

3. Atmospheric Supply of Nitrogen to the Baltic Sea in 2005

Nitrogen emission data, as well as the model results presented here have been approved by the 31th Session of the Steering Body of EMEP in Geneva in September 2007. The EMEP Unified Eulerian model system has been used for all nitrogen computations presented in this Chapter. Annual deposition of total nitrogen to the Baltic Sea basin in 2005 was 208 ktonnes approximately 3% less than in 2004. Deposition of oxidized nitrogen accounted for 56% of total nitrogen deposition in 2005.

3.1 Nitrogen emissions

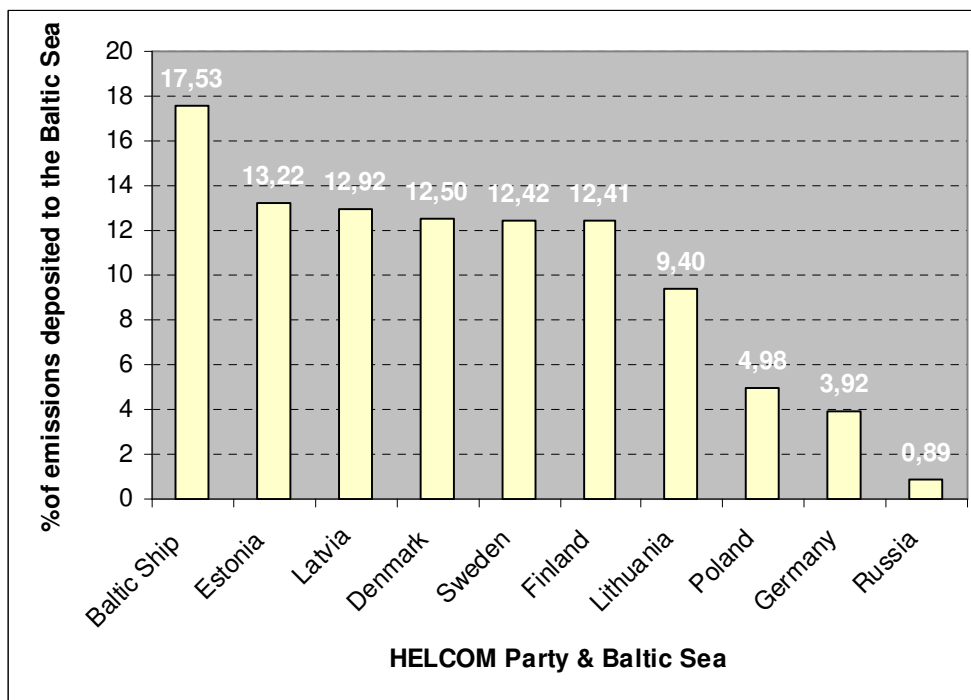


Figure 3.1. Percent of annual emissions of total (oxidized + reduced) nitrogen from the HELCOM Parties and international ship traffic emissions on the Baltic Sea (Baltic Ship) deposited to the Baltic Sea basin in 2005.

