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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Study of the effect of different type of aerosols on UV-B radiation from measurements during EARLINET" *by* D. S. Balis et al.

**Anonymous Referee #2**

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General comments:

This paper presents results from a combination of recent lidar measurements and UV-B measurements that are used to infer the impact of different types of aerosol on UV-B radiation. An indirect method of determining aerosol single scattering albedo from irradiance and optical depth measurements and a radiative transfer model is applied to a case from LACE98. Three case studies are discussed in terms of the lidar ratio and single scattering albedo. The paper's main hypothesis is that simulataneous knowledge of the lidar ratio and the single scattering albedo can greatly aid identification of aerosol type.

The topic of this paper is relevant to warrant publication in Atmospheric Chemistry and



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Physics. It discusses important ways in which data sources can usefully be combined to produce information about aerosol, and quantifies the impact of aerosol on UV-B radiation. I have some specific concerns regarding some parts of the paper which are outlined in the next section. These mainly concern the choice of, and inferences made from the three case studies. Once these have been addressed or justified by the authors, I recommend this paper be published.

Specific comments:

Section 2.3 Accuracy of single scattering albedo: The authors claim an accuracy of 0.1 for SSA in high aerosol load conditions and 0.2 in low aerosol load conditions. It is worth noting in the paper that a difference of 0.1 in SSA is substantial in terms of the interaction with radiation.

Section 3.2 (Block 4680) The authors point out the times when their results agree with other observations. However, looking at Figure 2a, there are several times when all of their simulations with different SSA are considerably different to the observations. It would be useful if a discussion of this was included. Could it be due to variability of humidity or aerosol profile? The latter is suggested since one of the times that does not agree is 1530, corresponding to an enhanced layer of aerosol in the lowest 1km of the profile in figure 2b.

Section 3.3 (Block 4681) I am a little concerned that although attempts to minimise the time difference between the two sets of observations, a substantial time difference remains in which there appears sufficient time for aerosol properties to change significantly given the results shown in Figure 2.

Could the authors please spell out the physical mechanism by which a decrease in ozone in high aerosol load cases can in fact lead to a decrease in UV radiation?

Section 3.3.1 Case 1. I am unconvinced by the choice of "clean" day for comparison here since the aerosol optical depth is still rather high at only 0.52 compared to 0.55.



**ACPD**

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Perhaps it would be better labelled "dust free" since the aerosol of one type or another remains.

Section 3.3.2. Case 2. The authors point out the fact that the lidar ratio does not take into account the first 800m but this is a crucial point and should in my view come much earlier in the paper as it applies to all 3 case studies although may affect the results in different ways. In addition the trajectories don't really seem to come from a substantially different direction on the two days being compared here. I agree that there is possibly a difference in vertical path of the trajectories.

Section 3.3.3 Case 3. Again the trajectories don't appear to completely distinguish between the different situations.

Figure 8. The source of this diagram needs more explanation as to what relative humidities were used etc.

Conclusions. (Block 4687). The authors correctly emphasize the fact that their method of combining SSA and lidar ratio can help for homogeneous aerosol layers. However, this is rarely the case in reality (as demonstrated in the rest of the paper) and therefore it is my view that this method should only be used with extreme caution until further refinements and rigourous validation are available. In addition, although the authors do mention the problem of column integrated measurements of optical properties of inhomogeneous aerosol profiles I think this would also benefit from more expansion in the discussion.

Minor point: In some places, particularly the introduction, the paper would benefit from careful proof-reading, there are several cases of words being missed out of sentences.

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Interactive comment on Atmos. Chem. Phys. Discuss., 3, 4671, 2003.