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Charge measurements within a Saharan dust layer using balloon-carried sensors

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Dust is commonly lofted from desert regions, as a result of erosion and meteorological processes. Previous surface measurements of a dust cloud passing over an astronomical polarimeter have shown surprising evidence of the alignment of the constituent particles. Alignment is not expected in conventional models of the atmospheric radiative effects of dust clouds, and the effect of alignment may be to substantially modify the transmitted radiation. There are few explanations for the alignment of dust, but one possibility is that the dust is charged and becomes aligned in the vertical atmospheric electric field. To test the hypothesis of electro-alignment, simultaneous measurements of dust and charge in a suitable dust cloud are required. Hybrid instrumentation for this investigation has been specially developed, by combining an optical particle counter with a sensitive electrostatic sensor. These instruments have been miniaturised, to allow them to be carried on a meteorological balloon, permitting a high resolution vertical profile of their measurements to be obtained. Using these instruments, a field campaign was carried out in the Cape Verde Islands in August 2009, a location chosen for the high frequency of Saharan dust events. Several flights were made through dust clouds, within which electric charge was commonly observed.