as shown in section 5.1).

From sector 10 (ammonia emissions) there is a negative contribution to deposition of oxidised nitrogen. Ammonia and $HNO_3$ form ammonium nitrate in an equilibrium reaction. The dry deposition is faster for $HNO_3$ than for ammonium nitrate. Thus, higher ammonia emissions will give less national depositions of oxidised nitrogen but subsequently more long range (transboundary) advection. This effect is in particular seen in several small countries with high ammonia emissions such as Denmark and Latvia. For larger countries, such as Poland and Spain the effect is apparently smaller as a larger portion of the oxidised nitrogen will be deposited domestically anyway. There are only small contributions from other sectors.

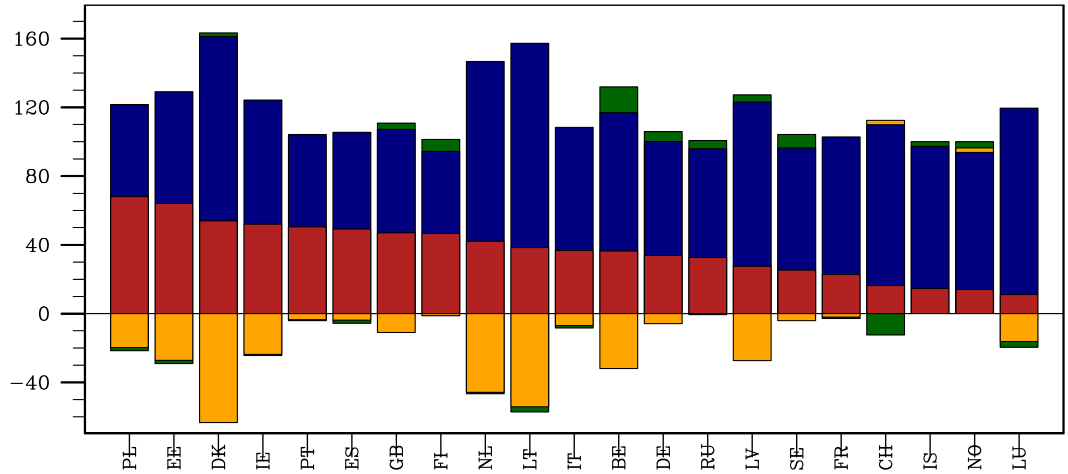
A complementary analysis (figures are not shown here) reveals that the relative contribution from $S_{78}$ increases compared to $S_{123}$ when indigenous depositions are normalized by the emissions. As a result of being injected directly at a higher level, emissions from $S_{123}$ are advected further and are thus more likely to be deposited outside the national borders.

### 5.2.2 Sector contributions to depositions of sulphur

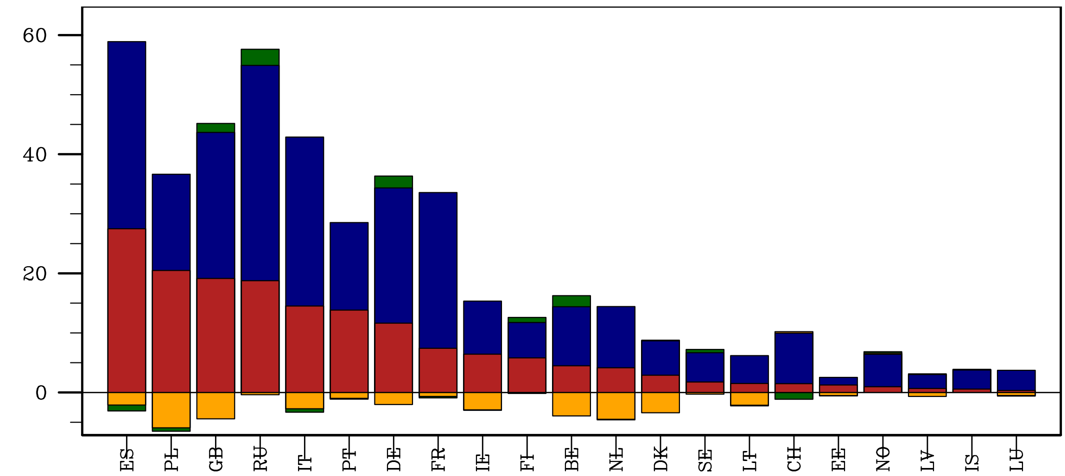
As also shown in section 5.1 the dominant sources of sulphur are in $S_{123}$ (See Figure 5.4(a) and (b)). However, as seen in Figure 5.4(a), for a number of countries a relatively large fraction of the total $SO_x$ deposition is from other sectors (sectors 4, 5, 6 and 9). As Figure 5.4(b) shows, in most of these countries the depositions due to national sources are relatively low compared to the depositions of transboundary origin. The contributions from $S_{78}$ are mainly an indirect effect caused by chemistry. The OH radical is needed in the oxidation of both $NO_2$ and $SO_2$. As $NO_2$ levels increase, less OH is available converting $SO_2$ to sulphate. As $SO_2$ is dry deposited faster than sulphate, more sulphur is deposited near its sources. This mechanism is in particular visible for Luxembourg.

### 5.2.3 Sector contributions to depositions of reduced nitrogen

As also shown in section 5.1, the dominant source of reduced nitrogen is $S_{10}$ (agriculture) in all countries. There are only small contributions from other sectors. Overall, reduced nitrogen species are deposited more efficiently than oxidised nitrogen and




(a) Indigenous OXN



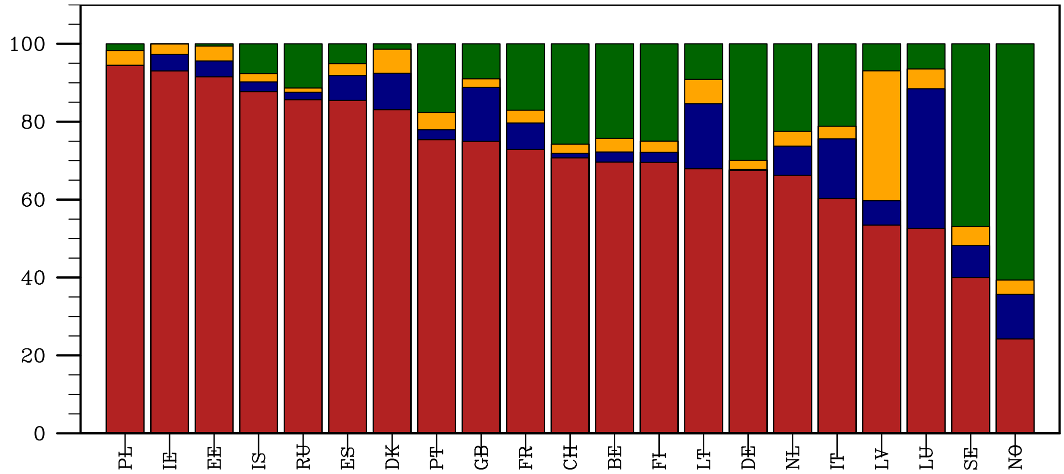

(b) Total OXN

Figure 5.3: National sector contribution [%] to the (a) indigenous and (b) total deposition of oxidised nitrogen. Red: $S_{123}$, blue: $S_{78}$, yellow: $S_{10}$ and green: other sectors.

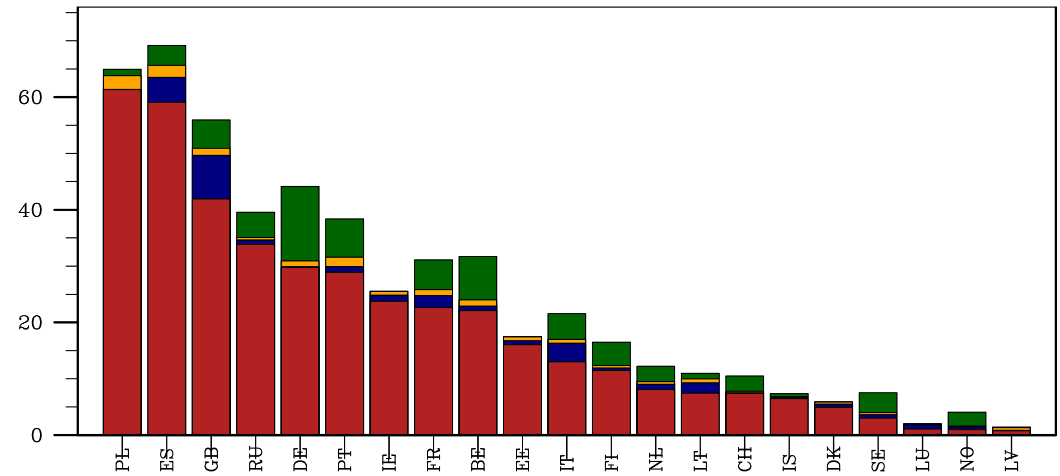
sulphur species, and thus transported over shorter distances. Hence, the national contributions to depositions of reduced nitrogen are larger compared to oxidised nitrogen and sulphur as shown in Figure 5.5 compared to Figures 5.3 and 5.4.

### 5.2.4 Sector contributions to ozone expressed as SOMO35

Figure 5.6 shows the national contributions to SOMO35 relative to the country specific averaged SOMO35 from the three aggregated sectors. Again the countries are ranked according to the national contributions from sectors $S_{123}$. The ranking is only marginally determined by the geographical size of the countries but is strongly linked




(a) Indigenous SOx




(b) Total SOx

Figure 5.4: National sector contribution [%] to the (a) indigenous and (b) total deposition of oxidised sulphur. Red: $S_{123}$, blue: $S_{78}$, yellow: $S_{10}$ and green: other sectors.

to non-linearities in the ozone chemistry. Ozone production requires ample sunlight and a favourable mix of $NO_x$ and VOC. High $NO_x$ emissions (or rather a high $NO_x$ to VOC ratio) will lead to ozone titration. For most countries, the contributions to SOMO35 from $NO_x$ emissions are a result of both positive and negative terms partially cancelling out. The net ozone production is typically most frequent in areas/seasons with intense sunlight, while ozone titration occurs in countries/regions with high $NO_x$ levels and less sunlight. In southern European countries as Spain, Portugal and Italy, and also in Russia, reduction of national emissions from $S_{123}$ and $S_{78}$ results in decreases in SOMO35. In northern parts of central Europe, as in Great Britain, the Netherlands and Belgium, there is less sunlight and $NO_x$ emissions are very high.

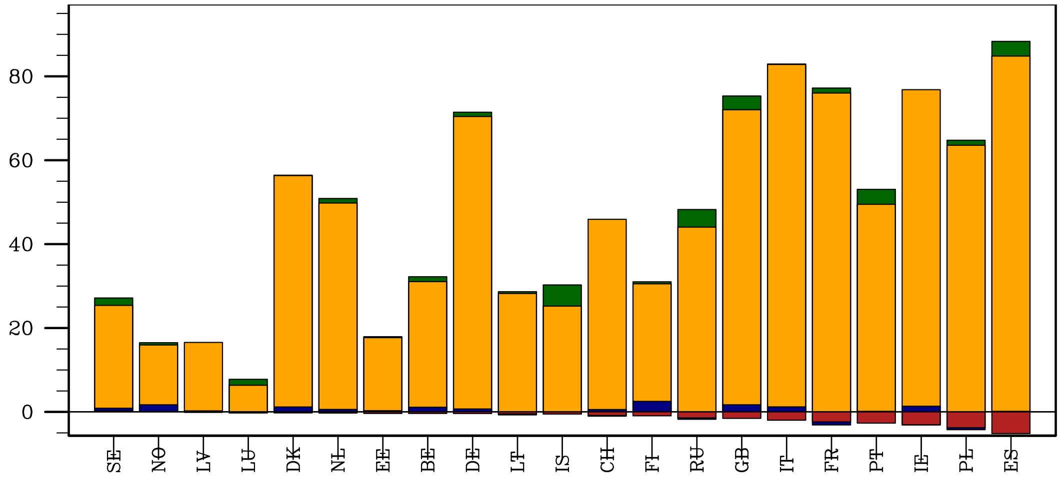



Figure 5.5: National sector contribution [%] to the total deposition of reduced nitrogen. Red: $S_{123}$, blue: $S_{78}$, yellow: $S_{10}$ and green: other sectors.

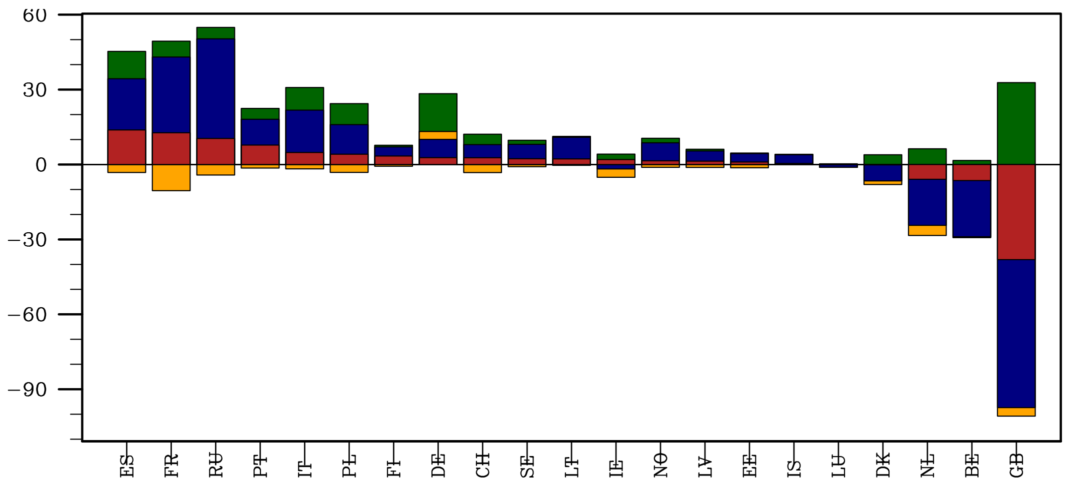



Figure 5.6: National sector contribution [%] to the total SOMO35. Red: $S_{123}$, blue: $S_{78}$, yellow: $S_{10}$ and green: other sectors.

Here, national emissions from $S_{123}$ and $S_{78}$ have effects opposite to those in southern Europe as a result of ozone titration. Emissions from other sectors than $S_{123}$ and $S_{78}$ have a much higher VOC to $NO_x$ ratio, and reduction of emissions from these other sectors results in a decrease in SOMO35. Similar results were also obtained when reducing all emissions in each sector separately (Simpson et al. 1999). In their work, the largest overall effects of emission reductions on AOT40 were calculated for sectors 6 and 7. Similarly to our study, contributions from sector 7 (and 8) were the net result of both negative and positive contributions.

### 5.2.5 Sector contributions to concentrations of SIA and $PM_{2.5}$

Figure 5.7 shows the national contributions from the three aggregated sector groups to the annual mean indigenous (i.e. from national emissions only) concentrations of SIA (Figure 5.7(a)) and to the total SIA concentrations (Figure 5.7(b)) in the considered countries. Figure 5.8 is analogical, but for $PM_{2.5}$. Note that only anthropogenic $PM_{2.5}$ is considered in this analysis (i.e. $PM_{2.5}$ does not include sea salt and natural dust), besides it does not include secondary organic aerosols.

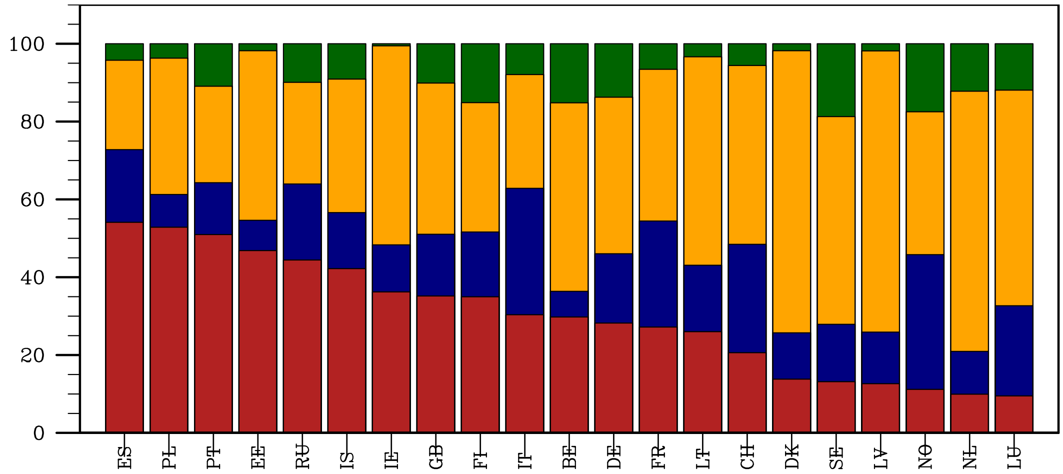
Among SIA precursors, $SO_x$ is emitted mostly from $S_{123}$, $NO_x$ is predominantly emitted from $S_{78}$, followed by $S_{123}$, while $NH_3$ originates almost entirely from $S_{10}$. The presence of $NH_3$ in the air is essential for formation of ammonium sulphate and ammonium nitrate aerosols from $SO_x$ and $NO_x$ emissions. Primary $PM_{2.5}$ is emitted from $S_{123}$ and somewhat less from $S_{78}$.

In Figures 5.7 and 5.8, the countries are ranked from left to right according to decreasing national contributions from $S_{123}$. Note that the countries' order in the upper and lower graphs differs, indicating a different importance of national $S_{123}$ emissions in the indigenous and in the total pollution by SIA and $PM_{2.5}$ in these countries. The role of the domestic emissions from different sectors is affected by the factors outlined in the beginning of the chapter.

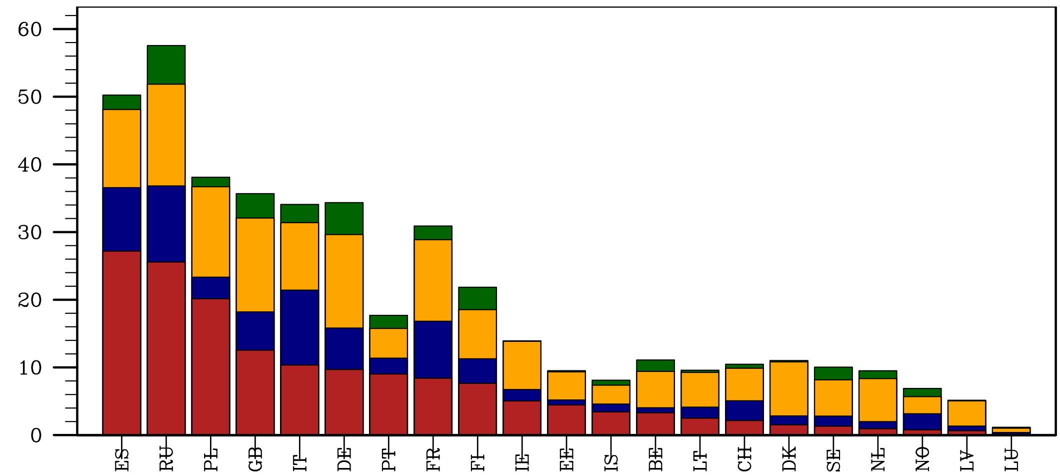
Regarding the domestic SIA pollution from the different sector groups (Figure 5.7), the model calculations show considerable contributions from agriculture ($S_{10}$) and stationary combustion sources $S_{123}$, whilst the contribution from mobile sources $S_{78}$ is generally smaller, with some exceptions (e.g. Italy, France and Norway). In several countries, such as Denmark, Latvia, the Netherlands, Luxembourg, Ireland, Sweden and Lithuania, ammonia emissions from $S_{10}$ are the source of more than 50% of the domestic SIA concentrations. This is different to what is found when reducing the pan-European emissions sector by sector, where mobile sources accounted for an equal or larger part of SIA concentrations as agriculture. However, because $NO_x$ (and $SO_x$) in general are more transboundary than $NH_3$, $S_{10}$ is relatively more important for domestic contributions.

On the other hand, for many countries (e.g. Spain, Poland and Portugal) emissions from $S_{123}$ are responsible for more than 50% of domestic SIA because of the high emissions in these sectors.

When looking at the national sector contributions (Figure 5.7(b)) to the total SIA concentrations, two major groups of countries can be identified. The first group (on the left side of the graph) is the countries with significant contribution from national $S_{123}$ to the total SIA (e.g. Spain, Russia, Poland, the UK, Italy and Germany). A common feature for these countries is that they are large countries with relatively large national contributions to their SIA concentrations. The second group consists of countries where $S_{10}$ is the major source of total SIA among the national sector emissions (on the left side of the graph). These are the countries which are typically small and in which SIA concentrations are predominantly due to the transboundary transport. The emissions from $S_{123}$ released from tall stacks are more likely to be transported beyond




(a) Indigenous SIA

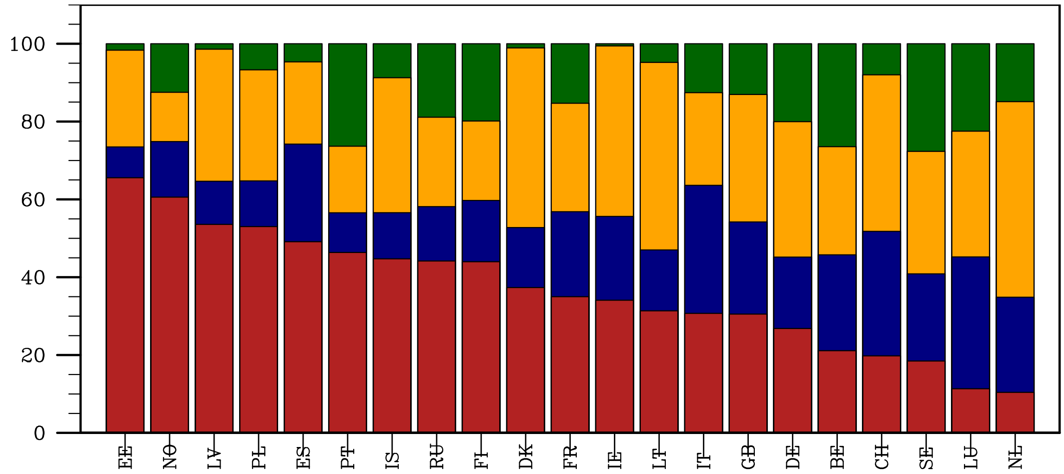



(b) Total SIA

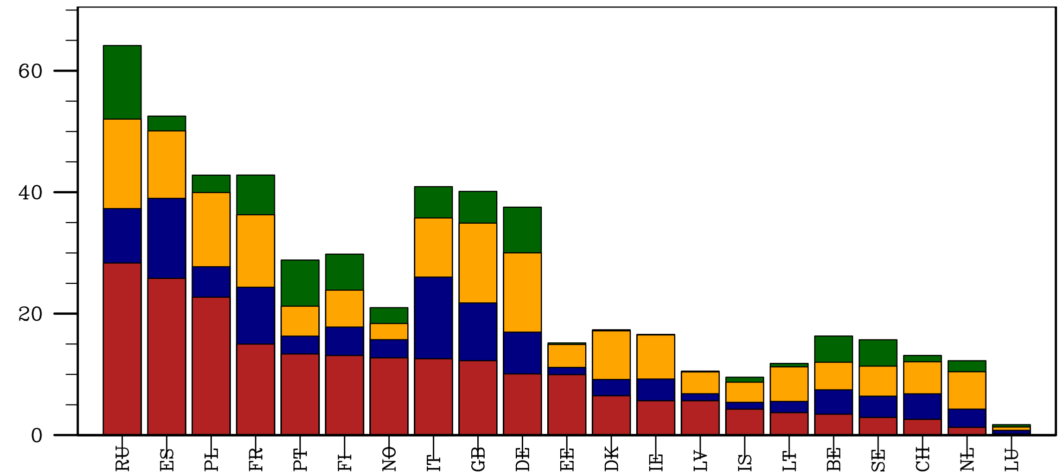
Figure 5.7: National sector contribution [%] to the (a) indigenous and (b) total SIA concentrations. Red: $S_{123}$, blue: $S_{78}$, yellow: $S_{10}$ and green: other sectors.

the country's borders and to participate in the transboundary pollution compared to the surface emissions. Thus, the national emissions from $S_{10}$, which are released at surface, play a more important role in SIA concentrations in these countries.

The main findings regarding the sector contributions to SIA concentrations also apply to $PM_{2.5}$ (here $PM_{2.5}$ = $PPM_{2.5}$ + SIA) (Figure 5.8). However, there are some differences as summarised below. In general, the contributions to national $PM_{2.5}$ concentrations from $S_{123}$ (and to some extent from $S_{78}$) are larger, while the contributions from $S_{10}$ are smaller compared to SIA. Furthermore compared to SIA, the emissions from $S_{123}$ are responsible for a larger portion of $PM_{2.5}$ than $S_{78}$ emissions. There is a larger contribution to $PM_{2.5}$ than to SIA concentrations from other domestic sectors




(a) Indigenous $PM_{2.5}$




(b) Total $PM_{2.5}$

Figure 5.8: National sector contribution [%] to the (a) indigenous and (b) total $\mathrm{PM}_{2.5}$. Red: $S_{123}$, blue: $S_{78}$, yellow: $S_{10}$ and green: other sectors.

(mostly from sector 4, production processes) in most of the countries studied. Overall, the role of domestic sources is somewhat larger in $\mathrm{PM}_{2.5}$ concentrations than in SIA concentrations in the countries. This is because the primary fraction within $\mathrm{PM}_{2.5}$, i.e. primary $\mathrm{PM}_{2.5}$, is characterized by somewhat shorter transport distances from the sources compared to secondary aerosols. Therefore $\mathrm{PPM}_{2.5}$ and also $\mathrm{PM}_{2.5}$ typically contribute less to the transboundary pollution and more to the domestic pollution compared to SIA.

## 5.3 Concluding remarks

Traditionally the source-receptor relationships are calculated applying the same percentage reductions for all sectors in a given country. This type of calculations is also included in this year's report (see Chapter 4). Here, we presented the results from two different setups of source-receptor model calculations: in the first one, the pan-European emissions were reduced from one sector at a time, while in the second one, the reductions were applied to national emissions from several sector groups (namely, combustion from stationary sources, mobile sources and agriculture). The results from such calculations give indications on what type of emissions are the most important in terms of air pollutants and depositions from pan-European sources, as well as from national emission sources.

Stationary combustion sources were shown to be the dominant source of oxidised sulphur deposition, both indigenous and transboundary. They also contribute significantly to the deposition of oxidised nitrogen in a number of countries and to the concentrations of SIA and $PM_{2.5}$. Emissions from tall pipes in these sectors ($S_{123}$) are advected over larger distances and thus have a larger transboundary effect.

Emissions from road traffic and other mobile sources (including shipping) make the largest contribution to the deposition of oxidised nitrogen and have the largest effect on ozone formation. They also make a significant (though not the major) contribution to SIA and $PM_{2.5}$ concentrations. Emissions from $S_{78}$ are emitted at or near the surface and they therefore in general have a larger effect on the indigenous pollution than emissions from $S_{123}$. However, precursors (e.g. $NO_x$) with low deposition velocities might in some circumstances have greater transboundary contributions than species (e.g. $SO_2$) with high deposition rates. Therefore, this generalisation apply to each precursor separately. The traffic sources are likely to be well correlated with population density (Thunis et al. 2008) thus affecting people exposure to air pollution.

Ammonia emissions from agriculture are a prerequisite for the formation of ammonium nitrate. They are the major source of reduced nitrogen depositions and an important source of SIA in many countries. In general, the contributions from agriculture to SIA concentrations is larger when considering only the sources from the country itself because of the larger long range transport potential of $NO_x$ and $SO_x$. It is shown that agricultural ammonia emissions can make both negative and positive contributions to oxidised nitrogen in different countries, and on the domestic versus transboundary depositions of oxidised nitrogen.

Emissions from non-industrial (residential) combustion and production processes are shown to be the most important sources of primary PM.

It should be noted that these are generic findings and a number of country specific diversions in the effects of sector emissions on air concentration and depositions, indigenous as well as transboundary, exist.

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CHAPTER 6

# The importance of the meteorological driver for Source-Receptor Calculations

**Michael Gauss**

Transboundary transport of air pollution strongly depends on meteorological conditions and processes occurring on different scales. The general circulation of the atmosphere determines the time required for long-range transport of pollutants. On smaller scales, enhanced precipitation will increase wet deposition and thus limit the export of pollutants out of a given region. Dry deposition depends on surface properties such as humidity, temperature and snow cover. Air temperature, cloudiness, and humidity strongly affect chemical and physical processes and thus the atmospheric lifetime of pollutants, which in turn limits their ability to travel over long distances. Small-scale processes such as convective activity, boundary layer height and ventilation influence the vertical transport of surface pollutants up to the free troposphere where they can undergo regional to intercontinental transport. Changes in meteorology on different scales thus have a rather large effect on long-range transport and source-receptor (SR) analyses. A large part of interannual variability found in the 'blame matrices' provided each year by MSC-W can be attributed to variability in meteorology. A study looking specifically at the effects of interannual meteorological variability on pollutant source allocation was described in detail by van Loon et al. (2005). For that study, the Unified EMEP model was run for five consecutive years with input from one meteorological model (PARLAM-PS) and with constant emissions Changes in source-receptor relationships from year to year were analysed. This section, by contrast, focuses on one single year (2006) and discusses differences in transboundary transport that arise solely from using different meteorological drivers.

The Unified EMEP model can be run with meteorological input from different Numerical Weather Prediction models (NWPs), e.g. WRF, HIRLAM, and the ECMWF-IFS model system.

Tarrasón et al. (2008) presented source-receptor calculations, which were conducted with two different sets of meteorological data for the year 2006, generated by the PARLAM-PS and ECMWF-IFS models, respectively. For this year's report we have performed a selection of additional source-receptor calculations for the same year, but driven by meteorological output from the HIRLAM model, as used this year in the operational runs.

In order to compare the uncertainties due to the use of different meteorological drivers with those changes that are due to interannual variability, some figures in this section will include results from the source-receptor calculations presented in the appendix of this status report, i.e. for the year 2007. These calculations are based on HIRLAM meteorology and can thus be compared to the HIRLAM calculations for 2006, keeping in mind that also the emissions changed from 2006 and 2007.

In the remainder of this section the following definitions will be used:

**PS-2006** - SR calculations with data from the PARLAM-PS model, a dedicated version of the HIRLAM model using the same grid as the Unified EMEP model (i.e. polar-stereographic, 50x50 $km^2$ ).

**EC-2006** - SR calculations with data from the IFS model system of ECMWF, run on T319 spectral resolution (corresponding to about $0.5° \times 0.5°$ lat/lon), interpolated to the polar-stereographic 50x50 $km^2$ grid of EMEP.

**H50-2006** - SR calculations with data from the HIRLAM model run on $0.2° \times 0.2°$ resolution, interpolated to the polar-stereographic 50x50 $km^2$ grid of EMEP.

**H50-2007** - same as H50-2006, but run for the year 2007.

The resolution of the Unified EMEP model is identical in all four sets of calculations. The three first sets use emissions for 2006, while H50-2007 uses emissions for 2007.

In addition we define the 'NWP effect' here as a measure of how different the results from SR calculations can be when different meteorological drivers are used. This measure is, in the present study, estimated from the range of results obtained when using different NWPs. It is not only related to differences in the NWP output itself but also to the different degrees of interpolation from the NWP grid to the EMEP grid.

The meteorological year in the first three analyses is the same (2006) so that variability in the results is solely due to the NWP effect, while differences between H50-2006 and H50-2007 can be caused by changes in emissions and meteorological conditions from 2006 and 2007, which are described elsewhere in this report.

A large number of factors influence the relative uncertainty in the calculation of transport from one area A to another area B (the term 'area' referring here to one country or a group of countries). The most relevant include:

- meteorological conditions in and between areas A and B (e.g. the prevailing wind velocity and direction, precipitation, etc.)

- the atmospheric lifetime of the pollutant in question, with respect to both chemical and physical loss mechanisms

- the distance between areas A and B

- the size of area B

- the time period over which the SR calculation is averaged

In the following subsections examples will be shown focusing on pollution export and import, and pollution due to indigenous emission sources.

## 6.1 Pollution export

As an example of pollution export Figure 6.1 shows the amounts of oxidized sulphur exported from the United Kingdom and Poland to other countries, based on the three calculations made for 2006 and the one made for 2007.

The blue, red and green bars are for 2006 and are based on the same emission data, i.e. the range of results reflects the NWP effect. Relative differences can be large when considering individual countries, but tend to affect only those areas receiving small shares of the total export. The export to large areas, such as the entire European Union, are rather robust. There is a tendency that transport to or across sea areas is more sensitive, notably the export from UK to Sweden and Norway, or to the North Sea areas. A comparison between PARLAM-PS and EC meteorology presented in Tarrasón et al. (2008) revealed that the former data set predicts much less precipitation over sea areas in 2006, thus allowing more oxidised sulphur to be transported from UK to Scandinavia. Apart from these exceptions the differences are relatively small, below 10 percent in most cases.

The purple bars depict pollution export in 2007 and have been included to enable a judgement on how important the NWP effect is compared to interannual variability in meteorology and emissions. In most cases the export from the UK to other countries decreased from 2006 to 2007, connected with a significant reduction in sulphur emissions. But also in the case of Poland, where emission reductions were less significant, the export decreased in many cases. In most cases the interannual variability is more pronounced than the NWP effect.

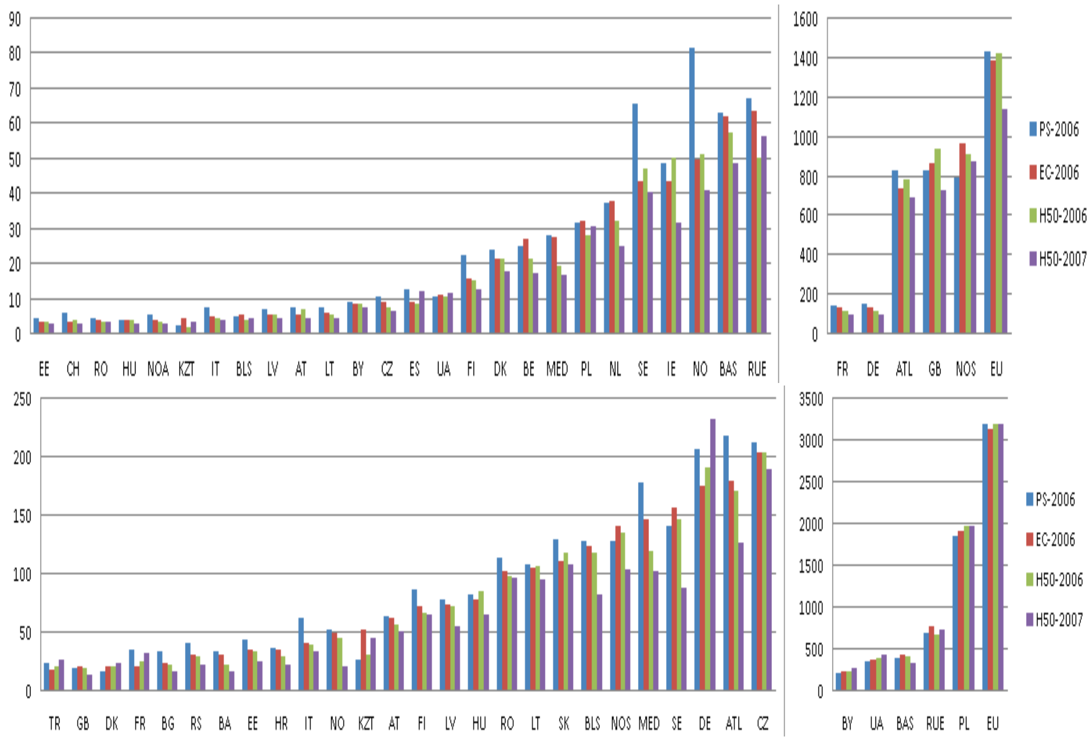


Figure 6.1: Export of oxidised sulphur from the United Kingdom (upper panels) and Poland (lower panels) to other areas, based on four different source receptor calculations. The six larges receptors are shown separately to the right (note the different vertical scales). Unit: 100 Mg(S)/year.

## 6.2 Pollution import

Focusing on the import of pollutants instead, an obvious finding is that the distance from source to sink is a major factor of uncertainty.

Figure 6.2 shows imports to Norway and Germany from other countries and areas. Norway is chosen because it is a country that is relatively far away from major emitters, with few neighbouring emission sources, and yet heavily influenced by import of pollutants. Germany is chosen as a relatively large country with significant indigenous pollution, but at the same time subject to large import of pollution due to its central geographic location.

Both the NWP effect and the interannual variability seem to be much larger for Norway than for Germany. The difference between 2006 and 2007 is much larger than the change in emission would suggest, so most of the change is due to meteorology.

It is not evident if ozone or particulate matter is the most sensitive component. SOMO35 changes due to transboundary transport of NOx emissions turn out to be rather sensitive to the NWP effect but also to real interannual variability in meteorology. As an example for a relatively large country with a central location, the impact on

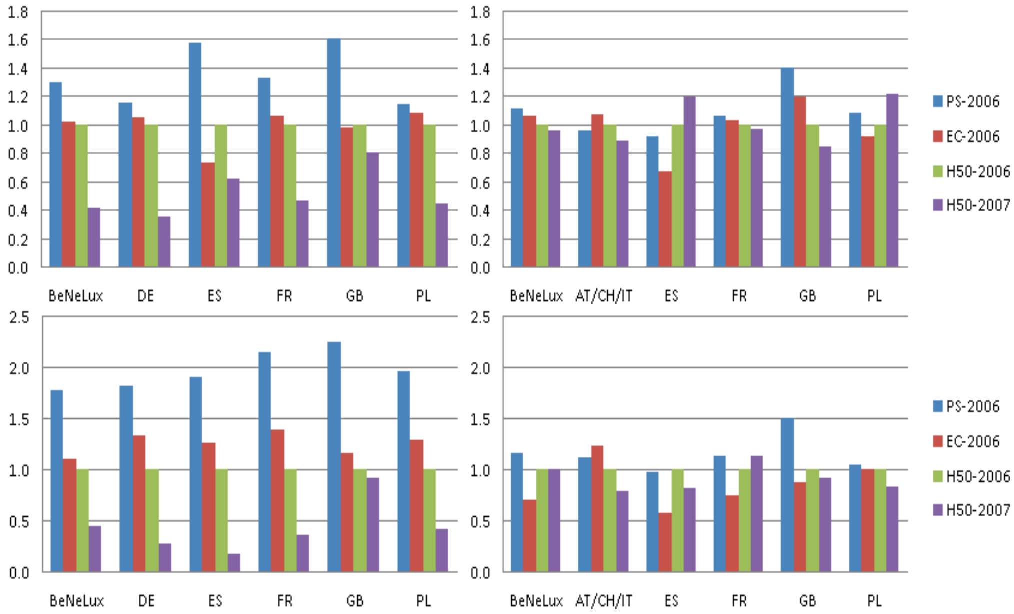


Figure 6.2: Change in wet deposition of oxidised sulphur (top, 100 Mg(S)/yr) and change in concentrations of $\mathrm{PPM}_{2.5}$ (bottom, $\mu$g m$^{-3}$) due to imported pollutants from selected areas. Left panels are for Norway, right panels for Germany. The results are normalised to H50-2006 results, i.e. H50-2006=1.

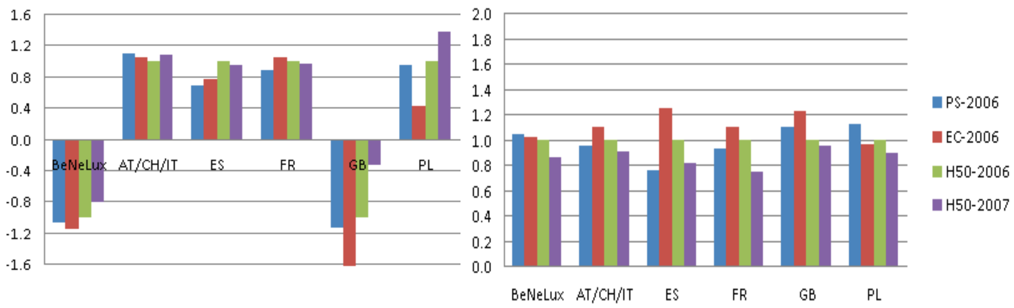


Figure 6.3: Change in SOMO35 (ppb days) in Germany due to imported NOx (left) and imported VOCs (right). The results are normalised to H50-2006 results, i.e. H50-2006=1 for positive contributions, H50-2006=-1 for negative contributions.

SOMO35 is shown for Germany in Figure 6.3. The figure includes changes both due to NOx emissions and VOC emissions from major contributors. The NWP effect is not significantly larger than for $\mathrm{PPM}_{2.5}$ shown in Figure 6.2. However, also for SOMO35 the uncertainties tend to be larger for countries that are either farther away from major emission sources or are smaller in size. Still, in most cases the uncertainties do not affect the very largest contributors as these usually include neighbouring countries.

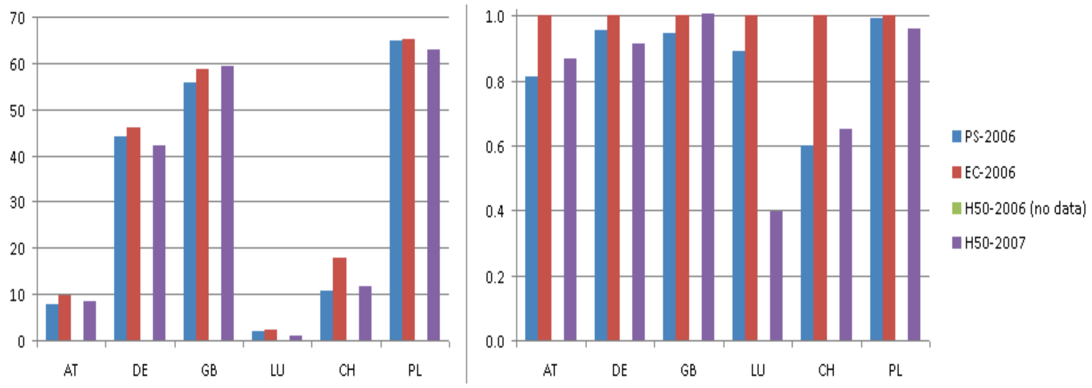


Figure 6.4: Left: Contribution of indigenous pollution to total wet deposition of oxidised sulphur in different countries (unit: percent). Right: Same data, but normalized to EC-2006 results, i.e. EC-2006=1. H50-2006 can not be shown here because only selected emitters could be re-calculated with HIRLAM data for 2006.

## 6.3 Indigenous pollution

Figure 6.4 shows the importance of indigenous pollution as compared to total pollution regarding oxidised sulphur in six selected countries of different size. The left panel shows the contribution of indigenous pollution sources to total wet deposition of oxidised sulphur. For large countries this share is about half of the total, while for smaller countries it is much smaller. To visualize the NWP effect more clearly the right panel shows these shares normalized to EC-2006. For countries with a relatively small area the NWP effect, as represented by the differences between the red and the blue bars, tends to be larger than for larger countries, where errors in meteorological parameters tend to average out, at least on longer time periods. Both the NWP effect and the interannual variability are larger for the relatively small countries that are strongly impacted by imported pollution.

## 6.4 Conclusions

The main findings can be summarized as follows:

- For large countries the uncertainty connected to the meteorological driver is smaller than for small countries.

- The relative uncertainty is larger for the small contributions, while the results for the large contributions, both in terms of export and import of pollutants, are rather robust.

- The change in SOMO35 due to imported NOx is rather sensitive to uncertainties in the meteorological driver.

- In general, the uncertainty due to the meteorological driver is smaller than or comparable in magnitude to the changes related to interannual variability.

However, the remarks made in this chapter have to be considered as being rather general. Although the examples shown have been chosen to reflect the main features seen in the data, other countries or emitter-receptor pairs can be found where the differences contrast the overall tendencies to varying degrees. Transboundary transport of air pollution is influenced by a complex interplay of precipitation, wind direction and other parameters, as well as correlations in between them. In some cases differences connected to the NWP model may largely cancel out on the way between the emitter and receptor areas and thus suggest a better agreement than is actually present.

Also, the averaging time used in the SR calculations (one year) is long compared to the timescales of regional transport in the troposphere. On shorter timescales, say a month or less, the error due to the NWP input would obviously be larger. However, when looking at total annual transport, the results seem to be rather robust at least for larger areas and the most important contributors.

In most cases the differences between H50-2006 and EC-2006 are smaller than the differences due to interannual variability. In many cases the difference between PS-2006 and H50-2006 is comparable in magnitude to the interannual variability. This is one of the reasons why we refrain from reporting year-to-year trends based on SR calculations that are performed with different NWPs.

The question about which meteorological variables contribute most to the differences can not be easily answered based on the available set of data. Cloudiness and precipitation are usually difficult to predict in NWPs. Earlier studies have shown that precipitation frequency is more important than precipitation amount in the case of highly soluble species. There is also less observational data over sea areas so that NWPs tend to be less certain there. This will affect source-receptor relations where a larger part of the travelled distance goes through marine areas or areas characterized by a complex interplay between precipitation events and dry periods.

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# Part III

# Ongoing work

# CHAPTER 7

## Improved resolution in the EMEP model

**Hilde Fagerli, Peter Wind, Michael Gauss, Ágnes Nyíri, David Simpson and Svetlana Tsyro**

Last year we presented for the first time EMEP model calculations for Europe (for 2006) with grid resolutions of 50 km, 25 km and 10 km, respectively. This year we have performed 50 and 25 km model runs for 2007. Furthermore, we have for the first time run the EMEP model for Europe in rotated spherical coordinates (in the real projection of the meteorology) at a resolution of 0.2°×0.2°. The same model version (rv3.1) have been used for all the runs.

For 2007 we have performed a preliminary analysis of the effect of resolution on source-receptor calculations. Only the 3 'simplest' components are considered in this first exercise; $\mathrm{SO_x}$, fine primary particulate matter ($\mathrm{PPM_{2.5}}$) and coarse primary particulate matter ($\mathrm{PPM_{co}}$). Unfortunately, appropriate landuse data (and thus implicitly BVOC) on high resolution have not yet become available. An analysis for e.g. photochemical compounds will be pursued once these data sets are available.

## 7.1 Meteorological Fields

The different meteorological data set for the EMEP model runs were provided by the HIRLAM model run in 0.1°×0.1° (2006) and 0.2°×0.2° (2006 and 2007) resolution. HIRLAM-20 (with 0.2°×0.2° resolution) was run for an extended area comprising both Europe and large parts of Central Asia (shown in green), while HIRLAM-10 (0.1°×0.1° resolution) was run for an European window only (yellow), which is due to numerical problems with HIRLAM-10 in high elevation areas of Central Asia. The

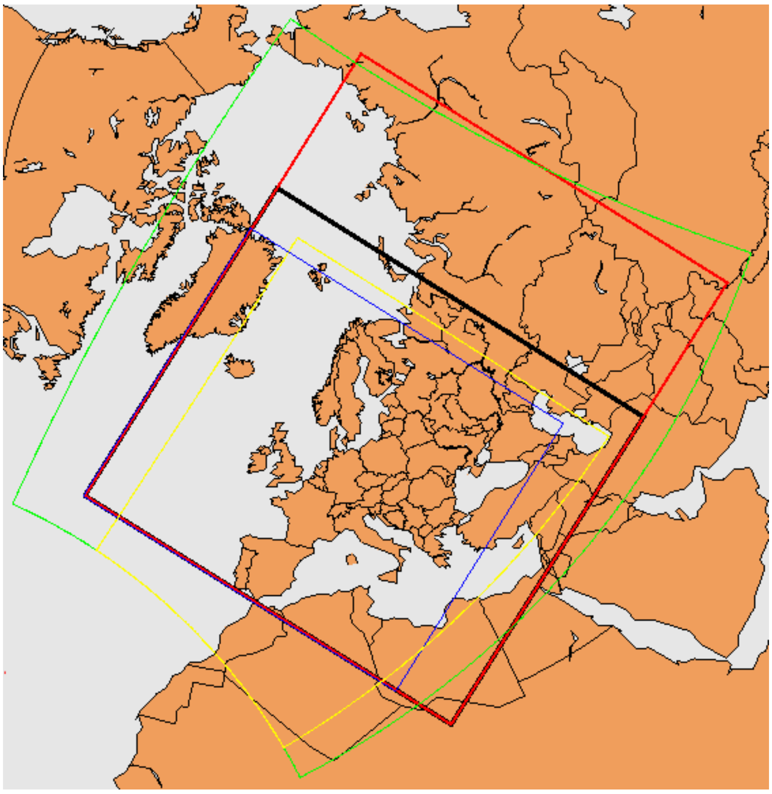

Figure 7.1: The different domains of meteorological input data. Black: EMEP official (132×111 boxes / 50×50 km$^2$), red: EMEP$_{ext}$ (132×159 boxes / 50×50 km$^2$ or 264×318 boxes / 25×25 km$^2$), blue: EMEP$_{red}$ (560×480 boxes / 10×10 km$^2$), green: HIRLAM-20 NWP (370×380 boxes / 0.2°×0.2°), yellow: HIRLAM-10 NWP (500×500 boxes / 0.1°×0.1°)

different domains are shown in Figure 7.1.

Based on the HIRLAM-20 output, two data sets were generated for the area depicted by the red rectangle: one on 25×25 km$^2$ resolution and one on 50×50 km$^2$ resolution. In addition, the HIRLAM-20 meteorological fields were used directly as input for the EMEP model. HIRLAM-10 output was interpolated into 10×10 km$^2$ resolution for the area marked in blue. A summary of the different meteorological input used for the model calculations is shown in Table 7.1.

The HIRLAM runs were started every 6 hours, and the meteorological fields for 9 and 12 hours prognoses are used by the EMEP model. The meteorological fields from HIRLAM-20 are defined in a rotated spherical projection and converted into a polar stereographic grid for use by the EMEP model, or used directly. Vertically the 40 eta levels from the meteorological model are interpolated into the 20 EMEP sigma levels. The interpolation process introduces some inconsistencies in the wind fields. In order to reduce the mass balance error, a filtering is applied to the wind fields. The filtering creates divergence free wind fields, by slightly modifying both the vertical

| Name | Resolution (original) | Resolution (input to EMEP model) | Year |
|---|---|---|---|
| H50 | $0.2^\circ \times 0.2^\circ$ | 50 km | 2006,2007 |
| H25 | $0.2^\circ \times 0.2^\circ$ | 25 km | 2006,2007 |
| H20 | $0.2^\circ \times 0.2^\circ$ | $0.2^\circ \times 0.2^\circ$ | 2006,2007 |
| H10 | $0.1^\circ \times 0.1^\circ$ | 10km | 2006 |

Table 7.1: Overview of the different sets of meteorological data used in the model runs.

and horizontal winds.

## 7.2 Emissions

Two different sets of gridded emission data have been made for the $50 \times 50$ km$^2$, $25 \times 25$ km$^2$ and $10 \times 10$ km$^2$ polar stereographic (PS) grids, respectively, as well as for $0.2^\circ \times 0.2^\circ$ rotated spherical (RS) grids. One data set is produced by distributing the EMEP emissions in each $50 \times 50$ km$^2$ grid cell equally among the finer resolution grid cells (EMEP$_{25}$ and EMEP$_{10}$), or interpolation to RS projection (EMEP$_{20}$ ).

In the other data set (EMEP+TNO$_{50}$, EMEP+TNO$_{25}$, EMEP+TNO$_{20}$ and EMEP +TNO$_{10}$) the emissions have been re-gridded based on a high resolution emission database developed by TNO for the EU integrated project GEMS (Visschedijk et al. 2007). The country sectors have been kept as in the EMEP emissions in both data sets. An overview of the different sets of gridded emissions can be found in Table 7.2. The different sets of emissions were produced both for 2006 and 2007.

| Name | Resolution | Distribution |
|---|---|---|
| EMEP$_{50}$ | $50 \times 50$ km$^2$ PS | |
| EMEP$_{25}$ | $25 \times 25$ km$^2$ PS | EMEP$_{50}$ grid cells divided into 4 cells |
| EMEP$_{20}$ | $0.2^\circ \times 0.2^\circ$ RS | EMEP$_{50}$ grid cells interpolated to RS |
| EMEP$_{10}$ | $10 \times 10$ km$^2$ PS | EMEP$_{50}$ grid cells divided into 25 cells |
| EMEP+TNO$_{50}$ | $50 \times 50$ km$^2$ PS | TNO spatial distribution |
| EMEP+TNO$_{25}$ | $25 \times 25$ km$^2$ PS | TNO spatial distribution |
| EMEP+TNO$_{20}$ | $0.2^\circ \times 0.2^\circ$ RS | TNO spatial distribution |
| EMEP+TNO$_{10}$ | $10 \times 10$ km$^2$ PS | TNO spatial distribution |

Table 7.2: Overview of the different sets of gridded emission data used in the model runs.

| Name | Meteorology | Emissions | Year |
|---|---|---|---|
| H50 | H50 | $EMEP_{50}$ | 2006,2007 |
| H50-TNO | H50 | $EMEP+TNO_{50}$ | 2006,2007 |
| H25 | H25 | $EMEP_{25}$ | 2006,2007 |
| H25-TNO | H25 | $EMEP+TNO_{25}$ | 2006,2007 |
| H20 | H20 | $EMEP_{20}$ | 2006,2007 |
| H20-TNO | H20 | $EMEP+TNO_{20}$ | 2006,2007 |
| H10 | H10 | $EMEP_{10}$ | 2007 |
| H10-TNO | H10 | $EMEP+TNO_{10}$ | 2007 |

Table 7.3: Overview of the different model runs. For a definition of meteorology and emissions, see Tables 7.1 and 7.2, respectively.

## 7.3 Landuse

As noted in Fagerli et al. (2008), very high resolution landuse data should in principal now be available from the combined CCE/SEI data base described in Cinderby et al. (2007), which would allow consistent landuse for any of the EMEP domain model runs. Unfortunately, problems with this data have still not been resolved. As with Fagerli et al. (2008), we therefore proceed with landuse derived from the basic 50 km data sets, and will improve upon these results once high-resolution data become available.

## 7.4 Comparison of model results and measurements

### 7.4.1 Acidifying and eutrophying compounds

We have compared the model results to all EMEP measurements available in 2006 and 2007. In order to have a consistent comparison between the different model runs, we have only used measurement sites that are within the smallest model domain ($EMEP_{red}$). Only a few sites (NO42, RU13) for a few components had to be excluded. In general, the bias between measurements and model results are relatively similar for the different model runs (changes in the order of $\pm$ 5%), therefore we do not discuss changes in absolute levels. Furthermore, concentration levels are relatively sensitive to model parameterizations of e.g. dry deposition and chemistry. Therefore, a decrease of bias between model results and measurements does not necessarily mean that the model is better - it can easily compare better to the measurements for the wrong reasons. Correlation between measurements and model results (spatial and temporal) is a better measure for model performance, thus we focus on those in the discussion in the following sections.

Tables 7.4-7.5 show that in general increased resolution, in either the meteorology

Table 7.4: Comparison between model results and observations (air concentrations) for 2006 and 2007 (spatial correlation coefficient). $NH_x$=$NH_3$+$NH_4^+$, $xNO_3$=$HNO_3$+$NO_3^-$. An overview of the different model runs is given in Table 7.3.

| | Year | H50 | **H50-TNO** | H25 | **H25-TNO** | H20 | **H20-TNO** | H10 | **H10-TNO** |
|---|---|---|---|---|---|---|---|---|---|
| $NO_2$ | 2006 | 0.58 | **0.65** | 0.62 | **0.69** | 0.63 | **0.68** | 0.63 | **0.69** |
| | 2007 | 0.73 | **0.77** | 0.76 | **0.83** | 0.75 | **0.81** | | |
| $SO_2$ | 2006 | 0.62 | **0.62** | 0.60 | **0.61** | 0.59 | **0.59** | 0.61 | **0.62** |
| | 2007 | 0.62 | **0.61** | 0.62 | **0.65** | 0.62 | **0.67** | | |
| $SO_4^{2-}$ | 2006 | 0.74 | **0.76** | 0.73 | **0.76** | 0.74 | **0.76** | 0.79 | **0.79** |
| | 2007 | 0.64 | **0.65** | 0.64 | **0.65** | 0.64 | **0.65** | | |
| $NH_3$ | 2006 | 0.44 | **0.48** | 0.49 | **0.52** | 0.50 | **0.47** | 0.59 | **0.60** |
| | 2007 | 0.93 | **0.91** | 0.93 | **0.94** | 0.89 | **0.93** | | |
| $NH_4^+$ | 2006 | 0.78 | **0.80** | 0.77 | **0.80** | 0.76 | **0.79** | 0.82 | **0.84** |
| | 2007 | 0.63 | **0.68** | 0.63 | **0.68** | 0.64 | **0.68** | | |
| $NH_x$ | 2006 | 0.65 | **0.78** | 0.67 | **0.78** | 0.68 | **0.77** | 0.66 | **0.74** |
| | 2007 | 0.79 | **0.84** | 0.78 | **0.82** | 0.75 | **0.81** | | |
| $HNO_3$ | 2006 | 0.09 | **0.13** | 0.11 | **0.13** | 0.35 | **0.44** | 0.23 | **0.28** |
| | 2007 | 0.49 | **0.51** | 0.47 | **0.47** | 0.64 | **0.67** | | |
| $xNO_3$ | 2006 | 0.83 | **0.83** | 0.81 | **0.81** | 0.84 | **0.84** | 0.83 | **0.83** |
| | 2007 | 0.87 | **0.86** | 0.84 | **0.84** | 0.85 | **0.85** | | |
| $NO_3^-$ | 2006 | 0.82 | **0.83** | 0.79 | **0.81** | 0.78 | **0.79** | 0.82 | **0.83** |
| | 2007 | 0.73 | **0.77** | 0.70 | **0.73** | 0.69 | **0.71** | | |

or the emission fields, leads to improved model performance. This is particularly true for the primary components $NO_2$ and $NH_3$. The largest improvement is seen for $NH_3$ in 2006, where the spatial correlation coefficient increase from 0.44 to 0.60 as a result of meteorology alone. For $SO_2$, there is no improvement in spatial correlation due to increased resolution of meteorology. Both $NO_x$ and ammonia emissions are to a large extent released close to the surface (from traffic and agriculture, respectively), whilst a dominant part of $SO_2$ emissions comes from industrial sources where emissions are released from high stacks, and travel further before impacting ground-level. Ground-level concentrations of $NO_x$ and $NH_3$ are thus more sensitive to changes in the local scale, whether in meteorology or emissions. Meteorological influences include such factors as stability or wind-field changes, we have not yet analysed such factors in detail.

