

Electrical characteristics of simulated tornadoes and dust devils

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It is well known that tornadoes and dust devils have the ability to accumulate significant, visible clouds of debris. Collisions between sand-like debris species produce different electric charges on different types of grains, which convect along different trajectories around the vortex. Thus, significant charge separations and electric currents are possible, which as the vortex fluctuates over time are thought to produce ULF radiation signatures that have been measured in the field. These electric and magnetic fields may contain valuable information about tornado structure and genesis, and may be critical in driving electrochemical processes within dust devils on Mars.

In the present work, existing large eddy simulations of debris-laden tornadoes performed at West Virginia University are coupled with a new debris-charging and advection code developed at Goddard Space Flight Center to investigate the detailed (meter-resolution) fluid-dynamic origins of electromagnetic fields within terrestrial vortices. First results are presented, including simulations of the electric and magnetic fields that would be observed by a near-surface, instrument-laden probe during a direct encounter with a tornado.

This research was supported by an appointment to the NASA Postdoctoral Program at the Goddard Space Flight Center, administered by Oak Ridge Associated Universities through a contract with NASA. The generous allocation of computing resources by Dr. Timothy J. Stubbs is gratefully acknowledged.