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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Climate and air quality trade-offs in altering ship fuel sulfur content" *by* A.-I. Partanen et al.

Anonymous Referee #1

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General Comments

This is a nice analysis of two effects of pollution from shipping, one clearly detrimental (pollution-induced mortality) and one arguably beneficial (climate cooling effects). The paper is very clearly written and the authors do a good job of pointing out the complexities of the issues involved. I think the paper should be published once the points described below have been addressed.

Specific Comments

1. Page 21993, lines 7-10: I think the authors need to re-word the sentence "We do not attempt to.....outside the scope of this paper", because they quite clearly do compare the two different metrics of RFP and mortality: Figure 6 shows "how many deaths a

certain amount of RFP corresponds to" (lines 8-9) which is something this sentence says they do not do.

2. Page 21999, line 9-11. Contrary to what is stated here, the most deaths are for the ships-2010_45 case, not ships-2010. I know that ships-2010_45 is a sensitivity study and not part of the main suite of simulations, but one can't just ignore its results and say that the biggest impact is from another simulation. A few words are required here for ships-2010_45, even if it's just to refer the reader to another section. An alternative would be to split up the results into different tables, with the "standard" simulations in Table 2 and the sensitivity studies (_45 and _corbett) in a separate table.

3. Page 22001 and after, and Table 2. All the RFP values should be quoted with some sort of uncertainty estimate: +/- one standard deviation would be the simplest thing to quote. This will allow the reader to get some feeling of the significance (or otherwise) of the difference between the various RFPs.

4. Page 22002, line 1-9: How were the RFPs from coastal regions determined? If it was just by masking so that only these regions contributed to the calculation of global-mean RFP, then this assumes local emissions are directly linked to local effects. I don't think one can conclude from this analysis that "emission reductions near the coasts have relatively little effect on the global radiative balance" without doing specific simulations with coastal emissions only. Non-linearities in aerosol- cloud effects could give different estimates of the RFP due to coastal shipping if done as either "all-emissions vs. all-emissions-except-coasts" or else as "coasts-only vs. no-ships".

5. Page 22004, lines 11-15. From Table 2 & Fig.6 it seems that increasing primary sulfate fraction to 4.5%, while indeed having little impact on mortality, strengthens RFP by 25-30% in geo-wide_45 and ships-2010_45. Does this increase really count as staying "roughly the same" (line 14)? Without +/- values for the RFPs the reader can't tell whether a 25% increase is significant or not. The size of the changes should certainly be noted (especially as smaller changes are subsequently discussed in Section 3.4.3).

6. Page 22008, lines 8-9: The phrase "could be achieved with sea spray injections" suggests that this technique is proven, which is not the case. I suggest toning-down this statement.

Minor Comments/Technical Corrections

1. Page 21991, lines 7-8: move the opening parenthesis from before "Koch and Del Genio" in line 8 to before "the aerosol indirect..." in line 7.

2. Page 21996, line 4: Insert "primary" before "sulfate fraction".

3. Page 22000, line 26: Insert "fixed SST" (or similar) before "simulations".

4. Page 22001, line 29: Insert "change in" before "global mean RFP".

5. Page 22007, line 15: I suggest replacing "should be" by "would need to be".

6. Page 22024, line 21: "...was more or less retained..." - in fact RFP is strengthened in both geo-wide and geo-narrow compared with ships-2010, so why not say so?

7. Page 22016, Table 1: The caption should state that the emissions of SO2, OC and BC are from shipping (just insert "from shipping" after "and black carbon (BC)").

8. Page 22024, Figure 6: A title is required for the x-axis, as is an indication of the units (thousands).

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 21989, 2013.