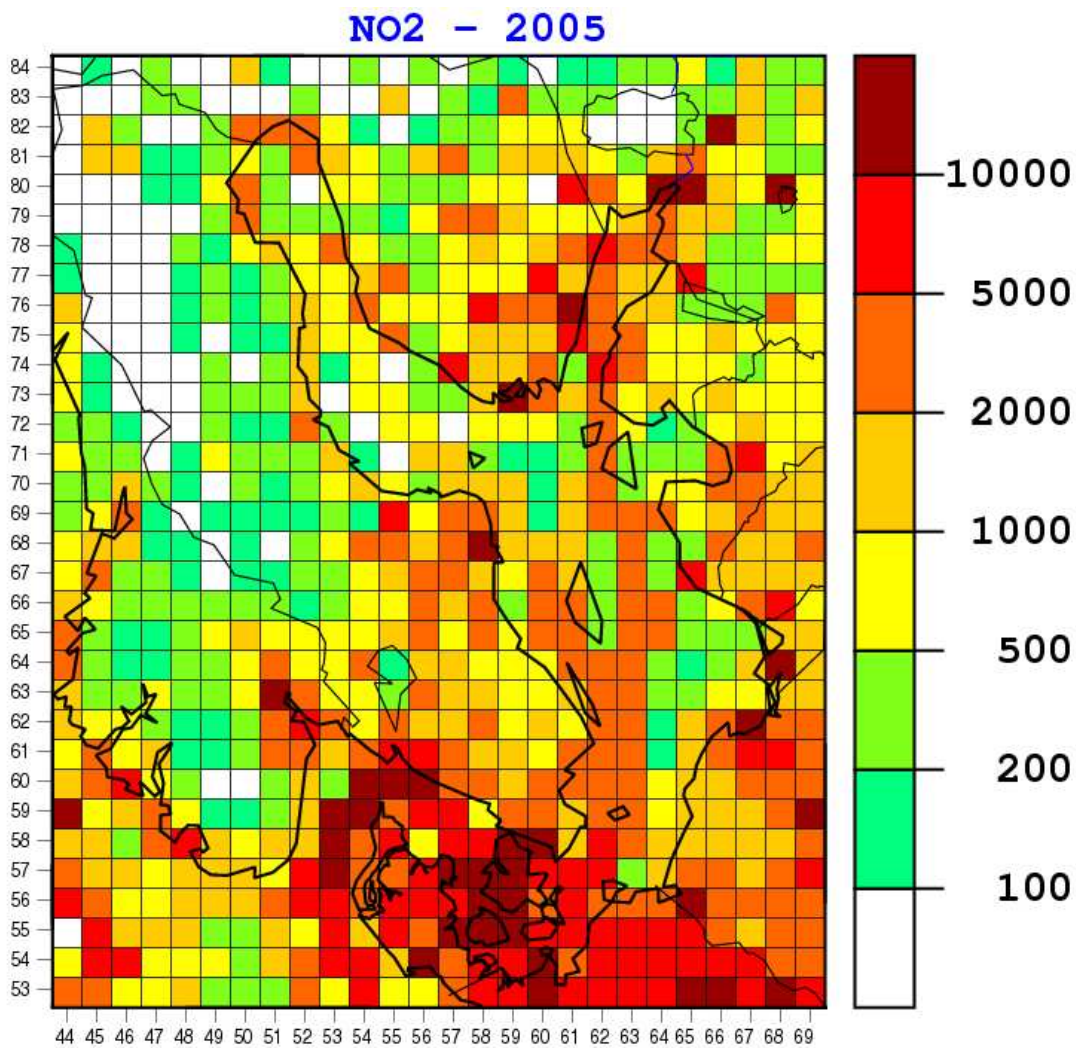


Figure 3.2. Map of annual emission of oxidized nitrogen (including emissions from the ship traffic) in the Baltic Sea region in 2005. Units: Mg (tonnes) of NO₂ per year and per 50×50 km grid cell.

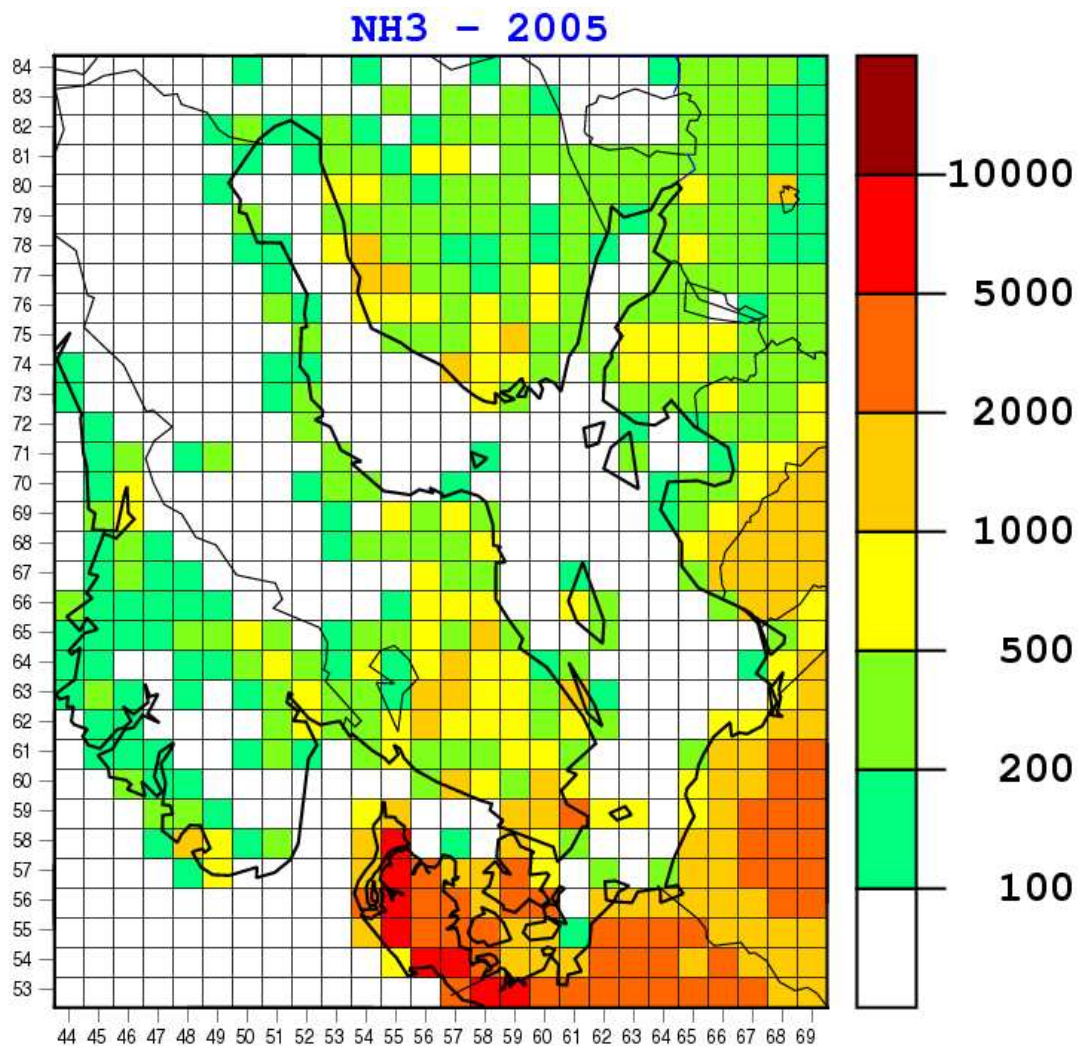


Figure 3.3. Map of annual emission of ammonia in the Baltic Sea region in 2005. Units: Mg of NH₃ per year and per 50x50 km grid cell.

Table 3.1. The list of 11 SNAP emissions sectors as specified in the EMEP-CORINAIR Emission Inventory Guidebook.