The spatial correlation for $NH_3$ is very different in 2006 and 2007 (r$\sim$0.5 and r$\sim$0.9, respectively). However, this is a result of the difference in number and characteristics of the sites that reported measurements in these two years. In 2007, ammonia concentrations ranging from very low concentrations (e.g. Norway) to very high concentrations (The Netherlands) were reported, and in general the high spatial correlation between model results and observations mirrors the gradient in emissions over Europe,

Table 7.5: Comparison between model results and observations (wet depositions and concentration in precipitation.) for 2006 and 2007 (spatial correlation coefficient). SOX = wet deposition of sulphur, OXN = wet deposition of oxidized nitrogen, RDN = wet deposition of reduced nitrogen. $XX_c$ = concentration in precipitation. An overview of the different model runs is given in Table 7.3.

| | Year | H50 | **H50-TNO** | H25 | **H25-TNO** | H20 | **H20-TNO** | H10 | **H10-TNO** |
|---|---|---|---|---|---|---|---|---|---|
| SOX | 2006 | 0.57 | **0.55** | 0.61 | **0.62** | 0.58 | **0.60** | 0.62 | **0.63** |
| | 2007 | 0.59 | **0.59** | 0.62 | **0.56** | 0.61 | **0.65** | | |
| $SOX_c$ | 2006 | 0.72 | **0.70** | 0.73 | **0.73** | 0.70 | **0.70** | 0.66 | **0.64** |
| | 2007 | 0.65 | **0.64** | 0.64 | **0.60** | 0.61 | **0.64** | | |
| RDN | 2006 | 0.80 | **0.77** | 0.82 | **0.79** | 0.82 | **0.78** | 0.80 | **0.77** |
| | 2007 | 0.74 | **0.73** | 0.74 | **0.72** | 0.72 | **0.69** | | |
| $RDN_c$ | 2006 | 0.69 | **0.71** | 0.69 | **0.72** | 0.70 | **0.73** | 0.63 | **0.65** |
| | 2007 | 0.68 | **0.72** | 0.66 | **0.69** | 0.65 | **0.70** | | |
| OXN | 2006 | 0.70 | **0.69** | 0.73 | **0.73** | 0.76 | **0.75** | 0.76 | **0.76** |
| | 2007 | 0.68 | **0.66** | 0.74 | **0.73** | 0.74 | **0.73** | | |
| $OXN_c$ | 2006 | 0.68 | **0.68** | 0.66 | **0.66** | 0.67 | **0.66** | 0.58 | **0.55** |
| | 2007 | 0.66 | **0.64** | 0.65 | **0.63** | 0.67 | **0.66** | | |
| Prec | 2006 | 0.73 | **0.73** | 0.72 | **0.72** | 0.68 | **0.68** | 0.73 | **0.73** |
| | 2007 | 0.65 | **0.65** | 0.68 | **0.68** | 0.67 | **0.67** | | |

which are rather well captured. In 2006, however, ammonia concentration from The Netherlands were not reported. Therefore, the rather poor spatial correlation in 2006 reflects problems in reproducing spatial variations in areas with relatively similar concentrations. It should be noted, however, that the number of sites that measure $NH_3$ is rather limited ($\sim$ 15) and that most of the measurements are filter-pack measurements which can be biased.

For the secondary components ($SO_4^{2-}$, $NO_3^-$ and $NH_4^+$), the improvement of spatial correlation with resolution is less clear, although the results from model run H10 is better or equal to H50 for all three components for 2006, with increases in both meteorological and emissions resolution providing the best performance. Still, the concentrations of the secondary components are a result of long range transport (because of their longer life time than the primary components), thus they are less sensitive to the resolution of meteorology or emissions.

### 7.4.2 Effects of improved resolution on PM model results

In this section, we summarize the main findings as regards the effect of using finer grid resolutions on model calculations of Particulate Matter (PM). The study is based on four model runs for the year of 2006: the base run on 50×50 km$^2$ using EMEP reported emissions (H50), and three runs using EMEP sector total emissions gridded

Table 7.6: The spatial correlation (r) between modelled and observed particle components, $\mathrm{PM}_{10}$, $\mathrm{PM}_{2.5}$, SIA and $\mathrm{Na}^{+}$ for 2006. An overview of the different model runs is given in Table 7.3.

| Comp | H50 | H50-TNO | H25-TNO | H10-TNO |
|---|---|---|---|---|
| $\mathrm{PM}_{10}$ | 0.46 | 0.49 | 0.54 | 0.56 |
| $\mathrm{PM}_{2.5}$ | 0.66 | 0.67 | 0.73 | 0.71 |
| SIA | 0.87 | 0.88 | 0.87 | 0.88 |
| $\mathrm{Na}^{+}$ | 0.83 | 0.83 | 0.88 | 0.89 |

according to TNO distribution: on 50×50 km$^2$ (H50-TNO), on 25×25 km$^2$ (H25-TNO), and 10×10 km$^2$ (H10-TNO). All runs were performed on the EMEP grid on a polar stereographic projection.

Comparison of the concentration fields (not presented here) showed that the differences in annual mean $\mathrm{PM}_{10}$ and $\mathrm{PM}_{2.5}$ are within 5-10% over most of EMEP area when calculated with these three resolutions. Somewhat larger differences (10-20%) are found in association with large emission sources, particularly in cities, and especially for primary PM.

Table 7.6 provides the comparison statistics between model calculated and observed $\mathrm{PM}_{10}$, $\mathrm{PM}_{2.5}$, SIA and $\mathrm{Na}^{+}$ for 2006, showing the spatial correlation coefficient. There is virtually no effect of using finer resolutions on the model bias for $\mathrm{PM}_{10}$ and $\mathrm{PM}_{2.5}$, and only a slight bias decrease is found for SIA, so these changes are not shown. In any case, the model results for PM shown here do not include secondary organic aerosol (SOA) or dust, so one should expect a bias. The SOA contribution is discussed in EMEP Report 4/2009 (EMEP CCC & MSC-W 2009).

For the same resolution of 50×50 km$^2$, the models underestimation of $\mathrm{PM}_{10}$ increases from 34% when using official EMEP emissions to 41% when EMEP emissions are re-gridded based on TNO distribution. The spatial correlation between calculated and measured $\mathrm{PM}_{10}$ and $\mathrm{PM}_{2.5}$ generally gets better as the grid resolution becomes finer. For SIA, the spatial correlation remains about the same for the model results at all three resolution. This suggests that the improvement of correlation for PM should be due to improvement in the spatial distribution of primary particles. This suggestion supports the results discussed in the previous section that the use of finer resolutions improves the spatial correlation of primary pollutants, while not affecting much the correlation of secondary components.

## 7.5 Fine resolution source-receptor matrices

The source-receptor calculations on fine scale (25 km) are very CPU demanding. Therefore, this first analysis is based on 3 example countries (The United Kingdom, The Netherlands and Germany). These countries are chosen because of their different characteristics; The UK is often upwind of continental sources, and hence more isolated, with a dominating part of the deposition originating from sources in the country itself. The Netherlands and Germany contrast each other by size (but they both have relatively large emissions); The Netherlands is a small country with most of its deposition originating from sources outside the country, whilst in Germany a much larger part of the emissions is deposited within the country.

Three different sets of model runs have been performed based on H50, H25 and H25-TNO (see Table 7.3 for a description of the runs). Only 3 pollutants are covered here; $\mathrm{SO_x}$, fine primary particulate matter ($\mathrm{PPM_{2.5}}$) and coarse primary particulate matter ($\mathrm{PPM_{co}}$). Since model calculations have been done only for 3 different countries, only the export budgets will be discussed here.

$\mathrm{PPM_{2.5}}$ and $\mathrm{PPM_{co}}$ are chemically inert, thus there are no interactions between scale and chemical non-linearities. This is not totally true for $\mathrm{SO_x}$, as the $\mathrm{SO_2}$ oxidation depends on $\mathrm{OH}$, $\mathrm{H_2O_2}$ and $\mathrm{O_3}$ (the modelled levels of these components might change somewhat as a result of changes in model resolution). However, these 3 pollutants are the 'simplest' examples, and the effect might be larger for $\mathrm{NO_x}$ and $\mathrm{O_3}$ where chemical non-linearities play a much larger role.

### 7.5.1 Results

**Effect of meteorology**

In order to separate out the effect of the resolution of meteorology from the combined effect of meteorology and emissions, we first compare the two runs where only the resolution of meteorology is changed and emissions are identical (H50 and H25). For all the 3 countries analysed, there is very little difference in the export budgets between the H50 and H25 runs. For the wet deposition of $\mathrm{SO_x}$, the differences are almost zero (Figure 7.2), whilst they are somewhat larger for $\mathrm{PM_{2.5}}$ (Figure 7.3, up to 5% for the largest contribution) and $\mathrm{PM_{co}}$ (up to 3% for the largest contribution). The differences are larger for the small contributions (since these in general result from emissions/components that have been transported over longer distances), but the order and magnitude of the larger contributions are the same. Differences between $\mathrm{SO_x}$ and $\mathrm{PPM_{2.5}}$ are likely due to different residence times, since $\mathrm{PPM_{2.5}}$ is pure-particulate, whereas $\mathrm{SO_x}$ is a mixture of gaseous $\mathrm{SO_2}$ and particulate $\mathrm{SO_4^{2-}}$. (In general, fine particles have a longer residence time in the atmosphere than $\mathrm{SO_2}$).

**Effect of emissions**

As shown in Figures 7.2 and 7.3, the effect of the emissions is much larger than the effect of scale in the meteorology. However, this is not purely an effect of the resolution of the emissions. Although the sector totals for each country are the same in the TNO emissions and the EMEP emissions, the spatial distribution is somewhat different, e.g.

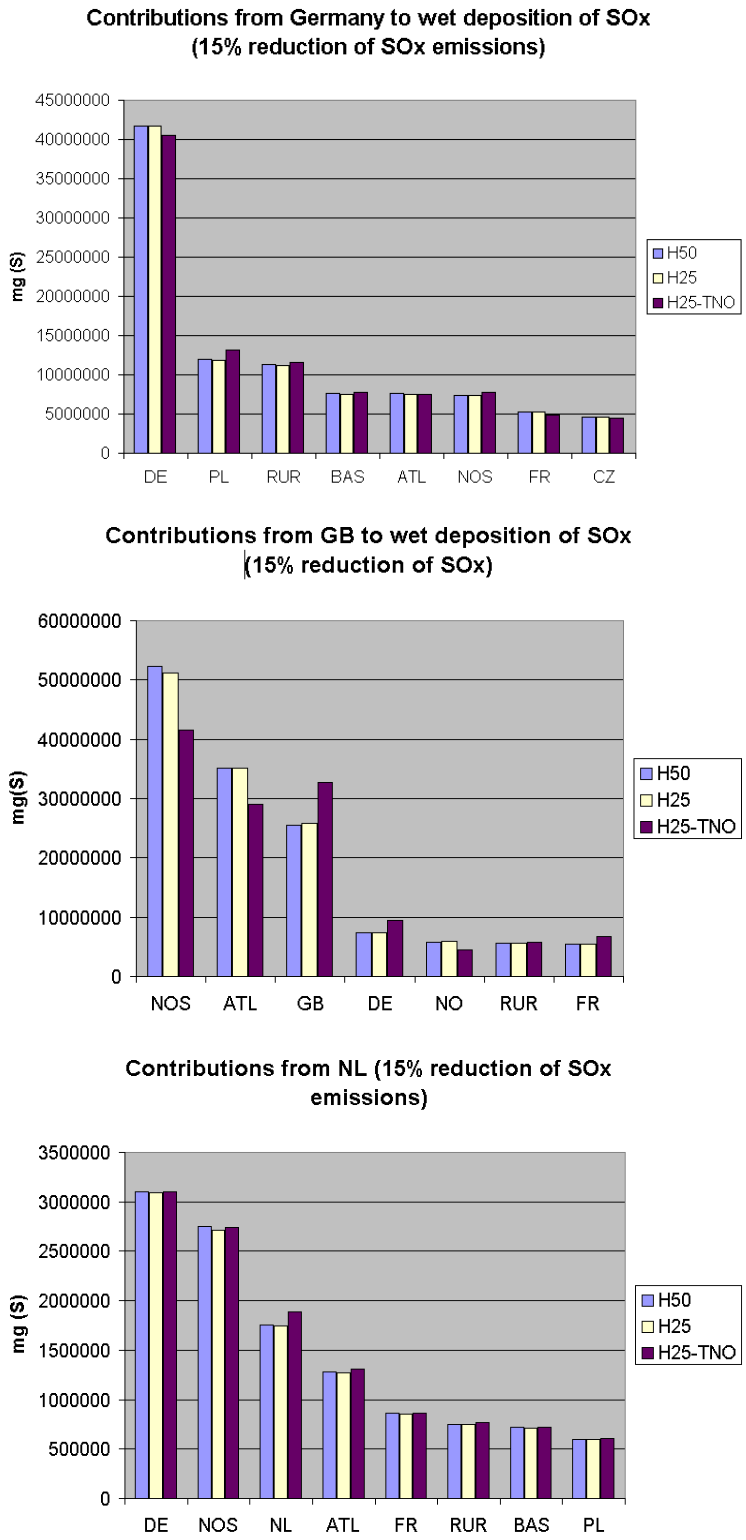


Figure 7.2: Contributions from Germany, Great Britain and The Netherlands (from 15% of $SO_x$ emissions in the respective countries) to wet deposition of oxidized sulphur. Only the largest contributions are shown. H50=EMEP model run in 50 km, H25=EMEP model run in 25 km and EMEP emissions (effectively 50 km), H25-TNO=EMEP model run in 25 km and TNO emissions.

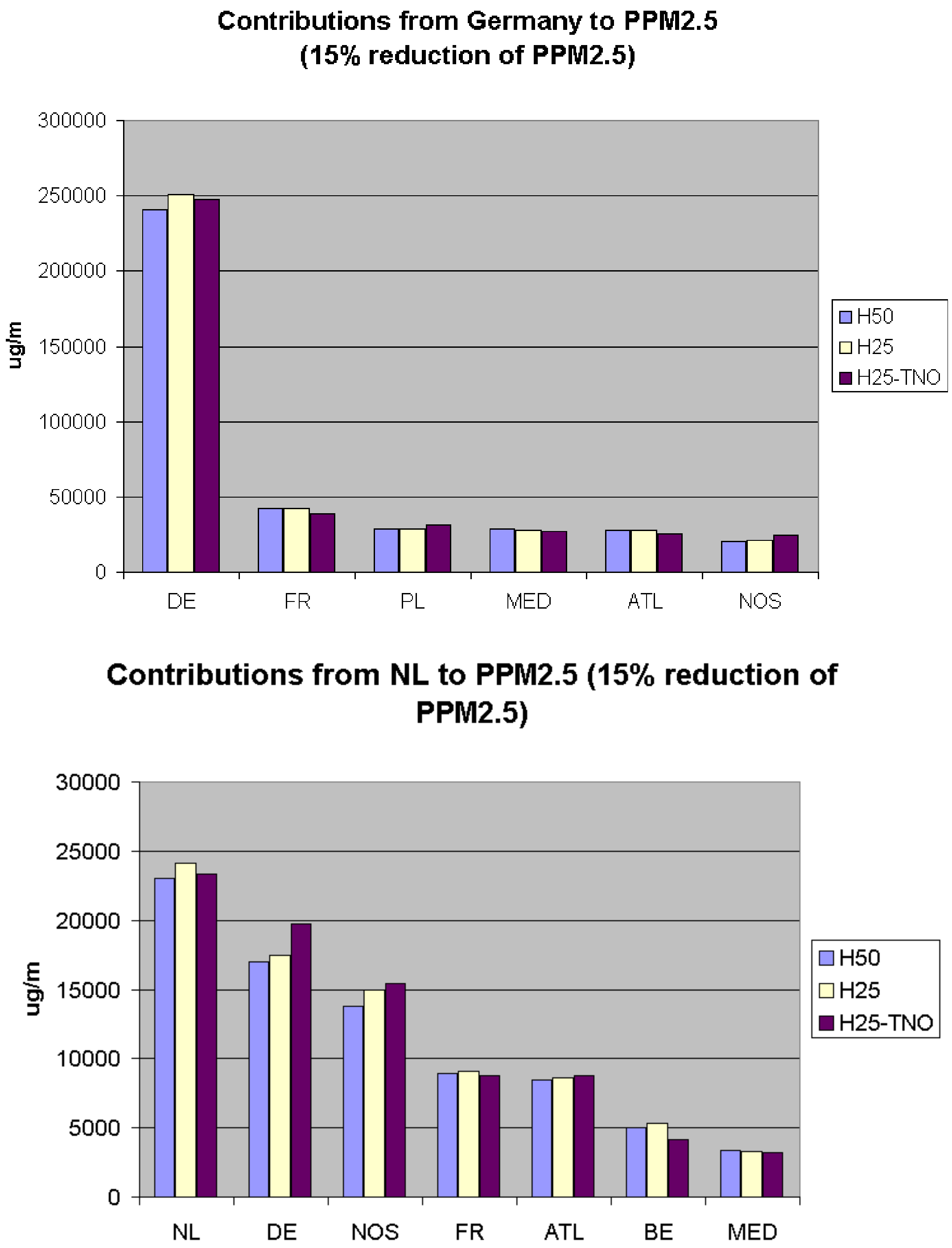


Figure 7.3: Contributions from Germany and The Netherlands (from 15% of $SO_x$ emissions in the respective countries) to $PPM_{2.5}$. Only the largest contributions are shown. H50=EMEP model run in 50 km, H25=EMEP model run in 25 km and EMEP emissions (effectively 50 km), H25-TNO=EMEP model run in 25 km and TNO emissions.

an aggregation of the TNO 25 km emissions into 50 km would not be equal to EMEP 50 km spatial distribution of emissions.

For Germany and the Netherlands, the effect of the re-distribution (and finer resolution) of emissions is rather small (a maximum difference of 10% for the largest contributions). For the UK (GB), however, the export from GB to the North Sea and the Atlantic is reduced by almost 20% in the H25-TNO run compared to H25, whilst the indigenous contribution (and the contribution to Germany) increased by more than 25%. In the EMEP emission data, a substantial part of emissions of $SO_x$ (from oil installations) is located in the sea areas, whilst there are no $SO_x$ emissions in the sea areas in the TNO data. It is evident that more emissions of $SO_x$ in the sea areas in the H25 run lead to larger depositions to the North Sea and the Atlantic Sea, and smaller indigenous contributions.

## 7.6 Conclusions

Overall the performance of the EMEP model improves with increased resolution. For primary components, both increased resolution of meteorology and emissions contribute to the improvement. For secondary components and wet depositions the results are less clear. With a 10 km resolution, the EMEP model is approaching suburban scale, and future work will include comparison with a network (AIRBASE) that contains sites that represent this scale and not just the background (like the EMEP network).

A preliminary analysis of the effect of scale (excluding the effect of fine resolution emissions) on source-receptor matrices shows that increasing the resolution of the model (from 50 km to 25 km) only has a minor impact on the results, at least for the largest contributions from one country to another. However, the analysis has only been done for $\mathrm{SO_x}$, $\mathrm{PPM_{2.5}}$ and $\mathrm{PPM_{co}}$, and this conclusion might change for components for which chemical non-linearities are important (e.g. $\mathrm{O_3}$ and $\mathrm{NO_x}$). In general, the effect of scale on source-receptor calculations is significantly smaller than the effect of using different meteorological drivers (chapter 6) or meteorological variability (van Loon et al. 2005).

The effect of improving the scale of emissions cannot be judged directly from this analysis since the aggregated fine scale emission (to 50 km) does not equal the EMEP 50 km emissions. However, it is clear that different spatial distribution of emissions (as in the two data sets used; TNO and EMEP) can lead to large differences (in the order of 25%) in the calculated contributions from one country to another.

This study has been limited to some extent by the lack of fine-scale landuse data. These runs need to be repeated when such data become available, and then a more systematic study of the impacts of scale on model results and performance can be undertaken.

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# CHAPTER 8

# Comparison of modelled nitrogen deposition and nitrogen concentrations in mosses

**Harry Harmens, David Cooper, David Norris, Winfried Schröder, Roland Pesch, Marcel Holy and Hilde Fagerli**

The European moss biomonitoring network was originally established in 1990 to estimate atmospheric heavy metal deposition at the European scale. Since 2001, the network has been coordinated by the ICP Vegetation, a subsidiary body of the UNECE Long-range Transboundary Air Pollution Convention (Harmens et al. 2008b).

The European moss survey has been repeated at five-yearly intervals. The most recent European moss survey was conducted in 2005/6. For the first time, 16 countries also determined the total N concentration in mosses at a total of almost 3,000 sites (Harmens et al. 2008a). The 2005/6 survey was the first attempt to establish whether mosses can be used as biomonitors of atmospheric N deposition at the European scale. Although a number of studies have shown the potential of mosses as monitors of atmospheric N deposition (see Harmens et al. 2008a), the robustness of the relationship between measured site-specific N deposition rates and concentrations in mosses at the European scale is not known.

In this preliminary study, EMEP modelled N deposition was compared to the 2005/6 data on N concentrations. This exercise may be regarded as a cross validation of moss data and EMEP model data, both because of potential limitations in the use of the moss data as monitors of atmospheric N deposition and due to uncertainties in the modelled N deposition (including uncertainties in emissions).

## 8.1 Results

The lowest total N concentrations in mosses were generally observed in northern Finland and northern parts of the UK (Figure 8.1). In Finland there was a clear north-south gradient which continued into the Baltic States. In the UK, locally high concentrations were found in the Midlands and South-East. The highest concentrations were found in parts of Western, Central and Eastern Europe, in particular in Belgium, Germany, Slovakia, Slovenia and parts of Bulgaria and France. The same spatial distribution is found in the EMEP modelled N deposition, except that the modelled N deposition tends to be lower in Eastern Europe.

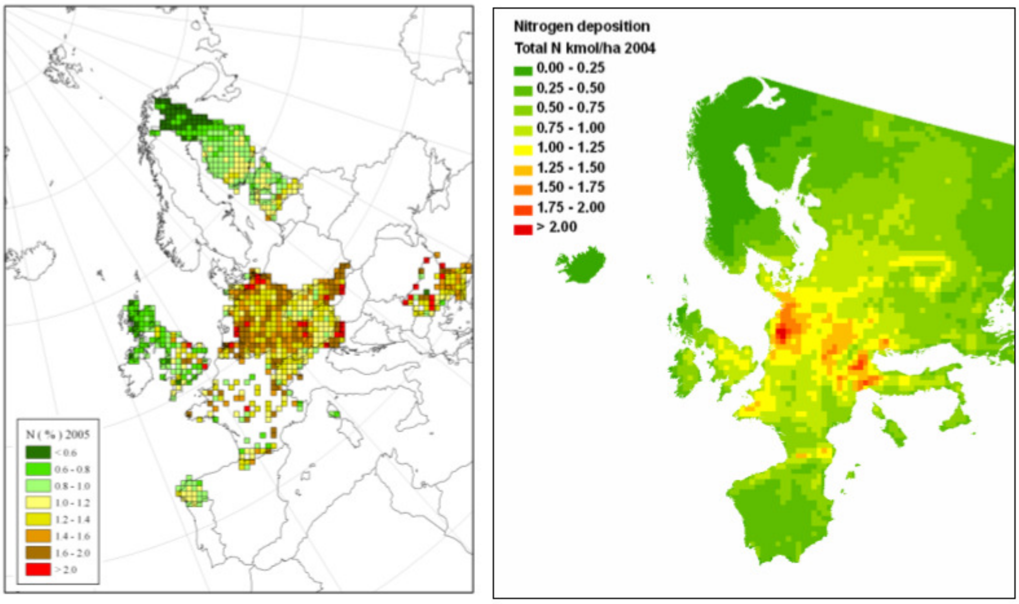


Figure 8.1: Mean total nitrogen concentration in mosses per EMEP grid cell [%] in 2005/2006 (a) and modelled nitrogen deposition [kmol ha$^{-1}$y$^{-1}$] in 2004 (b).

However, the relationship between total N concentration in mosses and modelled total N deposition shows considerable scatter (Figure 8.2). Some of the scatter can be explained by relating site-specific N concentrations in mosses with N depositions averaged per 50 $\times$ 50 km$^2$ EMEP grid. Actual deposition values vary considerably within each EMEP grid cell due to for instance topography, vegetation, local pollution sources and climate. The apparent asymptotic relationship shows saturation of the total N in mosses above a N deposition rate of approximately 10 kg ha$^{-1}$y$^{-1}$. It is not clear, however, whether this is due to an overestimation of modelled deposition at these sites, or that it indicates a non-linear relation between nitrogen deposition and total N concentration in mosses. For example in Switzerland, a significant linear relationship was found when based on measured site-specific bulk N deposition rates (Thöni et al. 2005). There is a need to measure atmospheric N deposition at selected

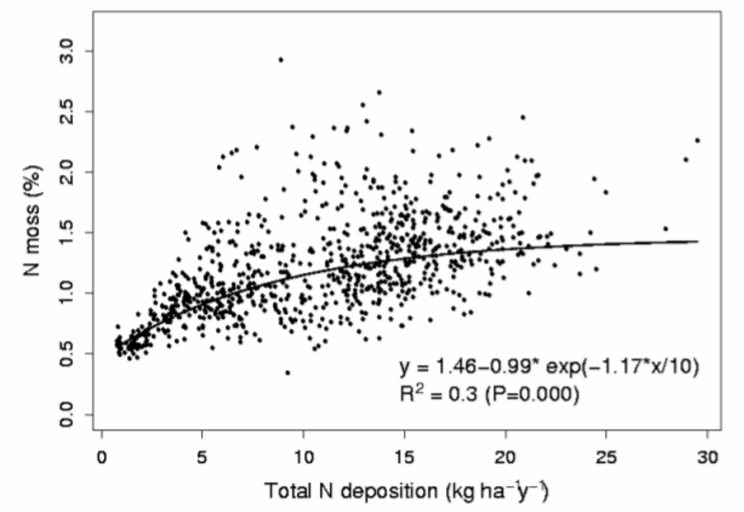


Figure 8.2: Relationship between EMEP modelled total nitrogen deposition (2004) and averaged nitrogen concentrations in mosses (2005/2006) across Europe.

moss sampling sites in other countries too in order to further investigate the robustness of the relationship with total N concentration in mosses.

The data on N concentrations in mosses have also been compared statistically to air concentrations of nitrogen species and dry and wet deposition of reduced and oxidized nitrogen, applying methods described by Pesch et al. (2008). Additional factors that are expected to influence the total nitrogen concentrations in mosses (for instance land use, population and livestock density, altitude, precipitation) were also included in the analysis. Moderate Spearman rank correlations coefficients (i.e. $0.5< r<0.7$) were found between nitrogen concentrations in mosses and EMEP modelled N concentrations and depositions, independent of form. The total N concentration in mosses appears to mirror land use-related atmospheric N deposition across Europe to a high degree.

## 8.2 Conclusions

The data on N concentrations in mosses from the European moss survey represent a valuable data set for evaluation of the EMEP modelled N deposition. The preliminary comparison has shown that the spatial pattern over Europe are the same in the mosses data and the modelled data. There are, however, some inconsistencies (for instance relatively lower N concentrations in mosses in Eastern Europe). It is not clear whether this is due to uncertainties in the model results or if there are other factors in the mosses data that need to be taken into account when applying the mosses data as monitors for N deposition. This will require further investigation.

Future work will include a comparison of fine resolution EMEP model runs (10 km and 25 km grid resolutions) with the N concentrations in mosses. Possibly, this will reduce the scatter between the mosses data and the modelled deposition. In forthcoming analyses, we will also include an average of deposition over several years.

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CHAPTER 9

# Modelled and observed $NO_2$ tropospheric column and surface concentrations

**Alvaro Valdebenito and Ann Mari Fjæraa**

Satellite products have an excellent spatial coverage on a resolution comparable to the model results and data availability is limited only by overpass time and cloudiness. On the other hand ground stations offer 24 hour coverage over an area which may or may not be representative for the average value in the model grid square. Data assimilation offers a method to combine both types of observations and model results into a consistent dataset. But before this is possible the relation between both measurement types and the model results needs to be carefully characterised. For instance, the development and operation of a 4D-Var assimilation system would require the characterisation of the model bias against each observation type and an error estimate for each observation type on each location and the covariances between these errors.

The Ozone Monitoring Instrument (OMI) provides daily global coverage with a $13 \times 24\ km^2$ resolution. $NO_2$ tropospheric column retrieved from OMI observations is made publicly available on near real time (Boersma et al. 2007) by TEMIS (`www.temis.nl`). From these resources a small dataset of satellite tracks for June 2007 was compiled and the values for the daily overpass over three EMEP sites were extracted. Additionally to the satellite data co-located over the EMEP sites the minimum and maximum values over a 50 $km$ radius around the sites were also extracted. This was done in order to evaluate the spatial variability associated with the co-location of the satellite data. Preliminary results for the comparison between the co-located satellite data, hourly observations for $NO_2$ surface concentrations and model result are presented in this study.

## 9.1 Results

Figure 9.1 shows the results for the preliminary comparison of $\mathrm{NO_2}$ tropospheric column and surface concentrations from both model results and observations. The inspection of the model hourly output (not shown here) indicates a correlation between tropospheric column and surface concentration. This is consequence of the large contribution of the four lowermost model levels to the tropospheric column, which account for more than 50 % of the column. These levels expand up to around half kilometer and are strongly correlated to the surface concentrations.

The variability of the satellite product at overpass time within a radius of 50 $km$ (red errorbars) show a range comparable to the model daily variability for the same location. The current size of the observational dataset used in this preliminary study is too small to quantify the correlation between satellite, surface observations and their modelled counterparts. A larger observational dataset would also allow to characterise the effect of seasonality and to screen for artifacts on the satellite retrieval (e.g. cloud contamination).

## 9.2 Conclusions

The preliminary comparison of satellite $\mathrm{NO_2}$ tropospheric column and model results indicates that the spatial variability of the satellite product within 50 $km$ is comparable to the model daily variability over the surface observation site. Hourly model results indicate a correlation between tropospheric column and surface concentration. The studied period is too short to quantify the correlation between both observation types and model results.

On a data assimilation system, the errors estimates for different observations are usually assumed uncorrelated. In order to use both observation types on a data assimilation system the relation between observed $\mathrm{NO_2}$ tropospheric column and surface concentration needs to be statistically characterised over a much larger observational dataset. This would allow the assimilation system to account for the effects of the correlation between observation errors. For this purpose the co-located OMI dataset will be expanded in order to include more than 30 EMEP sites for which hourly $\mathrm{NO_2}$ surface concentrations observations are available for 2007.

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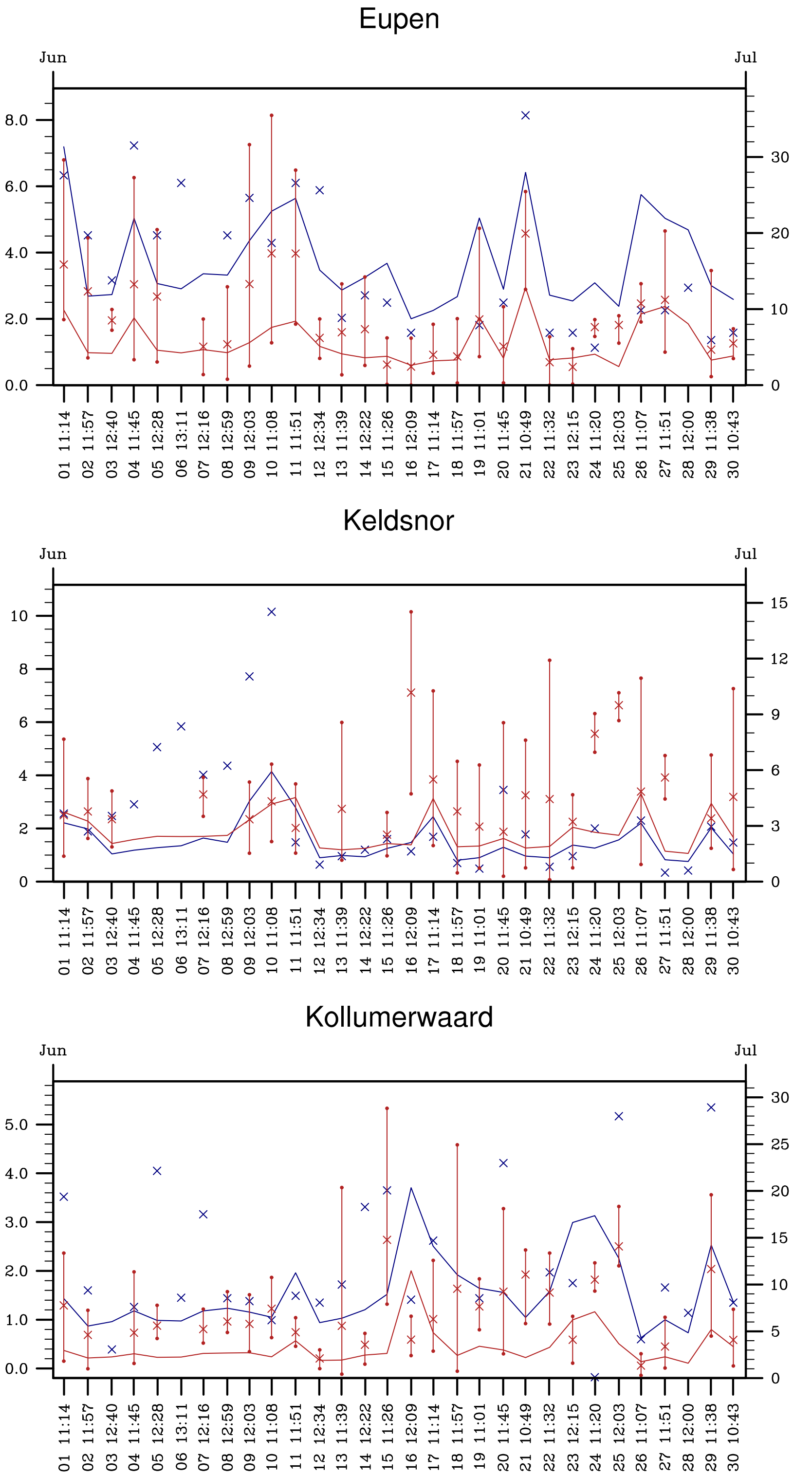


Figure 9.1: Comparison of $NO_2$ tropospheric column and surface concentration from model results and observations over three EMEP sites for June 2007. Model (blue line), observed surface concentrations (blue markers) [$\mu g/m^3$], model (red line) and OMI $NO_2$ tropospheric column (red markers) [$10^{15}$ $molec./cm^2$] at the time of the satellite overpass. The vertical errorbars denote the minimum and maximum for OMI $NO_2$ tropospheric column over a 50 $km$ radius around the site.

# Part IV

# Appendixes

# APPENDIX A

## National emission trends for 1997–2006

This appendix contains trends of national emission data for main pollutants and primary particle emissions in the old EMEP domain for the years 1997–2006. These emissions were used for the source-receptor trend studies.

The national total emissions for 1997–2004 have been derived from the 2006 official data submissions to UN-ECE CLRTAP (Vestreng et al. 2006), while the emissions for 2005 and 2006 have been derived from the respective 2007 (Vestreng et al. 2007) and 2008 (Mareckova et al. 2008) official data submissions to UN-ECE CLRTAP.

Note that emissions in this appendix are given in different units than used elsewhere in this report in order to keep consistency with the reported data.

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Table A:1: National total emission trends of sulphur, as used for SR trend modelling at the MSC-W (Gg of $SO_2$ per year).

| Area/Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| Albania | 21 | 25 | 29 | 32 | 32 | 32 | 32 | 32 | 32 | 31 |
| Armenia | 14 | 13 | 12 | 11 | 11 | 10 | 9 | 8 | 8 | 7 |
| Austria | 40 | 36 | 34 | 32 | 33 | 33 | 33 | 29 | 26 | 28 |
| Azerbaijan | 222 | 202 | 182 | 162 | 154 | 146 | 138 | 130 | 130 | 120 |
| Belarus | 271 | 235 | 198 | 162 | 126 | 117 | 107 | 97 | 103 | 91 |
| Belgium | 223 | 204 | 186 | 171 | 169 | 150 | 147 | 154 | 147 | 139 |
| Bosnia and Herzegovina | 384 | 396 | 408 | 420 | 422 | 423 | 425 | 427 | 427 | 429 |
| Bulgaria | 1365 | 1251 | 942 | 918 | 969 | 964 | 994 | 929 | 900 | 877 |
| Croatia | 80 | 89 | 90 | 60 | 63 | 68 | 75 | 85 | 60 | 63 |
| Cyprus | 48 | 49 | 51 | 51 | 47 | 51 | 45 | 45 | 42 | 36 |
| Czech Republic | 700 | 443 | 269 | 264 | 248 | 235 | 232 | 227 | 219 | 211 |
| Denmark | 95 | 73 | 53 | 27 | 24 | 24 | 30 | 23 | 22 | 25 |
| Estonia | 117 | 103 | 97 | 96 | 92 | 88 | 101 | 90 | 77 | 71 |
| Finland | 99 | 90 | 87 | 74 | 85 | 79 | 98 | 83 | 69 | 85 |
| France | 796 | 817 | 705 | 613 | 550 | 510 | 505 | 484 | 465 | 452 |
| Georgia | 6 | 6 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 14 |
| Germany | 1197 | 956 | 776 | 630 | 628 | 588 | 595 | 559 | 560 | 558 |
| Greece | 518 | 527 | 544 | 493 | 502 | 517 | 554 | 537 | 537 | 536 |
| Hungary | 659 | 592 | 590 | 486 | 400 | 360 | 339 | 240 | 129 | 118 |
| Iceland | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 8 | 8 |
| Ireland | 166 | 176 | 157 | 131 | 126 | 96 | 76 | 71 | 70 | 60 |
| Italy | 1132 | 995 | 899 | 752 | 708 | 632 | 506 | 418 | 496 | 358 |
| Kazakhstan (KZ) | 519 | 515 | 510 | 506 | 486 | 466 | 445 | 425 | 425 | 398 |
| Latvia | 38 | 35 | 29 | 10 | 8 | 6 | 5 | 4 | 4 | 3 |
| Lithuania | 72 | 63 | 53 | 43 | 45 | 43 | 39 | 40 | 44 | 43 |
| Luxembourg | 6 | 6 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Malta | 27 | 27 | 25 | 26 | 29 | 29 | 33 | 17 | 18 | 18 |
| Montenegro | 58 | 57 | 56 | 55 | 53 | 52 | 50 | 48 | 48 | 48 |
| Netherlands | 109 | 98 | 91 | 72 | 73 | 65 | 63 | 66 | 62 | 64 |
| Norway | 31 | 30 | 29 | 27 | 25 | 23 | 23 | 25 | 24 | 21 |
| Poland | 2185 | 1902 | 1724 | 1507 | 1564 | 1455 | 1375 | 1286 | 1222 | 1195 |
| Portugal | 292 | 341 | 341 | 306 | 294 | 294 | 200 | 203 | 215 | 190 |
| Republic of Moldova | 61 | 45 | 29 | 13 | 12 | 15 | 21 | 15 | 13 | 16 |
| Romania | 835 | 811 | 689 | 727 | 832 | 783 | 734 | 685 | 727 | 863 |
| Russian Federation | 2766 | 2599 | 2431 | 2263 | 2162 | 2061 | 1960 | 1858 | 1858 | 1723 |
| Serbia | 357 | 351 | 346 | 340 | 329 | 317 | 305 | 293 | 293 | 400 |
| Slovakia | 202 | 179 | 171 | 127 | 131 | 103 | 106 | 97 | 89 | 88 |
| Slovenia | 120 | 125 | 107 | 99 | 68 | 71 | 64 | 55 | 42 | 18 |
| Spain | 1748 | 1597 | 1607 | 1489 | 1446 | 1550 | 1352 | 1172 | 1215 | 1129 |
| Sweden | 70 | 67 | 54 | 52 | 51 | 51 | 52 | 47 | 40 | 39 |
| Switzerland | 24 | 22 | 20 | 19 | 18 | 18 | 18 | 17 | 17 | 18 |
| TFYR of Macedonia | 92 | 91 | 91 | 90 | 89 | 88 | 88 | 87 | 108 | 87 |
| Turkey | 1687 | 1832 | 1977 | 2122 | 2039 | 1957 | 1875 | 1792 | 1792 | 1682 |
| Ukraine | 2045 | 1896 | 1748 | 1599 | 1461 | 1324 | 1232 | 1145 | 1294 | 1446 |
| United Kingdom | 1635 | 1591 | 1202 | 1173 | 1111 | 994 | 973 | 833 | 706 | 676 |
| North Africa | 413 | 413 | 413 | 413 | 413 | 413 | 413 | 413 | 413 | 416 |
| Remaining Asian areas (ASI) | 854 | 854 | 854 | 854 | 854 | 854 | 854 | 854 | 854 | 853 |
| Baltic Sea | 200 | 205 | 211 | 216 | 221 | 227 | 233 | 239 | 245 | 225 |
| Black Sea | 54 | 55 | 56 | 58 | 59 | 61 | 62 | 64 | 65 | 66 |
| Mediterranean Sea | 1026 | 1053 | 1080 | 1108 | 1137 | 1166 | 1196 | 1227 | 1259 | 1277 |
| North Sea | 430 | 441 | 452 | 464 | 475 | 487 | 500 | 513 | 526 | 484 |
| Remaining N-E Atlantic Ocean | 457 | 468 | 480 | 492 | 504 | 517 | 530 | 543 | 557 | 566 |
| Natural marine emissions | 743 | 743 | 743 | 743 | 743 | 743 | 743 | 743 | 743 | 743 |
| Volcanic emissions | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| TOTAL | 29320 | 27799 | 25950 | 24617 | 24144 | 23374 | 22602 | 21490 | 21455 | 21114 |

Table A:2: National total emission trends of nitrogen oxides, as used for SR trend modelling at the MSC-W (Gg of $NO_2$ per year).

| Area/Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| Albania | 18 | 19 | 20 | 22 | 22 | 23 | 24 | 25 | 25 | 26 |
| Armenia | 23 | 26 | 28 | 31 | 32 | 33 | 38 | 38 | 38 | 41 |
| Austria | 200 | 212 | 199 | 204 | 213 | 220 | 230 | 227 | 225 | 225 |
| Azerbaijan | 80 | 78 | 76 | 76 | 77 | 80 | 86 | 85 | 85 | 89 |
| Belarus | 223 | 218 | 213 | 208 | 204 | 205 | 209 | 213 | 184 | 174 |
| Belgium | 355 | 347 | 338 | 330 | 316 | 300 | 298 | 298 | 293 | 278 |
| Bosnia and Herzegovina | 52 | 52 | 52 | 53 | 53 | 52 | 52 | 52 | 52 | 52 |
| Bulgaria | 225 | 223 | 202 | 184 | 192 | 197 | 202 | 216 | 233 | 246 |
| Croatia | 73 | 76 | 77 | 77 | 70 | 69 | 69 | 70 | 69 | 79 |
| Cyprus | 22 | 23 | 23 | 25 | 19 | 23 | 22 | 19 | 17 | 18 |
| Czech Republic | 423 | 413 | 391 | 398 | 332 | 316 | 324 | 328 | 278 | 282 |
| Denmark | 244 | 221 | 205 | 188 | 184 | 181 | 189 | 171 | 186 | 185 |
| Estonia | 40 | 39 | 35 | 37 | 38 | 40 | 39 | 37 | 32 | 30 |
| Finland | 259 | 251 | 247 | 235 | 220 | 208 | 218 | 205 | 177 | 193 |
| France | 1551 | 1532 | 1461 | 1390 | 1335 | 1282 | 1243 | 1218 | 1207 | 1351 |
| Georgia | 20 | 23 | 27 | 30 | 30 | 31 | 32 | 32 | 32 | 28 |
| Germany | 1976 | 1940 | 1916 | 1855 | 1763 | 1674 | 1605 | 1554 | 1443 | 1394 |
| Greece | 332 | 348 | 337 | 328 | 343 | 318 | 343 | 317 | 317 | 315 |
| Hungary | 200 | 204 | 205 | 194 | 192 | 196 | 192 | 190 | 203 | 208 |
| Iceland | 9 | 9 | 9 | 9 | 9 | 9 | 11 | 11 | 11 | 12 |
| Ireland | 122 | 126 | 123 | 129 | 132 | 122 | 117 | 116 | 116 | 119 |
| Italy | 1653 | 1552 | 1456 | 1377 | 1366 | 1275 | 1259 | 1244 | 1173 | 1142 |
| Kazakhstan (KZ) | 145 | 136 | 127 | 119 | 127 | 135 | 151 | 151 | 151 | 164 |
| Latvia | 41 | 39 | 37 | 34 | 38 | 37 | 38 | 39 | 41 | 44 |
| Lithuania | 63 | 65 | 57 | 49 | 47 | 51 | 53 | 55 | 58 | 61 |
| Luxembourg | 33 | 33 | 33 | 33 | 32 | 31 | 30 | 29 | 29 | 28 |
| Malta | 12 | 12 | 12 | 12 | 12 | 11 | 12 | 12 | 12 | 12 |
| Montenegro | 21 | 20 | 18 | 19 | 20 | 20 | 20 | 21 | 21 | 21 |
| Netherlands | 428 | 402 | 397 | 389 | 381 | 368 | 367 | 360 | 344 | 311 |
| Norway | 233 | 235 | 238 | 224 | 220 | 212 | 215 | 215 | 197 | 191 |
| Poland | 1114 | 991 | 953 | 838 | 848 | 796 | 808 | 804 | 811 | 890 |
| Portugal | 267 | 278 | 287 | 285 | 286 | 294 | 271 | 271 | 275 | 267 |
| Republic of Moldova | 58 | 48 | 37 | 27 | 23 | 25 | 30 | 38 | 31 | 25 |
| Romania | 372 | 358 | 345 | 331 | 335 | 338 | 342 | 346 | 346 | 326 |
| Russian Federation | 2423 | 2542 | 2577 | 2457 | 2582 | 2698 | 3105 | 3093 | 3093 | 3350 |
| Serbia | 127 | 126 | 113 | 118 | 121 | 121 | 125 | 128 | 128 | 51 |
| Slovakia | 125 | 130 | 118 | 109 | 109 | 101 | 98 | 98 | 97 | 87 |
| Slovenia | 71 | 64 | 58 | 60 | 59 | 58 | 56 | 58 | 58 | 47 |
| Spain | 1365 | 1376 | 1447 | 1477 | 1459 | 1522 | 1519 | 1519 | 1405 | 1361 |
| Sweden | 250 | 242 | 230 | 217 | 211 | 206 | 203 | 197 | 205 | 175 |
| Switzerland | 112 | 109 | 105 | 101 | 97 | 92 | 88 | 87 | 86 | 82 |
| TFYR of Macedonia | 37 | 37 | 38 | 39 | 41 | 42 | 43 | 42 | 30 | 30 |
| Turkey | 850 | 881 | 912 | 942 | 940 | 937 | 934 | 932 | 932 | 928 |
| Ukraine | 1091 | 1015 | 938 | 861 | 886 | 911 | 936 | 960 | 960 | 488 |
| United Kingdom | 2121 | 2052 | 1936 | 1857 | 1799 | 1693 | 1685 | 1621 | 1627 | 1595 |
| North Africa | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 |
| Remaining Asian areas (ASI) | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 | 169 |
| Baltic Sea | 281 | 288 | 296 | 303 | 311 | 318 | 327 | 335 | 343 | 347 |
| Black Sea | 74 | 76 | 78 | 80 | 82 | 84 | 86 | 88 | 90 | 91 |
| Mediterranean Sea | 1476 | 1514 | 1553 | 1593 | 1634 | 1677 | 1720 | 1765 | 1810 | 1831 |
| North Sea | 605 | 620 | 636 | 652 | 668 | 685 | 703 | 721 | 739 | 747 |
| Remaining N-E Atlantic Ocean | 672 | 689 | 706 | 724 | 742 | 760 | 779 | 799 | 819 | 828 |
| Natural marine emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volcanic emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 22828 | 22574 | 22188 | 21593 | 21515 | 21343 | 21809 | 21713 | 21400 | 21127 |

Table A:3: National total emission trends of ammonia, as used for SR trend modelling at the MSC-W (Gg of $NH_3$ per year).

| Area/Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| Albania | 20 | 21 | 21 | 22 | 22 | 23 | 23 | 23 | 23 | 24 |
| Armenia | 15 | 15 | 14 | 13 | 13 | 12 | 15 | 17 | 17 | 19 |
| Austria | 69 | 69 | 67 | 66 | 65 | 64 | 65 | 64 | 64 | 66 |
| Azerbaijan | 41 | 41 | 38 | 37 | 36 | 35 | 41 | 48 | 48 | 50 |
| Belarus | 152 | 150 | 143 | 142 | 134 | 128 | 120 | 121 | 135 | 134 |
| Belgium | 96 | 93 | 90 | 87 | 84 | 82 | 79 | 74 | 74 | 73 |
| Bosnia and Herzegovina | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| Bulgaria | 77 | 66 | 60 | 56 | 56 | 56 | 52 | 54 | 57 | 55 |
| Croatia | 53 | 54 | 55 | 53 | 52 | 53 | 53 | 53 | 44 | 42 |
| Cyprus | 6 | 6 | 6 | 6 | 7 | 5 | 6 | 6 | 5 | 5 |
| Czech Republic | 83 | 82 | 77 | 76 | 81 | 74 | 82 | 69 | 68 | 63 |
| Denmark | 110 | 111 | 106 | 105 | 104 | 102 | 98 | 98 | 93 | 90 |
| Estonia | 11 | 11 | 10 | 9 | 9 | 9 | 10 | 10 | 9 | 9 |
| Finland | 38 | 35 | 33 | 33 | 33 | 33 | 33 | 33 | 36 | 36 |
| France | 789 | 788 | 780 | 789 | 775 | 778 | 750 | 742 | 735 | 740 |
| Georgia | 22 | 22 | 20 | 20 | 19 | 19 | 22 | 26 | 26 | 25 |
| Germany | 636 | 644 | 650 | 646 | 659 | 649 | 648 | 641 | 619 | 621 |
| Greece | 70 | 73 | 73 | 73 | 73 | 72 | 72 | 72 | 72 | 73 |
| Hungary | 76 | 74 | 72 | 71 | 67 | 65 | 67 | 74 | 80 | 81 |
| Iceland | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Ireland | 125 | 128 | 128 | 123 | 123 | 119 | 116 | 113 | 113 | 110 |
| Italy | 426 | 428 | 436 | 424 | 433 | 435 | 423 | 412 | 426 | 419 |
| Kazakhstan (KZ) | 457 | 462 | 466 | 470 | 487 | 503 | 520 | 537 | 537 | 559 |
| Latvia | 14 | 13 | 12 | 12 | 14 | 13 | 14 | 13 | 14 | 15 |
| Lithuania | 38 | 40 | 41 | 43 | 45 | 46 | 47 | 49 | 39 | 35 |
| Luxembourg | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Malta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Montenegro | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Netherlands | 180 | 173 | 167 | 152 | 143 | 136 | 130 | 134 | 135 | 133 |
| Norway | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 | 23 |
| Poland | 349 | 369 | 340 | 321 | 328 | 325 | 323 | 317 | 326 | 287 |
| Portugal | 66 | 65 | 65 | 64 | 66 | 64 | 64 | 64 | 73 | 70 |
| Republic of Moldova | 38 | 35 | 31 | 28 | 30 | 30 | 27 | 26 | 27 | 27 |
| Romania | 213 | 223 | 237 | 252 | 253 | 257 | 261 | 266 | 266 | 199 |
| Russian Federation | 743 | 688 | 670 | 663 | 638 | 613 | 613 | 621 | 621 | 602 |
| Serbia | 55 | 55 | 55 | 55 | 56 | 56 | 56 | 57 | 57 | 57 |
| Slovakia | 39 | 34 | 32 | 32 | 33 | 33 | 31 | 28 | 29 | 27 |
| Slovenia | 20 | 20 | 20 | 20 | 20 | 20 | 19 | 17 | 19 | 19 |
| Spain | 339 | 358 | 370 | 388 | 384 | 385 | 399 | 413 | 398 | 421 |
| Sweden | 62 | 61 | 59 | 58 | 57 | 57 | 56 | 56 | 52 | 52 |
| Switzerland | 62 | 61 | 61 | 60 | 57 | 55 | 52 | 58 | 55 | 59 |
| TFYR of Macedonia | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 7 |
| Turkey | 394 | 397 | 400 | 403 | 404 | 405 | 406 | 407 | 407 | 408 |
| Ukraine | 472 | 476 | 481 | 485 | 500 | 517 | 533 | 550 | 550 | 227 |
| United Kingdom | 364 | 361 | 358 | 337 | 330 | 319 | 308 | 336 | 318 | 315 |
| North Africa | 235 | 235 | 235 | 235 | 235 | 235 | 235 | 235 | 235 | 235 |
| Remaining Asian areas (ASI) | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 278 | 277 |
| Baltic Sea | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Black Sea | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mediterranean Sea | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| North Sea | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Remaining N-E Atlantic Ocean | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Natural marine emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volcanic emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 7406 | 7387 | 7330 | 7284 | 7277 | 7236 | 7223 | 7288 | 7257 | 6824 |

Table A:4: National total emission trends of non-methane volatile organic compounds, as used for SR trend modelling at the MSC-W (Gg of NMVOC per year).

| Area/Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| Albania | 30 | 30 | 30 | 29 | 30 | 31 | 31 | 32 | 32 | 32 |
| Armenia | 41 | 43 | 45 | 47 | 47 | 48 | 49 | 49 | 49 | 49 |
| Austria | 203 | 190 | 179 | 179 | 182 | 176 | 175 | 172 | 154 | 172 |
| Azerbaijan | 215 | 221 | 227 | 233 | 233 | 233 | 234 | 234 | 234 | 234 |
| Belarus | 363 | 355 | 348 | 340 | 320 | 301 | 314 | 326 | 326 | 180 |
| Belgium | 233 | 223 | 212 | 201 | 194 | 181 | 173 | 165 | 155 | 150 |
| Bosnia and Herzegovina | 37 | 38 | 39 | 40 | 40 | 41 | 41 | 42 | 42 | 42 |
| Bulgaria | 138 | 144 | 140 | 123 | 128 | 123 | 121 | 132 | 147 | 159 |
| Croatia | 80 | 79 | 77 | 80 | 83 | 91 | 104 | 122 | 92 | 112 |
| Cyprus | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 12 | 9 | 11 |
| Czech Republic | 286 | 276 | 264 | 266 | 257 | 238 | 238 | 240 | 218 | 179 |
| Denmark | 144 | 135 | 130 | 127 | 122 | 118 | 116 | 116 | 118 | 110 |
| Estonia | 51 | 43 | 42 | 38 | 34 | 39 | 41 | 41 | 36 | 34 |
| Finland | 175 | 171 | 167 | 154 | 157 | 151 | 145 | 142 | 131 | 133 |
| France | 1870 | 1812 | 1733 | 1658 | 1587 | 1476 | 1411 | 1367 | 1439 | 1336 |
| Georgia | 76 | 87 | 99 | 110 | 110 | 109 | 108 | 107 | 107 | 120 |
| Germany | 1913 | 1842 | 1714 | 1569 | 1476 | 1381 | 1272 | 1268 | 1253 | 1349 |
| Greece | 304 | 308 | 303 | 295 | 289 | 261 | 278 | 262 | 262 | 291 |
| Hungary | 187 | 181 | 184 | 187 | 179 | 176 | 171 | 172 | 177 | 177 |
| Iceland | 11 | 10 | 10 | 9 | 10 | 10 | 11 | 11 | 11 | 12 |
| Ireland | 116 | 118 | 98 | 90 | 87 | 81 | 78 | 63 | 62 | 60 |
| Italy | 1904 | 1798 | 1711 | 1538 | 1453 | 1344 | 1307 | 1273 | 1261 | 1166 |
| Kazakhstan (KZ) | 129 | 133 | 136 | 140 | 143 | 145 | 147 | 150 | 150 | 153 |
| Latvia | 64 | 64 | 64 | 58 | 58 | 59 | 60 | 64 | 63 | 65 |
| Lithuania | 85 | 87 | 82 | 78 | 71 | 72 | 75 | 67 | 84 | 78 |
| Luxembourg | 18 | 17 | 15 | 13 | 12 | 11 | 11 | 10 | 10 | 9 |
| Malta | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 5 | 6 |
| Montenegro | 18 | 19 | 19 | 20 | 20 | 20 | 20 | 21 | 21 | 21 |
| Netherlands | 326 | 301 | 293 | 267 | 242 | 236 | 222 | 216 | 176 | 164 |
| Norway | 367 | 360 | 368 | 379 | 389 | 343 | 297 | 265 | 222 | 196 |
| Poland | 775 | 730 | 731 | 606 | 607 | 600 | 606 | 600 | 885 | 916 |
| Portugal | 293 | 293 | 285 | 282 | 284 | 286 | 287 | 287 | 302 | 312 |
| Republic of Moldova | 67 | 59 | 51 | 42 | 44 | 45 | 36 | 33 | 38 | 37 |
| Romania | 366 | 370 | 374 | 378 | 385 | 391 | 398 | 404 | 404 | 353 |
| Russian Federation | 2379 | 2371 | 2446 | 2445 | 2510 | 2574 | 2791 | 2675 | 2675 | 2799 |
| Serbia | 113 | 116 | 118 | 121 | 122 | 124 | 125 | 126 | 126 | 126 |
| Slovakia | 99 | 97 | 90 | 86 | 88 | 84 | 88 | 91 | 84 | 78 |
| Slovenia | 58 | 53 | 51 | 51 | 49 | 48 | 46 | 46 | 43 | 41 |
| Spain | 1126 | 1184 | 1181 | 1162 | 1147 | 1139 | 1146 | 1153 | 1055 | 926 |
| Sweden | 330 | 303 | 293 | 282 | 270 | 264 | 265 | 255 | 199 | 195 |
| Switzerland | 158 | 149 | 139 | 130 | 126 | 121 | 117 | 98 | 101 | 101 |
| TFYR of Macedonia | 27 | 26 | 26 | 25 | 26 | 27 | 27 | 28 | 28 | 45 |
| Turkey | 539 | 547 | 555 | 563 | 561 | 559 | 556 | 554 | 554 | 552 |
| Ukraine | 705 | 684 | 663 | 641 | 662 | 683 | 704 | 725 | 725 | 295 |
| United Kingdom | 1766 | 1617 | 1463 | 1348 | 1252 | 1175 | 1073 | 1024 | 977 | 910 |
| North Africa | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 |
| Remaining Asian areas (ASI) | 204 | 204 | 204 | 204 | 204 | 204 | 204 | 204 | 204 | 204 |
| Baltic Sea | 10 | 10 | 10 | 10 | 11 | 11 | 11 | 12 | 12 | 12 |
| Black Sea | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Mediterranean Sea | 50 | 51 | 52 | 54 | 55 | 56 | 58 | 59 | 61 | 62 |
| North Sea | 21 | 22 | 22 | 23 | 23 | 24 | 25 | 25 | 26 | 26 |
| Remaining N-E Atlantic Ocean | 22 | 23 | 24 | 24 | 25 | 25 | 26 | 27 | 27 | 28 |
| Natural marine emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volcanic emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 18615 | 18116 | 17629 | 16868 | 16527 | 16059 | 15964 | 15673 | 15674 | 14919 |

