TFMM Annual Meeting

Ship Emissions in the North Sea Region – the Impact of Emission Reduction Scenarios on Air Pollution in Coastal Areas

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17 – 19 January 2012 / Gozo, Malta

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

Objectives

1. Ship traffic in the North Sea is predicted to increase in the future
2. Measures are planned to limit pollutant emissions from ship engines (Emission Control Areas ECA)
3. Model simulations to evaluate the impact of technological and political measures on air quality and pollutant deposition

Projected SO_x emission factors for ships (IMO)

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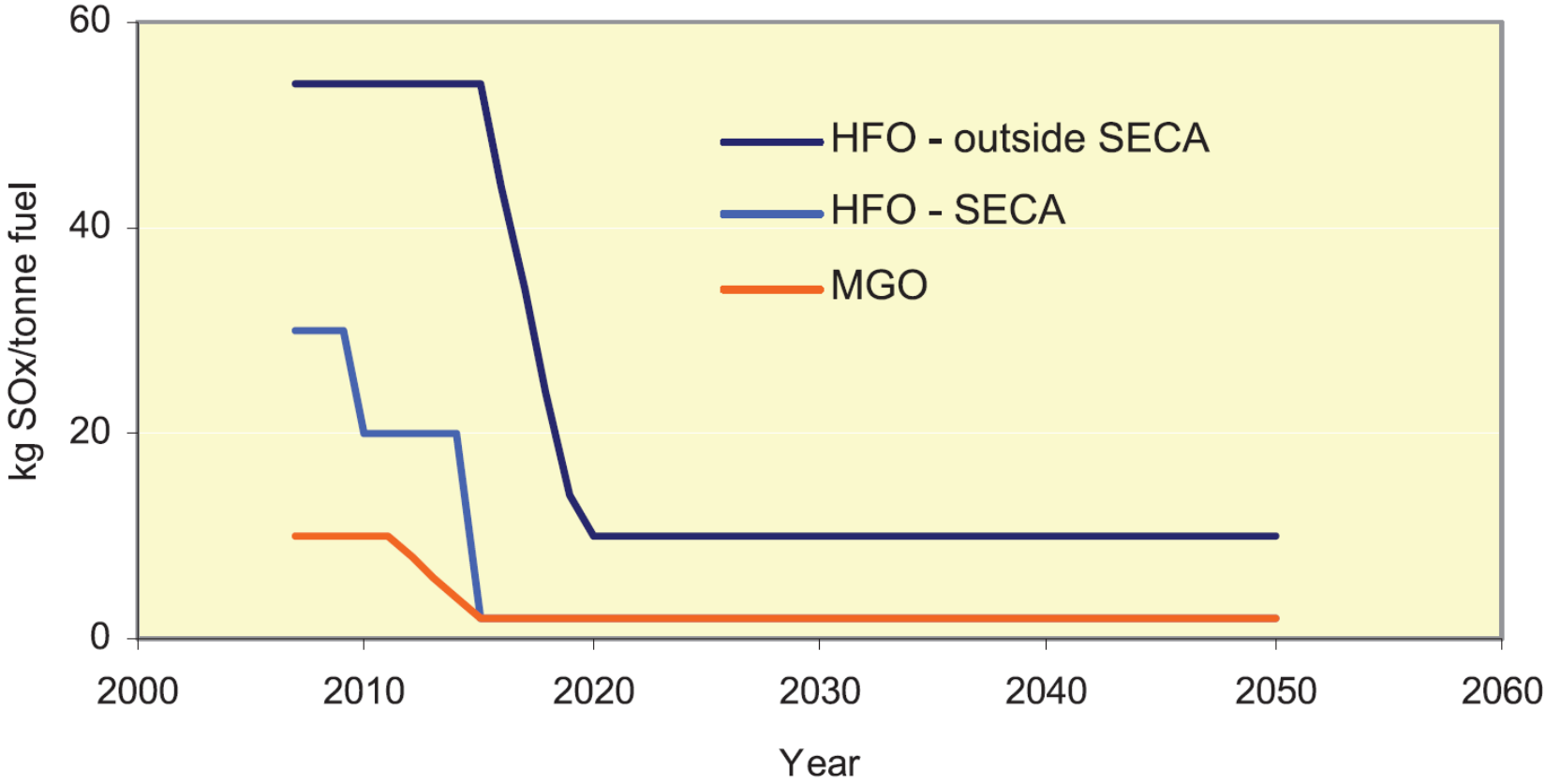

Figure 7.6 *Future SO_x emission factors used in scenarios. The future limit of 3.50% in 2012 on global sulphur content is not expected to influence the average emission factor*

Projected NO_x emission factors for ships (IMO)

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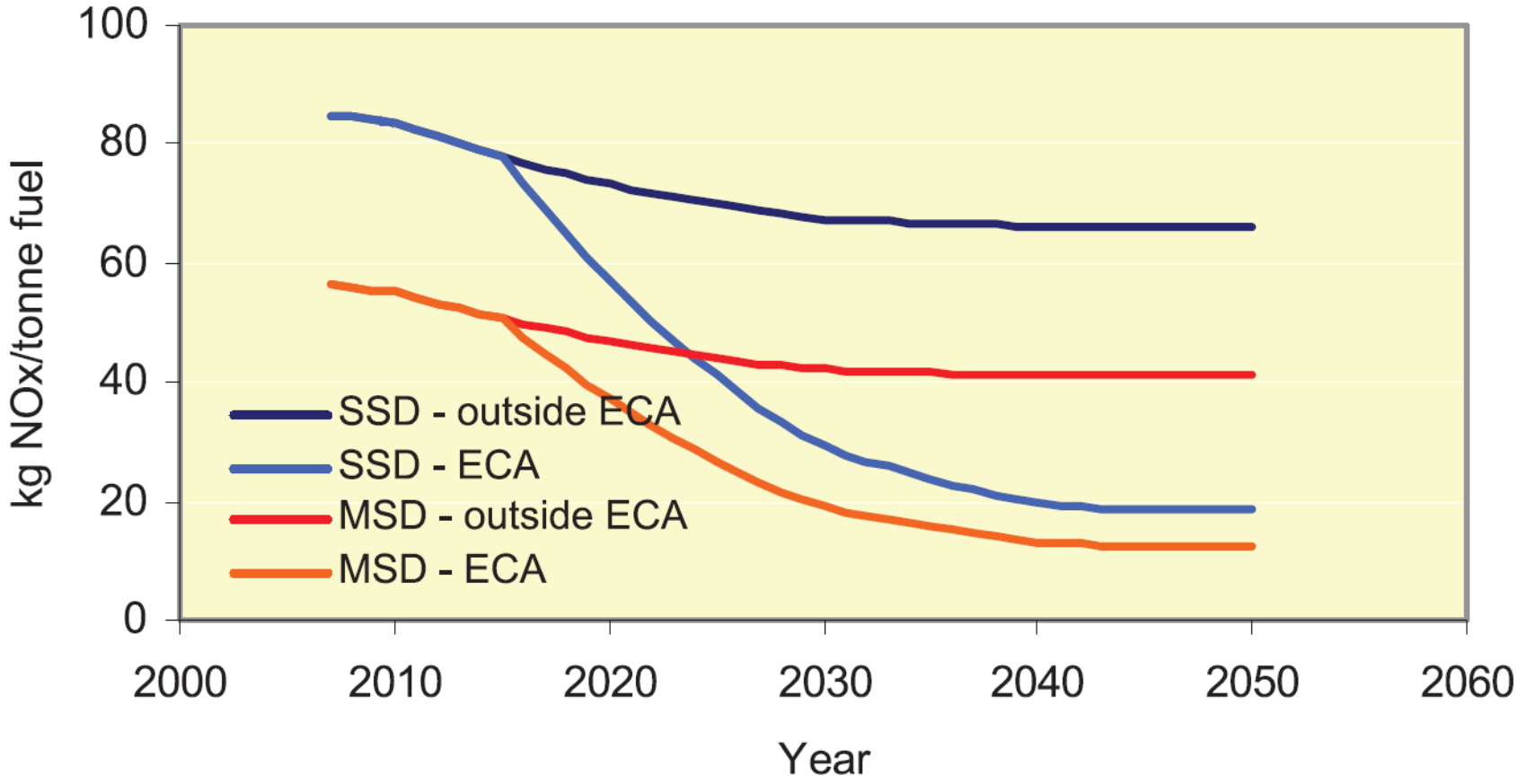

Figure 7.5 *Future NO_x emission factors (3% fleet growth per year, year vessel life)*

Annual increase of CO_2 emissions (i.e. fuel consumption)

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Table 7.24 *Projected annual growth in emissions of CO_2 from shipping, 2007–2050**

	Base	High	Low
A1FI	2.7%	5.1%	–0.4%
A1B	2.7%	5.2%	–0.4%
A1T	2.7%	5.2%	–0.4%
A2	2.2%	4.4%	–0.6%
B1	2.1%	4.3%	–0.7%
B2	1.9%	3.9%	–0.8%

* The same rate of growth is assumed to apply to domestic and international shipping.