Sector 1	Combustion in energy and transformation industry
Sector 2	Non-industrial combustion plants
Sector 3	Combustion in manufacturing industry
Sector 4	Production processes
Sector 5	Extraction and distribution of fossil fuels and geothermal energy
Sector 6	Solvent and other product use
Sector 7	Road transport
Sector 8	Other mobile sources and machinery (including ship traffic)
Sector 9	Waste treatment and disposal
Sector 10	Agriculture
Sector 11	Other sources and sinks

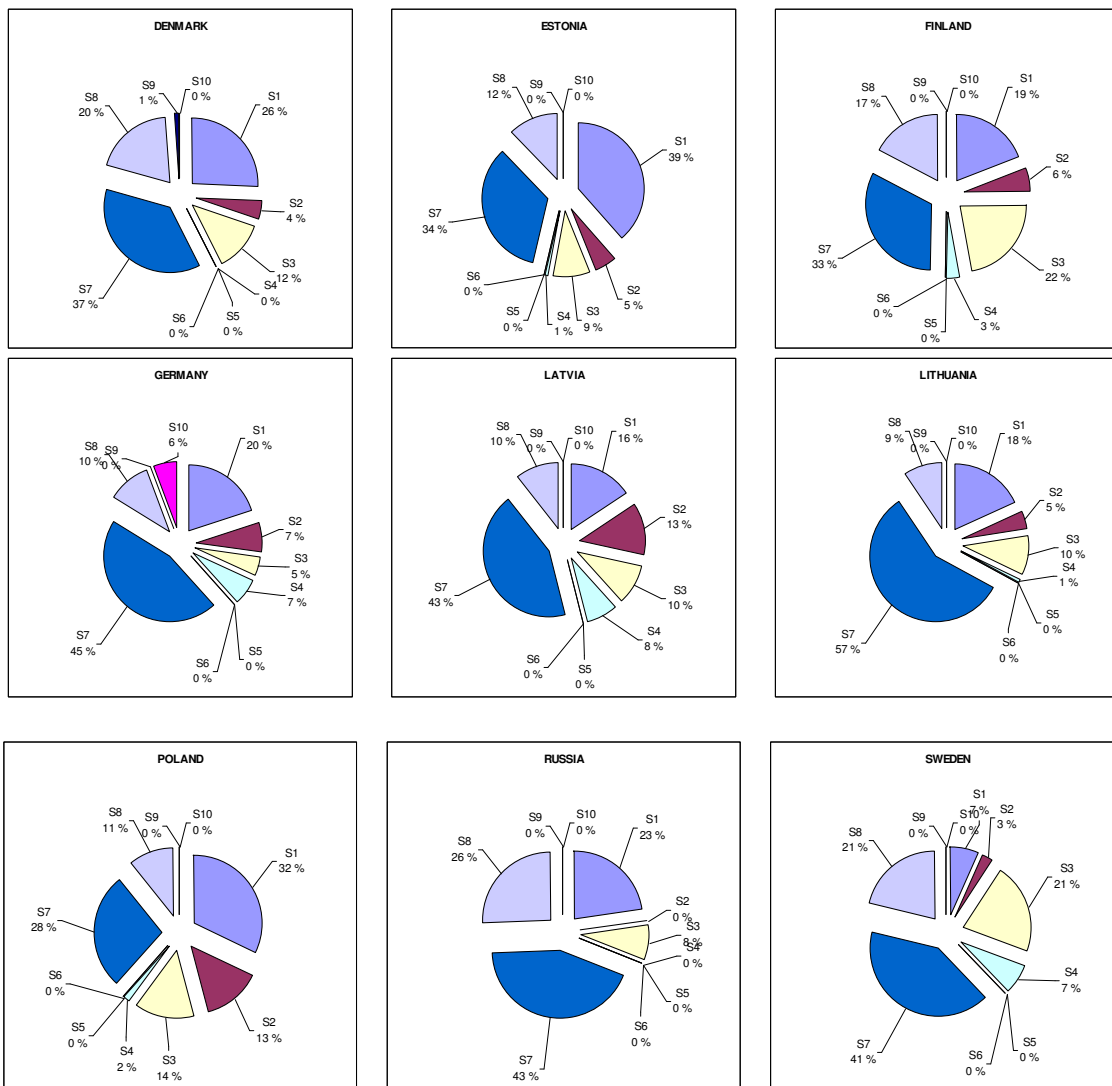


Figure 3.4. Annual 2005 nitrogen oxides emissions from the HELCOM Parties split into the SNAP sectors.