Table A:5: National total emission trends of carbon monoxide, as used for modelling at the MSC-W (Gg of CO per year).

| Area/Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| Albania | 133 | 130 | 127 | 124 | 122 | 119 | 117 | 114 | 114 | 111 |
| Armenia | 115 | 131 | 147 | 164 | 166 | 170 | 180 | 186 | 186 | 191 |
| Austria | 954 | 915 | 863 | 798 | 782 | 738 | 762 | 742 | 720 | 785 |
| Azerbaijan | 228 | 216 | 204 | 191 | 188 | 188 | 191 | 193 | 193 | 193 |
| Belarus | 736 | 733 | 729 | 725 | 719 | 727 | 741 | 758 | 765 | 592 |
| Belgium | 1097 | 1089 | 1080 | 1072 | 1009 | 969 | 956 | 972 | 876 | 838 |
| Bosnia and Herzegovina | 84 | 88 | 92 | 96 | 100 | 103 | 107 | 111 | 111 | 116 |
| Bulgaria | 651 | 706 | 689 | 667 | 659 | 700 | 696 | 755 | 740 | 785 |
| Croatia | 427 | 404 | 393 | 395 | 327 | 309 | 293 | 279 | 311 | 374 |
| Cyprus | 74 | 77 | 80 | 83 | 86 | 84 | 85 | 85 | 41 | 34 |
| Czech Republic | 872 | 773 | 727 | 650 | 602 | 544 | 578 | 572 | 511 | 484 |
| Denmark | 654 | 619 | 582 | 576 | 593 | 577 | 595 | 578 | 611 | 591 |
| Estonia | 237 | 200 | 191 | 177 | 178 | 178 | 183 | 175 | 158 | 148 |
| Finland | 477 | 455 | 550 | 530 | 604 | 599 | 564 | 554 | 525 | 511 |
| France | 7804 | 7664 | 7190 | 6628 | 6311 | 6010 | 5815 | 5977 | 5646 | 5179 |
| Georgia | 348 | 455 | 563 | 670 | 668 | 669 | 671 | 672 | 672 | 225 |
| Germany | 6033 | 5643 | 5286 | 4991 | 4696 | 4434 | 4311 | 4095 | 4035 | 4006 |
| Greece | 1342 | 1339 | 1312 | 1295 | 1266 | 1166 | 1199 | 1265 | 1265 | 954 |
| Hungary | 733 | 737 | 720 | 633 | 592 | 584 | 541 | 525 | 576 | 569 |
| Iceland | 44 | 45 | 45 | 46 | 46 | 46 | 46 | 46 | 46 | 46 |
| Ireland | 322 | 327 | 295 | 280 | 270 | 251 | 235 | 236 | 222 | 175 |
| Italy | 6571 | 6156 | 5890 | 5188 | 5108 | 4506 | 4403 | 4310 | 4193 | 3871 |
| Kazakhstan (KZ) | 307 | 300 | 293 | 287 | 291 | 298 | 313 | 321 | 321 | 333 |
| Latvia | 332 | 322 | 309 | 296 | 314 | 306 | 311 | 342 | 322 | 330 |
| Lithuania | 358 | 357 | 317 | 278 | 226 | 224 | 222 | 184 | 190 | 200 |
| Luxembourg | 54 | 53 | 50 | 49 | 49 | 48 | 48 | 48 | 48 | 48 |
| Malta | 23 | 22 | 21 | 20 | 17 | 15 | 12 | 10 | 10 | 7 |
| Montenegro | 50 | 51 | 53 | 54 | 55 | 56 | 57 | 58 | 58 | 58 |
| Netherlands | 832 | 809 | 780 | 751 | 669 | 668 | 648 | 623 | 599 | 519 |
| Norway | 671 | 631 | 595 | 564 | 552 | 546 | 510 | 483 | 446 | 421 |
| Poland | 4473 | 4027 | 3981 | 3414 | 3598 | 3412 | 3318 | 3426 | 3333 | 2800 |
| Portugal | 799 | 787 | 763 | 749 | 700 | 689 | 675 | 668 | 652 | 682 |
| Republic of Moldova | 188 | 156 | 123 | 90 | 95 | 91 | 91 | 77 | 90 | 137 |
| Romania | 1073 | 1155 | 1237 | 1319 | 1282 | 1246 | 1209 | 1172 | 1172 | 1417 |
| Russian Federation | 10909 | 10943 | 11340 | 11315 | 11856 | 12398 | 13286 | 13837 | 13837 | 14699 |
| Serbia | 305 | 315 | 325 | 335 | 341 | 346 | 352 | 358 | 358 | 358 |
| Slovakia | 379 | 348 | 335 | 320 | 322 | 299 | 315 | 316 | 303 | 290 |
| Slovenia | 125 | 110 | 102 | 101 | 95 | 90 | 83 | 84 | 84 | 108 |
| Spain | 3029 | 3004 | 2752 | 2597 | 2544 | 2427 | 2323 | 2231 | 2246 | 2365 |
| Sweden | 903 | 836 | 787 | 730 | 691 | 659 | 627 | 588 | 602 | 578 |
| Switzerland | 441 | 428 | 415 | 401 | 378 | 361 | 331 | 336 | 335 | 319 |
| TFYR of Macedonia | 86 | 85 | 84 | 84 | 83 | 83 | 80 | 77 | 117 | 96 |
| Turkey | 4337 | 4317 | 4209 | 3920 | 3663 | 3674 | 3685 | 3693 | 3693 | 3618 |
| Ukraine | 2366 | 2336 | 2306 | 2276 | 2318 | 2360 | 2295 | 2691 | 2424 | 2553 |
| United Kingdom | 5728 | 5332 | 5013 | 4285 | 4088 | 3617 | 3103 | 2923 | 2408 | 2268 |
| North Africa | 336 | 336 | 336 | 336 | 336 | 336 | 336 | 336 | 336 | 337 |
| Remaining Asian areas (ASI) | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 | 449 |
| Baltic Sea | 29 | 30 | 30 | 31 | 32 | 33 | 33 | 34 | 35 | 36 |
| Black Sea | 8 | 8 | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 10 |
| Mediterranean Sea | 148 | 152 | 156 | 160 | 164 | 168 | 173 | 177 | 182 | 187 |
| North Sea | 62 | 63 | 65 | 67 | 68 | 70 | 72 | 74 | 75 | 77 |
| Remaining N-E Atlantic Ocean | 65 | 67 | 69 | 70 | 72 | 74 | 76 | 78 | 80 | 82 |
| Natural marine emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volcanic emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 68803 | 66728 | 65057 | 61335 | 60446 | 58724 | 58310 | 58902 | 57333 | 56158 |

Table A:6: National total emission trends of fine particulate matter, as used for SR trend modelling at the MSC-W (Gg of $PM_{2.5}$ per year).

| Area/Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| Albania | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| Armenia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Austria | 26 | 26 | 26 | 26 | 27 | 26 | 27 | 27 | 26 | 23 |
| Azerbaijan | 5 | 4 | 4 | 6 | 6 | 5 | 5 | 5 | 5 | 4 |
| Belarus | 62 | 56 | 49 | 40 | 41 | 41 | 41 | 41 | 41 | 28 |
| Belgium | 33 | 32 | 32 | 35 | 32 | 32 | 30 | 30 | 29 | 28 |
| Bosnia and Herzegovina | 17 | 18 | 18 | 20 | 20 | 20 | 20 | 19 | 19 | 19 |
| Bulgaria | 76 | 68 | 54 | 59 | 58 | 57 | 56 | 56 | 56 | 55 |
| Croatia | 20 | 20 | 20 | 20 | 19 | 18 | 17 | 17 | 17 | 17 |
| Cyprus | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Czech Republic | 39 | 33 | 30 | 28 | 31 | 35 | 39 | 36 | 21 | 22 |
| Denmark | 34 | 31 | 29 | 23 | 23 | 22 | 23 | 23 | 28 | 28 |
| Estonia | 24 | 21 | 20 | 38 | 31 | 25 | 21 | 22 | 20 | 15 |
| Finland | 35 | 32 | 31 | 38 | 38 | 39 | 38 | 39 | 34 | 35 |
| France | 354 | 353 | 337 | 342 | 337 | 318 | 325 | 325 | 329 | 316 |
| Georgia | 1 | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| Germany | 124 | 115 | 107 | 115 | 113 | 109 | 108 | 105 | 111 | 112 |
| Greece | 55 | 57 | 57 | 49 | 50 | 52 | 53 | 54 | 54 | 55 |
| Hungary | 38 | 36 | 36 | 26 | 24 | 24 | 27 | 27 | 39 | 29 |
| Iceland | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ireland | 11 | 11 | 11 | 13 | 12 | 11 | 13 | 12 | 11 | 9 |
| Italy | 175 | 177 | 174 | 209 | 197 | 185 | 173 | 161 | 161 | 146 |
| Kazakhstan (KZ) | 21 | 19 | 18 | 31 | 30 | 29 | 28 | 27 | 27 | 26 |
| Latvia | 20 | 20 | 18 | 11 | 12 | 12 | 11 | 13 | 14 | 13 |
| Lithuania | 22 | 18 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 9 |
| Luxembourg | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |
| Malta | 2 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Montenegro | 7 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Netherlands | 57 | 47 | 39 | 29 | 28 | 26 | 25 | 24 | 23 | 20 |
| Norway | 56 | 54 | 56 | 58 | 57 | 60 | 56 | 55 | 50 | 48 |
| Poland | 158 | 140 | 142 | 135 | 142 | 138 | 136 | 134 | 138 | 136 |
| Portugal | 81 | 83 | 87 | 95 | 97 | 90 | 92 | 101 | 96 | 100 |
| Republic of Moldova | 57 | 46 | 34 | 23 | 23 | 24 | 25 | 25 | 25 | 7 |
| Romania | 97 | 97 | 95 | 115 | 112 | 109 | 106 | 103 | 103 | 99 |
| Russian Federation | 1053 | 1096 | 1104 | 694 | 711 | 728 | 745 | 762 | 762 | 784 |
| Serbia | 45 | 40 | 38 | 39 | 38 | 38 | 37 | 37 | 37 | 37 |
| Slovakia | 43 | 42 | 41 | 26 | 26 | 27 | 25 | 28 | 39 | 33 |
| Slovenia | 9 | 8 | 8 | 7 | 7 | 7 | 7 | 7 | 7 | 6 |
| Spain | 132 | 134 | 139 | 139 | 141 | 144 | 144 | 145 | 138 | 131 |
| Sweden | 40 | 40 | 37 | 46 | 46 | 46 | 47 | 47 | 33 | 36 |
| Switzerland | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 8 | 9 | 9 |
| TFYR of Macedonia | 13 | 14 | 15 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Turkey | 240 | 248 | 256 | 305 | 295 | 286 | 277 | 268 | 268 | 255 |
| Ukraine | 290 | 275 | 259 | 289 | 287 | 284 | 281 | 278 | 278 | 274 |
| United Kingdom | 140 | 134 | 127 | 108 | 107 | 99 | 96 | 95 | 95 | 95 |
| North Africa | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| Remaining Asian areas (ASI) | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 | 114 |
| Baltic Sea | 21 | 21 | 22 | 22 | 23 | 23 | 24 | 25 | 25 | 25 |
| Black Sea | 6 | 6 | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 |
| Mediterranean Sea | 113 | 116 | 119 | 123 | 126 | 129 | 132 | 136 | 139 | 142 |
| North Sea | 46 | 47 | 48 | 50 | 51 | 52 | 54 | 55 | 56 | 55 |
| Remaining N-E Atlantic Ocean | 53 | 54 | 55 | 57 | 58 | 60 | 61 | 63 | 64 | 66 |
| Natural marine emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volcanic emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 4145 | 4096 | 4018 | 3727 | 3713 | 3667 | 3661 | 3661 | 3653 | 3554 |

Table A:7: National total emission trends of particulate matter, as used for SR trend modelling at the MSC-W (Gg of $PM_{10}$ per year).

| Area/Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|
| Albania | 8 | 8 | 8 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| Armenia | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Austria | 47 | 47 | 46 | 44 | 46 | 46 | 46 | 47 | 46 | 43 |
| Azerbaijan | 5 | 5 | 5 | 7 | 6 | 6 | 6 | 5 | 5 | 5 |
| Belarus | 88 | 79 | 69 | 56 | 56 | 57 | 57 | 57 | 57 | 40 |
| Belgium | 49 | 48 | 47 | 66 | 64 | 63 | 61 | 62 | 43 | 40 |
| Bosnia and Herzegovina | 40 | 41 | 43 | 48 | 47 | 46 | 46 | 45 | 45 | 44 |
| Bulgaria | 126 | 113 | 89 | 94 | 94 | 93 | 92 | 92 | 92 | 91 |
| Croatia | 29 | 29 | 29 | 30 | 28 | 27 | 26 | 24 | 24 | 24 |
| Cyprus | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Czech Republic | 60 | 52 | 47 | 44 | 47 | 50 | 56 | 52 | 34 | 35 |
| Denmark | 47 | 44 | 41 | 30 | 31 | 30 | 31 | 31 | 38 | 38 |
| Estonia | 33 | 29 | 27 | 51 | 42 | 35 | 30 | 30 | 26 | 20 |
| Finland | 60 | 56 | 54 | 54 | 54 | 55 | 55 | 58 | 51 | 55 |
| France | 559 | 555 | 530 | 549 | 541 | 519 | 531 | 532 | 508 | 488 |
| Georgia | 2 | 2 | 2 | 4 | 3 | 3 | 3 | 3 | 3 | 3 |
| Germany | 165 | 154 | 146 | 193 | 187 | 184 | 184 | 173 | 193 | 194 |
| Greece | 99 | 101 | 98 | 75 | 78 | 80 | 82 | 84 | 84 | 88 |
| Hungary | 69 | 66 | 66 | 60 | 57 | 56 | 61 | 60 | 64 | 48 |
| Iceland | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Ireland | 16 | 17 | 17 | 20 | 19 | 18 | 18 | 18 | 15 | 11 |
| Italy | 233 | 237 | 230 | 273 | 258 | 243 | 229 | 214 | 214 | 194 |
| Kazakhstan (KZ) | 44 | 40 | 37 | 56 | 53 | 51 | 48 | 45 | 45 | 41 |
| Latvia | 24 | 24 | 22 | 14 | 15 | 14 | 14 | 16 | 16 | 15 |
| Lithuania | 26 | 21 | 21 | 21 | 21 | 21 | 21 | 20 | 20 | 11 |
| Luxembourg | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 3 |
| Malta | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Montenegro | 16 | 14 | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 12 |
| Netherlands | 112 | 91 | 74 | 48 | 47 | 45 | 41 | 41 | 40 | 37 |
| Norway | 64 | 63 | 65 | 64 | 64 | 66 | 62 | 61 | 56 | 55 |
| Poland | 321 | 284 | 289 | 279 | 300 | 291 | 286 | 280 | 289 | 285 |
| Portugal | 107 | 109 | 114 | 119 | 127 | 117 | 118 | 128 | 124 | 128 |
| Republic of Moldova | 113 | 90 | 66 | 41 | 42 | 43 | 45 | 46 | 46 | 8 |
| Romania | 148 | 148 | 143 | 171 | 167 | 162 | 157 | 152 | 152 | 145 |
| Russian Federation | 1778 | 1845 | 1855 | 1161 | 1220 | 1268 | 1336 | 1366 | 1366 | 1439 |
| Serbia | 95 | 85 | 80 | 80 | 78 | 77 | 75 | 74 | 74 | 74 |
| Slovakia | 58 | 56 | 54 | 45 | 46 | 41 | 38 | 41 | 50 | 40 |
| Slovenia | 11 | 11 | 10 | 9 | 9 | 9 | 9 | 9 | 9 | 8 |
| Spain | 171 | 173 | 179 | 208 | 209 | 215 | 214 | 213 | 177 | 170 |
| Sweden | 69 | 66 | 62 | 68 | 68 | 68 | 70 | 69 | 53 | 48 |
| Switzerland | 22 | 22 | 21 | 20 | 19 | 19 | 19 | 18 | 19 | 19 |
| TFYR of Macedonia | 25 | 27 | 29 | 21 | 21 | 20 | 20 | 19 | 19 | 19 |
| Turkey | 334 | 348 | 361 | 436 | 421 | 405 | 390 | 374 | 374 | 354 |
| Ukraine | 484 | 456 | 427 | 473 | 469 | 466 | 462 | 458 | 458 | 453 |
| United Kingdom | 219 | 209 | 198 | 180 | 176 | 160 | 155 | 154 | 150 | 152 |
| North Africa | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 148 | 149 |
| Remaining Asian areas (ASI) | 291 | 291 | 291 | 291 | 291 | 291 | 291 | 291 | 291 | 291 |
| Baltic Sea | 22 | 22 | 23 | 23 | 24 | 25 | 25 | 26 | 27 | 26 |
| Black Sea | 6 | 6 | 6 | 7 | 7 | 7 | 7 | 7 | 7 | 8 |
| Mediterranean Sea | 120 | 123 | 126 | 129 | 133 | 136 | 140 | 143 | 147 | 150 |
| North Sea | 49 | 50 | 51 | 52 | 54 | 55 | 57 | 58 | 59 | 58 |
| Remaining N-E Atlantic Ocean | 56 | 57 | 59 | 60 | 62 | 63 | 65 | 66 | 68 | 69 |
| Natural marine emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volcanic emissions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 6675 | 6568 | 6426 | 5958 | 5977 | 5923 | 5952 | 5940 | 5857 | 5739 |

# APPENDIX B

## National emissions for 2007 in the extended EMEP domain

This appendix contains the national emission data for 2007 used throughout this report for main pollutants and primary particle emissions in the extended EMEP domain. These are the emissions that are used as basis for the 2007 source-receptor calculations. Results of these source-receptor calculations are presented in Appendix C.

The emissions for 2007 have been derived from the 2009 official data submissions to UN-ECE CLRTAP (Mareckova et al. 2009).

The units in this appendix are the same as in Appendix A.

# References

Mareckova, K., Wankmüller, R., Wiesser, M., Poupa, S., Anderl, M., and Muik, B.: Inventory review 2009. Emission data reported under the LRTAP Convention and NEC Directive. Stage 1 and 2 review. Status of gridded data, EMEP/CEIP 1/2009, EEA/CEIP Vienna, 2009.

Table B:1: National total emissions for 2007 in the extended EMEP domain. (Unit: Gg.)

| Area/Pollutant | $SO_x$ | $NO_x$ | $NH_3$ | NMVOC | CO | $PM_{2.5}$ | $PM_{co}$ | $PM_{10}$ |
|---|---|---|---|---|---|---|---|---|
| Albania | 31 | 27 | 24 | 33 | 108 | 7 | 3 | 9 |
| Armenia | 6 | 43 | 19 | 50 | 198 | 0 | 0 | 0 |
| Austria | 26 | 220 | 66 | 180 | 769 | 23 | 20 | 43 |
| Azerbaijan | 113 | 92 | 53 | 234 | 194 | 4 | 1 | 4 |
| Belarus | 97 | 161 | 144 | 222 | 541 | 29 | 13 | 42 |
| Belgium | 126 | 260 | 70 | 145 | 750 | 23 | 11 | 34 |
| Bosnia and Herzegovina | 431 | 51 | 17 | 43 | 120 | 19 | 24 | 43 |
| Bulgaria | 859 | 187 | 58 | 82 | 250 | 54 | 36 | 90 |
| Croatia | 65 | 82 | 43 | 114 | 361 | 9 | 3 | 12 |
| Cyprus | 32 | 20 | 5 | 10 | 24 | 3 | 2 | 4 |
| Czech Republic | 217 | 284 | 60 | 174 | 509 | 21 | 13 | 35 |
| Denmark | 23 | 167 | 75 | 104 | 448 | 33 | 11 | 43 |
| Estonia | 88 | 34 | 10 | 36 | 170 | 20 | 8 | 28 |
| Finland | 83 | 183 | 35 | 129 | 501 | 34 | 14 | 48 |
| France | 435 | 1345 | 737 | 1199 | 4674 | 303 | 172 | 475 |
| Georgia | 13 | 28 | 23 | 197 | 244 | 2 | 0 | 2 |
| Germany | 493 | 1284 | 624 | 1278 | 3748 | 106 | 98 | 204 |
| Greece | 543 | 374 | 65 | 204 | 726 | 56 | 33 | 89 |
| Hungary | 84 | 190 | 71 | 148 | 507 | 21 | 14 | 36 |
| Iceland | 8 | 12 | 4 | 13 | 46 | 0 | 0 | 1 |
| Ireland | 54 | 117 | 106 | 57 | 171 | 10 | 4 | 14 |
| Italy | 339 | 1147 | 418 | 1194 | 3334 | 131 | 32 | 163 |
| Kazakhstan (KZT) | 3309 | 757 | 852 | 236 | 2048 | 458 | 790 | 1248 |
| Kyrgyzstan | 588 | 22 | 27 | 8 | 134 | 62 | 135 | 197 |
| Latvia | 3 | 43 | 15 | 58 | 300 | 13 | 1 | 15 |
| Lithuania | 39 | 69 | 36 | 74 | 208 | 10 | 2 | 12 |
| Luxembourg | 1 | 14 | 5 | 9 | 48 | 2 | 1 | 3 |
| Malta | 18 | 11 | 2 | 3 | 0 | 1 | 1 | 1 |
| Montenegro | 48 | 21 | 9 | 21 | 58 | 6 | 6 | 12 |
| Netherlands | 60 | 300 | 133 | 165 | 535 | 20 | 17 | 37 |
| Norway | 20 | 192 | 23 | 198 | 397 | 43 | 7 | 50 |
| Poland | 1131 | 885 | 292 | 596 | 2603 | 128 | 137 | 265 |
| Portugal | 170 | 233 | 56 | 283 | 601 | 111 | 28 | 139 |
| Republic of Moldova | 16 | 25 | 27 | 37 | 137 | 7 | 1 | 8 |
| Romania | 754 | 331 | 198 | 330 | 1495 | 55 | 49 | 104 |
| Russian Federation (RUE) | 3665 | 4359 | 911 | 3015 | 16393 | 864 | 815 | 1680 |
| Serbia | 428 | 130 | 57 | 126 | 358 | 37 | 37 | 74 |
| Slovakia | 71 | 83 | 32 | 74 | 277 | 29 | 5 | 34 |
| Slovenia | 14 | 45 | 19 | 39 | 99 | 5 | 2 | 7 |
| Spain | 1108 | 1357 | 422 | 921 | 2486 | 134 | 39 | 173 |
| Sweden | 33 | 165 | 50 | 178 | 565 | 32 | 13 | 44 |
| Switzerland | 14 | 78 | 60 | 95 | 295 | 8 | 11 | 19 |
| Tajikistan | 36 | 57 | 34 | 26 | 663 | 21 | 21 | 43 |
| TFYR of Macedonia | 100 | 35 | 7 | 26 | 98 | 9 | 9 | 18 |
| Turkey | 1612 | 926 | 409 | 550 | 3589 | 247 | 93 | 340 |
| Turkmenistan | 160 | 65 | 44 | 34 | 368 | 45 | 54 | 99 |
| Ukraine | 1363 | 732 | 213 | 408 | 3182 | 272 | 178 | 450 |
| United Kingdom | 591 | 1486 | 289 | 942 | 2114 | 82 | 53 | 135 |
| Uzbekistan | 775 | 227 | 82 | 80 | 1223 | 155 | 236 | 390 |
| North Africa | 413 | 96 | 235 | 96 | 336 | 60 | 88 | 149 |
| Asian areas (AST) | 1470 | 430 | 881 | 665 | 3935 | 189 | 231 | 421 |
| Baltic Sea | 205 | 350 | 0 | 12 | 37 | 24 | 1 | 26 |
| Black Sea | 66 | 92 | 0 | 3 | 10 | 7 | 0 | 8 |
| Mediterranean Sea | 1294 | 1852 | 0 | 64 | 192 | 145 | 8 | 153 |
| North Sea | 442 | 754 | 0 | 27 | 79 | 54 | 3 | 57 |
| Remaining N-E Atlantic Ocean | 575 | 837 | 0 | 29 | 84 | 67 | 4 | 71 |
| Natural marine emissions | 743 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Volcanic emissions | 2000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL | 27503 | 23368 | 8148 | 15275 | 63339 | 4312 | 3591 | 7903 |

# APPENDIX C

## Source-receptor tables for 2007 (Extended domain)

The source-receptor tables in this appendix are calculated for the meteorological and chemical conditions of 2007.

The tables are calculated for the extended EMEP domain and are based on model runs driven by HIRLAM meteorology.

The source-receptor (SR) relationships give the change in air concentrations or depositions resulting from a change in emissions from each emitter country.

For each country, reductions in six different pollutants have been calculated separately: with an emission reduction of 15% for $SO_x$, $NO_x$, $NH_3$, NMVOC, $PPM_{fine}$ or $PPM_{coarse}$ respectively.

The deposition tables show the contribution from one country to another. They have been calculated adding the differences obtained by a 15% reduction for all emissions in one country multiplied by a factor of 100/15, in order to arrive at total estimates.

For the concentrations and indicator tables, the differences obtained by the 15% emission reduction of the relevant pollutants are given directly. Thus, the tables should be interpreted as estimates of this reduction scenario from the chemical conditions in 2007.

The SR tables in the following aim to respond to two fundamental questions about transboundary air pollution:

1. Where do the pollutants emitted by a country or region end up?

2. Where do the pollutants in a given country or region come from?

Each column answers the first question. The numbers within a column give the change in the value of each pollutant (or indicator) for each receiver country caused by the emissions in the country given at the top of the column.

Each row answers the second question. The numbers given in each row show which emitter countries were responsible for the change in pollutants in the country given at the beginning of each row.

The following SR tables are presented in this appendix, all in the extended EMEP domain, including new EECCA countries, and using 2007 HIRLAM meteorology:

**Acidification and eutrophication**

- Deposition of OXS (oxidised sulphur). The contribution from $SO_x$, $NO_x$, $NH_3$ and VOC emissions have been summed up and scaled to a 100% reduction.
- Deposition of OXN (oxidised nitrogen). The contribution from $SO_x$, $NO_x$, $NH_3$ and VOC emissions have been summed up and scaled to a 100% reduction.
- Deposition of RDN (reduced nitrogen). The contribution from $SO_x$, $NO_x$, $NH_3$ and VOC emissions have been summed up and scaled to a 100% reduction.

**Ground Level Ozone**

- $AOT40_f^{3m}$. Effect of a 15% reduction in $NO_x$ emissions.
- $AOT40_f^{3m}$. Effect of a 15% reduction in VOC emissions.
- SOMO35. Effect of a 15% reduction in $NO_x$ emissions.
- SOMO35. Effect of a 15% reduction in VOC emissions.

**Particulate Matter**

- $PM_{2.5}$. Effect of a 15% reduction in PPM emissions.
- $PM_{2.5}$. Effect of a 15% reduction in $SO_x$ emissions.
- $PM_{2.5}$. Effect of a 15% reduction in $NO_x$ emissions.
- $PM_{2.5}$. Effect of a 15% reduction in $NH_3$ emissions.
- $PM_{2.5}$. Effect of a 15% reduction in VOC emissions.
- $PM_{2.5}$. Effect of a 15% reduction in all emissions. The contribution from a 15% reduction in PPM, $SO_x$, $NO_x$, $NH_3$ and VOC emissions have been summed up.

Table C.1: 2007 country-to-country blame matrices for **oxidised sulphur** deposition.
Units: 100 Mg of S. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | ME | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 39 | 0 | 0 | 0 | 11 | 0 | 17 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 44 | 0 | 1 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | AL |
| AM | 0 | 6 | 0 | 15 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | AM |
| AT | 0 | 0 | 32 | 0 | 14 | 4 | 6 | 0 | 4 | 0 | 31 | 58 | 0 | 0 | 17 | 0 | 17 | 5 | 0 | 1 | 0 | 5 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | AT |
| AZ | 0 | 3 | 0 | 134 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | AZ |
| BA | 2 | 0 | 2 | 0 | 450 | 1 | 14 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 10 | 0 | 4 | 1 | 0 | 10 | 0 | 8 | 0 | 0 | 19 | -0 | 0 | 0 | 0 | 0 | 0 | 16 | BA |
| BE | 0 | 0 | 0 | 0 | 0 | 109 | 0 | 0 | 0 | 0 | 2 | 21 | 0 | 0 | 8 | 0 | 59 | 18 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | BE |
| BG | 3 | 0 | 1 | 0 | 32 | 0 | 960 | 1 | 0 | 0 | 4 | 4 | 0 | 0 | 5 | 0 | 2 | 1 | 0 | 71 | 0 | 5 | 0 | 0 | 9 | 0 | 1 | 0 | 0 | 0 | 2 | 5 | BG |
| BY | 1 | 0 | 2 | 1 | 24 | 3 | 21 | 193 | 1 | 0 | 27 | 27 | 2 | 8 | 12 | 3 | 8 | 8 | 0 | 6 | 1 | 8 | 0 | 0 | 8 | 0 | 6 | 17 | 0 | 1 | 1 | 2 | BY |
| CH | 0 | 0 | 1 | 0 | 2 | 2 | 1 | 0 | 18 | 0 | 1 | 17 | 0 | 0 | 19 | 0 | 26 | 3 | -0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | CH |
| CY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | CY |
| CZ | 0 | 0 | 6 | 0 | 10 | 6 | 3 | 1 | 1 | 0 | 218 | 77 | 0 | 0 | 11 | 0 | 15 | 7 | 0 | 1 | 0 | 6 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | CZ |
| DE | 0 | 0 | 8 | 0 | 10 | 121 | 5 | 1 | 11 | 0 | 107 | 1012 | 6 | 1 | 82 | 1 | 209 | 104 | 0 | 2 | 0 | 4 | 5 | 0 | 15 | 0 | 1 | 1 | 2 | 0 | 0 | 1 | DE |
| DK | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 4 | 19 | 14 | 0 | 4 | 0 | 7 | 21 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | DK |
| EE | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 3 | 0 | 0 | 3 | 6 | 1 | 29 | 2 | 6 | 2 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 4 | 0 | 1 | 0 | 0 | EE |
| ES | 0 | 0 | 1 | 0 | 7 | 4 | 3 | 0 | 1 | 0 | 3 | 10 | 0 | 0 | 1427 | 0 | 38 | 10 | 0 | 3 | 0 | 1 | 1 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | ES |
| FI | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 5 | 0 | 0 | 7 | 14 | 2 | 35 | 5 | 146 | 5 | 13 | 0 | 1 | 29 | 1 | 1 | 0 | 1 | 0 | 4 | 5 | 0 | 1 | 0 | 0 | FI |
| FR | 0 | 0 | 2 | 0 | 13 | 79 | 7 | 0 | 8 | 0 | 16 | 118 | 1 | 0 | 431 | 0 | 775 | 98 | -0 | 2 | 0 | 2 | 7 | 0 | 38 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | FR |
| GB | 0 | 0 | 0 | 0 | 1 | 12 | 1 | 0 | 0 | 0 | 3 | 18 | 1 | 0 | 25 | 0 | 29 | 582 | -0 | 0 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GB |
| GE | 0 | 2 | 0 | 32 | 1 | 0 | 6 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | GE |
| GL | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 9 | 0 | 0 | 0 | 21 | 0 | 277 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 8 | 0 | 2 | 1 | 0 | 447 | 0 | 2 | 0 | 0 | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 4 | GR |
| HR | 1 | 0 | 3 | 0 | 111 | 1 | 9 | 0 | 0 | 0 | 9 | 7 | 0 | 0 | 10 | 0 | 6 | 1 | 0 | 6 | 0 | 11 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | HR |
| HU | 1 | 0 | 9 | 0 | 88 | 2 | 18 | 1 | 1 | 0 | 26 | 20 | 0 | 0 | 13 | 0 | 9 | 2 | 0 | 8 | 0 | 117 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | HU |
| IE | 0 | -0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 2 | 0 | 4 | 20 | -0 | 0 | 0 | 0 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 3 | 0 | 5 | 0 | 90 | 2 | 22 | 0 | 4 | 0 | 11 | 16 | 0 | 0 | 71 | 0 | 44 | 4 | 0 | 26 | 0 | 6 | 0 | 0 | 437 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | IT |
| KG | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 811 | 383 | 0 | 0 | 0 | 0 | 0 | KG |
| KZT | 1 | 5 | 1 | 46 | 19 | 1 | 50 | 6 | 0 | 1 | 7 | 8 | 0 | 4 | 7 | 2 | 4 | 3 | 4 | 19 | 2 | 3 | 0 | 0 | 5 | 603 | 6210 | 2 | 0 | 0 | 1 | 2 | KZT |
| LT | 0 | 0 | 1 | 0 | 4 | 2 | 3 | 8 | 0 | 0 | 9 | 15 | 1 | 2 | 5 | 1 | 4 | 5 | 0 | 1 | 0 | 2 | 0 | 0 | 2 | 0 | 1 | 46 | 0 | 1 | 0 | 0 | LT |
| LU | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | -0 | 0 | 3 | 0 | 0 | 1 | 0 | 6 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | LU |
| LV | 0 | 0 | 0 | 0 | 3 | 2 | 3 | 8 | 0 | 0 | 6 | 12 | 1 | 6 | 3 | 3 | 4 | 5 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 20 | 0 | 5 | 0 | 0 | LV |
| MD | 0 | 0 | 0 | 0 | 8 | 0 | 21 | 1 | 0 | 0 | 2 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 5 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 17 | 1 | MD |
| ME | 4 | 0 | 0 | 0 | 16 | 0 | 6 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 6 | 0 | 1 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | ME |
| MK | 6 | 0 | 0 | 0 | 8 | 0 | 53 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 73 | 0 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | MK |
| MT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | MT |
| NL | 0 | 0 | 0 | 0 | 0 | 45 | 0 | 0 | 0 | 0 | 1 | 31 | 0 | 0 | 6 | 0 | 29 | 30 | -0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NL |
| NO | 0 | 0 | 0 | 0 | 1 | 3 | 1 | 1 | 0 | 0 | 3 | 12 | 2 | 3 | 7 | 4 | 7 | 62 | 0 | 0 | 36 | 0 | 2 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | NO |
| PL | 1 | 0 | 6 | 1 | 37 | 15 | 28 | 13 | 2 | 0 | 168 | 189 | 8 | 2 | 30 | 2 | 31 | 35 | 0 | 10 | 1 | 18 | 1 | 0 | 17 | 0 | 3 | 7 | 0 | 0 | 1 | 3 | PL |
| PT | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 87 | 0 | 2 | 1 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | PT |
| RO | 5 | 0 | 4 | 1 | 126 | 2 | 284 | 3 | 1 | 0 | 24 | 20 | 0 | 1 | 16 | 0 | 9 | 4 | 0 | 59 | 0 | 36 | 0 | 0 | 23 | 0 | 3 | 1 | 0 | 0 | 7 | 14 | RO |
| RS | 8 | 0 | 2 | 0 | 141 | 1 | 80 | 0 | 0 | 0 | 8 | 8 | 0 | 0 | 9 | 0 | 5 | 1 | 0 | 34 | 0 | 15 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | RS |
| RUE | 5 | 7 | 9 | 102 | 152 | 17 | 307 | 163 | 3 | 3 | 102 | 122 | 8 | 249 | 65 | 117 | 47 | 61 | 14 | 87 | 55 | 33 | 3 | 1 | 34 | 105 | 4614 | 45 | 0 | 4 | 11 | 14 | RUE |
| SE | 0 | 0 | 1 | 0 | 4 | 8 | 4 | 5 | 0 | 0 | 12 | 37 | 14 | 11 | 12 | 21 | 13 | 48 | 0 | 2 | 73 | 1 | 2 | 0 | 2 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | SE |
| SI | 0 | 0 | 3 | 0 | 12 | 0 | 3 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 4 | 0 | 3 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | SI |
| SK | 0 | 0 | 4 | 0 | 26 | 2 | 7 | 0 | 1 | 0 | 36 | 16 | 0 | 0 | 6 | 0 | 5 | 2 | 0 | 3 | 0 | 25 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 52 | 59 | 0 | 0 | -0 | 0 | 0 | TJ |
| TM | 0 | 1 | 0 | 11 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | -0 | -0 | 0 | 11 | 135 | 0 | -0 | -0 | 0 | 0 | TM |
| TR | 3 | 3 | 1 | 10 | 26 | 1 | 227 | 2 | 0 | 16 | 6 | 7 | 0 | 1 | 15 | 0 | 5 | 2 | 3 | 126 | 0 | 4 | 0 | 0 | 13 | 0 | 10 | 0 | 0 | 0 | 2 | 4 | TR |
| UA | 4 | 1 | 5 | 10 | 107 | 5 | 223 | 35 | 1 | 1 | 59 | 48 | 2 | 7 | 24 | 3 | 16 | 12 | 2 | 54 | 1 | 37 | 1 | 0 | 24 | 0 | 35 | 6 | 0 | 0 | 19 | 11 | UA |
| UZ | 0 | 1 | 0 | 6 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -0 | 0 | 84 | 337 | 0 | -0 | -0 | 0 | 0 | UZ |
| ATL | 0 | 0 | 2 | 1 | 12 | 48 | 11 | 6 | 2 | 0 | 32 | 106 | 4 | 24 | 1152 | 38 | 201 | 564 | -0 | 4 | 125 | 3 | 111 | 30 | 8 | 1 | 59 | 4 | 0 | 0 | 0 | 1 | ATL |
| BAS | 0 | 0 | 2 | 0 | 11 | 18 | 9 | 8 | 1 | 0 | 35 | 112 | 28 | 38 | 21 | 53 | 30 | 52 | 0 | 4 | 8 | 4 | 2 | 0 | 5 | 0 | 4 | 17 | 0 | 2 | 0 | 1 | BAS |
| BLS | 3 | 1 | 2 | 11 | 49 | 1 | 356 | 6 | 0 | 2 | 13 | 12 | 0 | 2 | 9 | 1 | 5 | 4 | 7 | 83 | 0 | 10 | 0 | 0 | 11 | 0 | 16 | 1 | 0 | 0 | 9 | 6 | BLS |
| MED | 35 | 0 | 9 | 1 | 339 | 9 | 588 | 2 | 5 | 48 | 34 | 47 | 1 | 1 | 711 | 1 | 219 | 16 | 0 | 820 | 0 | 19 | 1 | 0 | 612 | 0 | 3 | 1 | 0 | 0 | 1 | 41 | MED |
| NOS | 0 | 0 | 1 | 0 | 7 | 66 | 4 | 2 | 1 | 0 | 18 | 125 | 15 | 3 | 71 | 2 | 153 | 1064 | 0 | 1 | 1 | 2 | 23 | 1 | 3 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | NOS |
| AST | 0 | 5 | 0 | 163 | 7 | 0 | 21 | 1 | 0 | 13 | 3 | 2 | 0 | 1 | 4 | 0 | 1 | 1 | 4 | 16 | 0 | 1 | 0 | -0 | 3 | 443 | 1152 | 0 | 0 | 0 | 0 | 1 | AST |
| NOA | 2 | 0 | 1 | 0 | 23 | 1 | 51 | 0 | 1 | 2 | 4 | 6 | 0 | 0 | 111 | 0 | 20 | 2 | 0 | 68 | 0 | 2 | 0 | 0 | 40 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | NOA |
| SUM | 139 | 35 | 128 | 546 | 2034 | 611 | 3724 | 478 | 70 | 92 | 1073 | 2405 | 114 | 430 | 4551 | 408 | 2085 | 2887 | 63 | 2115 | 338 | 400 | 263 | 41 | 1514 | 2112 | 13066 | 191 | 6 | 16 | 74 | 220 | SUM |
| EXC | 97 | 29 | 112 | 371 | 1586 | 465 | 2683 | 452 | 60 | 26 | 934 | 1995 | 66 | 362 | 2471 | 313 | 1457 | 1183 | 52 | 1119 | 202 | 359 | 126 | 11 | 832 | 1667 | 11830 | 164 | 5 | 14 | 63 | 166 | EXC |
| EU | 24 | 0 | 85 | 3 | 506 | 430 | 1639 | 50 | 34 | 4 | 697 | 1727 | 51 | 90 | 2280 | 182 | 1324 | 1022 | 1 | 641 | 106 | 235 | 118 | 1 | 650 | 0 | 19 | 92 | 5 | 8 | 11 | 46 | EU |
| emis | 156 | 32 | 128 | 566 | 2153 | 632 | 4294 | 487 | 68 | 158 | 1085 | 2466 | 117 | 442 | 5541 | 415 | 2173 | 2953 | 63 | 2716 | 325 | 422 | 271 | 42 | 1694 | 2938 | 16544 | 193 | 7 | 17 | 78 | 239 | emis |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | ME | |

Table C.1 Cont.: 2007 country-to-country blame matrices for **oxidised sulphur** deposition.
Units: 100 Mg of S. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | SUM | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 26 | 0 | 0 | 0 | 2 | 0 | 6 | 34 | 0 | 0 | 0 | 0 | -0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 3 | 4 | 1 | 67 | 306 | 209 | 89 | AL |
| AM | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 55 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 20 | 0 | 4 | 0 | 18 | 129 | 87 | 4 | AM |
| AT | 1 | 0 | 2 | 0 | 39 | 1 | 10 | 11 | 1 | 0 | 7 | 4 | 0 | 0 | 0 | 5 | 0 | 1 | 1 | 0 | 9 | 5 | 0 | 2 | 16 | 1 | 10 | 349 | 303 | 265 | AT |
| AZ | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 13 | 0 | 0 | 0 | 0 | 5 | 67 | 5 | 3 | 0 | 0 | 0 | 1 | 0 | 50 | 1 | 9 | 0 | 31 | 345 | 254 | 8 | AZ |
| BA | 4 | 0 | 0 | 0 | 16 | 0 | 18 | 76 | 1 | 0 | 1 | 4 | -0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 18 | 1 | 0 | 3 | 8 | 1 | 50 | 757 | 676 | 120 | BA |
| BE | 0 | 0 | 11 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 3 | 1 | 0 | 1 | 35 | 0 | 0 | 7 | 2 | 0 | 286 | 238 | 236 | BE |
| BG | 25 | 0 | 0 | 0 | 16 | 0 | 186 | 86 | 9 | 0 | 0 | 3 | 0 | 0 | 33 | 48 | 0 | 0 | 0 | 8 | 19 | 1 | 2 | 5 | 12 | 2 | 155 | 1721 | 1516 | 1270 | BG |
| BY | 2 | 0 | 1 | 1 | 315 | 1 | 49 | 24 | 51 | 2 | 1 | 9 | 0 | 0 | 10 | 142 | 1 | 1 | 13 | 1 | 6 | 8 | 2 | 1 | 26 | 3 | 67 | 1129 | 1000 | 538 | BY |
| CH | 0 | 0 | 1 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 2 | 0 | 1 | 9 | 1 | 3 | 135 | 113 | 91 | CH |
| CY | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 1 | 0 | 2 | 34 | 26 | 5 | CY |
| CZ | 1 | 0 | 2 | 0 | 119 | 1 | 7 | 10 | 1 | 0 | 1 | 12 | 0 | 0 | 1 | 9 | 0 | 1 | 2 | 0 | 3 | 7 | 0 | 1 | 13 | 1 | 8 | 573 | 536 | 500 | CZ |
| DE | 1 | 0 | 58 | 1 | 159 | 5 | 10 | 10 | 5 | 1 | 1 | 5 | 0 | 0 | 1 | 13 | 0 | 13 | 58 | 0 | 11 | 150 | 0 | 2 | 70 | 14 | 12 | 2307 | 1977 | 1923 | DE |
| DK | 0 | 0 | 3 | 0 | 19 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | -0 | 0 | 0 | 3 | 0 | 2 | 41 | 0 | 1 | 38 | 0 | 0 | 9 | 6 | 2 | 210 | 111 | 103 | DK |
| EE | 0 | 0 | 1 | 0 | 26 | 0 | 3 | 2 | 12 | 1 | 0 | 1 | 0 | 0 | 2 | 9 | 0 | 1 | 21 | 0 | 1 | 4 | 0 | 0 | 5 | 2 | 7 | 165 | 125 | 93 | EE |
| ES | 1 | 0 | 1 | 0 | 7 | 71 | 3 | 4 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 60 | 0 | 0 | 84 | 6 | 0 | 17 | 72 | 16 | 32 | 1900 | 1613 | 1596 | ES |
| FI | 0 | 0 | 1 | 2 | 60 | 0 | 7 | 4 | 55 | 13 | 0 | 2 | 0 | 0 | 6 | 29 | 0 | 4 | 45 | 0 | 1 | 11 | 1 | 0 | 35 | 9 | 26 | 601 | 467 | 328 | FI |
| FR | 1 | 0 | 19 | 0 | 29 | 16 | 8 | 9 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 4 | 0 | 69 | 4 | 0 | 56 | 126 | 0 | 8 | 110 | 33 | 28 | 2128 | 1694 | 1654 | FR |
| GB | 0 | 0 | 8 | 0 | 12 | 1 | 2 | 1 | 1 | 0 | 0 | 1 | -0 | 0 | 0 | 3 | 0 | 65 | 3 | 0 | 0 | 103 | 0 | 0 | 67 | 38 | 3 | 1012 | 733 | 725 | GB |
| GE | 1 | 0 | 0 | 0 | 4 | 0 | 7 | 2 | 12 | 0 | 0 | 0 | 0 | 2 | 123 | 16 | 2 | 0 | 0 | 3 | 2 | 0 | 24 | 1 | 8 | 1 | 48 | 332 | 246 | 24 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 110 | 2 | 2 | 124 | 8 | 6 | GL |
| GR | 57 | 1 | 0 | 0 | 10 | 0 | 38 | 39 | 4 | 0 | 0 | 1 | 0 | 0 | 25 | 19 | 0 | 0 | 0 | 2 | 73 | 0 | 1 | 8 | 13 | 5 | 148 | 1236 | 985 | 806 | GR |
| HR | 2 | 0 | 0 | 0 | 21 | 0 | 16 | 45 | 1 | 0 | 4 | 5 | -0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 22 | 1 | 0 | 2 | 7 | 1 | 28 | 366 | 304 | 134 | HR |
| HU | 4 | 0 | 1 | 0 | 67 | 1 | 53 | 88 | 2 | 0 | 5 | 33 | -0 | 0 | 2 | 17 | 0 | 1 | 1 | 0 | 12 | 2 | 0 | 2 | 14 | 1 | 43 | 688 | 611 | 403 | HU |
| IE | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 4 | 0 | 0 | 25 | 13 | 2 | 169 | 104 | 103 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 11 | 1 | 68 | 14 | 5 | IS |
| IT | 8 | 3 | 1 | 0 | 28 | 3 | 22 | 39 | 2 | 0 | 6 | 4 | -0 | 0 | 3 | 7 | 0 | 3 | 1 | 0 | 182 | 3 | 0 | 22 | 38 | 11 | 491 | 1624 | 874 | 711 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 24 | 7 | 9 | 2 | 452 | 0 | 0 | 0 | 0 | 0 | 46 | 0 | 16 | 0 | 52 | 1815 | 1701 | 3 | KG |
| KZT | 5 | 0 | 1 | 0 | 50 | 0 | 56 | 17 | 989 | 1 | 0 | 3 | 17 | 110 | 260 | 294 | 672 | 1 | 3 | 4 | 9 | 3 | 257 | 3 | 177 | 2 | 645 | 10598 | 9493 | 230 | KZT |
| LT | 0 | 0 | 1 | 0 | 102 | 0 | 7 | 4 | 12 | 1 | 0 | 2 | 0 | 0 | 2 | 15 | 0 | 1 | 14 | 0 | 1 | 6 | 0 | 0 | 9 | 2 | 13 | 310 | 264 | 215 | LT |
| LU | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 19 | 16 | 16 | LU |
| LV | 0 | 0 | 1 | 0 | 57 | 0 | 6 | 3 | 11 | 2 | 0 | 2 | -0 | 0 | 2 | 14 | 0 | 1 | 17 | 0 | 1 | 5 | 0 | 0 | 8 | 3 | 11 | 232 | 185 | 140 | LV |
| MD | 2 | 0 | 0 | 0 | 17 | 0 | 59 | 9 | 5 | 0 | 0 | 2 | -0 | 0 | 7 | 48 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 1 | 4 | 0 | 23 | 246 | 213 | 115 | MD |
| ME | 3 | 0 | 0 | 0 | 2 | 0 | 4 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 1 | 2 | 0 | 25 | 146 | 108 | 33 | ME |
| MK | 59 | 0 | 0 | 0 | 3 | 0 | 10 | 32 | 1 | 0 | 0 | 1 | -0 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 2 | 3 | 0 | 42 | 320 | 265 | 150 | MK |
| MT | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 3 | 3 | MT |
| NL | 0 | 0 | 47 | 0 | 5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 3 | 2 | 0 | 0 | 93 | 0 | 0 | 8 | 4 | 1 | 311 | 200 | 198 | NL |
| NO | 0 | 0 | 2 | 26 | 18 | 0 | 3 | 1 | 11 | 5 | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 16 | 11 | 0 | 1 | 49 | 0 | 0 | 65 | 27 | 14 | 405 | 221 | 138 | NO |
| PL | 4 | 0 | 8 | 1 | 1942 | 2 | 51 | 43 | 21 | 3 | 3 | 33 | 0 | 0 | 8 | 102 | 0 | 4 | 46 | 1 | 12 | 35 | 1 | 3 | 48 | 8 | 75 | 3083 | 2851 | 2611 | PL |
| PT | 0 | 0 | 0 | -0 | 1 | 187 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 0 | 3 | 1 | 0 | 1 | 14 | 5 | 1 | 348 | 281 | 280 | PT |
| RO | 25 | 0 | 1 | 0 | 102 | 1 | 1190 | 191 | 20 | 0 | 2 | 20 | 0 | 0 | 45 | 153 | 0 | 1 | 2 | 9 | 26 | 3 | 4 | 7 | 30 | 3 | 201 | 2680 | 2395 | 1801 | RO |
| RS | 25 | 0 | 0 | 0 | 22 | 0 | 99 | 455 | 2 | 0 | 1 | 6 | 0 | 0 | 6 | 14 | 0 | 0 | 0 | 1 | 16 | 1 | 0 | 4 | 11 | 1 | 104 | 1126 | 987 | 310 | RS |
| RUE | 28 | 1 | 8 | 7 | 763 | 3 | 431 | 138 | 12975 | 19 | 4 | 38 | 3 | 66 | 667 | 2328 | 180 | 23 | 96 | 32 | 49 | 48 | 208 | 15 | 817 | 44 | 1707 | 27254 | 24217 | 2580 | RUE |
| SE | 0 | 0 | 5 | 11 | 75 | 1 | 11 | 5 | 24 | 59 | 0 | 2 | -0 | 0 | 5 | 20 | 0 | 8 | 95 | 0 | 2 | 70 | 1 | 1 | 61 | 19 | 26 | 778 | 496 | 345 | SE |
| SI | 0 | 0 | 0 | 0 | 8 | 0 | 5 | 7 | 0 | 0 | 13 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 1 | 3 | 0 | 4 | 112 | 95 | 73 | SI |
| SK | 1 | 0 | 1 | 0 | 119 | 0 | 21 | 25 | 2 | 0 | 2 | 62 | 0 | 0 | 1 | 14 | 0 | 0 | 1 | 0 | 4 | 2 | 0 | 1 | 8 | 1 | 15 | 426 | 393 | 320 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 37 | 6 | 4 | 0 | 155 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 15 | 0 | 21 | 374 | 315 | 1 | TJ |
| TM | 0 | 0 | 0 | -0 | 2 | 0 | 2 | 1 | 17 | -0 | 0 | 0 | 2 | 159 | 52 | 7 | 180 | 0 | 0 | 0 | 1 | 0 | 148 | 1 | 39 | 0 | 63 | 842 | 589 | 9 | TM |
| TR | 17 | 1 | 0 | 0 | 30 | 0 | 97 | 41 | 42 | 0 | 1 | 3 | 0 | 1 | 2557 | 125 | 1 | 1 | 1 | 27 | 119 | 1 | 190 | 28 | 72 | 11 | 361 | 4216 | 3404 | 556 | TR |
| UA | 18 | 0 | 2 | 1 | 517 | 1 | 420 | 117 | 241 | 1 | 3 | 38 | 0 | 4 | 132 | 2094 | 6 | 2 | 11 | 24 | 29 | 10 | 15 | 7 | 70 | 8 | 330 | 4855 | 4348 | 1510 | UA |
| UZ | 0 | 0 | 0 | -0 | 2 | 0 | 2 | 1 | 20 | -0 | 0 | 0 | 16 | 54 | 41 | 9 | 591 | -0 | 0 | 0 | 1 | 0 | 76 | 0 | 31 | 0 | 73 | 1353 | 1171 | 9 | UZ |
| ATL | 2 | 0 | 18 | 27 | 116 | 98 | 19 | 10 | 318 | 12 | 1 | 5 | 0 | 1 | 7 | 56 | 2 | 1765 | 28 | 0 | 14 | 150 | 2 | 5 | 5042 | 2423 | 121 | 12791 | 3241 | 2582 | ATL |
| BAS | 1 | 0 | 11 | 4 | 277 | 1 | 25 | 13 | 51 | 38 | 1 | 6 | 0 | 0 | 7 | 42 | 0 | 6 | 437 | 1 | 4 | 76 | 1 | 1 | 56 | 29 | 36 | 1593 | 945 | 792 | BAS |
| BLS | 18 | 0 | 1 | 0 | 88 | 0 | 327 | 70 | 154 | 0 | 1 | 8 | 0 | 2 | 495 | 561 | 2 | 1 | 3 | 168 | 41 | 3 | 30 | 8 | 42 | 31 | 320 | 2998 | 2352 | 939 | BLS |
| MED | 89 | 52 | 3 | 0 | 101 | 20 | 180 | 199 | 18 | 0 | 9 | 14 | -0 | 0 | 790 | 92 | 0 | 14 | 3 | 13 | 3896 | 13 | 89 | 321 | 249 | 256 | 1160 | 11149 | 5133 | 3517 | MED |
| NOS | 1 | 0 | 70 | 17 | 90 | 3 | 11 | 6 | 10 | 5 | 0 | 3 | 0 | 0 | 3 | 17 | 0 | 70 | 44 | 0 | 4 | 1082 | 0 | 1 | 182 | 193 | 21 | 3401 | 1805 | 1737 | NOS |
| AST | 3 | 0 | 0 | -0 | 14 | 0 | 20 | 8 | 156 | 0 | 0 | 1 | 25 | 122 | 819 | 76 | 409 | 0 | 1 | 2 | 37 | 1 | 2493 | 16 | 278 | 4 | 454 | 6786 | 3500 | 104 | AST |
| NOA | 8 | 6 | 0 | 0 | 9 | 6 | 20 | 17 | 2 | 0 | 1 | 1 | -0 | 0 | 50 | 9 | 0 | 3 | 0 | 1 | 323 | 2 | 9 | 398 | 138 | 28 | 88 | 1459 | 469 | 352 | NOA |
| SUM | 446 | 71 | 293 | 99 | 5492 | 431 | 3527 | 1919 | 15291 | 165 | 70 | 341 | 124 | 542 | 6329 | 6451 | 2660 | 2219 | 1009 | 301 | 5156 | 2166 | 3696 | 908 | 8223 | 3279 | 7288 | 120727 | | | SUM |
| EXC | 324 | 12 | 190 | 51 | 4797 | 301 | 2925 | 1596 | 14582 | 110 | 58 | 304 | 99 | 416 | 4158 | 5597 | 2246 | 359 | 494 | 116 | 837 | 839 | 1071 | 157 | 2237 | 313 | 5088 | | 69038 | 23381 | EXC |
| EU | 130 | 8 | 173 | 17 | 3009 | 292 | 1644 | 582 | 187 | 82 | 42 | 192 | 0 | 1 | 158 | 490 | 2 | 306 | 355 | 22 | 519 | 711 | 13 | 83 | 696 | 198 | 1314 | | 19093 | 16723 | EU |
| emis | 500 | 91 | 302 | 99 | 5655 | 850 | 3772 | 2141 | 18326 | 167 | 71 | 353 | 182 | 800 | 8058 | 6817 | 3876 | 2873 | 1025 | 330 | 6469 | 2208 | 7352 | 2065 | 0 | 3715 | 10000 | 137515 | 101478 | 36987 | emis |
| | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | SUM | EXC | EU | |