Projected ship emissions in the North Sea

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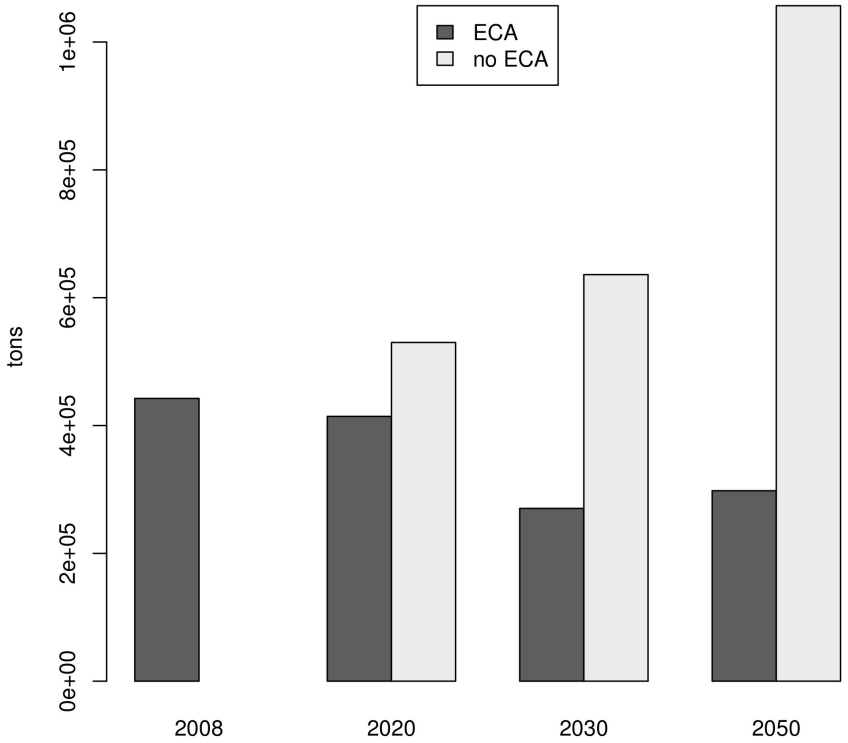
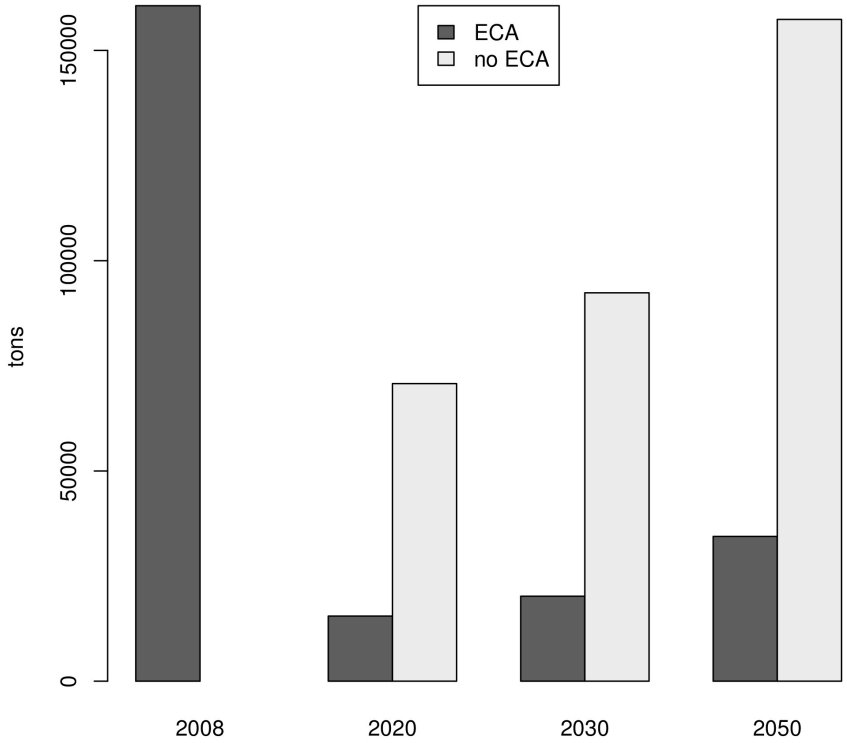
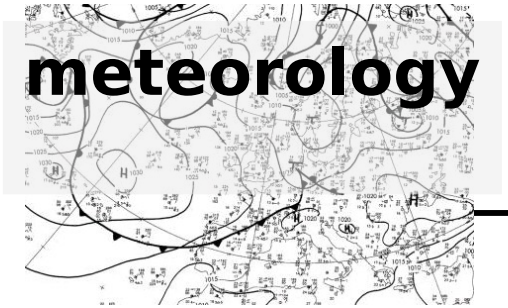
Yearly NO_x emissions in the North Sea



Yearly SO_x emissions in the North Sea



Modeling system



CCLM

CTM-CMAQ

gasphase chemistry

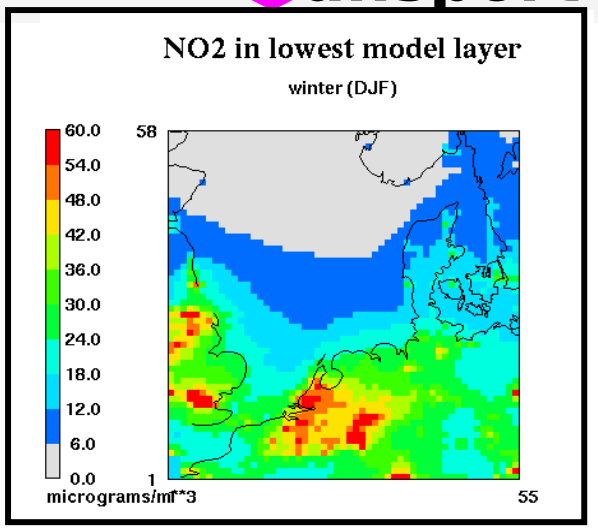
aerosol chemistry

cloud chemistry

transport

SMOKE-EU

Ship emissions



Ship emissions in the base year 2008

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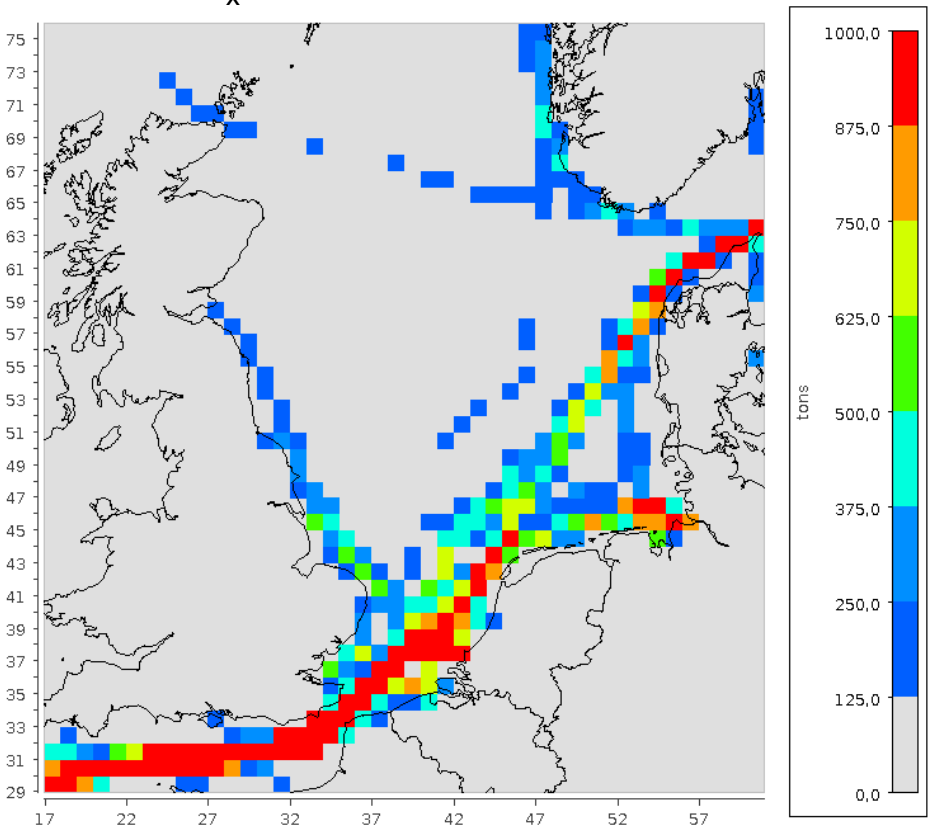
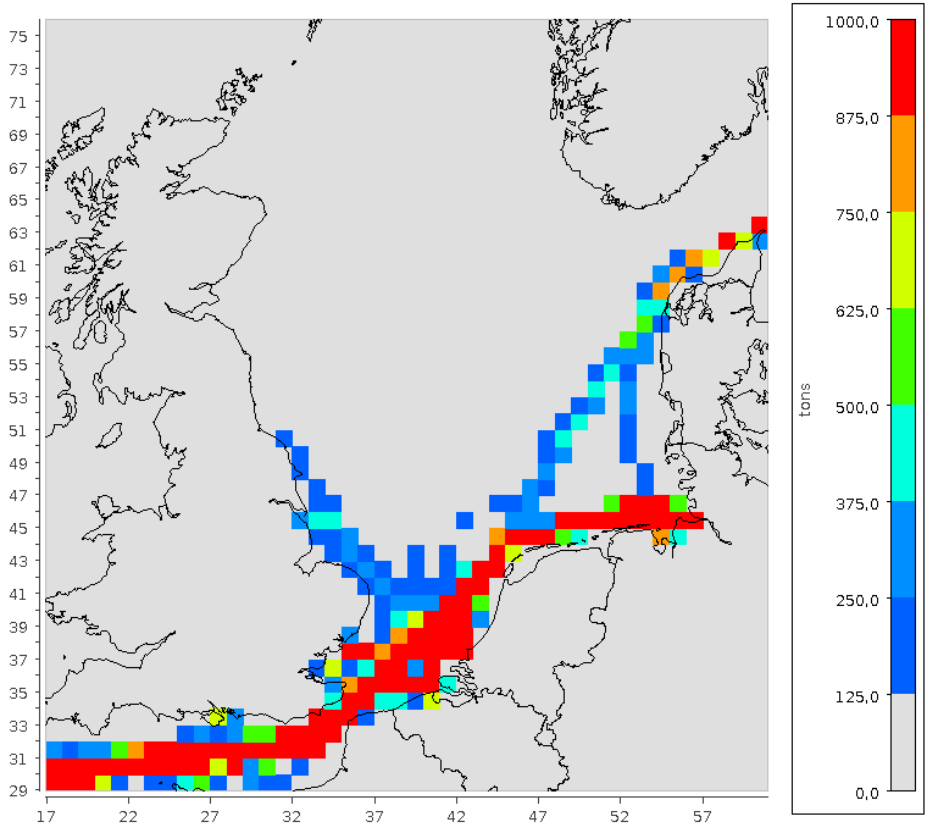
Layer 1