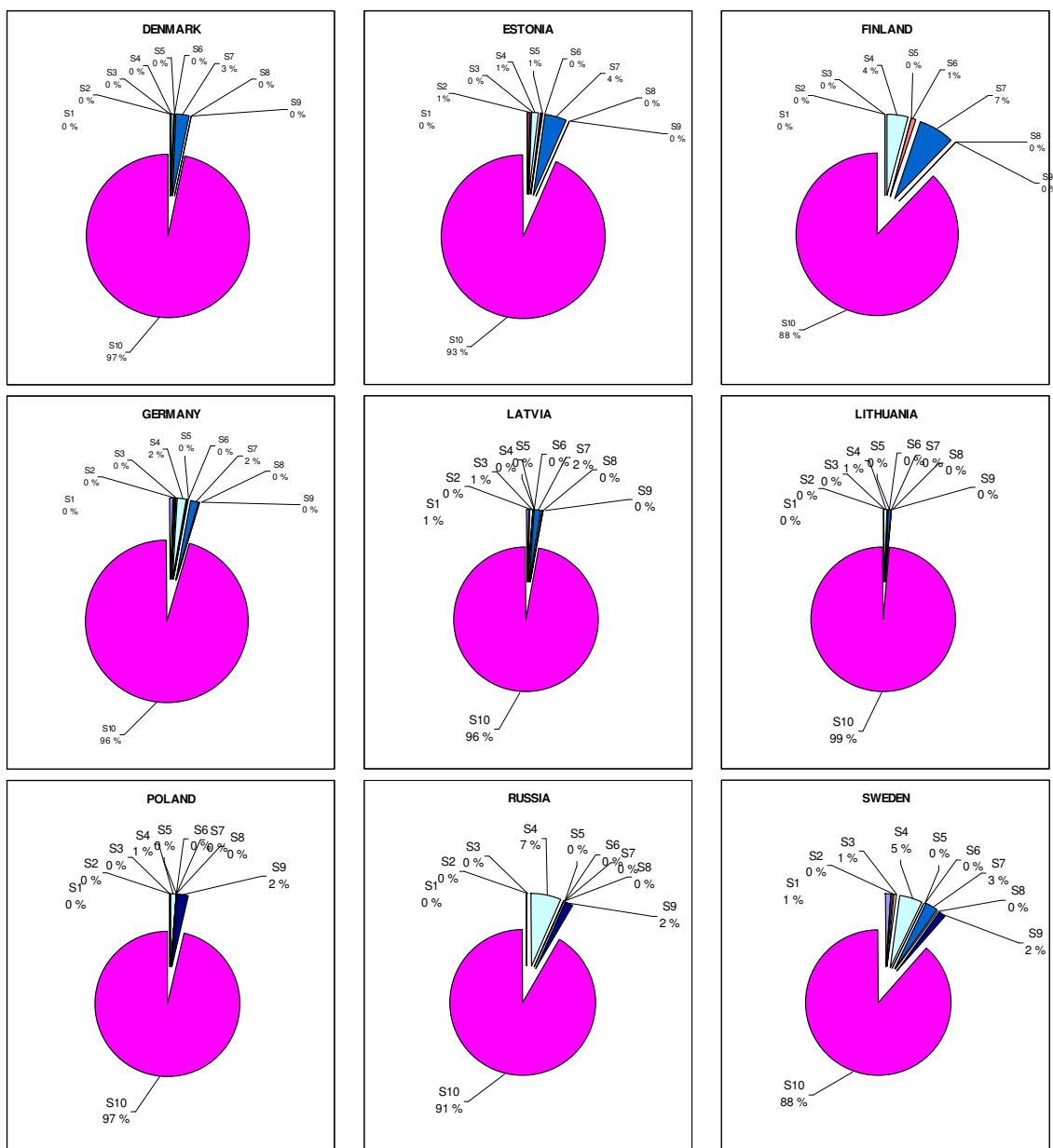


Figure 3.5. Annual 2004 ammonia emissions from the HELCOM Parties split into the SNAP sectors.

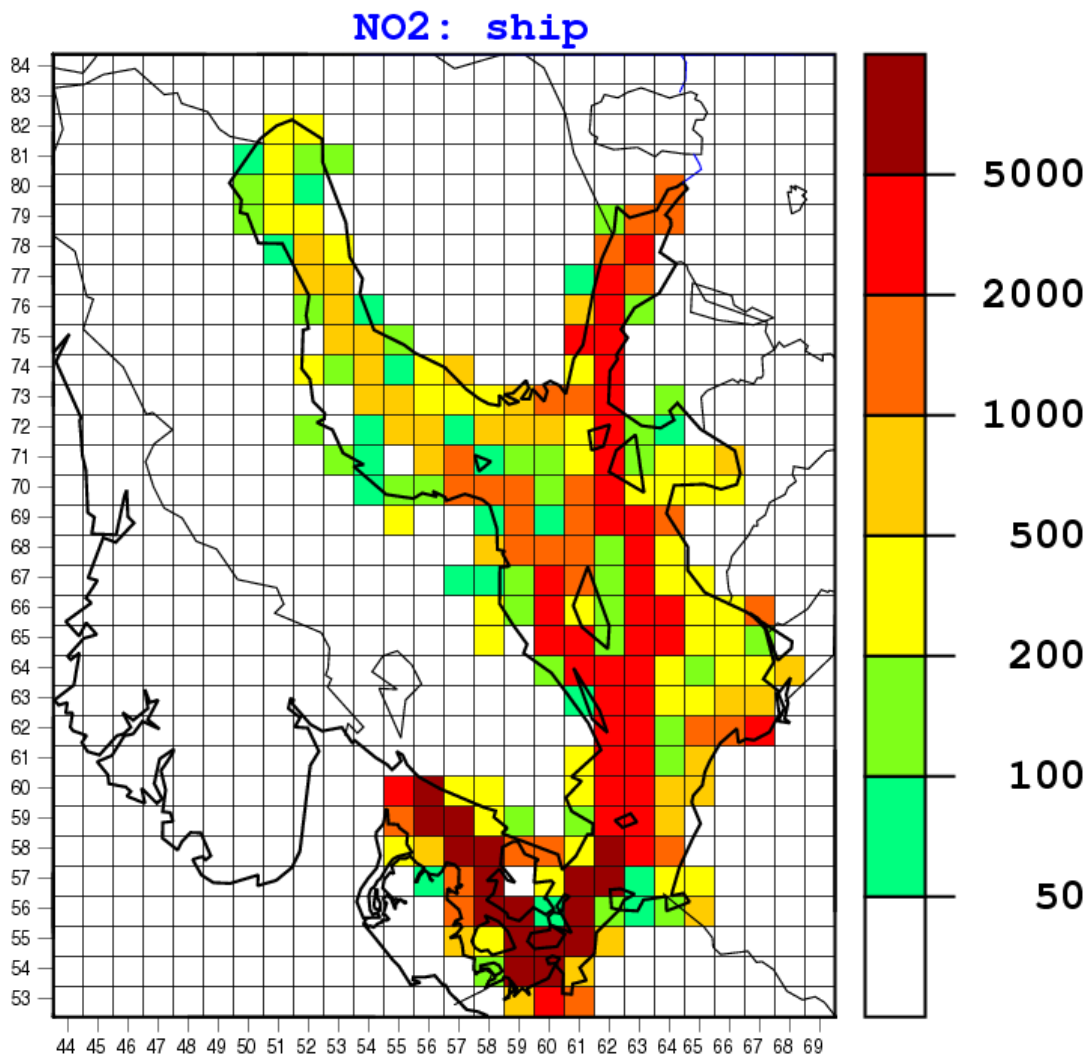


Figure 3.6 Map of annual emissions of nitrogen oxides from the international ship traffic on the Baltic Sea in 2005 used in the EMEP model calculations. Units: Mg of NO₂ per year and per 50x50 km grid cell. There are large uncertainties in the estimate for ship traffic emissions. The international ship emissions and their spatial distribution have been updated based on new emission estimates derived by ENTEC for the year 2000. Ship emissions for 2006, were deduced by applying an increase factor of 2.5 % per year on cargo vessel traffic and 3.9 % per year on passenger vessel traffic. The factors are the same as used by ENTEC for predicting emissions of nitrogen in 2010 based on the emission estimates for 2000.

