Geophysical Research Abstracts
Vol. 13, EGU2011-7091, 2011
EGU General Assembly 2011

First in situ analysis of dust devil tracks on Earth and their comparison with tracks on Mars

Dennis Reiss (1), Jan Raack (1), Angelo P. Rossi (2), Gaetano di Achille (3), and Harald Hiesinger (1)

(1) Institut für Planetologie, Westfälische Wilhelms-Universität Münster, Germany (dennis.reiss@uni-muenster.de), (2) Jacobs University Bremen, Department of Earth and Space Sciences, College Ring 1, 28759 Bremen, Germany, (3) Research and Scientific Support Department, European Space Agency, ESA-ESTEC, 2200AG Noordwijk, Netherlands

Dust devils are low pressure vortices formed from unstable near surface warm air generated by insolation and they can be visible due to the entrainment of dust and possibly sand (for further details, see [1]). On Mars, active dust devils have been observed leaving tracks, which are mostly darker than their surroundings, although some are brighter [2]. Image data of the Microscopic Imager (MI) [3] onboard of the Mars Exploration Rover (MER) Spirit in Gusev crater showed that surfaces consisting of sand grains within dust devil track zones are relatively free of finer grained dust compared to the bright regions outside the tracks [4]. It has been suggested that the albedo difference is caused by the different grain sizes because the brightness is photometrically inversely proportional to grain size [4]. The thickness of removed material by dust devils on Mars was estimated to be in the range of 2 – 40 μm [5] based on the results of [6] at the Mars Pathfinder landing site. Dust devil track simulations with the Mars Regional Atmospheric Modeling System (MRAMS) indicate removal thicknesses of 1 – 8 μm [7]. [8] estimated removal thicknesses of about 8 μm from active dust devil observations in Gusev crater. On Earth, dust devil tracks are rare. So far they were identified in satellite imagery in the Saharan desert [9, 10]. In this study we report about the first in situ analysis of terrestrial dust devil tracks observed in the Turpan depression desert in northwestern China [11]. Passages of active dust devils remove a thin layer of fine grained material ($<$ $\sim$63 μm), cleaning the upper surface of coarse sands (0.5 – 1 mm). This erosional process changes the photometric properties of the upper surface causing the albedo differences within the track to the surroundings. Measurements imply that a removal of an equivalent layer thickness of $\sim$2 μm is sufficient to form the dark dust devil tracks. Our terrestrial results are in agreement with the mechanism proposed by [4] for the formation of dust devil tracks on Mars.

References: [1] Balme, M., and R. Greeley (2006), Rev. Geophys., 44, RG3003, doi:10.1029/2005RG000188. [2] Malin, M.C., and K. S. Edgett (2001), J. Geophys. Res., 106, 23429-23570. [4] Greeley, R. et al. (2005), J. Geophys. Res., 110, E06002, doi:10.1029/2005JE002403. [3] Herkenhoff, K. E. et al. (2003), J. Geophys. Res., 108, 8065, doi:10.1029/2003JE002076. [5] Balme, M.R. et al. (2003), J. Geophys. Res., 108, 5086, doi:10.1029/2003JE002096. [6] Metzger, S. M. et al. (1999), Geophys. Res. Lett., 26, 2781-2784. [7] Michaels, T. I. (2006), Geophys. Res. Lett., 33, L19S08, doi:10.1029/2006GL026268. [8] Greeley, R. et al. (2006), J. Geophys. Res., 111, E12S09, doi: 10.1029/2006JE002743. [9] Rossi, A. P., and L. Marinangeli (2004), Geophys. Res. Lett., 31, L06702, doi: 10.1029/2004GL019428. [10] Neakrase, L.D.V. et al. (2008) GSA, 40, abstract 195-19. [11] Reiss, D. et al. (2010) GRL, 37, L14203, doi:10.1029/2010GL044016.