

Response to Anonymous Referee #3

- The paper examines interactions and contributions of halogens (bromine, chlorine, and iodine) to ozone depletion at Barrow using a 0D photochemical model. The model is run during an ODE event during which observations of O₃, VOCs and OVOCs, CO, Cl₂, Br₂, HOBr, BrO, ClO, NO₂, OH and HO₂ were available. In general the paper is well written and organized. I report some comments and suggestions.
- It takes me a certain time to realize which species was measured and how they were used with respect to model simulations. I think since the paper mainly deals with model simulations it would be great to first present in a short section the measurements (Fig. 1 and 2, and Table 5) and better explain why the model is constrained by measurements for Cl₂ but not for Br species.
 - Thank you for this suggestion and we agree that it would be useful to better explain the measurements done during the campaign. We have added now Section 2.1 Field Campaign and Measurements Description, that gives a brief overview of the OASIS campaign itself, the measurement site, and a brief description of the in situ measurements that went into driving the model. Also, and following the suggestions of Referee #2, we have adjusted the model to now be constrained to Br₂, and have updated the text to reflect this change.
- Also, page 28698, it is stated that “The fluxes of HONO, NO₂ and I₂ were scaled to JNO₂ since HONO and NO_x (and likely I₂) are photochemically produced (Honrath et al., 1999; Zhou et al., 2001; Saiz-Lopez et al., 2011). All fluxes, with the exception of I₂, were adjusted in order to agree with observed gas-phase concentrations of the respective species. However HONO is not listed in Table 5 ? I was unable to get typical values of the encountered mixing ratio of HONO in the paper? Also concerning HONO, you only consider a flux of HONO and not the recently pointed out production of HONO from reaction of the HO₂ (H₂O) complex with NO₂ (Lin et al., 2014) ? Li, X. et al.: Missing Gas-Phase Source of HONO Inferred from Zeppelin Measurements in the Troposphere, Science, 344, 292–296, 2014.
 - Thank you for bringing this recent paper to our attention. While it may certainly be the case that this proposed mechanism can be important for gas phase HONO formation, it appears from reading this paper that more work is needed before it can be added to a model mechanism. Currently, the rate constant for reaction and the product yield are both unknown. Because of this, we have not added this reaction to the model, but we have added an acknowledgement and reference to this paper in the text, and have added new Figure 3, which shows the modeled vs. observed HONO for simulations performed with and without the additional flux.
- On Figure 1 and 2, a double scale showing both concentrations and mixing ratio would be useful (for readers more familiar to compare values of mixing ratios).
 - This is good suggestion, thank you. We have left Figure 1 just with mixing ratios, as this is how the data was reported and is the more common metric used,

however, in Figure 2 and all other figures that used $\text{molecule}\cdot\text{cm}^{-3}$, we have included a second axis for mixing ratio.

- Page 28697, second paragraph: I am not sure if the discussion of estimated Br₂ emission from the snow is very useful here since it is very clear that the estimations are based on numerous assumptions including the values assumed for the quasi liquid layer. If you decide to report this discussion it would be important for the reader to report assumed bulk concentrations of Cl⁻ and Br⁻ in snow since even after 30 minutes of reading the paper from Krnavek et al. (2011) I was unable to guess the values that you have used.
 - We have added in the text that we use the snow over multi-year ice values for the model, on page 15 of the revised manuscript.