NO_x emissions from ships



Layer 2

NO_x emissions from ships



NO_2 concentrations increase by ships for the base case 2008

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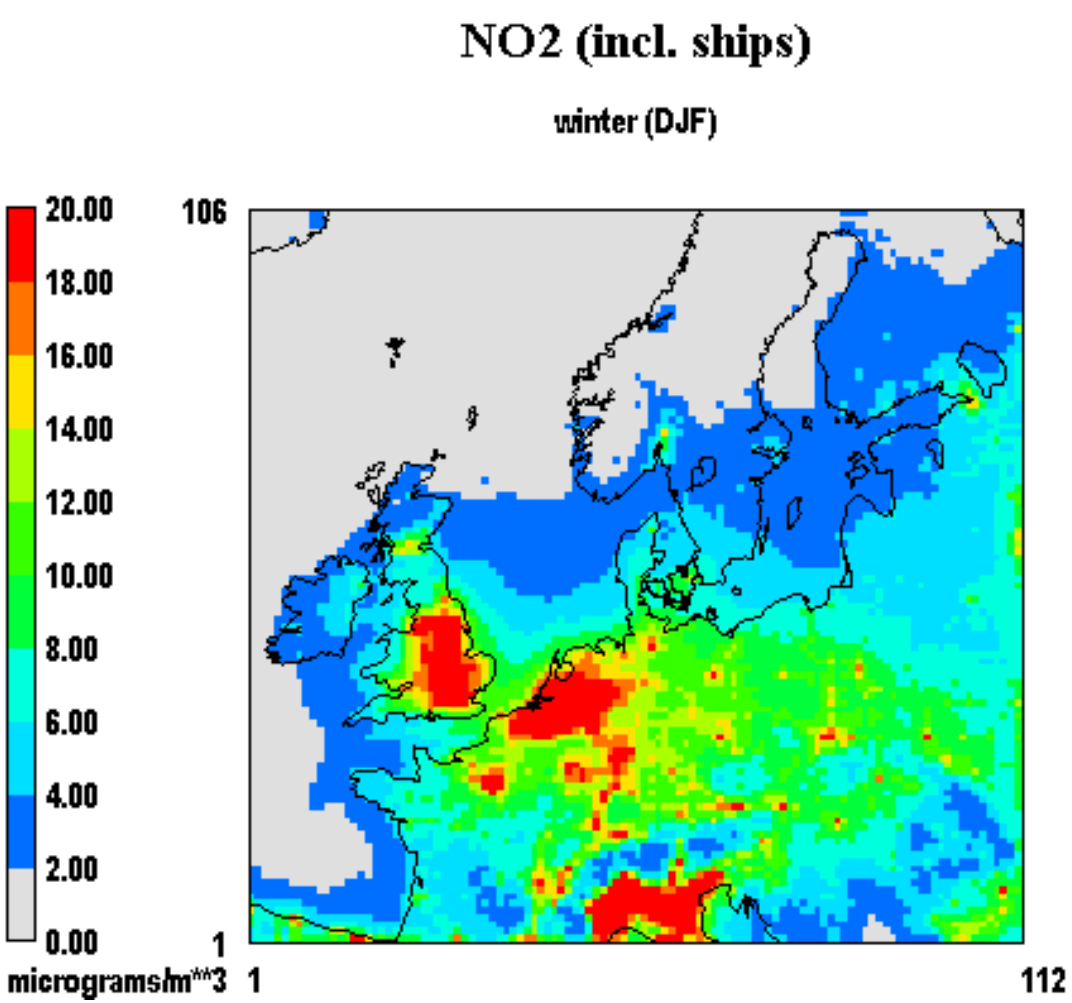

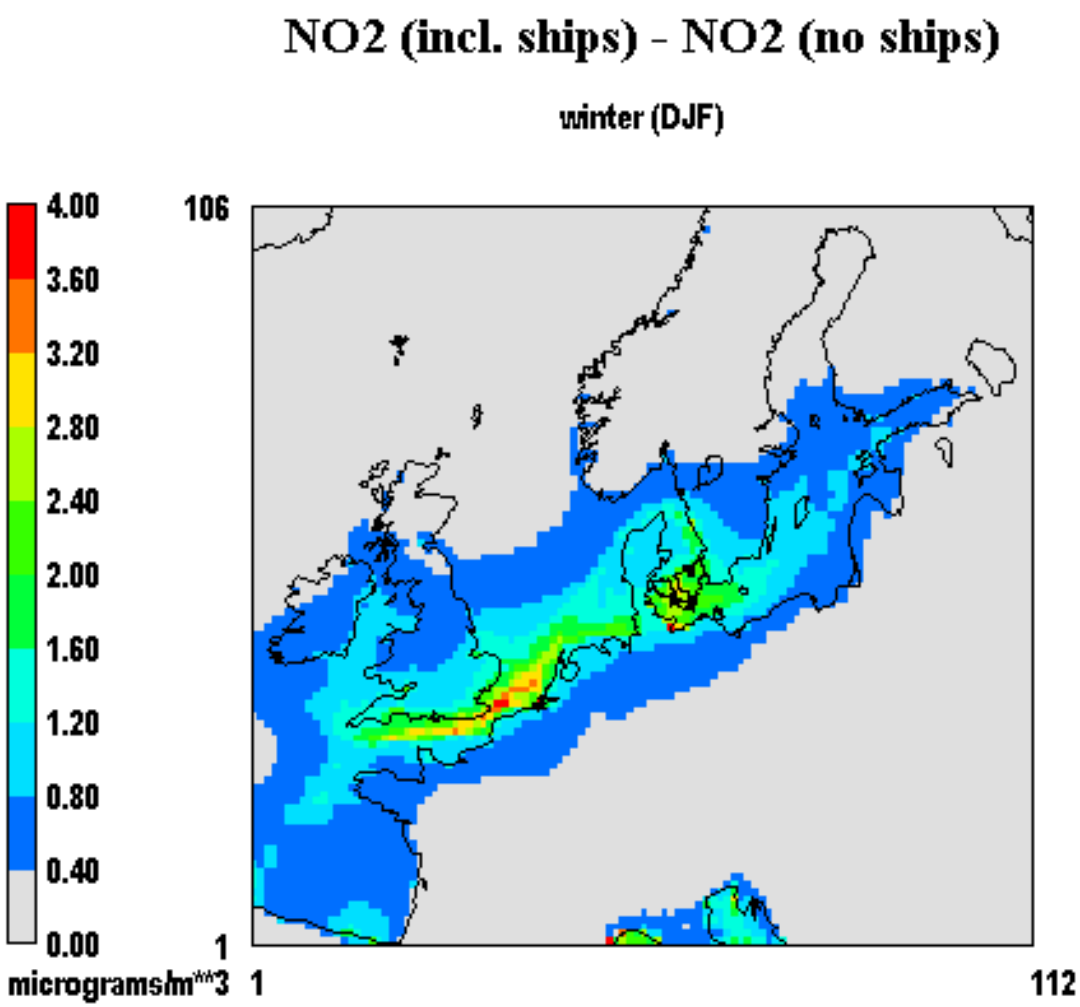

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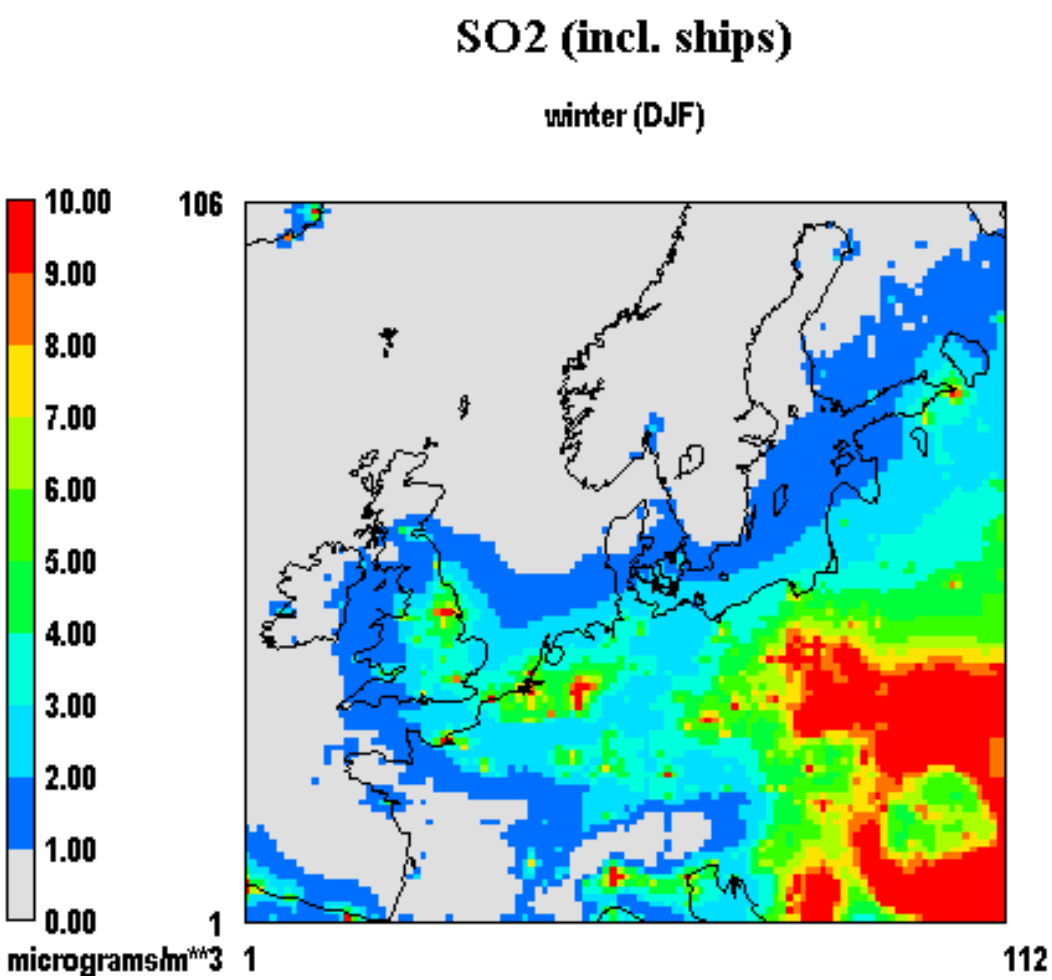

