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Surface ozone-aerosol behaviour and atmospheric boundary layer structure in Saharan dusty scenario

Jose Adame (1), Carmen Córdoba-Jabonero (1), Mar Sorrribas (2), Manuel Gil-Ojeda (1), Daniel Toledo (1), and Margarita Yela (1)

(1) INTA, Atmospheric Sounding Station - El Arenosillo, Huelva, Spain (adamecj@inta.es), (2) Department of Applied Physics. Huelva University. Campus de El Carmen. Huelva. Spain

A research campaign was performed for the AMISOC (Atmospheric Minor Species relevant to the Ozone Chemistry) project at El Arenosillo observatory (southwest Spain) in May-June 2012. The campaign focused on the impact of Saharan dust intrusions at the Atmospheric Boundary Layer (ABL) and ozone-aerosol interactions. In-situ and remote-sensing techniques for gases and aerosols were used moreover to modelling analyses. Meteorology features, ABL structures and evolution, aerosol profiling distributions and aerosol-ozone interactions on the surface were analysed. Two four-day periods were selected according to non-dusty (clean conditions) and dusty (Saharan dust) situations. In both scenarios, sea-land breezes developed in the lower atmosphere, but differences were found in the upper levels. Results show that surface temperatures were greater than 3°C and humidity values were lower during dusty conditions than non-dusty conditions. Thermal structures on the surface layer (estimated using an instrument on a 100 m tower) show differences, mainly during nocturnal periods with less intense inversions under dusty conditions. The mixing layer during dusty days was 400-800 m thick, less than observed on non-dusty days. Dust also disturbed the typical daily ABL evolution. Stable conditions were observed during the early evening during intrusions. Aerosol extinction on dusty days was 2-3 times higher, and the dust was confined between 1500 and 5500 m. Back trajectory analyses confirmed that the dust had an African origin. On the surface, the particle concentration was approximately 3.5 times higher during dusty events, but the local ozone did not exhibit any change. The arrival of Saharan dust in the upper levels impacted the meteorological surface, inhibited the daily evolution of the ABL and caused an increase in aerosol loading on the surface and at higher altitudes; however, no dust influence was observed on surface ozone.