



Mineral dust size distributions in the eastern Mediterranean from balloon-borne optical particle counter and validation with aircraft measurements and remote-sensing retrievals

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Measurements of the size distribution of atmospheric aerosols and cloud particles are fundamental to gain statistical insight into their microphysical properties and for understanding the physical processes governing aerosol-cloud interactions. There is an abundance of commercial and experimental instruments for such observations. Although, in-situ measurements of the size distribution of atmospheric aerosols above the planetary boundary layer are still scarce as they are mostly conducted with research aircraft. The Universal Cloud and Aerosol Sounding System (UCASS) is a disposable balloon-borne open-path optical particle counter developed at the University of Hertfordshire. In spring 2017, UCASS measurements have been performed during two international field experiments on Crete and Cyprus, in a region strongly affected by dust storms from the Saharan and Arabian deserts. Five soundings have been performed on coordination with lidar and sun photometer measurements during an outbreak of dust from western Africa that arrived at Cyprus between 20 and 22 April 2017. Dust mass concentrations of up to $900 \mu\text{g}/\text{m}^3$ were observed during a UCASS launch from Limassol on 21 April 2017. Lidar measurements showed a dust layer height of 7 km with a dense filament of dust at 3 km height. The dust size distributions from the UCASS soundings are compared to coinciding independent measurements with research aircraft as well as to the ones retrieved by combining data from sun photometer and lidar using state-of-the-art retrieval algorithms such as GARRLiC, LiRIC, the AERONET and SKYNET inversion and POLIPHON. This allows to evaluate the performance of the UCASS within different aerosol layers and to assess whether the UCASS could be used as an affordable alternative to research aircraft for in-situ profiling of the size distribution of coarse aerosol particles.