

Interactive comment on “Using airborne observations to improve estimates of short-lived halocarbon emissions during summer from Southern Ocean” by E. Asher et al.

Anonymous Referee #3

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The manuscript of Asher et al. describes airborne observations of halogenated volatile organic compounds over the Southern Ocean and improved emission flux estimates, based on modelling studies and correlative O₂ observations. This is an important and interesting study that should be published in Atmos. Chem. Phys. after consideration of the following points. The authors should consider improving the presentation by first presenting their data and methods and then discussing the results. This study contains important new methods and approaches compared to previous studies but the presentation is not always clear. As an example, a key result is the presentation of “regional enrichment ratios” for HVOCs, but it did not become sufficiently clear to me, how they are defined and how they were calculated.

Specific comments:

L32-34: in the same sentence “halogenated hydrocarbon” and “halogenated volatile organic compounds (HVOCs)” are used. If the two mean the same, use only one name. If there is a distinction, please define.

L47-49: Is there a particular logic for the order of the citations given? They are neither sorted according to year, nor alphabetically.

L50: “recent evidence indicates that sea salt is scarce and insufficient”: this is a strong statement that should be backed up with more than a manuscript in review.

L66: You may cite Abrahamsson et al. (2018) already at this stage.

L96: The point “support quantitative air-sea flux estimates” is less obvious than the other points so a reference may be helpful here.

L211: “We note that the non-linearity observed in ratios of these two gases at low CHBr_3 levels likely reflects the differences in emissions during strong phytoplankton blooms, as oppose to other periods.” Could not the different lifetimes also effect this?

Fig. 3. Units missing for the axes

Fig. 4. Why are some units given as nmol/mol and others as ppt ?

L222: Sorry, but I don't know what a type II major axis regression is. A few more words may help.

L250: Please explain how the molar enrichment ratios are defined and/or calculated. This seems to be critical, but not well explained. Is this just the slope of the regression between CHBr_3 (or CH_2Br_2) and O_2 ?

L351: “In its simplest approximation, the wind speed error will correlate with surface influence error” I understand that this is in general may be a reasonable assumption, but it is not obvious to me why the error in the influence function (in $\text{ppt m}^2 \text{ s pmol}^{-1}$)

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should be proportional to the error in wind speed. More justification of this argument would be needed here.

L389: PAR: please spell out (as far as I can see first defined in L476)

L431: “We note that over-turned first year sea-ice, which can expose under-ice algae colonies to the air, likely still present a local source of CHBr₃, CH₂Br₂, or other HVOCs to the MBL.” What is this statement based on?

L499: Reference to Fig.9 in L499 was not clear to me. Was really Fig.9 meant here?

Fig. 9c: Caption not very clear, would be helpful if the description in the caption can be improved.

5.2 Why are STILT based emission estimates presented only for CH₃I? Why is it not possible to perform this for other HVOCs as well?

Figure S4: “Consecutive samples in and out of dips into the MBL”: Sorry, I don’t really understand what is meant here, please re-word.

Technical corrections:

L134: “low attitude” -> “low altitude”

L183: citation should be part of the sentence

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