**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Modelling multi-phase halogen chemistry in the remote marine boundary layer: investigation of the influence of aerosol size resolution on predicted gas- and condensed-phase chemistry" *by* D. Lowe et al.

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Lowe et al present a modelling study about halogen chemistry in the marine boundary layer. The focus of their work is on the appropriate representation of multiphase chemistry is numerical models. The paper is well written, highlights the key points and I recommend publication after minor revisions as detailed below.

Methods

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Interactive Discussion

Discussion Paper

I second the comments by the first reviewer that more detail on the microphysics that are included in the model should be given in the text. Further specific points are:

- p. 5292, l. 8: Which 3rd order Rosenbrock solver are you using - ROS3 or RODAS3?

- I couldn't find information about temperature and relative humidity - are you keeping these parameters constant? What are the values that you used?

- p. 5293, l. 18-19: Even though this is the easiest way to describe wet deposition in a box model it is physically not correct because precipitation is not a process that streches over days but over short periods of time where a drastic reduction in aerosol and soluble gas concentrations occurs. What is your 8-day lifetime based on - global wet-deposition lifetime estimates? For coarse mode aerosol the lifetime due to dry deposition will dominate, so this is not a crucial point.

- P. 5293, l. 23: You do calculate phase exchange for NH_3 - don't you?

- p. 5294, l. 1-4: Do you calculate the entrainment of O_3 as a function of time, dependent on the calculated O_3 concentartions or do you simply prescibe a flux? How do you calculate the entrainment velocity?

- p. 5295, l. 21-23: Why do you think that the atmosphere is in steady state? There is cloud formation and dissipation, discrete precipitation events, airmass changes and mixing, all acting to drive the atmosphere away from steady state. Unless your long spin-up time is due to very non-steady state initial conditions or initialisation of key parameters with 0., I would conclude from your estimate of the time it takes to establish steady state in the model that the atmosphere is usually not in steady state - at least with regard to the parameters that you are studying. The fact that you do very long model runs is probably also the reason why your absolute gas phase reactive halogen levels are rather high.

Results and Discussion

- p. 5297, l. 12: A slightly semantic comment: would it not be better to refer to "reservoirs" instead of "sources", after steady state has been established? The aerosol will still be a net source (due to replenishment of deposited aerosol) but the gas phase is a mere reservoir unless you have significant concentrations of organic bromine.

- p. 5298, l. 21-22: Could you please add the lifetime of the largest particles? I am somewhat surprised that you have very small S(VI) production in these particles as oxidation by O_3 should be really fast (see e.g. Chameides and Stelson, 1992 or von Glasow, 2006, Fig. 3).

- Section 3.3: You should mention which accommodation coefficients have been measured and which haven't as currently the reader might assume that the uncertainty is the same for all accommodation coefficients, which is not the case (e.g. Wachsmuth et al., 2002, for HOBr).

- p. 5299, l. 2 vs. caption table 7: Please use a consistent term to describe case Base/Pechtl.

- p. 5299, l. 5, 19: It might be better to use "HOX" instead of "HO_X" as the latter might be confused with "HO_x" = OH + HO_2".

- p. 5300, l. 2: "reduce" $\longrightarrow$ "reduced".

Conclusions

- p. 5300, l. 9/10 and 23-25: From figure 3 I would conclude that the scenario "1 bin, S/V" reproduces the results of the full model rather well. Please comment.

Tables

- Table 1,2: Could you add references what these mixing ratios and fluxes are based on?

- Table 4: Could you please specify whether you are refering to $\log_{10}$ or ln?

- Table 5: The formatting of the blank lines is a bit odd, please improve.

Figures

Overall the figures are rather small, some at the limit of what can be read. Please make sure that the figures in the final version of the paper are not smaller and if possible larger than in the ACPD version. It might be useful to add a figure similar to figure 5 but for the case "N/V" as larger scale models might aim to reproduce cloud microphysics and chemistry and for cloud processes the number of aerosol particles/CCN is crucial.

- Figure 2 and 9: Please add "loss" between "ozone per" in the caption.

- Figure 4 and 10: Please add the unit for the molality.

- Figure 7: What is the unit for the aqueous phase concentrations? Why do you have a rather strong diurnal variation in the pH of the largest particles? What are the reasons for the morning peak of NO_3^- in the small sea salt particles? What is the source and what is the sink?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 5289, 2009.