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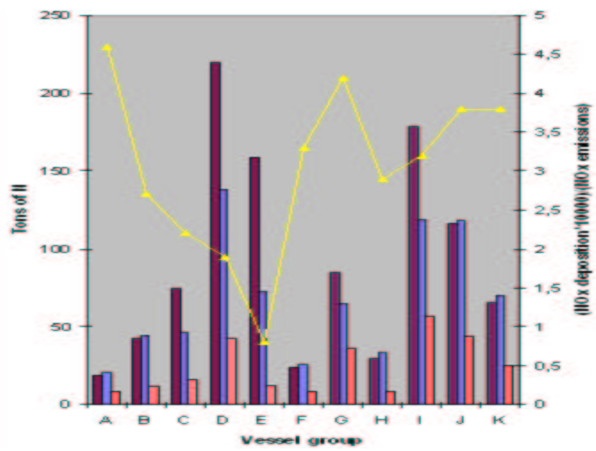
A study of contributions from the Norwegian fishing fleet to acidification and eutrophication

Leonor Tarrasón and Peter Wind

Fishing fleet: NO_x emissions and depositions in Norway



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Meteorological Synthesizing Centre - West
Norwegian Meteorological Institute
P.O. Box 43- Blindern, N-0313 Oslo, Norway

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A study of contributions from the Norwegian fishing fleet to acidification and eutrophication

Leonor Tarrasón and Peter Wind

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NORSK SAMMENDRAG

Dette prosjektet er utført på oppdrag fra Fiskeridepartementet, Miljøverndepartementet og Statens forurensningstilsyn. Hovedhensikten med prosjektet har vært å beskrive utslipp og deposisjon i Norge fra den norske fiskeflåten. Dette er informasjon som kan benyttes i vurdering av virkemidler for å redusere utslipp til luft fra den norske fiskeflåten.

Effekt-baserte utslippskontrollstrategier baserer seg på kunnskap og informasjon om luftforurensningens skadevirkninger på økosystemer og menneskehelse. I stedet for å pålegge en lik prosentvis utslippsreduksjon på alle fartøy i den norske fiskeflåten, analyserer denne studien de potensielle utslippsreduksjoner i forhold til miljøgevinsten, d.v.s. oppnådd beskyttelse av økosystemer utsatt for forsuring og eutrofiering. Denne innfallsvinkelen er basert på kunnskap om at økosystemer har varierende følsomhet overfor forsuring og eutrofiering samt forståelse om at utslippskontroller bør søke å minske skaden fra luftforurensning til å ligge under naturens tålegrenser. Denne tilnærmingen har vært brukt under Konvensjonen for Langtransporterte Luft forurensinger (CLRTAP) og ble lagt til grunn for de enkelte lands forpliktelser under Gøteborg-protokollen.

Utslipp fra den norske fiskeflåten er beregnet av Statistisk Sentralbyrå (SSB) for denne undersøkelsen og er basert på oppdatert informasjon fra Fiskeridirektoratet (Flugsrud 2000). Utslippsestimatene skiller mellom 11 ulike fartøytyper og er geografisk fordelt i EMEP gitteret med en romlig oppløsning på 50 x 50 km^2. Informasjon om den romlige fordelingen av utslippene er vesentlig forbedret i forhold til tidligere estimater (Barrett og Berge, 1993) og gjør det mulig å evaluere effekten av utslippsreduserende tiltak overfor bestemte fartøystyper. Den andre hovedforbedringen i metodologien som rapporten benytter seg av er bruken av den Eulerske UNIFIED EMEP modellen, med den forbedrede romlige oppløsningen på 50 x 50 km^2.

Utslipp fra hele den norske fiskflåten er estimert til ca 33,000 tonn NO_x, som NO_2 og ca 800 tonn SO_x som SO_2. Dette utgjør ca 15% av de totale NO_x utslippene i Norge og 3.2% av de totale SO_2 utslippene. Det er også viktig å merke seg at norske NO_x utslipp fra fiskeflåten utgjør ca. 30% av alle utslipp fra mobile kilder og maskiner annet enn vegtrafikk (kilde sektor 8) og er sammenlignbare med de totale norske utslippene fra kilde sektor 1. Over hele EMEP området utgjør utslippene fra den norske fiskeflåten kun 0.15% av de totale NO_x utslippene.

Fiskeflåtens bidrag til de norske NO_x utslippene er betydelig. Imidlertid er fiskeflåtens bidrag til deposisjon av NO_x i områder i Norge med overskridelse av tålegrensen for forsuring og eutrofiering betydelig mindre. Utslipp fra norske fiskerier er primært avsatt over marine områder slik at, avhengig av meteorologiske forhold, bare en liten prosentandel av disse utslippene når den norske fastlandet. Basert på de meteorologiske forhold og utslippsdata for 2000 er det beregnet at 7,4% (753 tonn) av fiskeflåtens utslipp i 2000 ble avsatt på fastlands Norge og at 2,7% (269 tonn) ble avsatt i områder utsatt for overskridelser av tålegrenser. Dette betyr at en reduksjon på 100 tonn (N) i norske fiskeriers utslipp slår ut i en tilsvarende reduksjon på avsetningene i norske områder utsatt for overskridelser av tålegrenser for forsuring og eutrofiering på 2,7 tonn (N).

Effektiviteten av utslippsreduksjoner kan beregnes som den oppnådde reduksjon på overskridelser av tålegrenser i et påvirket område i forhold til tonn av utslipp av forurensning. Denne effektiviteten er hovedsakelig påvirket av fordelingen av utslippskildene i forhold til transportmønstre for bestemte meteorologiske forhold og fordelingen av økosystemer som er utsatt for forsuring og eutrofiering langs disse transportmønstrene. Indikatorer av effektiviteten av utslippsreduksjoner for de enkelte fartøytyper i alle norske områder hvor økosystemer har overskridelser av tålegrensen for enten forsuring eller eutrofiering er gjengitt i rapporten i form av skyldmatriser.

For hver fartøytype er det beregnet effekten av redusert avsetning av nitrogen på det norske fastlandet. Beregningene viser at reduksjoner i NO_x utslipp fra industritrålere og ringnotsnurpere (fartøystyper G, I, J og K) er effektive i beskyttelsen av områder berørt av overskridelser av tålegrenser for forsuring og eutrofiering. I tillegg er utslippene fra konvensjonelle fartøy i type A, reketrålere i type F og notfartøy i type H lave, men på grunn av deres nærhet til kysten er reduksjoner av disse utslippene nokså effektive. Utslipp fra torsketrålere utgjør det største enkeltstående bidraget til NO_x utslipp fra den norske fiskeflåten men bidrar relativt lite til avsetningen over områder som er utsatt for overskridelser av naturens tålegrense for forsuring og eutrofiering.

Effektiviteten av utslippsreduksjoner fra den norske fiskeflåten er mindre enn gjennomsnittlig effektivitet for utslippsreduksjoner fra andre norske utslippskilder. Særlig er utslippsreduksjoner fra sektor 8 (andre mobile kilder og maskiner annet enn vegtransport) mer effektive enn for hvilken som helst fartøytype av fiskebåter som er vurdert i denne undersøkelsen. Dette tyder på at utslipp fra kysttrafikk, lufttrafikk, militærtransport (o.s.v.) er sannsynlige områder som krever videre oppmerksomhet i framtidige analyser av effektbaserte kontrollstrategier i Norge.

Beregningene som er presentert her har vært utført med en særskilt utgave av den

Eulerske UNIFIED EMEP modellen. Det er viktig å nevne at UNIFIED EMEP modellen for tiden er under utvikling og vurdering innenfor CLRTAP og at disse beregningene er begrenset til de meteorologiske forholdene for kalenderåret 2000. Forskjellige meteorologiske forhold kan forandre de konklusjonene som er presentert her. For videre bruk av disse resultater til utarbeidelse av utslippskontrol strategier, anbefales det å utvide disse beregningene til minimum 5 år med avvikende meteorologiske forhold, slik det er blir gjort tidligere med bruk av EMEP modell resultater.

Executive Summary

Upon request by Norwegian national authorities, the present study has been conducted to support the design of effect-based emission control strategies for the Norwegian fishing fleet.

Effect-based emission controls are educated strategies based on scientific data on the harmful impact of air pollution. Rather than imposing a single percentage emission reduction to all vessels types in the Norwegian fishing fleet, this study analyses the potential benefit of emission reductions in terms of the environmental protection of ecosystem areas exposed to acidification and eutrophication. This approach is based on the concept that ecosystems vary in their sensitivity to acidity and eutrophication and that emission controls should aim to reduce the damage from air pollutants below ecosystems critical loads. Such approach has been widely used under the Convention on Long-range Transboundary Air Pollution (CLRTAP) and most recently also under the design of the EU National Ceilings Directive. In these cases, effect-based emission controls are also analyzed from the point of view of cost-effectiveness. However, the evaluation of the costs related to the effect-based emission reductions proposed here is beyond the purpose of the present study.

The emissions from the Norwegian fishing fleet have been calculated specially for the purpose of this study by Statistics Norway (SN) on the basis of updated information from the directorate of Fisheries (Flugsrud, 2002). The emission estimates distinguish 11 vessel groups and have been spatially distributed in the EMEP grid with a spatial resolution of 50x50 km^2. These gridded emissions constitute a core of information improvement with respect to previous estimates (Barrett and Berge, 1993) as they allow the evaluation of the effect of emission reductions measures addressed at specific boat types. The other main improvement in the methodology used in this report is the use of the UNIFIED EMEP model, with refined spatial resolution of 50x50km^2. In addition, the calculation of critical loads of acidification and eutrophication has also been revised and updated according to the methods described in Posch et al., 2001.

Emissions from Norwegian fisheries have been estimated to be 33,313 tons NO_x, as NO_2 and 835 tons SO_x as SO_2. This constitutes 15% of the total nitrogen oxide emissions from Norway and 3.2% of the total sulphur dioxide emissions. The Norwegian NO_x emissions from fisheries represent about 30% of the all emissions from mobile sources and machinery different from road traffic (source sector 8)

and are comparable to the Norwegian emissions from power combustion (source sector 1). Over the whole EMEP area, however, emissions from the Norwegian fishing fleet represents only 0.15% of the total NO_x emissions.

The contribution of NO_x emissions from the Norwegian fishing fleet at national level is significant. However, the contribution of these emissions to deposition over Norwegian areas affected by acidification and eutrophication is considerably smaller. Emissions from the Norwegian fisheries are primarily deposited over marine areas, so that depending on the meteorological conditions, only a small percentage of these emissions reach the Norwegian coast. For the meteorological conditions of year 2000, of the emitted 10,139 tons NO_x, as N, from the Norwegian fishing fleet, only 753 tons (N), approximately 7.4%, were deposited in mainland Norway and of these only 269 tons (N) (2.7% of the emissions) were actually deposited in areas exposed to exceedance of critical loads of acidity and eutrophication. This implies that a reduction of 100 tons (N) in the emissions from Norwegian fisheries results in a reduction of the deposition in Norwegian areas affected by exceedances to critical loads of acidity and eutrophication of 2.7 tons (N).

The effectiveness of emission reductions can be quantified in terms of the reduction of deposition over ecosystem affected areas per tons of emitted pollutant. The main factors affecting this effectiveness are the distribution of emission sources with respect to transport patterns for particular meteorological conditions and the distribution of ecosystem areas affected by acidification and eutrophication along these transport patterns. Measures of the effectiveness of emissions reduction for each vessels group in all Norwegian areas where ecosystems are affected either by acidification or eutrophication, are given in the report in the form of source-receptor relationships.

Emission reductions from each different vessel type have been classified in terms of their effectiveness. It is shown that reductions of NO_x emissions from industrial trawlers and purse seiner vessels (vessel groups G, I, J and K) would be effective to protect acidification and eutrophication affected areas. In addition, vessel types A, F and H (small vessels, seiner vessels and shrimp trawlers other than freezing shrimp trawlers) have relatively small emissions, but because of their proximity to the coast, reductions of emissions from these vessels would also be effective. Note that although emissions from cod trawlers represent the largest single contribution to NO_x emissions from the Norwegian fishing fleet, these sources have relatively smaller impact on the deposition over areas affected by exceedances to critical loads.

The effectiveness of emission reductions from the Norwegian fishing fleet is smaller than the averaged effectiveness of emission reductions from other Norwegian emission sources. In particular, emission reductions from sector 8 (Other mobile sources and machine other than road transport) are more effective than for any type of fishing vessel considered in this study. Therefore it is recommended to extend this type of study to other activity sectors such as coastal traffic, air traffic or military transport, in future analysis of effect-based control strategies in Norway.

The calculations presented here have been carried out with a particular version the EMEP Unified Eulerian model. It is important to mention that the EMEP Unified Eulerian model is presently under development and evaluation within the CLRTAP and that the calculations are limited for the meteorological conditions of year 2000. For these reasons, it is recommended to extend the calculations to at least 5 other years with different meteorological conditions.

Contents

Chapter 1

Introduction

This report analyses the contribution of emissions of sulphur and nitrogen oxides from the Norwegian fishing fleet to acidification and eutrophication over Norway. It presents initial source-receptor relationships for 11 different types of fishing vessels for year 2000 and relates the individual vessel type emissions to depositions in Norwegian areas affected by exceedances to critical loads of acidity and eutrophication. The calculation of the impact of a planned emission reduction scenario for any of these fishing vessel types can be easily derived as a product of the planned emission values and source-receptor relationships presented here. The results are intended to support Norwegian national authorities in future scenario analysis and assist in the design of emission control strategies for the Norwegian fishing fleet.

The report has been produced in co-operation with the Directorate of Fisheries and Statistics Norway (SN) that provided a refined emission estimate for a relevant selection of 11 fishing vessel groups. The refined emission data has been spatially distributed according to established fishing routes in order to allow source-receptor calculations with the Unified EMEP Eulerian model in a 50x50 km^2 scale. This represents a clear advance with respect to previous estimates as presented in Barrett and Berge (1993). In the present report, calculations are spatially refined and emissions from fisheries are no longer treated as a whole. This level of disaggregation in emissions facilitates the evaluation of measures to reduce emissions as it allows to identify the vessel types where control measures result in increased protection over acidification and eutrophication exposed areas.

The methodology adopted in this report is presented in Chapter 2, including a short description of emission data and of the Unified EMEP Eulerian model. Chapter 3 presents the calculated deposition from each individual fishing boat type, relates these depositions to national totals, evaluates their influence on areas with exceedances and compares the new estimates with previous calculations by Barrett and Berge (1993). Main conclusions and recommendations for further use of this work are given in Chapter 4. Finally, the appendices include detailed graphic and tabulated information that substantiate the conclusions of the report and allow for its further use for scenario analysis.

This work has been financed by the Norwegian Ministry of Fisheries (FID), the Norwegian Ministry of the Environment (MD) and the Norwegian Pollution Control Authority (SFT), as part of a model development project to allow the development of a national modeling system able to link hemispheric-regional and local air pollution problems. Kristin Rypdal (now at CICERO) and Ketil Flugsrud (SN) are gratefully acknowledged for the compilation of the fishing fleet emission inventory and their support in project discussions related to the emission data from fisheries.

Chapter 2

Modeling approach

2.1 Model description

The model used for the calculations reported here is the EMEP Eulerian Unified model. The running version of this model is internally denoted UNI-ACID rv1.1_stack_height and has been tested and used for acid deposition application during the autumn 2002.

The EMEP Unified model is a 3-dimensional chemical transport model that uses a spatial distribution of 50x50km^2 and resolves 20 layers in the vertical. It describes the transport and transformation of pollutants in the atmosphere in terms of:

1) definition of some initial concentrations of pollutants and concentrations at domain boundaries
2) inclusion of pollutants by emissions (sources) distributed over the model domain
3) transport of pollutants according to meteorological conditions
4) chemical transformation of different chemical components
5) dry and wet deposition of pollutants in the domain (receptor area).

This particular version of the model considers primarily sulphur and nitrogen compounds, because these are the main components involved in acidification and eutrophication effects. It describes the transport, transformation and removal of 9 different chemical components. The chemical parametrisation of the sulphur oxidation is according to Eliassen and Saltbones (1983) and for nitrogen oxidation according to Hov et al. (1988). The model uses the same dry and wet deposition parametrisations as the Lagrangian EMEP model (EMEP/MSC-W Report 1/97). The main difference with respect to the EMEP Lagrangian model formulation is the description of transport both vertically and horizontally. The present version of the Unified EMEP model describes pollution transport in the atmosphere up to 100hPa, resolves 20 different layers in the vertical and differentiates the vertical extension of emissions from power stations and other sectors according to subgrid dispersion calculations (Vidic, 2002; pers. comm.). Horizontally, the EMEP Unified model uses a spatial resolution that is 9 times finer than in the Lagrangian model, that is 50x50km^2 instead of 150x150km^2. This implies that the model calculations presented here allow for a larger degree of spatial differentiation than previous estimates with the Lagrangian EMEP model (cf. Barrett and Berge, 1993).

2.2 Emissions

The emission data used in this report are, except for Norway, the officially reported EMEP emissions of sulphur oxides, nitrogen oxides and ammonia for year 2000 (Vestreng and Klein, 2002). Norwegian emissions have been modified in order to include the most recent emission data for the fishing fleet, which has been estimated specially for the purpose of this study. Since fisheries do not contribute to ammonia emissions, the modification of Norwegian emissions carried out in this study involves only emissions of sulphur and nitrogen oxides.

2.2.1 Emissions from the Norwegian fishing fleet evaluated by Statistics Norway

The emissions from the Norwegian fishing fleet used in this study have been calculated by Statistics Norway (SN) on the basis of updated information from the Directorate of Fisheries. These emissions distinguish 11 vessel types and have been spatially disaggregated with a resolution of 50x50 km^2 in the EMEP grid. These constitute the core of information for the present study and are a main requirement when evaluating the effect of emission control strategies.

Based on fuel costs and number of ships in each vessel type, Statistics Norway has estimated the fuel consumption for each of the 11 vessel types (Flugsrud, 2002). The total consumption of fuel has been divided into consumption in harbour, consumption at the fishing fields and consumption from vessels in transit. The repartition of emissions in harbours has been distributed according to the quantity of delivered fish. The repartition of emissions at the fishing fields has been distributed according to the quantity of caught fish and is spread evenly over the fishing fields. The emissions from vessels in transit has been distributed according to the overall length of the route and the weight of the vessels. The information on fuel consumption and routes together with the evaluation of emissions factors has then been used to calculate detailed gridded emissions data in the EMEP 50x50 km^2 map. The resulting maps with the gridded emissions of NO_x are presented in the Appendix (Chapter 5.1).

There are large differences both in the level of emissions and in the spatial distributions of emissions from the different vessel types. In particular, an important part of the NO_x emissions from conventional large vessels (vessel type C), cod trawlers (vessel type D), shrimpfreezing trawlers (vessel type E), industrial trawlers (vessel type G) and purse seiners for blue whitting season (vessel type I) are estimated to be emitted away from the Norwegian coast. This fact will have an impact, although it will not be determinant, when analyzing the effect of these emissions over Norwegian mainland areas.

The estimated emissions for each of the selected 11 vessel types from Norwegian fishing fleet are given in table 2.1. The table presents the total emission of NO_x per vessel type, the relative contribution to the total emissions from all vessels from the Norwegian fishing fleet and the fraction of emissions emitted near the coast. In this context, emissions near the coast are defined as those corresponding to the spatial distribution of vessel type A, that is, small vessels of size 8 m to 12.9 m. Emissions of sulphur oxides are also presented in the last column of table 2.1.

Emissions of sulphur oxides from the fishing fleet have been scaled from the derived nitrogen oxides emissions. The same routes and ship traffic as for nitrogen oxides have been considered to apply and only emission factor per vessel type are expected vary. The scaling factor applied is 0.03 for small vessels types (groups A, B, F, H and K) and 0.024 for large vessels (groups C, D, E, G, I and J). Since the gridded SO_x emissions are scaled from the NO_x emissions, the spatial distribution of SO_x and NO_x is also the same for each type of vessel.

2.2.2 Emissions from the Norwegian fishing fleet compared to previous estimates

The new gridded data on emissions from fisheries differs from the data reported to UNECE/EMEP in January 2002 and documented in Vestreng and Klein (2002).

- Firstly, this is because the number of ships which are included has been updated according to information from the Directorate of Fisheries.
- Secondly, because the average emission factors have been modified. The

basic emission factors are still 60 g NO_x/kg fuel for small vessels (less than 27 m) and 75 g NO_x/kg fuel for larger vessels. However, the proportion of fuel used by large vessels has now increased with respect to earlier estimates. Consequently the average emission factor used here is 71.8 g/kg instead of the 70.3 g/kg which was used for previous reporting to UNECE/EMEP in January 2002. This revised average emission factor is expected to be used in future submissions to UNECE/EMEP.

- Thirdly, the routes have been modified using new information from DF (Remøy, pers. communication, 2002). The most striking effect of the new information is that a large fraction of emissions is now allocated to shrimp trawlers in the Barents Sea.

Total emissions from the Norwegian fishing fleet are 33,313 tons NO_x (as NO_2) (and 835 tons SO_x, as SO_2). This estimate is somewhat larger than previous estimates reported to UNECE/EMEP in January 2002. In order to make this estimate consistent with the rest of Norwegian emissions reported to UNECE/EMEP, we have substituted in the measure of what was feasible, the reported emissions from fisheries (32,646 tons NO_x) with the present estimates.

The new estimates for Norwegian emissions from different emission sectors, as they have been used in this study, is shown in table 2.2. The table distinguishes 11 sources categories (SNAP level 1). For all sectors, except for sector 8 "Other mobile sources and machinery", the emissions in table 2.2 correspond to the emissions officially reported by Norway to UNECE/EMEP. Emission in SNAP sector 8 include mobile sources related to: military activities, railways, inland waterways, maritime activities, air traffic, agriculture, forestry, industry, household and gardening and other off-road activities. This implies that emissions from fisheries are included as a subdivision of maritime activities in SNAP sector 8 (SNAP 080403 National fishing).

The new emissions from SNAP sector 8 are 764 tons of NO_x (as NO_2) larger than the values reported to UNECE in January 2002. This includes 667 tons additional NO_x emissions from fisheries and 97 tons additional NO_x emissions from fish farming. For practical reasons, it has not been possible to remove fish farming activities from the UNECE/EMEP reported emissions and are they therefore included twice (once as part of fisheries and once as part of remainder sector 8 emissions). Since the emissions from fisheries used in this study take into account the latest information, they are considered to be a better starting point and closer to the data which will be included in the emissions reported to UNECE/EMEP in the future.

At national level, the contribution of emissions from Norwegian fisheries to total emissions is significant. The emissions of NO_x from fisheries represent 15% of the total NO_x emissions from all Norwegian sources. By contrast, the emissions of SO_x are only 3% of the total SO_x Norwegian emissions. The emissions of NO_x from fisheries represent 1/3 of all emissions from Sector 8, and this sector is dominant for Norwegian NO_x emissions, accounting for almost half of all Norwegian emissions. It can also be mentioned that the emissions from fisheries are comparable to total NO_x emissions from sector 1 ("Combustion in energy and transformation industries").

However, it should be kept in mind that Norwegian emissions (223.9 Gg NO_2) represent only 1% of the total NO_x emissions from the whole EMEP area (0.1% for total sulphur emissions) and that the contribution of emissions from the Norwegian fishing fleet represents only 0.15% of the total NO_x emissions in the EMEP area.

SOURCE TYPE NORWEGIAN FISHERIES	NO_x emissions (tons NO_2)	Contribution to NO_x emissions from all fisheries (%)	NO_x emission fraction emitted near coast (%)	SO_x emissions (tons SO_2)
Vessel group A *Vessel size 8-12.9 m*	614	2 %	100 %	18
Vessel group B *Conventional vessel size 13-27.9 m*	1384	42 %	97 %	4
Vessel group C *Conventional vessel size 28 m and larger*	2449	7 %	43 %	59
Vessel group D *Cod trawlers*	7221	22 %	53 %	173
Vessel group E *Shrimp freezing trawlers*	5218	16%	28 %	125
Vessel group F *Other shrimp trawlers*	781	2 %	94%	23
Vessel group G *Industrial trawlers*	2799	8 %	57 %	67
Vessel group H *Seiner vessels*	983	3 %	99 %	30
Vessel group I *Purse seiner with season for blue whitting*	5876	18 %	43 %	141
Vessel group J *Other purse seiner vessels*	3825	11.5 %	87 %	92
Vessel group K *Remaining fishing fleet*	2163	6.5 %	95 %	65
Fisheries - All vessels	33313	100 %	59 %	835

Table 2.1: Estimated emissions from Norwegian fisheries for year 2000 (Flugsrud, 2002).