Table C.2: 2007 country-to-country blame matrices for **oxidised nitrogen** deposition.
Units: 100 Mg of N. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | ME | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 5 | 0 | 2 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 1 | 3 | 0 | -0 | 5 | 0 | 4 | 2 | 0 | 20 | 0 | 1 | 0 | 0 | 23 | -0 | 0 | 0 | 0 | 0 | 0 | 2 | AL |
| AM | 0 | 9 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | AM |
| AT | 0 | 0 | 58 | 0 | 1 | 8 | 1 | 1 | 10 | 0 | 18 | 82 | 1 | 0 | 11 | 0 | 35 | 11 | 0 | 1 | 0 | 7 | 0 | 0 | 57 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | AT |
| AZ | 0 | 6 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | AZ |
| BA | 1 | 0 | 10 | 0 | 19 | 2 | 2 | 0 | 2 | 0 | 8 | 18 | 1 | 0 | 9 | 0 | 12 | 5 | 0 | 5 | 0 | 12 | 0 | 0 | 52 | -0 | 0 | 0 | 0 | 0 | 0 | 3 | BA |
| BE | 0 | 0 | 1 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 2 | 17 | 1 | 0 | 5 | 0 | 39 | 26 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | BE |
| BG | 2 | 0 | 6 | 0 | 4 | 2 | 91 | 1 | 1 | 0 | 7 | 15 | 1 | 0 | 5 | 0 | 9 | 6 | 0 | 39 | 0 | 10 | 0 | 0 | 22 | -0 | 0 | 0 | 0 | 0 | 2 | 2 | BG |
| BY | 0 | 0 | 11 | 0 | 2 | 6 | 3 | 41 | 3 | 0 | 24 | 65 | 11 | 3 | 7 | 7 | 22 | 27 | 0 | 2 | 1 | 13 | 1 | 0 | 17 | -0 | 1 | 16 | 0 | 5 | 2 | 0 | BY |
| CH | 0 | 0 | 3 | -0 | 0 | 3 | 0 | 0 | 16 | 0 | 1 | 22 | 0 | 0 | 12 | 0 | 41 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | CH |
| CY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | CY |
| CZ | 0 | 0 | 23 | 0 | 1 | 10 | 1 | 1 | 4 | 0 | 59 | 97 | 2 | 0 | 7 | 0 | 31 | 17 | 0 | 1 | 0 | 9 | 1 | 0 | 16 | -0 | 0 | 1 | 1 | 0 | 0 | 0 | CZ |
| DE | 0 | 0 | 33 | 0 | 1 | 94 | 1 | 2 | 22 | 0 | 60 | 534 | 13 | 1 | 51 | 2 | 267 | 173 | 0 | 1 | 1 | 6 | 8 | 0 | 35 | -0 | 0 | 2 | 7 | 1 | 0 | 0 | DE |
| DK | 0 | 0 | 1 | 0 | 0 | 6 | 0 | 1 | 1 | 0 | 3 | 23 | 10 | 0 | 2 | 0 | 12 | 38 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | DK |
| EE | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 2 | 14 | 4 | 5 | 1 | 7 | 5 | 10 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | -0 | 0 | 3 | 0 | 3 | 0 | 0 | EE |
| ES | 0 | 0 | 5 | -0 | 1 | 11 | 1 | 1 | 4 | 0 | 4 | 31 | 1 | -0 | 837 | 0 | 112 | 36 | -0 | 2 | 0 | 2 | 3 | 0 | 32 | -0 | -0 | 0 | 1 | 0 | 0 | 0 | ES |
| FI | 0 | 0 | 3 | 0 | 0 | 5 | 0 | 8 | 1 | 0 | 6 | 34 | 10 | 10 | 3 | 83 | 13 | 35 | 0 | 0 | 19 | 3 | 2 | 0 | 3 | 0 | 1 | 6 | 0 | 5 | 0 | 0 | FI |
| FR | 0 | 0 | 15 | 0 | 1 | 79 | 1 | 1 | 17 | 0 | 16 | 163 | 6 | 0 | 295 | 1 | 741 | 195 | 0 | 2 | 1 | 3 | 12 | 0 | 104 | -0 | 0 | 1 | 5 | 0 | 0 | 0 | FR |
| GB | 0 | 0 | 1 | 0 | 0 | 13 | 0 | 1 | 1 | 0 | 4 | 25 | 5 | 0 | 12 | 1 | 38 | 288 | 0 | 0 | 0 | 1 | 29 | 0 | 2 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | GB |
| GE | 0 | 8 | 0 | 15 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 10 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | GE |
| GL | 0 | -0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 3 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 5 | 0 | 4 | 0 | 3 | 1 | 37 | 1 | 1 | 0 | 4 | 11 | 1 | 0 | 10 | 0 | 10 | 5 | 0 | 119 | 0 | 5 | 0 | 0 | 35 | -0 | 0 | 0 | 0 | 0 | 1 | 2 | GR |
| HR | 1 | 0 | 14 | 0 | 8 | 2 | 1 | 0 | 2 | 0 | 10 | 21 | 1 | 0 | 10 | 0 | 15 | 4 | 0 | 3 | 0 | 13 | 0 | 0 | 60 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | HR |
| HU | 1 | 0 | 27 | 0 | 8 | 4 | 3 | 1 | 4 | 0 | 23 | 45 | 1 | 0 | 10 | 0 | 21 | 8 | 0 | 4 | 0 | 51 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | HU |
| IE | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 5 | 1 | 0 | 1 | 0 | 8 | 28 | 0 | 0 | 0 | 0 | 19 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | IE |
| IS | 0 | -0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 4 | -0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 2 | 0 | 34 | 0 | 14 | 7 | 4 | 1 | 14 | 0 | 16 | 58 | 2 | 0 | 94 | 1 | 125 | 19 | 0 | 15 | 0 | 14 | 1 | 0 | 621 | -0 | 0 | 0 | 0 | 0 | 0 | 3 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 57 | 0 | 0 | 0 | 0 | 0 | KG |
| KZT | 0 | 16 | 8 | 23 | 1 | 6 | 6 | 13 | 3 | 0 | 10 | 40 | 7 | 1 | 8 | 11 | 22 | 41 | 3 | 7 | 4 | 7 | 2 | 0 | 15 | 16 | 797 | 4 | 0 | 3 | 2 | 0 | KZT |
| LT | 0 | 0 | 3 | 0 | 0 | 4 | 0 | 7 | 1 | 0 | 8 | 32 | 8 | 1 | 3 | 2 | 11 | 14 | 0 | 0 | 0 | 3 | 1 | 0 | 4 | -0 | 0 | 11 | 0 | 2 | 0 | 0 | LT |
| LU | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | LU |
| LV | 0 | 0 | 2 | 0 | 0 | 4 | 0 | 6 | 1 | 0 | 5 | 27 | 6 | 2 | 2 | 4 | 9 | 13 | 0 | 0 | 1 | 2 | 1 | 0 | 3 | -0 | 0 | 8 | 0 | 7 | 0 | 0 | LV |
| MD | 0 | 0 | 2 | 0 | 1 | 1 | 4 | 1 | 0 | 0 | 3 | 5 | 1 | 0 | 1 | 0 | 2 | 2 | 0 | 3 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | MD |
| ME | 1 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 3 | 0 | 3 | 1 | 0 | 4 | 0 | 1 | 0 | 0 | 14 | -0 | 0 | 0 | 0 | 0 | 0 | 3 | ME |
| MK | 2 | 0 | 1 | 0 | 1 | 0 | 8 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 22 | 0 | 2 | 0 | 0 | 9 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | MK |
| MT | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | MT |
| NL | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 1 | 19 | 2 | 0 | 3 | 0 | 24 | 38 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | NL |
| NO | 0 | 0 | 1 | 0 | -0 | 7 | 0 | 2 | 0 | 0 | 3 | 27 | 11 | 1 | 3 | 6 | 16 | 94 | 0 | 0 | 14 | 1 | 4 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | NO |
| PL | 1 | 0 | 36 | 0 | 4 | 30 | 3 | 13 | 7 | 0 | 99 | 286 | 27 | 1 | 20 | 4 | 74 | 84 | 0 | 4 | 1 | 29 | 3 | 0 | 40 | -0 | 1 | 7 | 2 | 2 | 1 | 1 | PL |
| PT | 0 | 0 | 0 | 0 | -0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | -0 | 80 | 0 | 11 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | PT |
| RO | 3 | 0 | 21 | 0 | 12 | 5 | 51 | 5 | 4 | 0 | 26 | 52 | 3 | 0 | 12 | 1 | 24 | 16 | 0 | 30 | 0 | 44 | 1 | 0 | 58 | -0 | 0 | 1 | 0 | 1 | 5 | 4 | RO |
| RS | 3 | 0 | 11 | 0 | 11 | 2 | 14 | 1 | 2 | 0 | 11 | 24 | 1 | 0 | 8 | 0 | 12 | 7 | 0 | 20 | 0 | 19 | 0 | 0 | 39 | -0 | 0 | 0 | 0 | 0 | 0 | 5 | RS |
| RUE | 2 | 23 | 57 | 46 | 6 | 48 | 38 | 195 | 16 | 1 | 94 | 348 | 68 | 57 | 44 | 184 | 156 | 281 | 11 | 33 | 53 | 55 | 13 | 2 | 94 | 2 | 662 | 64 | 3 | 40 | 14 | 3 | RUE |
| SE | 0 | 0 | 5 | 0 | 0 | 14 | 0 | 7 | 2 | 0 | 11 | 75 | 34 | 5 | 6 | 25 | 30 | 103 | 0 | 0 | 25 | 3 | 4 | 0 | 4 | -0 | 1 | 6 | 0 | 4 | 0 | 0 | SE |
| SI | 0 | 0 | 9 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 3 | 10 | 0 | 0 | 4 | 0 | 7 | 2 | 0 | 0 | 0 | 4 | 0 | 0 | 34 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | SI |
| SK | 0 | 0 | 13 | 0 | 3 | 4 | 1 | 1 | 2 | 0 | 22 | 32 | 1 | 0 | 4 | 0 | 12 | 7 | 0 | 1 | 0 | 22 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 12 | 0 | 0 | 0 | 0 | 0 | TJ |
| TM | 0 | 5 | 1 | 8 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 4 | 0 | 0 | 1 | 1 | 3 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 2 | 1 | 39 | 0 | 0 | 0 | 0 | 0 | TM |
| TR | 2 | 15 | 10 | 6 | 3 | 3 | 38 | 4 | 2 | 6 | 9 | 27 | 2 | 0 | 15 | 1 | 19 | 15 | 3 | 62 | 0 | 10 | 1 | 0 | 36 | -0 | 2 | 1 | 0 | 1 | 3 | 1 | TR |
| UA | 2 | 3 | 30 | 5 | 9 | 12 | 39 | 38 | 6 | 0 | 58 | 124 | 14 | 3 | 17 | 7 | 44 | 50 | 2 | 26 | 2 | 50 | 2 | 0 | 61 | 0 | 10 | 9 | 1 | 4 | 14 | 3 | UA |
| UZ | 0 | 3 | 1 | 4 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 3 | 1 | 0 | 1 | 1 | 2 | 4 | 1 | 1 | 0 | 1 | 0 | 0 | 2 | 3 | 73 | 0 | 0 | 0 | 0 | 0 | UZ |
| ATL | 0 | 0 | 20 | -0 | -0 | 101 | 1 | 14 | 12 | 0 | 38 | 277 | 42 | 9 | 399 | 57 | 493 | 909 | -0 | 3 | 85 | 8 | 125 | 12 | 30 | 0 | 12 | 9 | 4 | 6 | 1 | 0 | ATL |
| BAS | 0 | 0 | 11 | 0 | 0 | 26 | 1 | 11 | 4 | 0 | 27 | 157 | 44 | 9 | 11 | 31 | 55 | 100 | 0 | 1 | 6 | 7 | 4 | 0 | 11 | -0 | 1 | 13 | 1 | 8 | 1 | 0 | BAS |
| BLS | 2 | 5 | 12 | 4 | 4 | 5 | 56 | 11 | 2 | 1 | 16 | 41 | 5 | 1 | 7 | 3 | 18 | 24 | 7 | 39 | 1 | 17 | 1 | 0 | 30 | -0 | 4 | 3 | 0 | 1 | 9 | 2 | BLS |
| MED | 25 | 1 | 86 | 0 | 40 | 34 | 93 | 7 | 32 | 18 | 54 | 218 | 9 | -0 | 822 | 4 | 545 | 106 | 0 | 385 | 0 | 51 | 6 | 0 | 1160 | -0 | 1 | 3 | 3 | 2 | 3 | 16 | MED |
| NOS | 0 | 0 | 6 | 0 | 0 | 52 | 1 | 4 | 3 | 0 | 15 | 142 | 35 | 2 | 37 | 4 | 143 | 684 | 0 | 1 | 2 | 3 | 32 | 1 | 8 | -0 | 1 | 3 | 1 | 2 | 0 | 0 | NOS |
| AST | 1 | 21 | 4 | 63 | 0 | 2 | 4 | 4 | 1 | 10 | 4 | 16 | 2 | 0 | 7 | 2 | 11 | 14 | 5 | 13 | 1 | 4 | 1 | 0 | 14 | 11 | 162 | 1 | 0 | 1 | 1 | 0 | AST |
| NOA | 5 | 0 | 18 | 0 | 2 | 8 | 19 | 1 | 8 | 2 | 10 | 52 | 2 | -0 | 231 | 1 | 118 | 28 | 0 | 87 | 0 | 9 | 2 | 0 | 196 | -0 | 0 | 1 | 1 | 0 | 1 | 3 | NOA |
| SUM | 70 | 118 | 622 | 219 | 165 | 670 | 529 | 411 | 216 | 40 | 802 | 3341 | 399 | 109 | 3141 | 456 | 3437 | 3595 | 47 | 958 | 221 | 507 | 286 | 23 | 3060 | 50 | 1842 | 179 | 36 | 102 | 62 | 58 | SUM |
| EXC | 37 | 90 | 465 | 151 | 118 | 441 | 354 | 360 | 153 | 9 | 637 | 2437 | 260 | 90 | 1627 | 354 | 2053 | 1730 | 35 | 429 | 126 | 408 | 115 | 9 | 1611 | 39 | 1662 | 148 | 25 | 82 | 47 | 37 | EXC |
| EU | 16 | 1 | 302 | 1 | 54 | 345 | 195 | 62 | 98 | 2 | 401 | 1692 | 140 | 26 | 1479 | 135 | 1672 | 1178 | 1 | 220 | 50 | 220 | 90 | 3 | 1146 | -0 | 6 | 50 | 19 | 28 | 11 | 14 | EU |
| emis | 81 | 129 | 670 | 280 | 156 | 793 | 568 | 490 | 238 | 60 | 864 | 3908 | 507 | 105 | 4131 | 556 | 4095 | 4522 | 85 | 1137 | 250 | 578 | 357 | 38 | 3492 | 67 | 2305 | 211 | 42 | 130 | 76 | 64 | emis |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | ME | |

Table C.2 Cont.: 2007 country-to-country blame matrices for **oxidised nitrogen** deposition.
Units: 100 Mg of N. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | SUM | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 4 | 0 | 0 | 0 | 2 | 0 | 2 | 7 | 1 | 0 | 0 | 0 | -0 | 0 | 1 | 1 | -0 | 1 | 0 | 0 | 24 | 1 | 0 | 0 | 1 | 0 | 0 | 120 | 92 | 70 | AL |
| AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | -0 | 0 | 36 | 32 | 2 | AM |
| AT | 0 | 0 | 8 | 1 | 17 | 1 | 3 | 2 | 2 | 1 | 8 | 2 | 0 | 0 | 0 | 2 | 0 | 2 | 2 | 0 | 9 | 9 | 0 | 0 | 6 | -0 | 0 | 379 | 350 | 330 | AT |
| AZ | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 20 | 0 | 0 | 0 | 0 | 1 | 13 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 7 | 0 | 5 | -0 | 0 | 105 | 90 | 6 | AZ |
| BA | 1 | 0 | 2 | 0 | 12 | 0 | 5 | 14 | 2 | 0 | 2 | 3 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 22 | 3 | 0 | 0 | 1 | -0 | 0 | 235 | 207 | 162 | BA |
| BE | 0 | 0 | 8 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 20 | 0 | 0 | 6 | 0 | 0 | 161 | 129 | 126 | BE |
| BG | 6 | 0 | 2 | 1 | 15 | 0 | 52 | 19 | 16 | 1 | 1 | 3 | 0 | 0 | 16 | 22 | 0 | 1 | 2 | 7 | 24 | 3 | 0 | 0 | 3 | -0 | 0 | 421 | 380 | 288 | BG |
| BY | 0 | 0 | 10 | 5 | 154 | 1 | 16 | 4 | 81 | 8 | 2 | 8 | 0 | 0 | 5 | 59 | 0 | 4 | 26 | 1 | 5 | 21 | 0 | 0 | 9 | -0 | 0 | 711 | 646 | 439 | BY |
| CH | 0 | 0 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 4 | 0 | 0 | 3 | 0 | 0 | 162 | 149 | 132 | CH |
| CY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | -0 | 0 | 21 | 16 | 5 | CY |
| CZ | 0 | 0 | 10 | 1 | 42 | 1 | 3 | 2 | 3 | 1 | 3 | 5 | 0 | 0 | 0 | 4 | 0 | 3 | 4 | 0 | 3 | 13 | 0 | 0 | 8 | 0 | 0 | 387 | 356 | 338 | CZ |
| DE | 0 | 0 | 86 | 6 | 78 | 4 | 3 | 1 | 12 | 7 | 2 | 4 | 0 | 0 | 1 | 6 | 0 | 24 | 34 | 0 | 10 | 134 | 0 | 0 | 46 | 2 | 0 | 1775 | 1525 | 1471 | DE |
| DK | 0 | 0 | 9 | 2 | 10 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 15 | 0 | 0 | 33 | 0 | 0 | 5 | 0 | 0 | 188 | 131 | 123 | DK |
| EE | 0 | 0 | 3 | 2 | 16 | 0 | 1 | 0 | 19 | 5 | 0 | 1 | 0 | 0 | 0 | 4 | 0 | 1 | 17 | 0 | 0 | 8 | 0 | 0 | 2 | -0 | 0 | 146 | 117 | 87 | EE |
| ES | 0 | 0 | 10 | 1 | 6 | 80 | 1 | 1 | 3 | 1 | 1 | 1 | -0 | -0 | 0 | 1 | -0 | 68 | 2 | 0 | 81 | 19 | -0 | 2 | 40 | 0 | 1 | 1404 | 1191 | 1179 | ES |
| FI | 0 | 0 | 7 | 14 | 36 | 0 | 2 | 0 | 74 | 27 | 0 | 2 | 0 | 0 | 2 | 9 | 0 | 7 | 45 | 0 | 1 | 27 | 0 | 0 | 12 | 0 | 0 | 518 | 426 | 297 | FI |
| FR | 0 | 0 | 52 | 4 | 19 | 17 | 2 | 1 | 7 | 3 | 3 | 2 | 0 | 0 | 1 | 2 | 0 | 83 | 8 | 0 | 57 | 140 | 0 | 1 | 55 | -1 | 0 | 2116 | 1772 | 1737 | FR |
| GB | 0 | 0 | 15 | 5 | 9 | 1 | 1 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 47 | 7 | 0 | 1 | 70 | 0 | 0 | 32 | 1 | 0 | 620 | 461 | 447 | GB |
| GE | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 25 | 5 | 0 | 0 | 0 | 2 | 1 | 1 | 3 | 0 | 1 | -0 | 0 | 108 | 99 | 15 | GE |
| GL | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | -0 | 77 | 0 | 0 | 93 | 13 | 9 | GL |
| GR | 10 | 0 | 2 | 1 | 9 | 0 | 14 | 11 | 7 | 0 | 1 | 2 | -0 | 0 | 14 | 8 | 0 | 1 | 1 | 4 | 84 | 3 | 0 | 1 | 2 | -0 | 0 | 431 | 335 | 271 | GR |
| HR | 1 | 0 | 2 | 0 | 14 | 0 | 5 | 9 | 2 | 0 | 4 | 3 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 22 | 3 | 0 | 0 | 2 | -0 | 0 | 239 | 209 | 182 | HR |
| HU | 1 | 0 | 5 | 1 | 42 | 1 | 17 | 19 | 4 | 1 | 6 | 12 | 0 | 0 | 1 | 8 | 0 | 2 | 2 | 0 | 13 | 7 | 0 | 0 | 5 | -0 | 0 | 410 | 382 | 332 | HU |
| IE | 0 | 0 | 3 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 1 | 0 | 0 | 8 | 0 | 0 | 10 | -0 | 0 | 105 | 73 | 71 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | -0 | 0 | 13 | 0 | 0 | 29 | 13 | 9 | IS |
| IT | 2 | 1 | 8 | 1 | 24 | 4 | 7 | 10 | 6 | 1 | 13 | 5 | -0 | 0 | 1 | 3 | -0 | 7 | 3 | 0 | 204 | 12 | 0 | 2 | 15 | -0 | 2 | 1376 | 1131 | 1073 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 19 | 2 | 2 | 0 | 89 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 6 | -0 | 0 | 211 | 196 | 4 | KG |
| KZT | 1 | 0 | 9 | 11 | 37 | 1 | 14 | 2 | 1170 | 9 | 1 | 4 | 15 | 21 | 66 | 108 | 111 | 12 | 16 | 7 | 11 | 20 | 42 | 0 | 38 | -1 | 1 | 2803 | 2656 | 273 | KZT |
| LT | 0 | 0 | 5 | 3 | 48 | 0 | 2 | 1 | 18 | 6 | 0 | 2 | 0 | 0 | 1 | 7 | 0 | 2 | 20 | 0 | 1 | 13 | 0 | 0 | 4 | 0 | 0 | 247 | 208 | 171 | LT |
| LU | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 16 | 13 | 13 | LU |
| LV | 0 | 0 | 5 | 3 | 33 | 0 | 2 | 1 | 20 | 7 | 0 | 1 | 0 | 0 | 1 | 6 | 0 | 2 | 21 | 0 | 1 | 12 | 0 | 0 | 3 | 0 | 0 | 222 | 183 | 144 | LV |
| MD | 0 | 0 | 1 | 0 | 12 | 0 | 16 | 2 | 9 | 0 | 0 | 1 | 0 | 0 | 3 | 19 | 0 | 0 | 1 | 2 | 2 | 1 | 0 | 0 | 0 | -0 | 0 | 103 | 96 | 59 | MD |
| ME | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | -0 | 0 | 60 | 48 | 36 | ME |
| MK | 6 | 0 | 0 | 0 | 2 | 0 | 3 | 7 | 1 | 0 | 0 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 8 | 1 | 0 | 0 | 1 | -0 | 0 | 92 | 81 | 60 | MK |
| MT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 1 | MT |
| NL | 0 | 0 | 19 | 1 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 31 | 0 | 0 | 8 | 0 | 0 | 178 | 132 | 128 | NL |
| NO | 0 | 0 | 11 | 44 | 13 | 0 | 1 | 0 | 15 | 13 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 13 | 17 | 0 | 1 | 51 | 0 | 0 | 21 | 0 | 0 | 397 | 293 | 215 | NO |
| PL | 1 | 0 | 41 | 9 | 402 | 2 | 16 | 8 | 31 | 13 | 6 | 19 | 0 | 0 | 3 | 36 | 0 | 10 | 56 | 1 | 10 | 72 | 0 | 0 | 28 | 0 | 0 | 1547 | 1369 | 1251 | PL |
| PT | 0 | 0 | 1 | 0 | 1 | 83 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 43 | 0 | 0 | 3 | 2 | 0 | 0 | 11 | 0 | 0 | 250 | 190 | 189 | PT |
| RO | 6 | 0 | 7 | 2 | 72 | 1 | 200 | 36 | 29 | 2 | 4 | 16 | 0 | 0 | 18 | 64 | 0 | 3 | 6 | 9 | 28 | 10 | 0 | 0 | 6 | -0 | 0 | 899 | 836 | 647 | RO |
| RS | 6 | 0 | 3 | 1 | 19 | 0 | 27 | 49 | 3 | 0 | 2 | 5 | 0 | 0 | 2 | 5 | 0 | 1 | 2 | 1 | 18 | 4 | 0 | 0 | 3 | -0 | 0 | 344 | 315 | 226 | RS |
| RUE | 4 | 0 | 71 | 75 | 438 | 3 | 113 | 19 | 7791 | 88 | 9 | 33 | 2 | 10 | 201 | 748 | 23 | 66 | 193 | 33 | 51 | 168 | 28 | 1 | 241 | -2 | 4 | 13125 | 12344 | 2434 | RUE |
| SE | 0 | 0 | 22 | 34 | 45 | 1 | 2 | 0 | 42 | 61 | 1 | 2 | 0 | 0 | 2 | 7 | 0 | 14 | 77 | 0 | 1 | 92 | 0 | 0 | 24 | 0 | 0 | 792 | 584 | 465 | SE |
| SI | 0 | 0 | 1 | 0 | 5 | 0 | 1 | 1 | 1 | 0 | 5 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | 1 | 0 | 0 | 1 | -0 | 0 | 106 | 94 | 88 | SI |
| SK | 0 | 0 | 4 | 1 | 45 | 0 | 7 | 6 | 2 | 1 | 3 | 9 | 0 | 0 | 1 | 5 | 0 | 1 | 2 | 0 | 4 | 5 | 0 | 0 | 3 | -0 | 0 | 246 | 230 | 209 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 25 | 2 | 1 | 0 | 33 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 10 | -0 | 0 | 96 | 78 | 2 | TJ |
| TM | 0 | 0 | 1 | 1 | 2 | 0 | 1 | 0 | 59 | 1 | 0 | 0 | 3 | 32 | 15 | 5 | 44 | 1 | 1 | 1 | 2 | 2 | 31 | 0 | 39 | -0 | 0 | 317 | 240 | 25 | TM |
| TR | 5 | 0 | 5 | 2 | 25 | 1 | 39 | 11 | 85 | 1 | 2 | 4 | 0 | 0 | 745 | 63 | 0 | 4 | 4 | 37 | 130 | 8 | 18 | 3 | 10 | -0 | 1 | 1504 | 1287 | 334 | TR |
| UA | 4 | 0 | 19 | 8 | 289 | 1 | 137 | 24 | 325 | 9 | 6 | 30 | 0 | 1 | 62 | 498 | 1 | 8 | 27 | 25 | 31 | 32 | 2 | 1 | 13 | -0 | 0 | 2197 | 2058 | 1040 | UA |
| UZ | 0 | 0 | 1 | 1 | 3 | 0 | 1 | 0 | 62 | 1 | 0 | 0 | 15 | 12 | 10 | 6 | 97 | 1 | 1 | 1 | 1 | 2 | 18 | 0 | 22 | -0 | 0 | 357 | 312 | 23 | UZ |
| ATL | 0 | 0 | 103 | 91 | 98 | 73 | 4 | 0 | 378 | 40 | 2 | 5 | 0 | -0 | 3 | 21 | 0 | 752 | 70 | 1 | 18 | 325 | 0 | 0 | 2189 | 8 | 3 | 6852 | 3484 | 2855 | ATL |
| BAS | 0 | 0 | 34 | 18 | 120 | 1 | 5 | 2 | 65 | 47 | 1 | 5 | 0 | 0 | 2 | 13 | 0 | 12 | 138 | 0 | 3 | 95 | 0 | 0 | 20 | 1 | 0 | 1123 | 852 | 729 | BAS |
| BLS | 4 | 0 | 7 | 4 | 60 | 0 | 96 | 15 | 232 | 4 | 2 | 8 | 0 | 0 | 204 | 198 | 0 | 4 | 9 | 76 | 45 | 13 | 3 | 1 | -15 | -0 | 0 | 1301 | 1165 | 457 | BLS |
| MED | 25 | 21 | 38 | 9 | 86 | 26 | 68 | 56 | 56 | 6 | 25 | 18 | -0 | -0 | 382 | 47 | -0 | 45 | 16 | 24 | 2579 | 61 | 11 | 32 | 93 | 1 | 6 | 7460 | 4591 | 3888 | MED |
| NOS | 0 | 0 | 70 | 42 | 49 | 4 | 3 | 1 | 20 | 16 | 0 | 2 | 0 | 0 | 1 | 7 | 0 | 77 | 47 | 0 | 4 | 343 | 0 | 0 | 80 | 6 | 1 | 1954 | 1397 | 1315 | NOS |
| AST | 1 | 0 | 3 | 3 | 13 | 1 | 9 | 2 | 245 | 2 | 1 | 2 | 26 | 25 | 305 | 33 | 81 | 4 | 4 | 6 | 72 | 7 | 239 | 3 | 256 | -0 | 1 | 1727 | 1134 | 143 | AST |
| NOA | 5 | 6 | 10 | 2 | 16 | 11 | 15 | 9 | 13 | 1 | 4 | 3 | -0 | 0 | 62 | 10 | 0 | 14 | 3 | 4 | 677 | 15 | 2 | 42 | 220 | -0 | -1 | 1949 | 973 | 850 | NOA |
| SUM | 98 | 30 | 741 | 413 | 2453 | 323 | 918 | 358 | 10973 | 392 | 123 | 227 | 106 | 107 | 2197 | 2054 | 481 | 1378 | 906 | 245 | 4294 | 1931 | 422 | 93 | 3700 | 16 | 27 | 60774 | | | SUM |
| EXC | 62 | 3 | 475 | 243 | 2011 | 207 | 718 | 272 | 9963 | 275 | 88 | 184 | 81 | 82 | 1238 | 1725 | 399 | 469 | 618 | 134 | 896 | 1071 | 167 | 14 | 856 | 0 | 15 | | 34169 | 17239 | EXC |
| EU | 28 | 2 | 335 | 92 | 982 | 197 | 335 | 120 | 307 | 143 | 58 | 89 | 0 | 0 | 73 | 199 | 0 | 348 | 327 | 23 | 550 | 745 | 1 | 8 | 337 | 4 | 6 | | 12615 | 11479 | EU |
| emis | 106 | 35 | 913 | 585 | 2692 | 708 | 1008 | 395 | 13267 | 503 | 136 | 253 | 174 | 198 | 2818 | 2228 | 691 | 2546 | 1066 | 279 | 5636 | 2296 | 1310 | 292 | 0 | 0 | 0 | 71119 | 57695 | 32975 | emis |
| | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | SUM | EXC | EU | |

Table C.3: 2007 country-to-country blame matrices for **reduced nitrogen** deposition.
Units: 100 Mg of N. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | ME | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 57 | 0 | 1 | 0 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 11 | 0 | 1 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | AL |
| AM | 0 | 47 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | AM |
| AT | 0 | 0 | 180 | 0 | 1 | 3 | 0 | 1 | 30 | -0 | 13 | 155 | 1 | 0 | 10 | 0 | 21 | 2 | 0 | 0 | 0 | 8 | 0 | 0 | 80 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | AT |
| AZ | 0 | 16 | 0 | 164 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | AZ |
| BA | 2 | 0 | 7 | 0 | 42 | 0 | 1 | 0 | 2 | 0 | 3 | 11 | 0 | 0 | 6 | 0 | 5 | 1 | 0 | 3 | 0 | 11 | 0 | 0 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | BA |
| BE | 0 | 0 | 1 | 0 | 0 | 153 | 0 | 0 | 1 | 0 | 0 | 25 | 1 | 0 | 3 | -0 | 79 | 14 | -0 | 0 | 0 | 0 | 1 | -0 | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | BE |
| BG | 4 | 0 | 3 | 0 | 1 | 0 | 149 | 2 | 1 | 0 | 2 | 6 | 0 | 0 | 3 | 0 | 2 | 1 | 0 | 24 | 0 | 5 | 0 | 0 | 11 | 0 | 2 | 0 | 0 | 0 | 3 | 1 | BG |
| BY | 1 | 0 | 5 | 1 | 2 | 2 | 3 | 539 | 3 | 0 | 9 | 41 | 5 | 1 | 7 | 1 | 11 | 4 | 0 | 1 | 1 | 9 | 1 | 0 | 18 | 0 | 9 | 30 | 0 | 7 | 5 | 1 | BY |
| CH | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 210 | 0 | 0 | 33 | 0 | 0 | 11 | 0 | 50 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 48 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | CH |
| CY | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | CY |
| CZ | 0 | 0 | 33 | 0 | 0 | 3 | 0 | 1 | 8 | 0 | 170 | 165 | 2 | 0 | 6 | 0 | 18 | 3 | 0 | 0 | 0 | 7 | 1 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | CZ |
| DE | 0 | 0 | 37 | 0 | 1 | 89 | 0 | 3 | 73 | 0 | 28 | 2560 | 24 | 0 | 42 | 0 | 253 | 51 | 0 | 1 | 0 | 4 | 8 | 0 | 38 | 0 | 1 | 1 | 16 | 0 | 0 | 0 | DE |
| DK | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 1 | 1 | 0 | 1 | 54 | 171 | 0 | 2 | 0 | 8 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | DK |
| EE | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 6 | 0 | 0 | 1 | 10 | 2 | 29 | 1 | 2 | 3 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 5 | 0 | 7 | 0 | 0 | EE |
| ES | 0 | 0 | 4 | 0 | -0 | 4 | 0 | 0 | 4 | 0 | 2 | 20 | 0 | 0 | 1495 | 0 | 127 | 8 | 0 | 0 | 0 | 1 | 2 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ES |
| FI | 0 | 0 | 2 | 0 | 1 | 2 | 0 | 11 | 1 | 0 | 3 | 21 | 5 | 5 | 3 | 165 | 7 | 6 | 0 | 0 | 92 | 2 | 1 | 0 | 3 | 0 | 4 | 5 | 0 | 3 | 1 | 0 | FI |
| FR | 0 | 0 | 12 | 0 | 1 | 63 | 1 | 1 | 43 | 0 | 4 | 132 | 3 | 0 | 210 | 0 | 3376 | 60 | -0 | 1 | 0 | 3 | 14 | 0 | 106 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | FR |
| GB | 0 | -0 | 1 | -0 | 0 | 8 | 0 | 1 | 1 | 0 | 1 | 24 | 3 | 0 | 8 | 0 | 57 | 946 | -0 | 0 | 0 | 0 | 92 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GB |
| GE | 0 | 14 | 0 | 34 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 77 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 12 | 0 | 2 | 0 | -0 | 0 | 12 | 1 | 1 | 0 | 1 | 4 | 0 | 0 | 5 | 0 | 3 | 1 | 0 | 174 | 0 | 3 | 0 | 0 | 14 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | GR |
| HR | 1 | 0 | 12 | 0 | 8 | 0 | 1 | 0 | 3 | 0 | 3 | 13 | 0 | 0 | 6 | 0 | 6 | 1 | 0 | 2 | 0 | 18 | 0 | 0 | 52 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | HR |
| HU | 1 | 0 | 33 | 0 | 3 | 1 | 1 | 1 | 5 | 0 | 9 | 33 | 1 | 0 | 8 | 0 | 9 | 1 | 0 | 2 | 0 | 205 | 0 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | HU |
| IE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 7 | 28 | 0 | 0 | 0 | 0 | 353 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 4 | 0 | 17 | 0 | -2 | 2 | 1 | 0 | 22 | 0 | 3 | 31 | 0 | 0 | 44 | 0 | 54 | 3 | 0 | 7 | 0 | 9 | 0 | 0 | 1629 | -0 | 0 | 0 | 0 | 0 | 0 | 2 | IT |
| KG | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 | 73 | 0 | 0 | 0 | 0 | 0 | KG |
| KZT | 1 | 16 | 2 | 35 | 1 | 1 | 4 | 10 | 2 | 0 | 3 | 12 | 1 | 1 | 5 | 1 | 5 | 2 | 12 | 3 | 1 | 3 | 0 | 0 | 9 | 41 | 3386 | 2 | 0 | 1 | 2 | 0 | KZT |
| LT | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 30 | 1 | 0 | 3 | 23 | 5 | 0 | 3 | 0 | 6 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 4 | 0 | 1 | 110 | 0 | 8 | 1 | 0 | LT |
| LU | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | -0 | 10 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | LU |
| LV | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 19 | 1 | 0 | 2 | 19 | 4 | 2 | 2 | 1 | 5 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 1 | 27 | 0 | 46 | 0 | 0 | LV |
| MD | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 48 | 0 | MD |
| ME | 6 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | ME |
| MK | 8 | 0 | 1 | 0 | -0 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 17 | 0 | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | MK |
| MT | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | MT |
| NL | 0 | -0 | 0 | -0 | 0 | 47 | 0 | 0 | 1 | -0 | -0 | 76 | 2 | -0 | 2 | -0 | 31 | 19 | -0 | 0 | -0 | 0 | 2 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NL |
| NO | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 1 | 22 | 12 | 0 | 3 | 2 | 12 | 21 | 0 | 0 | 16 | 0 | 4 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | NO |
| PL | 1 | 0 | 22 | 0 | 2 | 9 | 4 | 44 | 9 | 0 | 64 | 311 | 26 | 0 | 18 | 0 | 37 | 17 | 0 | 3 | 0 | 20 | 2 | 0 | 38 | 0 | 4 | 11 | 1 | 2 | 3 | 1 | PL |
| PT | 0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 2 | 0 | 0 | 66 | 0 | 8 | 1 | -0 | -0 | -0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | PT |
| RO | 6 | 0 | 12 | 1 | 3 | 1 | 27 | 8 | 4 | 0 | 8 | 31 | 1 | 0 | 10 | 0 | 8 | 2 | 1 | 13 | 0 | 50 | 0 | 0 | 39 | 0 | 3 | 1 | 0 | 0 | 23 | 3 | RO |
| RS | 12 | 0 | 7 | 0 | 5 | 0 | 5 | 1 | 2 | 0 | 3 | 13 | 0 | 0 | 6 | 0 | 4 | 1 | 0 | 9 | 0 | 25 | 0 | -0 | 27 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | RS |
| RUE | 6 | 25 | 23 | 71 | 14 | 12 | 34 | 307 | 13 | 1 | 37 | 168 | 24 | 22 | 37 | 52 | 59 | 33 | 51 | 16 | 38 | 32 | 4 | 0 | 66 | 10 | 2045 | 54 | 1 | 28 | 25 | 4 | RUE |
| SE | 0 | 0 | 3 | 0 | 1 | 6 | 1 | 10 | 2 | 0 | 5 | 70 | 53 | 2 | 6 | 12 | 18 | 18 | 0 | 1 | 148 | 2 | 3 | 0 | 4 | 0 | 2 | 6 | 0 | 3 | 1 | 0 | SE |
| SI | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 7 | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SI |
| SK | 1 | 0 | 17 | 0 | 1 | 1 | 1 | 1 | 3 | 0 | 17 | 25 | 1 | 0 | 4 | 0 | 5 | 1 | 0 | 1 | 0 | 29 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 3 | 9 | 0 | 0 | 0 | 0 | 0 | TJ |
| TM | 0 | 3 | 0 | 8 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | -0 | 1 | 0 | 45 | 0 | 0 | 0 | 0 | 0 | TM |
| TR | 4 | 17 | 4 | 10 | 0 | 1 | 12 | 4 | 1 | 4 | 3 | 12 | 1 | 0 | 10 | 0 | 5 | 1 | 9 | 16 | 0 | 5 | 0 | 0 | 16 | 0 | 8 | 1 | 0 | 0 | 4 | 1 | TR |
| UA | 5 | 3 | 14 | 7 | 7 | 3 | 27 | 106 | 6 | 0 | 21 | 71 | 5 | 0 | 14 | 1 | 16 | 7 | 6 | 11 | 1 | 38 | 1 | 0 | 45 | 0 | 45 | 8 | 0 | 2 | 59 | 3 | UA |
| UZ | 0 | 2 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | -0 | 1 | 4 | 70 | 0 | 0 | 0 | 0 | 0 | UZ |
| ATL | 0 | 0 | 15 | 0 | 2 | 44 | 2 | 11 | 14 | 0 | 17 | 214 | 21 | 3 | 244 | 14 | 836 | 485 | 0 | 1 | 51 | 5 | 315 | 19 | 22 | 0 | 20 | 4 | 3 | 2 | 1 | 0 | ATL |
| BAS | 0 | 0 | 8 | 0 | 2 | 11 | 2 | 21 | 4 | 0 | 13 | 255 | 144 | 10 | 13 | 32 | 35 | 21 | 0 | 2 | 8 | 5 | 3 | 0 | 12 | 0 | 5 | 21 | 1 | 13 | 1 | 0 | BAS |
| BLS | 4 | 6 | 6 | 10 | 3 | 1 | 51 | 12 | 1 | 1 | 5 | 20 | 2 | 0 | 6 | 0 | 5 | 3 | 21 | 16 | 0 | 10 | 0 | 0 | 17 | 0 | 19 | 2 | 0 | 1 | 20 | 1 | BLS |
| MED | 38 | 0 | 34 | 1 | 7 | 10 | 26 | 4 | 29 | 16 | 14 | 97 | 3 | 0 | 480 | 0 | 346 | 19 | 1 | 107 | 0 | 23 | 2 | 0 | 806 | 0 | 4 | 1 | 1 | 0 | 4 | 12 | MED |
| NOS | 0 | 0 | 4 | 0 | 1 | 63 | 1 | 5 | 4 | 0 | 5 | 255 | 90 | 1 | 27 | 1 | 345 | 546 | 0 | 1 | 0 | 2 | 50 | 0 | 6 | -0 | 1 | 2 | 1 | 1 | 1 | 0 | NOS |
| AST | 1 | 19 | 1 | 72 | -0 | 0 | 0 | 2 | 1 | 1 | 1 | 4 | 0 | 0 | 3 | 0 | 2 | 1 | 12 | 0 | 0 | 1 | 0 | -0 | 5 | 20 | 527 | 0 | 0 | 0 | 1 | 0 | AST |
| NOA | 3 | 0 | 3 | 0 | 1 | 2 | 1 | 0 | 3 | 0 | 2 | 13 | 0 | 0 | 72 | 0 | 40 | 3 | 0 | 5 | 0 | 2 | 0 | 0 | 50 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | NOA |
| SUM | 180 | 171 | 551 | 446 | 108 | 561 | 377 | 1171 | 510 | 27 | 480 | 5079 | 614 | 78 | 2915 | 288 | 5944 | 2351 | 207 | 452 | 357 | 553 | 865 | 32 | 3384 | 156 | 6304 | 297 | 43 | 125 | 208 | 69 | SUM |
| EXC | 134 | 146 | 479 | 363 | 92 | 429 | 294 | 1114 | 453 | 9 | 423 | 4221 | 354 | 63 | 2070 | 240 | 4336 | 1274 | 173 | 320 | 297 | 504 | 495 | 12 | 2466 | 135 | 5729 | 266 | 37 | 109 | 180 | 53 | EXC |
| EU | 32 | 1 | 398 | 3 | 12 | 404 | 200 | 142 | 211 | 3 | 338 | 3813 | 305 | 39 | 1957 | 182 | 4157 | 1199 | 2 | 229 | 241 | 357 | 484 | 1 | 2115 | 0 | 23 | 169 | 35 | 70 | 35 | 10 | EU |
| emis | 201 | 156 | 547 | 436 | 137 | 578 | 479 | 1183 | 492 | 44 | 492 | 5141 | 618 | 80 | 3477 | 290 | 6072 | 2381 | 192 | 537 | 354 | 581 | 869 | 30 | 3443 | 226 | 7016 | 299 | 43 | 126 | 219 | 76 | emis |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | ME | |

Table C.3 Cont.: 2007 country-to-country blame matrices for **reduced nitrogen** deposition.
Units: 100 Mg of N. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | SUM | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 3 | 1 | 0 | -0 | 106 | 103 | 34 | AL |
| AM | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 34 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 24 | 0 | 1 | 0 | -1 | 138 | 114 | 1 | AM |
| AT | 0 | 0 | 5 | 0 | 5 | 1 | 4 | 1 | 1 | 0 | 16 | 4 | -0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 4 | 0 | 0 | 553 | 546 | 511 | AT |
| AZ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 2 | 24 | 1 | 0 | -0 | 0 | -0 | 0 | 0 | 31 | 0 | 2 | 0 | -1 | 272 | 240 | 3 | AZ |
| BA | 0 | 0 | 1 | 0 | 3 | 0 | 6 | 10 | 1 | 0 | 2 | 3 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | -0 | 169 | 164 | 100 | BA |
| BE | 0 | 0 | 44 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -2 | 0 | 0 | 1 | 0 | -0 | 329 | 329 | 328 | BE |
| BG | 3 | 0 | 0 | 0 | 4 | 0 | 53 | 15 | 5 | 0 | 1 | 2 | 0 | 0 | 14 | 11 | 0 | 0 | 0 | -0 | 1 | 0 | 1 | 4 | 3 | 0 | 0 | 341 | 331 | 268 | BG |
| BY | 0 | 0 | 4 | 1 | 130 | 1 | 24 | 5 | 24 | 4 | 2 | 5 | -0 | 0 | 5 | 55 | 0 | 0 | -1 | 0 | 1 | 1 | 1 | 1 | 8 | 0 | -0 | 986 | 974 | 324 | BY |
| CH | 0 | 0 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 2 | 0 | 0 | 368 | 365 | 154 | CH |
| CY | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 4 | 0 | -0 | 0 | 0 | -0 | -0 | 0 | 1 | 0 | 0 | -0 | -0 | 8 | 7 | 3 | CY |
| CZ | 0 | 0 | 7 | 0 | 29 | 0 | 3 | 1 | 1 | 1 | 2 | 13 | -0 | 0 | 0 | 2 | 0 | 0 | -0 | 0 | 1 | -0 | 0 | 0 | 3 | 0 | -0 | 499 | 495 | 481 | CZ |
| DE | 0 | 0 | 265 | 0 | 48 | 3 | 3 | 2 | 1 | 3 | 1 | 3 | -0 | 0 | 0 | 3 | 0 | 2 | -4 | -0 | 2 | -12 | 0 | 1 | 12 | 1 | -0 | 3569 | 3566 | 3481 | DE |
| DK | 0 | 0 | 10 | 1 | 7 | 0 | 1 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | -2 | 0 | 0 | -3 | 0 | 0 | 2 | -0 | 0 | 278 | 281 | 276 | DK |
| EE | 0 | 0 | 1 | 0 | 11 | 0 | 1 | 0 | 5 | 3 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 105 | 102 | 83 | EE |
| ES | 0 | 0 | 5 | 0 | 3 | 52 | 1 | 0 | 0 | 0 | 1 | 1 | -0 | 0 | 0 | 1 | 0 | -8 | 0 | 0 | -5 | 1 | 0 | 8 | 12 | -2 | -3 | 1762 | 1759 | 1752 | ES |
| FI | 0 | 0 | 3 | 4 | 24 | 0 | 4 | 1 | 19 | 14 | 0 | 1 | 0 | 0 | 3 | 10 | 0 | 0 | 1 | 0 | 0 | 2 | 1 | 0 | 9 | 0 | 0 | 440 | 426 | 280 | FI |
| FR | 0 | 0 | 43 | 0 | 8 | 10 | 3 | 2 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 2 | 0 | -14 | 0 | 0 | -1 | -24 | 0 | 4 | 22 | -10 | -1 | 4088 | 4111 | 4062 | FR |
| GB | 0 | 0 | 13 | 0 | 3 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -4 | -0 | -0 | 0 | -5 | 0 | 0 | 14 | -4 | -0 | 1167 | 1165 | 1161 | GB |
| GE | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 19 | 0 | 0 | 0 | 0 | 1 | 64 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 1 | 2 | 0 | -1 | 244 | 227 | 9 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 36 | 6 | 5 | GL |
| GR | 3 | 0 | 0 | 0 | 3 | 0 | 10 | 6 | 2 | 0 | 0 | 1 | 0 | 0 | 14 | 4 | 0 | 0 | 0 | -0 | -1 | 0 | 0 | 6 | 4 | -0 | -1 | 287 | 279 | 233 | GR |
| HR | 0 | 0 | 1 | 0 | 3 | 0 | 5 | 7 | 0 | 0 | 11 | 3 | -0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 166 | 161 | 139 | HR |
| HU | 1 | 0 | 2 | 0 | 8 | 1 | 28 | 16 | 1 | 0 | 11 | 27 | 0 | 0 | 1 | 3 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | -0 | 459 | 453 | 421 | HU |
| IE | 0 | 0 | 1 | -0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -3 | -0 | -0 | 0 | -1 | 0 | 0 | 5 | -6 | 0 | 393 | 399 | 398 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | -0 | 0 | 25 | 16 | 5 | IS |
| IT | 0 | 0 | 3 | 0 | 4 | 2 | 7 | 3 | 1 | 0 | 11 | 3 | -0 | 0 | 2 | 2 | 0 | 1 | 0 | 0 | -14 | 1 | 0 | 12 | 7 | -1 | -3 | 1870 | 1866 | 1831 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 33 | 3 | 3 | 1 | 79 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 5 | 0 | 0 | 316 | 275 | 2 | KG |
| KZT | 0 | 0 | 1 | 0 | 16 | 0 | 16 | 3 | 326 | 1 | 1 | 2 | 23 | 43 | 94 | 30 | 110 | 0 | 1 | 0 | 1 | 1 | 217 | 2 | 45 | 1 | -4 | 4491 | 4227 | 89 | KZT |
| LT | 0 | 0 | 3 | 1 | 51 | 0 | 3 | 1 | 7 | 4 | 0 | 1 | -0 | 0 | 1 | 5 | 0 | 0 | -1 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 287 | 283 | 235 | LT |
| LU | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 29 | 29 | 29 | LU |
| LV | 0 | 0 | 3 | 1 | 23 | 0 | 3 | 1 | 5 | 5 | 0 | 1 | -0 | 0 | 1 | 4 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 193 | 189 | 154 | LV |
| MD | 0 | 0 | 0 | 0 | 4 | 0 | 39 | 2 | 2 | 0 | 0 | 1 | 0 | 0 | 3 | 20 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 140 | 138 | 59 | MD |
| ME | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | -0 | 55 | 53 | 21 | ME |
| MK | 14 | 0 | 0 | 0 | 1 | 0 | 3 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | -0 | 70 | 68 | 34 | MK |
| MT | -0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | 1 | 2 | 2 | MT |
| NL | 0 | 0 | 328 | 0 | 1 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -1 | -0 | 0 | -7 | 0 | 0 | 0 | -0 | -0 | 504 | 511 | 510 | NL |
| NO | 0 | 0 | 6 | 87 | 7 | 0 | 1 | 0 | 3 | 8 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 17 | -0 | 0 | 243 | 221 | 109 | NO |
| PL | 1 | 0 | 25 | 1 | 1166 | 1 | 24 | 6 | 11 | 9 | 5 | 20 | -0 | 0 | 4 | 30 | 0 | 1 | -4 | 0 | 2 | -0 | 1 | 2 | 11 | 1 | 0 | 1967 | 1953 | 1835 | PL |
| PT | -0 | 0 | 1 | 0 | 0 | 151 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -4 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | -1 | -0 | 229 | 231 | 231 | PT |
| RO | 3 | 0 | 2 | 0 | 20 | 1 | 693 | 35 | 9 | 0 | 3 | 11 | -0 | 0 | 18 | 41 | 0 | 0 | 0 | -0 | 2 | 0 | 2 | 5 | 8 | 0 | 0 | 1113 | 1094 | 935 | RO |
| RS | 4 | 0 | 1 | 0 | 4 | 0 | 37 | 158 | 1 | 0 | 2 | 4 | 0 | 0 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 | -0 | 349 | 343 | 146 | RS |
| RUE | 3 | 0 | 18 | 10 | 261 | 2 | 152 | 29 | 5951 | 29 | 5 | 20 | 4 | 26 | 265 | 432 | 31 | 4 | 13 | 2 | 8 | 14 | 154 | 10 | 206 | 6 | 11 | 10978 | 10549 | 1189 | RUE |
| SE | 0 | 0 | 13 | 20 | 33 | 0 | 5 | 1 | 10 | 203 | 0 | 2 | 0 | 0 | 3 | 8 | 0 | 1 | -1 | 0 | 1 | 1 | 1 | 1 | 15 | -0 | 0 | 695 | 677 | 470 | SE |
| SI | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 43 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | -0 | 124 | 122 | 118 | SI |
| SK | 0 | 0 | 2 | 0 | 23 | 0 | 10 | 4 | 1 | 0 | 3 | 75 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 250 | 246 | 232 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 81 | 2 | 1 | 0 | 20 | -0 | 0 | 0 | 0 | 0 | 41 | 0 | 4 | 0 | -1 | 162 | 118 | 0 | TJ |
| TM | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 9 | 0 | 0 | 0 | 4 | 93 | 15 | 0 | 22 | -0 | 0 | 0 | 0 | 0 | 46 | 0 | 10 | 0 | -2 | 260 | 206 | 4 | TM |
| TR | 1 | 0 | 1 | 0 | 10 | 0 | 24 | 6 | 25 | 0 | 1 | 2 | 0 | 1 | 1288 | 24 | 0 | 0 | 0 | -2 | -1 | 1 | 113 | 17 | 20 | -0 | -11 | 1669 | 1532 | 128 | TR |
| UA | 3 | 0 | 7 | 1 | 158 | 1 | 185 | 23 | 108 | 3 | 4 | 20 | 0 | 2 | 58 | 753 | 2 | 1 | 0 | -1 | 4 | 2 | 8 | 5 | 20 | 1 | 1 | 1902 | 1860 | 665 | UA |
| UZ | 0 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 9 | 0 | 0 | 0 | 24 | 23 | 13 | 1 | 139 | -0 | 0 | 0 | 0 | 0 | 32 | 0 | 8 | 0 | -1 | 337 | 297 | 4 | UZ |
| ATL | 0 | 0 | 57 | 32 | 57 | 58 | 10 | 3 | 73 | 11 | 1 | 5 | 0 | 0 | 3 | 18 | 0 | -13 | 8 | 0 | 3 | 19 | 1 | 3 | 1350 | -0 | 1 | 4069 | 2697 | 2448 | ATL |
| BAS | 0 | 0 | 28 | 7 | 123 | 1 | 12 | 3 | 19 | 92 | 1 | 4 | 0 | 0 | 5 | 16 | 0 | 1 | -15 | 0 | 1 | -2 | 1 | 1 | 14 | -1 | 1 | 958 | 956 | 862 | BAS |
| BLS | 2 | 0 | 2 | 0 | 22 | 0 | 97 | 14 | 87 | 1 | 1 | 5 | 0 | 1 | 199 | 109 | 1 | 0 | 1 | -4 | 3 | 1 | 18 | 6 | 11 | -0 | 2 | 818 | 781 | 273 | BLS |
| MED | 6 | 7 | 13 | 1 | 25 | 15 | 45 | 29 | 11 | 1 | 17 | 9 | 0 | 0 | 354 | 18 | 0 | 3 | 1 | -1 | -68 | 7 | 59 | 204 | 62 | -3 | -6 | 2895 | 2638 | 2118 | MED |
| NOS | 0 | 0 | 149 | 21 | 28 | 2 | 5 | 2 | 4 | 13 | 0 | 2 | -0 | 0 | 1 | 6 | 0 | 3 | -2 | 0 | 1 | -21 | 0 | 1 | 42 | 2 | 0 | 1672 | 1646 | 1598 | NOS |
| AST | 0 | 0 | 0 | 0 | 4 | 0 | 6 | 1 | 82 | 0 | 0 | 1 | 39 | 48 | 150 | 7 | 49 | -0 | 0 | -0 | -5 | 0 | 2701 | 6 | 68 | -0 | -21 | 3813 | 1064 | 33 | AST |
| NOA | 0 | 1 | 2 | 0 | 4 | 4 | 6 | 3 | 1 | 0 | 1 | 1 | 0 | 0 | 16 | 2 | 0 | 1 | 0 | -0 | -28 | 1 | 2 | 522 | 30 | -2 | -7 | 765 | 247 | 213 | NOA |
| SUM | 49 | 11 | 1075 | 189 | 2340 | 313 | 1541 | 414 | 6856 | 414 | 152 | 260 | 207 | 247 | 2672 | 1640 | 455 | -22 | -4 | -5 | -85 | -18 | 3506 | 843 | 2122 | -19 | -46 | 60010 | | | SUM |
| EXC | 41 | 3 | 822 | 128 | 2078 | 232 | 1360 | 359 | 6579 | 296 | 130 | 233 | 168 | 197 | 1943 | 1465 | 405 | -18 | 2 | -0 | 7 | -23 | 724 | 100 | 545 | -13 | -14 | | 43710 | 23543 | EXC |
| EU | 12 | 2 | 780 | 30 | 1476 | 226 | 860 | 97 | 79 | 249 | 102 | 172 | -0 | 1 | 67 | 134 | 1 | -26 | -13 | -0 | -8 | -46 | 7 | 50 | 148 | -21 | -7 | | 21452 | 20320 | EU |
| emis | 59 | 15 | 1097 | 186 | 2405 | 463 | 1632 | 468 | 7499 | 415 | 152 | 267 | 283 | 363 | 3366 | 1751 | 672 | 0 | 0 | 0 | 0 | 0 | 7258 | 1935 | 0 | 0 | 0 | 67103 | 57910 | 32544 | emis |
| | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | SUM | EXC | EU | |

