Earth Syst. Dynam. Discuss.,
doi:10.5194/esd-2016-46-RC1, 2017

Earth System Dynamics Discussions

Interactive comment on "Temporal and Spatial variation of Contribution from Ship Emissions to the concentration and deposition of air pollutants in the Baltic Sea" *by* Karin Haglund et al.

Anonymous Referee #1

Received and published: 4 January 2017

This manuscript considers ship emissions and deposition in the Baltic and North Seas, using a chemical atmospheric transport model that forms part of the European Monitoring and Evaluation Programme (EMEP). The authors assess the temporal and spatial variations in emissions using EMEP and present the results.

I find the potential of these results interesting even though the current manuscript is rather limited - there is no data that takes into account the use of scrubber technologies, changing fuel types, new 2015 sulfur regulation, etc. However, much of the writing appears to be rushed and has not been read through by an experienced English speaker before submission. The language and clarity of much of the text needs to be significantly improved. In addition, the text is very light in detail and limited in dis-

cussion, which affects the readability and clarity of the paper. Certain points would benefit from more than one sentence to be absolutely clear about the message that the authors hope to convey.

The reader is often referred to other reports, databases and publications for much of the methods section. This is ok within reason, but I think it is too much in this case. For example, what is the methodology used in Omstedt et al 2015 (Section 3.3, page 7/8)? The method seems relevant enough to this paper that I think at least a summary of the detail should be included here.

Before this paper is accepted for publication, the readability of the text must be improved and more detail should be included throughout the manuscript.

Other comments: Page 1, Line 23: suggest 'type of scrubber' rather than 'amount of scrubber'

Page 2, Line 13-14: Sentence beginning 'The main reasons for these emissions. . ..' does not make sense to me.

Page 2, Line 26-28: Other studies have come to different conclusions, in part due to the buffering capacity of seawater (e.g. Hunter et al 2011). This is worthy of more discussion because the Baltic has a reduced buffering capacity (as discussed later).

Page 6, Line 11: use of the word 'conformed' does not make sense

Page 6, Lines 10-16: it was not immediately clear that this paragraph is comparing the seasonal variability. I think more could be made of this – for example Uto data compares pretty well for much of the variables, especially the SO2.

Page 8, Line 14-15: Do you mean that the relative seasonal variability was retained? This sentence is unclear.

Page 8, Lines 25-28: The text here feels insufficient. How much lower are the SOx emissions? Where are they lower – in the N. Sea and Baltic in general, or in specific

regions? Also, I view SECA as a region, rather than an emission control level. In other words, the S emissions in SECA are different now compared to 2013. This should be stated very clearly, particularly as this paper appears not to model the 2015 regulations. . ..

Page 8, Lines 29-31: State the WHO guidelines first (and maybe in the legend of Fig. 6 as well).

Page 9, Lines 1-9: I found a lot of this text confusing, poorly worded and difficult to follow. There is no figure to look at for much of the text, so it is imperative that the text is clear.

Page 9, Line 9: Suggest new paragraph before 'In some areas..'

Page 9, Lines 15-16: No quantitative evidence is presented of the 'small variation'. Surely this could be done (either in absolute or percent terms)?

Page 10, Line 6: Again, no quantitative evidence is presented of the 'small variation'. Surely this could be done (either in absolute or percent terms)?

Page 10, Line 12: Why does the NOx show a seasonal cycle, but the SOx does not? This should be discussed.

Page 10, Line 24: This is unclear to me. If the modelling study INCLUDED maritime emissions, why would the actual emissions be higher?

Table 1: A lot of acronyms are used, which are confusing to the non-expert reader. Where possible these should be defined or (if projects or databases in their own right) weblinks should be provided.

Table 2: Not enough information here – what does tau represent?

Figures 2 and 3 could be substantially improved with additional labelling. Having Uto and Vavihill in the top row and NO2, SO2, PM2.5 and PM10 as the first column would help the reader immediately understand what was being plotted.

Figure 6: I recommend a clear delineation of the iso-line for the WHO PM10 and PM2.5 thresholds. This will clearly identify the regions that are exceeding the limits.

Figure 7: Label each plot with NOx, SOx, etc., rather than just in the figure legend.

Figure 9: Label each plot with Dry deposition of NOX, Dry deposition of SOx, etc., rather than just in the figure legend.

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