Source category (SNAP level I)	NO_x (tons NO_2)	SO_x (tons SO_2)
Sector 1: Combustion in energy and transformation industries	37499	982
Sector 2: Non-industrial combustion plants	2412	1104
Sector 3: Combustion in manufacturing industry	8350	2827
Sector 4: Production processes	12157	17184
Sector 5: Extraction & distribution of fossil fuels and geothermal energy	0	0
Sector 6: Solvent and other product use	0	0
Sector 7: Road transport	49084	714
Sector 8: Other mobile sources and machinery	105242	3324
Sector 9: Waste treatment and disposal	8888	1
Sector 10: Agriculture	313	0
Sector 11: Other sources and sinks	0	0
Norway (national total)	223945	26136

Table 2.2: Norwegian NO_x and SO_x emissions for year 2000 used in this study. Note that there are 764 tons additional NO_x emissions in sector 8 due to the revision of emissions from the Norwegian fishing fleet.

2.3 Verification of the model for 2000 results

The EMEP Unified model has been thoroughly verified. This is an important requirement for any model to be used in policy applications. The analysis of individual source contributions to air concentrations and depositions is mostly a modeling result and it is generally difficult to verify by using direct observation methods. However, the validity of the modeling approach can be established by evaluating the performance of the model against air quality measurements under different meteorological conditions and emission regimes. The result of all calculated national and sector contributions should, every day, sum up to the measured air concentrations and depositions at a certain receptor point/station. If a model manages to reproduce day-to-day values and variability under different meteorological conditions, then the allocated depositions and air concentrations would, with high likelihood, reflect reality.

The UNI-ACID version rv1.1_stack_height has been validated for the year 2000. Daily modelled concentrations of sulphur and nitrogen compounds have been compared with observations compiled over by the EMEP network. The EMEP network consist of about 100 background stations distributed all over Europe. This provides a reasonable basis for the analysis of model performance across Europe. Table 2.3 provides summary statistics of the performance of the EMEP model, while figures 2.1 and 2.2 present examples of the daily correlation and performance of modelled air concentrations versus observations.

component	unit	observed mean	modelled mean	bias	correlation
SO_2	$\mu g(S)/m^3$	0.62	1.09	33 %	0.68
NO_2	$\mu g(N)/m^3$	1.90	1.62	-14 %	0.72
SO_4	$\mu g(S)/m^3$	0.64	0.36	-43 %	0.66
NO_3+HNO_3	$\mu g(N)/m^3$	0.43	0.61	42 %	0.82
NH_3+NH_4	$\mu g(N)/m^3$	1.35	1.52	13 %	0.70
$SO_4^=$(l)	$mg(S)/m^2$	0.47	0.3	-35 %	0.84
NO_3+HNO_3(l)	$mg(N)/m^2$	0.36	0.22	-38 %	0.83
NH_3+NH_4(l)	$mg(N)/m^2$	0.44	0.34	-22 %	0.46
$SO_4^=$(l)	mg(S)/l	419.8	253.2	-39 %	0.64
NO_3+HNO_3(l)	mg(N)/l	334.8	184.8	-44 %	0.79
NH_3+NH_4(l)	mg(N)/l	409.6	291.7	-28 %	0.39

Table 2.3: summary statistics of the performance of the EMEP model

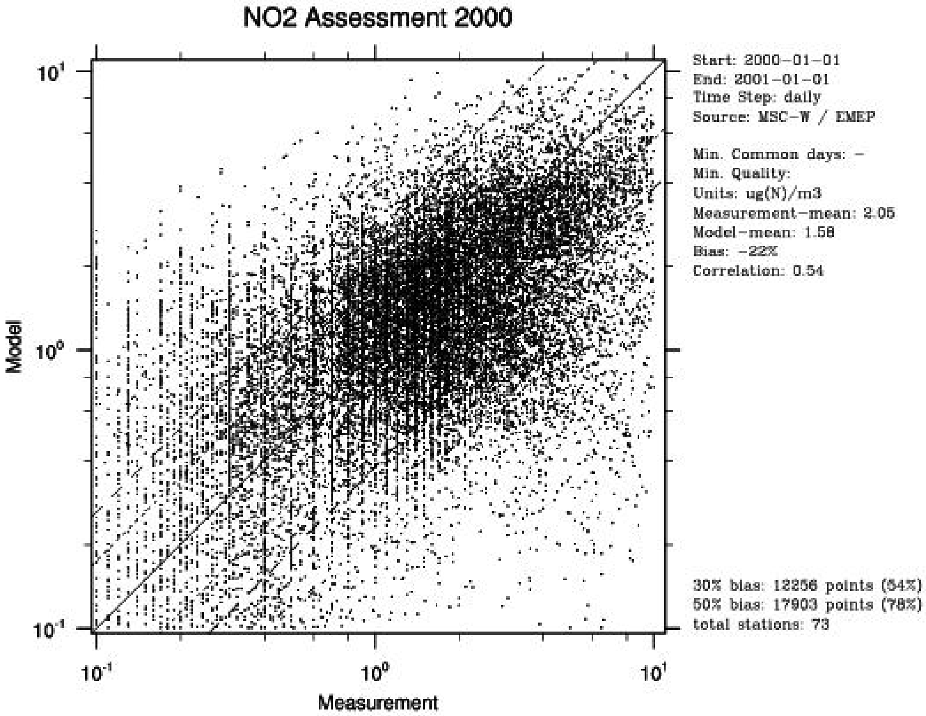

Figure 2.1: daily values of NO_2 concentration measured versus modelled for 73 stations in Europe

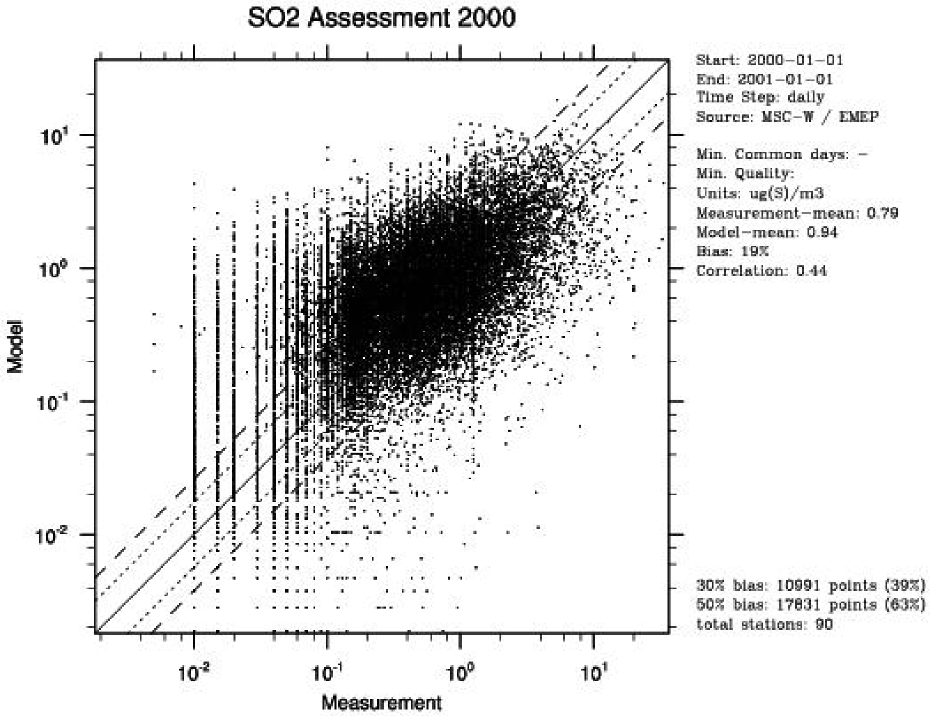

Figure 2.2: daily values of SO_2 concentration measured versus modelled for 90 stations in Europe

2.4 Approach of the study

The present study has been conducted to support the design of effect-based emission control strategies at national Norwegian level. Effect-based abatement strategies aim at reducing emissions in order to limit their adverse effects such as ecosystem damage by acidification and eutrophication. In this context, the preferred emission controls are those that result in a larger deposition reduction over areas affected by acidification and eutrophication.

Within the Convention for Long-Range Transboundary Air Pollution (CLRTAP), the impact of air pollution on acidification and eutrophication of ecosystems is studied in terms of the exceedance of critical loads. The same approach has been used here. The determination of exceedance to critical loads for acidity and eutrophication is based upon the well documented and revised methods developed by the Working Group on Effects under the LTRAP (Hettelingh et al., 2001; Posch et al., 1999). The averaged accumulated exceedances to critical loads presented here have been computed by Coordination Center for Effects (RIVM-CCE) as a function of the Unified EMEP model calculations of sulphur and nitrogen deposition for year 2000 (Max Posch; pers. comm. 2002)

The total deposition of sulphur and nitrogen from all emissions and boundary and background contributions determines the averaged accumulated exceedance to critical loads. Different sources contribute to the exceedance of critical loads in the same way as they contribute to the total deposition.

To find the contribution to depositions of a particular source (A), two runs are performed: a first run where all the emitters are active and a second run where the source A is “switched off”. The differences in the calculated depositions defines the contribution from the source of interest (A). The reason of this procedure, is that it avoids making a run with unrealistic low concentrations. If emissions from source (A) were considered alone in a model run, unrealistic results would be produced because the nitrate-sulphate-ammonium chemical system is non-linear and largely determined by the total air concentrations (Bartnicki, 2000).

The deposition of sulphur and nitrogen from each fishery vessel type has been calculated on the basis of their estimated gridded emissions. In this way, each of the eleven vessel types has been considered separatedly as an individual source. This because emissions from each vessel type are sufficiently resolved for source allocation purposes with the Eulerian EMEP model with its present resolution of 50x50km^2. This treatment is in accordance with the conclusion from recent studies within EMEP that indicate that Eulerian models are able to allocate deposition from resolved single sources with an accuracy of about 5% (Wind et al., 2002).

The calculations have been performed for the meteorological conditions of year 2000. Still, we can expect year-to-year meteorological variations to affect the actual deposition values presented in this report. Meteorological conditions have been estimated in average to cause 10-15% variability in the deposition of nitrogen oxides in Northern Europe (Barrett et al., 1995). However, the contribution of individual sources to deposition in specific areas along the Norwegian coast can be expected to be subject to even larger variability which is difficult to quantify at the moment. This needs to be kept in mind when analyzing the results of the present report. Given the variability in meteorological conditions and their effect on source-receptor relationships, it is recommended to use long-term (5 to 10 year) averages instead of one particular year results. However, as explained above, the Unified EMEP model is still under development and subject to revision within the LRTAP Convention. It would be misleading to prepare source-receptor relationships for fishing vessels at this stage. Therefore, we have chosen to report source-receptor matrices for each vessel type for year 2000 and qualify them instead by comparing them with the 5-year averaged results for the total fishing fleet emissions calculated with the Lagrangian EMEP model that are widely used for Norwegian national scenario analysis (Barrett and Berge, 1993).

Chapter 3

Results

3.1 Contribution of individual emission sources from fisheries to deposition in Norway

The contribution of individual fishing vessel emissions to depositions in Norway are presented in the Appendix (Chapter 5). The calculations are based on the emissions from each of the 11 fishing vessel types as derived by Flugsrud (2002), using the Unified EMEP model rv1.1._stack_height for the meteorological conditions of year 2000. The results are mainly presented as maps of the absolute and relative contribution of Norwegian emission sources to deposition of nitrogen oxides (see Appendix, Chapter 5.2).

The total deposition of NO_x from all fisheries in mainland Norway is 752.94 tons (as N). This represents roughly 20% of the deposition from Norwegian sources in SNAP sector 8*, which amounts to 3648.4 tons (as N) over mainland Norway. Most of the emissions from the Norwegian fishing fleet are deposited over sea areas and regions other than Norway so that, depending on the meteorological conditions, only a small percentage of the emissions contribute to depositions over Norway. For year 2000, only 7.4% of the emissions from Norwegian fisheries were deposited in mainland Norway. This is the reason why, although emissions from the fishing fleet represent 15% of total Norwegian emissions, their associated depositions in Norway represent only 10% of the total deposition from all Norwegian sources. It is worth noting that deposition over Norway from SNAP sector 8* emissions from Norwegian sources, contributes with ca. 50% to the total deposi-

* "Other mobile sources and machinery", see table 2.2

tion caused by all Norwegian sources, about in the same proportion as emissions.

The total deposition of NO_x in Norway in 2000 has been calculated to be 73,185.90 tons (as N). The deposition pattern shows a clear south-to-north decreasing gradient, consistent with the fact that long-range transport contributions are most important to deposition in Norway. Indeed, 90% of the deposition in Norway is allocated to sources abroad. The contribution of Norwegian sources to the total deposition amounts to 10% and Norwegian fisheries contribute with 1%. The relative contribution of Norwegian fisheries to deposition in Norway is largest over Northern Norway, where the total deposition is also smaller.

The calculations presented here are approximately linear. If we add the corresponding depositions for each type of vessels we get a sum of 752.96 tons of N which compares well with the 752.94 tons (as N) deposited from all fishing fleet vessels when calculated from a single model run. This shows that the chemical non-linearities are rather negligible and that the result of different scenario can be found by adding the contributions from individual sources.It also implies that scenario calculations for each vessel type can be derived as the product of the suggested new emissions and the ratios (source-receptor relationships) presented in the Appendix (Chapter 5.4), although in this case the focus is already with areas where there is exceedance to critical loads.

3.2 Contributions to exceedances of critical loads of acidification in Norway

Effect-based abatement strategies aim at reducing emissions in order to limit their adverse effects such as ecosystem damage by acidification and eutrophication. In this context, preferred emission controls are those that result in a larger deposition reduction over areas affected by acidification and eutrophication. Both sulphur and nitrogen deposition contribute to exceedance of critical loads of acidification. For eutrophication, deposition of both reduced and oxidised nitrogen contribute to exceedances to critical loads. The actual average accumulated exceedances to critical loads have been calculated by CCE (Max Posch, pers. comm. 2002) based upon the year 2000 calculation of depositions over the whole EMEP area with 50x50 km^2 resolution.

Maps with the distribution of exceedances to critical loads of acidification and eutrophication in Norway are presented in the Appendix (Chapter 5.3). Information on the contribution of fishing fleet emissions to exceedances of critical loads is presented in the Appendix in three different forms:

- Contributions to depositions in gridcells with exceedances (in tons as N/year)
- Contributions to depositions in gridcells with exceedances relative to contributions to deposition from all Norwegian sources (tons deposited from fisheries / tons deposited from all Norwegian sources)
- Contributions to depositions in gridcells with exceedances a relative to emissions (tons deposited / tons emitted). These are presented both as source-receptor relationships and as maps for each vessel type.

The contributions to depositions relative to emissions shows how much of the pollutants emitted are actually deposited in the selected gridcells. This gives indications of effectiveness of reductions, because it tells how much a reduction of 1 ton of pollutant will reduce the depositions in areas affected with acidification and eutrophication. The larger is the ratio between the deposition in the gridcell and the emission of the source type, the more effective is the source emission control.

Table 3.1 and 3.2 and figure 3.1 present a summary overview of the effectiveness of emission reductions for each vessel type. The tables refer to depositions in all gridcells with exceedances, except if mentioned otherwise. Only the part of the gridcell which is in mainland Norway is taken into account. A detailed description of contributions to deposition in each individual gridcells is given in appendix (Table 5.4 and maps in Chapter 5.3).

There are differences between the values presented in the overview Tables 3.1 and 3.2 and on the sums provided at the end of the Tables in the Appendix. These differences are caused by the fact that the tables below are calculated for mainland Norway. The tables in the Appendix show total values for all gridcells shared by mainland Norway.

Emissions from Norwegian fisheries are responsible of 6% of total nitrogen depositions from Norwegian emission sources in areas with exceedances over Norway (table 3.1). This result is the combination of estimates on actual emissions, their transport and deposition over areas affected by acidification. 2.7% of the nitrogen emitted by Norwegian fisheries is actually deposited in areas with exceedances. This can be compared with the average for all Norwegian emissions of NO_x where 6.5% of the total Norwegian emissions are deposited in areas with exceedances. The average effectiveness for all Norwegian sources is close to the effectiveness of emission reductions from all sources in SNAP sector 8[†],including Norwegian

[†]"Other mobile sources and machinery", see table 2.2

fisheries. This suggest that it can be interesting in the future to analyse the effectiveness of emission reduction from other sources in SNAP sector 8[‡], to investigate which reductions can be more effective to reduce exceedances to acidification critical loads in Norway.

The efficiency of a reduction is reflected in the last column of table 3.1 (or 3.2)and is well visualised in figure 3.1. If we consider the individual vessel types, the most effective emission reduction in terms of deposition to areas affected by exceedances are for small vessels of size 8-12.9m (Vessel group A) because of their distribution of sources along the Norwegian coast. However, emissions from this vessel group are so small that it appears to be more relevant to reduce emissions from industrial trawlers (Vessel group G), purse seiners (Vessel groups I and J) and vessels from group K (see figure 3.1). Vessels from group D, cod trawlers, are responsible for a large fraction of the NO_x emissions (22% of total fisheries NO_x emissions), however the relative contribution to the deposition is smaller (16% of oxidised nitrogen deposition) because of the actual spatial distribution of the emissions. This shows that a reduction (in tons) of emissions from vessels of type D, will be less effective than the same reduction (in tons) distributed evenly on all vessels.

In table 3.2, it is shown that compared to other Norwegian sources, SO_x emissions from fisheries are responsible for only 0.7% of the Norwegian depositions of sulphur in areas with exceedances. Since the contribution from fisheries to sulphur depositions is so small, the focus of this study is rather on the nitrogen contributions to acidification.

[‡]"Other mobile sources and machinery", see table 2.2

Source type	NO_x emissions	NO_x depositions over Norway	NO_x depositions in gridcells with exceedances	Contribution to deposition (% compared to other Norwegian sources)	Proportion deposited (% compared to source type emissions)
Vessel A	187	20.7	8.7	0.2	4.6
Vessel B	421	44.3	11.4	0.3	2.7
Vessel C	745	46.3	16.1	0.4	2.2
Vessel D	2198	138.3	42.4	1.0	1.9
Vessel E	1588	72.6	12.3	0.3	0.8
Vessel F	238	25.6	7.9	0.2	3.3
Vessel G	852	65.0	36.0	0.8	4.2
Vessel H	299	33.4	8.8	0.2	2.9
Vessel I	1788	118.5	56.4	1.3	3.2
Vessel J	1164	118.1	43.9	1.0	3.8
Vessel K	658	70.2	25.2	0.6	3.8
All fisheries	10139	752.9	268.9	6.0	2.7
Sector 8	32030	3648.4	1974.3	44.4	6.2
Norway	68157	7398.8	4446.1	100.0	6.5
EMEP	6393888	73185.9	52051.5	1170.7	0.8

Table 3.1: Repartition of the contribution from different sources to the depositions of oxidized nitrogen in mainland Norway. All values in tons as N. The two last columns refer to the contributions to NO_x deposition over Norwegian gridcells with exceedances. (Units: tons as N and % .)

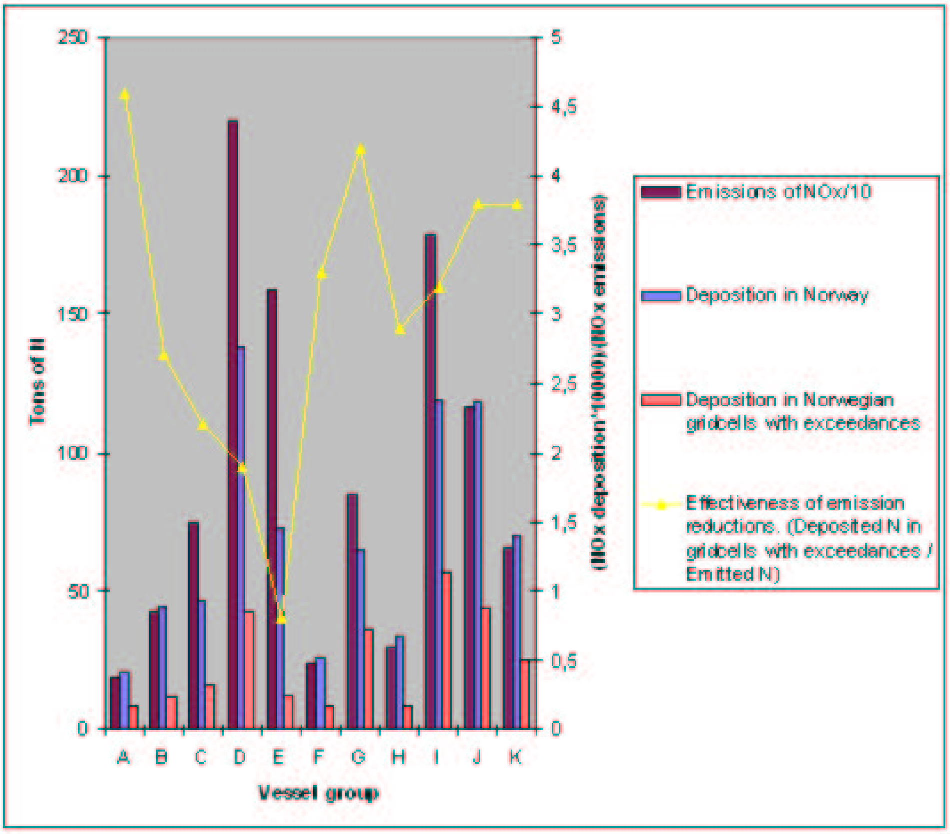

Figure 3.1: Comparison of level of NO_x emissions and deposition in Norway and in Norwegian gridcells with exceedances. Note that emissions have been divided by a factor 10. Effectiveness of emission reductions are given in the right hand axis.

Source type	SO_x emissions	SO_x depositions over Norway	SO_x depositions in gridcells with exceedances	Contribution to deposition (% compared to other Norwegian sources)	Proportion deposited (% compared to source type emissions)
Vessel A	9	1.4	0.6	0.0	6.4
Vessel B	21	3.0	0.6	0.0	3.1
Vessel C	29	1.9	0.6	0.0	1.9
Vessel D	87	5.8	1.5	0.1	1.8
Vessel E	63	3.5	0.4	0.0	0.6
Vessel F	12	1.8	0.6	0.0	4.7
Vessel G	34	2.8	1.5	0.1	4.6
Vessel H	15	2.3	0.5	0.0	3.4
Vessel I	71	5.1	2.3	0.1	3.3
Vessel J	46	5.7	1.9	0.1	4.2
Vessel K	32	4.5	1.5	0.1	4.6
All fisheries	418	37.9	12.1	0.7	2.9
Sector 8	1662	276.1	160.9	8.7	9.7
Norway	13069	2931.8	1857.8	100.0	14.2
EMEP	11629689	66754.5	45270.2	2436.8	0.4

Table 3.2: Repartition of the contribution from different sources to the depositions of oxidized sulphur in mainland Norway. The two last columns refer to the contributions to SO_x deposition over Norwegian gridcells with exceedances. (Units: tons as S and % .)

3.3 Comparison with previous estimates

At European scale, emissions of nitrogen oxides have been relatively stable since the beginning of the 90s. In the EMEP area there has been a 16% reduction of nitrogen oxides emissions from year 1993 to 2000. In Norway the corresponding NO_x emissions have been unchanged during that period. For sulphur, however, there have been major emission changes during the last decade. SO_x emissions have been reduced by 33% in the EMEP area and 25% in Norway during the period 1993-2000. The corresponding change in ammonia emissions are reduction of 7% and 2% respectively. These changes are according to the newest trend estimate as reported in Vestreng and Klein (2002).

However, when we compare with the emissions estimates used in Barrett and Berge (1993), Norwegian emissions of sulphur dioxide are now reduced by 56% and Norwegian ammonia emissions are reduced by 34%. Only nitrogen dioxide emissions are approximately the same, with only 4% reduction since the estimates used in Barret and Berge (1993). The same applies for the estimate of emissions from fisheries: the NO_x emission of all fisheries was estimated to 31,400 tons as NO_2, which compares well with the present estimate of 33, 313 tons, as NO_2. The estimate of SO_x emissions by fisheries is now reduced by 50% with respect to the 1993 previous estimates

This emission reduction has consequences for the calculation of exceedances of critical loads. The considerable reduction of sulphur dioxide emissions has decreased the actual exceedances. However, the position of the exceedance areas has not changed, despite the sulphur emission reductions (see Appendix). What has actually changed is the relative importance of sulphur and nitrogen on acidification. While at the beginning of the 1990s, exceedances were dominated by sulphur deposition, these are now dominated by nitrogen deposition. The first main difference with the previous estimates by Barrett and Berge is the identification of new areas exposed to acidification along the Norwegian coast, identified as the resolution of the EMEP model has improved from 150x150 km^2 to 50x50 km^2.

