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Atmospheric Measurement Techniques Discussions



# *Interactive comment on* "The 2018 fire season in North America as seen by TROPOMI: aerosol layer height validation and evaluation of model-derived plume heights" *by* Debora Griffin et al.

**Anonymous Referee #3**

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This manuscript presents the first analysis and evaluation of smoke injection heights retrieved from TROPOMI, using fires in North America from June to August 2018. The Authors compare the TROPOMI smoke height retrievals with MISR and CALIOP observations and plume heights derived from the CFFEPS. The manuscript presents results that are of interest to the readers of Atmos Meas Tech and the scientific community overall. As the Authors highlight, TROPOMI offers an additional smoke height plume product with higher spatial and temporal resolution than MISR and CALIOP, and with almost near real time availability. These characteristics are valuable for the modelling community, to forecast air quality impacts and for aviation safety, for example. I have added some comments and notes that will help improve the manuscript; I hope the



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Authors consider them during the revision process.

*Introduction. The discussion about differences between the satellite needs to be clearer. I agree MISR and CALIOP are different instruments and use different methods to retrieve smoke heights. For example, MISR has a swath of 380 km common to all cameras, and global coverage is obtained every 9 days at the Equator and every 2 days at the poles. CALIOP swath is about 70 m wide, not kilometres as state in the manuscript, and this provides a global coverage every 16 days. However, they are at the same time complementary as they observe fires at different times and CALIOP is able to retrieve smoke from optically thinner plumes, whereas MISR offers a larger sample size, near the fire source.

*Page 3-Line 9. The planetary boundary layer tends to be higher later in the afternoon and that may contribute to the difference between MISR and CALIOP smoke heights.

*Page 4- Line 25. I don't understand the TROPOMI quality flag. Does this flag provide an indication of retrieval quality, or is it simple to define if there is a smoke plume retrieved?

*Page 5 Line 31. Why do you consider CALIOP aerosol plumes with polluted dust? The evaluation is for 'smoke' plumes.

*Page 6 Line 5. MODIS can also miss fires under high dense smoke.

*Page 6 Line 5. Do you use all MODIS thermo anomalies pixels or only those pixels with some confidence level that indicate active fire?

*Page 6- GEM-MACH. It is not clear to me what type of smoke injection height scheme CFFEPS uses. A brief description indicating the parameterization and key drivers will really help.

*Page 11 Line 27. Again, CALIOP profiles are selected with smoke and polluted aerosols (aerosols, not dust?).

*Page 12 Line 10. How does your definition of CALIOP smoke height (method 3) differ/compare from Huan et al., (2015) and Gonzalez-Alonso et al. (2019)?

*Page 12 Line 14. How do you define 'thick' and 'thin' plumes? Is it by size or by density?

*There is a Table S1 (Supplementary Materials), but it is not referenced within the manuscript

*The Authors mention the near-real time smoke plume height retrievals, but there is not mention within the text where the TROPOMI smoke height can be downloaded. A refence will be very useful for the readers.

References Gonzalez-Alonso, L., Val Martin, M., and Kahn, R. A.: Biomass-burning smoke heights over the Amazon observed from space, Atmospheric Chemistry and Physics, 19, 1685–1702, https://doi.org/10.5194/acp-19-1685-2019, https://www.atmos-chem-phys.net/19/1685/2019/, 2019.

Huang, J., Guo, J., Wang, F., Liu, Z., Jeong, M.-J., Yu, H., and Zhang, Z.: CALIPSO inferred most probable heights of global dust and smoke layers, J. Geophys. Res.-Atmos., 120, 5085–5100, 2015.

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