The impact of international shipping on European air quality and climate forcing

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Acknowledgements:
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Understanding air and climate impact requires insight in:

- registration of ships, international maritime law and international and European environmental legislation
- monitoring and modelling of maritime fuel consumption and resulting emissions
- past and future trends of air pollutants and greenhouse gas (GHG) emissions from shipping
- attribution of air quality problems to emissions from the maritime transport sector by evaluating atmospheric observations and modelling data
- understanding the climate forcing characteristics of ship emissions and atmospheric modelling
Overview of number and type of vessels registered in EEA32 countries

Number of vessels (> 100 GT) registered in country

- Norway
- United Kingdom
- Malta
- Italy
- Spain
- Greece
- Turkey
- Netherlands
- Cyprus
- Denmark
- Germany
- France
- Sweden
- Portugal
- Poland
- Finland
- Belgium
- Ireland
- Iceland
- Latvia
- Luxembourg
- Lithuania
- Estonia
- Bulgaria
- Romania
- Switzerland
- Slovakia
- Slovenia
- Austria
- Czech Republic
- Hungary
- Liechtenstein

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Bar charts show the number of vessels registered in each country, with categories for oil tankers, bulk carriers, general cargo, container ships, and other types. TheSource: UNCTAD 2011
Figure 2.1 Fuels delivered to international and domestic maritime transport

International maritime transport

Million tonnes of oil equivalent

Note: Under IEA definitions, the statistics on international marine bunkers cover those quantities delivered to ships of all flags that are engaged in international navigation. Domestic navigation includes fuels delivered to vessels of all flags not engaged in international navigation. These amounts are used in inventory calculations as fuel consumed.

Source: EEA, based on IEA, 2012 and Buhau et al., 2009.
For the EU, (EMSA) collects the AIS data for SafeSeaNet.

For the Baltic Sea, the Helsinki Commission (HELCOM) collects the AIS data.

Commercial ship-tracking initiatives

Source: www.marinetraffic.com
Figure 4.1 Present-day emissions of greenhouse gases and air pollutants according to recent studies focusing on shipping in Europe and European seas

Relative contribution of ship emissions (in %) to annual mean NO₂, SO₂, PM₂.₅, and summer daily max O₃.

Comparison of NO\textsubscript{x} emission trends between EU27 land based sources and emissions from international shipping within European seas

Measures to reduce air pollutants and greenhouse gas emissions from shipping

Fuel quality/fuel switch:
- $\text{SO}_2$ emissions are proportional to sulphur content in the fuel
- LNG (does not emit $\text{SO}_2$ and about 90 % less $\text{NO}_X$, about 20 % less $\text{CO}_2$)

Emissions reduction technologies
- Sea water scrubbing is an established technology to reduce sulphur and PM concentrations in exhaust ($\text{SO}_2$ -75 % and PM -25 %).
- Selective catalytic reduction (SCR) technology (reduce $\text{NO}_X$ by 80 %.
- Use of slide valves instead of conventional fuel valves (reducing both $\text{NO}_X$ and PM.
- Diesel particulate filters (up to 70–95 % PM reduction)

Ship operating procedures
- Speed reduction of 10 % would result in approximately 19 % energy reduction
- Operate the ship against the EEIO
- Shore power

(Consumer behavior: reduced consumer demand for goods transported via shipping)
Global radiative forcing impact of global shipping emissions expressed in W/m²

Source: EEA based on Eyring et al. (2009) and Arctic Council (2012).
Summary

• Shipping emissions can contribute significantly to local air quality problems in Europe, but the pan-European knowledge and observation base needs to be improved to provide a more complete picture.

• Emissions from maritime transport in European waters constitute a significant share of worldwide ship emissions of air pollutants and greenhouse gases.

• There is a strong need for further harmonization of emissions information from the shipping sector across Europe.

• A consistent, European wide approach for monitoring, reporting and verification of both GHGs and air pollutant emissions from the shipping sector is key to address its contribution to climate change and air quality in tandem.

• At the global scale, studies shows that present-day ship emissions of both air pollutants and GHGs and their contribution to direct and indirect climate forcing indicate a net cooling effect.
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