

## ***Interactive comment on “Similarities and differences of aerosol optical properties between southern and northern slopes of the Himalayas” by C. Xu et al.***

**Anonymous Referee #1**

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Review for Atmospheric Chemistry and Physics Discussions

Title: Similarities and differences of aerosol optical properties between southern and northern slopes of the Himalayas

Authors: C. Xu, Y. M. Ma, K. Yang, Z. K. Zhu, J. M. Wang, P.M. Amatya and L. Zhao

General Comments:

This paper presents some information on aerosol optical properties in the Himalayan region that may possibly make a useful contribution to the literature. However the authors have failed to follow the AERONET guidelines for authorship of this paper. The

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paper analyzes data from only three AERONET sites therefore they should have offered co-authorship to the PI's of the sites they did not establish, both Pokhara and EVK2. From the AERONET web page (copied; same for Pokhara): “The public domain data you are about to download are contributed by the International AERONET Federation. Each site has a Principal Investigator(s) (PI), responsible for deployment, maintenance and data collection. The PI has priority use of the data collected at the site. The PI is entitled to be informed of any other use of that site data. The Principal Investigator(s) of 'EVK2-CNR' is(are): Brent Holben. If you intend to use the following data please consult with him/her/them via e-mail(s):brent@aeronet.gsfc.nasa.gov Recommended guidelines for data use and publication: Although journal paper authorship and acknowledgement is the domain of the senior author and no policy is universally applicable, the AERONET contributors ask that every practical attempt be made to honor the following general guidelines. Using AERONET data - Please consult with the PI(s) of the data to be used. Publishing AERONET data from a 'few' sites - Please consider authorship for the PI(s) and/or the following acknowledgement: We thank the (Project/PI) for (its/theirs) effort in establishing and maintaining (site name(s)) sites.”

Another issue that is almost as equally important is that the authors have used both level 1.5 and level 2 AERONET data even though level 1.5 data are of poorer quality. Since the AERONET data are the primary data used in this study it is strongly recommended that only Level 2 data be analyzed to maintain consistent and high data quality throughout the paper.

Additionally it should be noted in the paper that Angstrom Exponent (AE) has large uncertainty at low AOD and also that the AOD (and AE) have some significant cloud contamination in the rainy monsoon season months, thereby decreasing the AE and increasing the AOD. This is particularly significant in the high precipitation (and high cloud fraction) months of June through September. The uncertainty of the AE parameter should be computed by the authors so that it is clear that the AE values at low AOD conditions at EVK2 and QOMS\_CAS sites have very large uncertainty that increase as

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optical air mass decreases, thereby possibly creating erroneous diurnal variations. The authors currently present the data while ignoring these issues.

Figure 3 is one of the most important in the paper yet the large number of small panels makes it very difficult to read. I suggest breaking it up into 2 different figures, the first one for AOD and the second for Fine Mode AOD. More importantly, it is unusual to plot AOD figures with a logarithmic y-axis, and this makes these AOD plots very difficult to interpret. All other Figures in the paper have linear y-axis scales and are therefore much easier to interpret. I strongly suggest plotting the AOD data with linear y-axis and also removing the 99% and 1% values in the plots (these can be listed in a table if you feel they are valuable).

Specific Comments:

Page 20966, lines 20-21: This sentence is awkward, and does not specify whether the uncertainty you are discussing refers to the retrieval parameters or to the AOD.

Page 20968, lines 9-11: Please specify that the fine mode AOD you are utilizing is from the Dubovik retrievals and that the radius cutoff for fine versus coarse is defined as the minimum between the two modes for each individual almucantar retrieval, and that this cutoff radius varies from 0.44 to 0.99 microns radius.

Page 20968, line 26: ' $<0.44$ ' should be ' $< 0.40$ '

Page 20969 lines 3-7: The English here is awkward and confusing. Additionally it would be much better to use the Spectral Deconvolution Algorithm (SDA; also available from the AERONET web page) retrievals of fine and coarse mode AOD rather than the Dubovik retrievals since these are made for every AOD measurement rather than only a few times per day.

Page 20969 lines 10: Do you mean 'all hourly average observations in a day' here?

Page 20969 lines 27: Please replace 'rare' with 'sparse' here and at all other places in the paper.

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Page 20971 lines 17-18: Please mention here that since AE is low in August and precipitation is high that it is likely that the higher AOD here is partly due to cloud contamination.

Page 20972 line 25: 'shown' should be 'show'

Page 20973 lines 12-16: This sentence does not make much sense since you say seasonal yet are discussing monthly means that are not the seasonal 3-month intervals that were previously defined.

Page 20975 lines 4-5: This sentence does not really make much sense, so please clarify here.

Page 20976 both line 9 and line 24: Please note that ~15 to 20% range in daytime AOD variation is quite significant. By plotting all three sites on one plot the scaling makes it difficult to see the diurnal AOD trends in the sites with the lower ranges.

Page 20976, Section 3.3.2: Please make sure that you have enough observations at hour 18 to be representative versus the other hours of the day.

Page 20977, Lines 12-17: Please give the % diurnal range for the Pokhara site, similar as you did for the EVK2 site in the previous paragraph.

Page 20977, Lines 18: Make sure that you have enough observations at hour 18 to be representative versus the other hours of the day.

Page 20977, Lines 27-28: The diurnal pattern of AE at QOMS\_CAS could be due to greater uncertainty in AE at smaller solar zenith angles (minimum SZA at solar noon).

Page 20978 lines 9-12: Please put these ranges of AE into the context of the computed uncertainty in AE, see Hamonou et al. (1999) and Kato et al. (2000) both in JGR for equations to compute uncertainties for both AOD and AE.

Page 20979 lines 9-10 & lines 14-15: Please explain the physical mechanism that results in wet deposition selectively removing more fine versus coarse mode particles

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(or vice versa) and give references for this.

Page 20980 lines 15-17: Note that AE is much more sensitive to small errors especially at low AOD values, therefore this large diurnal pattern of AE may be an artifact of large uncertainty that is air mass (solar zenith angle) dependent.

Page 20980 lines 28-29: You need to provide a reference that supports your claim that the particle size is much smaller in the free troposphere than the surface layer in this region. Also define the altitude ranges in km for both layers.

Page 20981 lines 7-8: Give references to support your statement that the aerosol load in the upper atmosphere is similar to the lower atmosphere in this region and define upper and lower atmosphere altitudes in kilometers.

Page 20981 lines 19-23: Again, what is the source of your information on vertical distributions and dynamics here? Please provide references.

Page 20983 lines 14-15: I am not convinced that rainfall selectively removes more large particles (dust) than fine mode particles. You did not present any references or physical mechanism that support this. Also your AE data shows lower values in the rainy months which suggests the opposite, or alternatively that cloud contamination lowers the measured AE.

Page 20984 lines 4-5 and lines 11-13: There is too much speculation in the conclusions section. There are no data on vertical profiles of aerosol presented in this paper to support these statements.

Page 20984 lines 17-19: How did you deduce that the aerosol load in the upper and lower atmosphere were comparable? There was no data presented on vertical aerosol distribution, such as from lidar measurements. Therefore this statement is very inappropriate for the conclusions section.

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Interactive comment on Atmos. Chem. Phys. Discuss., 13, 20961, 2013.

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