Concerning the NO_x depositions from all fisheries, the present results correspond well with those presented in Barrett and Berge(1993). The second main difference is the fact that the emissions from fisheries are now disaggregated to 11 vessel types, so that emission controls can be investigated on the actual vessel types. The comparability of the new EMEP Eulerian model results for 2000 with the 5-year averages from the EMEP Lagrangian model (Barrett and Berge, 1993) is reassuring of the validity of the results presented here.

Chapter 4

Conclusions and recommendations

Emissions from Norwegian fisheries constitute 15% of the total nitrogen oxide emissions from Norway and 3.2% of the total sulphur dioxide emissions. The contribution of sulphur dioxide emissions are smaller than nitrogen oxide contributions, both in actual value and in relative terms. Sulphur emissions have been considered in this report only because sulphur depositions contributes to the exceedance of acidity critical loads. Sulphur emissions and depositions from national fisheries are included in the determination of exceedances to critical loads. Otherwise, the focus of the report is on the contribution of NO_x emissions.

NO_x emissions from the Norwegian fishing fleet represent about 30% of the emissions form sector 8* and are comparable to the Norwegian emissions from power combustion (sector 1). Over the whole EMEP area, emissions from the norwegian fishing fleet represents only 0.15% of the total NO_x emissions.

With respect to deposition, the total contribution of Norwegian fisheries to deposition over mainland Norway is estimated to be 10% of the total deposition from Norwegian sources (1% of the total deposition from all sources). If we restrict the sum over areas with exceedances, the contributions from fisheries represent only 6% of the total Norwegian contributions. This is considerably less than their contribution to emission totals and it is a consequence of the actual distribution of the emission sources. Emissions from the Norwegian fishing fleet pollute mainly the marine environment, and only a small portion (7.4%) of the emissions reach the

* "Other mobile sources and machinery", see table 2.2

Norwegian coast. For the meteorological conditions of year 2000, of the emitted 10,139 tons (N) from the Norwegian fishing fleet, only 753 tons (N) were deposited in mainland Norway and these only 269 tons (N) (2.7% of the emissions) were actually deposited in areas exposed to exceedance of critical loads of acidity and eutrophication. This implies that a reduction of 100 tons (N) in the emissions from norwegian fisheries results in a reduction of the deposition in Norwegian areas affected by exceedances to critical loads of acidity and eutrophication 2.7 tons (N).

The effectiveness of the measure can be established on the basis of the reduction of deposition over ecosystem affected area per ton of emitted pollutant. Thus, the main factors contributing to this effectiveness are
a) the distribution of emission sources with respect to transport patterns
b) the distribution of ecosystem areas affected by acidification and eutrophication along transport patterns.

The initial source-receptor relationships presented here give a measure of the effectiveness of any emission reduction. They provide a ratio between contribution to deposition over gridcells affected by acidification and eutrophication and the actual emission per vessel group. In the presentation of the data areas affected by eutrophication in Norway appear as a subset of the areas affected by acidification. Different scenarioes can be evaluated directly as the product of the envisaged emission reduction and source-receptor relationships presented here.

From these results, it is shown that reductions of NO_x emissions from industrial trawlers and purse seiner vessels (Vessel groups G, I, J and K) are more effective than from any other fishing vessel types. In addition, reductions of emissions from vessel types A, F and H, because of their proximity to the coast are also effective to protect acidification and eutrophication affected areas. Although emissions from cod trawlers represent the largest single contribution to NO_x emissions from the Norwegian fishing fleet, these sources have smaller impact on the deposition over areas affected by exceedances to critical loads.

The effectiveness of emission reductions from the Norwegian fishing fleet is smaller that the averaged effectiveness of emission reductions from other Norwegian emission sources. In particular, emission reductions from sector 8 (Other mobile sources and machine other than road transport) are more effective than for any type of fishing vessel considered in this study. This implies that emissions from air traffic, military transport (etc...) are probably sectors that need further attention in future analysis of effect-based control strategies in Norway.

The results presented here benefit from the detailed study of emission per source vessel compiled by Statistics Norway in cooperation with the Directorate of Fisheries. The modeling approach used here presents spatially refined calculations with the EMEP Unified Eulerian model, with a spatial distribution of 50x50km^2. The methods and concepts applied here are those used and validated under the Convention for Long-Range Transboundary of Air pollution. It is important to mention that the Eulerian Unified model is presently under development and evaluation within the CLRTAP and that the calculations are limited for the meteorological conditions of year 2000. Year-to-year meteorological variability can change the average deposition results in Nortehrn Europe by approximately 15-20%. However, the contribution of individual sources to deposition in specific areas along the Norwegian coast is subject to even larger variability which is difficult to quantify at the moment. For these reasons, it is recommended to extend these calculations to other years with different meteorological conditions to secure the representativeness of the results.

Chapter 5

Appendices

5.1 Emissions

- Figures 5.1 and 5.2: NO$_x$ and SO$_x$ gridded emissions for year 2000 from all sources in EMEP area.
- Figures 5.3, 5.4 and 5.5: NO$_x$ emissions in Norway, from the Norwegian SNAP sector 8* and emissions from the Norwegian fishing fleet.
- Figures 5.6 to 5.16: NO$_x$ emissions from individual fishing vessel groups. SO$_x$ emissions are scaled from NO$_x$ emissions with a constant factor and have therefore the same spatial distribution. For vessel groups A,B,F,H,K the scaling factor is $\frac{kgSO_x}{kgNO_x} = 0.03$ and for the vessel groups C,D,E,G,I,J the ratio $\frac{kgSO_x}{kgNO_x} = 0.024$.

All emissions are in tons per gridcells (each gridcell has an area of approximately 50x50 km^2, depending on latitude). Values are reported emissions to UN-ECE/EMEP for year 2000 (Vestreng and Klein, 2002) with new estimates of emissions from the Norwegian fishing fleet revised by Statistics Norway.

* "Other mobile sources and machinery", see table 2.2

Source Type	source name	NO_x emissions	SO_x emissions
Vessel group A	Vessels size 8-12,9 m	614	18
Vessel group B	Conventional vessels size 13-27,9 m	1384	42
Vessel group C	Conventional vessels size 28 m and larger	2449	59
Vessel group D	Cod trawlers	7221	173
Vessel group E	Shrimp freezing trawlers	5218	125
Vessel group F	Other shrimp trawlers	781	23
Vessel group G	Industrial trawlers	2799	67
Vessel group H	Seine vessels	983	29
Vessel group I	Purse seiner with season for blue whiting	5876	141
Vessel group J	Other purse seiner vessels	3825	92
Vessel group K	Remaining fishing fleet	2163	65
Sum	Norwegian fishing fleet	33313	835
SNAP sector 8	Other mobile sources and machinery (Norwegian sources)	105242	3324
Total	Total Norwegian sources	223942	26137

Table 5.1: Overview over total emissions of NO_x and SO_x for year 2000 used in this study. (Units: tons of NO_2 per year, tons of SO_2 per year).

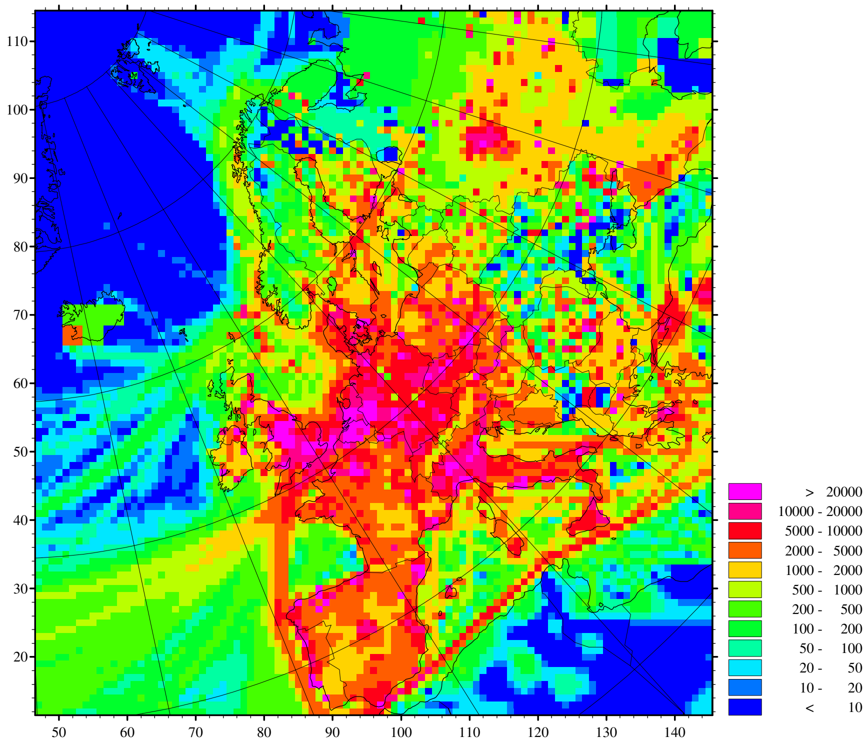

Figure 5.1: Distribution of NO_x emissions from all EMEP sources as used in this study. Values for year 2000. (Units: tons/gridcell).

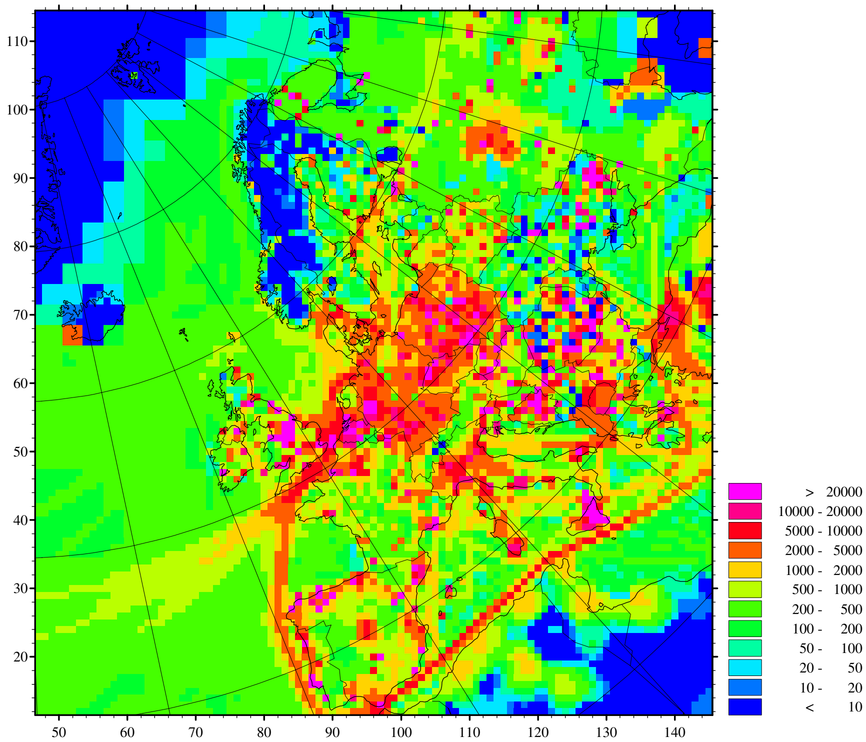

Figure 5.2: Distribution of SO_x emissions from all EMEP sources as used in this study. Values for year 2000. (Units: tons/gridcell).

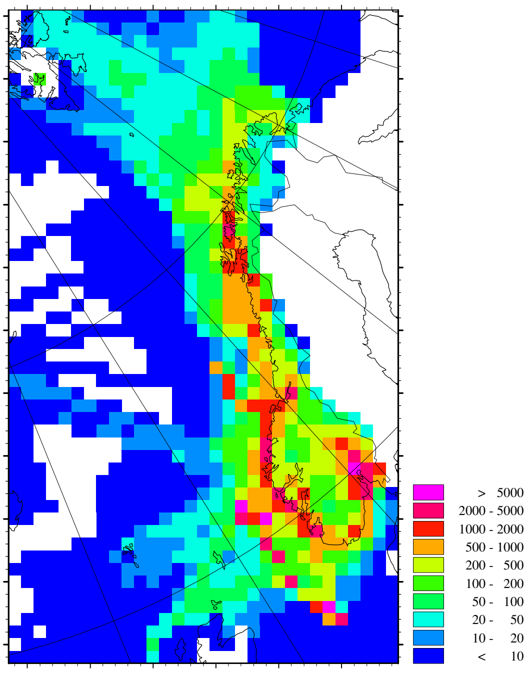

Figure 5.3: NO_x emissions from all Norwegian sources for year 2000 used in this study. (Units: tons/gridcell).

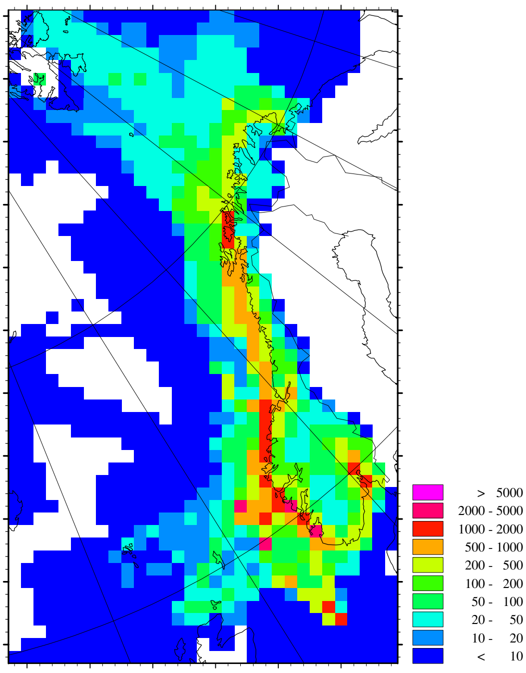

Figure 5.4: Norwegian NO_x emissions from SNAP sector 8 used in this study. (Units: tons/gridcell).

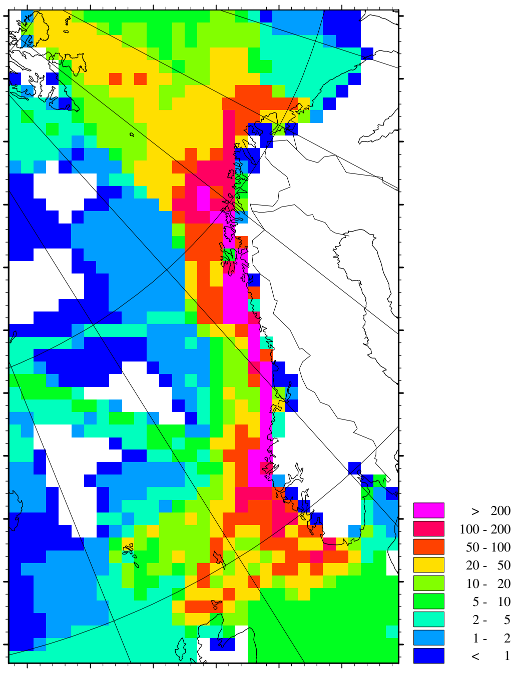

Figure 5.5: NO_x emissions from the Norwegian fishing fleet. Total emissions for all types of vessels for year 2000. Estimate by Statistics Norway. (Units: tons/gridcell).

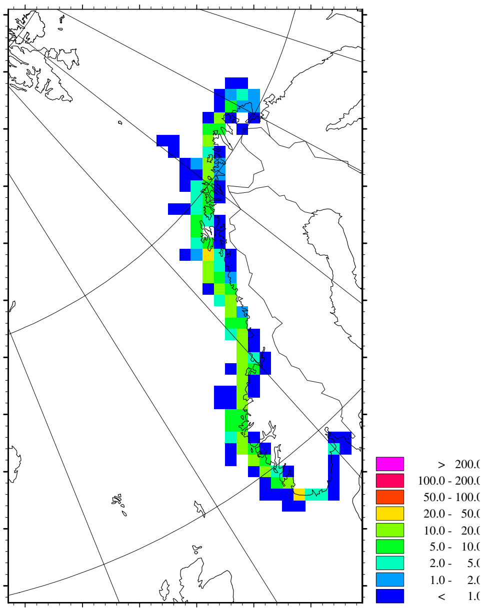

Figure 5.6: NO_x emissions from Norwegian fisheries. Vessel group A: "Vessel size 8-12.9 m". (Units: tons/gridcell).

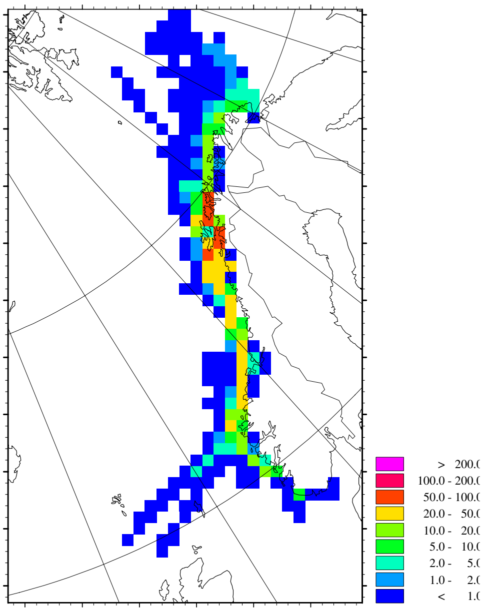

Figure 5.7: NO_x emissions from Norwegian fisheries. Vessel group B: "Conventional vessel size 13-27.9 m". (Units: tons/gridcell).

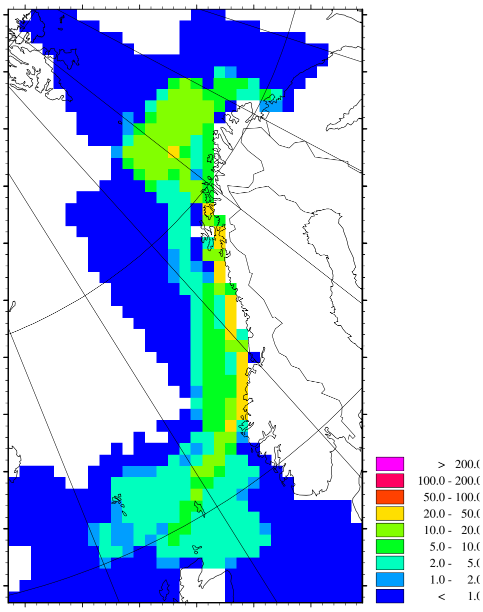

Figure 5.8: NO_x emissions from Norwegian fisheries. Vessel group C: "Conventional vessel size 28 m and larger". (Units: tons/gridcell).

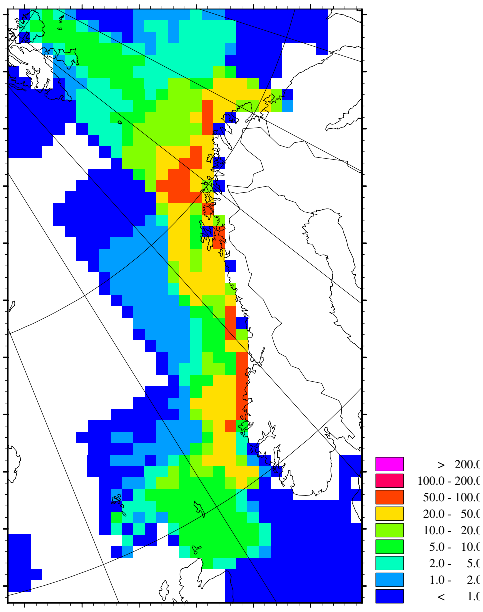

Figure 5.9: NO_x emissions from Norwegian fisheries. Vessel group D: "Cod trawlers". (Units: tons/gridcell).

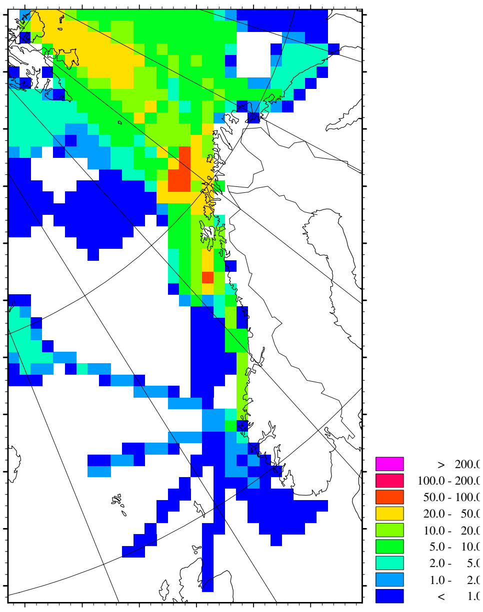

Figure 5.10: NO_x emissions from Norwegian fisheries. Vessel group E: "Shrimp freezing trawlers".
(Units: tons/gridcell).

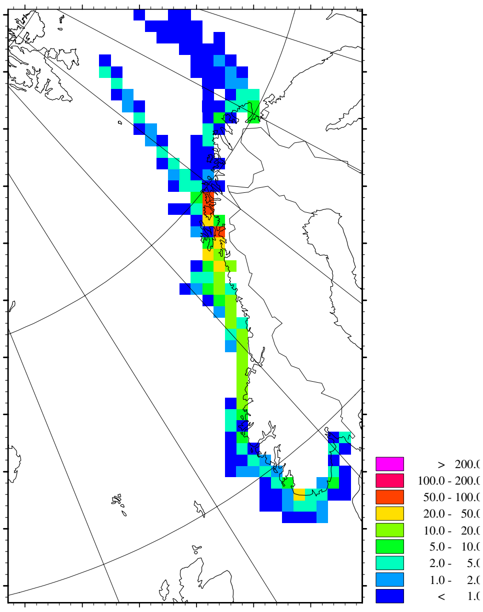

Figure 5.11: NO_x emissions from Norwegian fisheries. Vessel group F: "Other shrimp trawlers".
(Units: tons/gridcell).

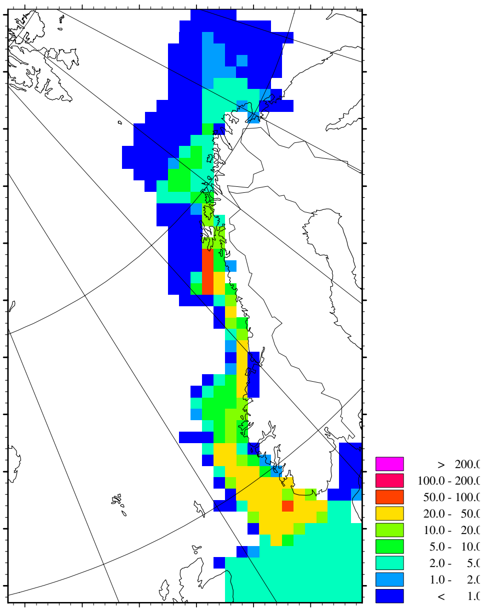

Figure 5.12: NO_x emissions from Norwegian fisheries. Vessel group G: "Industrial trawlers".
(Units: tons/gridcell).

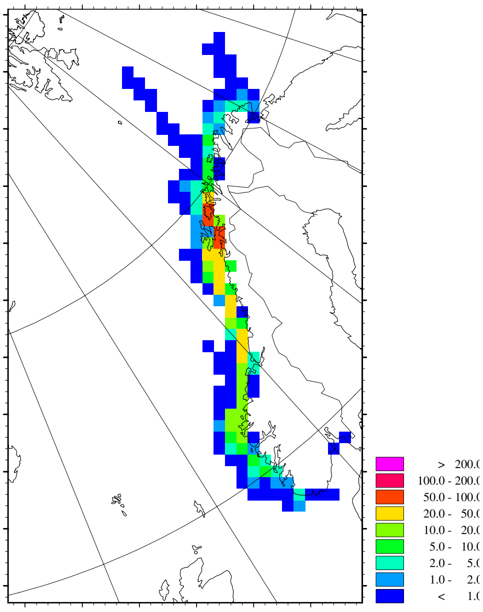

Figure 5.13: NO_x emissions from Norwegian fisheries. Vessel group H: "Seiner vessels".
(Units: tons/gridcell).

