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Monitoring of Saharan dust electrification using a ground-based electrometer in Crete & Antikythera, Greece

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Atmospheric electricity parameters, namely the vertical electric field strength and induced current flow through the Global Electric Circuit (GEC), greatly depend on ambient weather conditions. During dust storms and subsequent advection of elevated dust layers, these parameters vary highly from the corresponding values under fair weather conditions. These variations of the total vertical electric field component (E_z) caused by the elevated dust layers, indicate that charge separation occurs within the layer and that the internal electric field is potentially adequately strong to affect the gravitational settling of large dust particles. Therefore, we report consistent atmospheric Potential Gradient (PG) measurements, where PG=-E_z, over Finokalia in Crete and Antikythera, during recorded dust events with high AOD levels from a ground-based electrostatic JCI Fieldmeter (FM). The timeseries span from April 2017 to April 2018 in Finokalia, followed by the instrument's relocation in Antikythera in June 2018 to continuous monitoring of the ambient atmospheric electricity conditions until April 2019. The FM data are pre-processed so as to subtract seasonal and diurnal variations of the GEC, while field perturbations due to lightning activity are also considered. We, moreover, provide a comparison between the dust layers' progression and structure through PollyXT lidar measurements from both sites, with the diurnal behavior of the PG. By analyzing the cases of high dust loads above and advected within the Planetary Boundary Layer (PBL), we observe temporary inversion of the electric field direction and fluctuations from the $\sim$ 140 V/m fair weather vertical values. These findings are a potential indication of the dust layers retaining their electrification well away from the dust source.
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