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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Latitudinal variation in the multiphase chemical processing of inorganic halogens and related species over the eastern North and South Atlantic Oceans" *by* W. C. Keene et al.

Anonymous Referee #1

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The authors present results from a cruise across the eastern Atlantic Ocean. The data is divided into four regimes (European, North African, Intertropical Convergence Zone and South Atlantic) and a box-model is used to interpret the results within each regime. This work provides additional interesting insights for the role of multiphase bromine and chlorine chemistry in open ocean marine boundary layer chemistry. Therefore, this manuscript fits well within the scope of ACP however I suggest some major revisions of the manuscript before it is considered for publication.

General comments:

- The manuscript is unnecessarily hard to read. The document could be re-written in a clearer manner trying to avoid repetition and unnecessary details.

- Data interpretation is aided by the MECCA model. In the model parameterization an O3 entrainment flux from the FT is included. However, is there a treatment of trace gas exchange between the FT and the MBL?. Some of the conclusions presented by the authors on the impact of halogens upon MBL chemistry may rely on this point (see below).

- For the N-AFR regime this paper presents results that somehow differ from previously published work (i.e. Read et al., 2008, which reported on long-term measurements of a number of atmospheric species at the Cape Verde Observatory accompanied by box-model calculations). This manuscript reports calculations of large O3 net destruction by combined chlorine and bromine chemistry, much larger than that reported by Read et al. The simulated O3 values on this paper average 14 nmol mol-1 when the observed reported range was 45 to 20 nmol mol-1 (page 11915). How do the authors explain this large discrepancy between simulated and measured O3?

- In page 11915 the net O3 destruction in the halogens (Br + Cl) run, as compared to the "no halogen" run is around 63%. Read et al., reported IO mixing ratios around 1-2 pptv which indicates that iodine chemistry may play an important role on halogen-catalysed O3 depletion in this environment and should therefore be considered. It is also known that iodine chemistry is more efficient that bromine at depleting O3 which in this model configuration would likely lead to close to total O3 depletion. Therefore, have the authors carried out sensitivity runs on the combined impact on O3 depletion of bromine, chlorine and iodine chemistries? Considering the predicted O3 destruction of 63% with bromine and chlorine, does the inclusion of iodine lead to close to total O3 destruction in the current model configuration?

- The authors also mentioned that halogens in their N-AFR simulations lead to lower OH values, 5% to 12%, with respect to the "no halogens" run and in disagreement with

calculations by Read et al.,. Could this effect be the result of the significant difference between the halogen-catalysed O3 depletion as predicted by both papers?

- In general, the authors should be more cautious regarding statements on the effects of halogens (bromine and chlorine only) on the chemistry, for instance on HOx, considering the unrealistically large O3 depletion rates calculated here.

Minor comments:

- Page 11893, line 4: “(but not others, ” ?? please correct.

- The definition of Cl* is given on page 11907, please define at the beginning of the manuscript.

- Mentioned to Fig. 2 a, b c, d, etc is made across the manuscript and Fig. 2 caption however the letters are not written on the plot.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 11889, 2009.