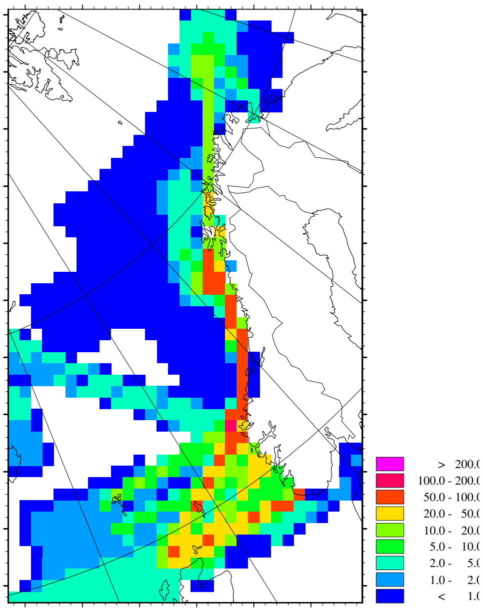

Figure 5.14: NO_x emissions from Norwegian fisheries. Vessel group I: “Purse seiner with season for blue whitting”. (Units: tons/gridcell).

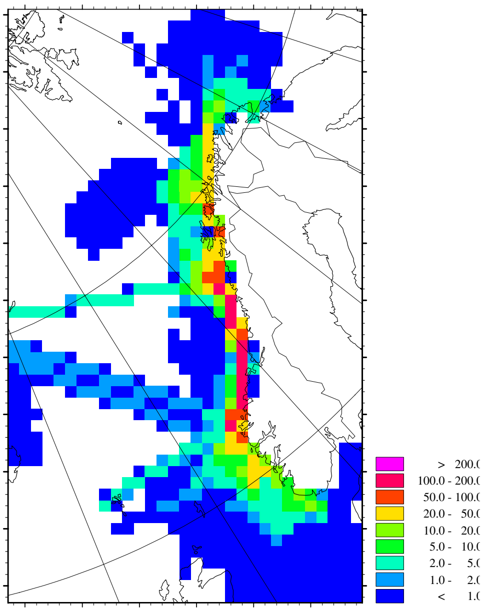

Figure 5.15: NO_x emissions from Norwegian fisheries. Vessel group J: “Other purse seiner vessels”. (Units: tons/gridcell).

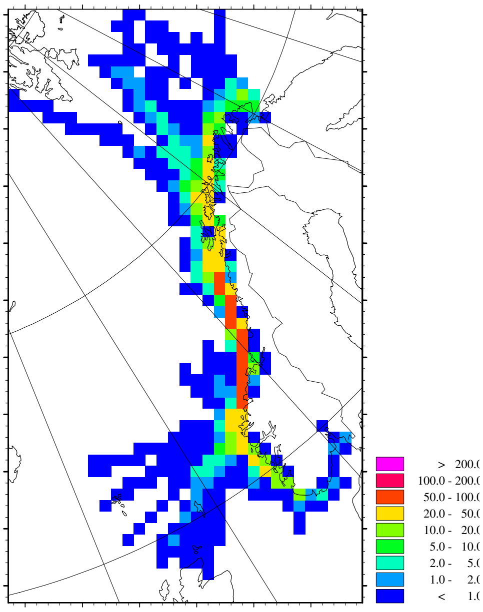

Figure 5.16: NO_x emissions from Norwegian fisheries. Vessel group K: “Remaining fishing fleet”. (Units: tons/gridcell).

5.2 Depositions

- Figures 5.17, 5.18 and 5.19: Total deposition of oxidised nitrogen, oxidised sulphur and reduced nitrogen in EMEP model domain for year 2000, from all sources.
- Figures 5.20 and 5.21: Absolute and relative contributions of Norwegian sources to NO_x depositions in Northern Europe.
- Figures 5.22 and 5.23: Relative contributions of Norwegian SNAP sector 8[†] and the Norwegian fishing fleet to NO_x depositions as compared to deposition from all Norwegian sources, for year 2000.
- Figures 5.24 to 5.34: Deposition of oxidized nitrogen from each individual fishing vessel groups, for year 2000.
- Figures 5.35: Total deposition of oxidized nitrogen from the Norwegian fishing fleet (all vessel groups), for year 2000.

[†] "Other mobile sources and machinery", see table 2.2

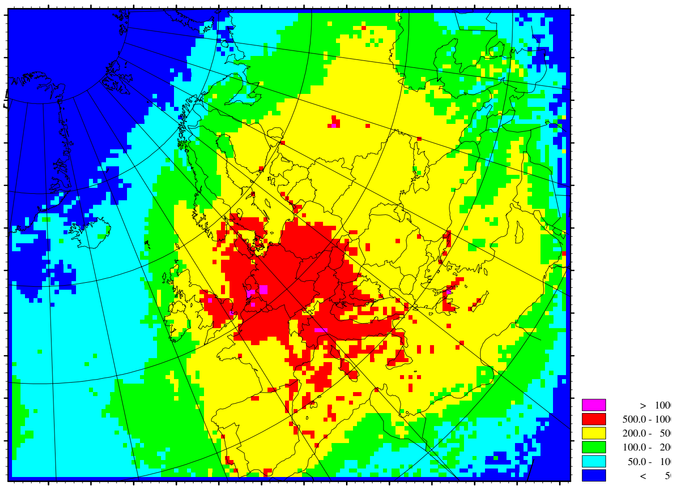

Figure 5.17: Deposition of oxidised nitrogen in EMEP model domain. Total depositions from all sources for year 2000. (Units: mg/m^2).

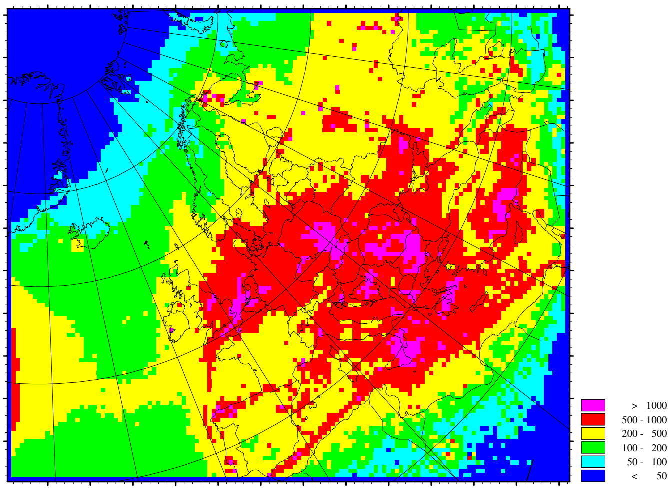

Figure 5.18: Deposition of oxidised sulphur in EMEP model domain. Total depositions from all sources for year 2000. (Units: mg/m^2).

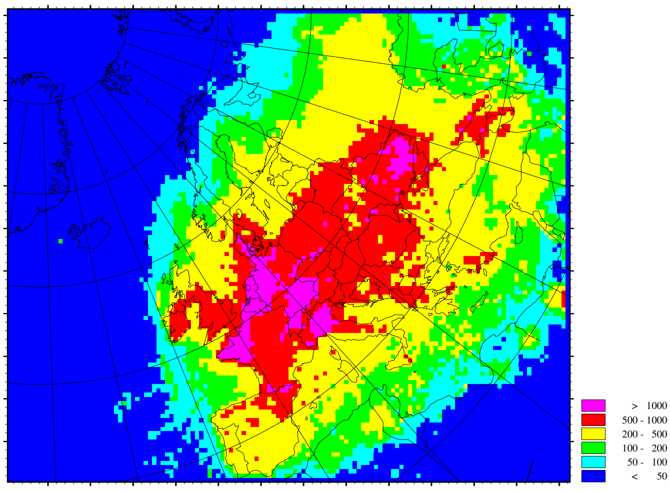

Figure 5.19: Deposition of reduced nitrogen in model domain. Total depositions from all sources for year 2000. (Units: mg/m^2).

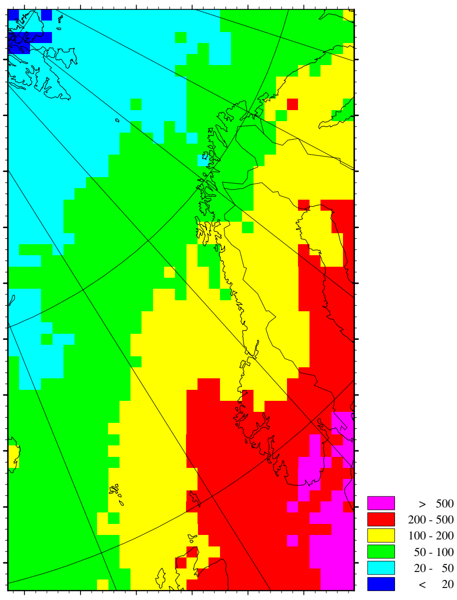

Figure 5.20: Deposition of oxidized nitrogen in the Norwegian area from all sources. Year 2000. (Units: mg/m^2).

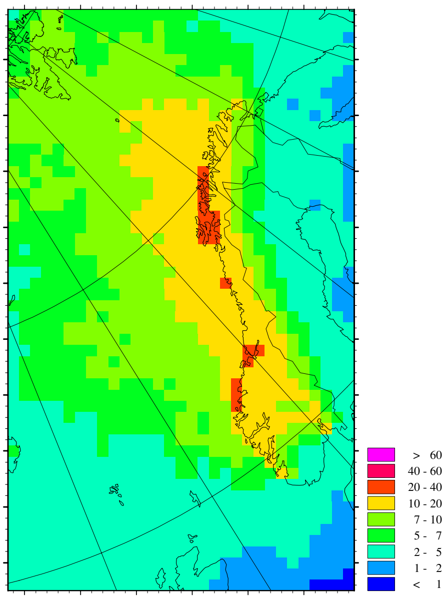

Figure 5.21: Contribution of Norwegian sources to total depositions. Year 2000. (Units: percent (%) of deposition of oxidized nitrogen).

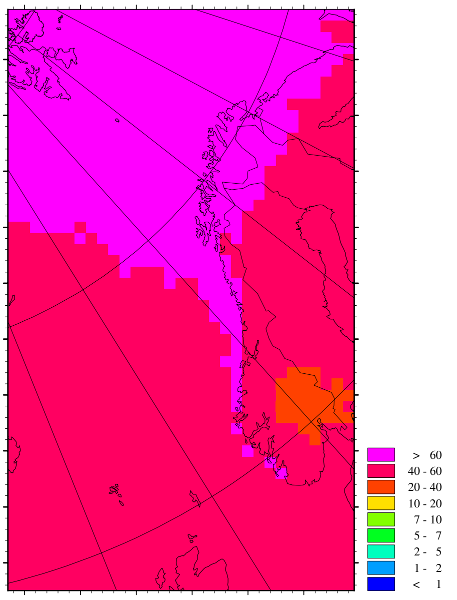

Figure 5.22: Contributions from SNAP sector 8 to NO_x deposition from all Norwegian sources. Year 2000. (Units: %).

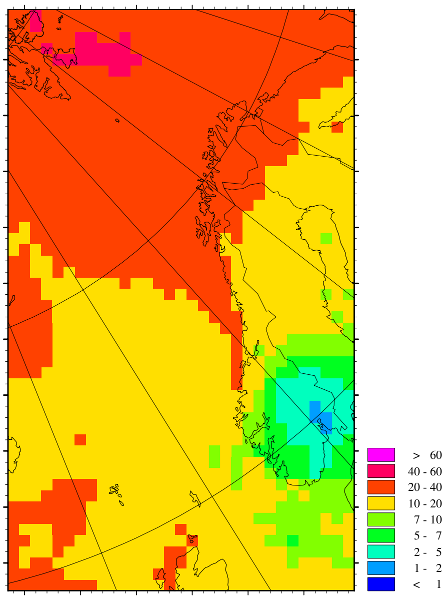

Figure 5.23: Contributions from the Norwegian fishing fleet to NO_x deposition from all Norwegian sources. Year 2000. (Units: %).

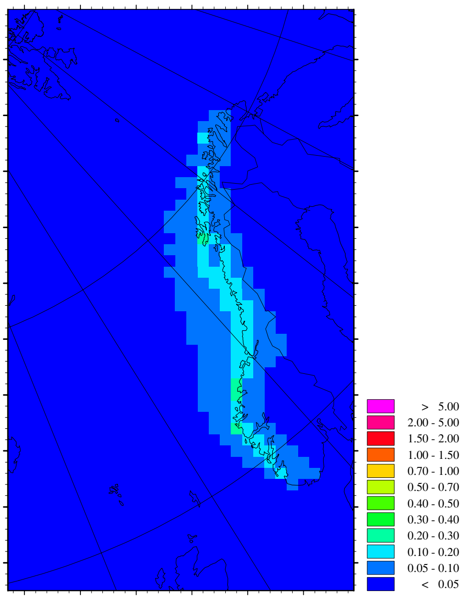

Figure 5.24: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group A: "Vessel size 8-12.9 m". Year 2000. (Units: mg/m^2).

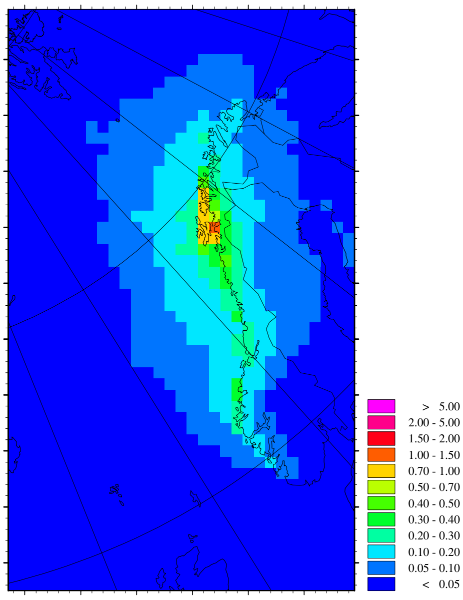

Figure 5.25: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group B: "Conventional vessel size 13-27.9 m". Year 2000. (Units: mg/m^2).

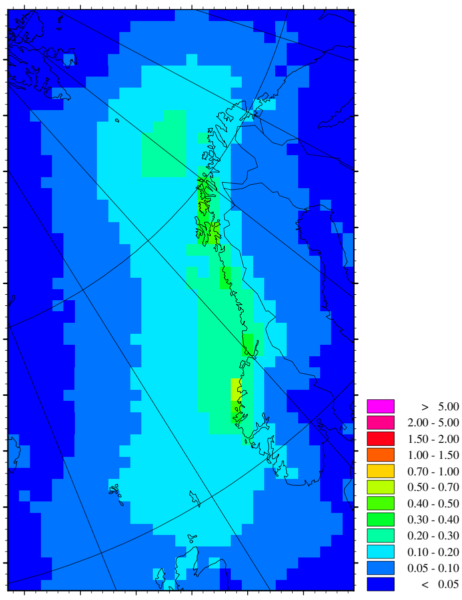

Figure 5.26: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group C: "Conventional vessel size 28 m and larger". Year 2000. (Units: mg/m^2).

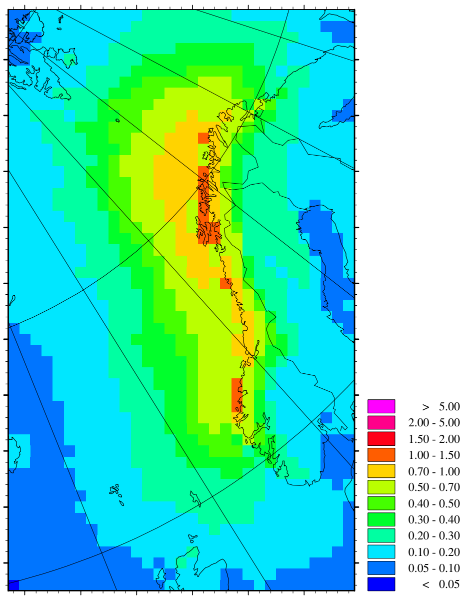

Figure 5.27: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group D: "Cod trawlers". Year 2000. (Units: mg/m^2).

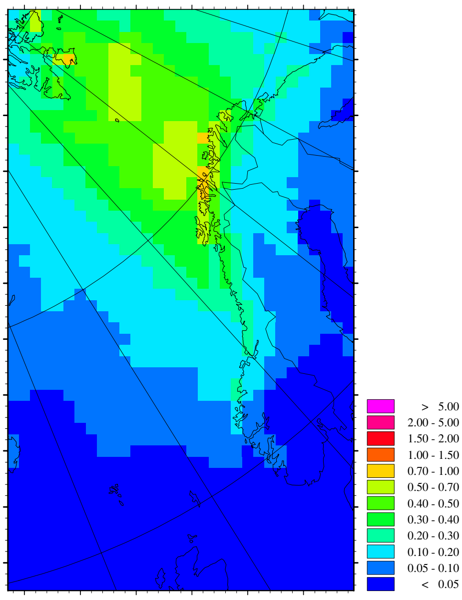

Figure 5.28: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group E: “Shrimp freezing trawlers”. Year 2000. (Units: mg/m^2).

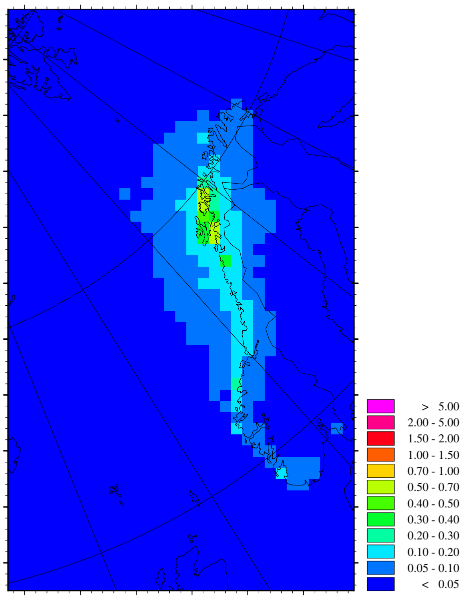

Figure 5.29: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group F: “Other shrimp trawlers”. Year 2000. (Units: mg/m^2).

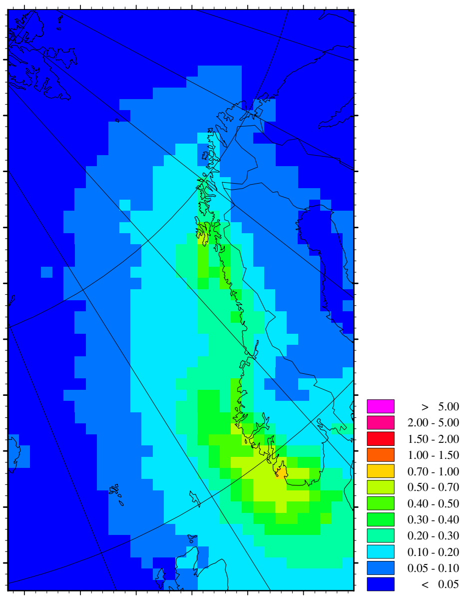

Figure 5.30: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group G: “Industrial trawlers”. Year 2000. (Units: mg/m^2).

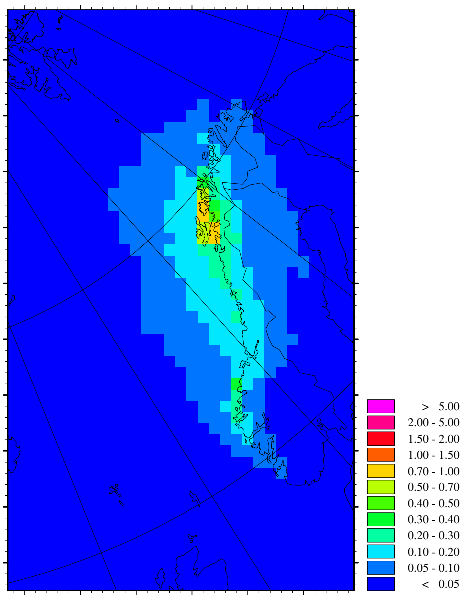

Figure 5.31: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group H: “Seiner vessels”. Year 2000. (Units: mg/m^2).

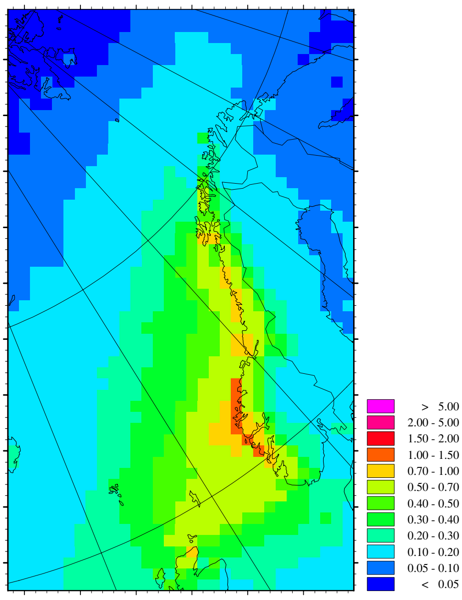

Figure 5.32: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group I: “Purse seiner with season for blue whitting”. Year 2000. (Units: mg/m^2).

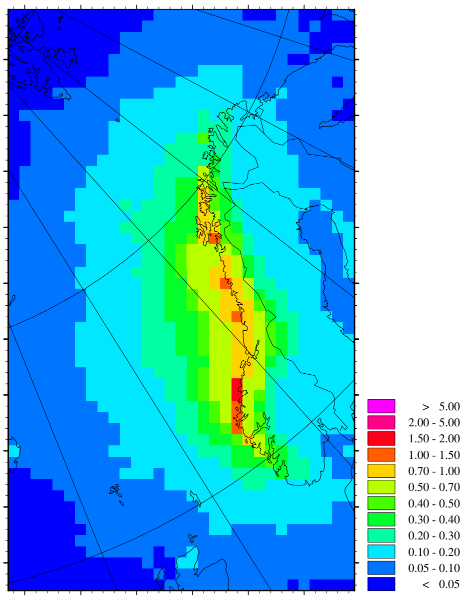

Figure 5.33: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group J: “Other purse seiner vessels”. Year 2000. (Units: mg/m^2).

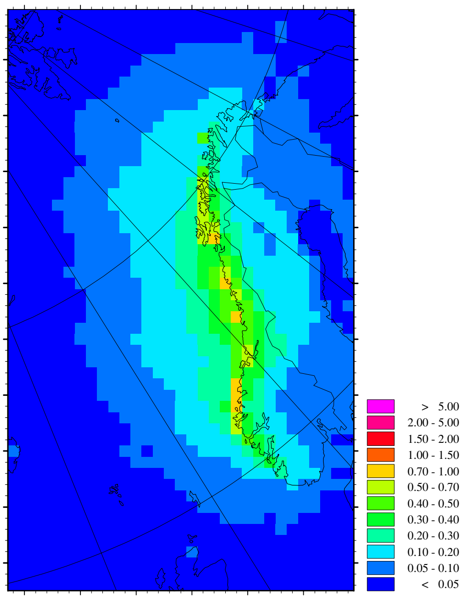

Figure 5.34: Deposition of oxidized nitrogen from Norwegian fisheries. Vessel group K: “Remaining fishing fleet”. Year 2000. (Units: mg/m^2).

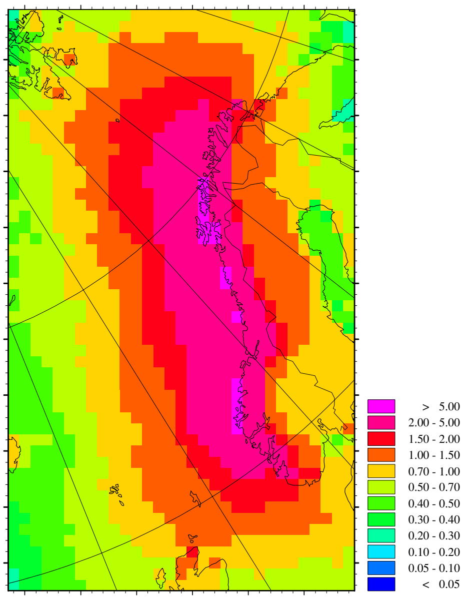

Figure 5.35: Deposition of oxidized nitrogen from Norwegian fisheries. Total for all types of vessels. Year 2000. (Units: mg/m^2).

