

# ***Interactive comment on “Large contrast in the vertical distribution of aerosol optical properties and radiative effects across the Indo-Gangetic Plain during SWAAMI-RAWEX campaign” by Aditya Vaishya et al.***

**Anonymous Referee #1**

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The paper reports aircraft measurements of aerosol optical properties collected in three locations in the Indo-Gangetic plain, just prior to the onset of the Indian summer monsoon. The authors report also on the results of radiative forcing and heating rates calculations. They conclude that the knowledge of the vertical distribution of the aerosol optical properties is key to perform accurate calculations. The dataset is surely interesting, and the paper is overall clearly written. I believe this work can be important to the community and should be published after addressing a few issues that I will discuss next.

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**GENERAL COMMENTS** The main issue with this analysis is a lack of careful discussion of the uncertainties associated with the different quantities presented. Such uncertainties can affect how the data are interpreted and especially how strong the conclusions might be. Therefore, before publication, the authors should discuss and include an analysis of the uncertainties to account for random as well as systematic errors (for example, the corrections applied to the aethalometer data are mentioned, but uncertainties associated with those methods and parameters are not included nor discussed). Some specific cases are discussed in the next section. Although, of minor importance from a scientific point of view, the authors should consider revising the use of the articles “the” and “a” in the manuscript, sometimes misused, but especially, often missing. Also, the use of some preposition and the punctuation could be improved.

**SPECIFIC COMMENTS** Page 6, lines 23-34: “Data points at a particular level lying outside two-sigma values of the level average were also removed.” The rationale behind this data filtering choice needs to be provided. It is not clear how such data manipulation might bias the averages. Page 6, lines 25: “...aircraft has...” maybe should be “...aircraft had...” Page 6, lines 25: comma after “This way”? Page 7, lines 2: “...data was extracted when...” what do the authors mean by “extracted”? Do they mean removed? Or something else? Please clarify. Page 11, lines 18: What wavelength was used and why this specific mass absorption cross-section? Please clarify. Even more importantly, and related to the general comment above, what is the uncertainty associated with the use of this specific mac? There is a wide range of mac values published in the literature, even for a specific given wavelength and even for laboratory generated aerosols; therefore, this certainly introduces a significant uncertainty in the aerosol absorption and SSA, and will propagate into derived forcings and heating rates. Page 11, lines 23: The choice of the factor value of 1.57 needs some discussion. In addition, certainly, some rather large uncertainty is associated with this parameter; that should be discussed and should be accounted for while discussing the significance of differences between different layers (these values could easily change even in the same region) and especially when comparing with other results published in the liter-

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ature that might have used different correction factors, for example. Page 12, lines 7: “aboard” maybe should be “onboard”? Page 14, line 2: Even just from the statistical error bars presented in the graph (meaning even ignoring the other potential sources of error discussed above), the increase in absorption coefficient seems hardly significant in a statistical sense. Table 2: As mentioned, in the table, the authors should add other uncertainties (e.g., instrument accuracies and precisions etc...) Page 16, lines 8-11: Specific to the interpretation of the aethalometer Ångström exponent, the authors might be interested in the paper by Fialho, P., Freitas, M. C., Barata, F., Vieira, B., Hansen, a. D. a., & Honrath, R. E. (2006). The Aethalometer calibration and determination of iron concentration in dust aerosols. *Journal of Aerosol Science*, 37(11), 1497–1506. <https://doi.org/10.1016/j.jaerosci.2006.03.002> Page 16, line 21: “... reveals the gradual transformation of aerosol...” the term “transformation” might be misinterpreted as the aging of an aerosol, but I believe the authors mean something different. Consider using a different term or clarifying. Page 19, line 25: Is the “reduction” statistically significant? See similar comments above. Page 20, line 4: “This clearly points...” The conclusion seems quite reasonable here, but I am not sure the data strongly (“clearly”) support this point because of the large standard errors that make several of the changes hardly significant. Maybe using terminology such as “...suggest” or “...data are compatible with...” might be more appropriate. Figure 6 requires error bars. Page 24, line 13: “This, they concluded was...” consider adding a comma before was. Figure 7 would greatly benefit from error bands. Page 28, line 9: The acronyms TOA and SUR were defined already just a couple of lines above. Figure 8 requires error bars. Page 31, line 21-23: Such comparison needs an uncertainty estimate and the discussion needs to be put in the context of the uncertainties. See previous comments. Figure 9 requires error bars. Page 33, line 3: Consider revising the sentence “Analysis of a decadal (2001-2010) aerosol data...” to “Analysis of decadal (2001-2010) aerosol data...” or “Analysis of a decadal (2001-2010) aerosol dataset...”. In the same sentence, “AERONET station” is this a specific station? If so, please provide the location. Or are they several “stations” Page 33, line 6: “of” in front of “1.5 km”? Also, consider

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adding a comma after “above” and before “there”. Page 33, line 8: Are these “2 to 3 C” or “2 to 3 C/d”? Also, consider using consistent units (meaning K instead of C) Page 34, line 3: “...both extrinsic and intrinsic...” what does that mean? Do the authors mean “...both intensive and extensive...” or something else? Page 34, line 14: The term “significant” should probably be used exclusively with a statistical meaning; so, is this “reduction” indeed significant from a statistical point of view? Or not? See also comments above. Page 34, line 22: the verb "become" seems to imply a transformation of the aerosol over time, while here I think the different sources and transport patterns might be more dominant? Page 35, line 5: see the previous comment on the use of “significantly” Page 35, line 10: “occurs” should be “occur”; also, “....implications to...” or “....implications for...”?

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