EGUsphere, author comment AC2
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reply to RC1 - discussing open questions

Wiebke Scholz et al.

Author comment on "Measurement report: Long-range transport and the fate of dimethyl sulfide oxidation products in the free troposphere derived from observations at the high-altitude research station Chacaltaya (5240□m□a.s.l.) in the Bolivian Andes" by Wiebke Scholz et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-887-AC2, 2022

Dear Colleague!

Thank you very much for your early and helpful review comments! I like to use the opportunity to respond to your questions now in case any of my answers would trigger any further discussion.

1. Operational vs. Analyzed periods of the different instruments:

- Nitrate CIMS: The nitrate-CIMS was operational for an extended period, as shown in figure 1. However, due to technical difficulties and many power cuts during the wet season, the instrument was not always in a good state, so large fractions of the MSA data are very uncertain. The 19th-25th of April would be of good quality. We however decided not to go into further detail with these data, because – as mentioned a few times throughout the manuscript - we focused our analysis on periods of typical dry season conditions (clear sky, westerly winds) that were not met in that time period. Maybe the word „analyzed" is also not perfect, as we have looked into all data, however, this paper only focuses on the marked periods. To clarify this, we will add a note in the caption of figure 1 and change the word „analyzed" to „herein presented" data.

- I□-Figaero: Yes, the inconsistency probably occurred due to a misunderstanding within the group, that was resolved shortly before submission and we forgot to update the figure. The dates given in the text are correct. The reason for not focusing on the data from April is again, that our aim was to focus on typical dry-season conditions for this manuscript.

2. Lines 274 – 275 (Anticorrelation):

„Anticorrelation" might be the wrong word, as we have no close-to-linear relationship between these data, but the scatter plot (appended) shows that the processes leading to high MSA vs. high summed C8H10Ox, are counteractive.

3. Line 300:

Yes, that must‘ve slipped my eye. Previous figs. 3 B1 and B2 are now figs. 3 E and F and we will correct it in the next version.

4. Why we used two methods for free troposphere (FT) identification:

The thresholds of the identifiers are more precise than the Flexpart analysis to analyze whether the station is above the boundary layer or not:

The FT intrusions happen on a timescale of hours which is close to the limit of the model time resolution, while the various identifiers have a higher temporal resolution.

In addition, the identifier approach uses direct on-site measurements that are generally more reliable than the Flexpart analysis, which builds upon the WRF model that cannot perfectly represent all the complex mountain meteorology in the vicinity.

The model, when evaluated against short-range BL influences does perform very well on average (see Bianchi et al 2021, doi.org/10.1175/BAMS-D-20-0187.1). Also, fig 3 of this paper shows this great performance and the agreement between these methods gives us confidence in our FT identification. However, for single events, there are generally higher chances of the model missing the complex local meteorological features that drive the FT/BL interactions.

To summarize, for a temporally accurate subdivision into „above“ and „within“ the boundary layer, the indicators are more targeted.

On the other hand, identification of the air mass origin with Flexpart is an excellent tool for determining the most likely source regions of a compound (footprint analysis). The footprint analysis requires as much data as possible to get a good statistic (we used the whole time series from the PTR3). It is still somewhat uncertain because it does not account for processes other than passive transport.

However, one advantage of the footprint analysis is that it shows where the air masses transporting the compound of interest came from. An origin analysis in the horizontal direction is only possible with Flexpart and not with the parameters measured directly at the station. It also identifies the height at which the long-range transport occurred.

5. Figure 5:

Each boxplot is based upon 32 data points (pre-averaged to 30min intervals beforehand). The night- and daytime boundary layer conditions were chosen to be as close as possible (time-wise) to the FT periods with the same prevailing wind direction (horizontal air mass origin) for the best comparison. I think it makes sense to show the mean value as you suggested (see the appended figure as an example. The mean value is the green triangle). In a few cases (like DMS), a few very high values impact the mean. The data are also not gaussian distributed, so giving the standard deviation is maybe not so purposeful. An alternative to the boxplots would be violin plots if anything.

As mentioned, I reply to you now to spark a short discussion on these topics, if necessary. Therefore, this reply does not resolve all your more technical comments regarding the different figures. We will however address all your comments and adjust our figures accordingly in our next version of the manuscript after receiving further reviewer comments.

All the best, Wiebke Scholz

Please also note the supplement to this comment:
https://egusphere.copernicus.org/preprints/2022/egusphere-2022-887/egusphere-2022-887-AC2-supplement.zip