3.2 Annual deposition of nitrogen

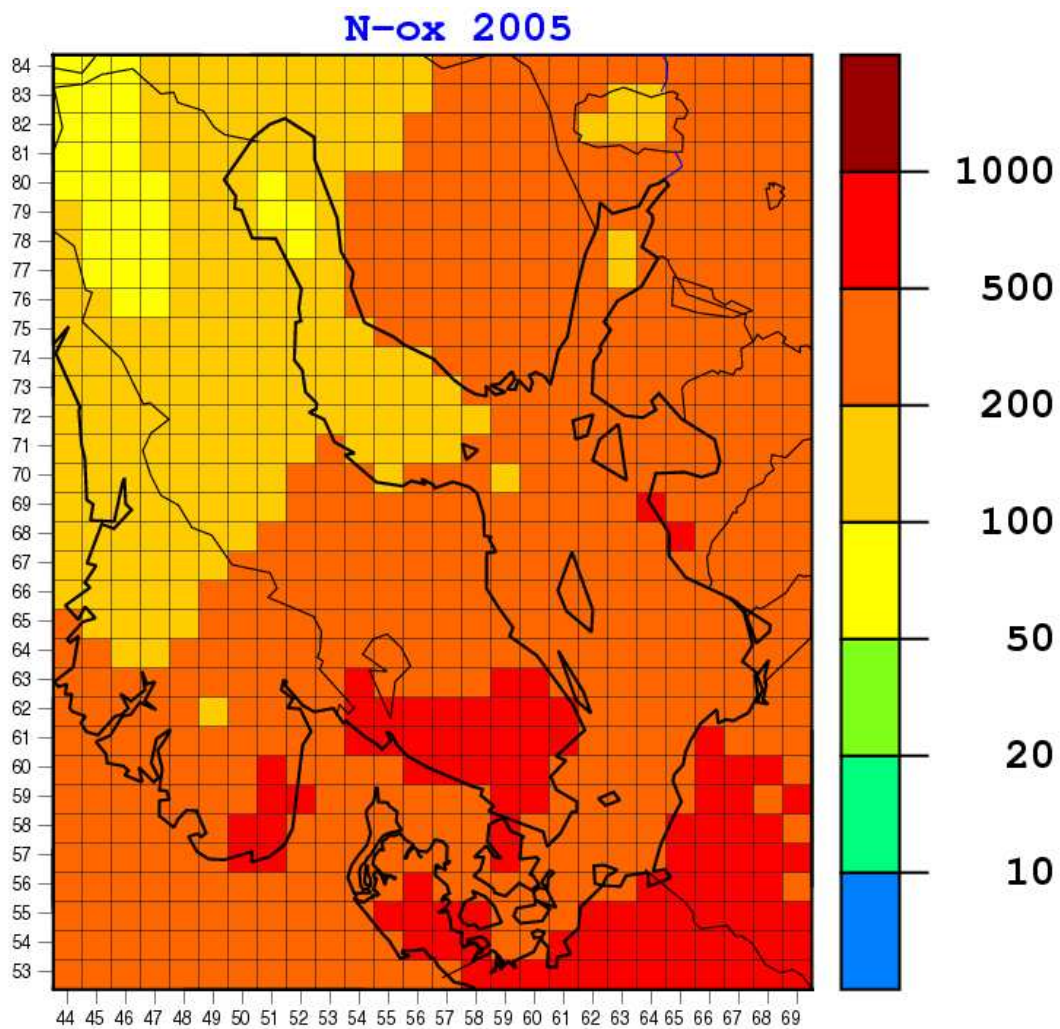


Figure 3.7. Map of annual deposition flux of oxidized nitrogen (dry + wet) in 2005. Units: mg N m⁻² yr⁻¹.

