

Review of the manuscript “Stratospheric pollution from Canadian forest fires” (now “MLS observations of biomass-burning products in the stratosphere from Canadian forest fires in August 2017”) by Hugh C. Pumphrey et al., second stage.

Dear Editor, Authors,

I have reviewed the resubmission of the manuscript “Stratospheric pollution from Canadian forest fires” (now “MLS observations of biomass-burning products in the stratosphere from Canadian forest fires in August 2017”) by Hugh C. Pumphrey et al., after the first stage of review and the subsequent Authors’ modifications of the previous version. During my first review stage, I pointed at a number of issues, including two major comments. The main point was (and is) the fact that the paper looks, at least to my eyes, as very confusing and superficial in places and, I suppose, rushed. For what I see, even if some critical points have been solved (e.g. now the title is much less generic, the trajectory analyses are clearer, the “Authors contributions” section is more complete) many of my comments have been rejected by the Authors and/or unsuccessfully tackled. Thus, from my point of view, the two major issues have only been partially solved and so, unfortunately, I cannot recommend the manuscript for publication in its present shape. As I am a bit puzzled by the fact that the Authors decided to dismiss many of my comments, I leave it to the Editor to judge if a Major Revision or another decision is the best choice (I suggest Major Revisions). As a guide for solving the mentioned issues – in case the Editor thinks it useful –, please find some elements in the following. Please consider that this is not supposed to be a complete list of the modifications needed, this is just a set of examples of unclear/unprecise bits of text. Besides these points, I strongly suggest the Authors to thoroughly revise the text to improve clarity, preciseness and completeness.

Major Comments:

- 1) My comment during the first stage of the review process: “ The originality of the manuscript must be clarified and openly discussed, in particular with respect to the previous work of Yu et al., 2019. What’s new and what’s complementary with respect to Yu et al., 2019? This is not clear at all in the present manuscript version, at least to me.” The Authors decided that this is not necessary because “Given that our paper references Yu et al. (2019) and notes which species are described in that paper it did not seem necessary to us to go into more detail.” I disagree on this point but might accept the small modification at L39-40, that implicitly mention the difference and complementarity of the two papers. It could (and should) be expanded a bit, so to be clearer: please consider this possibility.
- 2) I pointed at this, also: “The paper is unfortunately very confusing and certainly not very well crafted. The Abstract, Introduction and Conclusions are very short, incomplete, probably rushed. Many statements are not justified but just “written down”. Many discussions and argumentations are just lacking. All the analyses with trajectories (Sect. 4.2) are very obscure and must be extensively clarified/rewritten. Many crucial references are missing. The Authors should put a much larger effort in the writing of the text, the production of intelligible figures and the discussion of their results in the context of previous literature.” I commend the change in the title, the efforts in extending the Abstract, the Introduction and Conclusions and the new organization with a very welcome “Results” unitary section. Nevertheless, this is not

yet satisfactory, in my opinion, and many of my specific comments have been either superficially dealt with or even just dismissed. I don't think that a Reviewer should need to insist on this aspect: writing a clear, accessible, unambiguous and complete manuscript is one of the main tasks of the Authors. By the way, a selection of most urgent specific comments, as examples of possible improvement of the text, is in the following (please revise the manuscript beyond these comments):

a. Abstract:

- i. "Events such as this are rare": "such as this" in which sense?
- ii. "third of four", "preceding two events...like the most recent": this is obscure at best. Please mention the specific events you're comparing to.
- iii. "Unlike the preceding two events (sic), but like the most recent event (sic), the polluted air mass described here had an unusually high water vapour content": how much? Why not putting specific results in an Abstract?
- iv. "these are in roughly the ratios to CO reported elsewhere": what does this mean? Elsewhere where? Please use more words to express your ideas.
- v. "We use back-trajectories...": in Sect. 3.1, you have much more precise origin identification than just "originated in British Columbia fires" (also mentioned in the Conclusions): why a sentence so generic and superficial in the Abstract?

b. Introduction:

- i. "an important natural component": what do you mean with "component"? Please use a less generic word.
- ii. What do you mean with "nature" of fires? Again, too generic.
- iii. By the way, the full sentence is unclear to me. What do you mean with "even when...the fires"?
- iv. "more damaging": this is another generic statement I don't understand. You mean in terms of burned area? Of environmental/atmospheric impacts? Other?
- v. Please use reference in chronological order (e.g. Torres et al./Kloss et al.)
- vi. Kloss et al. is cited in a ACPD version and not the final ACP version. I did not check in the whole text but please double check if there are other occurrences of this.
- vii. "most detailed description" in terms of what?

c. Others:

- i. Specific comment 13 of first stage: "L34-37: Please justify these statements.", reply: "We regard the reference to the MLS data quality document to be sufficient for this purpose." It would be very easy to briefly mention the reasons why the use of lower levels are not recommended; a paper should be as self-sufficient as possible on these aspects, especially when referencing a technical document. Please expand.
- ii. Specific comment 14: "L40-41: "this is about. . .value": Where are these values (zonal mean; daily maximum) taken from?", reply

“From the MLS data at times outside of the event. We have made the wording of this sentence even more explicit.” If I understand well, the “more explicit wording” is the following: “for this latitude band, for times immediately before the PNE”. This is not explicit at all, in my opinion. Please specify this reference period, please.

- iii. L130: “some results are shown in Khaykin et al., 2020”: I don’t see how a sentence of this type, “some results” can be part of a scientific paper. Which results? During the first review stage I pointed at, and I still do at the second stage, the superficial writing style in this manuscript, which is well represented by this example. I strongly suggest the Authors to look through the manuscript for the many points where this kind of lack of precision and details occurs. A detailed revision of this point is surely well beyond the scopes of a Referee.
- iv. Specific comment 22: it is acceptable to cite open-source softwares these days but this is a scientific paper so, besides citing the `nlm()` function and R, please briefly explain how the errors are calculated.