

Interactive comment on “Scattering and absorption properties of near-surface aerosol over Gangetic–Himalayan region: the role of boundary layer dynamics and long-range transport” by U. C. Dumka et al.

Anonymous Referee #1

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Review of “Scattering and absorption properties of near-surface aerosol over Gangetic–Himalayan region: the role of boundary layer dynamics and long-range transport” by Dumka et al. Manuscript number: acp-2014-521.

The manuscript presents the results from approximately 1 year of aerosol measurements performed during the GVAX campaign at Nainital. Measurements include aerosol scattering and absorption for particles below 1 μm and 10 μm in diameter.

The paper needs major revisions before it can be published in ACP.

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The main issue with this manuscript is that some of the results were already presented in a recent paper published by Dumka and Kaskaoutis (2014). In the Abstract the authors write that “The present study examines the temporal (monthly, seasonal) evolution of scattering and absorption coefficients, their wavelength dependence. . .”. This was already presented in Dumka and Kaskaoutis (2014) together with the analysis of the scattering Angstrom exponent.

Thus, given the length of the manuscript, I suggest resuming in the Introduction the previously published results (obtained using the same database), shortening the present manuscript and avoiding repetitions. For example, the important differences between D1 and D10 optical properties at Nainital, as well as the effect of meteorology (monsoon vs. post-monsoon seasons) on aerosol extensive optical properties, were already presented in Dumka and Kaskaoutis (2014). Once the main findings from published articles are presented, the authors can better organize the manuscript presenting new results (which include analysis of AAE, backscatter, submicron scattering and absorption fractions) and avoiding repetitions.

The Introduction should resume the main findings from previous studies. For example (Pag. 21104, Lines 1-7) the main results from Panwar et al. (2013), Komppula et al. (2009) and Neitola et al. (2011) should be discussed in the Introduction.

The Abstract should be rewritten and it should present the novelty of this manuscript. As such, the Abstract only presents a list of measurements/analyses performed (some of these already presented in Dumka and Kaskaoutis (2014)).

The second issue, which has been not yet addressed by the authors, is related with the comparison of optical properties (both extensive and intensive) measured at Nainital with those measured at other mountain top sites worldwide. This will improve the scientific quality of the manuscript. To my opinion this is very important given the peculiar characteristics of aerosols in the Gangetic–Himalayan region in terms of scattering and absorption.

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Another issue is related with in-cloud data. I have understood that “handling such data is outside the scope of the present study”, but it would be useful to know how (and if) authors detected and removed the in-cloud data from the database.

Moreover, Table 1 shows the set of optical parameters derived during the GVAX campaign. Some of these (i.e.: up-scatter fraction, asymmetry parameter and hygroscopic growth factor) were presented in Table 1 but not discussed in the present manuscript. The backscatter Angstrom exponent is highlighted in Table 1 but not presented in the manuscript. Among the intensive aerosol optical properties available from the GVAX campaign, the SSA and scattering Angstrom exponents were already presented in Dumka and Kaskaoutis (2014), the scattering Angstrom exponent (with a few more details), absorption Angstrom exponent and hemispheric backscatter fraction were presented in this manuscript. The asymmetry parameter and hygroscopic growth factor are two important parameters derived from the GVAX campaign but not presented here. What are the reasons for this exclusion? To my opinion, adding these results will considerably improve the scientific quality of the present work. The authors could remove Figure 11 and 12 (which do not add relevant additional information compared to what already discussed in the manuscript) leaving space for additional results.

Moreover, it would be nice to know if the aerosol absorption at Nainital shows any trend given that absorption measurements are available since 2004 at this site (See Table 2 of this manuscript).

Another issue is related with Paragraph 3.2.2. The SAE measured at ground is higher during Monsoon and lower during post-Monsoon season. The former was related to the removal of aerosol accumulation mode by the rain, the latter was an indication of abundance of aged aerosols at the site. As stated by the authors these results deviate from those obtained using columnar data (Guleria et al., 2011; Dumka et al., 2008; Srivastava et al., 2012) showing lower columnar Angstrom exponent during pre-monsoon and monsoon, due to the influence of dust, and larger columnar SAE during post-Monsoon season, due to the dominance of anthropogenic aerosols and biomass

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burning. However, this difference between ground and columnar SAE is not as evident looking at Figure 7a in Dumka and Kaskaoutis (2014) where the seasonal evolution of columnar SAE and ground PM1 SAE during GVAX seems to agree quite well. What's the reason for this? Is this due to different periods analyzed in these different papers? How many dust episodes were detected during the study period reported in this manuscript? How much the seasonal evolution of the PBL is affecting the intensive aerosol optical properties measured at ground compared to the columnar ones?

The last issue is related with the effect of LRT and PBL on the measurements presented in this manuscript. LRT and PBL effects are highlighted in the title and abstract. However, only a small section (Paragraph 3.4) is dedicated to these issues. This part should be improved for example adding some cluster analysis using backtrajectory analysis and not only using wind data.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 21101, 2014.

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