

## ***Interactive comment on “The impact of shipping emissions on air pollution in the Greater North Sea region – Part 1: Current emissions and concentrations” by A. Aulinger et al.***

**A. Richter (Editor)**

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The following reply has been submitted by Reviewer 1:

Response to first round of author comments of Aulinger et al "The impact of shipping emissions on air pollution in the Greater North Sea region – Part 1: Current emissions and concentrations".

In the following, I will refer to my previous comments and author response by R1 (my comment) and A1 (author response).

R1 A1 (emission factors): Accepted

C8308

R2 A2 (emissions in port areas): Accepted

R3 A3 (missing model performance evaluation): Not good enough. Evaluating emission factors is one thing, but the second half of the emission calculations, power prediction, can be evaluated with ship owner fuel reports and these do not necessitate experimental measurements. Every vessel owner will keep a close eye on the fuel used and I am sure that the authors could contact some owners and check the validity of their predictions for a selected set of vessels. This is not beyond the scope of this paper, but is an essential step in checking the validity of predictions. I can accept the fact that some measurements are confidential, but in those cases vessels can usually be treated as anonymous ships which is not a breach against a non-disclosure agreement.

R4a A4 (sulphur directive): Accepted

R5b A5 (state-of-the-art): Accepted

R6c A6 (technical data): Accepted

R7d A7 (interpolation): Accepted

R8e A8 (data point removal): Accepted

R9f A9 (IMO, MMSI number linking): Accepted

R10g A10 (Aux engine data): Accepted

R11h A11 (missing IMO numbers in commercial ship data): Accepted

R12i A12 (BC double counting): Not good enough. The stance taken by the authors goes against the current best knowledge of BC emissions from marine engines. You should include at least some discussion of BC dependence on fuel sulphur and engine load and explain why your approach differs from the currently known literature. In this regard, papers from Lack, Corbett, Buffaloe, Petzold, Cappa are most relevant.

C8309

R13j A13j (Port areas): Accepted

R14k A14 (Aux engine load set to 0.3): Not acceptable. You are cutting corners here and introducing unnecessary uncertainty to your results. In the ENTEC report, which is more than a decade old anyway, no difference is made for the usage of aux engines in 2-stroke and 4-stroke engines and all are treated the same with arbitrary 0.3 engine load assignment. First, ENTEC lumps all aux engine power to one engine and does not consider the use of multiple engines. Second, there are fundamental differences in these two cases (2/4-stroke), because shaft generators can be used only in the latter cases because of the constant rotational speed of the main engines. For 2-stroke engines, this will increase the share of fuel burned in aux engines because this is the way to produce the electricity needed on board. It is exactly the opposite for 4-stroke engines. I would suggest you take a look at the work done for the Port of Long Beach (<http://www.polb.com/civica/filebank/blobdload.asp?BlobID=13033>) which are based on vessel boarding programs to determine the actual use of aux engine power instead of fleet-wide 0.3 load assignment.

R14l A14 (low load operation): Accepted

R14m A14 (treatment of vessel speeds larger than design speed): Accepted, as long as the authors include their answer to this question also in the manuscript.

R15n A15 (BC emission factors): Authors have partly responded this question, but have not addressed the fuel sulphur and BC dependency in any way. See my comment R12i.

R16o A16 (weird sentence): Accepted

R17p A17 (fuel consumption modeling): Accepted

R18q A18 (port emissions): Accepted

R19r A19 (primary SO<sub>4</sub>): Accepted

C8310

R20s A20 (contribution of ships to overall air quality): The authors are very close to nullifying their own emission work with the claim "Our primary goal was not to improve emission inventories". I find this odd, because significant effort was put to emission work but If the improvement of emission inventories was not the purpose of this paper then what was? You cannot shrug off the discussion of emission model performance evaluation by just declaring that this was not the purpose. What new information was produced which was not available with the use of EMEP ship emission inventories? Production of emission inventories for BC could be one benefit, but it is not discussed. I am sure there are other benefits, too, but the question about the reliability of newly generated emissions data sets remains.

R21t A21 (CCLM acronym): Accepted

R22u A22 (Equation numbering): Accepted

R23v A23 (Aux engine allocation for cargo ships): Not acceptable. If you take a look at the port of Long Beach emission inventory mentioned in R14k, you will notice that there is almost an order of magnitude difference in aux engine need within the containership class alone. It becomes even worse if all cargo ship classes are involved. All cargo ships should not be treated the same way. Perhaps it could help if vessel size categories would be introduced and the aux engine usage were to be considered as a function of both vessel type and size?

R24w A24 (Figure 7 labels): Accepted

R25x A25 (Figure 8): Accepted

R26y A26 (Figure 10): Accepted

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 15, 11277, 2015.

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