Martian and terrestrial vortices: Dust transport, electrification, and emission of non-thermal radiation

N. Renno

Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, Ann Arbor, MI, USA (renno@alum.mit.edu)

Atmospheric aerosols play an important role on terrestrial and martian weather and climate. On earth, mineral dust corresponds to about one third of all atmospheric aerosols. Small scale convective plumes and vortices contribute to about 35% of the global terrestrial budget of mineral dust (Koch and Renno, 2005). On Mars, mineral dust dominates the aerosol budget and convective plumes and vortices play an even more important role on weather and climate than on Mars (Ferri et al., 2003). Dust and sand particles get charged and emit non-thermal electromagnetic radiation when they collide with each other (Renno et al., 2003). During this process, the smaller dust particles get negatively charged with respect to the larger sand particles. Electric fields of a few 100 kV/m are produced when the smaller particles are lifted and separated from the larger ones by turbulent eddies and convective updrafts. There is evidence that electric forces play an important role on the dust lifting (Kok and Renno, 2006). Finally, the large electric fields generated by dust devils and dust storms accelerate ions and free electrons and dissociate water vapor and other atmospheric gazes. This process generates large quantities of hydrogen peroxide in the martian atmosphere (Atreya et al., 2006, Delory et al., 2006). Hydrogen peroxide breaks down complex organic molecules and makes the surface of Mars inhospitable to life as we know it.