

Interactive comment on “Assessment of Regional Aerosol Radiative Effects under SWAAMI Campaign – Part 1: Quality-enhanced Estimation of Columnar Aerosol Extinction and Absorption Over the Indian Subcontinent” by Harshavardhana Sunil Pathak et al.

Anonymous Referee #2

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Review on ‘Assessment of Regional Aerosol Radiative Effects under SWAAMI Campaign – PART 1: Quality-enhanced Estimation of Columnar Aerosol Extinction and Absorption Over the Indian Subcontinent’ by Harshavardhana Sunil Pathak et al., (ACP-2019-153)

This manuscript presents the construction of quality enhanced aerosol optical depth (AOD) and absorption aerosol optical depth (AAOD) while suitably assimilating the ob-

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servations from the ground based network (ARFINET and AERONET) and satellite (MODIS, MSIR, Kalpana-1, INSAT-3A, OMI) derived products. As rightly mentioned, ground based observations are more accurate and have good temporal sampling, though spatial coverage is poor than their counter parts (satellite measurements). Authors have taken full advantage of their (ground based and space borne) respective limitations and could able to produce more accurate gridded observations by suitably merging various data sets. Final products obtained through assimilation have been further validated with independent observations and could notice improved correlations, particularly in AODs. Finally, aerosol properties in different months representing contrasting seasons (winter and summer) has been presented in this part of the manuscript while leaving detailed results and discussion in part 2.

In general, results presented in this manuscript are unique which are first of its kind and authors made nice compilation of different data sets over Indian region where temporal and spatial heterogeneity of aerosol properties are large when compared to the rest of the world.

In general, paper is well written and will be interest to the researchers working in the aerosol field and very apt for publishing in ACP. However, there are few issues and sometimes interpretation is missing at some instances which demands careful editing or re-writing. Below are the some of the issues which authors may consider while revising the manuscript. Authors are strongly encouraged to revise and re-submit this manuscript.

Specific major comments/suggestions:

1. Page 8: Line 3. It was mentioned that PBL height is used from MERRA-2 and it has been validated previously by Sathyanadh et al. (2017). Though Sathyanadh et al. (2017) mentioned that good correlation between 0.74-0.83 is seen when MERRA-2 PBLH when compared with radiosonde and radio occultation (done for very few stations that too for one year 2011 only), our experience is that it underestimates heavily

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the PBLH. Since this is the one of important parameter while calculating AAOD, it is suggested to show detailed comparison of MERRA-2 with existing IMD radiosonde derived PBL heights or GPS RO measurements for the said period 2008-2016. A figure showing the PBL altitudes for the respective stations will be highly useful while interpreting the results particularly the AAODs.

2. Validation with independent measurements of AAOD: I am surprised to very poor correlations in AAOD shown in Figure 3. Since correlations are poor, how to trust the data for further applications. Perhaps need to be re-checked while using actual PBL heights.

3. I suggest adding another panel in Figures 4-5 showing the difference between SR AOD and MG AOD along with dAOD. I do not understand why the difference is not shown throughout the Indian region similar to that shown for dAAOD in Figures 6-7.

4. In the abstract it is listed as 44 stations for AOD and 32 stations for AAOD. However, I am unable to see them in the list of stations provided in the supplementary information.

Minor comments/suggestions:

1. Page 2: Line 21: remove repeated word 'have'

2. Figure 1: dot size used in this figure is too small to recognize different colors. Size should increase up to 3-4 times similar to that shown in Figures 4-7.

3. I suggest moving Figure 9 to supplementary information as the regional coordinates are already mentioned in Table 1. This figure is not adding much.

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