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Characterising aerosol transport during OASIS

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We report initial results from the Optimization of Aerosol Seeding In rain enhancement Strategies (OASIS) field campaign in the United Arab Emirates. Understanding the background aerosol properties is crucial when designing precipitation enhancement strategies. The 1-year OASIS field campaign aimed at characterising the vertical profile of aerosol and the boundary-layer dynamics. The measurement setup comprised in-situ aerosol measurements (DMPS, APS, aethalometer, CCN measurements, filter samples), multi-wavelength lidar (PollyXT), scanning Doppler lidar (Halo Photonics Streamline). Identifying turbulent mixing in the boundary layer enabled extending the information gleaned from the surface measurements into the vertical profile up to the top of the well-mixed layer. The boundary layer exhibited a consistent strong diurnal cycle, with calm conditions at night and a well-mixed convective boundary layer developing during the day to heights of at least 2 km and often reaching 4 km. The surface aerosol concentrations usually decrease during the morning, presumably as a result of dilution into the growing boundary layer, followed by new particle formation. Elevated aerosol layers were also common.

A major feature was the presence of low level jets in the wind profile, providing a mechanism for rapid horizontal transport of aerosol, both local and remote. The low-level jets often occurred after sunset, presumably as a response to the collapse of the convective boundary layer. We also identified significant dust events through the combined analysis of boundary layer winds and surface aerosol concentrations, where a rapid increase in aerosol concentrations coincide with wind changes throughout the vertical profile. This indicates air mass changes suggesting long-range transport of aerosol, with possible mechanisms including sea breezes or large-scale synoptic flows. Such flows can potentially generate clouds and convection.