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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Insights into the aging of biomass burning aerosol from satellite observations and 3D atmospheric modeling: Evolution of the aerosol optical properties in Siberian wildfire plumes" *by* Igor B. Konovalov et al.

Anonymous Referee #3

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This paper uses satellite retrievals of OMI AAOD, OMI SSA, MODIS AOD and IASI CO and the CHIMERE CTM to understand the aerosol evolution of a large smoke plume transported from Siberia to European Russia during July 2016, focusing on the different contributions of BC, BrC, POA and SOA. The motivation, methods and data are described with a high amount of detail. The model adjustment process for the VBS scheme in particular is described transparently and precisely. There is an interesting diagnosis of the contributions of POA and SOAs to AOD, and helpful sensitivity tests to

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Discussion paper

understand the importance of different contributing processes (e.g. wrt lensing effects, role of BC) to aerosol enhancement. The big picture interpretation of OA enhancement is nicely summarized (P27L14). Overall, this is a focused and very well-written paper.

My only main question was about model/satellite data harmonization. At P17L9, the approach to harmonize the model and satellite data, in terms of temporal and spatial sampling is described in detail. One important aspect, which I did not see described: as part of the satellite/model harmonization, how was the model data filtered for retrieval quality, by which, masking out of retrievals under cloudy conditions is meant? At P5L23, the predominantly cloudless conditions during this period are mentioned, but a quick inspection of the MODIS true color imagery and retrieved AOD show a mix of cloudy and clear sky conditions during the second half of July 2016. Under cloudy conditions, much of the AOD is masked out, as is the case for the OMI AOD and AAOD retrievals (for L3, at least, and presumably for many of the L2 pixels and individual CO retrievals). Is CTM filtered accordingly to not introduce a discrepancy due to the inclusion of simulated data under cloudy conditions where the retrievals fail? This could even be as basic as an ad-hoc threshold of cloud fraction or cloud optical depth, depending on what is available, so that the CTM data are 'biased' toward clear sky conditions in the same way as the satellite data. Or are the CTM cloud fields in sufficient enough agreement with those seen by the satellites that the retrieval co-location sampling handles this?

Minor comments P1L12: In the abstract, consider a basic description of importance of how the VBS scheme improved agreement between the model and satellite data (i.e. in Fig 4 b,d). This point is worth mentioning.

P21L6: In Figure 2b and 2d, I would suggest that the AOD scale range from, say, 0-2, to get a better sense of the AOD enhancement over the receptor region centered on Moscow.

P21L9: by correlation, do you mean spatial pattern correlation or something else?

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Minor editorial point throughout: use the word ‘rather’ fewer times.

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