Atmos. Chem. Phys. Discuss., 14, C8985–C8990, 2014
www.atmos-chem-phys-discuss.net/14/C8985/2014/

Atmospheric Chemistry and Physics Discussions

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.

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Received and published: 10 November 2014

Authors: The authors of the manuscript acknowledge the reviewer for carefully reading the original manuscript and providing the constructive comments. A point-by-point response to all the comments follows.

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 deals with a topic appropriate for ACP presenting the analyses of aerosol optical properties gathered during an experimental campaign in the Gangetic-Himalayan region. Although the study period roughly covers a complete annual seasonal cycle, the variety of variables potentially available for the study makes it really worthy. Bellow there are general and particular comments to help the authors in improving their manuscript. According to these comments, I consider that the manuscript requires substantial revision before to be accepted for publication in ACP.

Authors: We are grateful to the reviewer for his/her valuable and to-the-point comments that helped us in improving the scientific quality of the paper. We took the whole comments into consideration. Before our specific responses, we may mention here that the whole manuscript has been edited and revised substantially from the beginning, avoiding some repetitions and removing figures of lower importance (also following the suggestions of Reviewer A), like Figs. 3, 6, 11 and 12 of the original version. This gives us the possibility of extra analysis and presentation of two new figures (Figs. 8 and 10 in the revised version), highlighting the importance of the boundary-layer height and source of long-range aerosol transport as stated in the title.

General comment The experimental data set is really interesting, but the study will benefit from amore exhaustive analysis of some aspects like the PBL study or the use of additional data described in table 1 but excluded from the present study, like the hygroscopic growth information. Furthermore, as reviewer #1 states the authors must clearly distinguish the outreach of the present manuscript from the previous one Dumka and Kaskaoutis (2014) where some analyses of the same data set were presented.

Authors: As stated above, we included two new figures in the revised manuscript for the PBL height and long-range transport (CWT analysis). The current manuscript is considerably long and does not allow us to include comprehensive analysis of the hygroscopic growth factor, etc. The hygroscopic growth factor is under collaborative analysis with another scientific team, and its results are expected to be released soon. Thus, that analysis cannot be included in the current work. In the Introduction section,

ACPD
14, C8985–C8990, 2014

we clearly stated the results by Dumka and Kaskaoutis (2014) and clearly separated them from the current analysis. Note that the temporal variation of the scattering and absorption coefficients is very briefly discussed in the current work, since it was covered in our previous paper.

It is worthy to note that along the text there is some confusion on the interpretation of the separation of data measured with PM10 and PM1 cut-off. It seems that the authors consider data measured with these two cut-offs as completely separated categories, while in fact the larger cut-off allows measuring the effects of micron and submicron particles at the same time. An effective characterization of micron and submicron particles could be only got by subtraction of the PM10 and PM1 associated variables.

Authors: Authors agree with the Reviewer. The properties of the D10μm aerosols also contain those of D1μm, but the influence of the super-micron aerosols seems to be larger. This has been brought out in the revised manuscript. However, during the whole discussion, we made a clear separation between the properties of D10μm and D1μm particles in order to avoid any confusion on the interpretation of the results.

Particular comments Along the manuscript the authors use the term parameter to describe the variables the measure, compute and analyze. They must revise this misuse considering that they measure different variables that characterize the atmospheric aerosol properties. Some of these variables are used in different models, climate models, as parameter of the models and in this use the values are fixed according to a given choice of aerosol type for example. But in this study they determine the experimental values of these properties, so the term variable is the appropriate.

Authors: We agree with the reviewer and we replaced the term “parameter” “variable”.

The treatment of the PBL information is really superficial in the paragraph in page 21118 in spite of the relevance evidenced in the abstract. Details on the source of this information are required together with a more detailed discussion.

ACPD
14, C8985–C8990, 2014

Authors: This part of the manuscript has been substantially revised in view of the inclusion of the new Figure 8. The information of the derived PBL height is also indicated on the figure in the revised manuscript.

