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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling the regional impact of ship emissions on NO_x and ozone levels over the Eastern Atlantic and Western Europe using ship plume parameterization" *by* P. Huszar et al.

Anonymous Referee #2

Received and published: 18 May 2010

This paper relates a study of simulations of the effects of ship-emitted NOx in the atmosphere over the Northeastern Atlantic Ocean and Western Europe. The authors use a regional atmosphere model coupled to a chemical transport model to study the effects of ship emissions on the atmosphere. They apply a proven approach of the parametrization of aircraft emissions to the ship emission problem. The results agree with previous studies of parametrized ship emissions. The authors also compare their results with real observed ship emissions in the English Channel.

This is an interesting study which I recommend for publication with some corrections,

clarifications and expansion which I list below.

Scientific Corrections:

Figures:

1. Figure 7 (bottom row) potentially shows some model boundary effects. At the end of the shipping lanes in the western part of the domain there are changes over -25% which don't make physical sense, I think. Please explain if these are real changes or are a result of boundary conditions imposed at the western boundary.

2. Figure 14. The lines and triangles are far too small for easy visual comparison both in online and in the pdf for printing versions of this article. Perhaps it would be better to separate these three graphs into three individual figures. I think that a comparison of model results with actual observations for a paper such as this is important enough to merit 3 separate easily readable figures. Otherwise, the impact of doing the comparison is lost. Also, colour could be used effectively here, but if the figures were larger, gray scale would be OK too.

Text:

3. It would be helpful to hear more about the meteorology that the authors hope to capture at the regional scale. Which processes do they believe that the meteorological model represents well? Which processes are missing? What are the simulated differences between coastal and remote ocean in the model atmosphere?

Please specifically address the following:

3a. For a specific example, see Page 26748 line 26. "...during usual situations in the troposphere..." is a very vague statement. Are we to think large-scale, seasonal, midlatitude,...?

3b. Pg 26754 Line 25-27, what do "these variations" refer to? wind variability? cloud cover? stability of the boundary layer? And just to be clear, please state exactly what

the phases of plume dispersion are on line 27. Are you thinking of early high concentrations, transition to heterogenous conditions, and a dilute or homogeneous phase?

4. In Section 3, the models' resolutions are not described until section 3.3. I expected to read about this much sooner in a paper about ship plume parametrization. It would be helpful to have the models' resolutions briefly stated in section 3.1 and 3.2 and then a brief statement about how the resolution is discussed more deeply in section 3.3.

5. Pg 26748 Lines 23-25. Please be more specific about these "just small changes." Can you give a ratio of the values of surface to higher model level to illustrate the point? Also, absolut should read absolute.

6. Sometimes the word annual is used when referring to figures where seasonal results are displayed. This is confusing because I understand that the models are run for 2004, a single year with various parameters changed. There is no interannual variability being studied. For example, I found the reference to figure 5 on page 26749. line 11 confusing. "...contribution to total surface ozone as annual average makes 6-8% over the remote sea..." Do you mean that you have calculated an annual average which is not shown in this paper? Also, should write " is 6-8% over the remote ocean."

7. Pg. 26754 Line 18 Do you mean NO or NOx?

General Technical Corrections:

1. Use of the word "sea" in the context of "Remote sea" when authors really mean the remote Atlantic ocean. Should change references to "remote ocean". For eg. pg 26750 line 19.

2. Be consistent with usage. Choose either off-line or offline, on-line or online.

3. There are many places in the paper which need slight tuning to improve the English and make the paper more readable and clearer. For example on page 26737 line 6 should be 'aircraft' not 'aircrafts', and on the same page, line 26 should read "In the case of a chemically..." If possible, I would recommend the authors have a native

English speaker provide some editing. This is a good paper which would improve with such fine tuning and possibly make it more likely to be widely read.

Specific Technical Corrections:

figure and tables

1. Table 1 caption should read "marine boundary layer conditions"

2. Table 2 caption. should read: Summary of runs carried out by the RegCM/CAMx model pair coupled off-line.

3. Table 2 caption. "grid step" should be "grid size" or "grid spacing."

4. Information given in Table 3 would be much better as a simple graph showing the model height as a function of model level. This would provide a more intuitive and easier to visualize expression of model resolution. It would easily show how the model spacing varies as we go up in height.

5. Figure 1. Define "LCC"

6. Figure 5. Last sentence should read "... destroyed ozone.."

7. Figure 12. Would be more clear to state: " Sensitivity test on tau, the dilution time parameter:..."

8. Figure 13. "Sensitivity test on model resolution"

Text:

Pg. 26738. Line 10-12 The first part of this sentence "In the assessment..." does not make sense. Only the final bit "...these effects should be taken into account." makes sense. Please re-write.

Pg. 26741. Line 2. "Flux" typically implies quantity per unit area, so use of the term here is confusing.

Pg. 26741. Line 3. "Converted" is a better word here than "Restored".

Pg. 26741. Eqn. 4. Define terms delta, rho and ratio.

Pg. 26742. Line 17. What are the characteristics of the marine boundary layer that you are referring to? Please describe what you attempt to capture in the model.

Pg. 26742. Line 3. "...must be consistent." What must be consistent? Is it the values of I and EI_NOx? Can you give a set of specific values used in this study or tell us what constitutes a consistent set?

Pg. 26743 Line 1. The "rather short plume lifetime" is short because you assume it to be in this study. Please state that the shortness of the lifetime is a parameter chosen in the study.

Pg. 26743 Line 9. "meteorology" should be "meteorological."

Pg. 26745 Line 13. "one of the most intense vessel traffic" should be qualified. Is it the most intense in the world? in Europe? in the Atlantic?

Pg. 26746 Line 19. Land use is two separate words.

Pg. 26748 Line 3. "British Islands..." should read "British Isles to the North and Baltic Seas"

Pg. 26748 Lines 12 - 14. Sentence "Due to the decrease..." needs to be re-written because "...ship NOx over land makes negligible..." does not make sense.

Pg. 26749 Line 5 Please change "ozone is destroyed by the value" to "ozone is decreased by 2-3 ppbv."

Pg. 26749 Line 15 Change "is exceeding" to "exceeds."

Pg. 26750 Line 8 Please change "previous section" to a specific section number.

Pg. 26751 Line 11 Please change "previous equation" to a specific equation number.

Pg. 26753 Line 5 In my opinion "latter work" is too far in the paragraph from the last references to be clear. Please restate which work you are citing here.

Pg. 26753 Line 25-27 To be more clear, do you mean: "However, the relative reduction (20-30%) of ship NOx contribution is large not only along the major shipping routes, but also in those without significant ship traffic."

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 26735, 2009.