Table C.4: 2007 country-to-country blame matrices for $\mathbf{AOT40}_f^{\mathbf{3m}}$.
Units: ppb.h per 15% emis. red. of $NO_x$. **Emitters →, Receptors ↓.** (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 457 | 1 | 61 | 1 | 91 | 5 | 118 | 8 | 13 | 0 | 24 | 80 | 2 | 0 | 95 | 2 | 132 | 36 | 1 | 218 | 2 | 59 | 5 | 1 | 498 | 0 | 1 | 3 | 1 | 1 | 5 | AL |
| AM | 0 | 242 | 3 | 197 | 1 | 1 | 5 | 5 | 1 | 1 | 2 | 8 | 1 | 0 | 7 | 2 | 8 | 7 | 67 | 5 | 1 | 4 | 1 | 0 | 7 | 0 | 15 | 1 | 0 | 1 | 1 | AM |
| AT | 1 | 0 | 400 | 0 | 8 | -5 | 9 | 6 | 80 | 0 | 68 | 337 | 3 | 0 | 108 | 2 | 267 | 16 | 0 | 5 | 2 | 66 | 6 | 1 | 319 | 0 | 0 | 3 | 2 | 1 | 2 | AT |
| AZ | 0 | 44 | 4 | 594 | 1 | 1 | 6 | 9 | 1 | 1 | 4 | 14 | 2 | 1 | 9 | 4 | 12 | 12 | 59 | 5 | 2 | 6 | 1 | 0 | 8 | 0 | 70 | 3 | 0 | 1 | 2 | AZ |
| BA | 9 | 1 | 118 | 1 | 448 | 7 | 36 | 9 | 20 | 0 | 62 | 126 | 3 | 0 | 129 | 3 | 177 | 33 | 1 | 27 | 2 | 156 | 5 | 1 | 557 | 0 | 1 | 3 | 1 | 1 | 4 | BA |
| BE | 0 | 0 | 16 | 0 | 0 | -498 | 1 | 4 | 5 | 0 | 9 | 59 | 6 | 1 | 47 | 2 | 257 | -51 | 0 | 1 | 2 | 5 | 18 | 2 | 11 | 0 | 0 | 3 | 7 | 2 | 0 | BE |
| BG | 20 | 2 | 55 | 3 | 37 | 5 | 684 | 20 | 10 | 1 | 39 | 84 | 5 | 1 | 58 | 6 | 70 | 28 | 3 | 165 | 3 | 94 | 4 | 1 | 138 | 0 | 5 | 6 | 1 | 3 | 24 | BG |
| BY | 0 | 1 | 12 | 2 | 3 | 4 | 5 | 227 | 3 | 0 | 16 | 67 | 6 | 6 | 23 | 18 | 43 | 24 | 1 | 3 | 6 | 18 | 5 | 1 | 17 | 0 | 7 | 54 | 1 | 15 | 4 | BY |
| CH | 1 | 0 | 64 | 0 | 7 | 6 | 4 | 2 | 370 | 0 | 17 | 190 | 2 | 0 | 193 | 1 | 806 | 23 | 0 | 4 | 1 | 13 | 8 | 1 | 355 | 0 | 0 | 2 | 2 | 1 | 0 | CH |
| CY | 6 | 9 | 14 | 10 | 8 | 3 | 47 | 11 | 4 | 604 | 9 | 29 | 2 | 1 | 37 | 3 | 33 | 15 | 11 | 156 | 2 | 15 | 2 | 1 | 68 | 0 | 5 | 3 | 0 | 1 | 5 | CY |
| CZ | 1 | 0 | 144 | 0 | 7 | -4 | 6 | 12 | 24 | 0 | 159 | 332 | 5 | 1 | 61 | 4 | 187 | 20 | 0 | 4 | 3 | 76 | 8 | 1 | 80 | 0 | 1 | 3 | 3 | 1 | 3 | CZ |
| DE | 0 | 0 | 41 | 0 | 2 | -29 | 2 | 8 | 29 | 0 | 30 | 354 | 3 | 1 | 65 | 3 | 304 | 4 | 0 | 2 | 3 | 13 | 13 | 2 | 38 | 0 | 0 | 5 | 6 | 2 | 1 | DE |
| DK | 0 | 0 | 3 | 0 | 1 | -10 | 1 | 15 | 1 | 0 | 5 | 48 | -87 | 5 | 23 | 10 | 69 | 66 | 0 | 1 | 7 | 3 | 28 | 4 | 7 | 0 | 1 | 17 | 1 | 11 | 0 | DK |
| EE | 0 | 0 | 3 | 0 | 0 | 2 | 1 | 28 | 1 | 0 | 6 | 44 | 21 | 39 | 10 | 43 | 25 | 44 | 0 | 1 | 11 | 3 | 8 | 2 | 5 | 0 | 2 | 24 | 0 | 32 | 1 | EE |
| ES | 1 | 0 | 8 | 0 | 3 | 4 | 2 | 1 | 5 | 0 | 4 | 24 | 0 | 0 | 1196 | 0 | 206 | 20 | 0 | 5 | 1 | 4 | 5 | 1 | 55 | 0 | 0 | 1 | 1 | 0 | 0 | ES |
| FI | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 4 | 1 | 0 | 2 | 19 | 4 | 4 | 5 | 20 | 12 | 16 | 0 | 0 | 7 | 0 | 3 | 1 | 2 | 0 | 0 | 4 | 0 | 3 | 0 | FI |
| FR | 1 | 0 | 20 | 0 | 4 | -15 | 2 | 3 | 21 | 0 | 11 | 94 | 3 | 0 | 198 | 1 | 900 | -3 | 0 | 5 | 1 | 7 | 12 | 1 | 99 | 0 | 0 | 2 | 3 | 1 | 0 | FR |
| GB | 0 | 0 | 2 | 0 | 0 | -5 | 1 | 4 | 1 | 0 | 1 | 19 | 11 | 1 | 11 | 3 | 43 | -253 | 0 | 1 | 2 | 1 | 31 | 2 | 6 | 0 | 0 | 2 | 0 | 2 | 0 | GB |
| GE | 1 | 85 | 7 | 252 | 2 | 1 | 13 | 12 | 1 | 1 | 5 | 15 | 2 | 1 | 11 | 5 | 14 | 13 | 299 | 9 | 2 | 10 | 2 | 1 | 13 | 0 | 21 | 3 | 0 | 2 | 4 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 2 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 63 | 1 | 43 | 2 | 38 | 5 | 353 | 12 | 10 | 0 | 25 | 70 | 3 | 1 | 87 | 4 | 91 | 28 | 2 | 1037 | 3 | 50 | 4 | 1 | 272 | 0 | 5 | 4 | 1 | 2 | 12 | GR |
| HR | 5 | 1 | 183 | 1 | 160 | 6 | 21 | 10 | 25 | 0 | 77 | 168 | 3 | 1 | 135 | 3 | 199 | 33 | 1 | 14 | 2 | 197 | 6 | 1 | 618 | 0 | 1 | 3 | 1 | 1 | 4 | HR |
| HU | 3 | 1 | 167 | 1 | 42 | 2 | 17 | 22 | 19 | 0 | 85 | 196 | 4 | 1 | 71 | 5 | 138 | 27 | 1 | 8 | 3 | 524 | 6 | 1 | 205 | 0 | 1 | 8 | 1 | 3 | 5 | HU |
| IE | 0 | 0 | 2 | 0 | 0 | -1 | 1 | 3 | 2 | 0 | 2 | 18 | 7 | 1 | 9 | 2 | 34 | 52 | 0 | 1 | 1 | 1 | 42 | 2 | 9 | 0 | 0 | 2 | 0 | 1 | 0 | IE |
| IS | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 9 | 2 | 0 | 6 | 1 | 20 | 48 | 0 | 0 | 2 | 0 | 10 | 16 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 7 | 0 | 97 | 0 | 33 | 5 | 17 | 3 | 41 | 0 | 28 | 102 | 2 | 0 | 236 | 2 | 419 | 33 | 0 | 35 | 2 | 42 | 6 | 1 | 1156 | 0 | 0 | 1 | 1 | 1 | 1 | IT |
| KG | 0 | 4 | 4 | 8 | 1 | 1 | 2 | 4 | 2 | 0 | 3 | 14 | 1 | 1 | 17 | 3 | 18 | 8 | 3 | 3 | 2 | 3 | 1 | 0 | 10 | 234 | 609 | 1 | 0 | 1 | 1 | KG |
| KZT | 0 | 4 | 4 | 10 | 1 | 1 | 3 | 12 | 2 | 0 | 4 | 16 | 2 | 2 | 12 | 9 | 16 | 14 | 4 | 2 | 5 | 4 | 2 | 1 | 8 | 6 | 399 | 4 | 0 | 2 | 2 | KZT |
| LT | 0 | 0 | 7 | 1 | 2 | 4 | 3 | 83 | 3 | 0 | 14 | 87 | 21 | 8 | 20 | 21 | 48 | 38 | 1 | 2 | 9 | 12 | 7 | 2 | 13 | 0 | 3 | 155 | 1 | 25 | 3 | LT |
| LU | 0 | 0 | 33 | 0 | 1 | -20 | 2 | 4 | 8 | 0 | 28 | 217 | 5 | 1 | 64 | 3 | 547 | 8 | 0 | 2 | 2 | 12 | 10 | 2 | 21 | 0 | 0 | 2 | -31 | 1 | 1 | LU |
| LV | 0 | 0 | 4 | 1 | 1 | 3 | 1 | 51 | 2 | 0 | 8 | 63 | 21 | 13 | 13 | 29 | 34 | 39 | 1 | 1 | 9 | 6 | 7 | 1 | 7 | 0 | 3 | 69 | 1 | 64 | 2 | LV |
| MD | 2 | 4 | 28 | 7 | 11 | 5 | 51 | 49 | 7 | 0 | 41 | 86 | 4 | 4 | 32 | 13 | 60 | 30 | 7 | 22 | 5 | 58 | 5 | 1 | 43 | 0 | 9 | 14 | 1 | 5 | 188 | MD |
| ME | 71 | 1 | 82 | 1 | 210 | 5 | 86 | 9 | 16 | 0 | 34 | 98 | 3 | 0 | 104 | 2 | 147 | 36 | 1 | 92 | 2 | 98 | 5 | 1 | 522 | 0 | 1 | 3 | 1 | 1 | 5 | ME |
| MK | 95 | 1 | 61 | 1 | 60 | 4 | 291 | 10 | 12 | 0 | 30 | 84 | 2 | 0 | 83 | 3 | 96 | 28 | 1 | 269 | 2 | 84 | 4 | 1 | 273 | 0 | 2 | 3 | 1 | 1 | 9 | MK |
| MT | 12 | 0 | 41 | 0 | 20 | 5 | 28 | 3 | 10 | 0 | 17 | 69 | 1 | 0 | 275 | 2 | 288 | 26 | 0 | 89 | 2 | 18 | 6 | 1 | 754 | 0 | 1 | 2 | 1 | 1 | 1 | MT |
| NL | 0 | 0 | 8 | 0 | 0 | -96 | 0 | 6 | 2 | 0 | 4 | 56 | 10 | 1 | 28 | 2 | 100 | -78 | 0 | 1 | 3 | 2 | 23 | 2 | 5 | 0 | 0 | 5 | 1 | 2 | 1 | NL |
| NO | 0 | 0 | 1 | 0 | 0 | -1 | 0 | 2 | 1 | 0 | 1 | 12 | 5 | 1 | 8 | 9 | 17 | 30 | 0 | 1 | 7 | 1 | 8 | 3 | 4 | 0 | 0 | 2 | 0 | 2 | 0 | NO |
| PL | 1 | 0 | 37 | 1 | 6 | 1 | 4 | 49 | 7 | 0 | 55 | 187 | 9 | 2 | 40 | 11 | 96 | 28 | 1 | 4 | 7 | 51 | 9 | 2 | 42 | 0 | 1 | 18 | 2 | 6 | 2 | PL |
| PT | 0 | 0 | 4 | 0 | 2 | 2 | 1 | 1 | 3 | 0 | 2 | 12 | 0 | 0 | 536 | 0 | 108 | 21 | 0 | 2 | 1 | 3 | 6 | 1 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | PT |
| RO | 6 | 2 | 60 | 4 | 29 | 4 | 115 | 30 | 12 | 0 | 46 | 97 | 4 | 2 | 48 | 8 | 76 | 27 | 3 | 33 | 3 | 160 | 4 | 1 | 99 | 0 | 3 | 9 | 1 | 4 | 30 | RO |
| RS | 27 | 1 | 101 | 1 | 124 | 5 | 110 | 13 | 17 | 0 | 56 | 124 | 3 | 1 | 84 | 3 | 114 | 32 | 1 | 60 | 2 | 192 | 5 | 1 | 284 | 0 | 1 | 5 | 1 | 2 | 9 | RS |
| RUE | 0 | 1 | 1 | 5 | 0 | 1 | 1 | 9 | 0 | 0 | 2 | 7 | 1 | 1 | 3 | 4 | 5 | 5 | 2 | 1 | 2 | 2 | 1 | 0 | 2 | 0 | 19 | 3 | 0 | 2 | 1 | RUE |
| SE | 0 | 0 | 1 | 0 | 0 | -0 | 0 | 4 | 1 | 0 | 1 | 23 | 5 | 3 | 8 | 9 | 21 | 33 | 0 | 0 | 6 | 1 | 7 | 2 | 3 | 0 | 0 | 5 | 0 | 4 | 0 | SE |
| SI | 1 | 0 | 275 | 0 | 22 | -3 | 12 | 8 | 32 | 0 | 64 | 178 | 3 | 1 | 125 | 3 | 193 | 22 | 0 | 5 | 2 | 120 | 7 | 1 | 703 | 0 | 1 | 3 | 1 | 1 | 4 | SI |
| SK | 2 | 1 | 129 | 1 | 23 | -1 | 11 | 31 | 15 | 0 | 118 | 194 | 4 | 1 | 60 | 5 | 125 | 22 | 1 | 9 | 3 | 358 | 6 | 1 | 145 | 0 | 1 | 9 | 2 | 3 | 4 | SK |
| TJ | 0 | 4 | 3 | 6 | 1 | 1 | 2 | 3 | 1 | 0 | 2 | 9 | 1 | 0 | 15 | 2 | 14 | 6 | 2 | 2 | 1 | 3 | 1 | 0 | 9 | 50 | 329 | 1 | 0 | 1 | 0 | TJ |
| TM | 0 | 12 | 6 | 33 | 2 | 2 | 4 | 9 | 3 | 1 | 5 | 21 | 2 | 2 | 18 | 8 | 23 | 15 | 9 | 4 | 5 | 6 | 2 | 0 | 14 | 3 | 306 | 3 | 0 | 2 | 1 | TM |
| TR | 4 | 25 | 13 | 23 | 6 | 2 | 55 | 15 | 3 | 4 | 10 | 29 | 3 | 1 | 24 | 4 | 28 | 16 | 22 | 55 | 2 | 18 | 2 | 1 | 37 | 0 | 7 | 4 | 0 | 2 | 9 | TR |
| UA | 1 | 5 | 21 | 10 | 6 | 4 | 20 | 71 | 5 | 0 | 29 | 70 | 5 | 4 | 24 | 14 | 47 | 28 | 7 | 9 | 6 | 48 | 4 | 1 | 28 | 0 | 17 | 14 | 1 | 6 | 27 | UA |
| UZ | 0 | 8 | 6 | 18 | 1 | 2 | 3 | 9 | 2 | 0 | 5 | 21 | 2 | 1 | 16 | 8 | 21 | 16 | 6 | 3 | 5 | 5 | 2 | 1 | 11 | 17 | 514 | 3 | 0 | 2 | 1 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ATL |
| BAS | 0 | 0 | 2 | 0 | 0 | -1 | 0 | 15 | 1 | 0 | 5 | 48 | 1 | 9 | 11 | 22 | 31 | 50 | 0 | 0 | 10 | 3 | 11 | 2 | 4 | 0 | 1 | 17 | 0 | 12 | 1 | BAS |
| BLS | 1 | 7 | 4 | 12 | 1 | 1 | 19 | 11 | 1 | 0 | 6 | 16 | 2 | 1 | 6 | 4 | 11 | 10 | 20 | 8 | 2 | 8 | 1 | 0 | 7 | 0 | 6 | 3 | 0 | 1 | 8 | BLS |
| MED | 5 | 0 | 13 | 1 | 9 | 2 | 28 | 3 | 3 | 4 | 6 | 18 | 1 | 0 | 74 | 1 | 73 | 8 | 1 | 70 | 1 | 10 | 1 | 0 | 122 | 0 | 1 | 1 | 0 | 0 | 2 | MED |
| NOS | 0 | 0 | 1 | 0 | 0 | -6 | 0 | 2 | 0 | 0 | 0 | 7 | 3 | 1 | 5 | 2 | 16 | -32 | 0 | 0 | 1 | 0 | 8 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | NOS |
| AST | 0 | 5 | 2 | 15 | 1 | 1 | 3 | 3 | 1 | 6 | 2 | 7 | 1 | 0 | 8 | 2 | 8 | 5 | 3 | 6 | 1 | 2 | 1 | 0 | 7 | 12 | 126 | 1 | 0 | 1 | 1 | AST |
| NOA | 2 | 0 | 5 | 0 | 3 | 1 | 12 | 1 | 2 | 1 | 2 | 9 | 0 | 0 | 67 | 0 | 36 | 4 | 0 | 41 | 0 | 3 | 1 | 0 | 54 | 0 | 1 | 0 | 0 | 0 | 1 | NOA |
| EXC | 2 | 3 | 12 | 9 | 5 | -1 | 12 | 13 | 4 | 0 | 8 | 31 | 2 | 2 | 48 | 6 | 56 | 9 | 4 | 12 | 3 | 13 | 3 | 1 | 38 | 3 | 80 | 5 | 0 | 2 | 3 | EXC |
| EU | 4 | 0 | 40 | 1 | 9 | -8 | 37 | 12 | 13 | 1 | 23 | 104 | 4 | 2 | 218 | 6 | 237 | 4 | 0 | 41 | 4 | 41 | 10 | 1 | 144 | 0 | 1 | 8 | 1 | 4 | 3 | EU |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |

Table C.4 Cont.: 2007 country-to-country blame matrices for $\mathbf{AOT40}_f^{\mathbf{3m}}$.
Units: ppb.h per 15% emis. red. of $NO_x$. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 121 | 68 | 1 | 5 | 6 | 45 | 6 | 109 | 301 | 35 | 4 | 14 | 16 | 0 | 0 | 28 | 45 | 0 | 29 | 5 | 8 | 367 | 16 | 1 | 11 | 229 | 0 | 0 | 2723 | 1539 | AL |
| AM | 0 | 1 | 0 | 1 | 2 | 14 | 1 | 15 | 3 | 134 | 2 | 1 | 2 | 0 | 9 | 223 | 28 | 6 | 7 | 3 | 12 | 11 | 3 | 86 | 2 | 121 | 0 | 0 | 1032 | 97 | AM |
| AT | 2 | 1 | 0 | -6 | 7 | 64 | 10 | 42 | 15 | 22 | 5 | 81 | 27 | 0 | 0 | 7 | 26 | 0 | 41 | 6 | 2 | 49 | 6 | 0 | 2 | 191 | 0 | 0 | 2012 | 1829 | AT |
| AZ | 1 | 1 | 0 | 2 | 5 | 21 | 1 | 20 | 3 | 447 | 4 | 1 | 3 | 0 | 34 | 113 | 44 | 25 | 12 | 5 | 12 | 10 | 6 | 120 | 2 | 156 | 0 | 0 | 1603 | 148 | AZ |
| BA | 62 | 6 | 1 | 6 | 6 | 70 | 9 | 95 | 163 | 33 | 4 | 30 | 37 | 0 | 0 | 14 | 53 | 0 | 33 | 6 | 4 | 179 | 17 | 1 | 7 | 220 | 0 | 0 | 2530 | 1695 | BA |
| BE | 0 | 0 | 0 | -196 | 9 | 27 | 6 | 5 | 1 | 17 | 8 | 3 | 4 | 0 | 0 | 1 | 7 | 0 | 63 | 9 | 0 | 5 | -167 | 0 | 0 | 142 | 0 | 0 | -199 | -248 | BE |
| BG | 21 | 43 | 0 | 5 | 9 | 95 | 5 | 434 | 165 | 149 | 8 | 10 | 31 | 0 | 0 | 55 | 182 | 1 | 26 | 11 | 63 | 78 | 15 | 3 | 5 | 214 | 0 | 0 | 2787 | 2033 | BG |
| BY | 1 | 1 | 0 | 4 | 16 | 166 | 2 | 25 | 5 | 240 | 21 | 2 | 12 | 0 | 0 | 14 | 125 | 0 | 29 | 30 | 3 | 6 | 13 | 3 | 1 | 116 | 0 | 0 | 1227 | 570 | BY |
| CH | 1 | 1 | 0 | -5 | 4 | 21 | 16 | 10 | 7 | 10 | 3 | 10 | 6 | 0 | 0 | 2 | 4 | 0 | 47 | 3 | 0 | 53 | 11 | 0 | 3 | 204 | 0 | 0 | 2163 | 1751 | CH |
| CY | 5 | 8 | 0 | 3 | 5 | 35 | 3 | 55 | 23 | 156 | 4 | 3 | 6 | 0 | 1 | 1421 | 78 | 1 | 16 | 6 | 40 | 597 | 8 | 26 | 7 | 254 | 0 | 0 | 2922 | 1152 | CY |
| CZ | 1 | 1 | 0 | -10 | 9 | 116 | 8 | 37 | 11 | 31 | 9 | 22 | 73 | 0 | 0 | 7 | 46 | 0 | 45 | 12 | 1 | 20 | 7 | 0 | 1 | 163 | 0 | 0 | 1502 | 1345 | CZ |
| DE | 1 | 0 | 0 | -45 | 12 | 80 | 8 | 11 | 3 | 25 | 13 | 4 | 9 | 0 | 0 | 2 | 15 | 0 | 60 | -0 | 0 | 12 | -30 | 0 | 1 | 166 | 0 | 0 | 1041 | 937 | DE |
| DK | 0 | 0 | 0 | -20 | 52 | 63 | 4 | 3 | 1 | 64 | 55 | 1 | 2 | 0 | 0 | 2 | 10 | 0 | 112 | -78 | 0 | 3 | -53 | 0 | 0 | 215 | 0 | 0 | 464 | 306 | DK |
| EE | 0 | 0 | 0 | 4 | 24 | 63 | 1 | 6 | 1 | 104 | 55 | 0 | 3 | 0 | 0 | 4 | 24 | 0 | 35 | 80 | 1 | 2 | 26 | 1 | 0 | 107 | 0 | 0 | 646 | 442 | EE |
| ES | 1 | 1 | 0 | 2 | 3 | 7 | 124 | 3 | 3 | 5 | 1 | 2 | 1 | 0 | 0 | 1 | 2 | 0 | 106 | 1 | 0 | 83 | 9 | 0 | 5 | 227 | 0 | 0 | 1705 | 1677 | ES |
| FI | 0 | 0 | 0 | 2 | 10 | 14 | 1 | 1 | 0 | 24 | 15 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 16 | 18 | 0 | 1 | 8 | 0 | 0 | 43 | 0 | 0 | 178 | 128 | FI |
| FR | 1 | 1 | 0 | -18 | 6 | 18 | 13 | 4 | 4 | 11 | 4 | 4 | 3 | 0 | 0 | 1 | 4 | 0 | 70 | 5 | 0 | 50 | -21 | 0 | 2 | 156 | 0 | 0 | 1428 | 1368 | FR |
| GB | 0 | 0 | 0 | -13 | 27 | 13 | 2 | 2 | 1 | 20 | 14 | 0 | 1 | 0 | 0 | 1 | 5 | 0 | 93 | 12 | 0 | 3 | -15 | 0 | 0 | 148 | 0 | 0 | -41 | -105 | GB |
| GE | 1 | 1 | 0 | 1 | 5 | 29 | 1 | 36 | 6 | 395 | 4 | 1 | 4 | 0 | 13 | 199 | 76 | 9 | 13 | 6 | 48 | 13 | 6 | 63 | 2 | 155 | 0 | 0 | 1587 | 202 | GE |
| GL | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 13 | 0 | 0 | 15 | 10 | GL |
| GR | 26 | 73 | 1 | 5 | 7 | 60 | 6 | 163 | 125 | 102 | 5 | 9 | 17 | 0 | 0 | 88 | 106 | 0 | 26 | 7 | 37 | 374 | 14 | 2 | 9 | 240 | 0 | 0 | 3023 | 2347 | GR |
| HR | 20 | 3 | 0 | 6 | 8 | 80 | 9 | 81 | 101 | 33 | 5 | 83 | 41 | 0 | 0 | 12 | 53 | 0 | 41 | 7 | 4 | 223 | 16 | 1 | 5 | 205 | 0 | 0 | 2414 | 1974 | HR |
| HU | 7 | 2 | 0 | 2 | 8 | 159 | 7 | 155 | 101 | 46 | 8 | 54 | 122 | 0 | 0 | 13 | 109 | 0 | 38 | 10 | 2 | 54 | 12 | 1 | 3 | 184 | 0 | 0 | 2362 | 1975 | HU |
| IE | 0 | 0 | 0 | -6 | 16 | 11 | 1 | 2 | 1 | 15 | 9 | 0 | 1 | 0 | 0 | 1 | 4 | 0 | 93 | 8 | 0 | 3 | 8 | 0 | 0 | 123 | 0 | 0 | 247 | 201 | IE |
| IS | 0 | 0 | 0 | 1 | 8 | 2 | 0 | 0 | 0 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 61 | 3 | 0 | 1 | 9 | 0 | 0 | 101 | 0 | 0 | 145 | 110 | IS |
| IT | 10 | 6 | 2 | 2 | 6 | 33 | 13 | 29 | 31 | 16 | 3 | 34 | 12 | 0 | 0 | 7 | 15 | 0 | 52 | 4 | 2 | 313 | 15 | 0 | 9 | 236 | 0 | 0 | 2489 | 2308 | IT |
| KG | 1 | 0 | 0 | 1 | 3 | 9 | 1 | 5 | 2 | 167 | 3 | 1 | 1 | 175 | 23 | 38 | 12 | 590 | 7 | 3 | 1 | 7 | 4 | 148 | 1 | 312 | 0 | 0 | 1991 | 112 | KG |
| KZT | 0 | 0 | 0 | 2 | 8 | 20 | 1 | 11 | 2 | 618 | 7 | 1 | 2 | 3 | 8 | 26 | 40 | 21 | 14 | 8 | 3 | 5 | 7 | 24 | 1 | 171 | 0 | 0 | 1323 | 151 | KZT |
| LT | 1 | 0 | 0 | 6 | 24 | 191 | 2 | 23 | 3 | 163 | 44 | 2 | 9 | 0 | 0 | 8 | 59 | 0 | 41 | 73 | 2 | 5 | 26 | 1 | 0 | 127 | 0 | 0 | 1129 | 764 | LT |
| LU | 0 | 0 | 0 | -59 | 6 | 37 | 8 | 9 | 2 | 14 | 7 | 5 | 7 | 0 | 0 | 1 | 9 | 0 | 53 | 10 | 0 | 10 | -22 | 0 | 1 | 144 | 0 | 0 | 971 | 919 | LU |
| LV | 0 | 0 | 0 | 6 | 23 | 108 | 1 | 13 | 2 | 128 | 52 | 1 | 5 | 0 | 0 | 7 | 43 | 0 | 37 | 79 | 1 | 3 | 26 | 1 | 0 | 113 | 0 | 0 | 843 | 568 | LV |
| MD | 3 | 3 | 0 | 4 | 12 | 180 | 3 | 448 | 25 | 228 | 12 | 5 | 39 | 0 | 1 | 43 | 467 | 1 | 33 | 16 | 54 | 23 | 15 | 7 | 2 | 191 | 0 | 0 | 2265 | 1192 | MD |
| ME | 448 | 27 | 1 | 6 | 6 | 56 | 7 | 121 | 317 | 36 | 4 | 17 | 25 | 0 | 0 | 20 | 55 | 0 | 31 | 5 | 6 | 241 | 16 | 1 | 10 | 252 | 0 | 0 | 2785 | 1558 | ME |
| MK | 46 | 327 | 1 | 4 | 5 | 56 | 7 | 176 | 327 | 47 | 4 | 12 | 20 | 0 | 0 | 29 | 62 | 0 | 26 | 6 | 11 | 138 | 12 | 1 | 9 | 227 | 0 | 0 | 2635 | 1598 | MK |
| MT | 8 | 8 | -481 | 6 | 5 | 17 | 12 | 25 | 22 | 21 | 3 | 10 | 5 | 0 | 0 | 13 | 14 | 0 | 61 | 3 | 5 | -100 | 14 | 0 | 13 | 248 | 0 | 0 | 1362 | 1218 | MT |
| NL | 0 | 0 | 0 | -428 | 17 | 30 | 4 | 3 | 1 | 26 | 14 | 2 | 2 | 0 | 0 | 1 | 9 | 0 | 71 | 12 | 0 | 3 | -269 | 0 | 0 | 155 | 0 | 0 | -228 | -297 | NL |
| NO | 0 | 0 | 0 | -2 | 57 | 7 | 1 | 1 | 0 | 19 | 19 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 47 | 8 | 0 | 2 | 9 | 0 | 0 | 103 | 0 | 0 | 219 | 126 | NO |
| PL | 1 | 1 | 0 | -1 | 18 | 337 | 5 | 31 | 11 | 67 | 27 | 11 | 35 | 0 | 0 | 8 | 69 | 0 | 48 | 31 | 1 | 12 | 14 | 1 | 1 | 149 | 0 | 0 | 1297 | 1044 | PL |
| PT | 1 | 0 | 0 | 1 | 2 | 4 | 348 | 2 | 2 | 4 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 177 | 1 | 0 | 21 | 8 | 0 | 2 | 190 | 0 | 0 | 1093 | 1073 | PT |
| RO | 11 | 9 | 0 | 4 | 10 | 157 | 5 | 808 | 99 | 117 | 9 | 11 | 60 | 0 | 1 | 34 | 231 | 1 | 29 | 12 | 36 | 39 | 14 | 4 | 3 | 193 | 0 | 0 | 2487 | 1850 | RO |
| RS | 61 | 27 | 1 | 6 | 7 | 89 | 6 | 284 | 577 | 48 | 6 | 21 | 41 | 0 | 0 | 18 | 80 | 0 | 30 | 7 | 7 | 94 | 16 | 1 | 6 | 212 | 0 | 0 | 2651 | 1634 | RS |
| RUE | 0 | 0 | 0 | 1 | 3 | 10 | 0 | 5 | 1 | 265 | 4 | 0 | 1 | 0 | 1 | 6 | 22 | 1 | 5 | 5 | 2 | 1 | 3 | 2 | 0 | 34 | 0 | 0 | 402 | 63 | RUE |
| SE | 0 | 0 | 0 | -1 | 31 | 16 | 1 | 1 | 0 | 27 | 39 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 38 | 18 | 0 | 1 | 9 | 0 | 0 | 92 | 0 | 0 | 256 | 180 | SE |
| SI | 4 | 1 | 0 | -3 | 8 | 73 | 7 | 58 | 29 | 30 | 5 | 344 | 30 | 0 | 0 | 10 | 41 | 0 | 36 | 7 | 3 | 153 | 7 | 0 | 3 | 183 | 0 | 0 | 2421 | 2226 | SI |
| SK | 5 | 2 | 0 | -3 | 8 | 198 | 7 | 96 | 48 | 56 | 9 | 41 | 315 | 0 | 0 | 14 | 121 | 0 | 40 | 11 | 2 | 35 | 8 | 1 | 2 | 176 | 0 | 0 | 2198 | 1860 | SK |
| TJ | 1 | 0 | 0 | 1 | 2 | 6 | 1 | 4 | 2 | 127 | 2 | 1 | 1 | 616 | 46 | 32 | 10 | 622 | 5 | 2 | 1 | 6 | 3 | 250 | 1 | 310 | 0 | 0 | 1946 | 89 | TJ |
| TM | 1 | 1 | 0 | 2 | 8 | 17 | 2 | 13 | 3 | 477 | 6 | 1 | 3 | 12 | 183 | 70 | 31 | 234 | 14 | 7 | 4 | 8 | 7 | 113 | 1 | 292 | 0 | 0 | 1582 | 179 | TM |
| TR | 3 | 6 | 0 | 2 | 6 | 43 | 2 | 76 | 20 | 228 | 4 | 3 | 8 | 0 | 2 | 974 | 120 | 1 | 15 | 7 | 69 | 77 | 7 | 43 | 4 | 222 | 0 | 0 | 1918 | 444 | TR |
| UA | 2 | 2 | 0 | 4 | 14 | 157 | 2 | 113 | 14 | 406 | 13 | 5 | 30 | 0 | 1 | 30 | 524 | 2 | 30 | 19 | 33 | 12 | 15 | 7 | 1 | 155 | 0 | 0 | 1851 | 699 | UA |
| UZ | 1 | 1 | 0 | 2 | 8 | 18 | 1 | 11 | 3 | 479 | 7 | 1 | 3 | 73 | 43 | 50 | 30 | 386 | 14 | 7 | 4 | 7 | 7 | 75 | 1 | 276 | 0 | 0 | 1825 | 170 | UZ |
| ATL | 0 | 0 | 0 | -0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 0 | 0 | 12 | 9 | ATL |
| BAS | 0 | 0 | 0 | -2 | 26 | 59 | 1 | 4 | 1 | 65 | 51 | 1 | 2 | 0 | 0 | 2 | 12 | 0 | 47 | -0 | 0 | 2 | 15 | 0 | 0 | 111 | 0 | 0 | 478 | 342 | BAS |
| BLS | 1 | 1 | 0 | 1 | 4 | 31 | 1 | 39 | 4 | 231 | 3 | 1 | 4 | 0 | 1 | 43 | 132 | 1 | 9 | 5 | 69 | 7 | 5 | 5 | 0 | 51 | 0 | 0 | 672 | 187 | BLS |
| MED | 4 | 4 | 1 | 1 | 2 | 12 | 4 | 21 | 14 | 23 | 1 | 4 | 3 | 0 | 0 | 60 | 20 | 0 | 13 | 2 | 9 | 155 | 4 | 2 | 3 | 62 | 0 | 0 | 631 | 479 | MED |
| NOS | 0 | 0 | 0 | -12 | 14 | 5 | 1 | 1 | 0 | 10 | 7 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 35 | 3 | 0 | 1 | -62 | 0 | 0 | 53 | 0 | 0 | 42 | 12 | NOS |
| AST | 0 | 1 | 0 | 1 | 2 | 7 | 1 | 7 | 2 | 113 | 2 | 0 | 1 | 29 | 19 | 149 | 13 | 69 | 4 | 2 | 4 | 29 | 2 | 263 | 2 | 189 | 0 | 0 | 646 | 79 | AST |
| NOA | 2 | 2 | 1 | 1 | 1 | 5 | 4 | 9 | 6 | 9 | 0 | 1 | 1 | 0 | 0 | 27 | 7 | 0 | 8 | 1 | 3 | 141 | 2 | 1 | 19 | 81 | 0 | 0 | 322 | 260 | NOA |
| EXC | 2 | 2 | 0 | -1 | 7 | 29 | 6 | 26 | 10 | 252 | 7 | 3 | 6 | 7 | 7 | 46 | 44 | 24 | 19 | 7 | 6 | 18 | 3 | 13 | 1 | 102 | 0 | 0 | 863 | 333 | EXC |
| EU | 3 | 5 | 0 | -11 | 13 | 69 | 27 | 74 | 21 | 39 | 14 | 11 | 18 | 0 | 0 | 11 | 37 | 0 | 59 | 12 | 5 | 61 | -2 | 1 | 2 | 162 | 0 | 0 | 1300 | 1122 | EU |
| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |

Table C.5: 2007 country-to-country blame matrices for $\mathbf{AOT40}_f^{\mathbf{3m}}$.
Units: ppb.h per 15% emis. red. of VOC. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 32 | 0 | 18 | 2 | 8 | 8 | 12 | 4 | 8 | 0 | 17 | 103 | 4 | 0 | 39 | 1 | 61 | 42 | 2 | 34 | 1 | 14 | 2 | 0 | 190 | 0 | 0 | 1 | 1 | 1 | 1 | AL |
| AM | 0 | 45 | 1 | 22 | 0 | 1 | 1 | 2 | 1 | 0 | 2 | 13 | 1 | 0 | 3 | 1 | 6 | 7 | 19 | 1 | 1 | 2 | 0 | 0 | 6 | 0 | 2 | 1 | 0 | 0 | 0 | AM |
| AT | 0 | 0 | 101 | 1 | 1 | 21 | 2 | 4 | 27 | 0 | 32 | 269 | 4 | 0 | 28 | 1 | 87 | 60 | 1 | 2 | 1 | 12 | 2 | 0 | 137 | 0 | 0 | 1 | 2 | 1 | 1 | AT |
| AZ | 0 | 4 | 3 | 121 | 0 | 3 | 1 | 6 | 1 | 0 | 4 | 26 | 2 | 1 | 4 | 2 | 12 | 16 | 19 | 1 | 2 | 3 | 1 | 0 | 9 | 0 | 6 | 2 | 0 | 1 | 1 | AZ |
| BA | 2 | 0 | 19 | 1 | 9 | 11 | 4 | 4 | 10 | 0 | 22 | 123 | 4 | 0 | 44 | 1 | 63 | 45 | 1 | 6 | 1 | 17 | 2 | 0 | 183 | 0 | 0 | 1 | 1 | 1 | 1 | BA |
| BE | 0 | 0 | 10 | 0 | 0 | 141 | 1 | 4 | 3 | 0 | 17 | 294 | 12 | 0 | 16 | 1 | 159 | 177 | 0 | 1 | 1 | 3 | 7 | 0 | 10 | 0 | 0 | 2 | 3 | 1 | 0 | BE |
| BG | 3 | 1 | 13 | 3 | 3 | 7 | 46 | 7 | 5 | 0 | 19 | 86 | 5 | 0 | 22 | 2 | 38 | 40 | 3 | 14 | 2 | 15 | 2 | 0 | 61 | 0 | 1 | 2 | 1 | 1 | 3 | BG |
| BY | 0 | 0 | 5 | 3 | 0 | 6 | 1 | 19 | 2 | 0 | 11 | 57 | 5 | 1 | 8 | 2 | 24 | 30 | 2 | 1 | 1 | 4 | 2 | 0 | 13 | 0 | 2 | 4 | 0 | 2 | 1 | BY |
| CH | 0 | 0 | 20 | 0 | 1 | 20 | 1 | 2 | 104 | 0 | 12 | 228 | 3 | 0 | 45 | 1 | 148 | 64 | 0 | 1 | 1 | 5 | 3 | 0 | 213 | 0 | 0 | 1 | 2 | 1 | 0 | CH |
| CY | 3 | 3 | 9 | 11 | 3 | 5 | 12 | 8 | 3 | 10 | 11 | 58 | 4 | 1 | 18 | 2 | 29 | 28 | 15 | 38 | 2 | 9 | 1 | 0 | 51 | 0 | 2 | 2 | 0 | 1 | 2 | CY |
| CZ | 0 | 0 | 40 | 1 | 1 | 20 | 1 | 7 | 13 | 0 | 118 | 270 | 7 | 0 | 19 | 1 | 73 | 65 | 1 | 1 | 1 | 14 | 3 | 0 | 53 | 0 | 0 | 2 | 1 | 1 | 1 | CZ |
| DE | 0 | 0 | 19 | 0 | 0 | 39 | 1 | 4 | 14 | 0 | 29 | 410 | 11 | 0 | 19 | 1 | 116 | 132 | 0 | 1 | 1 | 5 | 5 | 0 | 26 | 0 | 0 | 2 | 3 | 1 | 0 | DE |
| DK | 0 | 0 | 3 | 0 | 0 | 21 | 0 | 4 | 1 | 0 | 6 | 122 | 72 | 1 | 9 | 3 | 63 | 214 | 0 | 0 | 2 | 2 | 9 | 0 | 7 | 0 | 0 | 3 | 1 | 2 | 0 | DK |
| EE | 0 | 0 | 1 | 1 | 0 | 5 | 0 | 3 | 1 | 0 | 3 | 40 | 9 | 6 | 4 | 11 | 18 | 45 | 1 | 0 | 2 | 1 | 2 | 0 | 4 | 0 | 1 | 2 | 0 | 2 | 0 | EE |
| ES | 0 | 0 | 5 | 0 | 1 | 8 | 1 | 1 | 3 | 0 | 5 | 49 | 2 | 0 | 240 | 0 | 72 | 40 | 0 | 2 | 0 | 2 | 2 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | ES |
| FI | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 14 | 3 | 1 | 2 | 4 | 6 | 13 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | FI |
| FR | 0 | 0 | 11 | 0 | 1 | 32 | 1 | 3 | 10 | 0 | 11 | 160 | 6 | 0 | 56 | 1 | 210 | 111 | 0 | 2 | 1 | 3 | 4 | 0 | 68 | 0 | 0 | 1 | 2 | 1 | 0 | FR |
| GB | 0 | 0 | 1 | 0 | 0 | 9 | 0 | 2 | 1 | 0 | 3 | 67 | 7 | 0 | 4 | 1 | 32 | 217 | 0 | 0 | 1 | 1 | 8 | 0 | 6 | 0 | 0 | 1 | 0 | 1 | 0 | GB |
| GE | 0 | 5 | 3 | 35 | 0 | 2 | 2 | 4 | 1 | 0 | 4 | 24 | 2 | 0 | 4 | 1 | 11 | 14 | 51 | 2 | 1 | 3 | 1 | 0 | 10 | 0 | 3 | 1 | 0 | 1 | 1 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 9 | 0 | 15 | 2 | 5 | 7 | 21 | 5 | 7 | 0 | 17 | 89 | 5 | 0 | 34 | 1 | 49 | 40 | 2 | 70 | 2 | 14 | 2 | 0 | 120 | 0 | 1 | 2 | 1 | 1 | 2 | GR |
| HR | 1 | 0 | 30 | 1 | 5 | 13 | 4 | 5 | 13 | 0 | 28 | 155 | 4 | 0 | 51 | 1 | 78 | 52 | 1 | 4 | 1 | 19 | 3 | 0 | 254 | 0 | 0 | 2 | 1 | 1 | 1 | HR |
| HU | 1 | 0 | 34 | 2 | 3 | 13 | 3 | 7 | 10 | 0 | 41 | 179 | 6 | 0 | 27 | 2 | 62 | 53 | 2 | 2 | 1 | 71 | 3 | 0 | 102 | 0 | 0 | 3 | 1 | 1 | 1 | HU |
| IE | 0 | 0 | 1 | 0 | 0 | 6 | 0 | 2 | 1 | 0 | 2 | 56 | 6 | 0 | 3 | 1 | 18 | 116 | 0 | 1 | 1 | 1 | 17 | 0 | 8 | 0 | 0 | 1 | 0 | 0 | 0 | IE |
| IS | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 13 | 1 | 0 | 2 | 0 | 9 | 14 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 3 | 0 | 31 | 1 | 5 | 12 | 4 | 3 | 21 | 0 | 18 | 133 | 3 | 0 | 80 | 1 | 121 | 53 | 1 | 7 | 1 | 11 | 3 | 0 | 752 | 0 | 0 | 1 | 1 | 1 | 1 | IT |
| KG | 0 | 1 | 2 | 4 | 0 | 1 | 1 | 3 | 1 | 0 | 2 | 15 | 1 | 0 | 6 | 1 | 9 | 8 | 3 | 1 | 1 | 1 | 0 | 0 | 7 | 2 | 18 | 1 | 0 | 0 | 0 | KG |
| KZT | 0 | 1 | 2 | 5 | 0 | 2 | 1 | 6 | 1 | 0 | 3 | 23 | 2 | 1 | 5 | 2 | 11 | 16 | 3 | 1 | 2 | 2 | 1 | 0 | 8 | 0 | 11 | 2 | 0 | 1 | 1 | KZT |
| LT | 0 | 0 | 3 | 1 | 0 | 10 | 1 | 8 | 2 | 0 | 10 | 76 | 13 | 1 | 7 | 3 | 31 | 52 | 1 | 1 | 2 | 3 | 2 | 0 | 12 | 0 | 1 | 12 | 0 | 3 | 1 | LT |
| LU | 0 | 0 | 13 | 0 | 0 | 62 | 1 | 3 | 4 | 0 | 22 | 272 | 8 | 0 | 18 | 2 | 150 | 111 | 0 | 1 | 1 | 5 | 4 | 0 | 17 | 0 | 0 | 2 | 20 | 1 | 1 | LU |
| LV | 0 | 0 | 2 | 1 | 0 | 7 | 1 | 5 | 1 | 0 | 5 | 52 | 10 | 1 | 5 | 4 | 23 | 44 | 1 | 1 | 1 | 2 | 2 | 0 | 7 | 0 | 1 | 4 | 0 | 6 | 0 | LV |
| MD | 1 | 1 | 8 | 7 | 1 | 6 | 6 | 7 | 4 | 0 | 14 | 71 | 5 | 1 | 12 | 2 | 31 | 41 | 6 | 5 | 2 | 8 | 2 | 0 | 26 | 0 | 2 | 2 | 0 | 1 | 7 | MD |
| ME | 8 | 0 | 17 | 2 | 6 | 9 | 7 | 4 | 8 | 0 | 18 | 108 | 4 | 0 | 37 | 1 | 57 | 40 | 1 | 12 | 1 | 14 | 2 | 0 | 174 | 0 | 0 | 1 | 1 | 1 | 1 | ME |
| MK | 9 | 0 | 14 | 1 | 3 | 7 | 15 | 4 | 6 | 0 | 17 | 88 | 3 | 0 | 30 | 1 | 41 | 32 | 1 | 41 | 1 | 14 | 2 | 0 | 95 | 0 | 1 | 1 | 1 | 1 | 2 | MK |
| MT | 6 | 0 | 26 | 1 | 7 | 10 | 8 | 3 | 11 | 0 | 17 | 121 | 3 | 0 | 112 | 1 | 116 | 50 | 1 | 24 | 2 | 12 | 3 | 0 | 645 | 0 | 0 | 1 | 1 | 1 | 1 | MT |
| NL | 0 | 0 | 6 | 0 | 0 | 54 | 0 | 4 | 2 | 0 | 14 | 303 | 18 | 0 | 12 | 1 | 108 | 216 | 0 | 0 | 1 | 2 | 8 | 0 | 6 | 0 | 0 | 2 | 2 | 1 | 0 | NL |
| NO | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 1 | 1 | 0 | 1 | 21 | 4 | 0 | 2 | 1 | 12 | 38 | 0 | 0 | 2 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | NO |
| PL | 0 | 0 | 16 | 1 | 1 | 16 | 1 | 9 | 5 | 0 | 34 | 166 | 15 | 1 | 14 | 2 | 56 | 75 | 1 | 1 | 2 | 11 | 3 | 0 | 34 | 0 | 1 | 3 | 1 | 1 | 1 | PL |
| PT | 0 | 0 | 4 | 0 | 1 | 7 | 1 | 1 | 2 | 0 | 3 | 37 | 1 | 0 | 113 | 0 | 62 | 40 | 0 | 1 | 0 | 2 | 2 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | PT |
| RO | 1 | 1 | 13 | 4 | 2 | 7 | 10 | 7 | 6 | 0 | 21 | 89 | 6 | 1 | 18 | 2 | 37 | 38 | 4 | 6 | 1 | 20 | 2 | 0 | 49 | 0 | 1 | 2 | 1 | 1 | 3 | RO |
| RS | 2 | 0 | 21 | 2 | 6 | 9 | 6 | 4 | 8 | 0 | 26 | 124 | 5 | 0 | 31 | 1 | 52 | 43 | 2 | 6 | 1 | 26 | 2 | 0 | 107 | 0 | 0 | 2 | 1 | 1 | 2 | RS |
| RUE | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | 7 | 1 | 0 | 1 | 1 | 4 | 6 | 1 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | RUE |
| SE | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 1 | 1 | 0 | 2 | 31 | 9 | 0 | 3 | 1 | 15 | 40 | 0 | 0 | 2 | 0 | 2 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | SE |
| SI | 0 | 0 | 49 | 1 | 2 | 16 | 2 | 5 | 15 | 0 | 28 | 175 | 3 | 0 | 44 | 1 | 81 | 54 | 1 | 2 | 1 | 15 | 3 | 0 | 350 | 0 | 0 | 1 | 1 | 1 | 1 | SI |
| SK | 1 | 0 | 31 | 2 | 2 | 15 | 2 | 9 | 8 | 0 | 51 | 166 | 8 | 0 | 22 | 2 | 58 | 55 | 2 | 2 | 1 | 37 | 3 | 0 | 90 | 0 | 0 | 3 | 1 | 1 | 1 | SK |
| TJ | 0 | 1 | 1 | 4 | 0 | 1 | 0 | 2 | 1 | 0 | 2 | 13 | 1 | 0 | 5 | 1 | 7 | 8 | 2 | 1 | 1 | 1 | 0 | 0 | 6 | 1 | 13 | 1 | 0 | 0 | 0 | TJ |
| TM | 0 | 2 | 4 | 13 | 0 | 3 | 1 | 7 | 2 | 0 | 5 | 31 | 3 | 1 | 8 | 3 | 16 | 20 | 8 | 1 | 3 | 3 | 1 | 0 | 13 | 0 | 14 | 2 | 0 | 1 | 1 | TM |
| TR | 1 | 3 | 5 | 9 | 1 | 3 | 6 | 5 | 2 | 0 | 7 | 37 | 3 | 0 | 10 | 1 | 18 | 20 | 10 | 9 | 1 | 5 | 1 | 0 | 23 | 0 | 2 | 1 | 0 | 1 | 1 | TR |
| UA | 0 | 1 | 7 | 9 | 1 | 6 | 3 | 9 | 3 | 0 | 12 | 61 | 5 | 1 | 9 | 2 | 27 | 37 | 6 | 2 | 2 | 7 | 2 | 0 | 20 | 0 | 3 | 2 | 0 | 1 | 2 | UA |
| UZ | 0 | 2 | 3 | 9 | 0 | 3 | 1 | 6 | 2 | 0 | 5 | 30 | 3 | 1 | 7 | 3 | 15 | 20 | 5 | 1 | 3 | 3 | 1 | 0 | 11 | 1 | 17 | 2 | 0 | 1 | 1 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ATL |
| BAS | 0 | 0 | 2 | 0 | 0 | 9 | 0 | 3 | 1 | 0 | 4 | 63 | 21 | 2 | 4 | 6 | 26 | 71 | 0 | 0 | 2 | 1 | 3 | 0 | 4 | 0 | 0 | 2 | 0 | 2 | 0 | BAS |
| BLS | 0 | 1 | 2 | 6 | 0 | 2 | 3 | 3 | 1 | 0 | 3 | 18 | 2 | 0 | 3 | 1 | 9 | 12 | 6 | 2 | 1 | 2 | 1 | 0 | 5 | 0 | 1 | 1 | 0 | 0 | 1 | BLS |
| MED | 2 | 0 | 5 | 1 | 2 | 3 | 3 | 2 | 3 | 0 | 5 | 28 | 1 | 0 | 27 | 0 | 26 | 14 | 1 | 12 | 0 | 3 | 1 | 0 | 72 | 0 | 0 | 0 | 0 | 0 | 1 | MED |
| NOS | 0 | 0 | 1 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 2 | 30 | 5 | 0 | 2 | 0 | 17 | 65 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | NOS |
| AST | 0 | 1 | 1 | 6 | 0 | 1 | 1 | 2 | 1 | 0 | 2 | 10 | 1 | 0 | 3 | 1 | 6 | 6 | 3 | 2 | 1 | 1 | 0 | 0 | 6 | 0 | 4 | 1 | 0 | 0 | 0 | AST |
| NOA | 1 | 0 | 3 | 0 | 1 | 2 | 2 | 1 | 2 | 0 | 3 | 17 | 1 | 0 | 20 | 0 | 17 | 8 | 0 | 6 | 0 | 2 | 0 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | NOA |
| EXC | 0 | 1 | 4 | 3 | 0 | 4 | 1 | 3 | 2 | 0 | 5 | 37 | 3 | 0 | 13 | 1 | 21 | 23 | 2 | 2 | 1 | 3 | 1 | 0 | 23 | 0 | 3 | 1 | 0 | 1 | 0 | EXC |
| EU | 1 | 0 | 13 | 1 | 1 | 16 | 3 | 4 | 7 | 0 | 16 | 126 | 7 | 0 | 52 | 2 | 77 | 75 | 1 | 4 | 1 | 7 | 3 | 0 | 90 | 0 | 0 | 2 | 1 | 1 | 1 | EU |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |

Table C.5 Cont.: 2007 country-to-country blame matrices for **AOT40$_f^{3m}$**.
Units: ppb.h per 15% emis. red. of VOC. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 11 | 13 | 0 | 11 | 5 | 27 | 5 | 25 | 39 | 18 | 3 | 4 | 6 | 0 | 0 | 5 | 12 | 0 | 0 | 0 | 0 | 6 | 1 | 0 | 1 | 254 | 0 | 0 | 795 | 632 | AL |
| AM | 0 | 0 | 0 | 2 | 1 | 8 | 1 | 4 | 1 | 34 | 1 | 0 | 1 | 0 | 0 | 8 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 52 | 0 | 0 | 206 | 63 | AM |
| AT | 0 | 0 | 0 | 24 | 5 | 49 | 5 | 10 | 3 | 13 | 3 | 11 | 8 | 0 | 0 | 2 | 8 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 175 | 0 | 0 | 938 | 871 | AT |
| AZ | 0 | 0 | 0 | 3 | 4 | 16 | 1 | 7 | 2 | 111 | 3 | 1 | 2 | 0 | 1 | 8 | 13 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 154 | 0 | 0 | 423 | 123 | AZ |
| BA | 3 | 1 | 0 | 14 | 5 | 37 | 6 | 17 | 17 | 17 | 3 | 4 | 8 | 0 | 0 | 3 | 10 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 207 | 0 | 0 | 722 | 636 | BA |
| BE | 0 | 0 | 0 | 105 | 8 | 35 | 4 | 4 | 1 | 14 | 7 | 2 | 3 | 0 | 0 | 0 | 6 | 0 | 1 | 1 | 0 | 0 | 9 | 0 | 0 | 217 | 0 | 0 | 1055 | 1015 | BE |
| BG | 2 | 4 | 0 | 9 | 6 | 44 | 4 | 58 | 16 | 48 | 5 | 2 | 8 | 0 | 0 | 9 | 30 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 202 | 0 | 0 | 649 | 504 | BG |
| BY | 0 | 0 | 0 | 7 | 4 | 45 | 2 | 5 | 2 | 47 | 5 | 1 | 3 | 0 | 0 | 2 | 13 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 100 | 0 | 0 | 341 | 243 | BY |
| CH | 0 | 0 | 0 | 20 | 4 | 23 | 6 | 5 | 2 | 8 | 3 | 4 | 3 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 155 | 0 | 0 | 960 | 832 | CH |
| CY | 2 | 3 | 0 | 6 | 5 | 32 | 3 | 25 | 13 | 85 | 4 | 2 | 5 | 0 | 0 | 171 | 32 | 0 | 0 | 0 | 1 | 6 | 1 | 3 | 1 | 316 | 0 | 0 | 729 | 365 | CY |
| CZ | 0 | 0 | 0 | 26 | 6 | 105 | 4 | 9 | 3 | 19 | 6 | 5 | 13 | 0 | 0 | 2 | 13 | 0 | 1 | 1 | 0 | 1 | 3 | 0 | 0 | 190 | 0 | 0 | 928 | 859 | CZ |
| DE | 0 | 0 | 0 | 48 | 8 | 57 | 4 | 5 | 1 | 15 | 7 | 2 | 4 | 0 | 0 | 1 | 7 | 0 | 1 | 1 | 0 | 0 | 5 | 0 | 0 | 208 | 0 | 0 | 1002 | 947 | DE |
| DK | 0 | 0 | 0 | 36 | 21 | 36 | 3 | 3 | 1 | 22 | 28 | 0 | 2 | 0 | 0 | 1 | 4 | 0 | 1 | 5 | 0 | 0 | 10 | 0 | 0 | 222 | 0 | 0 | 704 | 646 | DK |
| EE | 0 | 0 | 0 | 8 | 6 | 21 | 1 | 2 | 1 | 36 | 13 | 0 | 1 | 0 | 0 | 1 | 5 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 84 | 0 | 0 | 256 | 199 | EE |
| ES | 0 | 0 | 0 | 9 | 3 | 9 | 37 | 3 | 1 | 4 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 174 | 0 | 0 | 547 | 529 | ES |
| FI | 0 | 0 | 0 | 2 | 2 | 5 | 0 | 0 | 0 | 7 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 72 | 60 | FI |
| FR | 0 | 0 | 0 | 31 | 6 | 21 | 6 | 4 | 2 | 10 | 4 | 2 | 2 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 1 | 4 | 0 | 0 | 185 | 0 | 0 | 789 | 750 | FR |
| GB | 0 | 0 | 0 | 17 | 16 | 10 | 1 | 2 | 0 | 10 | 5 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 1 | 1 | 0 | 0 | 4 | 0 | 0 | 123 | 0 | 0 | 430 | 396 | GB |
| GE | 0 | 0 | 0 | 3 | 3 | 16 | 1 | 7 | 2 | 73 | 2 | 1 | 2 | 0 | 0 | 7 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 95 | 0 | 0 | 317 | 117 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 5 | 5 | GL |
| GR | 4 | 10 | 0 | 9 | 6 | 38 | 5 | 35 | 23 | 35 | 4 | 3 | 7 | 0 | 0 | 12 | 22 | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 1 | 258 | 0 | 0 | 739 | 591 | GR |
| HR | 2 | 1 | 0 | 17 | 6 | 49 | 7 | 17 | 14 | 18 | 4 | 9 | 9 | 0 | 0 | 3 | 12 | 0 | 1 | 0 | 0 | 4 | 2 | 0 | 0 | 241 | 0 | 0 | 896 | 810 | HR |
| HU | 1 | 1 | 0 | 16 | 6 | 85 | 5 | 22 | 15 | 26 | 5 | 6 | 21 | 0 | 0 | 3 | 17 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 214 | 0 | 0 | 860 | 765 | HU |
| IE | 0 | 0 | 0 | 12 | 10 | 9 | 1 | 2 | 0 | 8 | 4 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 84 | 0 | 0 | 292 | 267 | IE |
| IS | 0 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -5 | 0 | 0 | 57 | 53 | IS |
| IT | 2 | 2 | 0 | 14 | 5 | 31 | 9 | 12 | 9 | 12 | 3 | 12 | 5 | 0 | 0 | 2 | 7 | 0 | 1 | 0 | 0 | 8 | 2 | 0 | 1 | 301 | 0 | 0 | 1395 | 1321 | IT |
| KG | 0 | 0 | 0 | 2 | 2 | 7 | 1 | 3 | 1 | 57 | 2 | 0 | 1 | 6 | 0 | 5 | 5 | 40 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 98 | 0 | 0 | 222 | 73 | KG |
| KZT | 0 | 0 | 0 | 3 | 4 | 14 | 1 | 4 | 1 | 124 | 3 | 0 | 1 | 0 | 0 | 4 | 12 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 134 | 0 | 0 | 285 | 110 | KZT |
| LT | 0 | 0 | 0 | 12 | 8 | 56 | 2 | 6 | 2 | 39 | 11 | 1 | 2 | 0 | 0 | 2 | 10 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 117 | 0 | 0 | 407 | 330 | LT |
| LU | 0 | 0 | 0 | 57 | 6 | 40 | 4 | 6 | 1 | 13 | 6 | 2 | 4 | 0 | 0 | 1 | 7 | 0 | 1 | 1 | 0 | 0 | 5 | 0 | 0 | 185 | 0 | 0 | 863 | 825 | LU |
| LV | 0 | 0 | 0 | 9 | 6 | 32 | 1 | 4 | 1 | 30 | 12 | 0 | 2 | 0 | 0 | 1 | 7 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 91 | 0 | 0 | 294 | 236 | LV |
| MD | 1 | 1 | 0 | 7 | 6 | 52 | 3 | 42 | 5 | 65 | 4 | 1 | 5 | 0 | 0 | 6 | 42 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 169 | 0 | 0 | 518 | 355 | MD |
| ME | 23 | 3 | 0 | 12 | 5 | 28 | 5 | 20 | 27 | 17 | 3 | 3 | 6 | 0 | 0 | 4 | 11 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 1 | 209 | 0 | 0 | 701 | 579 | ME |
| MK | 3 | 18 | 0 | 8 | 4 | 28 | 5 | 28 | 26 | 19 | 3 | 2 | 6 | 0 | 0 | 5 | 12 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 1 | 189 | 0 | 0 | 599 | 484 | MK |
| MT | 3 | 4 | 140 | 14 | 5 | 24 | 11 | 18 | 13 | 17 | 3 | 7 | 5 | 0 | 0 | 4 | 8 | 0 | 1 | 0 | 0 | 54 | 1 | 0 | 2 | 486 | 0 | 0 | 1460 | 1372 | MT |
| NL | 0 | 0 | 0 | 131 | 11 | 35 | 3 | 2 | 0 | 15 | 8 | 1 | 2 | 0 | 0 | 0 | 7 | 0 | 1 | 2 | 0 | 0 | 11 | 0 | 0 | 224 | 0 | 0 | 977 | 935 | NL |
| NO | 0 | 0 | 0 | 6 | 9 | 5 | 0 | 1 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 27 | 0 | 0 | 124 | 107 | NO |
| PL | 0 | 0 | 0 | 20 | 8 | 157 | 3 | 8 | 4 | 27 | 10 | 3 | 8 | 0 | 0 | 2 | 13 | 0 | 1 | 1 | 0 | 0 | 3 | 0 | 0 | 178 | 0 | 0 | 737 | 660 | PL |
| PT | 0 | 0 | 0 | 7 | 2 | 6 | 190 | 2 | 1 | 4 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 148 | 0 | 0 | 515 | 500 | PT |
| RO | 1 | 2 | 0 | 9 | 5 | 56 | 4 | 86 | 12 | 41 | 5 | 2 | 9 | 0 | 0 | 5 | 29 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 178 | 0 | 0 | 617 | 492 | RO |
| RS | 3 | 2 | 0 | 13 | 5 | 43 | 5 | 38 | 59 | 20 | 4 | 4 | 10 | 0 | 0 | 3 | 14 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 201 | 0 | 0 | 715 | 580 | RS |
| RUE | 0 | 0 | 0 | 1 | 1 | 5 | 0 | 1 | 0 | 53 | 1 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 104 | 36 | RUE |
| SE | 0 | 0 | 0 | 7 | 5 | 7 | 1 | 1 | 0 | 7 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 43 | 0 | 0 | 157 | 138 | SE |
| SI | 0 | 0 | 0 | 18 | 5 | 49 | 5 | 13 | 5 | 16 | 4 | 32 | 8 | 0 | 0 | 2 | 10 | 0 | 1 | 0 | 0 | 2 | 2 | 0 | 0 | 224 | 0 | 0 | 1021 | 955 | SI |
| SK | 1 | 1 | 0 | 18 | 6 | 124 | 5 | 15 | 9 | 29 | 5 | 6 | 27 | 0 | 0 | 2 | 16 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 198 | 0 | 0 | 835 | 745 | SK |
| TJ | 0 | 0 | 0 | 2 | 2 | 6 | 1 | 2 | 1 | 55 | 1 | 0 | 1 | 15 | 1 | 4 | 5 | 32 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 95 | 0 | 0 | 204 | 63 | TJ |
| TM | 0 | 0 | 0 | 4 | 5 | 17 | 2 | 7 | 2 | 159 | 5 | 1 | 2 | 1 | 2 | 10 | 13 | 5 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 247 | 0 | 0 | 402 | 152 | TM |
| TR | 1 | 1 | 0 | 4 | 3 | 23 | 2 | 16 | 5 | 65 | 3 | 1 | 3 | 0 | 0 | 67 | 23 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 136 | 0 | 0 | 404 | 201 | TR |
| UA | 0 | 0 | 0 | 7 | 6 | 47 | 2 | 16 | 3 | 102 | 4 | 1 | 4 | 0 | 0 | 4 | 73 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 159 | 0 | 0 | 512 | 286 | UA |
| UZ | 0 | 0 | 0 | 4 | 5 | 17 | 1 | 6 | 1 | 141 | 4 | 1 | 2 | 5 | 1 | 7 | 12 | 25 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 227 | 0 | 0 | 387 | 143 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 9 | 9 | ATL |
| BAS | 0 | 0 | 0 | 13 | 9 | 25 | 1 | 2 | 1 | 22 | 18 | 0 | 1 | 0 | 0 | 1 | 4 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 102 | 0 | 0 | 326 | 283 | BAS |
| BLS | 0 | 0 | 0 | 2 | 2 | 13 | 1 | 8 | 1 | 52 | 2 | 0 | 1 | 0 | 0 | 6 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 65 | 0 | 0 | 196 | 92 | BLS |
| MED | 1 | 1 | 0 | 3 | 2 | 10 | 2 | 7 | 4 | 10 | 1 | 2 | 2 | 0 | 0 | 9 | 5 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 95 | 0 | 0 | 270 | 228 | MED |
| NOS | 0 | 0 | 0 | 9 | 7 | 5 | 1 | 1 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 47 | 0 | 0 | 164 | 150 | NOS |
| AST | 0 | 0 | 0 | 1 | 1 | 6 | 1 | 3 | 1 | 36 | 1 | 0 | 1 | 1 | 0 | 14 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 65 | 0 | 0 | 136 | 55 | AST |
| NOA | 0 | 1 | 0 | 2 | 1 | 6 | 2 | 4 | 2 | 6 | 1 | 1 | 1 | 0 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 80 | 0 | 0 | 156 | 133 | NOA |
| EXC | 0 | 0 | 0 | 5 | 3 | 15 | 3 | 5 | 2 | 56 | 3 | 1 | 2 | 0 | 0 | 4 | 9 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 85 | 0 | 0 | 268 | 176 | EXC |
| EU | 0 | 1 | 0 | 19 | 6 | 38 | 11 | 12 | 4 | 16 | 6 | 3 | 4 | 0 | 0 | 2 | 8 | 0 | 1 | 1 | 0 | 1 | 2 | 0 | 0 | 161 | 0 | 0 | 642 | 588 | EU |
| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |

