



Charged Saharan dust over the UK

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A “red sun” was widely noticed over the southern UK on 16th October 2017, which arose from a dense plume of Saharan dust and smoke particles, transported by the remnants of Hurricane Ophelia. Over Reading, the principal dust layer was at about 3 km, from which the dust fell into cloud-forming regions and reached the surface. Time series of backscatter from ceilometers at Reading and Chilbolton show two plumes, one carried upwards to 2.5 km, and another below 800 m into the boundary layer, with a clear slot between. Steady descent of dust continued throughout the morning, and coarse mode particles reached the surface. The plume passed over atmospheric electric field sensors at Bristol, Chilbolton and Reading. Consistent measurements at these three sites indicated negative plume charge. Dust plumes are frequently observed to be strongly charged, often through frictional effects. The lower edge plume charge density was $(-8.0 \pm 3.3) \text{ nC m}^{-2}$, which is several times greater than that typical for stratiform water clouds, implying an active charge generation mechanism such as turbulent triboelectrification. A meteorological radiosonde measuring temperature and humidity was launched into the plume at 1412 UTC, specially instrumented with additional charge and turbulence sensors. This detected charge in the boundary layer and in the upper dust region, and strong turbulent mixing was also observed throughout the lowest 4 km. Electrical aspects of dust are frequently observed, and should be included in numerical models to accurately represent both dust transport, and dust particle interactions in the atmosphere.