

Justification of decision on acp-2022-343

Kostas Tsigaridis (Editor)

Editor comment on "Self-lofting of wildfire smoke in the troposphere and stratosphere: simulations and space lidar observations" by Kevin Ohneiser et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-343-EC1>, 2023

I would like to start this note by thanking both the reviewers of this manuscript, in particular Mike Fromm, and the authors, for the extensive debates that took place during the discussion phase and later review cycles. I invite all readers to go through them, since they contain useful information, not all of which made it in the final manuscript. This discussion is a prime example that data interpretation is hard, and not easily attributable to individual events. It also showed how important it is to make a diligent model-data comparison. If anything, this discussion shows that there are still questions open to interpretations, and further work is required to minimize the uncertainties related with it, either for the case study presented in the manuscript or for past and future cases where conditions would be similarly convoluted.

Following multiple cycles of corrections, I believe that the manuscript is in a very good shape and deserves publication. I find the replies of the authors convincingly addressed Mike Fromm's concerns, and there are no flaws in the overall approach and interpretation of results. Uncertainties are also mentioned in the manuscript, and opposing opinions have been appropriately presented. I strongly believe the manuscript benefited from the discussion phase a lot and is now in a good shape to be accepted to ACP for publication.

The authors tried multiple approaches and did a deep literature search to support their claims, which I do not have to repeat here. Instead, I would only like to highlight a couple of example cases where the authors made a convincing case.

The mix of fire-originating and volcanic aerosols in the stratosphere in the summer of 2019 is a fact. These aerosol plumes and layers are very inhomogeneous, due to their temporal vicinity to the events that generated them. The discussion about point and mean values is valid, and they are properly separated during the discussion. The comparisons presented and conclusions drawn are scientifically sound.

The tracking of the aerosol layers was done carefully and appears to be robust. This includes the discussion about self-lofting, which can support the layers discussed in the manuscript, but also the evidence of mixed sulfate-smoke aerosol layers.

Last but not least, the authors did reply to the criticism of Mike Fromm in his last review adequately. Added text as needed, justified their disagreements adequately, and explained cases where they believe that changes were not needed in the manuscript.