

## Review comment on acp-2022-472

Anonymous Referee #2

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Referee comment on "Global seasonal distribution of CH<sub>2</sub>Br<sub>2</sub> and CHBr<sub>3</sub> in the upper troposphere and lower stratosphere" by Markus Jesswein et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-472-RC2>, 2022

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### General comments:

The manuscript "Global seasonal distribution of CH<sub>2</sub>Br<sub>2</sub> and CHBr<sub>3</sub> in the upper troposphere and lower stratosphere" written by Markus Jesswein, et al. presents seasonal cycles of CH<sub>2</sub>Br<sub>2</sub> and CHBr<sub>3</sub> in the global UTLS regions based on the combined analysis of multiple aircraft-campaign observation data and chemical transport models. The paper contains novel investigation to reveal seasonal cycles of CH<sub>2</sub>Br<sub>2</sub> and CHBr<sub>3</sub> in the UTLS of the northern and southern hemispheres and is generally well written, organized, and designed, but quantitative and clear descriptions are missing in some parts of the manuscript. It should be accepted for publication pending a modification of minor points. I provide general and specific comments that need to be addressed before moving forward publication processes below.

1. Please clarify what novel findings were made by integrating and analyzing data from the northern and southern hemispheres in the abstract and summary sections.
2. Can the limited temporal and spatial sampling, especially in the southern hemisphere, affect the conclusion of this paper? However, there is no quantitative discussion on such effects; could they be assessed using TOMCAT and CAM-Chem model data?
3. The methodology, especially the section on analytical methods, is insufficient. I would like additional explanation. Seems like different methods (e.g., with respect to equivalent latitude, sampling, etc.) were applied for observations and models, but I'm confused. Please sort them out.

### Specific comments:

p. 1, l. 12: "the same emission inventory" What emission inventory?

p. 2, l. 18-19: "Thus, both models reproduce equivalent "flushing" in both hemispheres, which is not confirmed by the available observations." □□ What does it mean that the models are reproducing a phenomenon not confirmed by observation?

p. 6, l. 175: "with fixed emissions of the VSLs during the whole modeling period" What time resolution is the emission data, Annual or monthly climatology?

p. 7, l. 188-200: 1) It would be better to separate this section as analysis methods.

2) From what data were the equivalent latitudes and temperatures calculated for the observational and model data analysis, respectively?

3) Please clarify which sections latitude-altitude,  $\theta$ ,  $\Delta\theta$ , and equivalent latitude coordinate systems are used for.

4) Please clarify how do you sample the model data, along the aircraft tracks or regional mean?

p. 8, l. 221: "While the distribution of CH<sub>2</sub>Br<sub>2</sub> in hemispheric spring is quite similar, ..." What is similar to what, the distributions of NH and SH?

p. 8, l. 222: "... differs with smaller values in the SH compared to the NH" How much is the difference?

p. 9, l. 258: "Ordonez et al. (2012) already identify some issues regarding..." Please clarify what issues were identified?

p. 9, l. 266: "Nonetheless, the NH shows larger values in autumn and winter compared to spring and summer ..." How much?

p. 10, l. 308-309 "Both models quantitatively reproduce the larger CH<sub>2</sub>Br<sub>2</sub> values in hemispheric winter and spring and smaller values in summer and autumn (see Fig. S3)." Which latitude bands does this statement refer? The models do not look like reproducing the observed seasonality of CH<sub>2</sub>Br<sub>2</sub> in low latitudes.

p. 12, l. 382: "hemispheric autumn profiles of CH<sub>2</sub>Br<sub>2</sub> and CHBr<sub>3</sub> are less similar than in hemispheric spring." What is less similar, profiles of CH<sub>2</sub>Br<sub>2</sub> and CHBr<sub>3</sub> or profiles in the NH and SH?

p. 13, l. 386; "Differences between the hemispheres become larger on lowest levels above the dynamical tropopause, i.e., in the ExTL." Compared to what, do the inter-hemispheric differences become larger?

Figures 2 and 3: What is the reason for missing values in the lower stratosphere in the TOMCAT model? (Second row).

Figures 5 and S1: description of line colors are missing.