5.3 Deposition to gridcells with exceedances of critical loads

- Figures 5.36 and 5.37: Total deposition from all sources of oxidised nitrogen and oxidised sulphur for year 2000 in Northern Europe.
- Figures 5.38 and 5.39: Average accumulated exceedances of acidity and nutrient critical loads in Northern Europe. Values for year 2000.
- Figures 5.40: Areas with exceedances to critical loads of acidity greater than 200 eq/ha/year used in Barrett and Berge (1993) for year 1990 (with 150x150 km^2 grid resolution).
- Figures 5.41 to 5.51: Ratio between deposition of oxidized nitrogen and emissions from individual fishing vessel groups for year 2000, in the areas with exceedance to critical load of acidity.
- Figures 5.52: Ratio between deposition of oxidized nitrogen and emissions from the Norwegian fishing fleet for year 2000, in the areas with exceedance to critical load of acidity.

Note: The areas with exceedances to critical load of eutrophications are (except for one gridcell) a subset of the areas with exceedance to critical load of acidity. Detailed information can be found in Appendix 5.4.

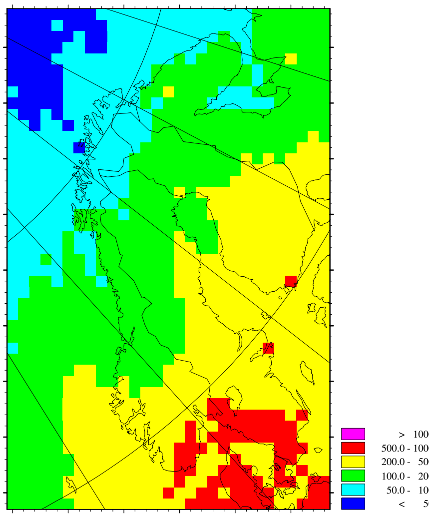

Figure 5.36: Total deposition of oxidized nitrogen in EMEP. Year 2000. (Units: mg/m^2).

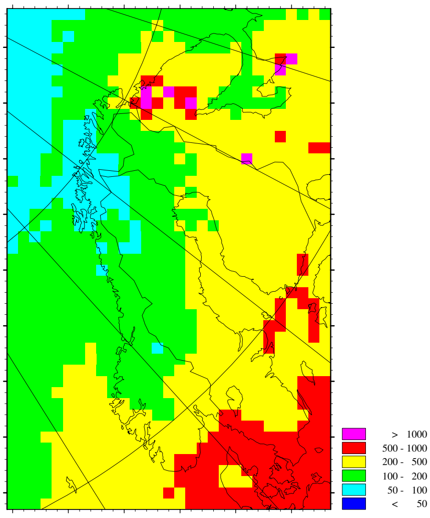

Figure 5.37: Total deposition of oxidized sulphur in EMEP. Year 2000. (Units: mg/m^2).

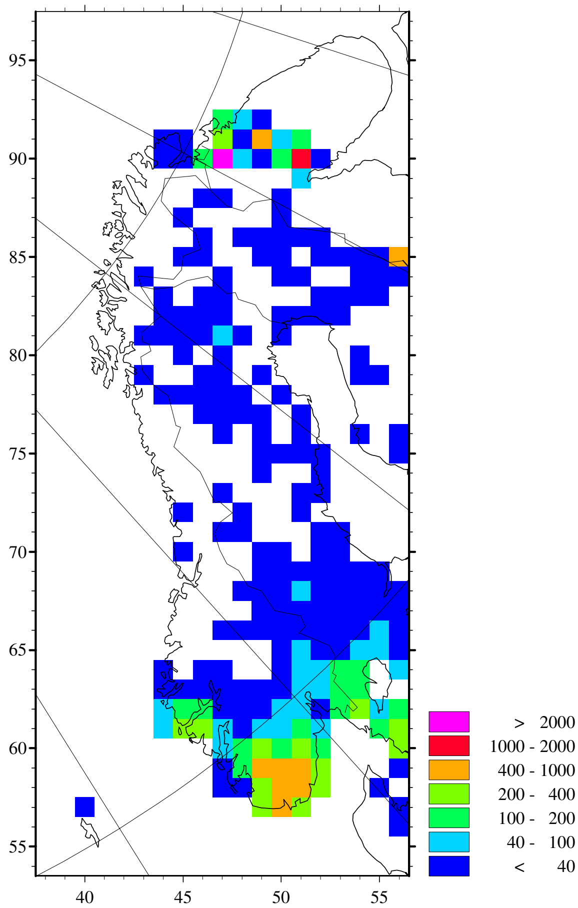

Figure 5.38: Average accumulated exceedances of acidity critical load. Values for year 2000. Contribution from all sources in EMEP. (Units: eq/ha/year).

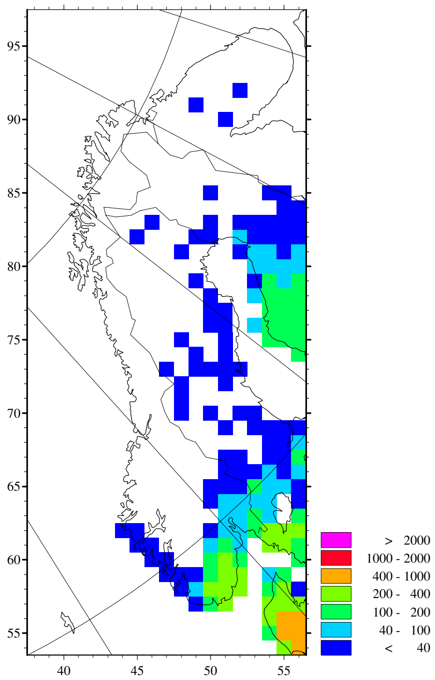

Figure 5.39: Average accumulated exceedances of nutrient critical load. Values for year 2000. Contribution from all sources in EMEP. (Units: eq/ha/year).

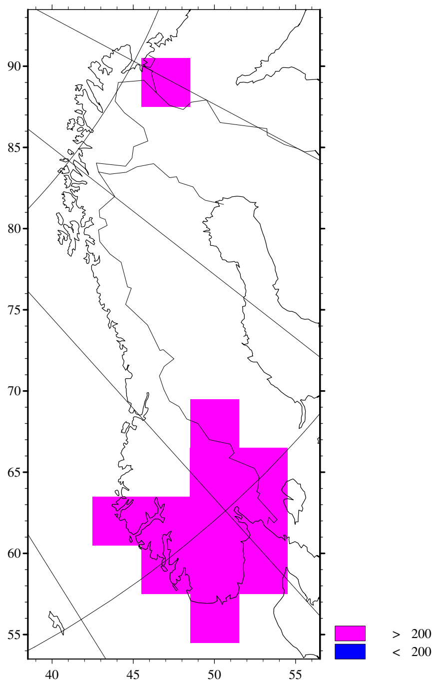

Figure 5.40: Areas with exceedances to critical loads of acidity greater than 200 eq/ha/year used in Barrett and Berge (1993) for year 1990 (with 150x150 km^2 grid resolution).

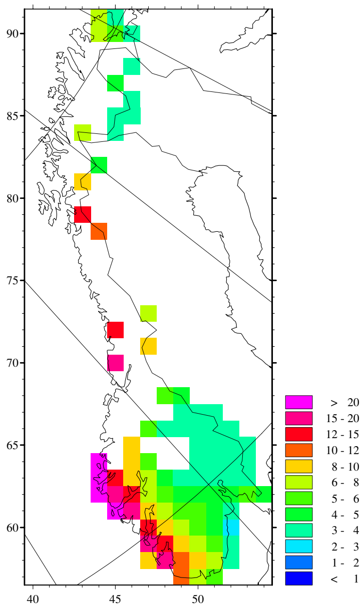

Figure 5.41: Ratio between deposition of oxidized nitrogen and emissions for vessel group A in areas with exceedance to critical load of acidity. (Units: %*100).

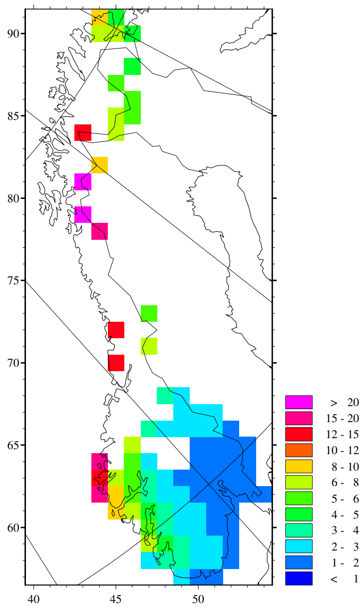

Figure 5.42: Ratio between deposition of oxidized nitrogen and emissions for vessel group B in areas with exceedance to critical load of acidity. (Units: %*100).

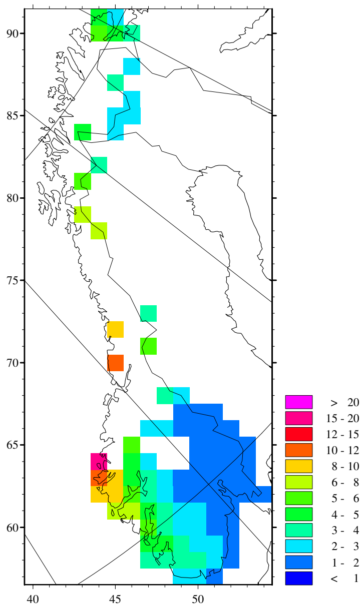

Figure 5.43: Ratio between deposition of oxidized nitrogen and emissions for vessel group C in areas with exceedance to critical load of acidity. (Units: %*100).

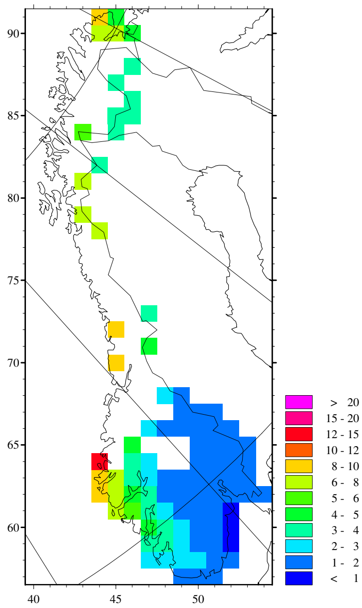

Figure 5.44: Ratio between deposition of oxidized nitrogen and emissions for vessel group D in areas with exceedance to critical load of acidity. (Units: %*100).

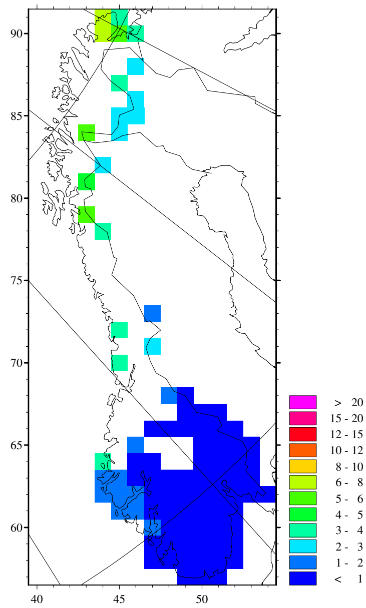

Figure 5.45: Ratio between deposition of oxidized nitrogen and emissions for vessel group E in areas with exceedance to critical load of acidity. (Units: %*100).

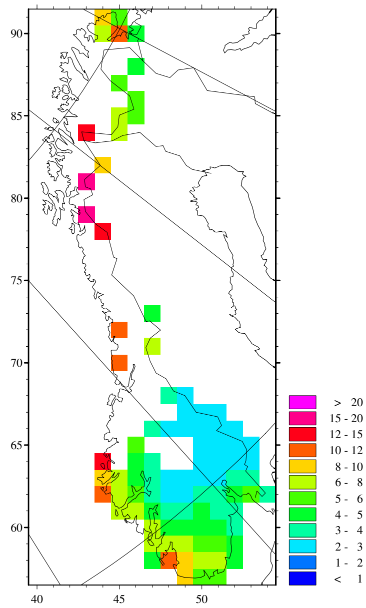

Figure 5.46: Ratio between deposition of oxidized nitrogen and emissions for vessel group F in areas with exceedance to critical load of acidity. (Units: %*100).

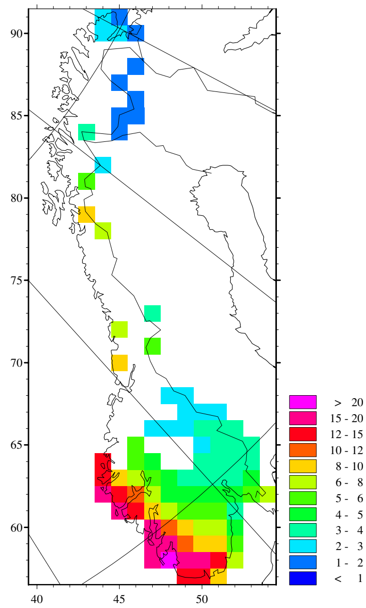

Figure 5.47: Ratio between deposition of oxidized nitrogen and emissions for vessel group G in areas with exceedance to critical load of acidity. (Units: %*100).

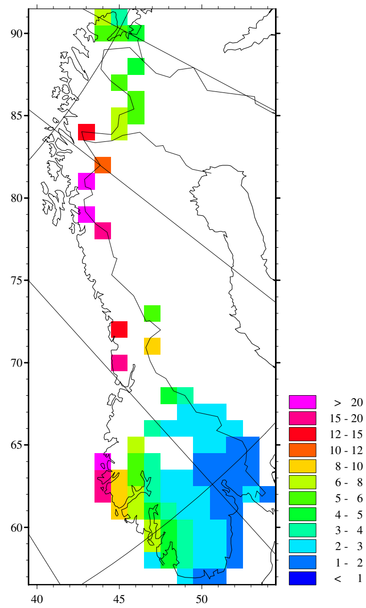

Figure 5.48: Ratio between deposition of oxidized nitrogen and emissions for vessel group H in areas with exceedance to critical load of acidity. (Units: %*100).

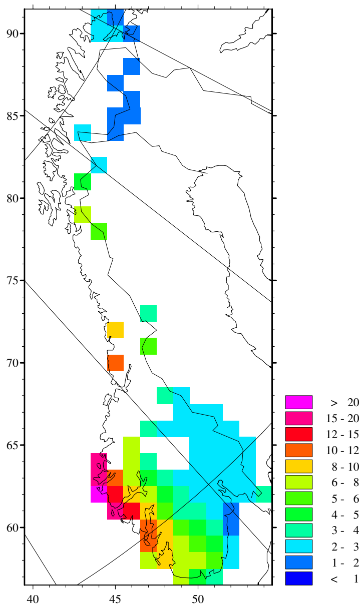

Figure 5.49: Ratio between deposition of oxidized nitrogen and emissions for vessel group I in areas with exceedance to critical load of acidity. (Units: %*100).

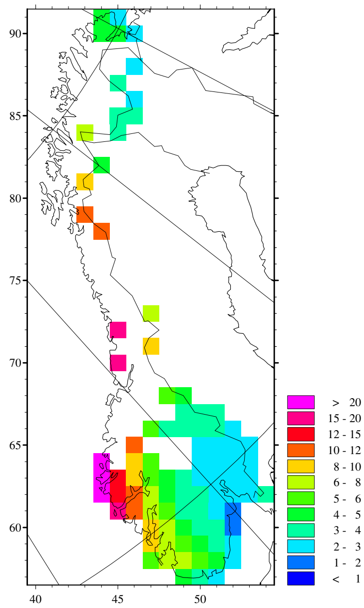

Figure 5.50: Ratio between deposition of oxidized nitrogen and emissions for vessel group J in areas with exceedance to critical load of acidity. (Units: %*100).

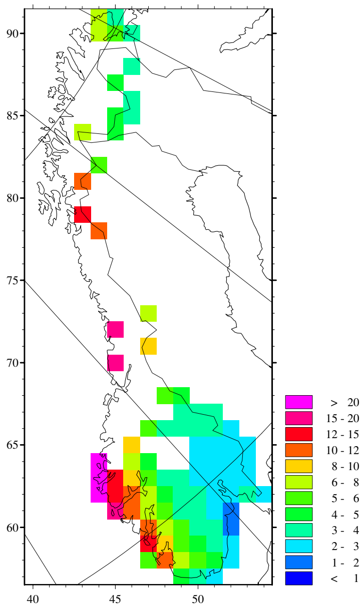

Figure 5.51: Ratio between deposition of oxidized nitrogen and emissions for vessel group K in areas with exceedance to critical load of acidity. (Units: %*100).

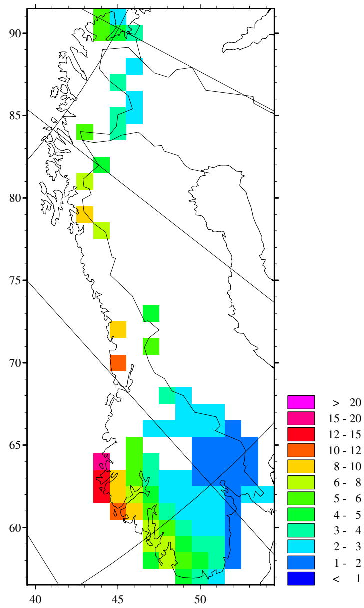

Figure 5.52: Ratio between deposition of oxidized nitrogen and emissions for the Norwegian fishing fleet in areas with exceedance to critical load of acidity. (Units: %*100).

5.4 Source-receptor relationship (vessel type to grid)

- Table 5.2: Tons of NO_x deposited in gridcells with exceedances by the different vessel groups
- Table 5.3: Relative NO_x contributions to gridcells with exceedances of the different vessel groups
- Table 5.4: Ratio of NO_x deposited in gridcells with exceedances to emissions for the different vessel groups
- Table 5.5: Tons of SO_x deposited in gridcells with exceedances by the different vessel groups
- Table 5.6: Relative SO_x contributions to gridcells with exceedances of the different vessel groups
- Table 5.7: Ratio of SO_x deposited in gridcells with exceedances to emissions for the different vessel groups

The lines with bold coordinates (**n i j**) refer to gridcells with exceedances of both nutrient and acidity critical loads. The last line with italic coordinates (n=*94*, i=*46* j=*60*) refers to the only gridcell in Norway with exceedance of nutrient critical load but not of acidity critical load. The level of exceedance represent the exceedance to critical loads of acidity expressed in units of tons of N (table 5.2) and tons of S (table 5.5).

n	i	j	% Norway	level of excee-dance	EMEP	Norway	sector 8	all fish-eries	A	B	C	D	E	F	G	H	I	J	K
					(tons of N)														
1	43	79	62.	16.4	322.3	46.3	27.3	9.2	0.2	0.9	0.5	1.7	0.8	0.4	0.7	0.6	1.2	1.3	0.8
2	43	81	51.	16.1	254.2	34.4	22.3	7.6	0.2	0.8	0.4	1.5	0.7	0.5	0.5	0.7	0.8	1.0	0.7
3	43	84	62.	8.8	209.6	25.1	16.5	5.8	0.1	0.5	0.4	1.3	0.8	0.3	0.3	0.4	0.5	0.7	0.5
4	**44**	**62**	22.	351.3	908.7	120.2	76.6	14.8	0.6	0.6	0.7	1.8	0.3	0.3	1.4	0.5	3.7	3.1	1.7
5	44	63	64.	33.8	698.0	110.3	62.8	13.4	0.4	0.6	0.8	1.9	0.3	0.2	1.1	0.5	3.0	3.0	1.5
6	44	64	26.	9.7	548.8	111.3	72.2	16.9	0.5	0.8	1.3	3.1	0.5	0.3	1.1	0.6	3.2	3.7	1.8
7	44	78	53.	6.3	338.1	41.5	23.3	7.9	0.2	0.7	0.5	1.4	0.6	0.4	0.6	0.5	1.0	1.3	0.8
8	44	82	12.	22.3	211.3	18.6	11.7	4.1	0.1	0.4	0.2	0.8	0.4	0.2	0.2	0.3	0.4	0.5	0.4
9	44	90	99.	4.4	222.0	20.4	14.0	5.4	0.1	0.3	0.4	1.7	1.1	0.2	0.2	0.2	0.4	0.5	0.4
10	44	91	51.	4.2	190.0	21.0	15.9	5.6	0.1	0.4	0.4	1.8	1.0	0.2	0.2	0.2	0.4	0.5	0.4
11	**45**	**61**	38.	821.3	1154.4	141.2	80.9	11.3	0.5	0.4	0.6	1.4	0.2	0.2	1.6	0.3	2.9	2.0	1.2
12	**45**	**62**	97.	414.7	907.0	106.1	59.0	9.7	0.3	0.3	0.6	1.5	0.2	0.2	1.2	0.3	2.4	1.7	0.9
13	45	63	100.	122.8	730.2	91.1	48.3	8.7	0.2	0.3	0.6	1.5	0.2	0.1	0.8	0.3	2.0	1.6	0.8
14	45	70	90.	26.2	412.6	72.1	41.1	11.4	0.3	0.6	0.8	2.2	0.6	0.3	0.7	0.5	1.9	2.2	1.2
15	45	72	100.	15.1	359.0	56.8	33.0	10.0	0.3	0.5	0.7	1.9	0.6	0.3	0.7	0.4	1.7	2.0	1.1
16	45	84	14.	0.7	234.9	14.8	9.3	3.2	0.1	0.3	0.2	0.7	0.4	0.2	0.2	0.2	0.3	0.4	0.3
17	45	85	62.	2.3	216.7	14.5	9.3	3.1	0.1	0.3	0.2	0.7	0.4	0.1	0.2	0.2	0.3	0.4	0.3
18	45	87	23.	7.6	203.7	14.5	9.5	3.4	0.1	0.2	0.2	0.9	0.6	0.1	0.2	0.2	0.3	0.4	0.3
19	45	90	75.	19.3	222.1	20.0	14.5	4.7	0.1	0.3	0.3	1.4	0.8	0.2	0.2	0.2	0.4	0.5	0.3
20	45	91	30.	83.6	142.9	11.0	8.0	2.9	0.1	0.2	0.2	0.9	0.5	0.1	0.1	0.1	0.2	0.3	0.2
21	**46**	**61**	98.	985.5	956.7	113.2	58.8	8.2	0.3	0.3	0.5	1.1	0.2	0.1	1.2	0.2	2.2	1.3	0.8
22	46	62	69.	623.5	829.3	96.9	53.1	7.0	0.2	0.2	0.4	1.0	0.2	0.1	0.9	0.2	1.8	1.2	0.7
23	46	63	98.	78.6	580.6	74.8	37.2	5.6	0.2	0.2	0.4	0.9	0.2	0.1	0.6	0.2	1.3	1.1	0.6
24	46	64	100.	14.0	465.8	61.1	30.2	5.2	0.2	0.2	0.4	0.9	0.2	0.1	0.5	0.2	1.1	1.0	0.5
25	46	65	100.	0.1	495.8	61.2	30.1	5.8	0.2	0.3	0.4	1.0	0.2	0.1	0.5	0.2	1.2	1.2	0.6
26	46	85	5.	9.2	289.6	14.5	8.9	3.0	0.1	0.2	0.2	0.7	0.4	0.1	0.2	0.2	0.3	0.4	0.3
27	46	86	17.	5.5	256.6	13.6	8.6	3.0	0.1	0.2	0.2	0.7	0.5	0.1	0.2	0.2	0.3	0.3	0.2
28	46	88	1.	2.2	204.5	11.7	7.7	2.9	0.1	0.2	0.2	0.8	0.5	0.1	0.1	0.1	0.2	0.3	0.2
29	46	90	58.	402.8	227.9	13.5	9.0	3.4	0.1	0.2	0.2	1.1	0.6	0.1	0.1	0.1	0.3	0.3	0.2
30	47	58	7.	75.3	854.5	54.0	30.2	4.9	0.2	0.1	0.2	0.5	0.1	0.1	1.3	0.1	1.3	0.6	0.4
31	**47**	**59**	29.	95.9	948.7	115.8	72.6	7.9	0.3	0.3	0.3	0.8	0.1	0.2	1.5	0.2	2.1	1.2	0.8
32	**47**	**60**	62.	198.8	903.1	110.8	62.2	7.5	0.3	0.2	0.4	1.0	0.2	0.2	1.3	0.2	2.0	1.2	0.7

Table 5.2: Oxidized nitrogen depositions in gridcells with exceedances. i and j are the EMEP coordinates of the gridcell and "%Norway" gives the fraction of the gridcell within mainland Norway. (Units: tons of N).

