

**“Sunphotometry of the 2006–2007 aerosol optical/radiative properties at the Himalayan Nepal Climate Observatory – Pyramid (5079 m a.s.l.)”
by G. P. Gobbi et al.**

Authors Reply to the Referees (AR, in blue)

Anonymous Referee #1

General comments: This is a piece of good work of high mountain measurements of aerosol loading through sun-sky photometry. Such measurements are useful for understanding the climate effect of aerosols of global and regional scales, especially that of high mountain region including the effect to the glacier system. The paper can be published with minor changes as suggested below.

Specific comments:

p1195 L3: Not only OC but also sulfate aerosol is important.

AR: The relevant sentence in the manuscript reads: ‘Light absorption by aerosols is mainly due to the black carbon (BC) and organic particulate produced by the combustion of fossil fuels or biomasses’. We do not mention ‘sulfate’ in this case since it does not contribute to the absorption portion of the aerosol extinction but essentially to the scattering one.

p1196: Mentioning the high ground surface albedo is good.

AR: If we understand correctly the Referee is addressing the following sentence: ‘This threshold rises to SSA ~ 0.95 (i.e., most of anthropogenic and mineral aerosols) over the highly-reflecting surfaces of snow and/or deserts (e.g., Haywood and Boucher, 2000)’. We can modify it as ‘This threshold rises to SSA ~ 0.95 (i.e., most of anthropogenic and mineral aerosols) over the highly-reflecting surfaces of snow and/or deserts (surface albedo > 0.5) (e.g., Haywood and Boucher, 2000)’.

General comment for the analysis: Are results meaningful for such small number of data during August-September period? This point should be discussed a little bit in terms of variability of data. Especially the seasonal change in the SSA looks difficult to discuss with such small data sets in the summer season. See the comment for Fig. 6 below.

AR: Although the number of data in August–September is reduced with respect to the other periods (see Fig. 3), we believe it is sufficient to obtain reliable results for the AOD statistics. In fact, the variability of AOD data is shown in Figure 4, where the (median) AOD statistics is reported together with the associated 25th–75th percentile range. In August-September such variability does not increase with respect to other periods, indicating consistency of the dataset.

Nevertheless, the Referee objection for the SSA statistics is certainly pertinent. In this respect, the SSA plot in figure 6 represents exactly the days of measurements we had, i.e., very little in the period June-November. We shall insert a sentence underlying the scarcity of inversion (SSA) data over most of the year, therefore the impossibility of determining a real statistics of SSA.

We believe, however, it is useful to give some description of the retrieved SSA. In this respect, we address both the probable errors in the inversions leading to very low SSA (page 11, line 13), while

stating (page 11, line 18) that the rather low values of the SSA observed in April and May in the presence of high Angstrom coefficients (i.e., in the absence of coarse particles) are likely to be real. We believe the latter is a rather interesting result to report since it is directly related to the biomass burning season.

Fig. 4: Vertical axis does not show the title.

AR: The Referee is right, Figure 4 will be corrected.

Fig. 4: It is interesting to find the negative-correlation between coarse particle AOD and precipitable water in Fig. 4. Usually the positive correlation is found in other parts of globe.

AR: This is attributed to rainout effects (page 9, line 18). We agree this point should be evidenced in the revised manuscript.

Fig. 6: It is difficult to find a reason for such small SSA less than 0.4 at EV-K2. SSA cannot be smaller than 0.5, i.e., large-particle limits, with dominant coarse particles shown in Fig. 4. Such small SSA can be only possible when very small particles are dominant. This looks not consistent with Fig. 4 results. The number of data is very small in the summer time as commented above, and the retrieval looks not reliable. Please discuss this issue.

AR: In this respect, we write in the manuscript (page 11, line 13) that SSA at Ev-K2-CNR decreases *‘to unrealistically low values at the onset of the monsoon until the winter season. As guessed before, such a behaviour can be explained by the presence of “giant” (over 20 μm) particles the inversion algorithm is unable to reproduce, then attributing the relevant extinction to absorption processes (Oleg Dubovik, personal communication, 2009)‘*. We believe this is the correct interpretation (and warning to the reader) for such evidently wrong retrievals. Note that we did not remove such low values from the dataset on purpose, since these indirectly provide a further evidence of the cirrus contamination of the aerosol dataset.

Conclusion: low fine particle SSA less than 0.9 is a good finding, but I feel there is large uncertainty in the finding if they include the summer time SSA. Please discuss this point.

AR: We actually write (page 14, line 23): *“When retrievable, the SSA of fine mode aerosols resulted to be mostly below the threshold of 0.9”*. Here we did not intend to provide a statistical value but just to confirm what was said at page 11, line 18: that high-Angstrom conditions led mostly to low SSA, i.e., absorbing aerosols. We shall rephrase the sentence to make it more clear by adding this latter point.

CALIOP AOD vs surface measured AOD will be very useful for readers.

The CALIOP lidar AODs have a rather large error bar (at least of the order of 30%). The transects we present were intended to provide a more general, vertically-resolved picture of the aerosol/clouds conditions discussed in the manuscript. Unfortunately, there is no spatio-temporal match between the position of the AERONET sites and the CALIPSO overpasses shown in Figure 7 (up to 200 km distance from NCO-P, as indicated at page 1204, line 18 and mostly nocturnal snapshots). We feel a one-to-one AOD comparison would have limited representativeness.