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Atmos. Chem. Phys., 9, 9209-9223, 2009

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## A modelling system for the exhaust emissions of marine traffic and its application in the Baltic Sea area

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**Abstract.** A method is presented for the evaluation of the exhaust emissions of marine traffic, based on the messages provided by the Automatic Identification System (AIS), which enable the identification and location determination of ships. The use of the AIS data facilitates the positioning of ship emissions with a high spatial resolution, which is limited only by the inaccuracies of the Global Positioning System (typically a few metres) that is used in vessel navigation. The emissions are computed based on the relationship of the instantaneous speed to the design speed, and the detailed technical information of the engines of the ships. The modelling of emissions is also based on a few basic principles of ship design, including the modelling of the propelling power of each vessel in terms of its speed. We have investigated the effect of waves on the consumption of fuel, and on the emissions to the atmosphere. The predictions of fuel consumption were compared with the actual values obtained from the shipowners. For a Roll on – Roll off cargo/passenger ship (RoPax), the predicted and reported values of annual fuel consumption agreed within an accuracy of 6%. According to the data analysis and model computations, the emissions of NO<sub>x</sub>, SO<sub>x</sub> and CO<sub>2</sub> originating from ships in the Baltic Sea during the full calendar year of 2007 were in total 400 kt, 138 kt and 19 Mt, respectively. A breakdown of emissions by flag state, the type of ship and the year of construction is also presented. The modelling system can be used as a decision support tool in the case of issues concerning, e.g., the health effects caused by shipping emissions or the construction of emission-based fairway dues systems or emissions trading. The computation of emissions can be automated, which will save resources in constructing emission inventories. Both the methodologies and the emission computation program can be applied in any sea region in the world, provided that the AIS data from that specific region are available.

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Citation: Jalkanen, J.-P., Brink, A., Kalli, J., Pettersson, H., Kukkonen, J., and Stipa, T.: A modelling system for the exhaust emissions of marine traffic and its application in the Baltic Sea area, *Atmos. Chem. Phys.*, 9, 9209-9223, 2009. [Bibtex](#) [EndNote](#) [Reference Manager](#)



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