n	i	j	% Norway	level of excee-dance	EMEP	Norway	sector 8	all fish-eries	A	B	C	D	E	F	G	H	I	J	K
											(tons of N)								
33	47	61	83.	287.7	797.9	99.1	46.6	5.6	0.2	0.2	0.3	0.8	0.1	0.1	0.8	0.1	1.5	0.9	0.5
34	47	62	94.	117.6	680.4	73.0	35.6	4.5	0.1	0.2	0.3	0.7	0.1	0.1	0.6	0.1	1.1	0.7	0.4
35	47	63	86.	21.6	566.1	68.5	30.6	3.7	0.1	0.1	0.2	0.6	0.1	0.1	0.5	0.1	0.9	0.7	0.4
36	47	64	100.	35.3	511.8	54.7	23.8	3.2	0.1	0.1	0.2	0.5	0.1	0.1	0.4	0.1	0.7	0.6	0.3
37	47	66	100.	16.4	377.1	47.5	19.6	3.0	0.1	0.1	0.2	0.5	0.1	0.1	0.2	0.1	0.6	0.6	0.3
38	47	71	18.	102.0	398.6	47.9	23.9	5.9	0.2	0.3	0.4	1.1	0.3	0.2	0.4	0.2	1.0	1.2	0.6
39	**47**	**73**	3.	9.3	368.5	30.2	15.8	4.2	0.1	0.2	0.3	0.8	0.2	0.1	0.3	0.2	0.7	0.8	0.4
40	**48**	**58**	20.	104.1	1041.7	129.0	78.4	6.9	0.4	0.1	0.3	0.6	0.1	0.3	1.9	0.1	1.7	0.8	0.7
41	**48**	**59**	94.	409.9	981.7	97.7	55.5	6.4	0.2	0.2	0.3	0.7	0.1	0.2	1.3	0.1	1.7	0.9	0.6
42	48	60	100.	410.7	869.1	81.3	42.1	5.3	0.2	0.2	0.3	0.7	0.1	0.1	0.9	0.1	1.4	0.8	0.5
43	48	61	100.	42.6	666.0	66.3	30.5	3.9	0.1	0.1	0.2	0.5	0.1	0.1	0.6	0.1	1.0	0.6	0.4
44	48	62	100.	11.3	555.3	57.8	25.7	3.0	0.1	0.1	0.2	0.4	0.1	0.1	0.4	0.1	0.7	0.5	0.3
45	48	63	100.	21.4	579.5	61.6	24.4	2.7	0.1	0.1	0.2	0.4	0.1	0.1	0.3	0.1	0.6	0.5	0.3
46	48	66	100.	27.2	396.6	48.2	18.8	2.3	0.1	0.1	0.1	0.4	0.1	0.1	0.2	0.1	0.4	0.5	0.3
47	48	68	93.	16.6	345.0	44.6	19.5	3.4	0.1	0.2	0.2	0.6	0.2	0.1	0.3	0.1	0.6	0.7	0.4
48	**49**	**57**	50.	871.1	1052.4	41.5	22.7	4.3	0.2	0.1	0.2	0.4	0.1	0.2	1.2	0.1	1.2	0.5	0.3
49	**49**	**58**	92.	1363.	1235.5	89.1	44.7	5.6	0.2	0.1	0.3	0.6	0.1	0.2	1.4	0.1	1.4	0.7	0.4
50	**49**	**59**	100.	1554.	1086.0	70.2	35.3	4.7	0.2	0.1	0.2	0.5	0.1	0.1	1.0	0.1	1.2	0.6	0.4
51	49	60	100.	821.5	962.7	65.0	31.5	3.9	0.1	0.1	0.2	0.5	0.1	0.1	0.7	0.1	1.0	0.6	0.3
52	49	61	100.	221.9	690.4	57.8	24.4	2.8	0.1	0.1	0.2	0.4	0.1	0.1	0.4	0.1	0.7	0.5	0.3
53	49	62	100.	38.2	589.4	56.6	23.4	2.4	0.1	0.1	0.1	0.4	0.1	0.1	0.3	0.1	0.6	0.4	0.2
54	49	63	100.	8.7	648.9	72.5	25.6	2.2	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.5	0.4	0.2
55	49	66	100.	14.6	537.3	54.4	20.2	2.1	0.1	0.1	0.1	0.3	0.1	0.1	0.2	0.1	0.4	0.4	0.2
56	49	67	97.	26.5	448.7	44.0	17.2	2.2	0.1	0.1	0.1	0.4	0.1	0.1	0.2	0.1	0.4	0.4	0.2
57	49	68	38.	28.8	386.2	37.6	15.6	2.5	0.1	0.1	0.2	0.4	0.1	0.1	0.2	0.1	0.4	0.5	0.3
58	**50**	**57**	44.	1675.	1278.9	39.6	21.5	3.4	0.1	0.1	0.2	0.3	0.1	0.1	1.0	0.1	0.8	0.4	0.2
59	**50**	**58**	100.	2390.	1596.7	77.2	37.4	4.8	0.2	0.1	0.2	0.5	0.1	0.2	1.3	0.1	1.1	0.6	0.3
60	**50**	**59**	100.	2094.	1356.4	61.2	29.4	3.7	0.1	0.1	0.2	0.4	0.1	0.1	0.8	0.1	0.9	0.5	0.3
61	**50**	**60**	100.	660.9	1175.1	55.9	26.2	3.0	0.1	0.1	0.2	0.4	0.1	0.1	0.6	0.1	0.7	0.4	0.3
62	**50**	**61**	100.	253.7	1114.4	67.0	26.8	2.7	0.1	0.1	0.2	0.4	0.1	0.1	0.5	0.1	0.6	0.4	0.2
63	**50**	**62**	100.	181.6	917.5	73.1	28.7	2.3	0.1	0.1	0.1	0.3	0.1	0.1	0.4	0.1	0.5	0.4	0.2
64	**50**	**63**	100.	110.9	805.8	92.1	30.0	2.0	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.3	0.2

Table 5.2: (cont. I) Oxidized nitrogen depositions in gridcells with exceedances. i and j are the EMEP coordinates of the gridcell and "%Norway" gives the fraction of the gridcell within mainland Norway. (Units: tons of N).

n	i	j	% Norway	level of exceedance	EMEP	Norway	sector 8	all fisheries	A	B	C	D	E	F	G	H	I	J	K
											(tons of N)								
65	**50**	**64**	100.	10.4	844.1	84.3	29.1	1.9	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.3	0.2
66	**50**	**65**	100.	68.9	788.6	79.9	26.5	1.9	0.1	0.1	0.1	0.3	0.1	0.1	0.2	0.1	0.4	0.3	0.2
67	50	66	100.	3.5	757.3	60.4	22.4	2.2	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.4	0.2
68	50	67	48.	55.7	594.7	44.9	17.4	2.1	0.1	0.1	0.1	0.4	0.1	0.1	0.2	0.1	0.4	0.4	0.2
69	**51**	**57**	35.	1112.	1322.6	35.8	18.5	2.8	0.1	0.1	0.1	0.3	0.1	0.1	0.8	0.0	0.7	0.3	0.2
70	**51**	**58**	100.	1389.	1715.9	81.9	33.0	3.9	0.1	0.1	0.2	0.4	0.1	0.2	1.1	0.1	0.9	0.5	0.3
71	**51**	**59**	100.	1742.	1588.4	64.2	27.2	3.2	0.1	0.1	0.2	0.4	0.1	0.1	0.8	0.1	0.7	0.4	0.2
72	**51**	**60**	100.	1259.	1402.9	57.4	24.4	2.6	0.1	0.1	0.1	0.3	0.1	0.1	0.6	0.1	0.6	0.4	0.2
73	**51**	**61**	100.	606.8	1302.0	81.9	26.7	2.3	0.1	0.1	0.1	0.3	0.1	0.1	0.5	0.1	0.5	0.3	0.2
74	**51**	**62**	100.	298.5	1144.1	100.0	34.3	2.2	0.1	0.1	0.1	0.3	0.1	0.1	0.4	0.1	0.5	0.3	0.2
75	**51**	**63**	95.	173.9	1095.6	191.3	50.9	2.0	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.3	0.2
76	**51**	**64**	100.	146.9	990.0	123.1	39.1	1.9	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.3	0.2
77	**51**	**65**	100.	149.6	899.1	82.0	27.4	2.0	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.3	0.2
78	**51**	**66**	67.	16.6	855.0	57.2	21.4	2.1	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.4	0.2
79	**51**	**67**	14.	59.2	802.0	43.7	16.8	2.0	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.4	0.2
80	**52**	**58**	15.	836.2	1200.8	32.5	16.1	2.0	0.1	0.0	0.1	0.2	0.0	0.1	0.5	0.0	0.4	0.3	0.1
81	**52**	**59**	33.	850.1	1275.9	39.8	17.5	1.8	0.1	0.1	0.1	0.2	0.1	0.1	0.4	0.0	0.4	0.2	0.1
82	**52**	**60**	45.	367.5	1195.3	35.7	16.5	1.5	0.1	0.0	0.1	0.2	0.0	0.1	0.4	0.0	0.3	0.2	0.1
83	**52**	**61**	66.	169.4	1051.3	43.6	18.0	1.5	0.1	0.0	0.1	0.2	0.0	0.1	0.3	0.0	0.3	0.2	0.1
84	**52**	**62**	64.	106.6	1184.3	125.0	51.0	2.0	0.1	0.1	0.1	0.3	0.1	0.1	0.4	0.1	0.4	0.3	0.2
85	**52**	**63**	96.	168.4	1096.3	107.0	33.2	1.8	0.1	0.1	0.1	0.2	0.1	0.1	0.3	0.0	0.4	0.3	0.2
86	**52**	**64**	100.	321.8	1126.8	72.3	25.1	1.8	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.3	0.2
87	**52**	**65**	91.	85.0	992.9	60.6	22.7	1.9	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.3	0.2
88	**52**	**66**	2.	136.4	872.6	42.1	16.9	1.9	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.3	0.2
89	**53**	**62**	46.	625.2	1422.4	66.6	27.2	2.4	0.1	0.1	0.1	0.3	0.1	0.1	0.5	0.1	0.5	0.3	0.2
90	**53**	**63**	54.	564.9	1328.1	72.5	21.2	1.9	0.1	0.1	0.1	0.3	0.1	0.1	0.4	0.0	0.4	0.3	0.2
91	**53**	**64**	16.	475.1	1220.8	50.6	18.4	1.9	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.3	0.2
92	**53**	**65**	8.	36.6	1063.0	46.6	17.1	1.9	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.4	0.3	0.2
93	**54**	**62**	8.	700.9	1684.6	51.6	21.9	2.5	0.1	0.1	0.1	0.3	0.1	0.1	0.6	0.1	0.5	0.4	0.2
94	*46*	*60*	54.	0.0	957.2	154.9	88.2	9.3	0.4	0.3	0.4	1.0	0.2	0.2	1.4	0.2	2.7	1.5	1.0
	sum				74291	6083	2841	412	13.5	18.4	24.3	65.8	20.5	12.4	54.0	14.1	84.5	66.7	38.9
	NO_x emission				$6.4\ 10^6$	68156	32030	10138	186	421	745	2197	1588	237	851	299	1788	1164	658

Table 5.2: (cont. II) Oxidised nitrogen depositions in gridcells with exceedances. i and j are the EMEP coordinates of the gridcell and "%Norway" gives the fraction of the gridcell within mainland Norway. (Units: tons of N).

n	i	j	sector 8	all fish-eries	A	B	C	D	E	F	G	H	I	J	K
1	43	79	58.9	19.9	0.5	2.0	1.1	3.6	1.8	1.0	1.6	1.4	2.5	2.8	1.8
2	43	81	64.7	22.1	0.5	2.5	1.3	4.2	2.1	1.3	1.3	1.9	2.2	2.9	1.9
3	43	84	65.9	23.3	0.5	2.1	1.4	5.2	3.2	1.2	1.1	1.6	2.0	2.8	2.0
4	**44**	**62**	63.7	12.3	0.5	0.5	0.6	1.5	0.3	0.2	1.2	0.4	3.1	2.5	1.4
5	44	63	56.9	12.1	0.4	0.5	0.7	1.7	0.3	0.2	1.0	0.5	2.7	2.7	1.4
6	44	64	64.9	15.2	0.4	0.7	1.1	2.8	0.4	0.3	1.0	0.6	2.9	3.3	1.6
7	44	78	56.0	19.1	0.5	1.7	1.1	3.5	1.5	0.9	1.4	1.2	2.5	3.1	1.8
8	44	82	62.8	21.8	0.4	2.2	1.3	4.4	2.3	1.2	1.2	1.7	2.1	2.9	1.9
9	44	90	68.7	26.5	0.6	1.4	1.9	8.2	5.2	0.8	1.1	0.8	2.0	2.5	2.0
10	44	91	75.9	26.5	0.6	1.7	1.7	8.6	4.8	1.0	1.1	0.9	1.8	2.3	2.0
11	**45**	**61**	57.3	8.0	0.4	0.3	0.4	1.0	0.2	0.1	1.1	0.2	2.1	1.4	0.8
12	**45**	**62**	55.6	9.1	0.3	0.3	0.6	1.4	0.2	0.2	1.1	0.3	2.3	1.6	0.9
13	45	63	53.0	9.5	0.3	0.4	0.7	1.6	0.3	0.2	0.9	0.3	2.2	1.8	0.9
14	45	70	57.0	15.8	0.4	0.8	1.1	3.0	0.8	0.4	1.0	0.6	2.7	3.1	1.7
15	45	72	58.2	17.7	0.5	0.9	1.2	3.3	1.0	0.5	1.2	0.7	3.0	3.4	1.9
16	45	84	62.9	21.4	0.5	1.8	1.3	4.8	2.8	1.0	1.1	1.3	2.1	2.7	1.8
17	45	85	64.1	21.6	0.5	1.8	1.4	5.0	3.1	1.0	1.1	1.3	2.0	2.6	1.8
18	45	87	65.8	23.4	0.5	1.7	1.6	5.9	3.9	1.0	1.1	1.2	2.0	2.6	1.9
19	45	90	72.7	23.5	0.5	1.3	1.5	6.8	4.1	1.3	1.0	0.8	1.9	2.5	1.7
20	45	91	72.3	26.3	0.6	1.5	1.7	8.0	4.6	1.1	1.1	0.9	2.2	2.6	1.9
21	**46**	**61**	51.9	7.2	0.3	0.2	0.4	1.0	0.2	0.1	1.1	0.2	1.9	1.2	0.7
22	46	62	54.8	7.2	0.2	0.3	0.5	1.1	0.2	0.1	0.9	0.2	1.8	1.3	0.7
23	46	63	49.7	7.5	0.2	0.3	0.5	1.2	0.2	0.1	0.8	0.2	1.7	1.4	0.7
24	46	64	49.5	8.5	0.3	0.3	0.6	1.4	0.3	0.2	0.8	0.3	1.8	1.7	0.9
25	46	65	49.2	9.4	0.3	0.4	0.7	1.6	0.3	0.2	0.8	0.3	1.9	2.0	1.0
26	46	85	61.3	20.5	0.5	1.6	1.3	4.8	2.9	0.9	1.1	1.1	2.1	2.5	1.7
27	46	86	62.8	21.7	0.5	1.6	1.4	5.3	3.3	0.9	1.1	1.2	2.0	2.5	1.8
28	46	88	66.0	24.4	0.6	1.7	1.7	6.6	4.1	0.9	1.1	1.2	2.1	2.7	1.9
29	46	90	66.8	25.4	0.5	1.5	1.8	7.8	4.6	0.9	1.1	0.9	2.0	2.5	1.9
30	47	58	55.9	9.1	0.3	0.2	0.4	0.9	0.2	0.2	2.5	0.1	2.5	1.1	0.7
31	**47**	**59**	62.7	6.9	0.3	0.3	0.3	0.7	0.1	0.2	1.3	0.2	1.8	1.0	0.7
32	**47**	**60**	56.2	6.8	0.2	0.2	0.4	0.9	0.1	0.1	1.2	0.2	1.8	1.0	0.6

Table 5.3: Relative contribution to total Norwegian contributions to oxidised nitrogen depositions in gridcells with exceedances (%)

33	47	61	47.0	5.7	0.2	0.2	0.3	0.8	0.1	0.1	0.9	0.1	1.5	0.9	0.5
34	47	62	48.8	6.1	0.2	0.2	0.4	0.9	0.2	0.1	0.8	0.2	1.6	1.0	0.6
35	47	63	44.6	5.4	0.2	0.2	0.3	0.8	0.2	0.1	0.7	0.2	1.3	1.0	0.5
36	47	64	43.6	5.8	0.2	0.2	0.4	0.9	0.2	0.1	0.6	0.2	1.3	1.1	0.6
37	47	66	41.3	6.4	0.2	0.3	0.4	1.1	0.3	0.2	0.5	0.2	1.2	1.3	0.7
38	47	71	49.8	12.4	0.4	0.6	0.8	2.3	0.7	0.3	0.9	0.5	2.1	2.4	1.3
39	**47**	**73**	52.1	13.8	0.4	0.8	0.9	2.5	0.8	0.4	1.0	0.6	2.3	2.6	1.5
40	**48**	**58**	60.8	5.4	0.3	0.1	0.2	0.5	0.1	0.2	1.5	0.1	1.3	0.6	0.5
41	**48**	**59**	56.8	6.5	0.3	0.2	0.3	0.7	0.1	0.2	1.3	0.1	1.7	0.9	0.6
42	48	60	51.8	6.5	0.2	0.2	0.4	0.8	0.2	0.1	1.2	0.2	1.8	1.0	0.6
43	48	61	46.0	5.8	0.2	0.2	0.3	0.8	0.2	0.1	0.9	0.1	1.5	0.9	0.5
44	48	62	44.5	5.2	0.2	0.2	0.3	0.8	0.1	0.1	0.7	0.1	1.3	0.9	0.5
45	48	63	39.7	4.3	0.1	0.2	0.3	0.7	0.1	0.1	0.6	0.1	1.0	0.8	0.4
46	48	66	38.9	4.8	0.2	0.2	0.3	0.8	0.2	0.1	0.4	0.2	0.9	0.9	0.5
47	48	68	43.7	7.6	0.2	0.4	0.5	1.4	0.4	0.2	0.6	0.3	1.3	1.5	0.8
48	**49**	**57**	54.6	10.3	0.5	0.2	0.4	0.9	0.2	0.5	2.8	0.2	2.8	1.1	0.7
49	**49**	**58**	50.2	6.3	0.2	0.2	0.3	0.7	0.1	0.2	1.6	0.1	1.6	0.8	0.5
50	**49**	**59**	50.3	6.7	0.2	0.2	0.3	0.8	0.2	0.2	1.4	0.1	1.8	0.9	0.5
51	49	60	48.4	6.0	0.2	0.2	0.3	0.7	0.2	0.2	1.1	0.1	1.5	0.9	0.5
52	49	61	42.2	4.8	0.2	0.2	0.3	0.7	0.1	0.1	0.8	0.1	1.2	0.8	0.4
53	49	62	41.4	4.2	0.1	0.2	0.3	0.6	0.1	0.1	0.6	0.1	1.0	0.7	0.4
54	49	63	35.4	3.0	0.1	0.1	0.2	0.4	0.1	0.1	0.4	0.1	0.7	0.5	0.3
55	49	66	37.2	3.8	0.1	0.2	0.2	0.6	0.2	0.1	0.4	0.1	0.7	0.7	0.4
56	49	67	39.0	5.1	0.2	0.2	0.3	0.9	0.3	0.1	0.5	0.2	0.9	1.0	0.5
57	49	68	41.4	6.6	0.2	0.3	0.4	1.2	0.3	0.2	0.6	0.3	1.2	1.3	0.7
58	**50**	**57**	54.1	8.5	0.3	0.2	0.4	0.8	0.2	0.3	2.6	0.1	2.0	1.0	0.5
59	**50**	**58**	48.4	6.2	0.2	0.1	0.3	0.7	0.1	0.2	1.7	0.1	1.5	0.8	0.4
60	**50**	**59**	47.9	6.0	0.2	0.2	0.3	0.7	0.2	0.2	1.4	0.1	1.5	0.8	0.5
61	**50**	**60**	46.9	5.4	0.2	0.2	0.3	0.7	0.2	0.2	1.1	0.1	1.3	0.8	0.5
62	**50**	**61**	40.1	4.1	0.1	0.1	0.2	0.5	0.1	0.1	0.7	0.1	0.9	0.6	0.4
63	**50**	**62**	39.2	3.1	0.1	0.1	0.2	0.4	0.1	0.1	0.5	0.1	0.7	0.5	0.3
64	**50**	**63**	32.6	2.1	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.5	0.3	0.2

Table 5.3: (cont. I) Relative contribution to total Norwegian contributions to oxidised nitrogen depositions in gridcells with exceedances (%)

65	**50**	**64**	34.5	2.3	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.1	0.5	0.4	0.2
66	**50**	**65**	33.2	2.4	0.1	0.1	0.1	0.4	0.1	0.1	0.3	0.1	0.5	0.4	0.2
67	50	66	37.0	3.6	0.1	0.2	0.2	0.6	0.2	0.1	0.4	0.1	0.7	0.7	0.4
68	50	67	38.7	4.8	0.1	0.2	0.3	0.8	0.2	0.1	0.5	0.2	0.9	0.9	0.5
69	**51**	**57**	51.6	7.9	0.3	0.2	0.4	0.8	0.2	0.3	2.3	0.1	1.9	0.9	0.5
70	**51**	**58**	40.3	4.8	0.2	0.1	0.2	0.5	0.1	0.2	1.3	0.1	1.1	0.6	0.3
71	**51**	**59**	42.3	5.0	0.2	0.1	0.2	0.6	0.1	0.2	1.2	0.1	1.2	0.7	0.4
72	**51**	**60**	42.5	4.6	0.2	0.1	0.2	0.6	0.1	0.2	1.0	0.1	1.0	0.6	0.4
73	**51**	**61**	32.7	2.8	0.1	0.1	0.2	0.4	0.1	0.1	0.6	0.1	0.6	0.4	0.2
74	**51**	**62**	34.3	2.2	0.1	0.1	0.1	0.3	0.1	0.1	0.4	0.1	0.5	0.3	0.2
75	**51**	**63**	26.6	1.1	0.0	0.0	0.1	0.2	0.0	0.0	0.2	0.0	0.2	0.2	0.1
76	**51**	**64**	31.8	1.5	0.1	0.1	0.1	0.2	0.1	0.0	0.2	0.0	0.3	0.2	0.1
77	**51**	**65**	33.5	2.4	0.1	0.1	0.1	0.4	0.1	0.1	0.3	0.1	0.5	0.4	0.2
78	**51**	**66**	37.4	3.6	0.1	0.2	0.2	0.6	0.2	0.1	0.5	0.1	0.7	0.6	0.4
79	**51**	**67**	38.3	4.7	0.1	0.2	0.3	0.8	0.2	0.1	0.6	0.2	0.9	0.8	0.5
80	**52**	**58**	49.5	6.2	0.2	0.2	0.3	0.7	0.1	0.3	1.6	0.1	1.3	0.8	0.4
81	**52**	**59**	44.0	4.6	0.2	0.1	0.2	0.5	0.1	0.3	1.1	0.1	1.0	0.6	0.3
82	**52**	**60**	46.0	4.3	0.2	0.1	0.2	0.5	0.1	0.2	1.0	0.1	0.9	0.6	0.3
83	**52**	**61**	41.3	3.5	0.2	0.1	0.2	0.4	0.1	0.2	0.7	0.1	0.7	0.5	0.3
84	**52**	**62**	40.8	1.6	0.1	0.0	0.1	0.2	0.1	0.1	0.3	0.0	0.3	0.2	0.1
85	**52**	**63**	31.0	1.7	0.1	0.1	0.1	0.2	0.1	0.1	0.3	0.0	0.4	0.3	0.1
86	**52**	**64**	34.8	2.5	0.1	0.1	0.1	0.4	0.1	0.1	0.4	0.1	0.5	0.4	0.2
87	**52**	**65**	37.5	3.2	0.1	0.1	0.2	0.5	0.1	0.1	0.5	0.1	0.7	0.5	0.3
88	**52**	**66**	40.2	4.5	0.1	0.2	0.3	0.7	0.2	0.1	0.6	0.1	0.9	0.8	0.4
89	**53**	**62**	40.8	3.6	0.1	0.1	0.2	0.4	0.1	0.2	0.8	0.1	0.8	0.5	0.3
90	**53**	**63**	29.3	2.6	0.1	0.1	0.1	0.3	0.1	0.1	0.5	0.1	0.6	0.4	0.2
91	**53**	**64**	36.3	3.8	0.1	0.1	0.2	0.5	0.1	0.1	0.7	0.1	0.8	0.6	0.3
92	**53**	**65**	36.8	4.1	0.1	0.1	0.2	0.6	0.2	0.1	0.7	0.1	0.9	0.7	0.4
93	**54**	**62**	42.5	4.8	0.2	0.1	0.3	0.6	0.2	0.2	1.1	0.1	1.1	0.7	0.4
94	*46*	*60*	56.9	6.0	0.3	0.2	0.3	0.6	0.1	0.1	0.9	0.2	1.8	1.0	0.6
	all		45.2	6.8	0.2	0.3	0.4	1.1	0.3	0.2	0.9	0.2	1.4	1.1	0.6