Table 1 describes a large number of variables that can be derived from the experimental data set. In this sense, it is clear that the potentiality of the data is not completely exploited by the authors in the manuscript, read my general comment. In my opinion the study will benefit of the analyses of additional variables like the hygroscopic growth factor that will compensate of the limited period of measurements and will contribute to enhance the advances over the previous study on the same experimental campaign (Dumka and Kaskaoutis, 2014). Furthermore, a good number of the variables included in the table are derived from experimental values assuming some empirical relationships that require the inclusion of the appropriate references to track their meaning and relevance.

Authors: It is really impossible to include a comprehensive analysis of all the measured and calculated variables in a single paper. Some of them, like scattering and absorption coefficients, SSA, ARFE have been documented in a previous paper (Dumka and Kaskaoutis, 2014). The analysis of hygroscopic growth factor is in progress and the results will be published in near future. To avoid confusion, we removed from the Table 1 all the parameters that were not analyzed in the current manuscript.

A relevant question concernsthe statistical information. In this sense, by one hand the information included in Box and whisker charts must be explained, see figure 1 and 2, the meanings of the elements in this figure are similar? Why they are described for figure 2 for the first time? On the other hand, along the text when the authors present average values, for example in their description of the meteorology it is necessary additional statistical information offering the reader a complete picture of the variability of each variable.

Authors: The box and whisker charts in Figs. 1 and 2 are similar. Figure 1 has been

ACPD
14, C8985–C8990, 2014

modified and this information is now given in the Figure 1 caption.

Concerning quantitative aspects the authors present a chaotic treatment of the significant figures of the measured variables. When they combine the information on average values and associated standard deviations they sometimes presents different number of decimals or significant figures for then (for example Line 17 page 21112, 1.5+-0.09). In other cases they express the results with an excessive number of significant figures (Line20, page 21110, 75.2+-41.7). They must carefully revise these expressions avoiding the use of more than two significant figures for the standard deviation, as a measure of the spreading of the data. In fact, they must reduce the number of significant figures to only one if the most significant figure is larger than 2. And finally, there must be an agreement between the significant figures used for the average and standard deviation. So the previous example must read 80+-40 (clearly evidencing the large spreading of data around the average value).

Authors: The presentation of the results (values +/- stdev) has been revised in order to attain coincidence between the decimal digits.

Furthermore, the authors must be careful with the uncertainties of the experimental values and those of the derived variables. In this sense for example the description of the Angström exponent for the scattering or absorption coefficients with more than one decimal figure is inappropriate, especially for the absorption coefficient, considering the large uncertainty of the experimental values used in their computations. So in this sense for the example on figure 21112, see about, 1.5+-0.1 would be more appropriate than 1.50+-0.09.

Authors: This issue was also incorporated in the revised version.

Another point that must be carefully revised is the use of duplicated notation for the same variable, for example he authors must revise the notation for SAE and AAE that is not coherent along the text, figures and tables.

ACPD
14, C8985–C8990, 2014

Authors: In the whole manuscript the terms SAE and AAE are used for the scattering and absorbing Angstrom exponents, respectively.

Concerning the figures, by one hand the authors must apply the previous comment on significant figures, but also must revise carefully the inclusion of information on the units used for the different variables, see for example figures 9, 10 and 11.

Authors: Some figures have been revised as suggested.

The last paragraph previous to the conclusions section (Pages 21121 and 21122) is a little bit confusing. In fact the comment is on figure 13 that for me is an example of figure that can be excluded from the analyses. The spread of the data in this figure hardly allows deriving any dependence between the analyzed variables. In this sense, the above mentioned paragraph must be carefully revised or excluded from the analyses.

Authors: Finally, we decided to maintain this figure and to remove the previous 2 (Figs. 11 and 12). Figure 13 shows a rather well-mixing of aerosols over the observational site and this is an important finding that warrants discussion at the end of the manuscript. Overall, this paragraph has been edited and modified in the revised manuscript.

The author must track the typos along the text. An example is the term “isentropic” in line 19, page 21114, they must correct the word otherwise they need to explain the meaning of “isentropic scattering”.

Authors: The term isentropic scattering is explained with parentheses as (homogeneous scattering at all directions).

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