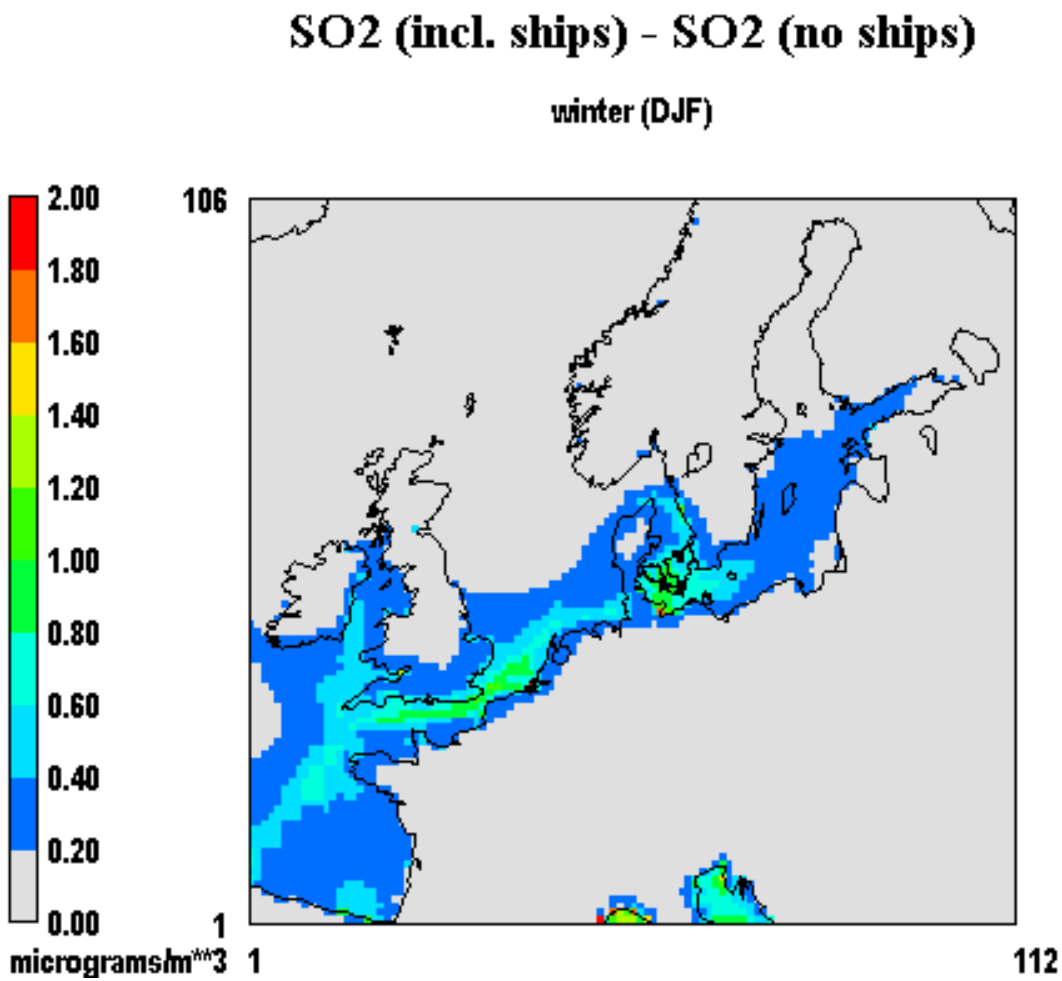

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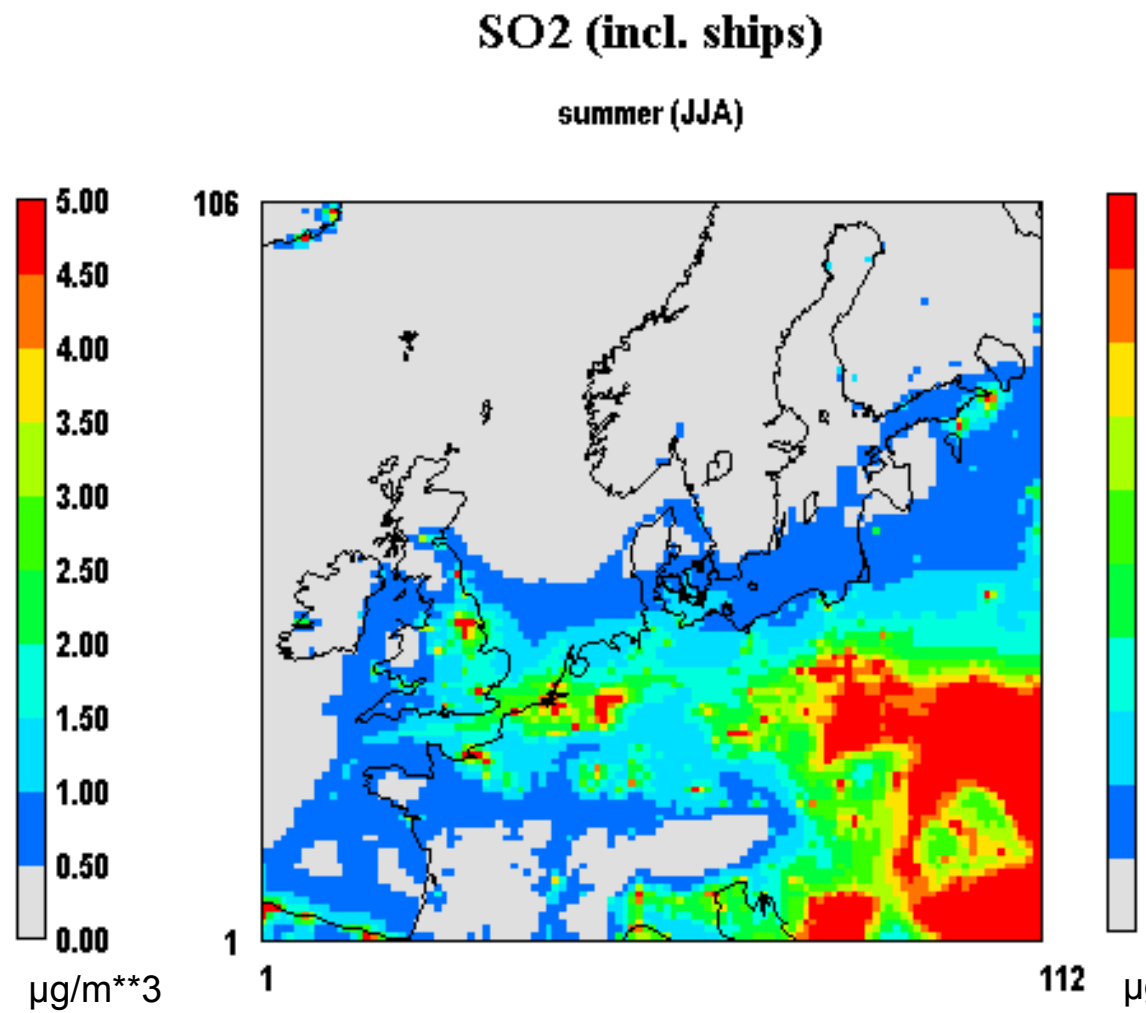