Table C.6: 2007 country-to-country blame matrices for **SOMO35**.
Units: ppb.d per 15% emis. red. of $NO_x$. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 31 | 0 | 5 | 0 | 9 | -0 | 10 | 1 | 1 | 0 | 1 | 4 | 0 | 0 | 10 | 0 | 10 | 1 | 0 | 17 | 0 | 5 | 0 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | AL |
| AM | 0 | 23 | 1 | 48 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 2 | 1 | 12 | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 4 | 0 | 0 | 0 | 0 | AM |
| AT | 0 | 0 | 12 | 0 | 1 | -2 | 1 | 1 | 5 | 0 | 3 | 13 | -0 | 0 | 12 | 0 | 23 | -2 | 0 | 1 | 0 | 7 | 1 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | AT |
| AZ | 0 | 7 | 1 | 93 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 1 | 2 | 2 | 11 | 1 | 0 | 1 | 0 | 0 | 2 | 0 | 12 | 0 | 0 | 0 | 0 | AZ |
| BA | 1 | 0 | 11 | 0 | 38 | -0 | 4 | 1 | 2 | 0 | 4 | 7 | 0 | 0 | 14 | 0 | 14 | 1 | 0 | 4 | 0 | 16 | 0 | 0 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | BA |
| BE | 0 | 0 | 1 | 0 | 0 | -73 | 0 | 0 | 1 | 0 | 0 | -2 | 1 | 0 | 7 | 0 | 26 | -13 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | BE |
| BG | 2 | 0 | 5 | 0 | 3 | 0 | 60 | 2 | 1 | 0 | 3 | 6 | 0 | 0 | 7 | 1 | 7 | 2 | 0 | 14 | 0 | 8 | 0 | 0 | 12 | 0 | 1 | 1 | 0 | 0 | 3 | BG |
| BY | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 26 | 0 | 0 | 2 | 7 | 1 | 1 | 3 | 3 | 5 | 3 | 0 | 1 | 1 | 2 | 1 | 0 | 3 | 0 | 1 | 7 | 0 | 2 | 1 | BY |
| CH | 0 | 0 | 4 | 0 | 1 | -2 | 0 | 0 | 19 | 0 | 1 | 5 | -0 | 0 | 19 | 0 | 73 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | CH |
| CY | 1 | 1 | 1 | 1 | 1 | 0 | 4 | 1 | 0 | 46 | 0 | 2 | 0 | 0 | 5 | 0 | 4 | 2 | 1 | 16 | 0 | 1 | 0 | 0 | 9 | 0 | 1 | 0 | 0 | 0 | 0 | CY |
| CZ | 0 | 0 | 12 | 0 | 1 | -2 | 1 | 1 | 2 | 0 | 3 | 15 | 0 | 0 | 8 | 0 | 20 | -0 | 0 | 1 | 0 | 7 | 1 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | CZ |
| DE | 0 | 0 | 3 | 0 | 0 | -6 | 0 | 1 | 2 | 0 | 1 | 9 | -0 | 0 | 8 | 0 | 29 | -4 | 0 | 0 | 0 | 1 | 2 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | DE |
| DK | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 2 | 0 | 0 | -0 | 2 | -13 | 0 | 2 | 1 | 6 | 1 | 0 | 0 | 1 | 0 | 3 | 1 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | DK |
| EE | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 5 | 0 | 0 | 1 | 3 | 2 | 4 | 1 | 6 | 3 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 3 | 0 | 4 | 0 | EE |
| ES | 0 | 0 | 1 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 112 | 0 | 17 | -0 | 0 | 1 | 0 | 0 | 1 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | ES |
| FI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 1 | 1 | 1 | 4 | 2 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | FI |
| FR | 0 | 0 | 1 | 0 | 0 | -4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 81 | -7 | 0 | 1 | 0 | 1 | 2 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | FR |
| GB | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | -0 | -1 | 0 | 0 | 2 | 0 | 5 | -51 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | GB |
| GE | 0 | 15 | 1 | 47 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 3 | 0 | 3 | 2 | 51 | 2 | 0 | 1 | 0 | 0 | 3 | 0 | 5 | 0 | 0 | 0 | 1 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 6 | 0 | 3 | 0 | 3 | 0 | 33 | 1 | 1 | 0 | 1 | 4 | 0 | 0 | 9 | 0 | 8 | 2 | 0 | 89 | 0 | 4 | 0 | 0 | 25 | 0 | 1 | 0 | 0 | 0 | 1 | GR |
| HR | 1 | 0 | 16 | 0 | 17 | -0 | 3 | 1 | 2 | 0 | 4 | 9 | 0 | 0 | 13 | 0 | 17 | 1 | 0 | 3 | 0 | 20 | 1 | 0 | 53 | 0 | 0 | 0 | 0 | 0 | 0 | HR |
| HU | 0 | 0 | 16 | 0 | 5 | -0 | 2 | 2 | 2 | 0 | 5 | 11 | -0 | 0 | 8 | 0 | 13 | 1 | 0 | 2 | 0 | 44 | 1 | 0 | 18 | 0 | 0 | 1 | 0 | 0 | 1 | HU |
| IE | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 2 | 0 | 2 | -0 | 0 | 0 | 0 | 0 | -5 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 1 | 0 | 0 | 1 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 1 | 0 | 6 | 0 | 3 | -0 | 2 | 0 | 3 | 0 | 1 | 2 | -0 | 0 | 22 | 0 | 33 | 1 | 0 | 4 | 0 | 3 | 1 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | IT |
| KG | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 3 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 23 | 63 | 0 | 0 | 0 | 0 | KG |
| KZT | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 1 | 2 | 3 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 57 | 0 | 0 | 0 | 0 | KZT |
| LT | 0 | 0 | 1 | 0 | 0 | -0 | 0 | 11 | 0 | 0 | 1 | 7 | 2 | 1 | 3 | 3 | 5 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 1 | 15 | 0 | 3 | 0 | LT |
| LU | 0 | 0 | 3 | 0 | 0 | -13 | 0 | 0 | 1 | 0 | 2 | 7 | 0 | 0 | 11 | 0 | 59 | -5 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 0 | 0 | 0 | -11 | 0 | 0 | LU |
| LV | 0 | 0 | 1 | 0 | 0 | -1 | 0 | 9 | 0 | 0 | 1 | 4 | 2 | 2 | 2 | 4 | 3 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 9 | 0 | 6 | 0 | LV |
| MD | 0 | 1 | 3 | 1 | 1 | 0 | 5 | 6 | 1 | 0 | 4 | 8 | 0 | 0 | 4 | 1 | 6 | 3 | 1 | 3 | 1 | 6 | 0 | 0 | 5 | 0 | 2 | 1 | 0 | 1 | 19 | MD |
| ME | 6 | 0 | 7 | 0 | 20 | -0 | 8 | 1 | 1 | 0 | 2 | 6 | -0 | 0 | 13 | 0 | 12 | 2 | 0 | 10 | 0 | 8 | 0 | 0 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | ME |
| MK | 9 | 0 | 5 | 0 | 5 | -0 | 30 | 1 | 1 | 0 | 2 | 5 | 0 | 0 | 9 | 0 | 8 | 1 | 0 | 19 | 0 | 7 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 1 | MK |
| MT | 1 | 0 | 3 | 0 | 2 | 0 | 2 | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 26 | 0 | 24 | 1 | 0 | 8 | 0 | 1 | 0 | 0 | 63 | 0 | 0 | 0 | 0 | 0 | 0 | MT |
| NL | 0 | 0 | 1 | 0 | 0 | -16 | 0 | 1 | 0 | 0 | -0 | 1 | 1 | 0 | 4 | 0 | 10 | -17 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | NL |
| NO | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 2 | -0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | NO |
| PL | 0 | 0 | 3 | 0 | 1 | -1 | 1 | 5 | 1 | 0 | 4 | 13 | 0 | 0 | 5 | 1 | 9 | 1 | 0 | 1 | 1 | 4 | 1 | 0 | 5 | 0 | 0 | 2 | 0 | 1 | 0 | PL |
| PT | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 57 | 0 | 9 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | -0 | 0 | 0 | PT |
| RO | 1 | 0 | 6 | 0 | 3 | 0 | 11 | 3 | 1 | 0 | 4 | 8 | 0 | 0 | 6 | 1 | 7 | 2 | 0 | 4 | 0 | 16 | 0 | 0 | 9 | 0 | 1 | 1 | 0 | 0 | 3 | RO |
| RS | 3 | 0 | 9 | 0 | 13 | 0 | 13 | 1 | 2 | 0 | 4 | 9 | 0 | 0 | 10 | 0 | 11 | 2 | 0 | 6 | 0 | 18 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 1 | RS |
| RUE | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | RUE |
| SE | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | SE |
| SI | 0 | 0 | 19 | 0 | 3 | -1 | 2 | 1 | 3 | 0 | 3 | 6 | 0 | 0 | 12 | 0 | 17 | -1 | 0 | 2 | 0 | 13 | 1 | 0 | 58 | 0 | 0 | 0 | 0 | 0 | 0 | SI |
| SK | 0 | 0 | 12 | 0 | 2 | -1 | 1 | 3 | 1 | 0 | 6 | 10 | -0 | 0 | 7 | 0 | 12 | 1 | 0 | 1 | 0 | 32 | 1 | 0 | 14 | 0 | 0 | 1 | 0 | 0 | 1 | SK |
| TJ | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 | 29 | 0 | 0 | 0 | 0 | TJ |
| TM | 0 | 3 | 1 | 7 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 3 | 1 | 4 | 3 | 2 | 1 | 1 | 1 | 0 | 0 | 3 | 0 | 42 | 0 | 0 | 0 | 0 | TM |
| TR | 0 | 4 | 1 | 4 | 1 | 0 | 5 | 1 | 0 | 1 | 1 | 2 | 0 | 0 | 4 | 0 | 4 | 2 | 3 | 7 | 0 | 2 | 0 | 0 | 6 | 0 | 1 | 0 | 0 | 0 | 1 | TR |
| UA | 0 | 1 | 2 | 1 | 1 | 0 | 2 | 8 | 1 | 0 | 3 | 7 | 0 | 0 | 3 | 2 | 5 | 3 | 1 | 1 | 1 | 5 | 0 | 0 | 3 | 0 | 3 | 2 | 0 | 1 | 3 | UA |
| UZ | 0 | 2 | 1 | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 3 | 1 | 3 | 4 | 1 | 1 | 1 | 1 | 0 | 0 | 2 | 2 | 65 | 0 | 0 | 0 | 0 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ATL |
| BAS | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 3 | 0 | 0 | 0 | 4 | -1 | 2 | 2 | 5 | 4 | 4 | 0 | 0 | 2 | 0 | 2 | 0 | 1 | 0 | 0 | 3 | 0 | 2 | 0 | BAS |
| BLS | 0 | 3 | 1 | 5 | 0 | 0 | 6 | 4 | 0 | 0 | 2 | 4 | 0 | 0 | 3 | 1 | 4 | 3 | 9 | 3 | 1 | 3 | 0 | 0 | 2 | 0 | 3 | 1 | 0 | 0 | 3 | BLS |
| MED | 1 | 0 | 3 | 0 | 3 | -0 | 7 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 24 | 0 | 25 | 1 | 0 | 22 | 0 | 2 | 0 | 0 | 44 | 0 | 0 | 0 | 0 | 0 | 0 | MED |
| NOS | 0 | 0 | 0 | 0 | 0 | -3 | 0 | 1 | 0 | 0 | -0 | -3 | -1 | 0 | 2 | 1 | 4 | -31 | 0 | 0 | 1 | 0 | 3 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | NOS |
| AST | 0 | 1 | 0 | 6 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 1 | 20 | 0 | 0 | 0 | 0 | AST |
| NOA | 1 | 0 | 2 | 0 | 1 | 0 | 4 | 0 | 1 | 0 | 1 | 3 | 0 | 0 | 21 | 0 | 13 | 2 | 0 | 14 | 0 | 1 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | NOA |
| EXC | 0 | 1 | 1 | 2 | 0 | -0 | 1 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 5 | 1 | 6 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 3 | 0 | 12 | 1 | 0 | 0 | 0 | EXC |
| EU | 0 | 0 | 3 | 0 | 1 | -2 | 4 | 1 | 1 | 0 | 1 | 4 | 0 | 0 | 22 | 1 | 21 | -3 | 0 | 4 | 1 | 4 | 1 | 0 | 11 | 0 | 0 | 1 | 0 | 0 | 0 | EU |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |

Table C.6 Cont.: 2007 country-to-country blame matrices for **SOMO35**.
Units: ppb.d per 15% emis. red. of $NO_x$. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 13 | 5 | 0 | -0 | 1 | 3 | 1 | 10 | 28 | 4 | 0 | 1 | 1 | 0 | 0 | 5 | 4 | 0 | 4 | 0 | 1 | 42 | 0 | 0 | 2 | 31 | 0 | 0 | 226 | 125 | AL |
| AM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 24 | 0 | 0 | 0 | 0 | 3 | 47 | 4 | 2 | 2 | 0 | 2 | 5 | 1 | 20 | 1 | 28 | 0 | 0 | 187 | 18 | AM |
| AT | 0 | 0 | 0 | -3 | 1 | 3 | 1 | 4 | 2 | 3 | 0 | 8 | 3 | 0 | 0 | 1 | 3 | 0 | 5 | 0 | 0 | 6 | -2 | 0 | 0 | 26 | 0 | 0 | 129 | 111 | AT |
| AZ | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 0 | 62 | 0 | 0 | 0 | 0 | 6 | 25 | 5 | 4 | 2 | 1 | 2 | 4 | 1 | 23 | 0 | 29 | 0 | 0 | 250 | 22 | AZ |
| BA | 6 | 1 | 0 | -0 | 1 | 4 | 1 | 11 | 20 | 4 | 0 | 3 | 4 | 0 | 0 | 2 | 5 | 0 | 5 | 0 | 1 | 19 | 0 | 0 | 1 | 29 | 0 | 0 | 227 | 145 | BA |
| BE | 0 | 0 | 0 | -24 | 1 | 2 | 1 | 1 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 11 | 1 | 0 | 1 | -23 | 0 | 0 | 22 | 0 | 0 | -58 | -66 | BE |
| BG | 2 | 3 | 0 | 0 | 1 | 8 | 1 | 44 | 16 | 17 | 1 | 1 | 3 | 0 | 0 | 7 | 19 | 0 | 3 | 1 | 8 | 12 | 1 | 0 | 1 | 27 | 0 | 0 | 261 | 183 | BG |
| BY | 0 | 0 | 0 | 0 | 2 | 19 | 0 | 4 | 1 | 31 | 3 | 0 | 1 | 0 | 0 | 2 | 18 | 0 | 4 | 4 | 1 | 1 | 1 | 0 | 0 | 18 | 0 | 0 | 153 | 68 | BY |
| CH | 0 | 0 | 0 | -3 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 7 | 0 | 0 | 6 | -2 | 0 | 0 | 28 | 0 | 0 | 152 | 127 | CH |
| CY | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 4 | 2 | 14 | 0 | 0 | 0 | 0 | 0 | 138 | 6 | 0 | 3 | 0 | 4 | 74 | 1 | 7 | 2 | 35 | 0 | 0 | 270 | 100 | CY |
| CZ | 0 | 0 | 0 | -3 | 1 | 4 | 1 | 4 | 1 | 4 | 1 | 2 | 6 | 0 | 0 | 1 | 5 | 0 | 6 | 1 | 0 | 3 | -1 | 0 | 0 | 21 | 0 | 0 | 107 | 89 | CZ |
| DE | 0 | 0 | 0 | -8 | 1 | 5 | 1 | 2 | 1 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 9 | -1 | 0 | 2 | -6 | 0 | 0 | 23 | 0 | 0 | 63 | 51 | DE |
| DK | 0 | 0 | 0 | -3 | 4 | 5 | 0 | 1 | 0 | 7 | 5 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 12 | -9 | 0 | 1 | -10 | 0 | 0 | 25 | 0 | 0 | 29 | 13 | DK |
| EE | 0 | 0 | 0 | -0 | 3 | 7 | 0 | 1 | 0 | 21 | 7 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 5 | 9 | 0 | 1 | 2 | 0 | 0 | 17 | 0 | 0 | 87 | 48 | EE |
| ES | 0 | 0 | 0 | -0 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | -0 | 0 | 9 | -0 | 0 | 1 | 33 | 0 | 0 | 157 | 154 | ES |
| FI | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 3 | 0 | 0 | 1 | 0 | 0 | 11 | 0 | 0 | 39 | 24 | FI |
| FR | 0 | 0 | 0 | -4 | 1 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 5 | -5 | 0 | 0 | 25 | 0 | 0 | 111 | 105 | FR |
| GB | 0 | 0 | 0 | -3 | 2 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 14 | 0 | 0 | 1 | -6 | 0 | 0 | 24 | 0 | 0 | -33 | -42 | GB |
| GE | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 4 | 1 | 61 | 0 | 0 | 0 | 0 | 3 | 41 | 9 | 2 | 2 | 1 | 8 | 5 | 1 | 13 | 1 | 30 | 0 | 0 | 267 | 28 | GE |
| GL | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 5 | 3 | GL |
| GR | 2 | 7 | 0 | 0 | 1 | 4 | 1 | 14 | 11 | 9 | 0 | 1 | 1 | 0 | 0 | 11 | 9 | 0 | 3 | 1 | 4 | 44 | 1 | 0 | 2 | 31 | 0 | 0 | 263 | 200 | GR |
| HR | 2 | 1 | 0 | -1 | 1 | 4 | 1 | 10 | 12 | 4 | 0 | 8 | 3 | 0 | 0 | 2 | 5 | 0 | 5 | 0 | 1 | 22 | 0 | 0 | 1 | 25 | 0 | 0 | 213 | 165 | HR |
| HU | 1 | 0 | 0 | -1 | 1 | 6 | 1 | 17 | 11 | 6 | 1 | 5 | 11 | 0 | 0 | 2 | 11 | 0 | 5 | -0 | 0 | 7 | -0 | 0 | 0 | 23 | 0 | 0 | 203 | 161 | HU |
| IE | 0 | 0 | 0 | -2 | 2 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 16 | 0 | 0 | 1 | -2 | 0 | 0 | 25 | 0 | 0 | 6 | -0 | IE |
| IS | 0 | 0 | 0 | 0 | 1 | -0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 1 | 0 | 0 | 19 | 0 | 0 | 15 | 10 | IS |
| IT | 1 | 1 | 0 | -1 | 1 | 1 | 1 | 3 | 3 | 2 | 0 | 3 | 1 | 0 | 0 | 1 | 1 | 0 | 6 | 0 | 0 | 31 | -0 | 0 | 1 | 29 | 0 | 0 | 175 | 158 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 18 | 0 | 0 | 0 | 20 | 4 | 6 | 1 | 60 | 1 | 0 | 0 | 2 | 1 | 22 | 0 | 39 | 0 | 0 | 217 | 17 | KG |
| KZT | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 85 | 1 | 0 | 0 | 1 | 2 | 4 | 5 | 4 | 2 | 1 | 0 | 1 | 1 | 5 | 0 | 26 | 0 | 0 | 189 | 23 | KZT |
| LT | 0 | 0 | 0 | 0 | 3 | 18 | 0 | 3 | 0 | 20 | 5 | 0 | 1 | 0 | 0 | 1 | 8 | 0 | 6 | 8 | 0 | 1 | 2 | 0 | 0 | 19 | 0 | 0 | 124 | 76 | LT |
| LU | 0 | 0 | 0 | -10 | 1 | 1 | 1 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 10 | 0 | 0 | 2 | -5 | 0 | 0 | 22 | 0 | 0 | 64 | 56 | LU |
| LV | 0 | 0 | 0 | -0 | 3 | 10 | 0 | 2 | 0 | 22 | 6 | 0 | 1 | 0 | 0 | 1 | 7 | 0 | 6 | 10 | 0 | 1 | 2 | 0 | 0 | 18 | 0 | 0 | 105 | 59 | LV |
| MD | 0 | 0 | 0 | 0 | 2 | 18 | 0 | 45 | 3 | 27 | 1 | 1 | 4 | 0 | 0 | 5 | 53 | 0 | 4 | 2 | 6 | 3 | 1 | 1 | 0 | 24 | 0 | 0 | 241 | 120 | MD |
| ME | 31 | 2 | 0 | -0 | 1 | 3 | 1 | 10 | 31 | 4 | 0 | 1 | 2 | 0 | 0 | 4 | 5 | 0 | 4 | 0 | 1 | 25 | 1 | 0 | 1 | 32 | 0 | 0 | 238 | 130 | ME |
| MK | 4 | 22 | 0 | -0 | 1 | 4 | 1 | 17 | 33 | 6 | 0 | 1 | 2 | 0 | 0 | 5 | 7 | 0 | 3 | 0 | 2 | 18 | 0 | 0 | 1 | 30 | 0 | 0 | 236 | 139 | MK |
| MT | 1 | 1 | -60 | -0 | 1 | 0 | 2 | 2 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 7 | 0 | 0 | 3 | 1 | 0 | 3 | 34 | 0 | 0 | 91 | 77 | MT |
| NL | 0 | 0 | 0 | -60 | 2 | 1 | 1 | 1 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 11 | 1 | 0 | 1 | -40 | 0 | 0 | 23 | 0 | 0 | -56 | -66 | NL |
| NO | 0 | 0 | 0 | -1 | 5 | 1 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 1 | 0 | 0 | -0 | 0 | 0 | 18 | 0 | 0 | 23 | 12 | NO |
| PL | 0 | 0 | 0 | -1 | 2 | 25 | 1 | 4 | 1 | 9 | 3 | 1 | 3 | 0 | 0 | 1 | 9 | 0 | 6 | 2 | 0 | 2 | 0 | 0 | 0 | 20 | 0 | 0 | 117 | 86 | PL |
| PT | 0 | 0 | 0 | -0 | 0 | 0 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 3 | 0 | 0 | 0 | 34 | 0 | 0 | 108 | 105 | PT |
| RO | 1 | 1 | 0 | 0 | 1 | 14 | 1 | 77 | 9 | 15 | 1 | 1 | 6 | 0 | 0 | 5 | 25 | 0 | 4 | 1 | 4 | 6 | 1 | 0 | 1 | 25 | 0 | 0 | 248 | 176 | RO |
| RS | 6 | 2 | 0 | 0 | 1 | 6 | 1 | 31 | 52 | 6 | 1 | 2 | 4 | 0 | 0 | 3 | 9 | 0 | 4 | 0 | 1 | 11 | 1 | 0 | 1 | 27 | 0 | 0 | 251 | 152 | RS |
| RUE | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 39 | 1 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 61 | 10 | RUE |
| SE | 0 | 0 | 0 | -0 | 4 | 2 | 0 | 0 | 0 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 7 | 3 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 39 | 25 | SE |
| SI | 1 | 0 | 0 | -1 | 1 | 4 | 1 | 7 | 4 | 3 | 0 | 19 | 3 | 0 | 0 | 1 | 4 | 0 | 5 | 0 | 0 | 16 | -1 | 0 | 1 | 25 | 0 | 0 | 184 | 163 | SI |
| SK | 1 | 0 | 0 | -1 | 1 | 8 | 1 | 10 | 5 | 6 | 1 | 4 | 22 | 0 | 0 | 2 | 12 | 0 | 5 | -0 | 0 | 5 | -1 | 0 | 0 | 22 | 0 | 0 | 177 | 142 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 12 | 0 | 0 | 0 | 56 | 6 | 5 | 1 | 59 | 1 | 0 | 0 | 1 | 1 | 32 | 0 | 36 | 0 | 0 | 188 | 12 | TJ |
| TM | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 1 | 61 | 1 | 0 | 0 | 2 | 31 | 14 | 4 | 34 | 3 | 1 | 1 | 2 | 1 | 23 | 0 | 44 | 0 | 0 | 233 | 28 | TM |
| TR | 0 | 1 | 0 | 0 | 1 | 4 | 0 | 7 | 2 | 28 | 0 | 0 | 1 | 0 | 0 | 108 | 12 | 0 | 2 | 1 | 9 | 15 | 1 | 8 | 1 | 35 | 0 | 0 | 219 | 49 | TR |
| UA | 0 | 0 | 0 | 0 | 2 | 17 | 0 | 13 | 1 | 47 | 2 | 0 | 3 | 0 | 0 | 4 | 55 | 0 | 4 | 2 | 4 | 2 | 2 | 1 | 0 | 21 | 0 | 0 | 203 | 74 | UA |
| UZ | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 2 | 0 | 67 | 1 | 0 | 0 | 7 | 9 | 9 | 4 | 41 | 3 | 1 | 1 | 2 | 2 | 14 | 0 | 40 | 0 | 0 | 243 | 28 | UZ |
| ATL | 0 | 0 | 0 | -0 | 1 | -0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 11 | 7 | ATL |
| BAS | 0 | 0 | 0 | -1 | 5 | 8 | 0 | 1 | 0 | 13 | 8 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 9 | -3 | 0 | 1 | -0 | 0 | 0 | 23 | 0 | 0 | 71 | 43 | BAS |
| BLS | 0 | 0 | 0 | 0 | 2 | 10 | 0 | 15 | 1 | 103 | 1 | 0 | 1 | 0 | 1 | 16 | 49 | 1 | 4 | 2 | 43 | 6 | 1 | 2 | 0 | 28 | 0 | 0 | 265 | 63 | BLS |
| MED | 1 | 1 | 1 | -0 | 1 | 1 | 2 | 5 | 4 | 6 | 0 | 1 | 1 | 0 | 0 | 24 | 4 | 0 | 7 | 0 | 3 | 78 | 0 | 1 | 2 | 35 | 0 | 0 | 192 | 143 | MED |
| NOS | 0 | 0 | 0 | -5 | 5 | -0 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 23 | -1 | 0 | 1 | -36 | 0 | 0 | 36 | 0 | 0 | -12 | -26 | NOS |
| AST | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 26 | 0 | 0 | 0 | 3 | 4 | 24 | 3 | 9 | 1 | 0 | 1 | 6 | 1 | 44 | 0 | 33 | 0 | 0 | 117 | 16 | AST |
| NOA | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 9 | 2 | 0 | 4 | 0 | 1 | 54 | 1 | 0 | 10 | 51 | 0 | 0 | 109 | 88 | NOA |
| EXC | 0 | 0 | 0 | -0 | 1 | 3 | 1 | 3 | 1 | 35 | 1 | 0 | 1 | 1 | 1 | 6 | 5 | 3 | 3 | 1 | 1 | 3 | 0 | 2 | 0 | 16 | 0 | 0 | 104 | 32 | EXC |
| EU | 0 | 0 | 0 | -2 | 2 | 5 | 3 | 7 | 2 | 6 | 2 | 1 | 2 | 0 | 0 | 2 | 4 | 0 | 9 | 1 | 1 | 7 | -2 | 0 | 0 | 24 | 0 | 0 | 110 | 89 | EU |
| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |

Table C.7: 2007 country-to-country blame matrices for **SOMO35**.
Units: ppb.d per 15% emis. red. of VOC. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 5 | 0 | 3 | 0 | 1 | 1 | 2 | 1 | 1 | 0 | 3 | 15 | 1 | 0 | 8 | 0 | 11 | 6 | 0 | 7 | 0 | 2 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | AL |
| AM | 0 | 12 | 0 | 7 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 0 | 2 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | AM |
| AT | 0 | 0 | 15 | 0 | 0 | 3 | 0 | 1 | 5 | 0 | 6 | 47 | 1 | 0 | 5 | 0 | 16 | 8 | 0 | 0 | 0 | 2 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | AT |
| AZ | 0 | 3 | 1 | 24 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 5 | 0 | 0 | 1 | 0 | 2 | 3 | 9 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | AZ |
| BA | 1 | 0 | 4 | 0 | 2 | 1 | 1 | 1 | 2 | 0 | 4 | 20 | 1 | 0 | 8 | 0 | 12 | 6 | 0 | 1 | 0 | 3 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | BA |
| BE | 0 | 0 | 2 | 0 | 0 | 16 | 0 | 0 | 1 | 0 | 2 | 37 | 1 | 0 | 3 | 0 | 28 | 25 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | BE |
| BG | 1 | 0 | 2 | 0 | 1 | 1 | 9 | 1 | 1 | 0 | 3 | 12 | 1 | 0 | 4 | 0 | 7 | 5 | 0 | 3 | 0 | 2 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 1 | BG |
| BY | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 2 | 10 | 1 | 0 | 1 | 0 | 4 | 6 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | BY |
| CH | 0 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 15 | 0 | 2 | 40 | 0 | 0 | 7 | 0 | 26 | 9 | 0 | 0 | 0 | 1 | 0 | 0 | 37 | 0 | 0 | 0 | 0 | 0 | 0 | CH |
| CY | 0 | 1 | 2 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 9 | 1 | 0 | 4 | 0 | 5 | 4 | 2 | 5 | 0 | 1 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | CY |
| CZ | 0 | 0 | 6 | 0 | 0 | 3 | 0 | 1 | 2 | 0 | 15 | 42 | 1 | 0 | 3 | 0 | 13 | 10 | 0 | 0 | 0 | 2 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | CZ |
| DE | 0 | 0 | 3 | 0 | 0 | 5 | 0 | 1 | 2 | 0 | 4 | 54 | 1 | 0 | 3 | 0 | 19 | 17 | 0 | 0 | 0 | 1 | 1 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | DE |
| DK | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 14 | 7 | 0 | 1 | 0 | 7 | 22 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | DK |
| EE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 7 | 1 | 1 | 1 | 2 | 4 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | EE |
| ES | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 9 | 0 | 0 | 39 | 0 | 15 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | ES |
| FI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | FI |
| FR | 0 | 0 | 2 | 0 | 0 | 5 | 0 | 0 | 2 | 0 | 2 | 27 | 1 | 0 | 9 | 0 | 36 | 17 | 0 | 0 | 0 | 1 | 1 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | FR |
| GB | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 11 | 1 | 0 | 1 | 0 | 5 | 28 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | GB |
| GE | 0 | 2 | 1 | 8 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 5 | 0 | 0 | 1 | 0 | 2 | 3 | 18 | 1 | 0 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 2 | 0 | 2 | 0 | 1 | 1 | 4 | 1 | 1 | 0 | 2 | 13 | 1 | 0 | 6 | 0 | 9 | 5 | 0 | 13 | 0 | 2 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | GR |
| HR | 0 | 0 | 5 | 0 | 1 | 2 | 1 | 1 | 2 | 0 | 5 | 24 | 1 | 0 | 8 | 0 | 13 | 7 | 0 | 1 | 0 | 3 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | HR |
| HU | 0 | 0 | 6 | 0 | 1 | 2 | 1 | 1 | 1 | 0 | 6 | 26 | 1 | 0 | 5 | 0 | 10 | 7 | 0 | 1 | 0 | 11 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | HU |
| IE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 9 | 1 | 0 | 1 | 0 | 4 | 16 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | -0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 0 | 0 | 5 | 0 | 1 | 2 | 1 | 1 | 3 | 0 | 3 | 22 | 1 | 0 | 12 | 0 | 19 | 7 | 0 | 2 | 0 | 2 | 0 | 0 | 107 | 0 | 0 | 0 | 0 | 0 | 0 | IT |
| KG | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | KG |
| KZT | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | KZT |
| LT | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 2 | 12 | 2 | 0 | 1 | 1 | 6 | 8 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | LT |
| LU | 0 | 0 | 2 | 0 | 0 | 9 | 0 | 0 | 1 | 0 | 2 | 40 | 1 | 0 | 5 | 0 | 30 | 18 | 0 | 0 | 0 | 1 | 1 | 0 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | LU |
| LV | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 10 | 1 | 0 | 1 | 1 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | LV |
| MD | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 2 | 10 | 1 | 0 | 2 | 0 | 5 | 5 | 1 | 1 | 0 | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 1 | MD |
| ME | 2 | 0 | 3 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 3 | 16 | 1 | 0 | 8 | 0 | 11 | 6 | 0 | 3 | 0 | 2 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | ME |
| MK | 2 | 0 | 2 | 0 | 1 | 1 | 3 | 1 | 1 | 0 | 2 | 12 | 1 | 0 | 6 | 0 | 8 | 5 | 0 | 9 | 0 | 2 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | MK |
| MT | 1 | 0 | 4 | 0 | 1 | 2 | 1 | 1 | 2 | 0 | 3 | 19 | 1 | 0 | 21 | 0 | 21 | 8 | 0 | 3 | 0 | 2 | 0 | 0 | 85 | 0 | 0 | 0 | 0 | 0 | 0 | MT |
| NL | 0 | 0 | 1 | 0 | 0 | 7 | 0 | 1 | 0 | 0 | 2 | 35 | 2 | 0 | 2 | 0 | 17 | 31 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | NL |
| NO | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 1 | 0 | 3 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | NO |
| PL | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 4 | 23 | 2 | 0 | 2 | 0 | 9 | 10 | 0 | 0 | 0 | 2 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | PL |
| PT | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 7 | 0 | 0 | 25 | 0 | 12 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | PT |
| RO | 0 | 0 | 2 | 0 | 1 | 1 | 2 | 1 | 1 | 0 | 3 | 14 | 1 | 0 | 4 | 0 | 7 | 5 | 0 | 1 | 0 | 3 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | RO |
| RS | 1 | 0 | 3 | 0 | 1 | 1 | 2 | 1 | 1 | 0 | 4 | 18 | 1 | 0 | 5 | 0 | 9 | 6 | 0 | 2 | 0 | 4 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | RS |
| RUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | RUE |
| SE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 1 | 0 | 3 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | SE |
| SI | 0 | 0 | 9 | 0 | 0 | 2 | 0 | 1 | 3 | 0 | 4 | 29 | 1 | 0 | 8 | 0 | 14 | 8 | 0 | 1 | 0 | 3 | 0 | 0 | 49 | 0 | 0 | 0 | 0 | 0 | 0 | SI |
| SK | 0 | 0 | 5 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 8 | 27 | 1 | 0 | 3 | 0 | 10 | 8 | 0 | 1 | 0 | 6 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | SK |
| TJ | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | TJ |
| TM | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 5 | 0 | 0 | 1 | 0 | 2 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | TM |
| TR | 0 | 1 | 1 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 6 | 0 | 0 | 2 | 0 | 4 | 3 | 2 | 2 | 0 | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | TR |
| UA | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 10 | 1 | 0 | 1 | 0 | 4 | 5 | 1 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | UA |
| UZ | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 4 | 0 | 0 | 1 | 0 | 2 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 3 | 5 | 0 | 0 | 0 | 0 | 0 | -0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | ATL |
| BAS | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 13 | 4 | 0 | 1 | 1 | 6 | 13 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | BAS |
| BLS | 0 | 1 | 1 | 3 | 0 | 1 | 2 | 2 | 1 | 0 | 2 | 12 | 1 | 0 | 2 | 1 | 6 | 7 | 4 | 2 | 0 | 2 | 0 | 0 | 5 | 0 | 1 | 1 | 0 | 0 | 1 | BLS |
| MED | 1 | 0 | 4 | 0 | 1 | 2 | 2 | 1 | 2 | 0 | 3 | 19 | 1 | 0 | 21 | 0 | 21 | 8 | 1 | 7 | 0 | 2 | 0 | 0 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | MED |
| NOS | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 14 | 2 | 0 | 1 | 0 | 9 | 33 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | NOS |
| AST | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | AST |
| NOA | 1 | 0 | 2 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 9 | 0 | 0 | 10 | 0 | 10 | 4 | 0 | 3 | 0 | 1 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | NOA |
| EXC | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 6 | 0 | 0 | 2 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | EXC |
| EU | 0 | 0 | 2 | 0 | 0 | 2 | 1 | 1 | 1 | 0 | 2 | 19 | 1 | 0 | 9 | 0 | 13 | 11 | 0 | 1 | 0 | 1 | 1 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | EU |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |

Table C.7 Cont.: 2007 country-to-country blame matrices for **SOMO35**.
Units: ppb.d per 15% emis. red. of VOC. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 2 | 2 | 0 | 1 | 1 | 5 | 1 | 4 | 6 | 4 | 1 | 1 | 1 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 44 | 0 | 0 | 132 | 103 | AL |
| AM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 13 | 0 | 0 | 60 | 17 | AM |
| AT | 0 | 0 | 0 | 4 | 1 | 7 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 156 | 144 | AT |
| AZ | 0 | 0 | 0 | 1 | 1 | 3 | 0 | 2 | 0 | 20 | 1 | 0 | 0 | 0 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 26 | 0 | 0 | 91 | 24 | AZ |
| BA | 1 | 0 | 0 | 2 | 1 | 6 | 1 | 4 | 4 | 3 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 37 | 0 | 0 | 124 | 107 | BA |
| BE | 0 | 0 | 0 | 12 | 1 | 4 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 30 | 0 | 0 | 145 | 139 | BE |
| BG | 0 | 1 | 0 | 1 | 1 | 7 | 1 | 10 | 3 | 9 | 1 | 0 | 1 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 109 | 82 | BG |
| BY | 0 | 0 | 0 | 1 | 1 | 7 | 0 | 1 | 0 | 8 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 58 | 42 | BY |
| CH | 0 | 0 | 0 | 4 | 1 | 4 | 1 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 163 | 142 | CH |
| CY | 0 | 0 | 0 | 1 | 1 | 5 | 0 | 4 | 2 | 12 | 1 | 0 | 1 | 0 | 0 | 36 | 5 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 55 | 0 | 0 | 124 | 58 | CY |
| CZ | 0 | 0 | 0 | 3 | 1 | 12 | 1 | 2 | 1 | 3 | 1 | 1 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 136 | 126 | CZ |
| DE | 0 | 0 | 0 | 6 | 1 | 7 | 1 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 28 | 0 | 0 | 138 | 130 | DE |
| DK | 0 | 0 | 0 | 4 | 2 | 5 | 0 | 1 | 0 | 4 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 25 | 0 | 0 | 80 | 72 | DK |
| EE | 0 | 0 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 45 | 34 | EE |
| ES | 0 | 0 | 0 | 1 | 0 | 2 | 6 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 97 | 92 | ES |
| FI | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 18 | 14 | FI |
| FR | 0 | 0 | 0 | 4 | 1 | 4 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 29 | 0 | 0 | 131 | 124 | FR |
| GB | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 0 | 63 | 57 | GB |
| GE | 0 | 0 | 0 | 1 | 1 | 3 | 0 | 2 | 1 | 16 | 0 | 0 | 0 | 0 | 0 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 20 | 0 | 0 | 82 | 26 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 4 | 3 | GL |
| GR | 1 | 2 | 0 | 1 | 1 | 6 | 1 | 6 | 4 | 7 | 1 | 1 | 1 | 0 | 0 | 3 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 43 | 0 | 0 | 122 | 95 | GR |
| HR | 0 | 0 | 0 | 2 | 1 | 8 | 1 | 3 | 3 | 3 | 1 | 2 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 136 | 122 | HR |
| HU | 0 | 0 | 0 | 2 | 1 | 13 | 1 | 5 | 3 | 4 | 1 | 1 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 0 | 0 | 133 | 117 | HU |
| IE | 0 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 47 | 42 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 11 | 9 | IS |
| IT | 0 | 0 | 0 | 2 | 1 | 5 | 1 | 2 | 2 | 3 | 1 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 47 | 0 | 0 | 213 | 199 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 0 | 0 | 31 | 9 | KG |
| KZT | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 19 | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 43 | 16 | KZT |
| LT | 0 | 0 | 0 | 2 | 1 | 7 | 0 | 1 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 61 | 50 | LT |
| LU | 0 | 0 | 0 | 7 | 1 | 5 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 27 | 0 | 0 | 134 | 128 | LU |
| LV | 0 | 0 | 0 | 2 | 1 | 5 | 0 | 1 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 51 | 41 | LV |
| MD | 0 | 0 | 0 | 1 | 1 | 7 | 0 | 7 | 1 | 10 | 1 | 0 | 1 | 0 | 0 | 1 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 79 | 54 | MD |
| ME | 3 | 1 | 0 | 1 | 1 | 5 | 1 | 4 | 5 | 3 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 37 | 0 | 0 | 119 | 96 | ME |
| MK | 1 | 4 | 0 | 1 | 1 | 5 | 1 | 5 | 5 | 4 | 1 | 0 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | 106 | 82 | MK |
| MT | 0 | 0 | 14 | 2 | 1 | 5 | 3 | 4 | 2 | 4 | 1 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 79 | 0 | 0 | 219 | 202 | MT |
| NL | 0 | 0 | 0 | 13 | 2 | 5 | 0 | 1 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 29 | 0 | 0 | 128 | 120 | NL |
| NO | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 24 | 20 | NO |
| PL | 0 | 0 | 0 | 3 | 1 | 19 | 0 | 2 | 1 | 4 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 100 | 89 | PL |
| PT | 0 | 0 | 0 | 1 | 0 | 2 | 35 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 101 | 97 | PT |
| RO | 0 | 0 | 0 | 1 | 1 | 8 | 1 | 15 | 3 | 8 | 1 | 0 | 1 | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 0 | 106 | 83 | RO |
| RS | 1 | 1 | 0 | 2 | 1 | 7 | 1 | 7 | 10 | 4 | 1 | 1 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 | 0 | 0 | 117 | 91 | RS |
| RUE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 18 | 7 | RUE |
| SE | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 29 | 25 | SE |
| SI | 0 | 0 | 0 | 2 | 1 | 7 | 1 | 2 | 1 | 3 | 1 | 5 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 0 | 0 | 161 | 149 | SI |
| SK | 0 | 0 | 0 | 3 | 1 | 17 | 1 | 4 | 2 | 4 | 1 | 1 | 4 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 | 0 | 0 | 132 | 117 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 3 | 0 | 1 | 1 | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 0 | 0 | 25 | 7 | TJ |
| TM | 0 | 0 | 0 | 1 | 1 | 3 | 0 | 1 | 0 | 23 | 1 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 31 | 0 | 0 | 64 | 24 | TM |
| TR | 0 | 0 | 0 | 1 | 1 | 4 | 0 | 3 | 1 | 12 | 1 | 0 | 1 | 0 | 0 | 19 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 27 | 0 | 0 | 83 | 38 | TR |
| UA | 0 | 0 | 0 | 1 | 1 | 7 | 0 | 3 | 1 | 15 | 1 | 0 | 1 | 0 | 0 | 1 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 0 | 78 | 45 | UA |
| UZ | 0 | 0 | 0 | 1 | 1 | 3 | 0 | 1 | 0 | 22 | 1 | 0 | 0 | 1 | 0 | 1 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 28 | 0 | 0 | 62 | 21 | UZ |
| ATL | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 19 | 16 | ATL |
| BAS | 0 | 0 | 0 | 2 | 2 | 5 | 0 | 1 | 0 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 21 | 0 | 0 | 69 | 58 | BAS |
| BLS | 0 | 0 | 0 | 1 | 1 | 8 | 0 | 6 | 1 | 34 | 1 | 0 | 1 | 0 | 0 | 8 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 0 | 0 | 136 | 65 | BLS |
| MED | 1 | 1 | 0 | 2 | 1 | 6 | 2 | 5 | 3 | 7 | 1 | 1 | 1 | 0 | 0 | 7 | 4 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 73 | 0 | 0 | 192 | 161 | MED |
| NOS | 0 | 0 | 0 | 4 | 4 | 3 | 0 | 1 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 24 | 0 | 0 | 86 | 76 | NOS |
| AST | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 11 | 0 | 0 | 34 | 13 | AST |
| NOA | 0 | 0 | 0 | 1 | 1 | 3 | 1 | 2 | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 44 | 0 | 0 | 86 | 73 | NOA |
| EXC | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 44 | 28 | EXC |
| EU | 0 | 0 | 0 | 3 | 1 | 5 | 2 | 2 | 1 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 101 | 92 | EU |
| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |

Table C.8: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of PPM. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 50 | 0 | 1 | 0 | 4 | 0 | 5 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 23 | 0 | 2 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | AL |
| AM | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | AM |
| AT | 0 | 0 | 60 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 5 | 19 | 0 | 0 | 1 | 0 | 12 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | AT |
| AZ | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | AZ |
| BA | 1 | 0 | 4 | 0 | 43 | 0 | 1 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 2 | 0 | 5 | 0 | 0 | 1 | 0 | 5 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | BA |
| BE | 0 | 0 | 1 | 0 | 0 | 137 | 0 | 0 | 0 | 0 | 1 | 32 | 2 | 0 | 1 | 0 | 100 | 13 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | BE |
| BG | 1 | 0 | 1 | 0 | 2 | 0 | 146 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 9 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 1 | BG |
| BY | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 2 | 3 | 1 | 2 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 3 | 0 | 2 | 0 | BY |
| CH | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 49 | 0 | 1 | 18 | 0 | 0 | 2 | 0 | 50 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | CH |
| CY | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | CY |
| CZ | 0 | 0 | 12 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 54 | 29 | 1 | 0 | 1 | 0 | 15 | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | CZ |
| DE | 0 | 0 | 4 | 0 | 0 | 6 | 0 | 0 | 2 | 0 | 4 | 105 | 4 | 0 | 1 | 0 | 46 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | DE |
| DK | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 89 | 0 | 0 | 0 | 5 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | DK |
| EE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 2 | 59 | 0 | 8 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 8 | 0 | EE |
| ES | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 99 | 0 | 18 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | ES |
| FI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 33 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | FI |
| FR | 0 | 0 | 1 | 0 | 0 | 6 | 0 | 0 | 2 | 0 | 1 | 12 | 1 | 0 | 5 | 0 | 216 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 1 | 0 | 0 | FR |
| GB | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 6 | 66 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GB |
| GE | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 4 | 0 | 1 | 0 | 2 | 0 | 24 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 84 | 0 | 1 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | GR |
| HR | 0 | 0 | 8 | 0 | 12 | 0 | 1 | 0 | 1 | 0 | 3 | 5 | 0 | 0 | 2 | 0 | 6 | 1 | 0 | 1 | 0 | 9 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | HR |
| HU | 0 | 0 | 12 | 0 | 3 | 0 | 1 | 1 | 1 | 0 | 6 | 7 | 1 | 0 | 1 | 0 | 6 | 1 | 0 | 0 | 0 | 66 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | HU |
| IE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 4 | 9 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 0 | 0 | 3 | 0 | 2 | 0 | 1 | 0 | 2 | 0 | 1 | 3 | 0 | 0 | 5 | 0 | 14 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 143 | 0 | 0 | 0 | 0 | 0 | 0 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 47 | 0 | 0 | 0 | 0 | KG |
| KZT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 80 | 0 | 0 | 0 | 0 | KZT |
| LT | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 7 | 0 | 0 | 1 | 4 | 3 | 3 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 29 | 0 | 8 | 0 | LT |
| LU | 0 | 0 | 1 | 0 | 0 | 26 | 0 | 0 | 1 | 0 | 2 | 43 | 1 | 0 | 1 | 0 | 323 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 73 | 0 | 0 | LU |
| LV | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 3 | 2 | 9 | 0 | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 37 | 0 | LV |
| MD | 0 | 0 | 1 | 0 | 1 | 0 | 4 | 2 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 41 | MD |
| ME | 6 | 0 | 2 | 0 | 11 | 0 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 3 | 0 | 2 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | ME |
| MK | 8 | 0 | 1 | 0 | 3 | 0 | 21 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 36 | 0 | 2 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | MK |
| MT | 0 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 8 | 0 | 11 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | MT |
| NL | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 0 | 0 | 1 | 36 | 3 | 0 | 1 | 0 | 35 | 15 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NL |
| NO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NO |
| PL | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 8 | 14 | 4 | 1 | 0 | 0 | 7 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | PL |
| PT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 37 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | PT |
| RO | 0 | 0 | 2 | 0 | 2 | 0 | 11 | 1 | 0 | 0 | 2 | 2 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 7 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | RO |
| RS | 2 | 0 | 3 | 0 | 10 | 0 | 8 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 3 | 0 | 9 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | RS |
| RUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | RUE |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SE |
| SI | 0 | 0 | 22 | 0 | 2 | 1 | 1 | 0 | 1 | 0 | 3 | 7 | 0 | 0 | 2 | 0 | 8 | 1 | 0 | 0 | 0 | 4 | 0 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | SI |
| SK | 0 | 0 | 10 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 11 | 8 | 1 | 0 | 1 | 0 | 6 | 1 | 0 | 0 | 0 | 18 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 22 | 0 | 0 | 0 | 0 | TJ |
| TM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 25 | 0 | 0 | 0 | 0 | TM |
| TR | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | TR |
| UA | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 3 | UA |
| UZ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 57 | 0 | 0 | 0 | 0 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ATL |
| BAS | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 5 | 12 | 4 | 0 | 7 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | BAS |
| BLS | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | BLS |
| MED | 1 | 0 | 1 | 0 | 2 | 0 | 4 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 12 | 0 | 15 | 0 | 0 | 9 | 0 | 1 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | MED |
| NOS | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 0 | 10 | 20 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NOS |
| AST | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 0 | 0 | 0 | 0 | AST |
| NOA | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 4 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | NOA |
| EXC | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 3 | 1 | 0 | 3 | 1 | 7 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 3 | 1 | 14 | 0 | 0 | 0 | 0 | EXC |
| EU | 0 | 0 | 3 | 0 | 1 | 3 | 5 | 1 | 1 | 0 | 3 | 14 | 2 | 1 | 14 | 3 | 38 | 6 | 0 | 3 | 1 | 3 | 1 | 0 | 12 | 0 | 0 | 1 | 0 | 1 | 0 | EU |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |

