Atmospheric
Chemistry
and Physics
Discussions

Open Access

ACPD

Interactive
comment

Interactive comment on "Stratospheric pollution from Canadian forest fires" *by* Hugh C. Pumphrey et al.

Pasquale Sellitto (Referee)

pasquale.sellitto@lisa.ipsl.fr

Received and published: 2 November 2020

The manuscript "Stratospheric pollution from Canadian forest fires" shows satellite (basically with the MLS sensor) observations of different gaseous pollutants in the smoke plume derived from the well-studied Canadian wildfire event in 2017, as well as some complementary studies with back-trajectories to determine the specific plume source at the surface. This work looks like a complement to the previous paper by Yu et al., 2019. The topic is with no doubt of interest for the ACP readers. While I see some potential in this manuscript, I cannot recommend its publication in the present form due to the following major and specific issues:

Major comments:

1)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.

2) 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 discussion 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.

Details on these major comments and more specific comments are given in the following:

1) Title: The title looks like a bit too general. "Pollution" with respect to what? With which tools? Please be more specific.

2) Abstract: I feel that the Abstract is totally inadequate to represent concisely the overall scopes of the study and the results. Please rewrite it in a more extended way so to include scopes and results of the manuscript.

3) Introduction: The section called "Introduction" is not nearly sufficient to introduce the present work. This must be significantly widened to frame the present study in its general context. Examples (not exhaustive): Why we study fires? What are their impacts on the atmosphere (perturbations with respect to background conditions)? How we study fires? What we know about British Columbia fires so far? Please extend significantly the Introduction so that this section is a real "Introduction" to the present work.

4) L10-11: "On 12August...(215 hPa)": Please add a reference.

5) L11: "The fires are described in some detail...": What do you mean with "some" detail?

6) L12-14: ''The polluted airmass...(26 hPa)'': All this is described by Peterson et al.? Please clarify.

7) L16-17: In Khaykin et al. there is a very detailed description of the event, so please develop what you mean with "the global evolution of the plume".

8) L16: Just a suggestion but "LiDAR" is an acronym (I prefer "LiDAR" rather than "lidar").

9) Introduction: About the BC fire plume dispersion, the Authors are missing here an important reference about the larger scale dispersion of the plume: Kloss, C., Berthet, G., Sellitto, P., Ploeger, F., Bucci, S., Khaykin, S., Jégou, F., Taha, G., Thomason, L. W., Barret, B., Le Flochmoen, E., von Hobe, M., Bossolasco, A., Bègue, N., and Legras, B.: Transport of the 2017 Canadian wildfire plume to the tropics via the Asian monsoon circulation, Atmos. Chem. Phys., 19, 13547–13567, https://doi.org/10.5194/acp-19-13547-2019, 2019. Please add the reference and a discussion, in particular in terms of the larger scale dispersion of the BC fires plume.

10) Introduction: A detailed description of: a. the results of Yu et al., 2019; b. what is new in the present work, with respect to Yu et al., and worth publication is required in the Introduction.

11) Sect. 3: A general section title "Results" (joining "Observations", "Trajectories" etc) seems necessary here

12) L34: "recommended": Recommended by whom?

13) L34-37: Please justify these statements.

14) L40-41: "this is about...value": Where are these values (zonal mean; daily maximum) taken from?

15) Fig. 1: Please put units next to the colorbar

16) L55-56: "...and the other returning westwards across the Atlantic at about 33 N.": this is probably linked to the Asian Monsoon anticyclone circulation - see Kloss et al., 2019, mentioned in a previous comment, please add discussion.

17) Fig. 5: "PNE" not visible in panel a. Also, please put more human-readable dates in the xaxis.

18) L69 and Fig. 5: Where is the annual sinusoid? I see only a semiannual one. Please be more precise in the text about periods for the fitting sinusoids.

19) L69: "99": why exactly 99?

20) L70-71: I find the sentence a bit clumsy ("...after...after..."). Please rephrase.

21) L73: "...the injected mass..."–>"...the estimated the injected mass..."

22) L74: The nlm() function in R might be not known by many people. Please explain how the errors are calculated.

23) L80-81: Please mention these estimates. This might be given as a table and briefly discussed, like a "sensitivity analysis".

24) L85: Please mention year/month for the "Black Saturday event". Please state clearly how much water vapour was released during this event, so that it is comparable with the present study.

25) Fig. 9: It would be informative to also show the MLS observations locations (starting points of back-trajectories).

26) L153: "They attribute these anomalies to rapid ascent of tropospheric air": This is also discussed by Khaykin et al., 2020 (https://www.nature.com/articles/s43247-020-00022-5), which don't exclude that part of the ozone depletion in the fire plumes are linked to chemical processes, in addition to dynamical/vertical transport processes.

From my perspective, I don't see how a chemical component can be excluded, e.g. due to the heterogeneous chemistry linked to high aerosol content in the plume, or a radiative component, due to the strong absorption of solar radiation in the plume. Please add the reference and mention this aspect in the text.

27) Fig. 11: What are the values mentioned for MLS (0.15, 0.3, 0.8)?

28) All section 4.2 is very unclear to me. The assumptions, methodology and results are all very confusing. Assumptions are generally not justified and looks like quite arbitrary (as also mentioned by the Authors); the methodology is discussed in 1 line and not sufficient at all to understand and replicate the experiment; results (fig. 12) is very unclear or maybe it is just not well explained in the caption and text (where are "the small points"? what about the "colour according to time", e.g. which time?).

29) L175 and the "cuboid": This is very vague and imprecise. Please show the cuboid on a map and discuss of the reasons behind your choice(s) and inherent limitations/uncertainties in the results shown in Fig. 11.

30) L181-182: "Some experimentation...in time": This sentence is really really obscure. Please develop/clarify what you mean.

31) L182-185: All choices look here very arbitrary or otherwise not discussed with the sufficient care and details. Please clarify the whole thing.

32) L199-200: "Significant injections...cold front": Please justify this statement or add a reference.

33) L206-207: Please cite Khaykin et al., 2020 (see comment 26). Please discuss this work also in terms of the ascension of black carbon polluted airmasses due to fires emissions (L238-247), which is widely discussed in that paper.

34) L216-218: ''Measurements of aerosols...over Europe": Please add to the discussion the aerosol observations of Kloss et al. 2019 (see comment 9)

35) L246-247: "Once it did reach…PNE": Please justify this sentence

36) Conclusion: same comment as for the Introduction. This has to be significantly widened/rewritten.

37) L256-257: "Whether they will become…be seen": Sentences like this one are so generic that contain basically no information content. Please avoid throughout the text (i.e. be more specific, refer to previous literature, extend, etc).

38) Authors contributions: Who did the work (this is not mentioned in this section)? In addition, please check if only "suggesting many improvements to the text" is sufficient to grant a co-authorship in a scientific paper. This has to be checked with the ACP Editor as it is generally considered a very important ethical issue.

Printer-friendly version

Discussion paper