MARS ATMOSPHERIC CHEMISTRY IN ELECTRIFIED DUST DEVILS AND STORMS. W. M. Farrell[1], G. T. Delory[2], S. K. Atreya[3], A.-S. Wong[3], N. O. Renno[3], D. D. Sentmann[4], J. G. Marshall[5], S. A. Cummer[6], S. Rafkin[7], and D. Catling[8], [1]Goddard Space Flight Center, [2]UC Berkeley, [3]Univ. of Michigan, [4]Univ. of Alaska, [5]SETI Inst. , [6]Duke Univ., [7]SWRI, and [8]Univ. of Washington.

Introduction: Laboratory studies, simulations and desert field tests all indicate that aeolian mixing dust can generate electricity via contact electrification or "triboelectricity". In convective structures like dust devils or storms, grain stratification (or charge separation) occurs giving rise to an overall electric dipole moment to the aeolian feature, similar in nature to the dipolar electric field generated in terrestrial thunderstorms. Previous simulation studies [1] indicate that this storm electric field on Mars can approach atmospheric breakdown field strength of 20 kV/m. In terrestrial dust devils, coherent dipolar electric fields exceeding 20 kV/m have been measured directly via electric field instrumentation.

Given the expected electrostatic fields in Martian dust devils and storms, electrons in the low pressure CO_2 gas can be energized via the electric field to values exceeding the electron dissociative attachment energy of both CO_2 and H_2O, resulting in the formation of new chemical products CO and O^- and OH and H^- within the storm. Using a collisional plasma physics model we present a calculation of the CO/O^- and OH/H^- reaction and production rates. We demonstrate that these rates vary geometrically with ambient electric field, with substantial production of dissociative products when fields approach breakdown levels of 20-30 kV/m.

This storm-related anomalous ion production is then used as an input into a Martian atmospheric chemistry model. Subsequent reaction pathways of these new species with the ambient molecular species are derived. It is found that negative ions greatly enhanced production of the oxidant H_2O_2, with the species abundance due to dust devil/storm electrochemical production greatly exceeding that produced via nominal photochemical production by orders of magnitude.

The study suggests that dust devils and storms are sources of oxidants, with global production possibly being greatest during dust storm season. Further, the seasonal deposition of oxidants into the soil may affect the habitability of the near-surface and may account for the highly reactive soil found by Viking, as previously suggested by Mills [2].

References: [1] Melnik, O., and Parrot, M., (1998), *JGR, 103, 29107.* [2] Mills A. A., (1977), *Nature, 268, 614.*