Table C.8 Cont.: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of PPM. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 7 | 10 | 0 | 0 | 0 | 3 | 1 | 3 | 22 | 1 | 0 | 0 | 2 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 161 | 62 | AL |
| AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 20 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 36 | 1 | AM |
| AT | 0 | 0 | 0 | 1 | 0 | 6 | 0 | 1 | 1 | 1 | 0 | 4 | 5 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 137 | 129 | AT |
| AZ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 2 | 8 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 46 | 2 | AZ |
| BA | 5 | 0 | 0 | 0 | 0 | 5 | 1 | 3 | 15 | 1 | 0 | 1 | 4 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 122 | 53 | BA |
| BE | 0 | 0 | 0 | 26 | 1 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 324 | 321 | BE |
| BG | 1 | 3 | 0 | 0 | 0 | 4 | 0 | 21 | 13 | 4 | 0 | 0 | 3 | 0 | 0 | 5 | 15 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 244 | 198 | BG |
| BY | 0 | 0 | 0 | 0 | 1 | 20 | 0 | 2 | 0 | 13 | 1 | 0 | 3 | 0 | 0 | 1 | 24 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 124 | 48 | BY |
| CH | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 144 | 95 | CH |
| CY | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 78 | 5 | 0 | 0 | 0 | 1 | 15 | 0 | 5 | 1 | 0 | 0 | 0 | 128 | 39 | CY |
| CZ | 0 | 0 | 0 | 1 | 1 | 25 | 0 | 1 | 1 | 1 | 1 | 1 | 11 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 170 | 161 | CZ |
| DE | 0 | 0 | 0 | 7 | 1 | 8 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 3 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 201 | 194 | DE |
| DK | 0 | 0 | 0 | 2 | 6 | 5 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 17 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 132 | 123 | DK |
| EE | 0 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 13 | 4 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 8 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 115 | 93 | EE |
| ES | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 147 | 147 | ES |
| FI | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 51 | 42 | FI |
| FR | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 6 | 0 | 0 | 0 | 0 | 0 | 262 | 259 | FR |
| GB | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 86 | 84 | GB |
| GE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 1 | 16 | 3 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 45 | 3 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 1 | 7 | 0 | 0 | 0 | 3 | 1 | 5 | 7 | 2 | 0 | 0 | 1 | 0 | 0 | 9 | 7 | 0 | 0 | 0 | 1 | 13 | 0 | 0 | 1 | 0 | 0 | 0 | 173 | 134 | GR |
| HR | 1 | 0 | 0 | 0 | 0 | 7 | 1 | 3 | 11 | 1 | 0 | 7 | 5 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 114 | 83 | HR |
| HU | 0 | 0 | 0 | 0 | 1 | 17 | 0 | 9 | 11 | 2 | 0 | 4 | 34 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 203 | 175 | HU |
| IE | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 38 | 37 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | IS |
| IT | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 187 | 179 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 8 | 1 | 0 | 0 | 77 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 210 | 0 | KG |
| KZT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 7 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 123 | 1 | KZT |
| LT | 0 | 0 | 0 | 1 | 2 | 20 | 0 | 1 | 0 | 13 | 3 | 0 | 1 | 0 | 0 | 1 | 8 | 0 | 0 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 115 | 84 | LT |
| LU | 0 | 0 | 0 | 8 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 495 | 491 | LU |
| LV | 0 | 0 | 0 | 0 | 2 | 9 | 0 | 0 | 0 | 10 | 3 | 0 | 1 | 0 | 0 | 1 | 6 | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 105 | 81 | LV |
| MD | 0 | 0 | 0 | 0 | 1 | 11 | 0 | 37 | 2 | 8 | 0 | 0 | 3 | 0 | 0 | 3 | 70 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 198 | 69 | MD |
| ME | 47 | 2 | 0 | 0 | 0 | 3 | 0 | 3 | 19 | 1 | 0 | 0 | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 128 | 40 | ME |
| MK | 2 | 44 | 0 | 0 | 0 | 3 | 0 | 5 | 23 | 1 | 0 | 0 | 2 | 0 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 173 | 85 | MK |
| MT | 0 | 0 | 22 | 0 | 0 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 96 | 0 | 0 | 3 | 0 | 0 | 0 | 92 | 86 | MT |
| NL | 0 | 0 | 0 | 99 | 1 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 2 | 0 | 0 | 44 | 0 | 0 | 0 | 0 | 0 | 228 | 223 | NL |
| NO | 0 | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 31 | 5 | NO |
| PL | 0 | 0 | 0 | 1 | 2 | 118 | 0 | 1 | 1 | 3 | 2 | 0 | 7 | 0 | 0 | 0 | 10 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 195 | 175 | PL |
| PT | 0 | 0 | 0 | 0 | 0 | 0 | 292 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 344 | 343 | PT |
| RO | 1 | 1 | 0 | 0 | 0 | 9 | 0 | 96 | 9 | 4 | 0 | 0 | 7 | 0 | 0 | 2 | 24 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 193 | 147 | RO |
| RS | 5 | 3 | 0 | 0 | 0 | 7 | 0 | 14 | 90 | 1 | 0 | 1 | 7 | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 190 | 70 | RS |
| RUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 3 | RUE |
| SE | 0 | 0 | 0 | 0 | 9 | 1 | 0 | 0 | 0 | 1 | 17 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 44 | 29 | SE |
| SI | 0 | 0 | 0 | 0 | 0 | 6 | 1 | 1 | 2 | 1 | 0 | 47 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 155 | 146 | SI |
| SK | 0 | 0 | 0 | 1 | 1 | 36 | 0 | 4 | 4 | 2 | 0 | 2 | 113 | 0 | 0 | 0 | 10 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 238 | 218 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 50 | 2 | 0 | 0 | 65 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 152 | 0 | TJ |
| TM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 2 | 38 | 2 | 1 | 33 | 0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 111 | 1 | TM |
| TR | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 118 | 7 | 0 | 0 | 0 | 1 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 145 | 13 | TR |
| UA | 0 | 0 | 0 | 0 | 1 | 13 | 0 | 6 | 1 | 19 | 1 | 0 | 4 | 0 | 0 | 3 | 177 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 248 | 38 | UA |
| UZ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 8 | 8 | 1 | 1 | 119 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 215 | 1 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 7 | ATL |
| BAS | 0 | 0 | 0 | 1 | 4 | 8 | 0 | 0 | 0 | 5 | 12 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 19 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 74 | 61 | BAS |
| BLS | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 8 | 2 | 21 | 0 | 0 | 1 | 0 | 0 | 37 | 47 | 0 | 0 | 0 | 9 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 141 | 29 | BLS |
| MED | 1 | 1 | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 17 | 4 | 0 | 0 | 0 | 0 | 46 | 0 | 1 | 2 | 0 | 0 | 0 | 105 | 75 | MED |
| NOS | 0 | 0 | 0 | 3 | 5 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 54 | 47 | NOS |
| AST | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 2 | 7 | 1 | 5 | 0 | 0 | 0 | 1 | 0 | 21 | 0 | 0 | 0 | 0 | 33 | 1 | AST |
| NOA | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 8 | 0 | 0 | 0 | 30 | 22 | NOA |
| EXC | 0 | 0 | 0 | 0 | 1 | 3 | 2 | 2 | 1 | 25 | 1 | 0 | 1 | 1 | 1 | 5 | 8 | 5 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 96 | 32 | EXC |
| EU | 0 | 0 | 0 | 2 | 2 | 13 | 9 | 6 | 2 | 2 | 3 | 1 | 4 | 0 | 0 | 1 | 4 | 0 | 1 | 2 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 162 | 149 | EU |
| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |

Table C.9: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of $SO_x$. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 38 | 0 | 1 | 0 | 59 | 1 | 60 | 0 | 0 | 0 | 5 | 7 | 0 | 0 | 17 | 0 | 5 | 2 | 0 | 69 | 0 | 4 | 0 | 0 | 28 | 0 | 1 | 0 | 0 | 0 | 0 | AL |
| AM | 0 | 9 | 0 | 55 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 4 | 2 | 0 | 0 | -0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | AM |
| AT | 0 | 0 | 11 | 0 | 6 | 4 | 5 | 0 | 4 | 0 | 20 | 44 | 0 | 0 | 10 | 0 | 14 | 4 | 0 | 1 | 0 | 4 | 0 | 0 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | AT |
| AZ | 0 | 2 | 0 | 97 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 44 | 0 | 0 | 0 | 0 | AZ |
| BA | 2 | 0 | 2 | 0 | 190 | 1 | 16 | 0 | 1 | 0 | 11 | 13 | 0 | 0 | 17 | 0 | 7 | 3 | 0 | 7 | 0 | 8 | 0 | 0 | 26 | -0 | 0 | 0 | 0 | 0 | 0 | BA |
| BE | 0 | 0 | 1 | 0 | 1 | 69 | 1 | 0 | 0 | 0 | 8 | 51 | 1 | 0 | 14 | 0 | 54 | 42 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | BE |
| BG | 2 | 0 | 1 | 0 | 28 | 1 | 277 | 1 | 0 | 0 | 7 | 7 | 0 | 1 | 7 | 0 | 3 | 2 | 0 | 25 | 0 | 6 | 0 | 0 | 7 | 0 | 4 | 0 | 0 | 0 | 1 | BG |
| BY | 0 | 0 | 0 | 0 | 4 | 1 | 6 | 28 | 0 | 0 | 6 | 9 | 1 | 4 | 3 | 2 | 2 | 4 | 0 | 2 | 1 | 2 | 0 | 0 | 1 | 0 | 6 | 5 | 0 | 0 | 0 | BY |
| CH | 0 | 0 | 2 | 0 | 4 | 6 | 2 | 0 | 19 | -0 | 7 | 40 | 0 | 0 | 20 | 0 | 36 | 5 | 0 | 0 | 0 | 1 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | CH |
| CY | 1 | 0 | 0 | 1 | 8 | 0 | 39 | 1 | 0 | 11 | 2 | 2 | 0 | 0 | 5 | 0 | 2 | 1 | 0 | 45 | 0 | 1 | 0 | 0 | 5 | 0 | 4 | 0 | 0 | 0 | 0 | CY |
| CZ | 0 | 0 | 5 | 0 | 6 | 5 | 4 | 1 | 1 | 0 | 65 | 58 | 1 | 0 | 8 | 0 | 14 | 8 | 0 | 1 | 0 | 5 | 1 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | CZ |
| DE | 0 | 0 | 2 | 0 | 1 | 13 | 2 | 1 | 2 | 0 | 17 | 91 | 1 | 1 | 11 | 0 | 26 | 21 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | DE |
| DK | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 2 | 14 | 7 | 2 | 2 | 1 | 6 | 26 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | DK |
| EE | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 3 | 0 | 0 | 1 | 4 | 1 | 23 | 1 | 8 | 2 | 6 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | -0 | 3 | 3 | 0 | 0 | 0 | EE |
| ES | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 0 | 0 | 0 | 1 | 5 | 0 | 0 | 184 | 0 | 14 | 6 | 0 | 1 | -0 | 0 | 0 | 0 | 4 | -0 | 0 | 0 | 0 | 0 | 0 | ES |
| FI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 15 | 0 | 3 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | FI |
| FR | 0 | 0 | 1 | -0 | 3 | 12 | 2 | 0 | 2 | -0 | 6 | 28 | 0 | 0 | 40 | 0 | 63 | 21 | -0 | 1 | 0 | 1 | 2 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | FR |
| GB | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 7 | 1 | 0 | 2 | 0 | 5 | 67 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GB |
| GE | 0 | 2 | 0 | 44 | 2 | 0 | 5 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 15 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 19 | 0 | 0 | 0 | 0 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 8 | 0 | 1 | 0 | 31 | 1 | 173 | 1 | 0 | 0 | 5 | 6 | 0 | 0 | 12 | 0 | 4 | 1 | 0 | 126 | 0 | 4 | 0 | 0 | 17 | 0 | 3 | 0 | 0 | 0 | 1 | GR |
| HR | 1 | 0 | 4 | 0 | 90 | 2 | 13 | 1 | 1 | 0 | 15 | 17 | 0 | 0 | 18 | 0 | 9 | 3 | 0 | 4 | 0 | 11 | 0 | 0 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | HR |
| HU | 1 | 0 | 4 | 0 | 37 | 2 | 12 | 1 | 1 | 0 | 24 | 23 | 0 | 0 | 10 | 0 | 7 | 4 | 0 | 3 | 0 | 40 | 0 | 0 | 17 | 0 | 1 | 1 | 0 | 0 | 0 | HU |
| IE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 1 | 0 | 3 | 25 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 1 | 0 | 3 | 0 | 34 | 2 | 10 | 0 | 2 | 0 | 8 | 13 | 0 | 0 | 35 | 0 | 19 | 3 | 0 | 8 | 0 | 3 | 0 | 0 | 115 | 0 | 0 | 0 | 0 | 0 | 0 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 229 | 185 | 0 | 0 | 0 | 0 | KG |
| KZT | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 227 | 0 | 0 | 0 | 0 | KZT |
| LT | 0 | 0 | 0 | 0 | 2 | 2 | 3 | 8 | 0 | 0 | 4 | 11 | 1 | 5 | 2 | 3 | 3 | 6 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 3 | 16 | 0 | 1 | 0 | LT |
| LU | 0 | 0 | 1 | 0 | 1 | 33 | 1 | 0 | 1 | 0 | 12 | 63 | 1 | 1 | 18 | 0 | 53 | 27 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | -0 | 0 | 0 | 2 | 0 | 0 | LU |
| LV | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 7 | 0 | 0 | 2 | 7 | 1 | 8 | 1 | 4 | 2 | 6 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | -0 | 3 | 7 | 0 | 1 | 0 | LV |
| MD | 0 | 0 | 1 | 1 | 10 | 1 | 27 | 4 | 0 | 0 | 8 | 7 | 0 | 1 | 4 | 1 | 2 | 2 | 0 | 6 | 0 | 4 | 0 | 0 | 2 | 0 | 7 | 1 | 0 | 0 | 12 | MD |
| ME | 8 | 0 | 1 | 0 | 91 | 1 | 32 | 0 | 0 | 0 | 6 | 9 | 0 | 0 | 15 | 0 | 6 | 2 | 0 | 21 | 0 | 4 | 0 | 0 | 24 | 0 | 1 | 0 | 0 | 0 | 0 | ME |
| MK | 11 | 0 | 1 | 0 | 41 | 1 | 132 | 0 | 0 | 0 | 6 | 7 | 0 | 0 | 11 | 0 | 4 | 1 | 0 | 69 | 0 | 5 | 0 | 0 | 14 | 0 | 2 | 0 | 0 | 0 | 0 | MK |
| MT | 2 | 0 | 1 | 0 | 33 | 1 | 19 | 0 | 0 | 0 | 4 | 7 | 0 | 0 | 50 | 0 | 14 | 3 | 0 | 23 | 0 | 2 | 0 | 0 | 86 | 0 | 0 | 0 | 0 | 0 | 0 | MT |
| NL | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 6 | 48 | 2 | 0 | 9 | 0 | 28 | 46 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | NL |
| NO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 4 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NO |
| PL | 0 | 0 | 1 | 0 | 7 | 3 | 3 | 4 | 0 | 0 | 20 | 32 | 2 | 1 | 5 | 1 | 7 | 9 | 0 | 1 | 0 | 4 | 1 | 0 | 4 | 0 | 1 | 2 | 0 | 0 | 0 | PL |
| PT | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 160 | 0 | 9 | 5 | 0 | 0 | -0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | PT |
| RO | 1 | 0 | 1 | 1 | 24 | 1 | 44 | 2 | 0 | 0 | 10 | 10 | 0 | 1 | 6 | 0 | 3 | 2 | 0 | 8 | 0 | 11 | 0 | 0 | 6 | 0 | 3 | 1 | 0 | 0 | 2 | RO |
| RS | 4 | 0 | 2 | 0 | 79 | 1 | 42 | 1 | 0 | 0 | 12 | 14 | 0 | 0 | 12 | 0 | 5 | 2 | 0 | 14 | 0 | 13 | 0 | 0 | 15 | 0 | 1 | 0 | 0 | 0 | 1 | RS |
| RUE | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 30 | 0 | 0 | 0 | 0 | RUE |
| SE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 3 | 1 | 2 | 1 | 3 | 1 | 7 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | SE |
| SI | 0 | 0 | 8 | 0 | 22 | 3 | 9 | 1 | 2 | 0 | 16 | 24 | 0 | 0 | 17 | 0 | 11 | 4 | 0 | 2 | 0 | 7 | 0 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | SI |
| SK | 0 | 0 | 4 | 0 | 20 | 2 | 6 | 2 | 1 | 0 | 30 | 24 | 0 | 0 | 7 | 0 | 7 | 5 | 0 | 2 | 0 | 20 | 0 | 0 | 12 | 0 | 1 | 1 | 0 | 0 | 0 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 121 | 0 | 0 | 0 | 0 | TJ |
| TM | 0 | 0 | 0 | 4 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 12 | 123 | 0 | 0 | 0 | 0 | TM |
| TR | 1 | 1 | 0 | 4 | 5 | 0 | 29 | 1 | 0 | 1 | 2 | 2 | 0 | 0 | 3 | 0 | 1 | 1 | 1 | 15 | 0 | 1 | 0 | 0 | 2 | 0 | 6 | 0 | 0 | 0 | 0 | TR |
| UA | 0 | 0 | 0 | 2 | 6 | 1 | 14 | 6 | 0 | 0 | 6 | 7 | 0 | 2 | 3 | 1 | 2 | 2 | 0 | 4 | 0 | 3 | 0 | 0 | 2 | 0 | 11 | 1 | 0 | 0 | 2 | UA |
| UZ | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 | 209 | 0 | 0 | 0 | 0 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ATL |
| BAS | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 2 | 9 | 2 | 5 | 1 | 5 | 3 | 11 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | BAS |
| BLS | 0 | 0 | 0 | 6 | 6 | 1 | 36 | 2 | 0 | 0 | 4 | 4 | 0 | 1 | 2 | 0 | 1 | 2 | 2 | 9 | 0 | 2 | 0 | 0 | 2 | 0 | 12 | 1 | 0 | 0 | 1 | BLS |
| MED | 2 | 0 | 1 | 0 | 27 | 1 | 43 | 0 | 0 | 2 | 4 | 7 | 0 | 0 | 48 | 0 | 14 | 3 | 0 | 41 | 0 | 2 | 0 | 0 | 41 | 0 | 2 | 0 | 0 | 0 | 0 | MED |
| NOS | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 8 | 1 | 1 | 2 | 0 | 6 | 35 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NOS |
| AST | 0 | 0 | 0 | 4 | 1 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 15 | 53 | 0 | 0 | 0 | 0 | AST |
| NOA | 1 | 0 | 0 | 0 | 10 | 0 | 23 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 24 | 0 | 5 | 1 | 0 | 25 | 0 | 1 | 0 | 0 | 14 | 0 | 1 | 0 | 0 | 0 | 0 | NOA |
| EXC | 0 | 0 | 0 | 1 | 3 | 1 | 6 | 1 | 0 | 0 | 2 | 5 | 0 | 1 | 7 | 1 | 3 | 3 | 0 | 2 | 1 | 1 | 0 | 0 | 3 | 6 | 50 | 0 | 0 | 0 | 0 | EXC |
| EU | 0 | 0 | 1 | 0 | 8 | 5 | 17 | 1 | 1 | 0 | 8 | 21 | 1 | 1 | 36 | 2 | 16 | 13 | 0 | 6 | 1 | 3 | 1 | 0 | 12 | 0 | 1 | 1 | 0 | 0 | 0 | EU |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |

Table C.9 Cont.: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of SO$_x$. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 23 | 40 | 1 | 0 | 0 | 17 | 1 | 36 | 101 | 3 | 0 | 1 | 2 | 0 | 0 | 4 | 13 | 0 | 1 | 1 | 1 | 52 | 1 | 0 | 4 | 7 | 3 | 23 | 541 | 258 | AL |
| AM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 4 | 1 | 12 | 0 | 0 | 0 | 0 | 6 | 99 | 7 | 5 | 0 | 0 | 1 | 1 | 0 | 41 | 0 | 8 | 0 | 21 | 233 | 13 | AM |
| AT | 0 | 0 | 0 | 2 | 0 | 36 | 1 | 14 | 8 | 2 | 0 | 4 | 4 | 0 | 0 | 1 | 10 | 0 | 1 | 1 | 0 | 6 | 5 | 0 | 1 | 8 | 1 | 3 | 235 | 201 | AT |
| AZ | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 4 | 1 | 29 | 0 | 0 | 0 | 0 | 10 | 49 | 11 | 9 | 0 | 0 | 1 | 1 | 0 | 31 | 0 | 6 | 0 | 16 | 273 | 13 | AZ |
| BA | 11 | 3 | 0 | 1 | 0 | 29 | 1 | 35 | 84 | 3 | 0 | 1 | 5 | -0 | 0 | 2 | 15 | 0 | 1 | 1 | 0 | 22 | 3 | 0 | 2 | 6 | 2 | 7 | 495 | 183 | BA |
| BE | 0 | 0 | 0 | 14 | 0 | 19 | 0 | 2 | 1 | 2 | 0 | 0 | 1 | -0 | 0 | 0 | 5 | 0 | 7 | 5 | 0 | 1 | 53 | 0 | 0 | 13 | 8 | 2 | 295 | 284 | BE |
| BG | 5 | 10 | 0 | 0 | 0 | 32 | 0 | 131 | 59 | 15 | 0 | 0 | 4 | 0 | 0 | 8 | 56 | 0 | 0 | 1 | 5 | 10 | 2 | 1 | 2 | 6 | 2 | 10 | 702 | 512 | BG |
| BY | 0 | 1 | 0 | 1 | 0 | 64 | 0 | 11 | 5 | 30 | 1 | 0 | 2 | -0 | 0 | 4 | 40 | 0 | 1 | 6 | 0 | 1 | 4 | 1 | 0 | 4 | 2 | 2 | 250 | 129 | BY |
| CH | 0 | 0 | 0 | 2 | 0 | 14 | 1 | 3 | 3 | 0 | 0 | 0 | 1 | -0 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 6 | 6 | 0 | 1 | 9 | 2 | 3 | 188 | 160 | CH |
| CY | 2 | 4 | 0 | 0 | 0 | 9 | 0 | 22 | 13 | 13 | 0 | 0 | 1 | 0 | 0 | 380 | 30 | 0 | 0 | 0 | 4 | 60 | 1 | 22 | 3 | 9 | 10 | 32 | 605 | 146 | CY |
| CZ | 0 | 0 | 0 | 2 | 0 | 84 | 0 | 12 | 9 | 4 | 0 | 1 | 8 | 0 | 0 | 1 | 17 | 0 | 1 | 3 | 0 | 3 | 9 | 0 | 0 | 9 | 2 | 2 | 331 | 290 | CZ |
| DE | 0 | 0 | 0 | 7 | 0 | 41 | 0 | 5 | 2 | 3 | 1 | 0 | 2 | -0 | 0 | 0 | 8 | 0 | 3 | 9 | 0 | 2 | 24 | 0 | 0 | 10 | 5 | 2 | 265 | 247 | DE |
| DK | 0 | 0 | 0 | 3 | 1 | 19 | 0 | 2 | 1 | 5 | 2 | 0 | 0 | -0 | 0 | 0 | 5 | 0 | 3 | 28 | 0 | 0 | 39 | 0 | 0 | 8 | 10 | 1 | 108 | 93 | DK |
| EE | 0 | 0 | 0 | 1 | 0 | 14 | 0 | 3 | 1 | 31 | 2 | 0 | 0 | -0 | 0 | 3 | 14 | 0 | 1 | 18 | 0 | 0 | 6 | 1 | 0 | 4 | 3 | 2 | 132 | 72 | EE |
| ES | 0 | 0 | 0 | 1 | 0 | 3 | 19 | 1 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 14 | 3 | 0 | 2 | 13 | 5 | 5 | 249 | 243 | ES |
| FI | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | 0 | 14 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | 6 | 0 | 0 | 2 | 0 | 0 | 3 | 2 | 1 | 61 | 34 | FI |
| FR | 0 | 0 | 0 | 4 | 0 | 13 | 1 | 2 | 2 | 1 | 0 | 0 | 1 | -0 | 0 | 0 | 1 | 0 | 9 | 2 | 0 | 8 | 20 | 0 | 1 | 11 | 7 | 3 | 215 | 204 | FR |
| GB | 0 | 0 | 0 | 2 | 0 | 6 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | -0 | 0 | 0 | 2 | 0 | 10 | 2 | 0 | 0 | 17 | 0 | 0 | 10 | 11 | 0 | 105 | 99 | GB |
| GE | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 8 | 2 | 23 | 0 | 0 | 0 | 0 | 5 | 68 | 18 | 4 | 0 | 0 | 3 | 1 | 0 | 22 | 0 | 6 | 1 | 19 | 226 | 23 | GE |
| GL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | GL |
| GR | 7 | 26 | 1 | 0 | 0 | 21 | 1 | 52 | 48 | 8 | 0 | 0 | 3 | -0 | 0 | 13 | 31 | 0 | 1 | 1 | 2 | 49 | 1 | 1 | 4 | 7 | 4 | 24 | 604 | 428 | GR |
| HR | 4 | 2 | 0 | 1 | 0 | 39 | 1 | 32 | 57 | 3 | 0 | 4 | 6 | -0 | 0 | 2 | 16 | 0 | 1 | 1 | 0 | 28 | 3 | 0 | 1 | 7 | 2 | 5 | 398 | 221 | HR |
| HU | 2 | 2 | 0 | 1 | 0 | 79 | 1 | 51 | 54 | 6 | 0 | 3 | 17 | -0 | 0 | 3 | 34 | 0 | 1 | 2 | 0 | 9 | 4 | 1 | 1 | 7 | 2 | 4 | 444 | 301 | HU |
| IE | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 12 | 1 | 0 | 0 | 5 | 0 | 0 | 12 | 13 | 0 | 62 | 59 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 6 | 0 | 6 | 4 | IS |
| IT | 3 | 3 | 1 | 1 | 0 | 19 | 2 | 12 | 19 | 1 | 0 | 2 | 3 | 0 | 0 | 1 | 5 | 0 | 2 | 0 | 0 | 57 | 2 | 0 | 3 | 9 | 4 | 15 | 325 | 256 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 8 | 2 | 4 | 1 | 190 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 7 | 0 | 20 | 629 | 1 | KG |
| KZT | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 1 | 79 | 0 | 0 | 0 | 0 | 2 | 3 | 12 | 15 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 5 | 0 | 6 | 371 | 9 | KZT |
| LT | 0 | 0 | 0 | 1 | 0 | 51 | 0 | 8 | 3 | 23 | 1 | 0 | 1 | -0 | 0 | 3 | 23 | 0 | 1 | 14 | 0 | 1 | 7 | 1 | 0 | 5 | 3 | 2 | 194 | 124 | LT |
| LU | 0 | 0 | 0 | 9 | 0 | 26 | 1 | 4 | 1 | 2 | 0 | 0 | 2 | -0 | 0 | 0 | 7 | 0 | 5 | 3 | 0 | 2 | 26 | 0 | 0 | 12 | 5 | 3 | 272 | 258 | LU |
| LV | 0 | 0 | 0 | 1 | 0 | 27 | 0 | 6 | 2 | 24 | 2 | 0 | 1 | -0 | 0 | 3 | 19 | 0 | 1 | 14 | 0 | 1 | 7 | 1 | 0 | 4 | 3 | 2 | 146 | 82 | LV |
| MD | 1 | 2 | 0 | 0 | 0 | 57 | 0 | 102 | 14 | 25 | 0 | 0 | 5 | 0 | 0 | 9 | 134 | 1 | 0 | 2 | 4 | 4 | 2 | 2 | 1 | 6 | 2 | 5 | 455 | 234 | MD |
| ME | 59 | 11 | 0 | 0 | 0 | 17 | 1 | 35 | 95 | 3 | 0 | 1 | 3 | 0 | 0 | 3 | 12 | 0 | 1 | 1 | 0 | 29 | 2 | 0 | 3 | 7 | 2 | 15 | 461 | 177 | ME |
| MK | 10 | 48 | 0 | 0 | 0 | 21 | 1 | 53 | 93 | 5 | 0 | 1 | 3 | 0 | 0 | 5 | 19 | 0 | 1 | 1 | 1 | 19 | 1 | 0 | 3 | 7 | 2 | 18 | 567 | 331 | MK |
| MT | 3 | 4 | 81 | 0 | 0 | 10 | 2 | 14 | 17 | 1 | 0 | 1 | 1 | 0 | 0 | 3 | 4 | 0 | 2 | 0 | 0 | 265 | 2 | 0 | 16 | 9 | 17 | 41 | 386 | 319 | MT |
| NL | 0 | 0 | 0 | 24 | 0 | 21 | 0 | 2 | 0 | 3 | 1 | 0 | 1 | -0 | 0 | 0 | 7 | 0 | 6 | 8 | 0 | 1 | 76 | 0 | 0 | 12 | 10 | 2 | 232 | 218 | NL |
| NO | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 4 | 0 | 0 | 3 | 3 | 0 | 22 | 12 | NO |
| PL | 0 | 0 | 0 | 2 | 0 | 160 | 0 | 12 | 9 | 9 | 1 | 1 | 5 | -0 | 0 | 2 | 26 | 0 | 1 | 10 | 0 | 2 | 10 | 0 | 0 | 7 | 3 | 2 | 339 | 278 | PL |
| PT | 0 | 0 | 0 | 1 | 0 | 2 | 70 | 1 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 41 | 0 | 0 | 3 | 3 | 0 | 1 | 13 | 10 | 2 | 261 | 257 | PT |
| RO | 3 | 4 | 0 | 0 | 0 | 52 | 0 | 219 | 41 | 13 | 0 | 1 | 8 | -0 | 0 | 7 | 69 | 0 | 0 | 2 | 3 | 6 | 2 | 1 | 1 | 6 | 1 | 6 | 556 | 385 | RO |
| RS | 11 | 9 | 0 | 1 | 0 | 39 | 1 | 94 | 187 | 6 | 0 | 1 | 7 | -0 | 0 | 3 | 28 | 0 | 1 | 1 | 1 | 14 | 2 | 1 | 2 | 7 | 2 | 10 | 606 | 275 | RS |
| RUE | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 69 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 1 | 127 | 10 | RUE |
| SE | 0 | 0 | 0 | 1 | 1 | 5 | 0 | 1 | 0 | 5 | 4 | 0 | 0 | -0 | 0 | 0 | 2 | 0 | 1 | 8 | 0 | 0 | 7 | 0 | 0 | 4 | 3 | 1 | 47 | 29 | SE |
| SI | 1 | 1 | 0 | 1 | 0 | 39 | 1 | 23 | 21 | 3 | 0 | 13 | 5 | 0 | 0 | 1 | 14 | 0 | 1 | 1 | 0 | 27 | 4 | 0 | 1 | 8 | 2 | 4 | 326 | 259 | SI |
| SK | 1 | 1 | 0 | 1 | 0 | 115 | 1 | 30 | 27 | 6 | 0 | 2 | 26 | 0 | 0 | 3 | 32 | 0 | 1 | 2 | 0 | 6 | 5 | 1 | 1 | 7 | 2 | 3 | 390 | 295 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 25 | 6 | 4 | 1 | 180 | 0 | 0 | 0 | 0 | 0 | 16 | 0 | 8 | 0 | 23 | 406 | 1 | TJ |
| TM | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 1 | 30 | 0 | 0 | 0 | 2 | 22 | 16 | 7 | 61 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 6 | 0 | 15 | 289 | 9 | TM |
| TR | 1 | 2 | 0 | 0 | 0 | 10 | 0 | 23 | 9 | 16 | 0 | 0 | 1 | 0 | 1 | 220 | 35 | 1 | 0 | 0 | 5 | 12 | 0 | 19 | 2 | 8 | 2 | 27 | 394 | 90 | TR |
| UA | 1 | 1 | 0 | 0 | 0 | 51 | 0 | 33 | 8 | 45 | 0 | 0 | 3 | 0 | 1 | 9 | 165 | 1 | 0 | 2 | 3 | 2 | 2 | 2 | 0 | 5 | 2 | 4 | 396 | 137 | UA |
| UZ | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 1 | 34 | 0 | 0 | 0 | 5 | 8 | 8 | 8 | 144 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 6 | 0 | 12 | 476 | 9 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 8 | 0 | 18 | 14 | ATL |
| BAS | 0 | 0 | 0 | 1 | 1 | 21 | 0 | 3 | 1 | 12 | 3 | 0 | 1 | -0 | 0 | 1 | 8 | 0 | 2 | 29 | 0 | 0 | 13 | 0 | 0 | 5 | 5 | 1 | 104 | 74 | BAS |
| BLS | 1 | 2 | 0 | 0 | 0 | 28 | 0 | 46 | 10 | 53 | 0 | 0 | 2 | 0 | 1 | 45 | 125 | 1 | 0 | 1 | 21 | 5 | 1 | 6 | 1 | 6 | 6 | 7 | 409 | 141 | BLS |
| MED | 4 | 6 | 2 | 0 | 0 | 14 | 2 | 22 | 22 | 5 | 0 | 1 | 2 | 0 | 0 | 49 | 17 | 0 | 2 | 1 | 2 | 133 | 2 | 4 | 8 | 9 | 12 | 24 | 388 | 250 | MED |
| NOS | 0 | 0 | 0 | 2 | 1 | 7 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 5 | 4 | 0 | 0 | 35 | 0 | 0 | 7 | 13 | 0 | 78 | 71 | NOS |
| AST | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 14 | 0 | 0 | 0 | 1 | 4 | 47 | 6 | 20 | 0 | 0 | 0 | 4 | 0 | 65 | 1 | 11 | 1 | 15 | 178 | 12 | AST |
| NOA | 2 | 4 | 2 | 0 | 0 | 5 | 2 | 10 | 9 | 2 | 0 | 0 | 1 | 0 | 0 | 15 | 7 | 0 | 1 | 0 | 1 | 53 | 1 | 1 | 21 | 12 | 5 | 29 | 171 | 118 | NOA |
| EXC | 0 | 1 | 0 | 0 | 0 | 11 | 1 | 8 | 4 | 47 | 0 | 0 | 1 | 0 | 1 | 11 | 16 | 9 | 1 | 1 | 0 | 3 | 2 | 3 | 0 | 5 | 1 | 4 | 209 | 57 | EXC |
| EU | 1 | 2 | 0 | 2 | 0 | 31 | 4 | 22 | 10 | 6 | 1 | 1 | 2 | -0 | 0 | 2 | 13 | 0 | 5 | 4 | 0 | 10 | 10 | 0 | 1 | 8 | 5 | 4 | 254 | 207 | EU |
| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |

Table C.10: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of NO$_x$. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 14 | 0 | 2 | 0 | 6 | 0 | 6 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 1 | 0 | 3 | 2 | 0 | 8 | 0 | 3 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | AL |
| AM | 0 | 29 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | AM |
| AT | 0 | 0 | 40 | 0 | 0 | 5 | 1 | 0 | 12 | 0 | 15 | 85 | 1 | 0 | 2 | 0 | 20 | 9 | 0 | 0 | 0 | 7 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | AT |
| AZ | 0 | 12 | 0 | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | AZ |
| BA | 0 | 0 | 5 | 0 | 20 | 1 | 1 | 0 | 1 | 0 | 4 | 9 | 0 | 0 | 1 | 0 | 3 | 2 | 0 | 0 | 0 | 5 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | BA |
| BE | 0 | 0 | 5 | 0 | 0 | -2 | 0 | 0 | 2 | 0 | 7 | 58 | 3 | 0 | 3 | 0 | 52 | 35 | 0 | 0 | 0 | 1 | 3 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | BE |
| BG | 1 | 0 | 1 | 0 | 2 | 0 | 23 | 1 | 0 | 0 | 1 | 3 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 4 | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | BG |
| BY | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 9 | 1 | 0 | 3 | 10 | 2 | 1 | 0 | 2 | 4 | 5 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 2 | 2 | 0 | 1 | 0 | BY |
| CH | 0 | 0 | 14 | 0 | 0 | 7 | 0 | 0 | 66 | 0 | 6 | 109 | 0 | 0 | 3 | 0 | 65 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 43 | 0 | 0 | 0 | 1 | 0 | 0 | CH |
| CY | 0 | 0 | 0 | 0 | 0 | -0 | 2 | 0 | 0 | 5 | -0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -0 | 0 | 0 | CY |
| CZ | 0 | 0 | 23 | 0 | 1 | 5 | 1 | 1 | 4 | 0 | 14 | 75 | 1 | 0 | 2 | 0 | 19 | 12 | 0 | 0 | 0 | 8 | 1 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | CZ |
| DE | 0 | 0 | 11 | 0 | 0 | 9 | 0 | 1 | 7 | 0 | 10 | 89 | 3 | 0 | 2 | 0 | 35 | 21 | 0 | 0 | 0 | 2 | 1 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | DE |
| DK | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 2 | 18 | 7 | 0 | 0 | 0 | 7 | 11 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | DK |
| EE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | EE |
| ES | 0 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 1 | 7 | 0 | 0 | 61 | 0 | 25 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | ES |
| FI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 2 | 0 | -0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | FI |
| FR | 0 | 0 | 5 | 0 | 0 | 15 | 0 | 0 | 7 | 0 | 5 | 55 | 1 | 0 | 6 | 0 | 103 | 27 | 0 | 0 | 0 | 1 | 1 | 0 | 13 | 0 | 0 | 0 | 1 | 0 | 0 | FR |
| GB | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 14 | 2 | 0 | 0 | 0 | 5 | 31 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GB |
| GE | 0 | 7 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 12 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | GE |
| GL | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 2 | 0 | 1 | 0 | 2 | 0 | 17 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 28 | 0 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | GR |
| HR | 0 | 0 | 9 | 0 | 8 | 1 | 1 | 0 | 1 | 0 | 6 | 14 | 0 | 0 | 1 | 0 | 4 | 3 | 0 | 0 | 0 | 5 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | HR |
| HU | 0 | 0 | 14 | 0 | 4 | 2 | 2 | 1 | 2 | 0 | 12 | 26 | 1 | 0 | 1 | 0 | 7 | 6 | 0 | 1 | 0 | 23 | 0 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | HU |
| IE | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 11 | 2 | 0 | 0 | 0 | 5 | 41 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 0 | 0 | 13 | 0 | 2 | 1 | 1 | 0 | 6 | 0 | 4 | 18 | 0 | 0 | 2 | 0 | 13 | 3 | 0 | 1 | 0 | 3 | 0 | 0 | 200 | 0 | 0 | 0 | 0 | 0 | 0 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 23 | 0 | 0 | 0 | 0 | KG |
| KZT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 27 | 0 | 0 | 0 | 0 | KZT |
| LT | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 6 | 0 | 0 | 3 | 12 | 2 | 1 | 1 | 1 | 5 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 3 | 0 | 2 | 0 | LT |
| LU | 0 | 0 | 6 | 0 | 0 | 18 | 0 | 0 | 4 | 0 | 9 | 69 | 1 | 0 | 3 | 0 | 62 | 22 | 0 | 0 | 0 | 1 | 2 | 0 | 4 | -0 | 0 | 0 | -1 | 0 | 0 | LU |
| LV | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 5 | 0 | 0 | 1 | 5 | 1 | 1 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | LV |
| MD | 0 | 0 | 2 | 0 | 1 | 1 | 4 | 3 | 0 | 0 | 3 | 8 | 1 | 0 | 1 | 1 | 3 | 4 | 0 | 1 | 0 | 4 | 0 | 0 | 3 | 0 | 1 | 1 | 0 | 1 | 5 | MD |
| ME | 3 | 0 | 3 | 0 | 13 | 0 | 4 | 0 | 1 | 0 | 2 | 5 | 0 | 0 | 1 | 0 | 3 | 2 | 0 | 4 | 0 | 4 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | ME |
| MK | 4 | 0 | 2 | 0 | 4 | 0 | 14 | 0 | 0 | 0 | 2 | 4 | 0 | 0 | 1 | 0 | 2 | 2 | 0 | 11 | 0 | 3 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | MK |
| MT | 0 | 0 | 0 | 0 | 1 | -0 | 1 | 0 | 0 | 0 | -0 | -1 | -0 | -0 | 1 | -0 | 1 | -1 | 0 | 3 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | -0 | -0 | -0 | 0 | MT |
| NL | 0 | 0 | 3 | 0 | 0 | 8 | 0 | 0 | 1 | 0 | 5 | 65 | 6 | 0 | 2 | 0 | 34 | 31 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | NL |
| NO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NO |
| PL | 0 | 0 | 7 | 0 | 1 | 2 | 0 | 3 | 1 | 0 | 10 | 28 | 3 | 0 | 1 | 1 | 9 | 8 | 0 | 0 | 0 | 4 | 1 | 0 | 3 | 0 | 0 | 1 | 0 | 1 | 0 | PL |
| PT | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 31 | 0 | 9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | PT |
| RO | 0 | 0 | 4 | 0 | 2 | 1 | 7 | 1 | 1 | 0 | 4 | 9 | 1 | 0 | 1 | 0 | 3 | 3 | 0 | 1 | 0 | 8 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 1 | RO |
| RS | 1 | 0 | 5 | 0 | 8 | 1 | 6 | 1 | 1 | 0 | 5 | 12 | 1 | 0 | 1 | 0 | 4 | 4 | 0 | 4 | 0 | 11 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | RS |
| RUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | RUE |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SE |
| SI | 0 | 0 | 31 | 0 | 2 | 2 | 1 | 0 | 5 | 0 | 13 | 40 | 1 | 0 | 1 | 0 | 10 | 6 | 0 | 1 | 0 | 8 | 0 | 0 | 67 | 0 | 0 | 0 | 0 | 0 | 0 | SI |
| SK | 0 | 0 | 13 | 0 | 2 | 2 | 1 | 1 | 2 | 0 | 13 | 25 | 1 | 0 | 1 | 0 | 7 | 6 | 0 | 0 | 0 | 19 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 12 | 0 | 0 | 0 | 0 | TJ |
| TM | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | TM |
| TR | 0 | 2 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | TR |
| UA | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 3 | 0 | 0 | 2 | 6 | 1 | 0 | 0 | 1 | 2 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | UA |
| UZ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 23 | 0 | 0 | 0 | 0 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | -0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ATL |
| BAS | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 6 | 1 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | BAS |
| BLS | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | 1 | BLS |
| MED | 0 | 0 | 1 | 0 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | -0 | 0 | 1 | 0 | 3 | -0 | 0 | 4 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | MED |
| NOS | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 11 | 2 | 0 | 0 | 0 | 6 | 5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NOS |
| AST | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | AST |
| NOA | 0 | 0 | 0 | 0 | 0 | -0 | 1 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | -0 | 0 | 0 | NOA |
| EXC | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 6 | 0 | 0 | 2 | 0 | 5 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 6 | 0 | 0 | 0 | 0 | EXC |
| EU | 0 | 0 | 5 | 0 | 1 | 4 | 2 | 1 | 3 | 0 | 4 | 26 | 1 | 0 | 9 | 0 | 24 | 11 | 0 | 1 | 0 | 2 | 1 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | EU |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |

Table C.10 Cont.: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of $NO_x$. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 6 | 4 | 0 | 1 | 0 | 4 | 0 | 5 | 19 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 6 | 1 | 0 | 0 | 5 | 0 | 0 | 107 | 53 | AL |
| AM | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 5 | 0 | 0 | 0 | 0 | 1 | 28 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 5 | 0 | 5 | 0 | 0 | 98 | 10 | AM |
| AT | 0 | 0 | 0 | 6 | 1 | 8 | 0 | 3 | 1 | 2 | 0 | 5 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 2 | 6 | 0 | 0 | 6 | 0 | 0 | 249 | 230 | AT |
| AZ | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 13 | 0 | 0 | 0 | 0 | 1 | 11 | 2 | 1 | 0 | 0 | 1 | 0 | 1 | 5 | 0 | 4 | 0 | 0 | 102 | 9 | AZ |
| BA | 2 | 0 | 0 | 1 | 0 | 3 | 0 | 3 | 7 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 4 | 0 | 0 | 84 | 51 | BA |
| BE | 0 | 0 | 0 | 29 | 1 | 8 | 0 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 6 | 4 | 0 | 1 | 25 | 0 | 0 | 15 | 0 | 0 | 218 | 209 | BE |
| BG | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 15 | 7 | 3 | 0 | 0 | 1 | 0 | 0 | 1 | 5 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 5 | 0 | 0 | 82 | 58 | BG |
| BY | 0 | 0 | 0 | 1 | 1 | 18 | 0 | 3 | 1 | 28 | 2 | 0 | 1 | 0 | 0 | 1 | 11 | 0 | 1 | 4 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 116 | 62 | BY |
| CH | 0 | 0 | 0 | 7 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 7 | 0 | 0 | 6 | 0 | 0 | 343 | 274 | CH |
| CY | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 23 | 1 | 0 | 0 | -0 | 1 | 9 | -0 | 2 | 0 | 5 | 0 | 0 | 42 | 13 | CY |
| CZ | 0 | 0 | 0 | 7 | 1 | 14 | 0 | 2 | 1 | 4 | 1 | 2 | 4 | 0 | 0 | 0 | 3 | 0 | 2 | 3 | 0 | 1 | 8 | 0 | 0 | 8 | 0 | 0 | 216 | 199 | CZ |
| DE | 0 | 0 | 0 | 14 | 1 | 12 | 0 | 1 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 4 | 5 | 0 | 1 | 16 | 0 | 0 | 10 | 0 | 0 | 235 | 220 | DE |
| DK | 0 | 0 | 0 | 4 | 3 | 10 | 0 | 1 | 0 | 4 | 3 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 10 | 0 | 0 | 13 | 0 | 0 | 6 | 0 | 0 | 82 | 72 | DK |
| EE | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 24 | 12 | EE |
| ES | 0 | 0 | 0 | 2 | 0 | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 2 | 3 | 0 | 0 | 6 | 0 | 0 | 117 | 115 | ES |
| FI | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 0 | 9 | 3 | FI |
| FR | 0 | 0 | 0 | 12 | 1 | 5 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 2 | 0 | 2 | 21 | 0 | 0 | 8 | 0 | 0 | 268 | 256 | FR |
| GB | 0 | 0 | 0 | 6 | 1 | 5 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 3 | 0 | 0 | 11 | 0 | 0 | 6 | 0 | 0 | 78 | 73 | GB |
| GE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 16 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 70 | 7 | GE |
| GL | 0 | -0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | GL |
| GR | 1 | 3 | 0 | 0 | 0 | 1 | 0 | 6 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 1 | 0 | 1 | 5 | 0 | 0 | 0 | 5 | 0 | 0 | 83 | 64 | GR |
| HR | 1 | 0 | 0 | 1 | 0 | 3 | 0 | 4 | 5 | 1 | 0 | 2 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 3 | 2 | 0 | 0 | 4 | 0 | 0 | 99 | 80 | HR |
| HU | 1 | 0 | 0 | 2 | 1 | 16 | 0 | 14 | 11 | 5 | 0 | 3 | 8 | 0 | 0 | 0 | 5 | 0 | 2 | 2 | 0 | 2 | 4 | 0 | 0 | 7 | 0 | 0 | 189 | 157 | HU |
| IE | 0 | 0 | 0 | 5 | 1 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 5 | 2 | 0 | 0 | 7 | 0 | 0 | 4 | 0 | 0 | 84 | 80 | IE |
| IS | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | IS |
| IT | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 2 | 2 | 1 | 0 | 5 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 10 | 2 | 0 | 0 | 7 | 0 | 0 | 285 | 272 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 7 | 1 | 1 | 0 | 27 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 7 | 0 | 0 | 84 | 2 | KG |
| KZT | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 70 | 5 | KZT |
| LT | 0 | 0 | 0 | 2 | 1 | 18 | 0 | 2 | 0 | 21 | 2 | 0 | 1 | 0 | 0 | 0 | 6 | 0 | 1 | 4 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 101 | 63 | LT |
| LU | 0 | 0 | 0 | 20 | 1 | 9 | 0 | 1 | 0 | 3 | 1 | 0 | 1 | -0 | 0 | 0 | 1 | 0 | 5 | 2 | 0 | 1 | 15 | 0 | 0 | 12 | 0 | 0 | 241 | 231 | LU |
| LV | 0 | 0 | 0 | 1 | 0 | 7 | 0 | 1 | 0 | 16 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 57 | 30 | LV |
| MD | 0 | 0 | 0 | 1 | 1 | 16 | 0 | 35 | 3 | 17 | 1 | 0 | 2 | 0 | 0 | 1 | 31 | 0 | 1 | 3 | 2 | 1 | 3 | 0 | 0 | 5 | 0 | 0 | 158 | 93 | MD |
| ME | 14 | 1 | 0 | 0 | 0 | 3 | 0 | 5 | 16 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 0 | 3 | 1 | 0 | 0 | 5 | 0 | 0 | 100 | 49 | ME |
| MK | 2 | 8 | 0 | 1 | 0 | 3 | 0 | 7 | 15 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 1 | 3 | 1 | 0 | 0 | 5 | 0 | 0 | 102 | 61 | MK |
| MT | 0 | 0 | -11 | -0 | 0 | -0 | 0 | 1 | 1 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | -0 | 0 | -37 | -0 | 0 | 1 | 5 | 0 | 0 | 5 | 1 | MT |
| NL | 0 | 0 | 0 | 14 | 1 | 11 | 0 | 1 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 7 | 8 | 0 | 1 | 25 | 0 | 0 | 14 | 0 | 0 | 198 | 188 | NL |
| NO | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 3 | NO |
| PL | 0 | 0 | 0 | 3 | 1 | 22 | 0 | 3 | 1 | 9 | 2 | 1 | 3 | 0 | 0 | 0 | 6 | 0 | 2 | 5 | 0 | 1 | 6 | 0 | 0 | 7 | 0 | 0 | 140 | 116 | PL |
| PT | 0 | 0 | 0 | 1 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 6 | 0 | 0 | 57 | 56 | PT |
| RO | 1 | 1 | 0 | 1 | 1 | 11 | 0 | 50 | 7 | 8 | 1 | 1 | 3 | 0 | 0 | 1 | 12 | 0 | 1 | 1 | 1 | 1 | 2 | 0 | 0 | 5 | 0 | 0 | 151 | 115 | RO |
| RS | 3 | 2 | 0 | 1 | 1 | 10 | 0 | 17 | 26 | 3 | 0 | 1 | 3 | 0 | 0 | 1 | 4 | 0 | 1 | 1 | 0 | 2 | 2 | 0 | 0 | 6 | 0 | 0 | 147 | 96 | RS |
| RUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 25 | 3 | RUE |
| SE | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 13 | 8 | SE |
| SI | 0 | 0 | 0 | 3 | 1 | 8 | 0 | 4 | 3 | 2 | 0 | 12 | 2 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 5 | 4 | 0 | 0 | 6 | 0 | 0 | 227 | 213 | SI |
| SK | 0 | 0 | 0 | 2 | 1 | 13 | 0 | 8 | 5 | 5 | 1 | 3 | 9 | 0 | 0 | 0 | 5 | 0 | 2 | 2 | 0 | 1 | 4 | 0 | 0 | 6 | 0 | 0 | 157 | 134 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 19 | 2 | 1 | 0 | 23 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 5 | 0 | 0 | 63 | 1 | TJ |
| TM | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 1 | 6 | 1 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 4 | 0 | 0 | 43 | 3 | TM |
| TR | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 51 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 0 | 5 | 0 | 0 | 76 | 14 | TR |
| UA | 0 | 0 | 0 | 1 | 1 | 12 | 0 | 10 | 1 | 23 | 1 | 0 | 1 | 0 | 0 | 1 | 20 | 0 | 1 | 2 | 1 | 0 | 2 | 0 | 0 | 4 | 0 | 0 | 104 | 50 | UA |
| UZ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 4 | 2 | 1 | 1 | 18 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 5 | 0 | 0 | 66 | 3 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 5 | 4 | ATL |
| BAS | 0 | 0 | 0 | 1 | 1 | 5 | 0 | 1 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | -0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 33 | 25 | BAS |
| BLS | 0 | -0 | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 3 | -0 | 0 | 0 | 0 | 3 | 0 | 0 | 25 | 8 | BLS |
| MED | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | -0 | 0 | -3 | -0 | 0 | 0 | 4 | 0 | 0 | 36 | 27 | MED |
| NOS | 0 | 0 | 0 | 2 | 0 | 4 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 42 | 38 | NOS |
| AST | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 1 | 8 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 18 | 0 | 5 | 0 | 0 | 28 | 2 | AST |
| NOA | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | -0 | 0 | 2 | -0 | 0 | 1 | 3 | 0 | 0 | 11 | 7 | NOA |
| EXC | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 1 | 1 | 14 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 2 | 1 | 0 | 3 | 0 | 0 | 59 | 30 | EXC |
| EU | 0 | 0 | 0 | 5 | 1 | 6 | 1 | 4 | 1 | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 0 | 2 | 2 | 0 | 2 | 7 | 0 | 0 | 6 | 0 | 0 | 142 | 129 | EU |
| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |

Table C.11: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of $NH_3$. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 69 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | -0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 3 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | AL |
| AM | 0 | 11 | 0 | 5 | -0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | -0 | -0 | -0 | -0 | -0 | 0 | 1 | -0 | -0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | AM |
| AT | 0 | 0 | 56 | 0 | 0 | 3 | 0 | 0 | 8 | -0 | 13 | 71 | 1 | 0 | 0 | 0 | 9 | 2 | 0 | 0 | 0 | 4 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | AT |
| AZ | -0 | 3 | 0 | 26 | -0 | -0 | 0 | -0 | 0 | -0 | -0 | 0 | -0 | -0 | -0 | -0 | -0 | -0 | 3 | -0 | -0 | -0 | -0 | -0 | 0 | 0 | 1 | -0 | 0 | -0 | 0 | AZ |
| BA | 1 | 0 | 7 | 0 | 45 | 0 | 0 | 0 | 1 | -0 | 5 | 12 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 14 | 0 | 0 | 14 | -0 | 0 | 0 | 0 | 0 | 0 | BA |
| BE | 0 | 0 | 3 | 0 | 0 | 113 | 0 | 0 | 1 | -0 | 2 | 62 | 2 | 0 | 1 | -0 | 54 | 25 | 0 | 0 | -0 | 0 | 2 | 0 | 1 | -0 | 0 | 0 | 3 | 0 | 0 | BE |
| BG | 2 | 0 | 2 | 0 | 1 | 0 | 49 | 1 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 6 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | BG |
| BY | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 55 | 1 | -0 | 6 | 15 | 1 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 4 | 3 | 0 | 1 | 1 | BY |
| CH | 0 | 0 | 4 | 0 | 0 | 4 | 0 | 0 | 62 | -0 | 3 | 60 | 0 | 0 | 1 | -0 | 30 | 3 | 0 | 0 | -0 | 0 | 0 | 0 | 28 | -0 | 0 | 0 | 1 | 0 | 0 | CH |
| CY | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 22 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 2 | -0 | 0 | -0 | -0 | 1 | 0 | 0 | -0 | 0 | -0 | 0 | CY |
| CZ | 0 | 0 | 17 | -0 | 0 | 3 | 0 | 1 | 3 | 0 | 72 | 87 | 2 | 0 | 1 | 0 | 10 | 4 | 0 | 0 | 0 | 5 | 1 | 0 | 5 | -0 | 0 | 0 | 0 | 0 | 0 | CZ |
| DE | 0 | 0 | 5 | 0 | 0 | 10 | 0 | 1 | 4 | -0 | 7 | 155 | 4 | 0 | 1 | 0 | 22 | 9 | 0 | 0 | -0 | 1 | 1 | 0 | 2 | -0 | 0 | 0 | 1 | 0 | 0 | DE |
| DK | -0 | 0 | 1 | 0 | -0 | 3 | 0 | 1 | 0 | 0 | 2 | 33 | 54 | 0 | 0 | -0 | 6 | 5 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | DK |
| EE | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 5 | 0 | 0 | 1 | 6 | 1 | 16 | 0 | 1 | 1 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 1 | 4 | 0 | 5 | 0 | EE |
| ES | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 1 | -0 | 0 | 6 | 0 | 0 | 84 | -0 | 29 | 2 | 0 | 0 | -0 | 0 | 0 | 0 | 2 | -0 | 0 | 0 | 0 | 0 | 0 | ES |
| FI | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 1 | 0 | -0 | 0 | 0 | 0 | 1 | 0 | 10 | 0 | 0 | -0 | -0 | 2 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | FI |
| FR | 0 | 0 | 3 | 0 | 0 | 14 | 0 | 0 | 5 | -0 | 2 | 41 | 1 | 0 | 3 | -0 | 139 | 14 | 0 | 0 | -0 | 0 | 1 | 0 | 10 | -0 | 0 | 0 | 1 | 0 | 0 | FR |
| GB | 0 | 0 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 21 | 2 | 0 | 0 | -0 | 8 | 81 | 0 | 0 | -0 | 0 | 2 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | GB |
| GE | 0 | 2 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | -0 | -0 | -0 | -0 | 11 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | GE |
| GL | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | GL |
| GR | 5 | 0 | 1 | 0 | 1 | 0 | 12 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 59 | 0 | 2 | 0 | 0 | 5 | -0 | 0 | 0 | 0 | 0 | 0 | GR |
| HR | 0 | 0 | 15 | 0 | 11 | 0 | 0 | 0 | 1 | 0 | 8 | 17 | 1 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 23 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | HR |
| HU | 0 | -0 | 15 | -0 | 1 | 1 | 0 | 1 | 2 | -0 | 12 | 24 | 1 | 0 | -0 | 0 | 3 | 2 | -0 | 0 | 0 | 99 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | HU |
| IE | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 14 | 2 | 0 | 0 | 0 | 7 | 33 | 0 | 0 | 0 | 0 | 33 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | IE |
| IS | -0 | -0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 1 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | IS |
| IT | 0 | 0 | 6 | 0 | 1 | 0 | 0 | 0 | 4 | 0 | 2 | 11 | 0 | -0 | 1 | -0 | 5 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 167 | -0 | 0 | 0 | 0 | 0 | 0 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | -0 | 0 | 0 | -0 | 0 | -0 | -0 | 0 | 40 | 24 | 0 | -0 | -0 | 0 | KG |
| KZT | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 1 | 60 | 0 | 0 | 0 | 0 | KZT |
| LT | 0 | -0 | 1 | -0 | 0 | 1 | 0 | 14 | 1 | -0 | 5 | 21 | 3 | 0 | 0 | 0 | 4 | 1 | -0 | 0 | -0 | 1 | 0 | 0 | 1 | -0 | 2 | 29 | 0 | 3 | 0 | LT |
| LU | 0 | 0 | 3 | 0 | 0 | 54 | 0 | 0 | 2 | -0 | 3 | 81 | 1 | 0 | 1 | 0 | 63 | 13 | 0 | 0 | -0 | 0 | 1 | 0 | 2 | -0 | 0 | 0 | 25 | 0 | 0 | LU |
| LV | 0 | -0 | 1 | -0 | 0 | 1 | 0 | 12 | 0 | -0 | 2 | 15 | 2 | 2 | 0 | 0 | 2 | 1 | -0 | 0 | 0 | 1 | 0 | -0 | 1 | -0 | 1 | 13 | 0 | 16 | 0 | LV |
| MD | 0 | 0 | 1 | 0 | 0 | 0 | 3 | 3 | 0 | -0 | 2 | 4 | 1 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | 4 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 46 | MD |
| ME | 8 | 0 | 3 | 0 | 7 | 0 | 1 | 0 | 0 | -0 | 2 | 6 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 0 | 6 | 0 | 0 | 7 | 0 | -0 | 0 | 0 | 0 | 0 | ME |
| MK | 14 | 0 | 2 | 0 | 1 | 0 | 6 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 | 0 | 5 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | MK |
| MT | 0 | -0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 2 | -0 | 0 | -0 | -0 | 1 | -0 | 0 | -0 | -0 | 15 | 0 | -0 | 0 | 0 | 0 | 0 | MT |
| NL | 0 | 0 | 2 | 0 | 0 | 25 | 0 | 1 | 1 | 0 | 2 | 70 | 5 | 0 | 0 | -0 | 26 | 24 | 0 | 0 | -0 | 0 | 2 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | NL |
| NO | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NO |
| PL | 0 | -0 | 4 | -0 | 0 | 1 | 0 | 3 | 1 | -0 | 14 | 42 | 5 | 0 | 0 | 0 | 6 | 2 | -0 | 0 | -0 | 4 | 0 | 0 | 3 | -0 | 1 | 1 | 0 | 0 | 0 | PL |
| PT | -0 | 0 | 0 | -0 | -0 | 1 | 0 | 0 | 0 | -0 | 0 | 2 | 0 | 0 | 38 | -0 | 11 | 1 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | PT |
| RO | 1 | 0 | 3 | 0 | 1 | 0 | 4 | 1 | 1 | -0 | 3 | 8 | 1 | 0 | 0 | -0 | 1 | 1 | 0 | 1 | 0 | 18 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 3 | RO |
| RS | 3 | 0 | 5 | -0 | 5 | 0 | 2 | 0 | 0 | -0 | 5 | 11 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 3 | 0 | 25 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | RS |
| RUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | RUE |
| SE | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 1 | 0 | 0 | 0 | 4 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | -0 | 2 | 0 | 0 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | SE |
| SI | 0 | 0 | 30 | -0 | 1 | 1 | 0 | 0 | 3 | -0 | 8 | 30 | 0 | 0 | 0 | 0 | 4 | 2 | -0 | 0 | 0 | 7 | 0 | 0 | 64 | 0 | 0 | 0 | 0 | 0 | 0 | SI |
| SK | 0 | 0 | 12 | 0 | 1 | 1 | 0 | 1 | 2 | -0 | 19 | 30 | 2 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 31 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | SK |
| TJ | 0 | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | -0 | 0 | 0 | -0 | 0 | -0 | -0 | 0 | 4 | 9 | -0 | -0 | -0 | 0 | TJ |
| TM | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | -0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 1 | 16 | -0 | 0 | -0 | 0 | TM |
| TR | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 1 | -0 | 0 | 0 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | TR |
| UA | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 7 | 1 | 0 | 3 | 6 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 | 0 | 3 | 1 | 0 | 0 | 4 | UA |
| UZ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 4 | 35 | 0 | 0 | -0 | 0 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ATL |
| BAS | -0 | -0 | 1 | -0 | 0 | 1 | 0 | 3 | 0 | -0 | 1 | 19 | 9 | 1 | 0 | 2 | 2 | 2 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 3 | 0 | 2 | 0 | BAS |
| BLS | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | -0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | BLS |
| MED | 1 | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 8 | -0 | 6 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 21 | -0 | 0 | 0 | 0 | 0 | 0 | MED |
| NOS | 0 | 0 | 1 | 0 | 0 | 5 | 0 | 1 | 0 | 0 | 1 | 24 | 7 | 0 | 0 | 0 | 13 | 26 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NOS |
| AST | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | -0 | -0 | 0 | 0 | 5 | 0 | 0 | -0 | 0 | AST |
| NOA | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 2 | -0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 4 | -0 | 0 | 0 | 0 | 0 | 0 | NOA |
| EXC | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 7 | 0 | 0 | 2 | 0 | 5 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 3 | 1 | 12 | 0 | 0 | 0 | 0 | EXC |
| EU | 0 | 0 | 4 | 0 | 0 | 5 | 2 | 1 | 2 | 0 | 5 | 31 | 2 | 0 | 11 | 1 | 26 | 9 | 0 | 2 | 0 | 5 | 1 | 0 | 15 | -0 | 0 | 1 | 0 | 0 | 0 | EU |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |