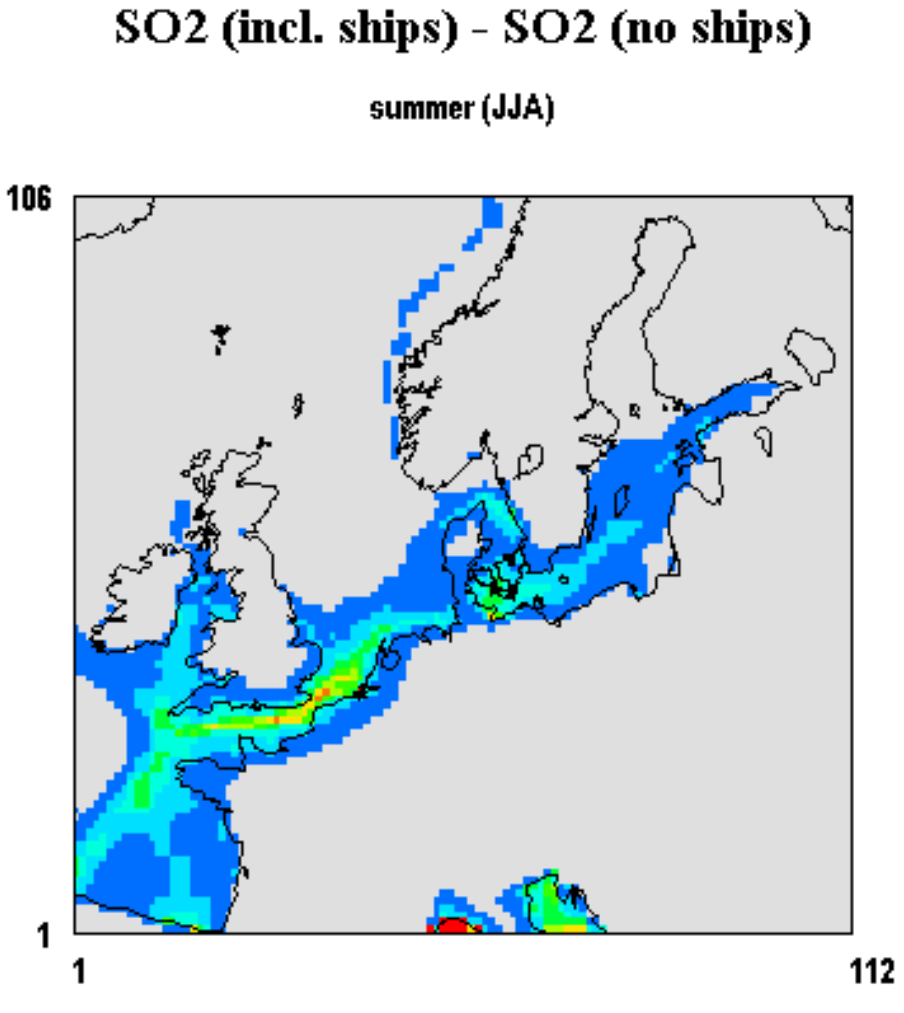

SO_4 concentrations increase by ships in summer

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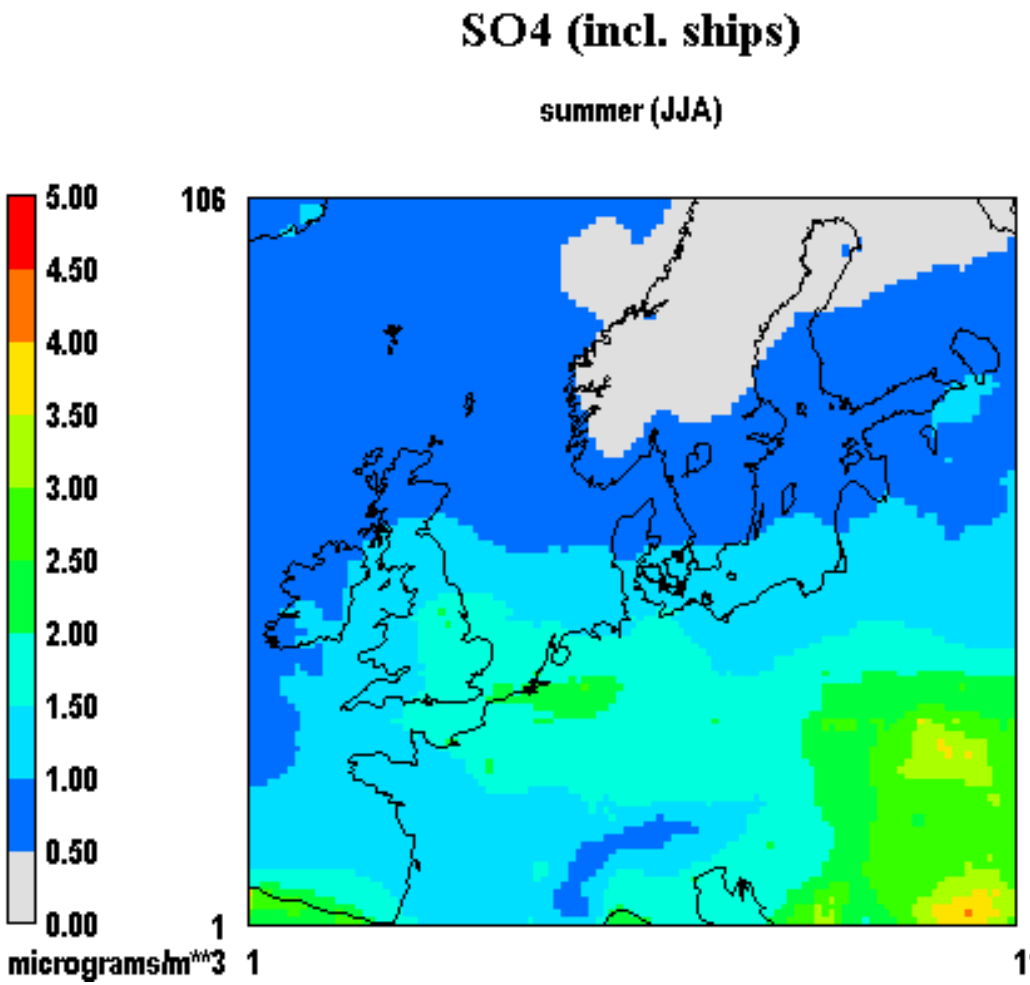