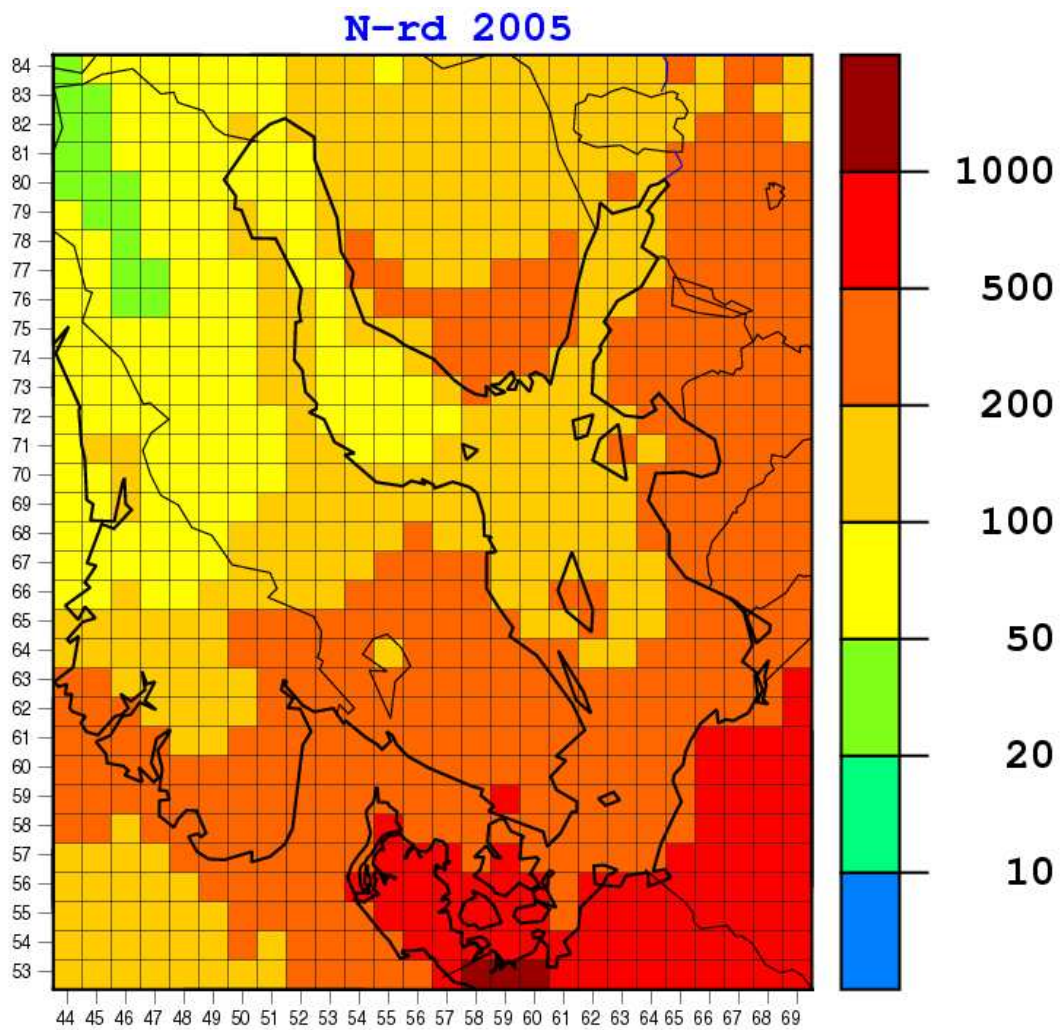


Figure 3.8. Map of annual deposition flux of reduced nitrogen (dry + wet) in 2005. Units: $\text{mg N m}^{-2} \text{ yr}^{-1}$.

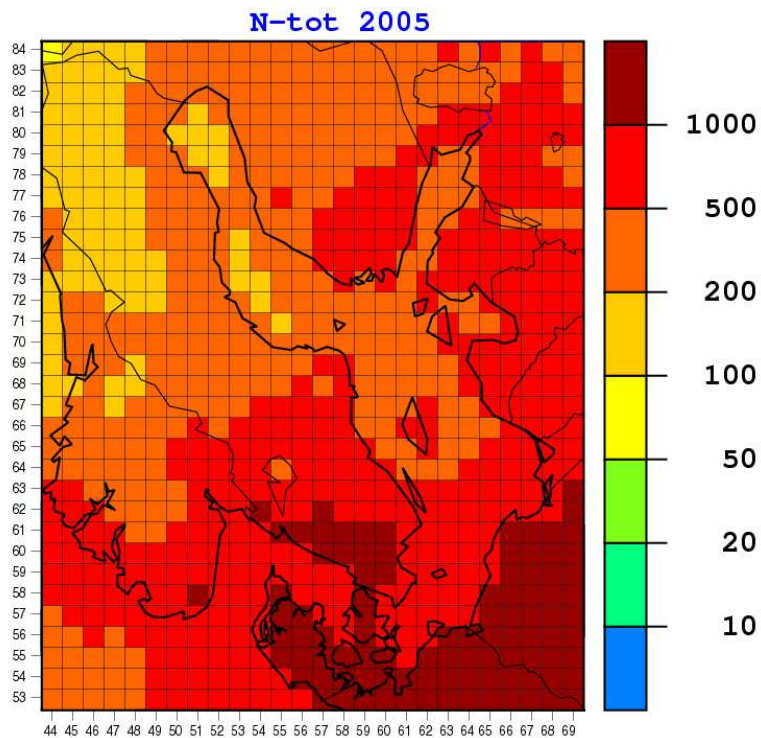


Figure 3.9. Map of annual deposition flux of total (oxidized + reduced) nitrogen in 2005. Units: mg N m⁻² yr⁻¹.

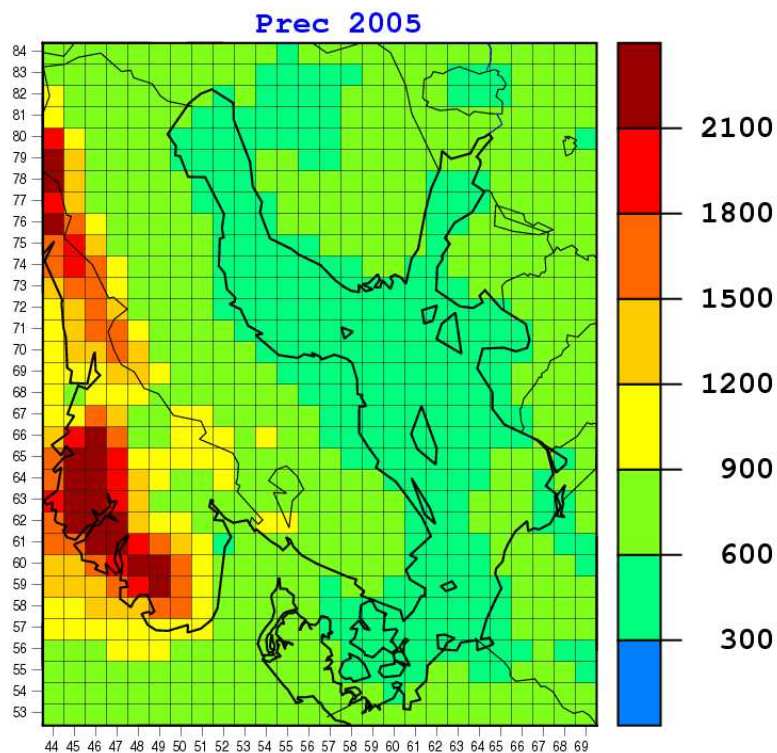


Figure 3.10. Map of annual precipitation in 2005. Units: mm yr⁻¹.

