

Aerosol classification by airborne in-situ and high spectral resolution lidar measurements during EUCAARI

F. Abicht¹, M. Esselborn¹, T. Hamburger¹, B. Y. Liu^{1,2}, A. Minikin¹, and A. Petzold¹

¹Institut für Physik der Atmosphäre, DLR, Oberpfaffenhofen, 82234 Wessling, Germany

²Ocean Remote Sensing Institute, Ocean University of China (OUC), Qingdao, 266003, China

Keywords: optical properties, extinction, optical depth, lidar, lidar ratio.

In the framework of the EUCAARI-LONGREX (European integrated project on Aerosol Cloud Climate and Air Quality Interactions - LONG Range EXperiment) flight campaign high spectral resolution lidar (HSRL; Esselborn et al., 2008) measurements were performed over several regions of Europe. Based on the HSRL measurements aerosol-specific quantities at $\lambda = 532$ nm were deduced including the aerosol backscatter coefficient, aerosol extinction coefficient, aerosol optical depth, the lidar ratio and aerosol depolarisation ratio.

Simultaneous to the HSRL measurements, airborne in-situ aerosol measurements were performed, including aerosol number size distribution, aerosol absorption, and aerosol volatility analyses. For selected aerosol layers, in situ data were used to deduce characteristic aerosol microphysical properties and link them to HSRL aerosol properties like lidar ratio and depolarisation.

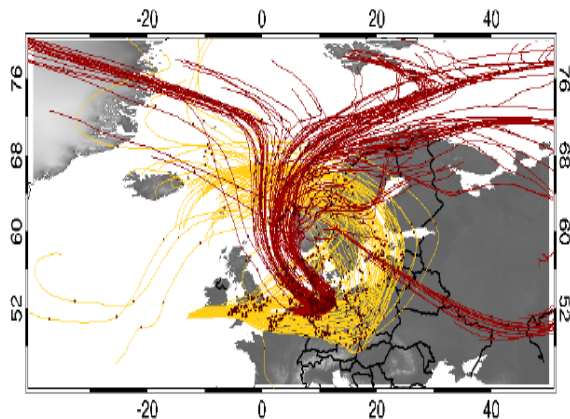


Figure 1. Air mass back trajectories for two key days during EUCAARI-LONGREX: 14 May 2008 (yellow) and 21 May 2008 (brown).

Figure 1 shows examples of back-trajectories for air mass which were probed in-situ and by HSRL: On 14 May 2008 air masses were probed which circulated for several days over Central Europe during a stagnant high pressure system situation, collecting anthropogenic pollution from various source regions. On 21 May, air masses were probed which moved into Central Europe across the North Sea, being considered as relatively clean compared to the previous weather situation.

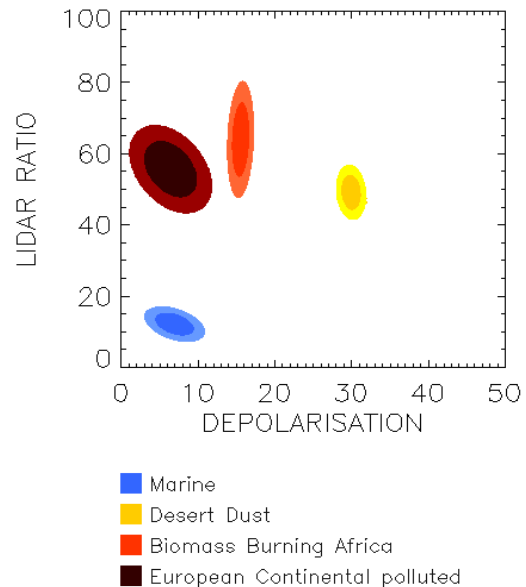


Figure 2. Lidar properties for different aerosol types measured during EUCAARI-LONGREX and SAMUM (desert dust, biomass burning).

Aerosol properties accessible by HSRL cluster in characteristic patterns for different aerosol classes as shown in Figure 2. Aerosol in-situ microphysical data will be used to further investigate the HSRL aerosol classification capabilities and limitations. The favourable synoptic situation during the first part (06 – 14 May) of EUCAARI-LONGREX with an almost stationary anticyclone over Europe enables us to study aerosol transformation and aging over an anthropogenic source region from in-situ observations collocated with active remote sensing studies of the same aerosol.

The presented results serve as an important first step towards the assessment of future spaceborne active remote sensing instruments for the large-scale monitoring of the tropospheric aerosol.

This work has been partly funded by EUCAARI (European Integrated Project on Aerosol Cloud Climate and Air Quality Interactions) No 036833-2.

Esselborn, M., M. Wirth, A. Fix, M. Tesche, and G. Ehret (2008). *Applied Optics*, 47, 346-358.