Geophysical Research Abstracts
Vol. 20, EGU2018-19035, 2018
EGU General Assembly 2018

Modelling the long-term effects of wash water from emission control systems on seagoing vessels

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The main objective of the project ‘Scrubber Water Survey’ (SWS), is to gain further knowledge about the effects of waste gas treatment plants (scrubbers), which are increasingly used in shipping industries. A better understanding of the ingredients of wash water from scrubbers on vessels as well as their possible long-term accumulation will enable to assess the impact on the marine environment.

In order to reduce the pollution of the coastal atmosphere and to improve the air quality in port cities, the limit for permissible sulfur content in marine fuels was reduced from 1.00% to 0.10% on 01.01.2015. However, combustion of highly sulfurous fuels is still permitted if the ship has installed a scrubber that filters the pollutants from fumes. The installation enables the same emission reduction as low-sulfur fuel. This technique uses seawater for waste gas scrubbing. During the process, this wash water is enriched with water-soluble and particulate-bound pollutants, which are finally released into the sea.

An increased use of the scrubber technology can lead to more widespread adverse effects on the marine environment. Here, the long-term spatial effect is estimated by simulation of the distribution of wash water and its ingredients in the North and Baltic Seas. The dilution and spread are calculated conservatively as passive tracers by means of a mesoscale eulerian propagation model coupled to the ocean circulation model HBM, which is operationally used at the BSH. The necessary information on the type and concentration of pollutant inputs is determined by other work packages in the context of various measurement campaigns. The pollutant source distribution is derived from the spatial AIS ship density maps in the North and Baltic Seas, obtained from the publicly accessible GeoSeaPortal of the BSH.

With the information about possible pollutant inputs, source functions for the temporal and spatial immersion of pollutants are formed. A variation of the source function allows the calculation of different emission scenarios. Here, a period of 12 months is modelled with monthly resolved ship density distribution from January 2015 to December 2015. The potential impacts of the use of scrubbers on the marine environment are discussed. Which concentrations of different pollutants are reached and where are the hotspots of highly accumulated substances? The most important ship types are investigated in the study, which are tanks, cargo, and passenger ships. Furthermore, deposition and reactivity is not modeled in this project because chemical and sedimentation processes cannot be mapped in the use model system yet. Spatially differentiated conclusions for the "German Bight" sea area are made possible from the calculated distribution patterns.