3.3 Monthly depositions of nitrogen

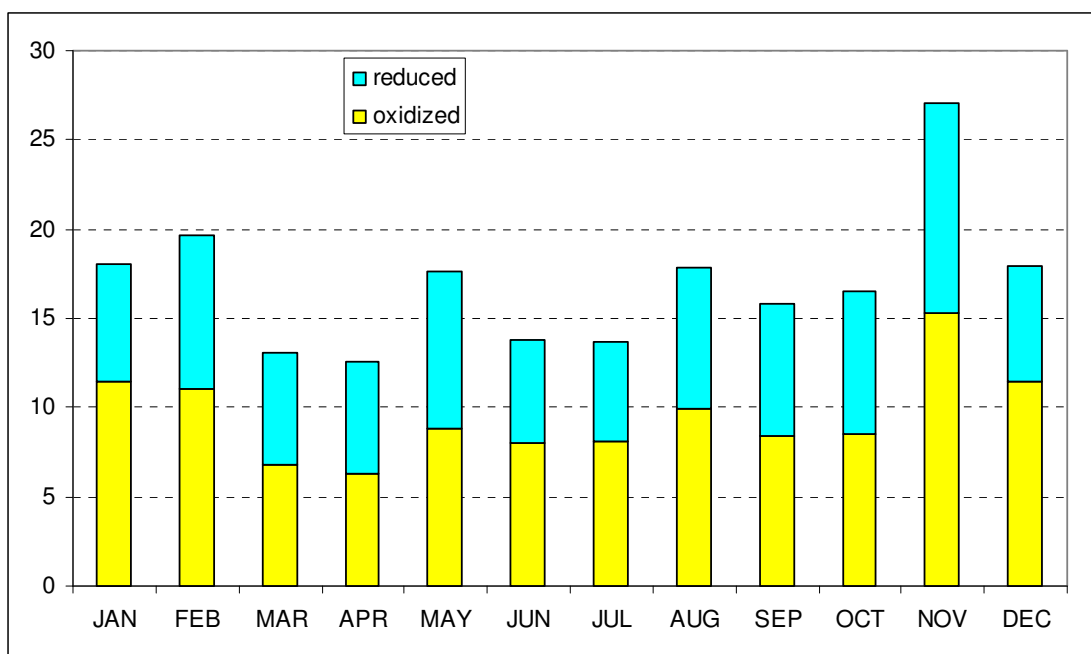


Figure 3.11. Monthly depositions of oxidized, reduced and total (oxidized +reduced) nitrogen to the entire Baltic Sea basin in 2005. Units: ktonnes N month⁻¹.

Table 3.2. Values of monthly depositions of oxidized, reduced and total (oxidized +reduced) nitrogen to the entire Baltic Sea basin in 2005. Units: ktonnes N month⁻¹.

Month	Oxidized	Reduced	Total
January	11,5	6,5	18,0
February	11,1	8,5	19,6
March	6,8	6,3	13,1
April	6,3	6,3	12,6
May	8,8	8,8	17,7
June	8,0	5,9	13,8
July	8,1	5,6	13,7
August	10,0	7,9	17,8
September	8,4	7,4	15,9
October	8,5	8,0	16,5
November	15,3	11,8	27,1
December	11,5	6,4	17,9

3.4 Source allocation of nitrogen deposition

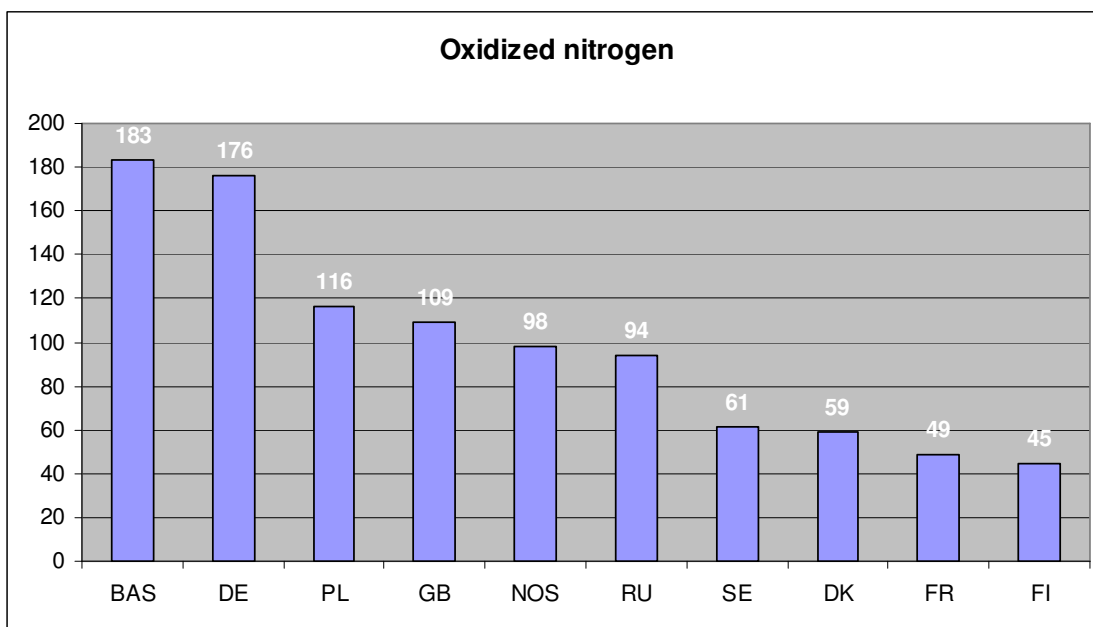


Figure 3.12. Top ten countries with highest contributions of nitrogen emissions to annual deposition of oxidized nitrogen into the Baltic Sea basin in the year 2005. Units: 100 tonnes N year⁻¹. BAS and NOS denote ship emissions from the Baltic Sea and from the North Sea, respectively.

