

## ***Interactive comment on “Smoke-charged vortices in the stratosphere generated by wildfires and their behaviour in both hemispheres: comparing Australia 2020 to Canada 2017” by Hugo Lestrelin et al.***

**Anonymous Referee #3**

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### **General:**

This is an important paper that should be published by ACP after taking into account few points listed below

### **Major comments:**

- My strongest criticism, is related to the explanation how the reanalysis data, like

C1

ERA5 does work (sections 2.2.1 and 2.2.2). A more careful explanations would help to understand better this paper, especially if you assume that not every reader is an expert in the assimilation procedure. Because either ECMWF operational analysis nor the ERA5 reanalysis does assimilate the aerosol observations (the only pure observational evidence from CALIOP) it is difficult to imagine that ECMWF/EAR5 data does contain any smoke-related information at all. However, you show that in the PV/ozone fields (Figure 3/7) there are clear signatures of such smoke clouds. Thus, if these structures are reproduced by the reanalysis, the respective assimilation increments should be small...?

- On the other hand, you also show that the assimilation increments within such structures (Figure 9) are really large. Is it true only within such “undetected clouds”? Maybe a separate figure (like Figure 7) but only for the assimilation increments would also help to follow the cloud? In any case I would recommend to explain better the applied method, especially the apparent contradiction between the “resolved” clouds in ERA5 data and unresolved properties manifesting in the “large” assimilation increments.

### **Minor comments:**

- L103-106  
difficult to understand...please reformulate (see my main point)
- Figure 10  
You mentioned in section 2.2.1 that you do not use the ERA5 PV but calculate your own PV from eq. (1). How do you proceed for the assimilation increments of PV discussed in section 4.2.2