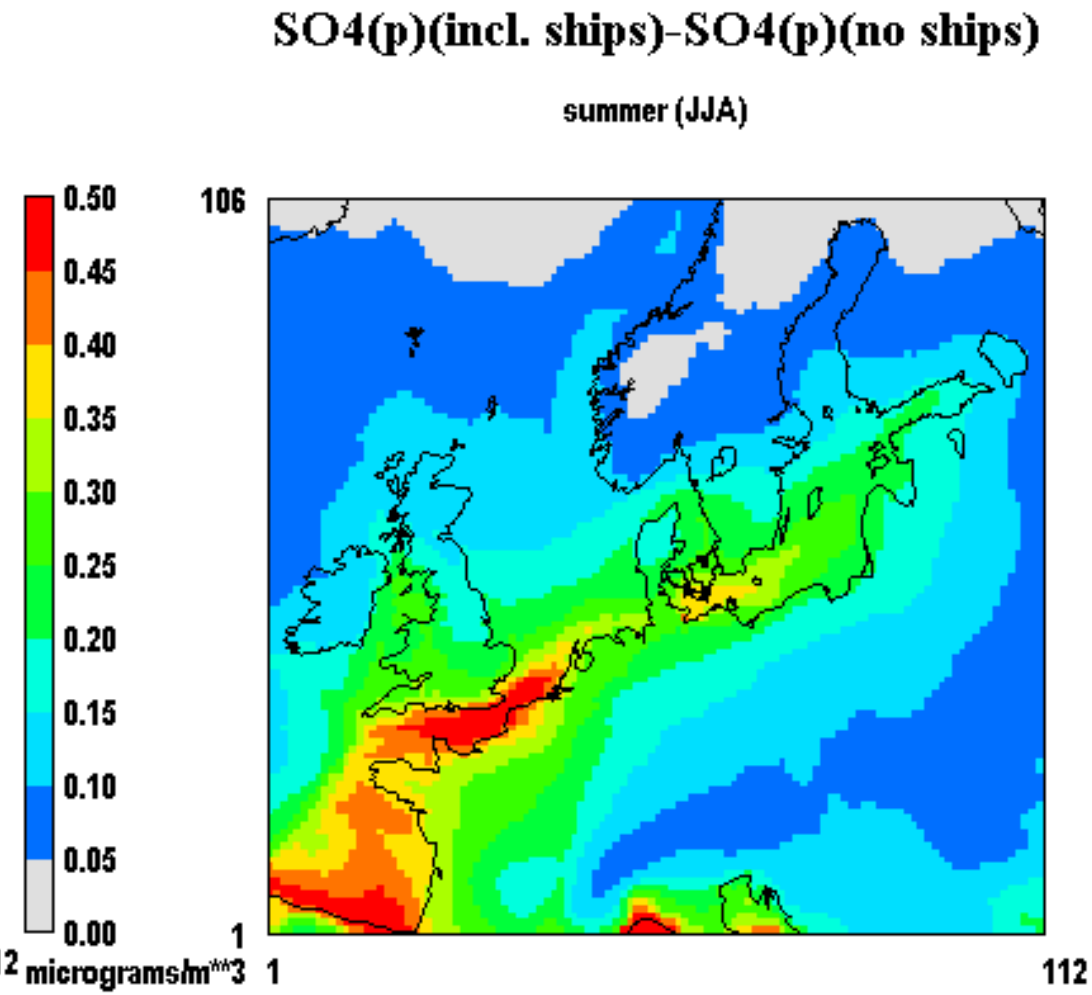

NO_3 concentrations increase by ships in summer

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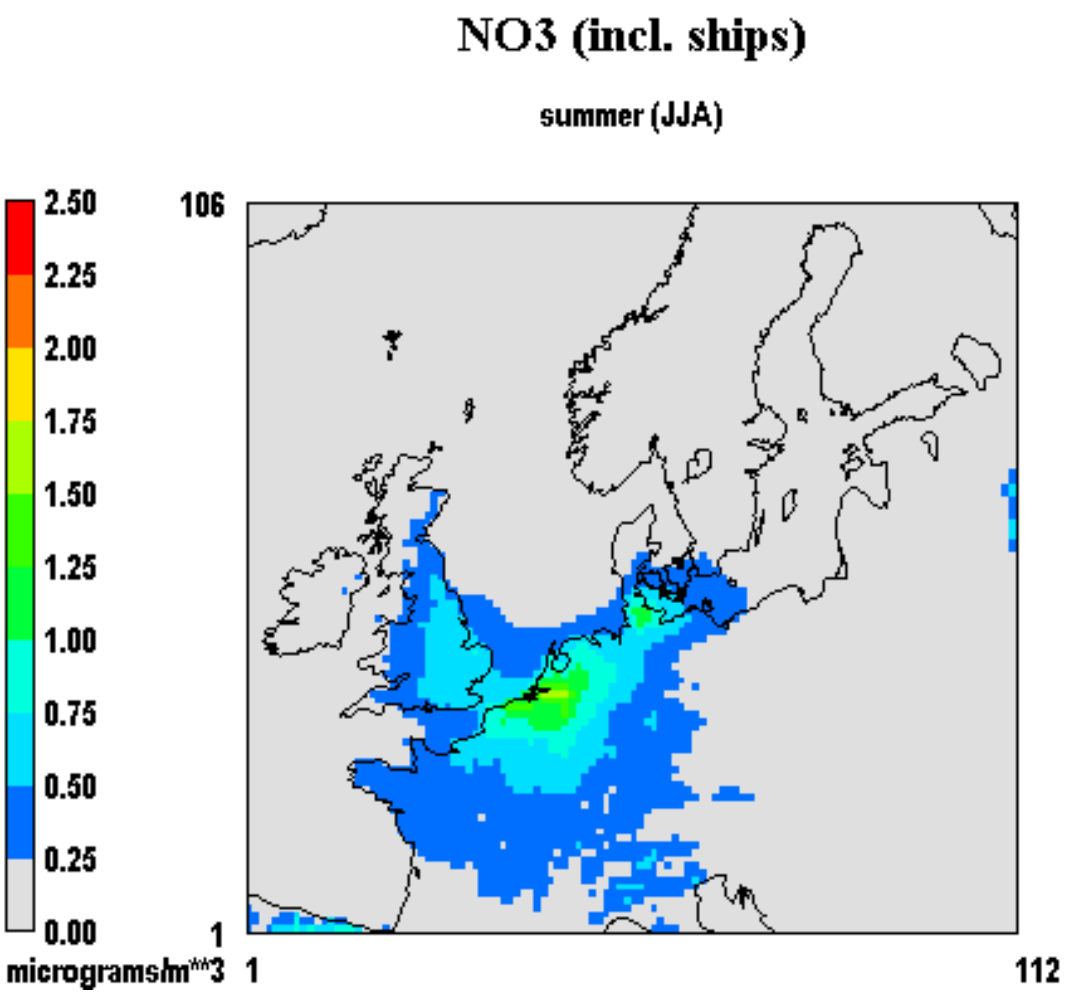

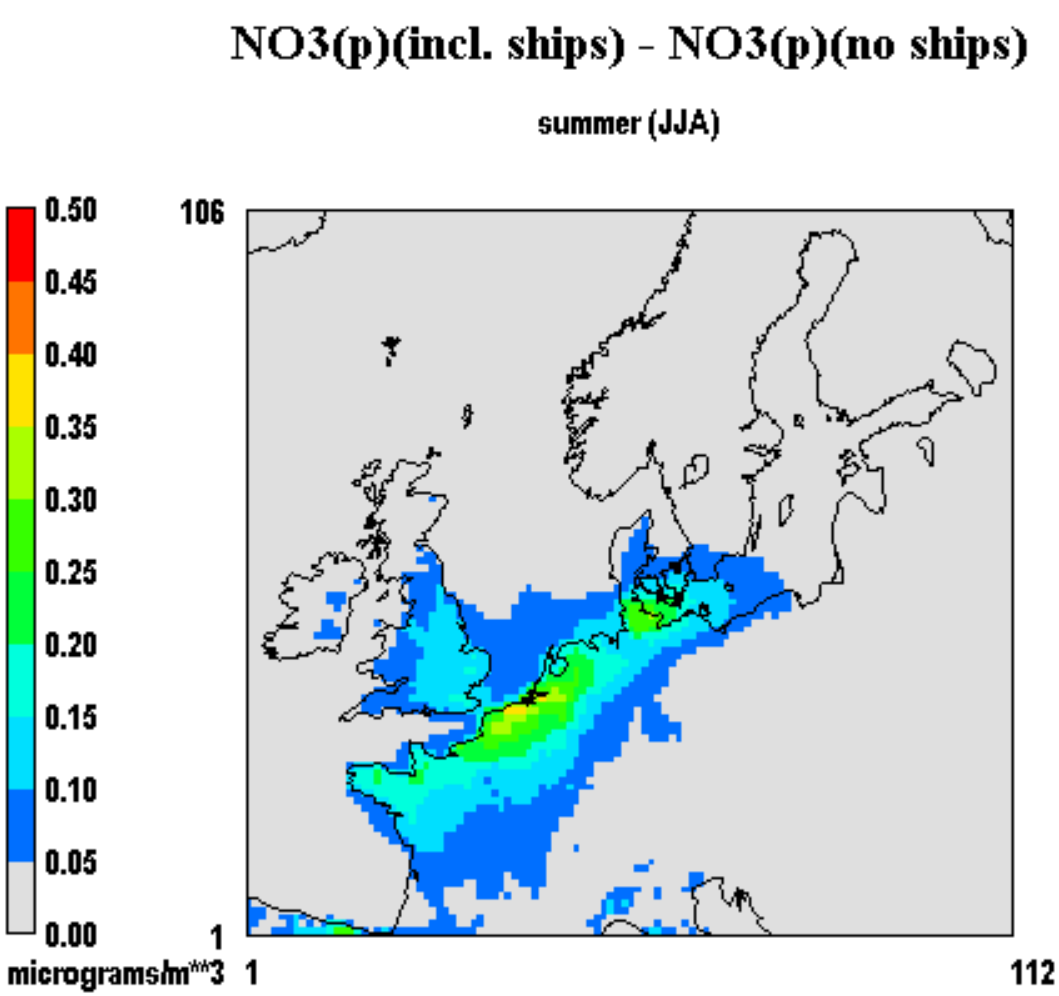

SO_4 concentrations decrease by ECA in summer

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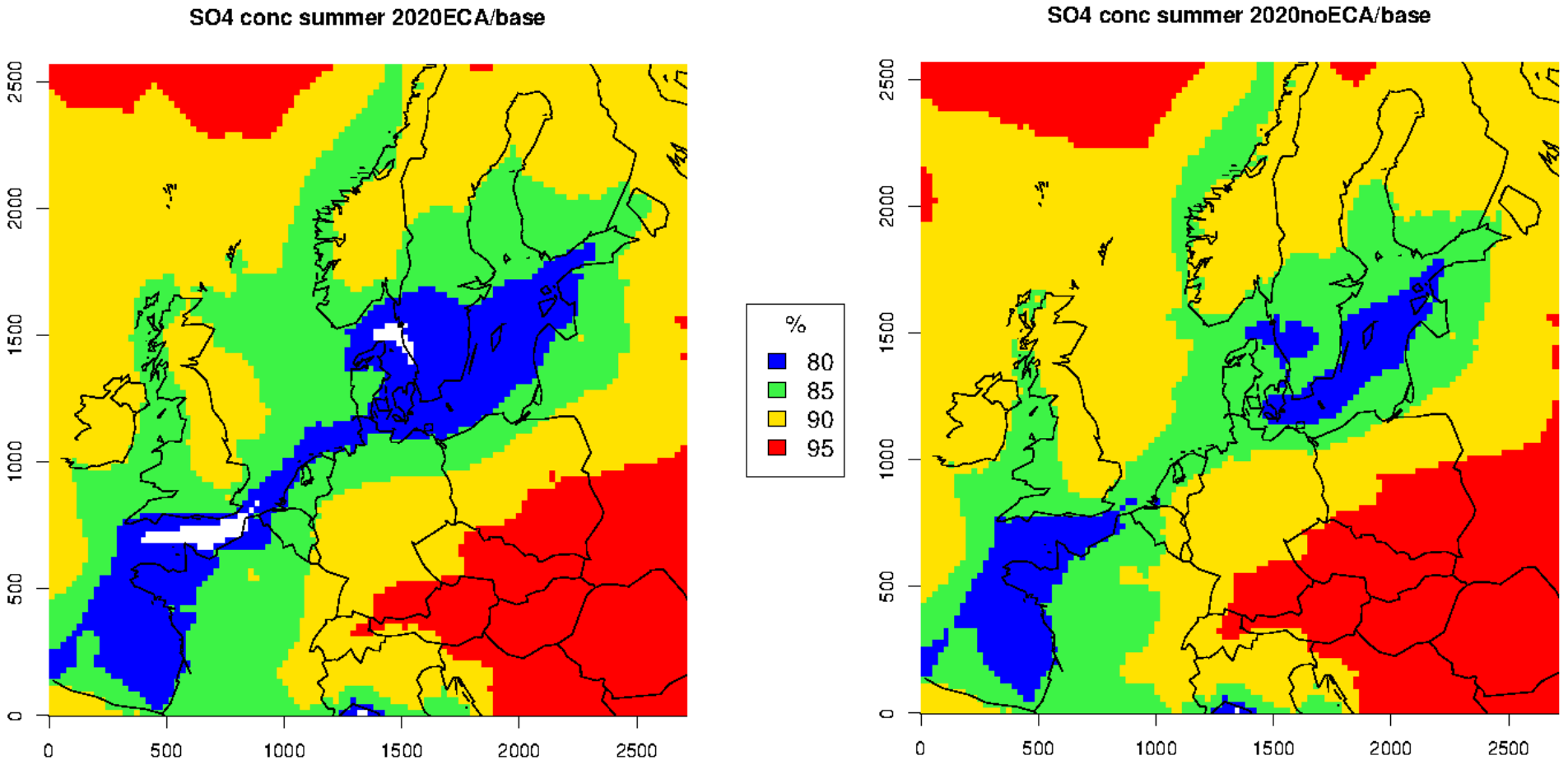