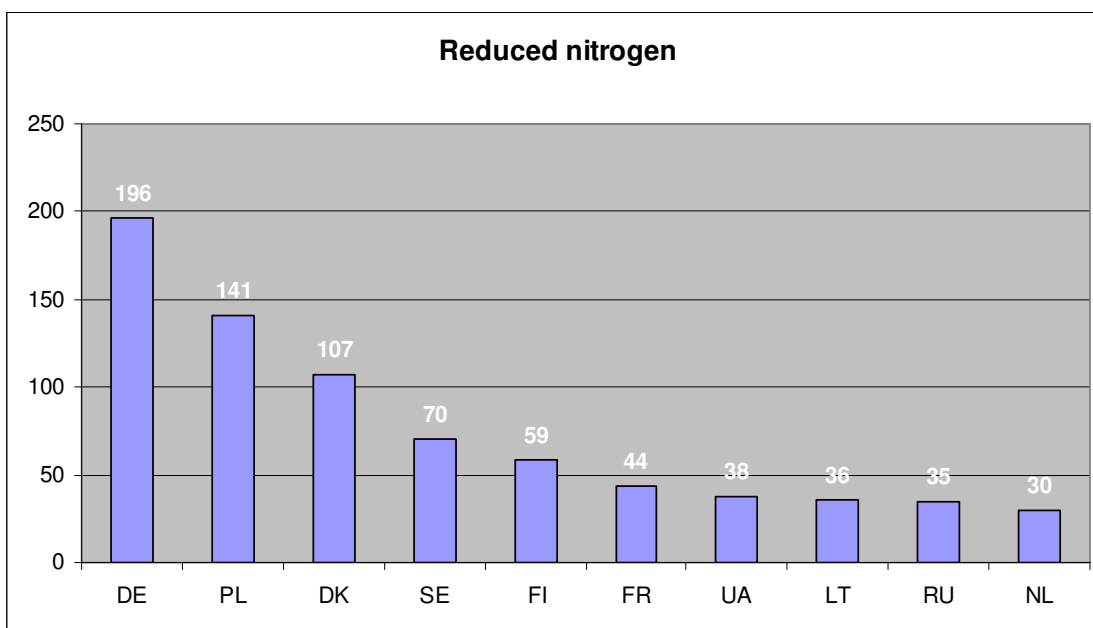


Figure 3.13. Top ten countries with highest contributions of nitrogen emissions to annual deposition of reduced nitrogen into the Baltic Sea basin in the year 2005. Units: 100 tonnes N year⁻¹. BAS and NOS denote ship emissions from the Baltic Sea and from the North Sea, respectively.

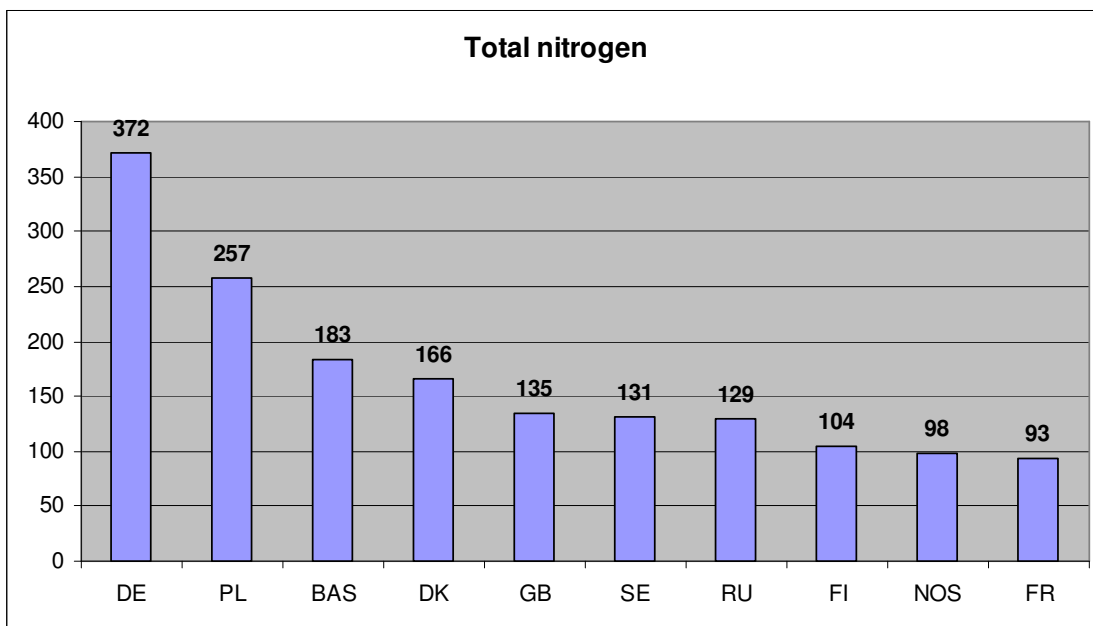


Figure 3.14. Top ten countries with highest contributions of nitrogen emissions to annual deposition of total(oxidized + reduced) nitrogen into the Baltic Sea basin in the year 2005. Units: 100 tonnes N year⁻¹. BAS and NOS denote ship emissions form the Baltic Sea and from the North Sea, respectively.