

Response to Short Comment on “Pyrocumulonimbus Events over British Columbia in 2017: The Long-term Transport and Radiative Impacts of Smoke Aerosols in the Stratosphere” by Das et al.

Dear Dr. Albert Ansmann,

Thank you very much for posting your insightful and important comments on the discussion forum. Please see our detailed response below and the related changes are reflected in the revised manuscript (in red ink) that is being submitted along with.

[SC]: Short comment

[AR]: *Author Response in Italic*

[SC:] This paper will become an important contribution to the stratospheric smoke literature! That motivated me to write this comment. Baars et al. (ACP, 2019) presented a dense set of lidar network information on geometrical, optical and microphysical properties of the stratospheric smoke over Europe after the strong pyro-CB-related smoke event of August 2017. You mention the paper briefly in your article. The paper covers six months of smoke observations!

The Baars et al paper should be mentioned already in the introduction as it is an important observational contribution to the research and documentation of the recordbreaking smoke event, that you are modelling. Furthermore, the European lidar network results should then be compared with your model findings (for Europe).

I am curious to see how your model results agree with this height-resolved smoke lidar data set!

How well do the model results agree with the lidar data in terms of optical depth or even layer-mean extinction coefficient?

Does the model resolve properly the height range of smoke observed over Europe, from Northern Norway to southern Portugal and Spain (western Mediterranean) and Cyprus and Israel, in the Eastern Mediterranean.

To be more precise:

Figure 2: Why did you not use the Baars-et-al.-2019 data (although knowing this paper and the results) in the comparisons shown here?

Figure 3: Here, you use lidar data from Europe (even from Leipzig)! Very good, thank you!

Figure 4: Here, it would make really sense to take the European lidar data (on smoke layer top heights) to check the quality of the model results.

Figure 6c, 6d, 6e: another excellent opportunity for lidar (Baars et al.) vs model comparisons,...with Europe in the center of all your plots.

Finally, Figure 7 and Figure 8 results should or could be compared with the extinction coefficients presented by Baars et al. (2019).

[AR]: We acknowledge the important contribution that Baars et al. (2019) has made in providing the detailed lidar observations for the smoke event of interest. We have now emphasized this further in our revised manuscript in the introduction section (section1, lines 50-52) as well.

We have also included additional details in section 3.1 (revised Fig. 3a, new Figures 3b, 3d) following some of your suggestions above. Most importantly, we attempted to show the mean and maximum of stratospheric AOT over Europe from our model (Fig. 3d) that would be comparable to Fig. 4b of Baars et al. (2019). The associated discussion is added in lines 297-304 under the same section.

Regarding your remaining comments, we agree they are excellent suggestions and worthy of further analysis, but is beyond the scope of this paper, which studies the long term and global impact of the BrCo pyroCb event. Your suggestions are certainly worth pursuing in a separate paper that specifically compare the model results to the lidar network measurements over Europe.