

Interactive comment on “Vertical profiles, optical and microphysical properties of Saharan dust layers determined by a ship-borne lidar” by F. Immler and O. Schrems

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We are grateful for the valuable comments made by the referee. He has expressed doubt whether the two layers present during both the dust events reported are composed of different material. We think that our data shows very clearly, that during the Saharan dust events there were two different aerosol layers present. The optical behavior as well as the backtrajectory analysis strongly suggest, that the upper layer is predominantly composed of dust particles, while the lower one consists of marine aerosol. This becomes evident most clearly from the measured depolarization profiles. The low depolarization observed in the PBL is typical for undisturbed marine conditions that have been observed throughout our Polarstern cruise at all the different latitudes. The small peak in the depolarization profile of the second event (Fig.4 b) does in our opinion not affect this conclusion. Such peaks are frequently observed at the top of the

PBL and are attributed to dried sea salt particles emerging at the edge to the very dry air on top of the PBL.

The extinction and optical depth (AOD) of the dust layer was determined directly using the Raman lidar technique. The AOD of the marine aerosol in the boundary layer could not be calculated this way and was estimated using an assumption for the extinction-to-backscatter ratio (lidar ratio). We used a value of 40, which was calculated by Barnaba and Gobbi, 2001 (The citation has been added to the manuscript.) In other publications, one finds other values (e.g. Sasano and Browell, 1989). Thus, the errors in the AOD retrieved this way are quite large. However, it is still save to state that during most of the time, the PBL contributes a large part of the total atmospheric aerosol content. (We have rewritten our text in order to clarify this point).

We did not intent to doubt the great value of photometer measurements for the retrieval of aerosol properties and for routine monitoring purposes. The value of this data has been emphasized in our text. In fact, the retrieval of aerosol properties proposed in our manuscript would not have been possible without the results reported by Dubovik et al. based on the AERONET data. To clarify this point, the sentence in our conclusion referred to by the referee has been rewritten. We intended to point out, that column measurements of the optical depth should be interpreted with care, since there might be cases where two (or more) aerosol layers of about equal strength, but with different optical properties, are laying one on top of the other.

Our remark concerning the ability of lidars to distinguish the origin of different dust plumes by its optical properties was meant to be an outlook of what information this type of measurements can deliver. The paragraph was rewritten accordingly. Also, we did not intent to claim the ability of our lidar measurements alone to determine the global impact of dust on climate, but we think that our data are a valuable contribution to this important task. The last paragraph was changed to express this in an improved form.

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More details on times and duration of the measurements shown in the Figures and tables were added as suggested by the referee. We hope this also clarifies the remaining comments by the referee. Fig 6. is omitted.

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