Table 5.3: (cont. II) Relative contributions to total Norwegian contributions to oxidised nitrogen depositions in gridcells with exceedances (%)

n	i	j	EMEP	Norway	sector 8	all fish-eries	A	B	C	D	E	F	G	H	I	J	K
1	43	79	0.5	6.8	8.5	9.1	12.9	21.7	6.7	7.6	5.1	18.9	8.7	21.0	6.5	11.3	12.4
2	43	81	0.4	5.0	7.0	7.5	8.6	20.2	5.9	6.6	4.6	19.3	5.3	21.9	4.2	8.6	10.2
3	43	84	0.3	3.7	5.2	5.8	7.1	12.4	4.8	5.9	5.1	12.9	3.2	13.2	2.9	6.1	7.7
4	**44**	**62**	1.4	17.6	23.9	14.6	34.7	15.1	9.8	8.0	1.9	10.9	16.5	16.9	20.6	26.3	26.4
5	44	63	1.1	16.2	19.6	13.2	23.3	13.1	10.4	8.8	2.0	8.8	12.9	17.5	16.9	25.9	22.9
6	44	64	0.9	16.3	22.5	16.7	25.7	18.1	16.9	14.3	3.1	14.4	12.5	21.5	17.8	31.8	27.5
7	44	78	0.5	6.1	7.3	7.8	10.6	17.1	6.2	6.5	3.9	14.9	6.7	17.0	5.8	11.0	11.5
8	44	82	0.3	2.7	3.7	4.0	4.5	9.8	3.3	3.8	2.7	9.8	2.6	10.7	2.2	4.6	5.4
9	44	90	0.3	3.0	4.4	5.3	6.9	7.0	5.2	7.6	6.6	7.1	2.6	5.8	2.3	4.4	6.1
10	44	91	0.3	3.1	5.0	5.5	7.2	8.5	4.8	8.2	6.3	8.7	2.6	6.1	2.1	4.1	6.4
11	**45**	**61**	1.8	20.7	25.2	11.1	26.5	9.0	7.8	6.5	1.5	7.7	18.8	9.9	16.3	16.8	18.2
12	**45**	**62**	1.4	15.6	18.4	9.6	17.6	8.1	8.3	6.8	1.5	6.7	13.5	9.1	13.6	14.6	14.3
13	45	63	1.1	13.4	15.1	8.6	13.3	7.8	8.2	6.7	1.5	6.3	10.0	8.8	11.3	14.2	12.8
14	45	70	0.6	10.6	12.8	11.2	16.9	13.4	10.9	9.9	3.8	11.8	8.6	15.2	10.8	19.3	18.9
15	45	72	0.6	8.3	10.3	9.9	14.7	12.4	9.3	8.5	3.7	11.0	8.0	13.9	9.4	16.8	16.5
16	45	84	0.4	2.2	2.9	3.1	3.9	6.4	2.7	3.2	2.6	6.3	2.0	6.7	1.7	3.4	4.2
17	45	85	0.3	2.1	2.9	3.1	3.9	6.1	2.6	3.3	2.8	6.1	1.9	6.3	1.6	3.3	4.1
18	45	87	0.3	2.1	3.0	3.3	4.2	5.9	3.0	3.9	3.6	5.8	1.8	5.8	1.6	3.2	4.2
19	45	90	0.3	2.9	4.5	4.6	5.4	6.2	4.1	6.2	5.2	10.5	2.4	5.7	2.1	4.3	5.2
20	45	91	0.2	1.6	2.5	2.9	3.6	4.0	2.5	4.0	3.2	5.2	1.4	3.2	1.3	2.5	3.2
21	**46**	**61**	1.5	16.6	18.3	8.1	15.4	6.5	6.3	5.1	1.2	6.3	14.1	7.0	12.2	11.4	12.0
22	46	62	1.3	14.2	16.6	6.9	12.3	5.9	5.9	4.7	1.1	5.4	10.0	6.5	9.9	10.4	10.2
23	46	63	0.9	11.0	11.6	5.5	9.4	5.1	4.9	4.0	1.0	4.5	6.9	5.8	7.3	9.1	8.5
24	46	64	0.7	9.0	9.4	5.1	8.4	5.0	4.8	4.0	1.0	4.5	5.6	5.7	6.3	8.7	8.0
25	46	65	0.8	9.0	9.4	5.7	9.3	6.0	5.5	4.5	1.2	5.5	5.4	6.7	6.5	10.3	9.3
26	46	85	0.5	2.1	2.8	2.9	3.7	5.5	2.6	3.2	2.7	5.4	1.9	5.6	1.7	3.1	3.8
27	46	86	0.4	2.0	2.7	2.9	3.6	5.3	2.6	3.3	2.9	5.1	1.8	5.3	1.5	3.0	3.7
28	46	88	0.3	1.7	2.4	2.8	3.5	4.7	2.6	3.5	3.0	4.7	1.5	4.5	1.4	2.7	3.4
29	46	90	0.4	2.0	2.8	3.4	3.9	4.7	3.2	4.8	3.9	4.8	1.7	4.3	1.5	2.9	3.8
30	47	58	1.3	7.9	9.4	4.8	8.3	2.3	3.0	2.3	0.5	4.7	15.8	2.7	7.5	5.1	5.5
31	**47**	**59**	1.5	17.0	22.7	7.8	18.2	6.9	4.7	3.7	0.9	7.8	18.1	6.6	11.7	9.9	12.7
32	**47**	**60**	1.4	16.3	19.4	7.4	14.2	5.8	5.5	4.3	1.0	6.7	15.1	6.2	11.4	10.0	10.5

Table 5.4: Ratio between nitrogen deposited and emissions in gridcells with exceedances ((deposited tons of N *10000)/(emitted tons of N))

33	47	61	1.2	14.5	14.5	5.5	9.9	4.3	4.5	3.6	0.9	4.7	9.9	4.7	8.3	7.7	7.7
34	47	62	1.1	10.7	11.1	4.4	7.8	3.6	3.7	3.0	0.8	3.8	7.2	4.0	6.4	6.4	6.3
35	47	63	0.9	10.0	9.5	3.7	6.3	3.2	3.2	2.6	0.7	3.3	5.4	3.6	4.9	5.7	5.4
36	47	64	0.8	8.0	7.4	3.1	5.4	3.0	2.8	2.3	0.6	3.1	4.2	3.3	4.0	5.0	4.8
37	47	66	0.6	7.0	6.1	3.0	5.1	3.4	2.7	2.4	0.9	3.3	2.9	3.8	3.1	5.2	5.0
38	47	71	0.6	7.0	7.5	5.9	9.1	7.1	5.5	5.0	2.1	6.4	5.0	8.0	5.7	10.0	9.8
39	**47**	**73**	0.6	4.4	4.9	4.1	6.2	5.4	3.7	3.4	1.5	5.0	3.6	6.0	3.9	6.8	6.8
40	**48**	**58**	1.6	18.9	24.5	6.8	18.8	3.3	3.6	2.8	0.7	10.8	22.2	4.2	9.3	7.1	10.3
41	**48**	**59**	1.5	14.3	17.3	6.3	13.3	4.5	4.3	3.3	0.8	6.8	15.2	4.7	9.4	7.6	8.9
42	48	60	1.4	11.9	13.2	5.2	9.7	3.9	4.0	3.0	0.8	5.0	11.0	4.2	8.0	6.7	7.1
43	48	61	1.0	9.7	9.5	3.8	7.0	3.0	3.0	2.4	0.6	3.7	7.0	3.3	5.6	5.3	5.4
44	48	62	0.9	8.5	8.0	3.0	5.3	2.5	2.4	2.0	0.5	2.9	5.0	2.7	4.1	4.3	4.3
45	48	63	0.9	9.0	7.6	2.6	4.7	2.4	2.2	1.8	0.5	2.8	4.0	2.6	3.4	4.1	3.9
46	48	66	0.6	7.1	5.9	2.3	4.0	2.6	2.0	1.7	0.7	2.8	2.4	2.9	2.4	3.9	3.9
47	48	68	0.5	6.5	6.1	3.4	5.6	3.9	3.1	2.7	1.1	3.8	3.0	4.4	3.2	5.9	5.7
48	**49**	**57**	1.6	6.1	7.1	4.2	10.3	2.4	2.4	1.8	0.4	8.6	13.6	2.3	6.5	4.1	4.3
49	**49**	**58**	1.9	13.1	14.0	5.5	11.9	3.3	3.4	2.6	0.7	8.5	16.5	3.5	8.0	6.1	6.6
50	**49**	**59**	1.7	10.3	11.0	4.6	9.3	3.2	3.2	2.4	0.7	6.1	11.8	3.4	6.9	5.4	5.8
51	49	60	1.5	9.5	9.8	3.8	7.2	2.8	2.8	2.2	0.6	4.4	8.6	3.1	5.6	4.9	5.1
52	49	61	1.1	8.5	7.6	2.8	5.2	2.3	2.1	1.7	0.5	3.2	5.3	2.5	3.8	3.9	3.9
53	49	62	0.9	8.3	7.3	2.4	4.3	2.0	1.9	1.6	0.5	2.7	4.1	2.3	3.1	3.5	3.4
54	49	63	1.0	10.6	8.0	2.1	3.9	1.9	1.7	1.4	0.5	2.6	3.5	2.1	2.7	3.2	3.2
55	49	66	0.8	8.0	6.3	2.1	3.7	2.2	1.8	1.5	0.6	2.6	2.6	2.5	2.2	3.4	3.4
56	49	67	0.7	6.5	5.4	2.2	3.8	2.5	2.0	1.7	0.7	2.7	2.5	2.8	2.3	3.7	3.7
57	49	68	0.6	5.5	4.9	2.5	4.1	2.8	2.2	2.0	0.8	2.9	2.5	3.2	2.4	4.2	4.1
58	**50**	**57**	2.0	5.8	6.7	3.3	6.3	1.6	2.0	1.5	0.4	5.5	12.3	1.8	4.5	3.5	3.1
59	**50**	**58**	2.5	11.3	11.7	4.8	8.3	2.7	3.1	2.4	0.7	7.0	15.6	3.0	6.4	5.3	5.2
60	**50**	**59**	2.1	9.0	9.2	3.6	6.9	2.5	2.5	1.9	0.6	5.5	9.8	2.7	5.1	4.3	4.4
61	**50**	**60**	1.8	8.2	8.2	3.0	5.6	2.2	2.1	1.7	0.5	4.3	7.1	2.4	4.0	3.8	3.9
62	**50**	**61**	1.7	9.8	8.4	2.7	5.3	2.1	2.0	1.7	0.5	4.1	5.8	2.4	3.5	3.6	3.7
63	**50**	**62**	1.4	10.7	8.9	2.3	4.4	1.9	1.8	1.5	0.5	3.3	4.5	2.1	2.8	3.1	3.2
64	**50**	**63**	1.3	13.5	9.4	1.9	3.8	1.7	1.5	1.3	0.4	2.8	3.6	1.9	2.4	2.7	2.8

Table 5.4: (cont. I) Ratio between nitrogen deposited and emissions in gridcells with exceedances ((deposited tons of N *10000)/(emitted tons of N))

65	**50**	**64**	1.3	12.4	9.1	1.9	3.6	1.8	1.6	1.3	0.5	2.6	3.3	2.0	2.3	2.8	2.9
66	**50**	**65**	1.2	11.7	8.3	1.9	3.4	1.9	1.5	1.3	0.5	2.5	2.8	2.1	2.1	2.9	2.9
67	50	66	1.2	8.9	7.0	2.1	3.8	2.2	1.8	1.6	0.6	2.7	3.0	2.5	2.3	3.4	3.4
68	50	67	0.9	6.6	5.4	2.1	3.6	2.3	1.8	1.6	0.7	2.6	2.6	2.6	2.2	3.4	3.4
69	**51**	**57**	2.1	5.2	5.8	2.8	5.6	1.4	1.7	1.3	0.3	5.1	9.8	1.5	3.8	2.8	2.7
70	**51**	**58**	2.7	12.0	10.3	3.9	6.7	2.2	2.5	1.9	0.6	7.5	13.0	2.4	5.1	4.2	4.1
71	**51**	**59**	2.5	9.4	8.5	3.1	5.9	2.1	2.1	1.7	0.5	5.6	8.9	2.3	4.1	3.7	3.7
72	**51**	**60**	2.2	8.4	7.6	2.6	4.7	1.8	1.8	1.5	0.5	4.2	6.8	2.0	3.4	3.2	3.2
73	**51**	**61**	2.0	12.0	8.3	2.3	4.6	1.7	1.7	1.3	0.5	4.0	5.4	1.9	2.9	2.9	2.9
74	**51**	**62**	1.8	14.7	10.7	2.1	4.2	1.7	1.7	1.4	0.5	3.5	4.6	1.9	2.6	2.8	2.9
75	**51**	**63**	1.7	28.1	15.9	2.0	3.8	1.6	1.6	1.3	0.4	2.8	3.9	1.8	2.5	2.7	2.8
76	**51**	**64**	1.5	18.1	12.2	1.8	3.4	1.6	1.5	1.2	0.4	2.5	3.4	1.8	2.2	2.6	2.6
77	**51**	**65**	1.4	12.0	8.6	1.9	3.5	1.9	1.6	1.3	0.5	2.6	3.2	2.1	2.2	2.9	2.9
78	**51**	**66**	1.3	8.4	6.7	2.0	3.6	2.1	1.7	1.5	0.6	2.7	3.2	2.4	2.2	3.1	3.2
79	**51**	**67**	1.3	6.4	5.2	2.0	3.4	2.1	1.7	1.5	0.7	2.7	2.9	2.4	2.1	3.1	3.1
80	**52**	**58**	1.9	4.8	5.0	2.0	3.2	1.2	1.3	1.1	0.3	4.7	6.3	1.2	2.4	2.2	2.1
81	**52**	**59**	2.0	5.8	5.5	1.8	3.3	1.2	1.2	1.0	0.3	4.3	5.3	1.3	2.2	2.1	2.1
82	**52**	**60**	1.9	5.2	5.1	1.5	2.9	1.1	1.0	0.8	0.3	3.2	4.2	1.2	1.9	1.8	1.9
83	**52**	**61**	1.6	6.4	5.6	1.5	3.6	1.0	1.1	0.9	0.3	3.6	3.6	1.3	1.8	1.8	1.9
84	**52**	**62**	1.9	18.3	15.9	2.0	4.7	1.5	1.4	1.2	0.4	4.1	4.7	1.7	2.4	2.5	2.7
85	**52**	**63**	1.7	15.7	10.3	1.8	3.5	1.4	1.3	1.1	0.4	3.0	3.8	1.6	2.1	2.3	2.4
86	**52**	**64**	1.8	10.6	7.8	1.8	3.3	1.5	1.4	1.2	0.5	2.6	3.6	1.7	2.1	2.5	2.5
87	**52**	**65**	1.6	8.9	7.1	1.9	3.4	1.7	1.5	1.3	0.5	2.6	3.5	2.0	2.2	2.7	2.8
88	**52**	**66**	1.4	6.2	5.3	1.9	3.3	1.9	1.5	1.3	0.5	2.5	3.1	2.1	2.1	2.8	2.8
89	**53**	**62**	2.2	9.8	8.5	2.4	5.1	1.6	1.6	1.3	0.5	5.2	6.0	2.1	2.8	2.8	3.3
90	**53**	**63**	2.1	10.6	6.6	1.9	3.5	1.4	1.4	1.1	0.4	3.0	4.4	1.6	2.3	2.4	2.5
91	**53**	**64**	1.9	7.4	5.7	1.9	3.3	1.6	1.5	1.2	0.5	2.7	4.0	1.8	2.2	2.6	2.6
92	**53**	**65**	1.7	6.8	5.3	1.9	3.3	1.6	1.5	1.2	0.5	2.5	3.6	1.9	2.2	2.6	2.6
93	**54**	**62**	2.6	7.6	6.8	2.5	4.2	1.7	1.8	1.4	0.5	3.9	6.8	1.9	3.0	3.0	2.9
94	*46*	*6*0	1.5	22.7	27.5	9.2	22.1	8.1	5.4	4.4	1.1	6.8	16.1	7.8	15.4	12.7	15.2
	sum (/100)		1.1	8.9	8.9	4.1	7.2	4.4	3.2	2.9	1.3	5.3	6.4	4.7	4.7	5.7	5.9

Table 5.4: (cont. II) Ratio between nitrogen deposited and emissions in gridcells with exceedances ((deposited tons of N *10000)/(emitted tons of N))

n	i	j	% Norway	level of exceedance	EMEP	Norway	sector 8	all fisheries	A	B	C	D	E	F	G	H	I	J	K
											(tons of S)								
1	43	79	62.	18.7	287.3	28.5	1.8	0.5	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1
2	43	81	51.	18.3	233.0	8.4	1.4	0.4	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.1	0.0
3	43	84	62.	10.0	250.4	5.8	0.9	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	**44**	**62**	22.	401.5	778.2	23.4	7.9	0.9	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.2	0.2
5	44	63	64.	38.7	658.7	59.0	5.4	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.2	0.1
6	44	64	26.	11.1	502.3	26.0	6.4	1.2	0.0	0.1	0.1	0.2	0.0	0.0	0.1	0.1	0.2	0.3	0.2
7	44	78	53.	7.2	318.5	27.4	1.5	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0
8	44	82	12.	25.4	203.3	4.1	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
9	44	90	99.	5.1	565.1	2.6	0.7	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10	44	91	51.	4.8	440.9	2.6	1.0	0.3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	**45**	**61**	38.	938.7	938.1	83.2	8.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1
12	**45**	**62**	97.	473.9	770.9	43.1	5.1	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1
13	45	63	100.	140.3	625.1	27.5	3.6	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0
14	45	70	90.	30.0	340.8	23.6	2.5	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1
15	45	72	100.	17.2	298.0	12.9	2.0	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1
16	45	84	14.	0.9	279.4	3.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	45	85	62.	2.7	314.3	2.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	45	87	23.	8.7	387.7	2.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	45	90	75.	22.1	828.7	2.9	1.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	45	91	30.	95.6	885.7	3.4	1.5	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	**46**	**61**	98.	1126.	794.0	29.7	5.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1
22	46	62	69.	712.6	703.5	22.2	4.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
23	46	63	98.	89.8	488.4	20.5	2.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
24	46	64	100.	16.0	397.7	15.0	2.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
25	46	65	100.	0.1	467.2	15.8	2.4	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0
26	46	85	5.	10.5	404.0	2.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	46	86	17.	6.3	430.6	2.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	46	88	1.	2.5	491.0	1.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	46	90	58.	460.4	1964.3	1.6	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	47	58	7.	86.1	946.5	42.9	8.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.1	0.1
31	**47**	**59**	29.	109.6	760.3	21.2	6.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1
32	**47**	**60**	62.	227.2	726.1	35.9	4.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0

Table 5.5: Oxidized sulphur depositions in gridcells with exceedances. i and j are the EMEP coordinates of the gridcell and “%Norway” gives the fraction of the gridcell within mainland Norway. (Units: tons of S).

n	i	j	% Norway	level of excee-dance	EMEP	Norway	sector 8	all fish-eries	A	B	C	D	E	F	G	H	I	J	K
											(tons of S)								
33	47	61	83.	328.8	714.5	67.5	3.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
34	47	62	94.	134.4	579.9	24.4	2.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35	47	63	86.	24.7	494.5	41.0	2.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
36	47	64	100.	40.3	445.2	18.6	1.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
37	47	66	100.	18.7	328.6	13.3	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	47	71	18.	116.6	352.8	23.4	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
39	**47**	**73**	3.	10.6	330.2	8.2	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	**48**	**58**	20.	118.9	844.1	36.0	8.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1
41	**48**	**59**	94.	468.5	786.8	21.2	4.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
42	48	60	100.	469.3	744.4	23.2	3.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
43	48	61	100.	48.7	541.5	19.3	2.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
44	48	62	100.	12.9	420.1	13.7	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
45	48	63	100.	24.4	463.2	17.8	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
46	48	66	100.	31.1	313.7	11.3	1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
47	48	68	93.	19.0	255.2	10.9	1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48	**49**	**57**	50.	995.5	1101.2	18.1	5.8	0.7	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.2	0.1	0.1
49	**49**	**58**	92.	1557.	975.6	24.3	3.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
50	**49**	**59**	100.	1776.	896.6	21.2	2.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
51	49	60	100.	938.9	830.5	22.3	2.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
52	49	61	100.	253.6	572.8	20.4	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
53	49	62	100.	43.7	437.0	16.6	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
54	49	63	100.	9.9	485.3	22.7	1.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
55	49	66	100.	16.6	431.5	13.8	1.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
56	49	67	97.	30.3	351.1	10.1	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
57	49	68	38.	32.9	287.2	9.0	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58	**50**	**57**	44.	1914.	1244.3	26.7	5.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
59	**50**	**58**	100.	2731.	1237.6	35.2	2.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
60	**50**	**59**	100.	2393.	1074.3	31.7	2.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	**50**	**60**	100.	755.4	941.5	24.9	1.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
62	**50**	**61**	100.	289.9	896.8	32.1	2.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
63	**50**	**62**	100.	207.6	707.4	30.7	2.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
64	**50**	**63**	100.	126.8	614.3	32.4	2.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 5.5: (cont. I) Oxidized sulphur depositions in gridcells with exceedances. i and j are the EMEP coordinates of the gridcell and “%Norway” gives the fraction of the gridcell within mainland Norway. (Units: tons of S).

n	i	j	% Norway	level of excee- dance	EMEP	Norway	sector 8	all fish- eries	A	B	C	D	E	F	G	H	I	J	K
											(tons of S)								
65	**50**	**64**	100.	11.9	665.9	26.3	2.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66	**50**	**65**	100.	78.7	648.2	23.7	2.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
67	50	66	100.	4.0	629.1	17.1	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
68	50	67	48.	63.7	485.1	11.7	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
69	**51**	**57**	35.	1271.0	1285.0	17.7	4.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
70	**51**	**58**	100.	1588.	1302.8	92.7	2.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	**51**	**59**	100.	1991.	1194.1	49.8	2.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72	**51**	**60**	100.	1439.	1037.4	27.2	1.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
73	**51**	**61**	100.	693.5	971.4	48.9	2.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	**51**	**62**	100.	341.1	869.4	46.2	3.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	**51**	**63**	95.	198.8	804.2	63.4	4.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
76	**51**	**64**	100.	167.8	782.9	37.2	4.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	**51**	**65**	100.	171.0	728.4	24.9	2.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
78	**51**	**66**	67.	19.0	706.1	17.3	1.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
79	**51**	**67**	14.	67.6	665.5	12.7	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80	**52**	**58**	15.	955.7	1228.8	24.8	4.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
81	**52**	**59**	33.	971.5	1366.8	177.3	4.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	**52**	**60**	45.	420.0	1190.1	47.9	4.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
83	**52**	**61**	66.	193.6	1095.4	92.7	5.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
84	**52**	**62**	64.	121.8	929.0	98.3	5.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85	**52**	**63**	96.	192.4	880.4	54.1	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	**52**	**64**	100.	367.8	948.5	29.7	1.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
87	**52**	**65**	91.	97.1	833.4	20.8	1.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
88	**52**	**66**	2.	155.8	718.2	13.3	0.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
89	**53**	**62**	46.	714.5	1134.5	30.4	1.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	**53**	**63**	54.	645.6	1125.1	96.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
91	**53**	**64**	16.	543.0	1062.1	26.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
92	**53**	**65**	8.	41.8	887.0	18.7	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
93	**54**	**62**	8.	801.0	1412.9	16.3	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
94	*46*	*60*	54.	0.0	774.4	26.4	8.7	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.1	0.1
	sum				67541	2635	249.5	20.0	1.0	1.1	0.9	2.4	0.7	1.0	2.6	0.8	3.8	3.2	2.5
	SO_x emission				11.6 10^6	13068	1662	417.5	9.2	20.8	29.4	86.7	62.6	11.7	33.6	14.7	70.5	45.9	32.4

