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Comment on acp-2021-223

Anonymous Referee #1

Referee comment on "Evaluation and intercomparison of wildfire smoke forecasts from multiple modeling systems for the 2019 Williams Flats fire" by Xinxin Ye et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-223-RC1, 2021

The present study highlights the importance of various physical processes in smoke dispersion from wildfire biomass burning. The manuscript is clearly structured, it is well written and presents important analysis regarding the comparison between twelve state-of-the-art atmospheric models during a specific case study in US. Overall, it will be a very useful addition to current literature, and I suggest publication with a few minor comments as shown below:

- It is clear from this work that there is still significant lack of knowledge regarding several processes like the quantification of fire emissions and their diurnal cycles, plume injection heights, calculation of AOD and PM2.5, the spatiotemporal representation of smoke plumes in forecasting models etc... However, this is something more-or-less known due to the complexity of the mechanisms involved in these events. Since none of the models managed to provide a realistic description of the case study, the study remains somehow non-conclusive. It might be useful to elaborate more in the conclusions section and provide more physical interpretation on the reported differences between the models as well as some quantification on which of the analyzed parameterizations are more important for similar studies (e.g. plume rise, FRP emissions, etc.). This could help future studies to focus on improving certain model features and discard those that look problematic.
- The computation of modeled smoke AOD in Section 3.2.2 should be further explained with regards to the optical properties of smoke used in each model.
- At several places (e.g. Lines 89-94, 414-419, 607-610) the authors discuss the importance of including the diurnal variation of smoke emissions inside the forecasting window and the possibility to incorporate data from geostationary satellites. A similar system is available in Europe adopting a modeling strategy of hourly-sequential warm start runs with FLEXPART-WRF, driven by METEOSAT geostationary observations (Solomos et al., 2015, 2019). In this approach, the emissions are updated every hour from the MSG/SEVIRI detections, and each simulation is initialized with the smoke from the previous run (warm start). This provides an efficient way of removing the minor or extinguished fires from the simulation and at the same time to enhance the emissions from the actual burning fires, thus representing the diurnal cycle of biomass burning.

Solomos, S., V. Amiridis, P. Zanis, E. Gerasopoulos, F.I. Sofiou, T. Herekakis, J. Brioude, A. Stohl, R.A. Kahn, C. Kontoes, Smoke dispersion modeling over complex terrain using high resolution meteorological data and satellite observations – The FireHub platform, Atmospheric Environment, Volume 119, October 2015, Pages 348–361, doi:10.1016/j.atmosenv.2015.08.066, 2015

Solomos S., A. Gialitaki, E. Marinou, E. Proestakis, V. Amiridis, Holger Baars, Mika Compula, Albert Ansmann, Modeling and remote sensing of an indirect Pyro-Cb formation and biomass transport from Portugal wildfires towards Europe, Atmospheric Environment, https://doi.org/10.1016/j.atmosenv.2019.03.009 , 2019

4. Line 320 typo “biome maps”