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Radiative Properties of Aligned Atmospheric Mineral Dust

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Mineral dust in the atmosphere exerts significant indirect influence on radiation by acting as a source of efficient nuclei for cloud formation, modifies both the shortwave and the longwave radiation, and is a major source of nutrients in the marine environment.There is also growing evidence that Saharan dust outbreaks may be reducing Atlantic hurricane activity. Consequently, much effort has been directed at the development of global-scale measurement of aerosol properties, including both satellite and ground-based instruments such as sun photometers and lidar.

Recent polarimetric observations of atmospheric Saharan dust have provided strong evidence for the presence of vertically aligned particles. The alignment is thought to be due to electric field of the order of 2 kV/m, present because of dust charging. It was concluded that partial alignment was likely to be a common feature of atmospheric mineral dust layers, and suggested that the alignment and the associated electric field could modify dust transport by aiding the retention of larger particles (Ulanowski et al. 2007 Atmos. Chem. Phys., 7, 6161-6173).

We carry out a preliminary investigation of the influence of the alignment on the radiative properties of dust layers, including polarization. Our modelling indicates that the alignment can significantly alter the optical thickness of the dust layer, leading to a "Venetian blind effect" dependent on the strength of the electric field. For example, shortwave optical thickness in the vertical direction can change due to the alignment by as much as 10% for the observed Saharan dust layer case. Effects of the alignment

on remote sensing retrievals will also be examined.