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Atmospheric Chemistry and Physics Discussions

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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We thank Referee 1 for their helpful comments, and address specific issues that they raised below.

- *In general there is one dominant issue with the paper : it is either difficult to interpret in a way that conclusions may be directly linked to the relevant results, or the conclusions are inappropriately drawn ? though I believe it is the former.*

  Re-reading the paper we agree that the links between the discussion and conclusions are not as clear as they should be. We have added explanatory text to these sections to emphasise the links.

- *References are given that point to a specific microphysical scheme, but there is — I believe — insufficient detail regarding the structure of the microphysics...*

  We agree that more detail is needed on the microphysics of the model and this has been added to the paper.

- *Also, perhaps a table detailing the set of runs conducted.*

  We have compiled a table detailing the different scenarios used for the model runs in this paper. It has been added to the supplementary material.

- *I am surprised to see such little difference, for example, in halogen mixing ratios between the bulk-turnover 1-bin model and the size-resolved turnover 16-bin. Our investigations demonstrated a more acute sensitivity of most of the gas-phase species to size-resolved turnover rates... though I suspect this would become far more clear were the descriptions of the microphysical processes more accessible. Is this difference because we conserve N/V rather than S/V? Do N/V and N/S show similar results in your case?*

  For the initial, fixed turnover rate testcases we used an aerosol of lifetime of 0.57 days, calculated from the 16-section model using volumetric averaging (see Table 6). The differences between the 1-section N/V and N/S runs and the 16-section size-resolved turnover run can been seen by comparing the results in Figures 3 and 6. This comparison shows large differences between the N/V 1-section run and the size-resolved turnover 16-section run, just as the investigations of Toyota et al. (2001) showed. This indicates that the differences are a result of the N/V initialisation.

- *What would be helpful to see: If two scenarios demonstrate little difference (e.g. 16 v 1-bin), does this result hold up if, for example, the emissions of some centrally dominant species were different? Though, as the title says, it is a remote MBL study which suggests a constrained set of environmental/initialization parameters. What about in areas influenced by ship plumes, for example?*

  This would be an interesting study, but is outside of the scope of this paper. Gas-phase concentrations of HNO_3 (which is intimately linked with condensed-phase compositions) do show sensitivity to size-resolved chemical processes. It would be interesting to see if increasing the pollutant levels increased or decreased this dependence. Such a sensitivity analysis will be reported as part of a larger ongoing atmospheric multiphase process characterisation study.

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