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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.

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The authors would like to thank the Referee #1 for the useful comments that he considers to improve our paper's quality.

Our response follows point by point:

Specific comments
COMMENT: Page 26743, line 24: I would suggest the authors to specify which

convective scheme is used for their RegCM3 simulations.
RESPONSE: The convective scheme (Grell) was specified as suggested by the referee.
COMMENT: Page 26746, lines 4-5: The authors note that the initial and boundary conditions for the climate runs were interpolated from the ERA40 reanalysis. However the year chosen for the simulations was 2004 but ERA-40 reanalysis stops in August 2002 (http://dataportal.ecmwf.int/data/d/era40_daily/). I think that authors should clarify what kind of meteorological data they have used for initial and boundary conditions.
RESPONSE: Indeed, specifying ERA40 as a boundary condition for the climate runs was a mistake, the NCEP/NCAR reanalysis was used which is available till present.
COMMENT: From my point of view Figures 4 and 5 are similar and can be possibly merged into one common Figure with both the absolute and relative (in percent) difference due to ship emissions for summer and winter. Also I would suggest that Figure 4c (for the whole year) may be skipped in the new Figure 4 and the authors may only mention these results in the text without illustration.
RESPONSE: Figures 4 and 5 were merged into a new Figure 4 without the annual average plot, as suggested. The corresponding paragraphs in the text were changed accordingly.
COMMENT: In Figure 8, at the left panel plots, as the values get more negative the color scale becomes more violet while at the right panel plots is the reverse order. In Figure 7 as the values become more negative the color gets redder. I suggest that the authors use a common color order for positive or negative values.
RESPONSE: The color scale for parameterization's effect on the ozone was changed as suggested by the referee. The color scale in each figure is now getting darker corresponding to higher impact either of the ship emissions (the color getting darker with increasing values) or the introduction of the plume parameterization (the color getting darker with decreasing negative values). In Figure 13, where the sensitivity on the resolution was studied, we however left the old color scale as here emphasis is

put on the comparision of the two resolutions rather than on the actual effect of the parameterization.
COMMENT: According to Figure 8 ship plume effects lead to decrease of ozone due to suppressed ozone production resulted from the fraction of NOx remaining in the plume form. This ozone decrease is more evident along the shipping corridors. Furthermore since a certain NOx fraction remains within the plume we also note a NOx decrease (according to Figure 7) along the shipping corridors. My question is if the NOx decrease outside the plume (along the corridors) would lead to less NO titration by O3 and hence an O3 increase thus counteracting partially the decrease of ozone due to suppressed ozone production resulted from the fraction of NOx remaining in the plume form.
RESPONSE: It is true that the reduction of NOx in the diluted phase within the vicinity of corridors with high concentrated plumes lessen the titration of O_3 by NOx. Although, this is what happens in the atmosphere. Titration is enhanced within the plume (and the parameterization cope with that) and is less efficient outside the plumes since the NOx is diluted and its concentration is lower (and the "standard" part of the chemical system takes care of this). In our calculations it appears that reduction of the O_3 production due to the high concentrations of NOx within the plume encompasses the reduction of the titration effects outside the plumes.
COMMENT: Page 26753, lines 10-14: The authors state "The simulated effect varies substantially between winter and summer despite the fact that ship emission's variation throughout the year is not large. The reason is in the different meteorological conditions (primarily temperature) and in the consequent photochemical processes." How is concluded that primarily temperature is the reason for the differences in the simulated effects in summer and winter. Why not the radiation? Please clarify.
RESPONSE: The authors admit that they have been mistaken here, so changed the text in the manuscript to "primarily higher radiation and temperature".

Technical Correction: Page 26750, line 14: " by the introduction the plume pa-

rameterization." should be "by introducing the plume parameterization." or " by the introduction of the plume parameterization."
RESPONSE: the recommended correction has been implemented in the revised manuscript.

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