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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Case study of a multi-layer aerosol structure in the eastern Mediterranean observed with the airborne polarized lidar ALEX during a STAAARTE campaign (7 June 1997)" *by* F. Dulac and P. Chazette

F. Dulac and P. Chazette

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1. Author response to M. Bennett's comment

M. Bennett points our effort to constrain the lidar inversion by satellite-derived optical depth, and questions the lag-time between the satellite image and the airborne observations. The STAAARTE programme was useful to give an opportunity of a first airborne experiment to selected new users of research aircrafts. However, it offered few flight hours, within a limited campaign common to several groups with very different objectives and payloads, making the flight planning difficult. Because frequencies of dust

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events rapidly decrease in summer in the eastern Mediterranean, our flight occurred at the early beginning of the campaign when the first opportunity to encounter dust was found, although the optical depth was moderate as seen from the Meteosat image of the day before. We had no opportunity for a second chance with better conditions. The flight was planned following model predictions, in the area where maximum dust and minimum cloud cover were expected. The early flight hour minimized convective clouds and was presumably also needed for the users who benefited from the second part of the same flight. Unfortunately the cloud cover was found larger than predicted and even the earlier POLDER image (10:30 GMT) was not exploitable. As seen from the lidar observations, clouds were even embedded in the dust layer although such turbid layers are generally made of relatively warm and dry air from Africa. Limits in optical depth retrieval from satellite due the observation geometry prevent from exploitable satellite observations in the early morning and in our case prevent from exact coincidence with our lidar observation. We try to compensate the absence of exact coincidence of the lidar and Meteosat data by matching average optical depths along the two tracks across the dust plume rather than matching coincident pixels. We believe the 3-4 h delay is reasonable for a case study and for showing the methodology since dust plumes are relatively stable structures transported long-distance. In a next future the Aqua Train of spaceborne sensors will hopefully allow perfectly coincident measurement between spaceborne lidar profiles and aerosol optical depth (and other products).

The effect of multiple scattering is, indeed, the probable cause of the maximum depolarisation in the vicinity of clouds embedded in the dust layer. This is mentioned in our revised conclusion.

2. Author response to Anonymous Referee #1

The reviewer refers to several papers to point out that a number of lidar observations of dust events in the Mediterranean show similar information than reported in the abstract from our new case study. Although two out of his five references do not contain lidar

ACPD
3, S1666–S1668, 2003

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data, we acknowledge the fact in our revision.

The suggestion to cite a number of recent papers in the Introduction section has also been followed in our revision. We also mention recent new methodological developments which now allow lidar observations of the lowermost troposphere.

Following the reviewer suggestion, we discuss uncertainties of lidar and photometer measurements in the Observations section of the revised manuscript. The most important source of error in the aerosol extinction retrieval is linked to the choice of the BER. The optical constrain given from Meteosat-retrieved optical thickness helps to minimize such an uncertainty on a statistical basis. The rms error on Meteosat-retrieved optical thickness is ˜0.05. The impact of such an uncertainty has been assessed following a Monte Carlo approach (Chazette, 2003) and was found close to 35% for both the BER and the extinction coefficient.

As suggested by the reviewer, in our revised version we refer to additional references in section 3.4 Aerosol extinction profiles.

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 2393, 2003.

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