Table C.11 Cont.: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of $NH_3$. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 5 | 4 | 0 | 0 | 0 | 4 | -0 | 3 | 15 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 133 | 38 | AL |
| AM | 0 | 0 | -0 | 0 | -0 | -0 | -0 | 0 | 0 | -0 | -0 | 0 | 0 | -0 | -0 | 10 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 2 | -0 | 0 | 0 | 0 | 26 | 0 | AM |
| AT | 0 | 0 | -0 | 4 | 0 | 7 | -0 | 1 | 0 | 0 | 0 | 5 | 3 | 0 | -0 | -0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 205 | 195 | AT |
| AZ | -0 | 0 | 0 | -0 | -0 | -0 | -0 | -0 | -0 | 2 | -0 | 0 | -0 | 0 | 0 | 4 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | -0 | 0 | 0 | 0 | 38 | -0 | AZ |
| BA | 3 | 0 | 0 | 1 | 0 | 7 | -0 | 4 | 12 | 0 | 0 | 2 | 5 | -0 | -0 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 139 | 76 | BA |
| BE | 0 | 0 | -0 | 57 | 0 | 4 | -0 | 1 | 0 | 1 | 0 | 0 | 1 | -0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 336 | 332 | BE |
| BG | 1 | 3 | 0 | 0 | 0 | 4 | 0 | 41 | 19 | 2 | 0 | 0 | 2 | 0 | -0 | 1 | 6 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 164 | 127 | BG |
| BY | 0 | 0 | 0 | 1 | 0 | 35 | 0 | 4 | 0 | 11 | 1 | 0 | 3 | -0 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 171 | 81 | BY |
| CH | 0 | 0 | 0 | 5 | 0 | 2 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 205 | 142 | CH |
| CY | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 1 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | 46 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 75 | 27 | CY |
| CZ | 0 | 0 | -0 | 7 | 0 | 24 | -0 | 2 | 1 | 1 | 0 | 2 | 8 | -0 | -0 | 0 | 2 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 258 | 250 | CZ |
| DE | 0 | 0 | -0 | 21 | 0 | 8 | -0 | 1 | 0 | 1 | 1 | 0 | 1 | -0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 255 | 248 | DE |
| DK | -0 | -0 | -0 | 7 | 1 | 11 | 0 | 1 | -0 | 1 | 4 | 0 | 1 | -0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 133 | 128 | DK |
| EE | -0 | -0 | -0 | 1 | 0 | 8 | 0 | 1 | 0 | 8 | 1 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 63 | 47 | EE |
| ES | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 130 | 129 | ES |
| FI | -0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | -0 | -0 | 0 | 1 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | 0 | 0 | 0 | 0 | 21 | 13 | FI |
| FR | 0 | 0 | 0 | 12 | 0 | 2 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 248 | 242 | FR |
| GB | 0 | 0 | -0 | 10 | 0 | 4 | -0 | 0 | 0 | 1 | 0 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | -0 | -0 | -0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 139 | 136 | GB |
| GE | 0 | 0 | -0 | 0 | -0 | -0 | -0 | 0 | 0 | 2 | -0 | 0 | 0 | 0 | -0 | 7 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 1 | GE |
| GL | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | GL |
| GR | 1 | 3 | 0 | 0 | 0 | 2 | 0 | 6 | 6 | 1 | 0 | 0 | 1 | -0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 116 | 93 | GR |
| HR | 1 | 0 | 0 | 1 | 0 | 9 | -0 | 4 | 10 | 0 | 0 | 10 | 6 | 0 | -0 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 160 | 134 | HR |
| HU | 0 | 0 | -0 | 2 | 0 | 21 | -0 | 10 | 9 | 0 | 1 | 5 | 25 | -0 | -0 | -0 | 2 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 249 | 233 | HU |
| IE | 0 | 0 | -0 | 5 | 0 | 3 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 104 | 102 | IE |
| IS | -0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | -0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 2 | 0 | IS |
| IT | 0 | 0 | 0 | 1 | 0 | 2 | -0 | 1 | 0 | 0 | 0 | 3 | 1 | -0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 209 | 203 | IT |
| KG | 0 | 0 | 0 | -0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 10 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 106 | 0 | KG |
| KZT | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 14 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 78 | 1 | KZT |
| LT | 0 | 0 | -0 | 2 | 0 | 48 | 0 | 1 | 0 | 7 | 1 | 0 | 1 | -0 | -0 | -0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 152 | 124 | LT |
| LU | 0 | 0 | -0 | 30 | 0 | 4 | -0 | 1 | 0 | 0 | 0 | 0 | 1 | -0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 288 | 284 | LU |
| LV | 0 | -0 | 0 | 1 | 0 | 22 | 0 | 1 | 0 | 8 | 1 | 0 | 1 | -0 | -0 | -0 | 2 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 105 | 81 | LV |
| MD | 0 | 0 | 0 | 0 | 0 | 13 | -0 | 46 | 2 | 5 | 0 | 0 | 3 | 0 | -0 | 1 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 179 | 81 | MD |
| ME | 42 | 1 | 0 | 0 | 0 | 4 | -0 | 3 | 17 | 0 | 0 | 1 | 3 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 115 | 39 | ME |
| MK | 1 | 41 | 0 | 0 | 0 | 4 | -0 | 7 | 29 | 0 | 0 | 0 | 2 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 157 | 68 | MK |
| MT | 0 | 0 | 57 | 0 | -0 | -0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | -0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 76 | 75 | MT |
| NL | 0 | 0 | -0 | 122 | 0 | 5 | -0 | 1 | 0 | 1 | 1 | 0 | 1 | -0 | 0 | 0 | 1 | 0 | -0 | -0 | -0 | -0 | -0 | -0 | 0 | 0 | 0 | 0 | 289 | 285 | NL |
| NO | -0 | -0 | -0 | 0 | 3 | 1 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 13 | 7 | NO |
| PL | 0 | 0 | -0 | 3 | 0 | 102 | -0 | 2 | 1 | 1 | 1 | 1 | 5 | -0 | -0 | -0 | 3 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 209 | 198 | PL |
| PT | -0 | -0 | -0 | 1 | 0 | 0 | 35 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 91 | 90 | PT |
| RO | 0 | 0 | 0 | 1 | 0 | 10 | -0 | 100 | 9 | 2 | 0 | 1 | 6 | -0 | -0 | 0 | 10 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 191 | 162 | RO |
| RS | 2 | 2 | 0 | 1 | 0 | 9 | -0 | 21 | 88 | 0 | 0 | 1 | 7 | 0 | -0 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 202 | 98 | RS |
| RUE | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 2 | RUE |
| SE | -0 | -0 | -0 | 1 | 1 | 2 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 29 | 24 | SE |
| SI | 0 | 0 | 0 | 2 | 0 | 7 | -0 | 2 | 1 | 0 | 0 | 51 | 3 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 219 | 213 | SI |
| SK | 0 | 0 | 0 | 2 | 0 | 42 | -0 | 6 | 3 | 1 | 1 | 3 | 66 | 0 | 0 | 0 | 3 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 239 | 227 | SK |
| TJ | 0 | 0 | 0 | -0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 32 | 1 | 0 | -0 | 22 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 68 | 0 | TJ |
| TM | 0 | 0 | 0 | -0 | -0 | -0 | -0 | 0 | -0 | 2 | -0 | 0 | 0 | 1 | 16 | 1 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 48 | 0 | TM |
| TR | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | -0 | 73 | 2 | -0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 89 | 10 | TR |
| UA | 0 | 0 | 0 | 1 | 0 | 19 | -0 | 13 | 1 | 17 | 0 | 0 | 3 | 0 | 0 | 1 | 85 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 178 | 58 | UA |
| UZ | 0 | 0 | -0 | 0 | -0 | 0 | -0 | 0 | 0 | 3 | -0 | 0 | 0 | 6 | 2 | 0 | 0 | 41 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 92 | 0 | UZ |
| ATL | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | -0 | -0 | -0 | 0 | 0 | 1 | 0 | 0 | 10 | 9 | ATL |
| BAS | -0 | -0 | -0 | 2 | 0 | 14 | 0 | 1 | 0 | 2 | 6 | 0 | 0 | -0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 74 | 66 | BAS |
| BLS | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 13 | 1 | 11 | 0 | 0 | 1 | 0 | 0 | 6 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 71 | 27 | BLS |
| MED | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 67 | 52 | MED |
| NOS | 0 | 0 | -0 | 10 | 1 | 5 | -0 | 0 | 0 | 1 | 1 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | -0 | -0 | -0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 98 | 94 | NOS |
| AST | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 1 | -0 | 0 | 0 | 1 | 1 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 1 | 0 | 0 | 14 | 0 | AST |
| NOA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 1 | 0 | 0 | 17 | 12 | NOA |
| EXC | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 2 | 1 | 17 | 0 | 0 | 1 | 0 | 0 | 3 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 76 | 34 | EXC |
| EU | 0 | 0 | 0 | 6 | 0 | 13 | 1 | 8 | 2 | 1 | 1 | 1 | 3 | -0 | -0 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 161 | 152 | EU |
| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |

Table C.12: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of VOC. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | -1 | 0 | -0 | -0 | -1 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | -1 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | AL |
| AM | -0 | 2 | -0 | -3 | -0 | -0 | -0 | -0 | -0 | -0 | 0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -1 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | 0 | -0 | 0 | AM |
| AT | 0 | 0 | 2 | -0 | -0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | AT |
| AZ | -0 | -0 | -0 | -7 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | 0 | -0 | -0 | -0 | -2 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | AZ |
| BA | 0 | 0 | 0 | 0 | -2 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | BA |
| BE | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 1 | 0 | 0 | 1 | 24 | 1 | 0 | 1 | 0 | 10 | 17 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | BE |
| BG | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | -0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | BG |
| BY | -0 | -0 | 0 | -0 | -0 | 0 | -0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | BY |
| CH | 0 | 0 | -0 | 0 | -0 | 0 | -0 | 0 | -2 | 0 | 0 | -6 | 0 | 0 | -0 | 0 | -1 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | -2 | 0 | 0 | 0 | 0 | 0 | 0 | CH |
| CY | -0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | CY |
| CZ | 0 | 0 | 1 | 0 | 0 | 1 | -0 | 0 | 0 | 0 | 2 | 10 | 0 | 0 | 1 | 0 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | -0 | CZ |
| DE | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 14 | 1 | 0 | 1 | 0 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | DE |
| DK | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | DK |
| EE | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | EE |
| ES | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | -0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ES |
| FI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | FI |
| FR | 0 | 0 | -0 | 0 | -0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | FR |
| GB | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | GB |
| GE | -0 | -0 | -0 | -3 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -3 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | 0 | -0 | -0 | GE |
| GL | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | GL |
| GR | -0 | 0 | 0 | -0 | -0 | 0 | -2 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | -2 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | GR |
| HR | 0 | 0 | 0 | -0 | -1 | 0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | HR |
| HU | 0 | 0 | 1 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 1 | 1 | -0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | -0 | HU |
| IE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | IS |
| IT | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | IT |
| KG | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | KG |
| KZT | 0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | -0 | -0 | KZT |
| LT | 0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | 0 | 0 | 0 | 0 | LT |
| LU | 0 | 0 | -0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 14 | 1 | 0 | 1 | 0 | 8 | 9 | 0 | 0 | 0 | -0 | 0 | 0 | 1 | -0 | 0 | 0 | 1 | 0 | 0 | LU |
| LV | -0 | -0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | LV |
| MD | 0 | -0 | 0 | -0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | MD |
| ME | -0 | 0 | -0 | -0 | -1 | 0 | -0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | ME |
| MK | -0 | -0 | -0 | -0 | -0 | 0 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -1 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | MK |
| MT | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | -0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | MT |
| NL | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 17 | 1 | 0 | 1 | 0 | 10 | 14 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | NL |
| NO | 0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | NO |
| PL | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 1 | 0 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | PL |
| PT | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | PT |
| RO | 0 | -0 | 0 | -0 | -0 | 0 | -0 | -0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | RO |
| RS | 0 | 0 | 0 | -0 | -1 | 0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | -0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | RS |
| RUE | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | RUE |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | SE |
| SI | 0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | -0 | 0 | -0 | -2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 5 | 0 | -0 | 0 | 0 | 0 | -0 | SI |
| SK | 0 | 0 | 1 | -0 | -0 | 0 | -0 | -0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | SK |
| TJ | 0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | -0 | -0 | -0 | 0 | -0 | -0 | TJ |
| TM | -0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | -0 | -0 | -0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | TM |
| TR | -0 | -0 | 0 | -0 | -0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | -0 | TR |
| UA | 0 | -0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | UA |
| UZ | 0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | ATL |
| BAS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | BAS |
| BLS | 0 | -0 | 0 | -0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | 0 | 0 | 0 | -0 | BLS |
| MED | -0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | -0 | -1 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | MED |
| NOS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NOS |
| AST | -0 | -0 | 0 | -0 | -0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | -0 | -0 | -0 | 0 | 0 | -0 | 0 | -0 | -0 | -0 | 0 | -0 | -0 | AST |
| NOA | -0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | NOA |
| EXC | -0 | -0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | EXC |
| EU | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 3 | 0 | 0 | 1 | 0 | 2 | 2 | 0 | -0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | EU |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |

Table C.12 Cont.: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of VOC. **Emitters →, Receptors ↓**. (Based on HIRLAM meteorology.)

| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | -1 | -0 | -0 | 0 | 0 | -0 | 0 | -1 | -2 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | -7 | 0 | 0 | -4 | -0 | AL |
| AM | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -1 | -0 | -0 | -0 | -0 | -0 | -1 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -13 | 0 | 0 | -5 | -1 | AM |
| AT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -6 | 0 | 0 | 6 | 6 | AT |
| AZ | -0 | -0 | -0 | -0 | -0 | -0 | 0 | -0 | -0 | -1 | -0 | -0 | -0 | -0 | -0 | -1 | -0 | -0 | -0 | 0 | -0 | -0 | -0 | -0 | -0 | -11 | 0 | 0 | -12 | -1 | AZ |
| BA | -0 | 0 | 0 | 0 | 0 | 1 | 0 | -0 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | -4 | 0 | 0 | 1 | 2 | BA |
| BE | 0 | 0 | 0 | 8 | 1 | 3 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 11 | 0 | 0 | 84 | 78 | BE |
| BG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | -0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | -5 | 0 | 0 | 6 | 4 | BG |
| BY | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | 0 | -2 | 0 | 0 | 7 | 5 | BY |
| CH | 0 | -0 | 0 | -0 | 0 | 0 | 0 | -0 | -0 | 1 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -6 | 0 | 0 | -8 | -8 | CH |
| CY | -0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | -3 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | -11 | 0 | 0 | -3 | 0 | CY |
| CZ | 0 | 0 | 0 | 1 | 0 | 2 | 0 | -0 | 0 | 1 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 30 | 27 | CZ |
| DE | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 40 | 36 | DE |
| DK | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 17 | 14 | DK |
| EE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | -1 | 0 | 0 | 5 | 3 | EE |
| ES | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -6 | 0 | 0 | 4 | 3 | ES |
| FI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 2 | 1 | FI |
| FR | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -2 | 0 | 0 | 16 | 13 | FR |
| GB | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 13 | GB |
| GE | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -1 | -0 | -0 | -0 | -0 | -0 | -1 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -9 | 0 | 0 | -9 | -1 | GE |
| GL | -0 | -0 | 0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | 0 | 0 | -0 | -0 | GL |
| GR | -0 | -0 | -0 | 0 | 0 | 0 | 0 | -1 | -0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | -0 | -7 | 0 | 0 | -2 | -2 | GR |
| HR | -0 | 0 | 0 | 0 | 0 | 1 | 0 | -1 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | -3 | 0 | 0 | 5 | 5 | HR |
| HU | 0 | 0 | 0 | 0 | 0 | 2 | 0 | -1 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -3 | 0 | 0 | 14 | 14 | HU |
| IE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -3 | 0 | 0 | 1 | 1 | IE |
| IS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | IS |
| IT | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 1 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 14 | 13 | IT |
| KG | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | -0 | -0 | 0 | -1 | 0 | 0 | 0 | 0 | 0 | -1 | -0 | -15 | 0 | 0 | -3 | 0 | KG |
| KZT | 0 | 0 | 0 | 0 | -0 | -0 | -0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -8 | 0 | 0 | -0 | 0 | KZT |
| LT | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | -1 | 0 | 0 | 10 | 7 | LT |
| LU | 0 | 0 | 0 | 4 | 0 | 2 | 0 | -0 | 0 | 2 | 1 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 49 | 46 | LU |
| LV | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | -1 | 0 | 0 | 6 | 4 | LV |
| MD | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | -0 | -0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | -7 | 0 | 0 | 4 | 3 | MD |
| ME | -1 | -0 | -0 | 0 | 0 | -0 | 0 | -1 | -2 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | -7 | 0 | 0 | -6 | -1 | ME |
| MK | -0 | -0 | 0 | 0 | 0 | -0 | 0 | -1 | -1 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | -7 | 0 | 0 | -3 | -1 | MK |
| MT | -0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -2 | 0 | 0 | 7 | 7 | MT |
| NL | 0 | 0 | 0 | 9 | 1 | 2 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 0 | 0 | 70 | 64 | NL |
| NO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | -0 | 0 | -0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | -0 | 0 | 0 | 1 | 0 | NO |
| PL | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 25 | 21 | PL |
| PT | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -6 | 0 | 0 | 3 | 2 | PT |
| RO | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -6 | 0 | 0 | 5 | 4 | RO |
| RS | -0 | 0 | 0 | 0 | 0 | 1 | 0 | -2 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | -6 | 0 | 0 | 3 | 3 | RS |
| RUE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 2 | 1 | RUE |
| SE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 2 | 2 | SE |
| SI | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | -5 | 0 | 0 | 5 | 5 | SI |
| SK | -0 | 0 | 0 | 0 | 0 | 2 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -2 | 0 | 0 | 15 | 14 | SK |
| TJ | 0 | 0 | -0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -1 | -0 | -0 | -0 | -1 | 0 | 0 | -0 | 0 | 0 | -1 | -0 | -8 | 0 | 0 | -2 | 0 | TJ |
| TM | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | -1 | 0 | 0 | 0 | 0 | -0 | -0 | -0 | -0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | -9 | 0 | 0 | -3 | 0 | TM |
| TR | -0 | -0 | 0 | 0 | 0 | -0 | 0 | -0 | -0 | -0 | 0 | 0 | -0 | 0 | -0 | -1 | -0 | -0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | -11 | 0 | 0 | -3 | -0 | TR |
| UA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | -4 | 0 | 0 | 5 | 3 | UA |
| UZ | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | 0 | -1 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | -9 | 0 | 0 | 1 | 0 | UZ |
| ATL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | 0 | 0 | 0 | 0 | ATL |
| BAS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 6 | BAS |
| BLS | 0 | 0 | 0 | 0 | 0 | -0 | 0 | -0 | 0 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | -1 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | -3 | 0 | 0 | 4 | 3 | BLS |
| MED | -0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | -4 | 0 | 0 | 2 | 2 | MED |
| NOS | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 12 | 11 | NOS |
| AST | -0 | -0 | -0 | 0 | -0 | -0 | 0 | -0 | -0 | -0 | 0 | 0 | 0 | -0 | -0 | -1 | -0 | -0 | 0 | 0 | -0 | -0 | 0 | -3 | -0 | -10 | 0 | 0 | -2 | 0 | AST |
| NOA | -0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | -3 | 0 | 0 | 1 | 1 | NOA |
| EXC | -0 | 0 | 0 | 0 | 0 | 0 | 0 | -0 | -0 | 1 | 0 | 0 | 0 | 0 | -0 | -0 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | -0 | -0 | -3 | 0 | 0 | 3 | 3 | EXC |
| EU | 0 | 0 | 0 | 1 | 0 | 1 | 0 | -0 | -0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | -2 | 0 | 0 | 13 | 11 | EU |
| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |

Table C.13: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of PPM, $SO_x$, $NO_x$, $NH_3$ and VOC. **Emitters →, Receptors ↓.**
(Based on HIRLAM meteorology.)

| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 164 | -6 | 0 | -6 | 65 | -4 | 65 | -5 | 1 | -6 | 4 | 11 | -5 | -6 | 15 | -5 | 7 | 2 | -6 | 107 | -6 | 7 | -5 | 0 | 53 | -6 | -5 | -5 | 0 | -6 | -4 | AL |
| AM | 0 | 52 | 0 | 77 | 1 | 0 | 3 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 9 | 2 | -0 | 1 | -0 | 0 | 1 | 0 | 23 | -0 | 0 | -0 | 0 | AM |
| AT | -0 | -0 | 168 | -0 | 7 | 12 | 6 | 1 | 27 | -0 | 53 | 218 | 1 | -0 | 13 | 0 | 57 | 17 | -0 | 1 | -0 | 17 | 1 | 0 | 68 | -0 | 0 | 0 | 1 | -0 | 0 | AT |
| AZ | -1 | 17 | -1 | 170 | 0 | -1 | 2 | -0 | 0 | -1 | -0 | 1 | -1 | -1 | -0 | -1 | 0 | 1 | 14 | 1 | -1 | -0 | -1 | 0 | 0 | -0 | 52 | -1 | 0 | -1 | -0 | AZ |
| BA | 1 | -3 | 15 | -2 | 295 | 0 | 16 | -2 | 2 | -3 | 19 | 35 | -1 | -2 | 17 | -2 | 14 | 5 | -2 | 7 | -2 | 31 | -2 | 0 | 62 | -3 | -2 | -2 | 0 | -2 | -1 | BA |
| BE | -9 | -9 | -1 | -9 | -9 | 316 | -9 | -8 | 4 | -9 | 9 | 219 | -1 | -9 | 10 | -9 | 260 | 127 | -9 | -4 | -9 | -4 | -1 | 0 | -4 | -9 | -8 | -8 | 6 | -9 | -7 | BE |
| BG | 4 | -1 | 4 | -1 | 32 | 0 | 495 | 2 | 1 | -1 | 9 | 16 | -0 | -1 | 7 | -1 | 6 | 3 | -1 | 48 | -1 | 16 | -1 | 0 | 15 | -1 | 4 | -0 | 0 | -1 | 3 | BG |
| BY | -1 | -1 | 5 | -0 | 4 | 2 | 7 | 127 | 2 | -1 | 16 | 38 | 5 | 6 | 3 | 4 | 12 | 10 | -1 | 2 | 1 | 7 | -0 | 0 | 4 | -1 | 12 | 13 | 0 | 4 | 2 | BY |
| CH | -0 | -0 | 24 | -0 | 4 | 18 | 2 | 0 | 194 | -0 | 17 | 222 | 1 | -0 | 25 | 0 | 180 | 19 | -0 | 1 | 0 | 2 | 1 | 0 | 102 | -0 | -0 | 0 | 2 | -0 | -0 | CH |
| CY | -7 | -8 | -8 | -7 | -0 | -9 | 35 | -8 | 0 | 53 | -7 | -6 | -9 | -9 | -2 | -9 | -6 | -3 | -8 | 49 | -9 | -5 | -9 | 0 | 1 | -9 | -4 | -9 | 0 | -9 | -6 | CY |
| CZ | -2 | -2 | 57 | -2 | 5 | 13 | 2 | 1 | 10 | -2 | 206 | 256 | 3 | -2 | 9 | -1 | 59 | 27 | -2 | 0 | -2 | 20 | 0 | 0 | 21 | -2 | -1 | -1 | 1 | -2 | -1 | CZ |
| DE | -5 | -5 | 18 | -5 | -3 | 34 | -3 | -2 | 15 | -5 | 34 | 449 | 8 | -4 | 10 | -4 | 129 | 57 | -5 | -2 | -4 | 0 | -1 | 0 | 7 | -5 | -4 | -3 | 3 | -4 | -3 | DE |
| DK | -11 | -11 | -9 | -11 | -11 | -1 | -11 | -8 | 0 | -11 | -4 | 64 | 147 | -9 | -8 | -10 | 14 | 45 | -11 | -5 | -11 | -7 | -9 | 0 | -10 | -11 | -10 | -8 | 0 | -10 | -8 | DK |
| EE | -2 | -2 | -1 | -2 | -1 | 0 | -1 | 11 | 0 | -2 | 1 | 12 | 2 | 97 | -1 | 17 | 3 | 7 | -2 | -0 | 1 | -0 | -1 | 0 | -1 | -2 | 2 | 8 | 0 | 14 | -1 | EE |
| ES | -1 | -1 | 1 | -1 | 2 | 6 | 0 | -1 | 2 | -1 | 2 | 19 | -0 | -1 | 429 | -1 | 85 | 15 | -1 | 1 | -1 | 0 | 0 | 0 | 10 | -1 | -1 | -1 | 0 | -1 | -1 | ES |
| FI | -0 | -0 | -0 | -0 | -0 | -0 | -0 | 2 | 0 | -0 | 0 | 2 | 0 | 7 | -0 | 60 | 1 | 4 | -0 | -0 | 13 | -0 | -0 | 0 | -0 | -0 | 1 | 1 | 0 | 1 | -0 | FI |
| FR | -3 | -3 | 6 | -3 | 0 | 45 | -1 | -2 | 16 | -3 | 10 | 134 | -0 | -3 | 51 | -3 | 521 | 71 | -3 | -1 | -3 | -1 | 1 | 0 | 32 | -3 | -3 | -2 | 4 | -3 | -2 | FR |
| GB | -12 | -12 | -10 | -12 | -12 | -2 | -12 | -11 | 1 | -12 | -6 | 36 | -6 | -12 | -9 | -12 | 14 | 244 | -12 | -6 | -12 | -8 | 0 | 0 | -11 | -12 | -11 | -12 | 0 | -12 | -9 | GB |
| GE | -0 | 11 | 0 | 60 | 2 | 0 | 6 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 1 | 1 | 44 | 2 | -0 | 1 | -0 | 0 | 1 | 0 | 22 | -0 | 0 | -0 | 0 | GE |
| GL | -0 | -0 | -0 | -0 | -0 | -0 | -0 | -0 | 0 | -0 | -0 | 0 | -0 | -0 | 0 | -0 | 0 | 0 | -0 | -0 | 0 | -0 | -0 | 0 | -0 | -0 | 0 | -0 | 0 | -0 | -0 | GL |
| GR | 11 | -7 | -4 | -7 | 28 | -6 | 218 | -6 | 1 | -7 | -1 | 4 | -7 | -7 | 8 | -7 | 1 | -1 | -7 | 291 | -7 | 3 | -7 | 0 | 26 | -7 | -3 | -7 | 0 | -7 | -4 | GR |
| HR | -2 | -4 | 32 | -4 | 117 | -0 | 11 | -2 | 4 | -4 | 28 | 51 | -2 | -4 | 18 | -3 | 18 | 7 | -4 | 3 | -4 | 46 | -3 | 0 | 119 | -4 | -3 | -3 | 0 | -4 | -2 | HR |
| HU | -1 | -2 | 45 | -2 | 43 | 3 | 13 | 2 | 5 | -2 | 52 | 81 | 1 | -2 | 10 | -1 | 22 | 13 | -2 | 3 | -2 | 228 | -1 | 0 | 53 | -2 | -1 | -1 | 0 | -2 | -0 | HU |
| IE | -10 | -10 | -8 | -10 | -9 | -4 | -9 | -9 | 1 | -10 | -6 | 22 | -6 | -9 | -8 | -9 | 9 | 104 | -10 | -5 | -9 | -7 | 67 | 0 | -9 | -10 | -9 | -9 | 0 | -9 | -7 | IE |
| IS | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | 2 | -1 | -1 | -1 | -1 | -1 | 4 | -1 | -1 | -1 | -1 | 0 | -1 | -1 | IS |
| IT | -2 | -4 | 21 | -4 | 34 | -0 | 7 | -4 | 14 | -4 | 10 | 41 | -3 | -4 | 40 | -4 | 48 | 5 | -4 | 7 | -4 | 5 | -4 | 0 | 630 | -4 | -4 | -4 | 0 | -4 | -3 | IT |
| KG | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 362 | 278 | 0 | 0 | 0 | 0 | KG |
| KZT | -0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | -0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | -0 | 0 | 0 | 25 | 393 | 0 | 0 | -0 | 0 | KZT |
| LT | -1 | -1 | 2 | -1 | 2 | 4 | 2 | 35 | 1 | -1 | 13 | 49 | 8 | 8 | 2 | 4 | 15 | 13 | -1 | 1 | -0 | 3 | -1 | 0 | 3 | -1 | 5 | 76 | 0 | 13 | -0 | LT |
| LU | -6 | -6 | 5 | -6 | -5 | 130 | -4 | -5 | 8 | -6 | 21 | 263 | -1 | -5 | 18 | -5 | 503 | 74 | -6 | -2 | -5 | -1 | -0 | 0 | 3 | -6 | -5 | -5 | 100 | -5 | -4 | LU |
| LV | -2 | -2 | -0 | -2 | 0 | 2 | 1 | 26 | 1 | -2 | 4 | 30 | 4 | 19 | -0 | 6 | 7 | 9 | -2 | 0 | -0 | 1 | -1 | 0 | 0 | -2 | 4 | 28 | 0 | 53 | -1 | LV |
| MD | 0 | -1 | 4 | 0 | 11 | 1 | 36 | 11 | 1 | -1 | 13 | 21 | 3 | 1 | 5 | 1 | 7 | 7 | -0 | 8 | -0 | 14 | -0 | 0 | 8 | -1 | 9 | 2 | 0 | 0 | 103 | MD |
| ME | 22 | -3 | 6 | -3 | 116 | -2 | 35 | -3 | 1 | -3 | 8 | 18 | -3 | -3 | 14 | -3 | 9 | 3 | -3 | 28 | -3 | 13 | -3 | 0 | 49 | -3 | -3 | -3 | 0 | -3 | -2 | ME |
| MK | 34 | -2 | 4 | -2 | 47 | -1 | 170 | -1 | 1 | -2 | 8 | 16 | -1 | -2 | 11 | -2 | 7 | 3 | -2 | 143 | -2 | 13 | -2 | 0 | 28 | -2 | -0 | -2 | 0 | -2 | -1 | MK |
| MT | -7 | -10 | -8 | -10 | 25 | -9 | 12 | -10 | 1 | -10 | -5 | -1 | -10 | -10 | 52 | -10 | 16 | -2 | -10 | 24 | -10 | -5 | -10 | 0 | 133 | -10 | -10 | -10 | 0 | -10 | -7 | MT |
| NL | -15 | -15 | -9 | -15 | -15 | 75 | -15 | -13 | 2 | -15 | -1 | 221 | 1 | -14 | -2 | -14 | 118 | 122 | -15 | -7 | -14 | -9 | -7 | 0 | -11 | -15 | -14 | -14 | 2 | -15 | -11 | NL |
| NO | -2 | -2 | -2 | -2 | -2 | -1 | -1 | -1 | 0 | -2 | -1 | 2 | 1 | -1 | -1 | 0 | -0 | 6 | -2 | -1 | 6 | -1 | -1 | 0 | -2 | -2 | -1 | -1 | 0 | -1 | -1 | NO |
| PL | -2 | -2 | 13 | -2 | 5 | 5 | 1 | 10 | 4 | -2 | 50 | 119 | 13 | -0 | 5 | -0 | 29 | 22 | -2 | 0 | -2 | 13 | -1 | 0 | 10 | -2 | 0 | 4 | 1 | -1 | -1 | PL |
| PT | -1 | -1 | -1 | -1 | 1 | 2 | -1 | -1 | 1 | -1 | -0 | 8 | -1 | -1 | 267 | -1 | 39 | 9 | -1 | -0 | -1 | -1 | -0 | 0 | 1 | -1 | -1 | -1 | 0 | -1 | -1 | PT |
| RO | 1 | -1 | 8 | -0 | 28 | 1 | 66 | 4 | 2 | -1 | 18 | 29 | 2 | 0 | 6 | 0 | 9 | 6 | -1 | 11 | -1 | 43 | -1 | 0 | 18 | -1 | 3 | 0 | 0 | -1 | 7 | RO |
| RS | 8 | -2 | 13 | -1 | 100 | 1 | 56 | -0 | 2 | -2 | 23 | 39 | 0 | -1 | 12 | -1 | 12 | 8 | -2 | 22 | -1 | 58 | -1 | 0 | 34 | -2 | 0 | -1 | 0 | -2 | 0 | RS |
| RUE | -0 | -0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | -0 | 1 | 2 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 1 | 0 | -0 | 0 | 0 | 1 | 47 | 0 | 0 | 0 | 0 | RUE |
| SE | -2 | -2 | -2 | -2 | -2 | -1 | -2 | 1 | 0 | -2 | -1 | 9 | 6 | 1 | -1 | 4 | 2 | 9 | -2 | -1 | 13 | -1 | -1 | 0 | -2 | -2 | -1 | 0 | 0 | -1 | -1 | SE |
| SI | -2 | -3 | 89 | -3 | 23 | 4 | 8 | -1 | 11 | -3 | 37 | 97 | -1 | -2 | 18 | -2 | 31 | 11 | -3 | 1 | -2 | 23 | -2 | 0 | 249 | -3 | -2 | -2 | 0 | -2 | -2 | SI |
| SK | -1 | -2 | 38 | -1 | 22 | 4 | 6 | 4 | 6 | -2 | 72 | 89 | 3 | -1 | 8 | -1 | 23 | 14 | -1 | 2 | -1 | 88 | -0 | 0 | 31 | -2 | -1 | 0 | 0 | -1 | -0 | SK |
| TJ | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 | 165 | 0 | 0 | 0 | 0 | TJ |
| TM | -0 | 1 | 0 | 4 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | -0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | -0 | 0 | 1 | 14 | 174 | 0 | 0 | -0 | 0 | TM |
| TR | -1 | 1 | -1 | 3 | 4 | -2 | 35 | -1 | 0 | -0 | 0 | 2 | -2 | -2 | 1 | -2 | 0 | 0 | -1 | 19 | -2 | 1 | -2 | 0 | 2 | -2 | 5 | -2 | 0 | -2 | -1 | TR |
| UA | -1 | -1 | 3 | 1 | 6 | 1 | 16 | 18 | 1 | -1 | 10 | 20 | 2 | 1 | 3 | 1 | 6 | 6 | -1 | 4 | -0 | 12 | -1 | 0 | 4 | -1 | 17 | 2 | 0 | -0 | 9 | UA |
| UZ | -0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 | -0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | -0 | 0 | 1 | 64 | 324 | 0 | 0 | -0 | 0 | UZ |
| ATL | -5 | -5 | -5 | -5 | -5 | -4 | -5 | -5 | 0 | -5 | -4 | -2 | -5 | -5 | 0 | -5 | 4 | 6 | -5 | -2 | -4 | -4 | -3 | 0 | -5 | -5 | -5 | -5 | 0 | -5 | -4 | ATL |
| BAS | -5 | -5 | -4 | -5 | -4 | -0 | -4 | 1 | 0 | -5 | 0 | 36 | 19 | 5 | -3 | 10 | 6 | 15 | -5 | -2 | -2 | -2 | -4 | 0 | -4 | -5 | -3 | 1 | 0 | -0 | -4 | BAS |
| BLS | -2 | -2 | -2 | 4 | 3 | -2 | 47 | 2 | 0 | -3 | 2 | 5 | -2 | -2 | 0 | -2 | 0 | 1 | 1 | 10 | -3 | 2 | -3 | 0 | 1 | -3 | 12 | -2 | 0 | -3 | 3 | BLS |
| MED | -6 | -11 | -7 | -10 | 20 | -9 | 42 | -10 | 2 | -8 | -5 | 2 | -10 | -11 | 59 | -11 | 28 | -2 | -11 | 52 | -11 | -4 | -10 | 0 | 86 | -11 | -8 | -11 | 0 | -11 | -7 | MED |
| NOS | -16 | -16 | -15 | -16 | -16 | -5 | -16 | -14 | 1 | -16 | -12 | 33 | -2 | -15 | -13 | -16 | 21 | 81 | -16 | -8 | -16 | -11 | -12 | 0 | -15 | -16 | -15 | -15 | 0 | -16 | -12 | NOS |
| AST | -1 | -0 | -1 | 4 | -0 | -1 | 2 | -1 | 0 | 0 | -1 | -1 | -1 | -1 | -0 | -1 | -1 | -0 | -1 | 2 | -1 | -1 | -1 | 0 | -0 | 16 | 71 | -1 | 0 | -1 | -1 | AST |
| NOA | 1 | -2 | -1 | -1 | 9 | -1 | 26 | -1 | 0 | -1 | 0 | 3 | -1 | -1 | 29 | -1 | 9 | 0 | -1 | 31 | -2 | 0 | -1 | 0 | 24 | -2 | 0 | -1 | 0 | -2 | -1 | NOA |
| EXC | -0 | -1 | 2 | 1 | 3 | 2 | 7 | 3 | 2 | -1 | 4 | 20 | 1 | 1 | 13 | 1 | 20 | 8 | -0 | 3 | 0 | 3 | -0 | 0 | 12 | 7 | 82 | 0 | 0 | -0 | 0 | EXC |
| EU | -2 | -3 | 10 | -3 | 6 | 13 | 22 | 0 | 6 | -3 | 17 | 91 | 3 | -0 | 68 | 3 | 102 | 39 | -3 | 10 | -0 | 10 | 0 | 0 | 57 | -3 | -2 | -0 | 1 | -2 | -2 | EU |
| | AL | AM | AT | AZ | BA | BE | BG | BY | CH | CY | CZ | DE | DK | EE | ES | FI | FR | GB | GE | GR | HR | HU | IE | IS | IT | KG | KZT | LT | LU | LV | MD | |

Table C.13 Cont.: 2007 country-to-country blame matrices for **PM2.5**.
Units: ng/m$^3$ per 15% emis. red. of PPM, $SO_x$, $NO_x$, $NH_3$ and VOC. **Emitters →, Receptors ↓.**
(Based on HIRLAM meteorology.)

| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AL | 36 | 53 | -5 | -4 | 1 | 21 | -4 | 41 | 150 | -1 | -5 | 2 | 3 | -6 | -6 | 0 | 12 | -6 | -4 | -5 | -5 | 62 | -3 | -5 | 2 | 6 | 3 | 23 | 697 | 275 | AL |
| AM | 0 | 0 | -0 | 0 | 0 | 3 | -0 | 5 | 1 | 19 | 0 | 0 | 0 | -0 | 7 | 156 | 9 | 6 | 0 | 0 | 1 | 2 | 1 | 56 | 1 | -1 | 0 | 21 | 384 | 22 | AM |
| AT | 0 | 0 | -0 | 12 | 1 | 57 | 1 | 18 | 10 | 5 | 1 | 17 | 13 | -0 | -0 | 1 | 14 | -0 | 2 | 2 | -0 | 8 | 12 | -0 | 1 | 9 | 1 | 3 | 815 | 752 | AT |
| AZ | -1 | -0 | -1 | -1 | 0 | 3 | -1 | 4 | 0 | 52 | -1 | 0 | -0 | -1 | 12 | 71 | 13 | 11 | -0 | -0 | 0 | 0 | -0 | 46 | -0 | -1 | 0 | 16 | 409 | 2 | AZ |
| BA | 18 | 2 | -2 | 0 | 1 | 42 | -1 | 42 | 115 | 3 | -2 | 5 | 13 | -3 | -3 | 1 | 17 | -2 | -1 | -1 | -2 | 24 | 2 | -2 | 1 | 7 | 2 | 7 | 733 | 304 | BA |
| BE | -9 | -7 | -9 | 125 | 3 | 28 | -8 | -5 | -8 | -0 | -6 | 1 | -4 | -9 | -9 | -9 | 1 | -9 | 5 | 0 | -9 | -8 | 94 | -9 | -5 | 38 | 8 | 2 | 859 | 1000 | BE |
| BG | 6 | 16 | -1 | -0 | 1 | 41 | -0 | 207 | 97 | 23 | -0 | 1 | 9 | -1 | -1 | 14 | 81 | -1 | -0 | 0 | 7 | 12 | 1 | -0 | 2 | 7 | 2 | 10 | 1148 | 871 | BG |
| BY | -0 | 0 | -1 | 2 | 3 | 137 | -1 | 19 | 5 | 83 | 4 | 1 | 8 | -1 | -1 | 5 | 92 | -0 | 1 | 11 | -0 | 1 | 7 | 0 | -0 | 6 | 2 | 2 | 635 | 306 | BY |
| CH | 0 | 0 | -0 | 14 | 1 | 21 | 2 | 4 | 3 | 2 | 0 | 1 | 2 | -0 | -0 | 0 | 2 | -0 | 3 | 2 | -0 | 8 | 14 | -0 | 1 | 10 | 2 | 3 | 864 | 659 | CH |
| CY | -7 | -2 | -9 | -9 | 0 | 1 | -8 | 16 | 6 | 9 | -9 | 0 | -5 | -9 | -9 | 516 | 28 | -8 | -8 | -8 | -4 | 76 | -8 | 23 | 0 | 4 | 10 | 32 | 475 | 17 | CY |
| CZ | -2 | -1 | -2 | 16 | 2 | 147 | -1 | 15 | 9 | 8 | 0 | 7 | 29 | -2 | -2 | -0 | 24 | -2 | 2 | 5 | -2 | 2 | 17 | -2 | -1 | 17 | 2 | 2 | 914 | 877 | CZ |
| DE | -5 | -3 | -5 | 47 | 3 | 66 | -4 | 2 | -2 | 5 | -1 | 1 | 0 | -5 | -5 | -4 | 7 | -5 | 2 | 13 | -5 | -2 | 43 | -5 | -2 | 24 | 5 | 2 | 795 | 833 | DE |
| DK | -11 | -8 | -11 | 5 | 11 | 34 | -11 | -8 | -11 | 1 | 3 | 0 | -7 | -11 | -11 | -10 | -2 | -11 | -5 | 44 | -11 | -11 | 57 | -11 | -6 | 15 | 10 | 1 | -4 | 163 | DK |
| EE | -2 | -1 | -2 | 0 | 2 | 26 | -2 | 2 | -1 | 58 | 5 | 0 | -0 | -2 | -2 | 2 | 20 | -2 | -0 | 25 | -2 | -1 | 6 | -1 | -1 | 5 | 3 | 2 | 261 | 184 | EE |
| ES | -0 | -0 | -1 | 4 | 0 | 4 | 46 | 0 | 1 | 0 | -0 | 0 | 0 | -1 | -1 | -0 | -0 | -1 | 20 | -0 | -1 | 19 | 7 | -1 | 2 | 14 | 5 | 5 | 617 | 620 | ES |
| FI | -0 | -0 | -0 | -0 | 3 | 5 | -0 | 0 | -0 | 23 | 6 | 0 | -0 | -0 | -0 | 0 | 4 | -0 | 1 | 7 | -0 | -0 | 2 | -0 | -0 | 3 | 2 | 1 | 125 | 83 | FI |
| FR | -3 | -2 | -3 | 28 | 1 | 19 | -0 | -0 | -0 | 1 | -2 | 1 | -1 | -3 | -3 | -3 | -0 | -3 | 12 | 1 | -3 | 8 | 44 | -3 | -1 | 17 | 7 | 3 | 876 | 900 | FR |
| GB | -12 | -9 | -12 | 8 | 2 | 5 | -12 | -10 | -12 | -7 | -10 | 0 | -8 | -12 | -12 | -12 | -7 | -12 | 6 | -7 | -12 | -12 | 25 | -12 | -6 | 16 | 11 | 0 | -80 | 125 | GB |
| GE | 0 | 0 | -0 | 0 | 0 | 5 | -0 | 9 | 2 | 43 | 0 | 0 | 0 | -0 | 6 | 107 | 22 | 5 | 0 | 0 | 4 | 1 | 0 | 27 | 0 | 1 | 1 | 19 | 354 | 29 | GE |
| GL | -0 | -0 | -0 | -0 | 0 | -0 | -0 | -0 | -0 | 0 | -0 | 0 | -0 | -0 | -0 | -0 | -0 | -0 | 0 | -0 | -0 | -0 | -0 | -0 | -0 | 10 | 0 | 0 | -0 | -0 | GL |
| GR | 2 | 33 | -7 | -7 | 0 | 19 | -6 | 60 | 59 | 5 | -7 | 1 | -0 | -7 | -7 | 18 | 34 | -7 | -6 | -7 | -4 | 58 | -6 | -7 | 1 | 6 | 4 | 24 | 664 | 543 | GR |
| HR | 3 | -1 | -4 | 0 | 1 | 54 | -2 | 39 | 78 | 2 | -3 | 22 | 16 | -4 | -4 | -1 | 17 | -4 | -2 | -2 | -3 | 33 | 2 | -3 | -0 | 9 | 2 | 5 | 617 | 436 | HR |
| HU | 1 | 1 | -2 | 3 | 2 | 132 | -1 | 81 | 84 | 11 | -0 | 15 | 84 | -2 | -2 | 2 | 48 | -2 | 0 | 2 | -2 | 11 | 7 | -2 | -0 | 12 | 2 | 4 | 1006 | 827 | HU |
| IE | -10 | -7 | -10 | 1 | 1 | 2 | -9 | -8 | -9 | -8 | -8 | 0 | -6 | -10 | -10 | -9 | -6 | -10 | 12 | -6 | -10 | -9 | 4 | -10 | -5 | 12 | 13 | 0 | -113 | 54 | IE |
| IS | -1 | -1 | -1 | -1 | 0 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | -1 | -1 | -1 | -1 | -1 | -1 | 1 | -1 | -1 | -1 | -1 | -1 | -1 | 7 | 6 | 0 | -42 | -24 | IS |
| IT | -1 | 0 | -4 | -1 | 0 | 22 | -1 | 10 | 18 | -2 | -4 | 12 | 2 | -4 | -4 | -3 | 3 | -4 | -1 | -3 | -4 | 76 | 0 | -4 | 2 | 16 | 4 | 15 | 841 | 823 | IT |
| KG | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 32 | 4 | 5 | 2 | 325 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | -0 | 0 | 20 | 1026 | 4 | KG |
| KZT | -0 | 0 | -0 | 0 | 0 | 4 | -0 | 2 | 1 | 150 | 0 | 0 | 0 | 1 | 4 | 4 | 16 | 26 | 0 | 1 | 0 | 0 | 0 | 13 | 0 | 1 | 0 | 6 | 636 | 13 | KZT |
| LT | -1 | -1 | -1 | 4 | 4 | 136 | -1 | 11 | 3 | 65 | 6 | 1 | 3 | -1 | -1 | 3 | 39 | -1 | 1 | 21 | -1 | 0 | 11 | -0 | -0 | 7 | 3 | 2 | 516 | 370 | LT |
| LU | -6 | -4 | -6 | 66 | 2 | 38 | -4 | 0 | -4 | 1 | -3 | 1 | -1 | -6 | -6 | -5 | 5 | -6 | 4 | 0 | -6 | -3 | 43 | -6 | -3 | 30 | 5 | 3 | 1098 | 1172 | LU |
| LV | -2 | -1 | -2 | 2 | 3 | 63 | -2 | 6 | 1 | 57 | 5 | 0 | 1 | -2 | -2 | 2 | 30 | -1 | -0 | 19 | -2 | -1 | 7 | -1 | -1 | 5 | 3 | 2 | 340 | 234 | LV |
| MD | 1 | 2 | -1 | 1 | 2 | 96 | -0 | 220 | 20 | 54 | 2 | 1 | 13 | -1 | -0 | 13 | 272 | 0 | 1 | 4 | 6 | 4 | 4 | 1 | 0 | 4 | 2 | 5 | 957 | 460 | MD |
| ME | 157 | 12 | -3 | -2 | 1 | 23 | -2 | 42 | 142 | 1 | -3 | 2 | 6 | -3 | -3 | 1 | 13 | -3 | -2 | -2 | -3 | 34 | -1 | -3 | 2 | 5 | 2 | 15 | 656 | 223 | ME |
| MK | 14 | 139 | -2 | -1 | 1 | 29 | -1 | 69 | 157 | 6 | -2 | 2 | 6 | -2 | -2 | 5 | 24 | -2 | -1 | -1 | -1 | 23 | 0 | -2 | 2 | 5 | 2 | 18 | 893 | 487 | MK |
| MT | -6 | -2 | 140 | -10 | 0 | 0 | -6 | 6 | 9 | -9 | -10 | 1 | -6 | -10 | -10 | -6 | -5 | -10 | -7 | -10 | -10 | 315 | -8 | -10 | 15 | 12 | 17 | 41 | 148 | 254 | MT |
| NL | -15 | -11 | -15 | 252 | 4 | 27 | -14 | -11 | -14 | -4 | -11 | 1 | -9 | -15 | -15 | -14 | -2 | -15 | -0 | 3 | -15 | -14 | 131 | -15 | -7 | 36 | 10 | 2 | 384 | 625 | NL |
| NO | -2 | -1 | -2 | -1 | 29 | 2 | -2 | -1 | -1 | 2 | 1 | 0 | -1 | -2 | -2 | -1 | -1 | -2 | 1 | 1 | -2 | -2 | 4 | -2 | -1 | 4 | 3 | 0 | 3 | -10 | NO |
| PL | -2 | -1 | -2 | 7 | 4 | 403 | -2 | 17 | 10 | 21 | 4 | 3 | 19 | -2 | -2 | 1 | 44 | -2 | 1 | 16 | -2 | 1 | 16 | -2 | -1 | 15 | 3 | 2 | 804 | 730 | PL |
| PT | -1 | -1 | -1 | 1 | 0 | 1 | 402 | -1 | -0 | -1 | -1 | 0 | -1 | -1 | -1 | -1 | -1 | -1 | 57 | -1 | -1 | 2 | 4 | -1 | 0 | 14 | 10 | 2 | 698 | 716 | PT |
| RO | 3 | 5 | -1 | 1 | 1 | 83 | -0 | 464 | 66 | 25 | 1 | 2 | 24 | -1 | -1 | 9 | 115 | -1 | 0 | 2 | 4 | 7 | 3 | 0 | 1 | 6 | 1 | 6 | 1053 | 789 | RO |
| RS | 19 | 16 | -2 | 1 | 1 | 64 | -1 | 143 | 389 | 9 | -1 | 3 | 23 | -2 | -2 | 3 | 37 | -2 | 0 | 0 | -1 | 16 | 4 | -1 | 1 | 7 | 2 | 10 | 1074 | 501 | RS |
| RUE | -0 | -0 | -0 | 0 | 0 | 5 | -0 | 2 | 0 | 160 | 0 | 0 | 0 | -0 | 0 | 2 | 16 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | -0 | 4 | 0 | 1 | 247 | 15 | RUE |
| SE | -2 | -1 | -2 | 0 | 12 | 8 | -2 | -1 | -1 | 7 | 28 | 0 | -1 | -2 | -2 | -1 | 2 | -2 | 0 | 10 | -2 | -2 | 9 | -2 | -1 | 4 | 3 | 1 | 61 | 50 | SE |
| SI | -1 | -1 | -3 | 4 | 1 | 58 | -1 | 27 | 24 | 3 | -2 | 124 | 11 | -3 | -3 | -1 | 16 | -3 | -0 | -0 | -2 | 34 | 6 | -2 | -0 | 10 | 2 | 4 | 819 | 773 | SI |
| SK | 0 | 0 | -2 | 4 | 2 | 206 | -1 | 45 | 37 | 11 | 1 | 10 | 213 | -2 | -1 | 2 | 49 | -1 | 1 | 3 | -1 | 6 | 8 | -1 | -0 | 11 | 2 | 3 | 971 | 851 | SK |
| TJ | 0 | 0 | -0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 125 | 10 | 5 | 2 | 288 | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 5 | 0 | 23 | 686 | 3 | TJ |
| TM | 0 | 0 | -0 | 0 | 0 | 2 | -0 | 2 | 1 | 48 | 0 | 0 | 0 | 5 | 82 | 19 | 8 | 114 | 0 | 0 | 0 | 1 | 0 | 39 | 0 | 2 | 0 | 15 | 484 | 11 | TM |
| TR | -1 | 1 | -2 | -2 | 0 | 10 | -2 | 28 | 9 | 22 | -2 | 0 | 0 | -2 | -1 | 458 | 45 | -1 | -1 | -1 | 6 | 15 | -1 | 24 | 1 | 2 | 2 | 27 | 616 | 79 | TR |
| UA | -0 | 0 | -1 | 1 | 2 | 94 | -1 | 61 | 10 | 103 | 1 | 1 | 11 | -1 | -0 | 14 | 447 | 0 | 0 | 4 | 3 | 2 | 3 | 2 | -0 | 5 | 2 | 4 | 878 | 256 | UA |
| UZ | 0 | 0 | -0 | 0 | 0 | 3 | 0 | 2 | 1 | 57 | 0 | 0 | 0 | 23 | 21 | 10 | 10 | 322 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 2 | 0 | 12 | 848 | 12 | UZ |
| ATL | -5 | -4 | -5 | -4 | 0 | -4 | -3 | -5 | -5 | -2 | -5 | 0 | -4 | -5 | -5 | -5 | -4 | -5 | 3 | -5 | -5 | -5 | -3 | -5 | -2 | 11 | 8 | 0 | -167 | -82 | ATL |
| BAS | -5 | -4 | -5 | 0 | 6 | 43 | -5 | -1 | -4 | 19 | 16 | 0 | -2 | -5 | -5 | -4 | 8 | -5 | -3 | 43 | -5 | -5 | 13 | -5 | -2 | 8 | 5 | 1 | 74 | 110 | BAS |
| BLS | -2 | -0 | -3 | -2 | 1 | 31 | -3 | 67 | 10 | 89 | -2 | 0 | 1 | -3 | -2 | 88 | 192 | -1 | -2 | -1 | 30 | 3 | -1 | 4 | -1 | 6 | 6 | 7 | 524 | 137 | BLS |
| MED | -6 | -0 | -8 | -10 | 0 | 5 | -6 | 16 | 16 | -3 | -10 | 2 | -5 | -11 | -11 | 68 | 12 | -11 | -8 | -10 | -8 | 165 | -8 | -5 | 7 | 9 | 12 | 24 | 146 | 153 | MED |
| NOS | -16 | -12 | -16 | 3 | 7 | 2 | -16 | -15 | -16 | -10 | -13 | 0 | -11 | -16 | -16 | -16 | -12 | -16 | -7 | -8 | -16 | -16 | 45 | -16 | -8 | 12 | 13 | 0 | -399 | -120 | NOS |
| AST | -1 | -0 | -1 | -1 | 0 | 1 | -1 | 1 | -0 | 21 | -1 | 0 | -1 | 3 | 7 | 64 | 6 | 28 | -1 | -1 | -1 | 4 | -1 | 114 | 0 | 6 | 1 | 15 | 204 | -10 | AST |
| NOA | 1 | 3 | 0 | -1 | 0 | 4 | 1 | 11 | 9 | 2 | -1 | 0 | -0 | -2 | -1 | 21 | 7 | -1 | -0 | -1 | -1 | 65 | -1 | 0 | 40 | 12 | 5 | 29 | 164 | 124 | NOA |
| EXC | -0 | 0 | -1 | 2 | 1 | 19 | 2 | 12 | 5 | 103 | 1 | 1 | 2 | 1 | 2 | 19 | 28 | 16 | 1 | 1 | -0 | 3 | 4 | 5 | -0 | 6 | 1 | 4 | 407 | 135 | EXC |
| EU | -2 | -0 | -3 | 13 | 3 | 60 | 12 | 37 | 11 | 9 | 2 | 3 | 7 | -3 | -3 | 0 | 17 | -3 | 6 | 5 | -3 | 10 | 17 | -3 | -1 | 13 | 5 | 4 | 595 | 573 | EU |
| | ME | MK | MT | NL | NO | PL | PT | RO | RS | RUE | SE | SI | SK | TJ | TM | TR | UA | UZ | ATL | BAS | BLS | MED | NOS | AST | NOA | BIC | DMS | VOL | EXC | EU | |