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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of strengthening the Baltic Sea ECA regulations" *by* Jan Eiof Jonson et al.

Anonymous Referee #1

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The study presents model calculations with the regional scale EMEP model covering Europe and its adjacent seas with a focus on shipping emissions from the Baltic Sea. The EMEP model is used regularly in the reporting within the frame of the Convention on Long-Range Transboundary Air Pollution. Air pollutant concentrations and deposition from the EMEP model has been evaluated and inter-compared in numerous studies with favorable outcomes. The EMEP model has been used previously in the North Sea and Baltic Sea region for estimating the effect of shipping. Based on the title, I had expected a discussion to which extent the enforced ECA regulations improve air quality in European countries. However, the paper falls short in precisely addressing the effects of the ECA regulations. The paper refers in many places to the use of the presented model results in upcoming studies that are in preparation. To improve

the presentation, I recommend to better emphasize the objectives of this study and the value of the model calculations in itself by deriving recommendations for emission control policies.

The use of three years to compute an average of the present situation is not clear. Information regarding the averaging of computed years is given piecewise and the reader is left alone with finding out which emissions and meteorology of which years are used for the different scenario simulations and which output year is compared. Definitely, a table presenting this information in one place would be very helpful. Why was only one year (2016) compared with the future scenarios?

The non-consistent numbering of sections adds to the confusion: section one starts with the Introduction, followed by a section 'Experimental Setup' which is not numbered and then beginning with 1.1 Emissions. This should probably be section two and renamed 'Model Setup'.

Projections for the future ship emissions are not described and justified in the manuscript. How would the air quality change in future if a higher growth of the ship fleet or non-compliance to the stricter regulations are assumed?

Specific Comments:

1.) P. 2 line 30: Please add a discussion on emissions from open loop scrubbers to air and to water in the Introduction. Moreover, the different alternative fuels and control technologies to fulfil the stricter ECA regulations and their actual use by the BAS ship fleet needs to be addressed.

2.) P.3 line 1-2: At the end of the Introduction, it is referred to two papers in preparation which are based on results of this study. This reference somehow weakens the scientific relevance of the present study. Either delete or move to the Conclusions.

3.) P.3 line 8-9: ECLIPSEv5a: how high is the expected variability of land-based emissions between 2014 and 2016?

4.) P.3 line 18: Which fraction of open loop scrubbers is assumed for BAS shipping emissions in 2014 and in 2016? What is assumed about primary particle emissions from open loop scrubbers?

5.) P.3 line 19-21: Are the total BAS shipping emissions for all other pollutants unchanged between 2014 and 2016?

6.) On P.3 line 17, daily emission grids are introduced. On the same page, line 30-31 it is stated that hourly data was aggregated into monthly ship emissions. The purpose of the daily emission grid remains unclear. How high is the uncertainty of monthly versus hourly emissions when considering the titration of ozone by ship emissions?

7.) P.4 line 6-7: Add reference or delete the sentence on ecosystem specific deposition.

8.) P.5 line 16-23: What is the criterion in this study to conclude that measurements are reproduced by the model, either with or without including ship emissions in the model simulations? The present assessment could be strengthened by use of a quantitative indication for the match between model and measurements.

9.) P. 6 line 1-2: What is the fraction of sulfate in the modelled PM2.5 in 2014 and 2016? If possible, add a comparison of measured and calculated SO4 at the monitoring stations in Table 1.

10.) P. 7 line 1-2: The small national contribution of ship emissions in countries with large in-land area does not really reflect the local significance of this sector. It would be better to calculate the average value in the coastal zone of the countries.

11.) P. 8 line 8: Does the statement about unaffected emissions of non-sulphur particles hold in view of realistic emissions from open loop scrubbers and the PM emissions from burning ultra-low sulfur heavy fuel oil (HFO)? The use of scrubbers might capture a large fraction of PM, not only sulfate.

12.) P. 8 line 20: What is the health impact of negative SOMO35?

Technical Corrections:

P. 5 line 6: The lifetime of NO2 is relatively short.

P. 7 line 19: Please replace “show” by “shown”.

Figure 1 and Figure 2: Please add annotation of x- and y-axis (degrees longitude and latitude) around the concentration maps. The plot header lines are partly cut off and not visible.

Figure 3: For some countries the green and red bars are hardly visible. I suggest to add additional plots where the contributions from BAS and from high-sulphur fuel are enhanced.

Figure 4: In figure part (a) cut the x-axis in the plot at 2000 ppb days and add the values for the bars above 2000 inside the plot.

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