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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global impacts of tropospheric halogens (Cl, Br, I) on oxidants and composition in GEOS-Chem" *by* T. Sherwen et al.

Anonymous Referee #1

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This manuscript presents a comprehensive model study of halogen chemistry; using an updated version of the global model GEOS-Chem, the authors examine the impact of halogens on the composition of the troposphere. It is a very interesting paper and it adds to the growing corpus of studies that try to assess the global impact of halogen chemistry. The manuscript is well written and the material clearly presented and discussed. I recommend publication in Atmos. Chem. Phys., with minor corrections.

GENERAL COMMENTS

In the introduction it should be noted that some halogen chemistry actually leads to increased O3 formation, due to increased oxidation of VOC and recycling of NOx. Especially since ClNO2 chemistry is highlighted later in the paper.

A few clarifications about the chemical mechanism are needed. In particular: is nucle-

ation included for IxOy species? Or are the only losses for these species photolysis and heterogeneous uptake? Release of Cl and Br is described as only via uptake of N2O5 (page 4, line 30) which seems to contrast with the description of acid catalysed release described earlier in the same section (page 3, line 31). This (apparent?) contradiction should be clarified.

The importance of aqueous-phase chemistry is briefly mentioned in Section 3.4.3 as a possible explanation for the disagreement between modelled and measured chlorine, but is probably an issue for bromine, and maybe iodine, as well. Given that this is likely the main uncertainty in the model (with regard to halogen chemistry) more discussion seems warranted.

The section on the impact of halogens on ozone concentration should be expanded. While it is true that halogens generally improve the agreement with ozone, this is not always the case (eg, Mace Head, Mont Cimone, Neumayer in Figure 12, Lindenberg, Marambio in Fig 13). It is also quite clear that the model often fails to reproduce ozone at higher altitudes. These discrepancies should be discussed.

MINOR COMMENTS

It may not be clear to everybody where the measurements were taken. I suggest either a map indicating the location of the sites and of the campaigns or an expansion of Table 3 to include all the measurements used in the paper.

Section 4.2: is HO2 increased in the model with halogen chemistry? If so by how much.

Page 8, Line 2: higher

Page 8, Line 12: dominated

Page 10, Line 27: suggested

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