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The effect of dust lifting process on the electrical properties of the atmosphere

Francesca Esposito (1), Roberto Molinaro (1), Ciprian Ionut Popa (1), Cesare Molfese (1), Fabio Cozzolino (1,2), Laurent Marty (1), Kamal Taj-Eddine (3), Gaetano Di Achille (4), Simone Silvestro (1), Gian Gabriele Ori (5,3)

(1) INAF - Osservatorio Astronomico di Capodimonte, Napoli, Italy (francesca.esposito@na.astro.it), (2) Università di Napoli "Federico II", Napoli, Italy, (3) Ibn Battuta Centre - University Cadi Ayyad, Marrakech, Morocco, (4) INAF-Osservatorio Astronomico di Teramo, Teramo, Italy, (5) IRSPS Università G. D'Annunzio

Airborne dust and aerosol particles affect climate by absorbing and scattering thermal and solar radiation and acting as condensation nuclei for the formation of clouds. So, they strongly influence the atmospheric thermal structure, balance and circulation. On Earth and Mars, this 'climate forcing' is one of the most uncertain processes in climate change predictions. Wind-driven blowing of sand and dust is also responsible for shaping planetary surfaces through the formation of sand dunes and ripples, the erosion of rocks, and the creation and transport of soil particles. These processes are not confined to Earth, but occur also on Mars, Venus and Titan.
It is clear that the knowledge of the atmospheric dust properties and the mechanisms of dust settling and raising into the atmosphere are important to understand planetary climate and surface evolution.
On Mars the physical processes responsible for dust injection into the atmosphere are still poorly understood, but they likely involve saltation as on Earth. Saltation is a process where large sand grains are forced by the wind to move in ballistic trajectories on the soil surface. During these hops they hit dust particles, that are well bound to the soil due to interparticle cohesive forces, thus transferring to them the momentum necessary to be entrained into the atmosphere.
Recently, it has been shown that this process is also responsible to generate strong electric fields in the atmosphere up to 100-150 kV/m. This enhanced electric force acts as a feedback in the dust lifting process, lowering the threshold of the wind friction velocity u* necessary to initiate sand saltation. It is an important aspect of dust lifting process that need to be well characterized and modeled. Even if literature reports several measurements of E-fields in dust devils events, very few reports deal with atmospheric electric properties during dust storms or isolated gusts.
We present here preliminary results of an intense field test campaign we performed in the West Sahara during the 2013 and 2014 dust storm seasons. We collected a statistical meaningful set of data characterizing relationship between dust lifting and atmospheric E-field that had never been achieved so far.