**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "A modelling system for the exhaust emissions of marine traffic and its application in the Baltic Sea area" *by* J.-P. Jalkanen et al.

Anonymous Referee #3

Received and published: 24 September 2009

General Comments: Improving the accuracy of the estimation and spatial allocation of marine vessel activity and air emissions has been a great challenge. This manuscript presents a modeling ship exhaust emissions system that improves the estimation of regional ship activity and the spatial allocation of emissions using information from the Automatic Identification System (AIS). The topic is very interesting and the manuscript is well written.

A scientifically sound methodology described in this manuscript and AIS data with good quality can significantly improve the accuracy and precision of the estimation and allocation of regional marine vessels emissions and thus provide much better emissions

data for atmospheric modeling. The work presented in this manuscript is a great improvement over existing methodologies. The limited coverage of AIS data currently available is one of the constraints to apply this methodology to produce larger scale marine vessel emissions inventories.

The manuscript can be improved by providing more details about some important aspects of the methodology and by providing citations of some numbers used. For example, the domain or the spatial coverage needs to be clearly defined so other can use the results to compare theirs. It may be better to providing more information, like the sources, the processing, and a descriptive statistical analysis, about the input data, perhaps in a separate section.

Specific Comments:

1. Line 7 of page 15340: "The emissions are computed based on the relationship of the instantaneous speed to the design speed, and these computations also take into account the detailed technical information of the ships' engines." Actually it is engine load that is based on the relationship of the instantaneous speed to the design speed. The sentence could be revised to: "The emissions are computed based on the relationship of the instantaneous speed to the design speed, and the detailed technical information of the ships' engines." 2. Line 14 of page 15340: "For a RoPax vessel, the predicted and reported values of fuel consumption agreed within an accuracy of 6%." It sounds that for any RoPac vessel, the difference will be 6%. This sentence should to be revised to avoid this confusion. 3. Lines 20 -22 of page 15341: Please give the source and/or citation of these numbers and specify the size limit of the vessels included in the numbers. 4. Lines 6 -7 of page 15342: "...the typical maximum range of an AIS base station is therefore from 50 to 90 km...". Please describe how the gaps outside of the 90km AIS range, e.g. in the middle of Baltic, are filled. AIS data are the foundation of this modeling system. It will be useful if the authors can describe how the AIS data were processed and the techniques used to process AIS data. Have the data been examined by looking at the path of each vessel, or at least by looking a certain

number of randomly selected vessels? If yes, what are the findings? 5. Lines 21-28 of page 15342: Were the results of the ENTEC 2002 study compared with the results of this study? If yes, what are the findings? 6. Top of Page 15343: What's the temporal resolution of this study? Please clarify whether the instantaneous speed and load will apply to this time period. 7. Lines 21-23 of page 15344: When dealing with AIS data gaps, the positions of the consecutive records should be considered. For example, if a vessel is at different locations at the beginning of the gap and the end of the gap, the vessel was moved and the activity should be included in the inventory. Please provide more detailed information on how the vessel path between data gaps was determined and how to determine whether the vessel was idling at dock or was just out of AIS coverage when there is a gap no matter greater or less than 72 hours. 8. Lines 11 -19 of page 15346: please explain how the numbers used here were determined or the source of these numbers. 9. Line 22 of page 15350: please provide the source of the specific fuel consumption rate used here. 10. Line 15 to line 24 of page 15351: for those vessels that operated out of the study area, how the reported fuel used within the study area was separated from fuel burned out of the study area? 11. Line 14 of page 15352: please explain why the predictions with wave effects have larger difference with the reported fuel. Does that mean including wave effects in the calculation actually reduces the accuracy of the results? The effect of waves on monthly total fuel consumption which is in the order of 0-2% is small and maybe negligible. If that's the truth, perhaps it is not worth the efforts to include the wave effects in the model and/or the section describing the wave effect can be shortened or removed. 12. Bottom of page 15353 and Figure 8: please explain why vessel built after 2000 contribute much more to the emissions than the percentage of vessel population. Do they operate more and/or are they much larger than average? For figure 9, please explain why RoRo/Passenger vessels contribute much more emissions than the percentage of vessel population? And how about container vessels?