SO_4 concentrations: difference between 2020 and 2030 in summer

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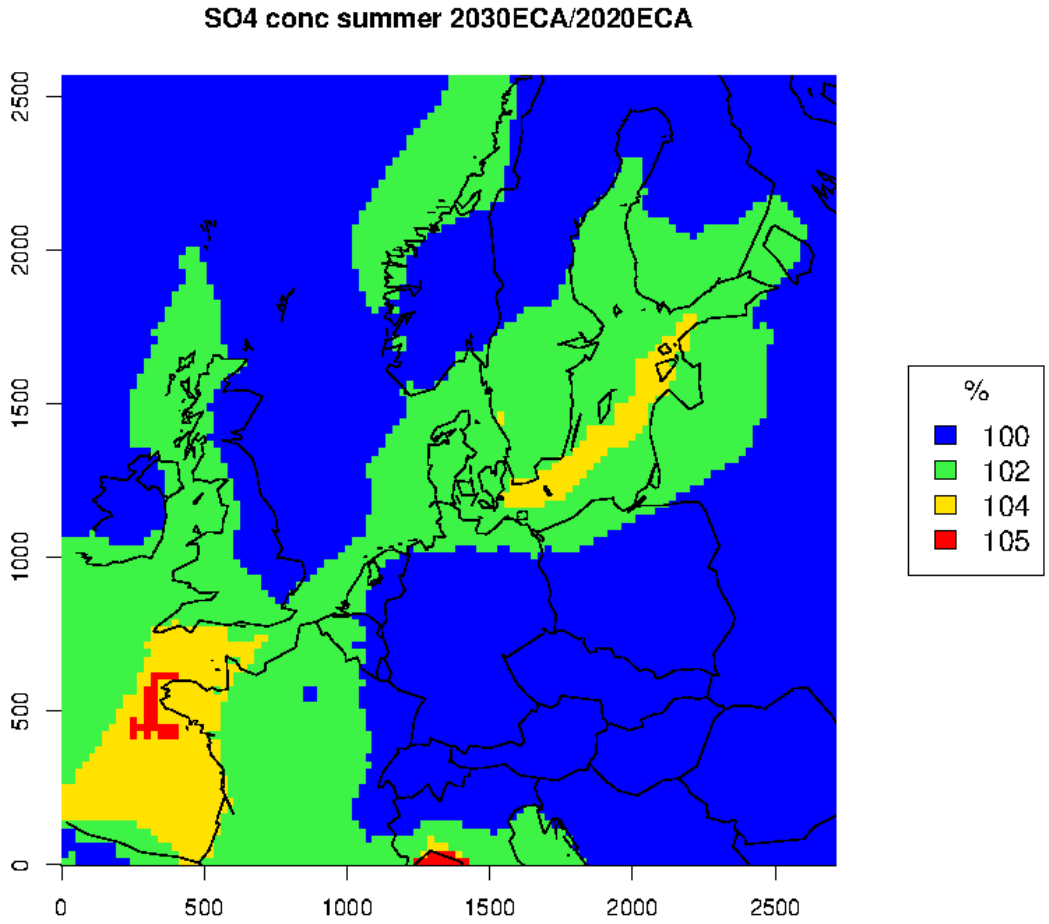

NO_3 depositions increase by ships in summer

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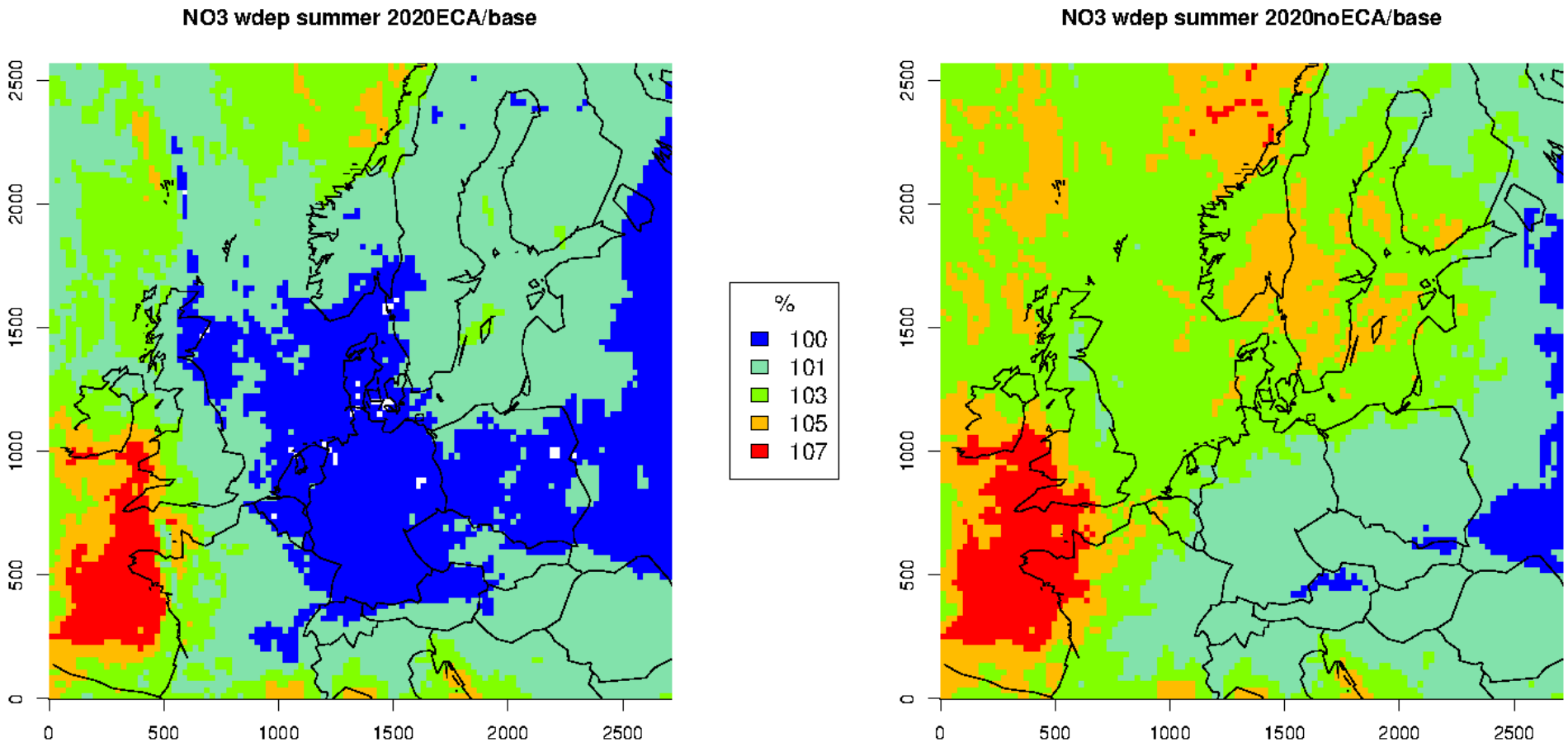

NO_3 depositions: difference between 2020 and 2030 in summer

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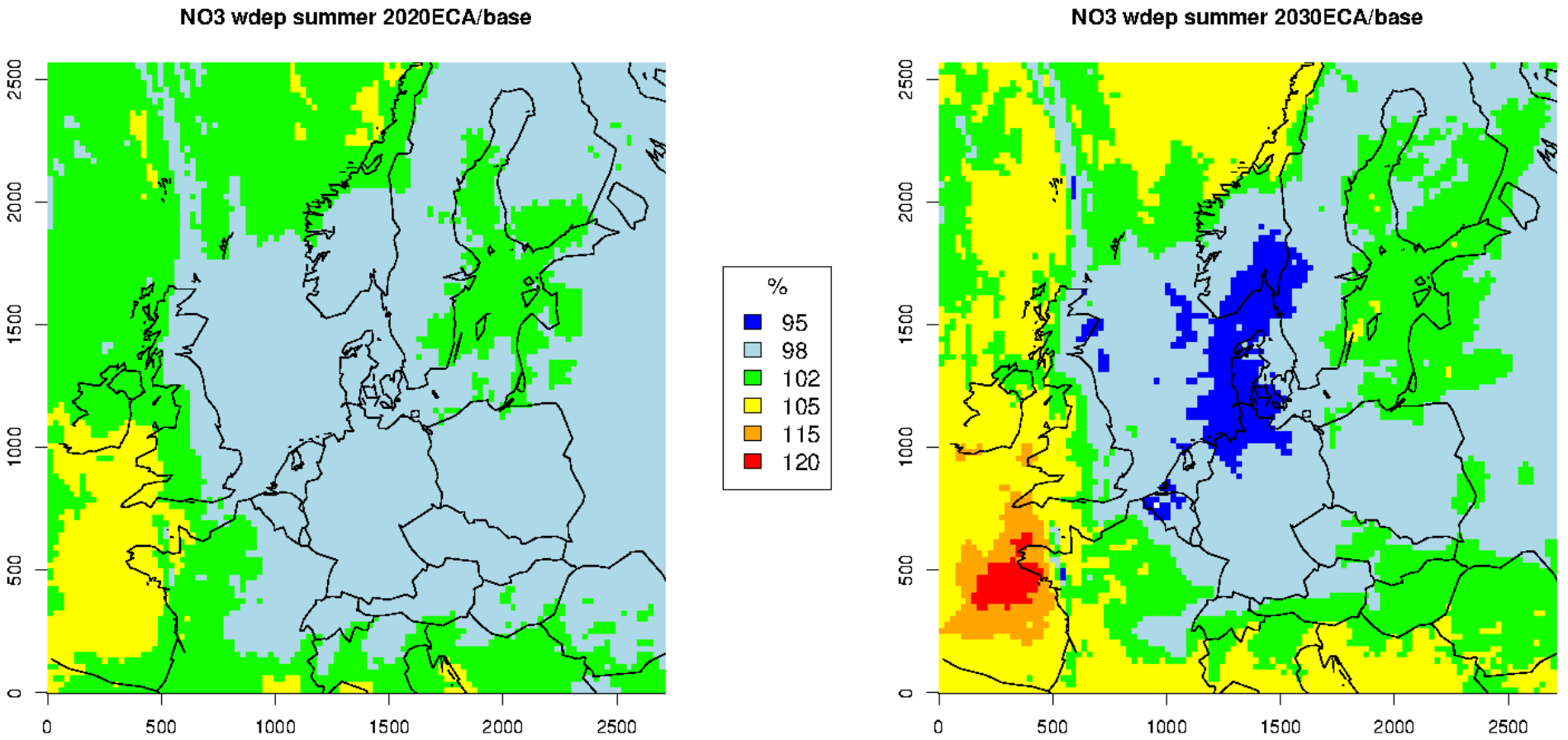