Table 5.5: (cont. II) Oxidised sulphur depositions in gridcells with exceedances. i and j are the EMEP coordinates of the gridcell and "%Norway" gives the fraction of the gridcell within mainland Norway. (Units: tons of S).

n	i	j	sector 8	all fish-eries	A	B	C	D	E	F	G	H	I	J	K
1	43	79	6.3	1.8	0.1	0.2	0.1	0.3	0.1	0.1	0.1	0.2	0.2	0.2	0.2
2	43	81	17.0	5.2	0.1	0.8	0.3	0.8	0.4	0.4	0.2	0.6	0.4	0.6	0.5
3	43	84	15.2	4.7	0.1	0.5	0.3	0.9	0.6	0.3	0.2	0.4	0.3	0.5	0.5
4	**44**	**62**	33.6	4.0	0.3	0.2	0.1	0.3	0.0	0.1	0.3	0.2	1.0	0.9	0.7
5	44	63	9.1	1.4	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.3	0.3	0.2
6	44	64	24.6	4.7	0.2	0.3	0.3	0.8	0.1	0.1	0.2	0.2	0.8	1.0	0.6
7	44	78	5.5	1.5	0.0	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2
8	44	82	13.1	3.9	0.1	0.5	0.2	0.7	0.3	0.3	0.2	0.4	0.3	0.5	0.4
9	44	90	27.5	7.9	0.3	0.6	0.5	2.3	1.3	0.4	0.3	0.3	0.5	0.7	0.8
10	44	91	39.5	10.4	0.3	1.0	0.5	3.3	1.3	0.6	0.4	0.5	0.5	0.8	1.1
11	**45**	**61**	10.4	0.6	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.1	0.1
12	**45**	**62**	11.8	1.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.2	0.1
13	45	63	13.2	1.4	0.1	0.1	0.1	0.2	0.0	0.0	0.1	0.1	0.3	0.3	0.2
14	45	70	10.7	2.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.3	0.4	0.3
15	45	72	15.5	3.4	0.1	0.2	0.2	0.5	0.1	0.1	0.2	0.2	0.5	0.7	0.5
16	45	84	12.9	3.7	0.1	0.4	0.2	0.7	0.4	0.2	0.2	0.3	0.3	0.4	0.4
17	45	85	14.7	4.1	0.1	0.4	0.2	0.9	0.5	0.3	0.2	0.3	0.3	0.5	0.4
18	45	87	17.1	5.1	0.1	0.5	0.3	1.2	0.8	0.3	0.2	0.3	0.4	0.5	0.5
19	45	90	36.1	7.9	0.2	0.5	0.4	2.0	1.1	0.7	0.3	0.3	0.6	0.9	0.7
20	45	91	43.5	10.4	0.4	0.9	0.4	2.9	1.2	0.9	0.4	0.4	0.8	1.1	1.1
21	**46**	**61**	17.0	1.3	0.1	0.1	0.1	0.1	0.0	0.0	0.2	0.0	0.3	0.2	0.2
22	46	62	19.7	1.5	0.1	0.1	0.1	0.2	0.0	0.0	0.2	0.1	0.4	0.3	0.2
23	46	63	13.2	1.2	0.1	0.1	0.1	0.2	0.0	0.0	0.1	0.0	0.3	0.2	0.2
24	46	64	14.4	1.8	0.1	0.1	0.1	0.3	0.0	0.0	0.1	0.1	0.4	0.3	0.2
25	46	65	15.5	2.3	0.1	0.1	0.1	0.4	0.1	0.1	0.1	0.1	0.4	0.5	0.3
26	46	85	13.3	3.7	0.1	0.4	0.2	0.8	0.5	0.2	0.2	0.3	0.3	0.4	0.4
27	46	86	14.6	4.3	0.1	0.4	0.3	1.0	0.6	0.2	0.2	0.3	0.3	0.5	0.4
28	46	88	15.8	5.0	0.1	0.4	0.3	1.2	0.7	0.2	0.2	0.3	0.4	0.5	0.5
29	46	90	16.7	4.7	0.1	0.3	0.3	1.4	0.7	0.2	0.2	0.2	0.4	0.4	0.4
30	47	58	19.4	1.3	0.1	0.0	0.0	0.1	0.0	0.1	0.4	0.0	0.3	0.2	0.2
31	**47**	**59**	30.7	1.8	0.1	0.1	0.0	0.1	0.0	0.1	0.3	0.1	0.4	0.3	0.3
32	**47**	**60**	13.1	0.9	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.2	0.1	0.1

Table 5.6: Relative contribution to total Norwegian contributions to oxidised sulphur depositions in gridcells with exceedances (%)

33	47	61	5.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0
34	47	62	10.8	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.1	0.1
35	47	63	5.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
36	47	64	8.9	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.1	0.1
37	47	66	9.7	1.0	0.0	0.1	0.1	0.2	0.0	0.0	0.1	0.0	0.2	0.2	0.1
38	47	71	6.3	1.1	0.0	0.1	0.1	0.2	0.0	0.0	0.1	0.1	0.2	0.2	0.2
39	**47**	**73**	10.0	1.9	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.3	0.4	0.3
40	**48**	**58**	23.6	1.1	0.1	0.0	0.0	0.0	0.0	0.1	0.3	0.0	0.2	0.1	0.2
41	**48**	**59**	22.3	1.3	0.1	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.3	0.2	0.2
42	48	60	15.2	1.1	0.1	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.3	0.2	0.1
43	48	61	10.3	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.1	0.1
44	48	62	10.6	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2	0.1	0.1
45	48	63	8.5	0.6	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1
46	48	66	9.9	0.7	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1
47	48	68	10.2	1.2	0.0	0.1	0.1	0.2	0.0	0.0	0.1	0.1	0.2	0.3	0.2
48	**49**	**57**	32.3	4.1	0.4	0.1	0.0	0.1	0.0	0.5	1.0	0.1	1.1	0.3	0.4
49	**49**	**58**	14.5	1.0	0.1	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.3	0.1	0.1
50	**49**	**59**	12.6	1.0	0.1	0.0	0.0	0.1	0.0	0.1	0.2	0.0	0.2	0.1	0.1
51	49	60	10.5	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.2	0.1	0.1
52	49	61	7.6	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1
53	49	62	8.0	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1
54	49	63	7.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
55	49	66	8.9	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1
56	49	67	8.8	0.7	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1
57	49	68	8.3	0.9	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.2	0.1
58	**50**	**57**	18.9	1.2	0.1	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.2	0.2	0.1
59	**50**	**58**	8.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.1	0.0
60	**50**	**59**	6.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0
61	**50**	**60**	7.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0
62	**50**	**61**	6.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
63	**50**	**62**	6.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
64	**50**	**63**	6.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 5.6: (cont. I) Relative contribution to total Norwegian contributions to oxidised sulphur depositions in gridcells with exceedances (%)

65	**50**	**64**	9.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
66	**50**	**65**	8.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
67	50	66	8.6	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1
68	50	67	8.2	0.6	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1
69	**51**	**57**	25.4	1.2	0.1	0.0	0.0	0.1	0.0	0.1	0.3	0.0	0.2	0.1	0.1
70	**51**	**58**	2.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
71	**51**	**59**	4.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
72	**51**	**60**	6.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
73	**51**	**61**	4.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
74	**51**	**62**	6.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
75	**51**	**63**	7.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
76	**51**	**64**	12.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
77	**51**	**65**	8.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
78	**51**	**66**	7.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
79	**51**	**67**	7.1	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1
80	**52**	**58**	17.1	0.5	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1
81	**52**	**59**	2.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	**52**	**60**	8.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
83	**52**	**61**	5.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
84	**52**	**62**	5.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
85	**52**	**63**	4.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
86	**52**	**64**	6.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
87	**52**	**65**	6.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
88	**52**	**66**	6.7	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.0
89	**53**	**62**	5.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	**53**	**63**	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
91	**53**	**64**	3.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
92	**53**	**65**	4.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
93	**54**	**62**	6.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0
94	*46*	*60*	33.0	2.0	0.1	0.1	0.0	0.1	0.0	0.0	0.2	0.1	0.6	0.3	0.3
	all		9.5	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1

Table 5.6: (cont. II) Relative contributions to total Norwegian contributions to oxidised sulphur depositions in gridcells with exceedances (%)

n	i	j	EMEP	Norway	sector 8	all fisheries	A	B	C	D	E	F	G	H	I	J	K
1	43	79	0.2	21.8	10.8	12.3	16.5	34.0	7.9	8.9	5.7	30.1	10.4	33.7	7.3	14.7	16.8
2	43	81	0.2	6.4	8.6	10.5	10.3	32.2	7.3	8.0	5.2	31.4	5.9	36.1	4.5	11.0	13.9
3	43	84	0.2	4.5	5.3	6.6	8.3	15.4	5.0	6.1	5.6	16.5	3.0	16.8	2.8	6.7	9.0
4	**44**	**62**	0.7	17.9	47.2	22.6	68.5	26.1	9.5	8.0	1.8	17.2	19.3	29.7	31.7	45.3	48.0
5	44	63	0.6	45.1	32.4	19.9	40.8	20.2	11.3	10.1	1.7	10.9	16.8	30.3	25.5	43.8	38.8
6	44	64	0.4	19.9	38.6	29.4	45.7	32.8	28.7	24.7	4.5	24.4	18.2	40.5	29.3	59.2	50.1
7	44	78	0.3	21.0	9.0	9.8	13.2	23.5	6.9	7.1	4.1	20.8	7.8	23.0	6.5	13.7	14.4
8	44	82	0.2	3.2	3.2	3.8	4.0	10.3	2.9	3.2	2.2	10.5	2.1	11.5	1.8	4.2	5.2
9	44	90	0.5	2.0	4.3	4.9	7.3	7.1	4.2	6.9	5.4	7.8	2.2	5.7	1.9	4.1	6.1
10	44	91	0.4	2.0	6.2	6.4	9.8	12.6	4.4	9.8	5.5	12.6	2.8	8.4	1.9	4.7	8.7
11	**45**	**61**	0.8	63.7	52.2	12.8	45.1	11.4	5.5	5.0	0.9	7.8	18.1	12.7	18.1	21.6	26.9
12	**45**	**62**	0.7	33.0	30.6	10.4	26.0	8.9	6.9	5.9	1.0	6.8	14.6	10.6	15.2	16.7	18.1
13	45	63	0.5	21.1	21.8	9.3	16.9	8.3	7.6	6.4	1.1	5.9	11.0	9.9	13.0	16.1	14.9
14	45	70	0.3	18.0	15.2	12.0	20.8	15.0	10.5	9.0	2.8	13.1	7.7	18.0	10.7	22.7	23.4
15	45	72	0.3	9.9	12.1	10.5	17.5	13.2	9.1	7.9	2.8	12.0	7.2	15.9	9.6	19.5	19.8
16	45	84	0.2	2.3	2.4	2.7	3.4	6.0	2.1	2.6	2.1	6.1	1.5	6.4	1.3	2.9	3.7
17	45	85	0.3	2.1	2.4	2.7	3.4	5.6	2.1	2.7	2.2	5.8	1.4	5.9	1.3	2.8	3.6
18	45	87	0.3	1.9	2.5	3.0	3.9	5.5	2.5	3.4	3.0	5.6	1.4	5.4	1.2	2.8	3.8
19	45	90	0.7	2.2	6.2	5.4	7.2	7.1	4.1	6.6	5.2	17.9	2.9	6.7	2.3	5.5	6.2
20	45	91	0.8	2.6	8.8	8.4	13.6	14.4	4.5	11.1	6.3	26.6	3.9	9.6	3.6	8.4	11.3
21	**46**	**61**	0.7	22.7	30.3	9.2	22.1	8.0	5.3	4.5	0.8	6.8	15.7	8.1	14.5	13.3	15.8
22	46	62	0.6	17.0	26.4	8.0	17.1	7.1	5.5	4.6	0.9	5.9	11.6	7.7	11.9	12.4	13.0
23	46	63	0.4	15.7	16.3	6.0	11.5	5.5	4.5	3.8	0.7	4.4	7.4	6.4	8.3	10.2	9.8
24	46	64	0.3	11.4	13.0	6.3	11.0	6.3	5.5	4.6	0.9	5.1	6.2	7.3	7.7	11.3	10.3
25	46	65	0.4	12.1	14.7	8.7	14.4	9.3	7.9	6.6	1.5	8.0	7.0	10.4	9.5	16.6	14.7
26	46	85	0.3	2.0	2.1	2.4	3.1	4.6	2.0	2.5	2.1	4.6	1.4	4.8	1.2	2.5	3.2
27	46	86	0.4	1.8	2.1	2.4	3.1	4.6	2.1	2.6	2.2	4.5	1.3	4.7	1.2	2.5	3.1
28	46	88	0.4	1.4	1.7	2.1	2.7	3.8	1.9	2.5	2.1	3.7	1.0	3.8	0.9	2.0	2.7
29	46	90	1.7	1.3	1.6	1.8	2.0	2.6	1.8	2.7	1.9	2.4	0.9	2.6	0.8	1.6	1.9
30	47	58	0.8	32.9	50.0	13.4	39.4	4.9	3.9	2.7	0.5	20.0	56.2	7.2	16.1	14.4	22.7
31	**47**	**59**	0.7	16.2	39.1	9.4	27.9	10.1	3.2	2.7	0.6	11.0	21.9	8.8	12.7	12.3	18.7
32	**47**	**60**	0.6	27.4	28.4	7.4	17.2	6.1	4.0	3.3	0.7	7.2	16.4	6.3	11.3	10.0	11.8

Table 5.7: Ratio between sulphur deposited and emissions in gridcells with exceedances ((deposited tons of S *10000)/(emitted tons of S))

33	47	61	0.6	51.6	23.2	6.3	13.4	5.1	4.1	3.5	0.7	5.4	11.8	5.5	9.5	8.9	9.7
34	47	62	0.5	18.6	15.8	4.7	9.6	3.9	3.4	2.8	0.6	3.9	7.7	4.4	6.9	7.0	7.3
35	47	63	0.4	31.4	12.8	3.6	6.9	3.2	2.8	2.4	0.5	3.2	5.3	3.6	5.0	5.7	5.7
36	47	64	0.4	14.2	10.0	3.4	6.3	3.3	2.8	2.4	0.5	3.3	4.3	3.8	4.3	5.7	5.5
37	47	66	0.3	10.1	7.7	3.3	5.8	3.9	2.8	2.5	0.8	3.7	2.7	4.4	3.1	5.8	5.8
38	47	71	0.3	17.9	8.9	6.4	10.7	7.9	5.5	4.9	1.7	7.2	4.7	9.3	5.8	11.6	11.7
39	**47**	**73**	0.3	6.3	4.9	3.8	6.0	5.0	3.2	2.8	1.1	4.6	3.0	5.7	3.4	6.6	6.7
40	**48**	**58**	0.7	27.5	51.1	9.3	36.9	3.4	2.3	1.8	0.3	20.9	35.1	5.3	10.9	8.2	17.4
41	**48**	**59**	0.7	16.2	28.4	6.7	18.5	4.4	3.0	2.3	0.5	9.6	19.4	4.7	9.6	7.5	10.7
42	48	60	0.6	17.7	21.1	6.1	13.9	4.4	3.6	2.8	0.6	6.6	14.3	4.8	9.2	7.8	9.3
43	48	61	0.5	14.8	12.0	3.9	8.1	3.2	2.6	2.1	0.5	3.8	7.2	3.4	5.6	5.5	6.0
44	48	62	0.4	10.5	8.7	2.5	5.1	2.2	1.8	1.5	0.3	2.6	4.2	2.4	3.5	3.8	4.0
45	48	63	0.4	13.6	9.1	2.4	4.7	2.2	1.8	1.5	0.3	2.7	3.5	2.6	3.0	3.9	3.8
46	48	66	0.3	8.6	6.7	1.9	3.5	2.2	1.5	1.4	0.5	2.4	1.8	2.6	1.8	3.4	3.4
47	48	68	0.2	8.3	6.7	3.2	5.7	3.9	2.8	2.4	0.9	3.7	2.5	4.5	3.0	6.0	5.9
48	**49**	**57**	0.9	13.8	35.1	17.8	85.1	11.7	2.3	1.9	0.3	75.8	54.4	8.5	28.9	13.0	20.6
49	**49**	**58**	0.8	18.6	21.3	6.1	18.9	3.3	2.1	1.6	0.3	15.5	21.1	3.4	8.9	5.8	7.4
50	**49**	**59**	0.8	16.2	16.1	4.8	12.4	3.2	2.3	1.7	0.4	9.0	14.6	3.2	7.2	5.3	6.3
51	49	60	0.7	17.1	14.1	4.0	8.9	2.9	2.3	1.8	0.4	5.8	10.2	3.1	5.7	5.0	5.7
52	49	61	0.5	15.6	9.3	2.5	5.3	2.1	1.7	1.4	0.3	3.4	4.8	2.4	3.3	3.6	3.8
53	49	62	0.4	12.7	8.0	1.8	3.8	1.7	1.3	1.1	0.3	2.4	2.9	1.9	2.3	2.9	2.9
54	49	63	0.4	17.4	9.7	1.7	3.5	1.6	1.2	1.1	0.3	2.4	2.5	1.8	2.0	2.7	2.8
55	49	66	0.4	10.6	7.4	1.5	2.9	1.7	1.2	1.0	0.4	2.1	1.8	2.0	1.5	2.5	2.6
56	49	67	0.3	7.7	5.3	1.6	2.9	1.9	1.3	1.2	0.5	2.1	1.7	2.2	1.6	2.8	2.8
57	49	68	0.2	6.9	4.5	1.9	3.4	2.3	1.6	1.4	0.5	2.3	1.7	2.7	1.8	3.4	3.5
58	**50**	**57**	1.1	20.4	30.3	7.6	26.8	2.4	1.7	1.5	0.3	25.8	34.4	3.3	7.2	9.2	6.8
59	**50**	**58**	1.1	26.9	17.0	4.2	9.9	2.0	1.7	1.4	0.3	10.3	16.7	2.3	5.0	4.6	4.6
60	**50**	**59**	0.9	24.3	13.1	3.2	7.5	2.0	1.5	1.2	0.3	7.5	10.1	2.2	4.1	3.6	4.0
61	**50**	**60**	0.8	19.1	11.5	2.6	5.8	1.9	1.4	1.2	0.3	5.2	6.7	2.1	3.3	3.3	3.6
62	**50**	**61**	0.8	24.6	12.0	2.4	5.7	1.9	1.4	1.2	0.3	4.9	4.8	2.2	2.8	3.3	3.5
63	**50**	**62**	0.6	23.5	12.5	1.8	4.2	1.5	1.2	1.0	0.3	3.3	3.2	1.9	2.0	2.6	2.8
64	**50**	**63**	0.5	24.8	13.4	1.4	3.2	1.2	1.0	0.8	0.2	2.4	2.4	1.5	1.6	2.0	2.2

Table 5.7: (cont. I) Ratio between sulphur deposited and emissions in gridcells with exceedances ((deposited tons of S *10000)/(emitted tons of S))

65	**50**	**64**	0.6	20.1	14.3	1.4	3.1	1.3	1.0	0.9	0.2	2.3	2.3	1.6	1.6	2.1	2.2
66	**50**	**65**	0.6	18.2	12.6	1.5	3.1	1.5	1.1	1.0	0.3	2.3	2.2	1.8	1.6	2.4	2.4
67	50	66	0.5	13.1	8.8	1.6	3.1	1.8	1.3	1.1	0.4	2.3	2.3	2.1	1.7	2.7	2.7
68	50	67	0.4	9.0	5.8	1.6	3.0	1.9	1.3	1.2	0.5	2.2	1.9	2.1	1.6	2.7	2.8
69	**51**	**57**	1.1	13.5	27.0	5.1	19.6	2.3	1.4	1.2	0.2	18.9	18.4	3.2	5.1	5.2	6.8
70	**51**	**58**	1.1	70.9	15.2	2.8	6.2	1.5	1.1	1.0	0.2	12.0	10.2	1.6	3.0	2.8	3.1
71	**51**	**59**	1.0	38.1	12.2	2.3	5.3	1.5	1.1	0.9	0.3	7.7	7.0	1.6	2.7	2.5	2.8
72	**51**	**60**	0.9	20.8	10.7	1.9	4.4	1.4	1.1	0.9	0.3	4.8	5.1	1.6	2.3	2.4	2.7
73	**51**	**61**	0.8	37.4	12.9	1.7	5.1	1.3	1.0	0.8	0.2	4.9	3.8	1.7	2.0	2.1	2.4
74	**51**	**62**	0.7	35.4	17.8	1.4	3.8	1.1	0.9	0.8	0.2	3.2	2.9	1.4	1.7	1.9	2.1
75	**51**	**63**	0.7	48.5	29.0	1.4	3.1	1.1	1.0	0.8	0.2	2.3	2.6	1.4	1.7	1.9	2.1
76	**51**	**64**	0.7	28.4	28.4	1.3	2.7	1.1	1.0	0.8	0.2	2.1	2.4	1.4	1.5	1.9	2.0
77	**51**	**65**	0.6	19.0	12.4	1.4	2.7	1.4	1.0	0.9	0.3	2.1	2.3	1.6	1.5	2.1	2.2
78	**51**	**66**	0.6	13.2	8.2	1.5	2.8	1.6	1.1	1.0	0.3	2.1	2.2	1.8	1.5	2.2	2.3
79	**51**	**67**	0.6	9.7	5.4	1.4	2.7	1.6	1.1	1.0	0.4	2.1	2.0	1.8	1.4	2.3	2.3
80	**52**	**58**	1.1	19.0	25.6	3.3	6.9	2.2	1.1	1.0	0.2	28.6	9.0	1.4	2.8	2.7	3.9
81	**52**	**59**	1.2	135.7	26.4	2.5	6.2	1.4	1.0	0.9	0.2	19.2	6.5	1.5	2.4	2.5	3.2
82	**52**	**60**	1.0	36.7	25.4	2.1	6.8	1.3	0.9	0.8	0.2	8.6	5.0	1.5	2.2	2.3	3.5
83	**52**	**61**	0.9	71.0	32.5	2.6	17.1	1.3	1.1	0.9	0.2	19.4	4.0	3.1	2.0	2.2	3.5
84	**52**	**62**	0.8	75.2	31.4	1.3	4.6	0.9	0.7	0.6	0.2	3.8	2.4	1.3	1.3	1.5	1.9
85	**52**	**63**	0.8	41.4	15.9	1.2	3.0	0.9	0.8	0.6	0.2	2.7	2.4	1.1	1.3	1.5	1.7
86	**52**	**64**	0.8	22.8	10.8	1.2	2.7	1.1	0.9	0.7	0.2	2.2	2.3	1.3	1.3	1.8	1.9
87	**52**	**65**	0.7	15.9	8.7	1.3	2.7	1.3	0.9	0.8	0.3	2.1	2.3	1.5	1.5	1.9	2.0
88	**52**	**66**	0.6	10.2	5.4	1.3	2.4	1.3	0.9	0.8	0.3	1.9	2.0	1.5	1.4	1.9	2.0
89	**53**	**62**	1.0	23.2	9.7	1.4	5.1	0.8	0.7	0.6	0.2	6.2	2.8	2.1	1.4	1.5	3.0
90	**53**	**63**	1.0	73.5	7.1	1.1	2.6	0.8	0.7	0.6	0.2	2.4	2.5	1.1	1.3	1.4	1.6
91	**53**	**64**	0.9	20.0	5.0	1.1	2.3	1.0	0.8	0.6	0.2	2.1	2.4	1.2	1.3	1.5	1.6
92	**53**	**65**	0.8	14.3	5.1	1.2	2.4	1.1	0.9	0.7	0.2	1.9	2.3	1.3	1.4	1.7	1.8
93	**54**	**62**	1.2	12.5	5.9	1.3	2.5	1.0	0.8	0.7	0.2	2.4	3.4	1.1	1.5	1.8	1.8
94	*46*	*60*	0.7	20.2	52.4	12.5	38.7	12.6	4.1	3.6	0.8	8.8	18.4	11.1	22.1	18.1	25.0
	sum (/100)		0.6	20.2	15.0	4.8	11.0	5.3	2.9	2.8	1.1	8.2	7.6	5.9	5.3	6.9	7.7

Table 5.7: (cont. II) Ratio between sulphur deposited and emissions in gridcells with exceedances ((deposited tons of S *10000)/(emitted tons of S))

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