Transect across the Nort Sea

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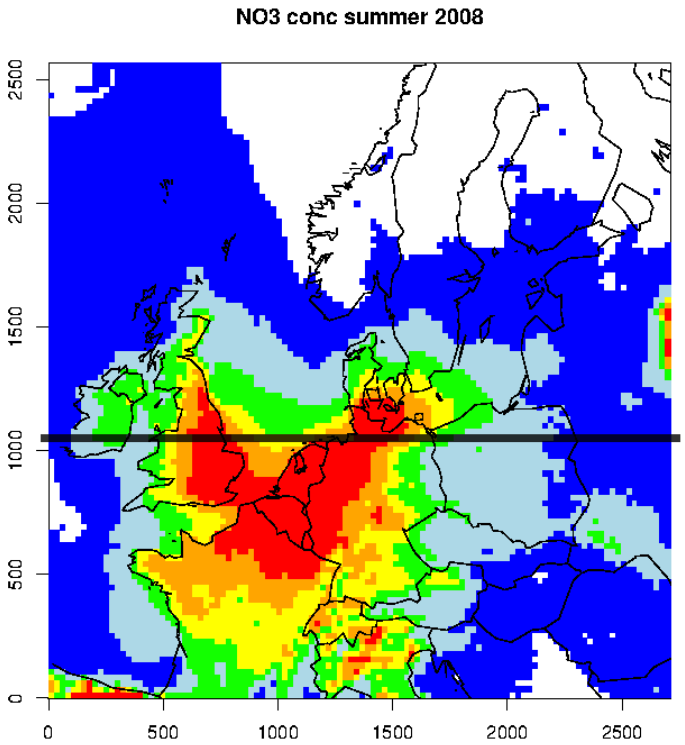

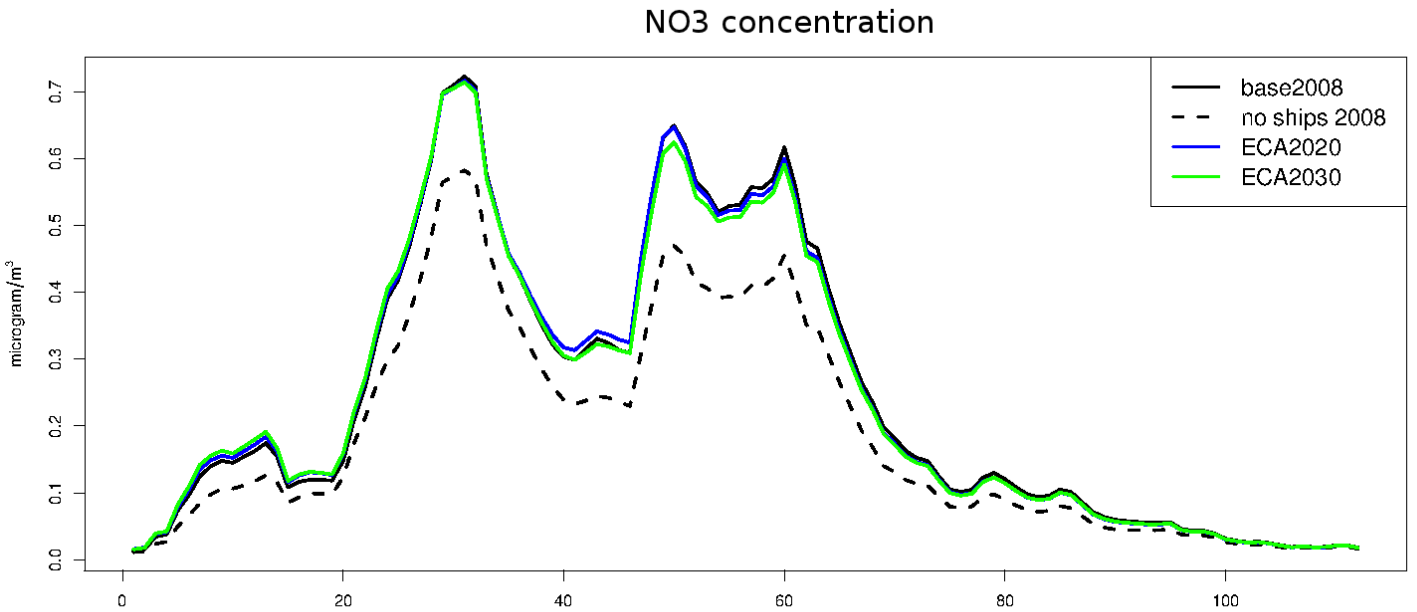

Conclusions

1. Influence of ships up to 20% in coastal areas
2. Effect of NO_3 and SO_4 can be seen far inland
3. Decrease of SO_4 immediately, of NO_3 slowly
4. Reductions counteracted by fuel consumption increase

Ship tracks from AIS signals

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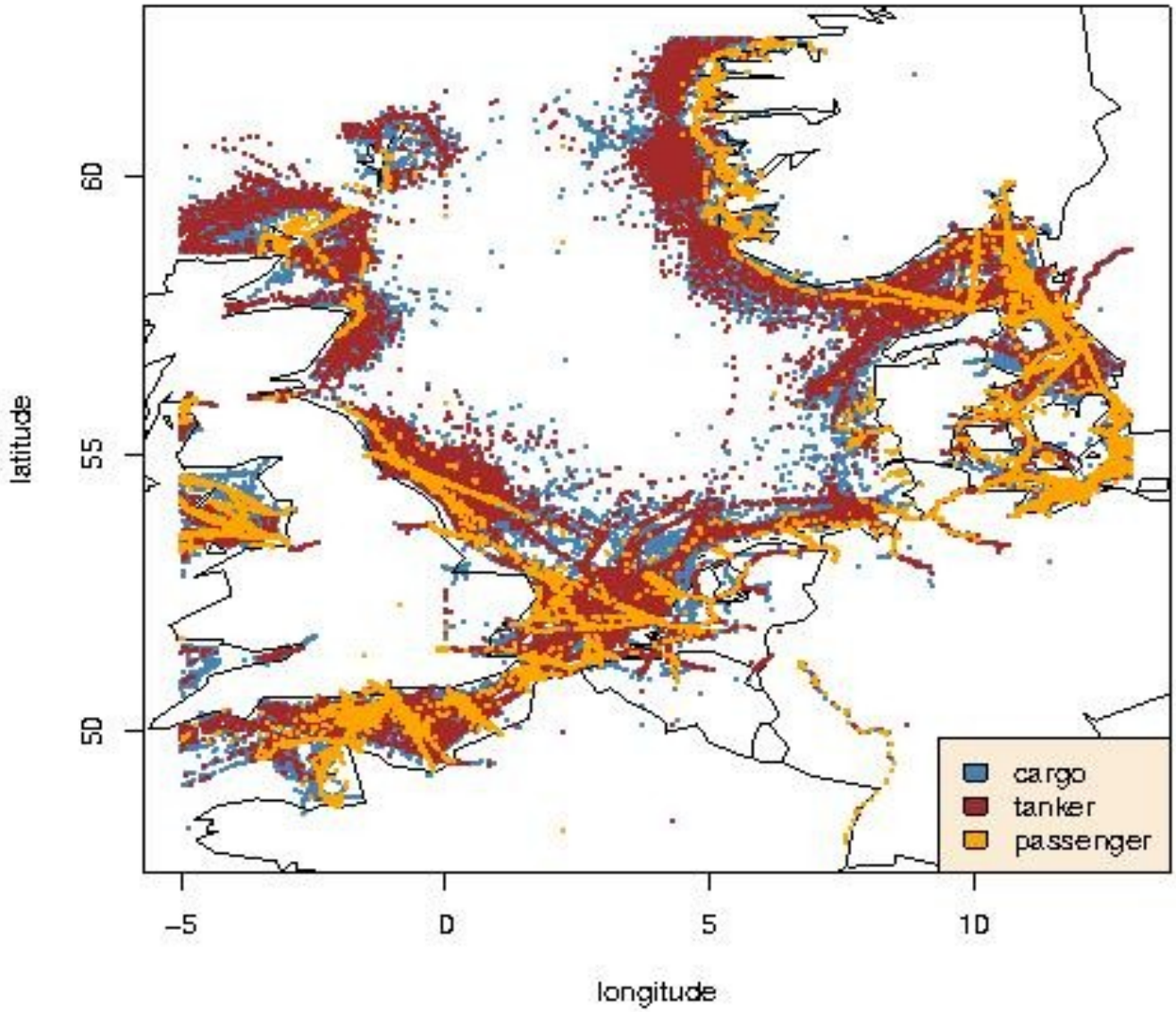
Ship traffic in January 2010



CNSS – Clean North Sea Shipping

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1. Strategies to facilitate implementation of clean shipping technologies for the North Sea
2. Bottom up modeling of ship emissions by means of AIS data
3. Emission factors by onboard measurements
4. Surveys to investigate behavior of ships at berth
5. Investigating several technological options in detail (e.g. different mesures for different ships)