Geophysical Research Abstracts
Vol. 15, EGU2013-11155, 2013
EGU General Assembly 2013

Radiation obscuration by dust devils at Gale as observed by the REMS UV Sensor

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The Rover Environmental Monitoring Station (REMS) on board the Curiosity rover has been exploring the surface environment of Mars since its arrival to Gale on August 2012. REMS provides a mimimum of 5 minutes of acquisitions every hour and extended 1-hour acquisitions of all its sensors, namely wind, air temperature, ground temperature, pressure, humidity and ultraviolet sensors. The UV sensor (UVS) of REMS is dedicated to monitoring the downwelling UV irradiance as well as to monitor the atmospheric dust cycle of Mars. This includes observation of plausible dust loading processes such as dust devils.

A dust devil is a convective vortex that rises dust in a whirlwind structure. The base of the dust devil moves with a certain speed and its column of dust may traverse the path of observation of the Sun. Usually when this happens a sudden drop of the UV signature is observed. In other cases a plume rises dust and changes the UV diffuse irradiance profile.

Since the beginning of REMS operations in Mars, a number of processes have left signatures on the UV direct or diffuse irradiance as observed by the REMS UV sensor. The signatures of some specific examples are analyzed and compared with the observations provided by other REMS sensors. These are the first measurements of its kind of a dust devil in Mars and provide estimates of the UV opacity of these structures and of their scale. When an obscuration is observed the decay of each specific channel can used to evaluate the spectral variation of the irradiance. This kind of studies may be extremelly interesting to compare with visible opacities of dust devils as observed by the MSL cameras. The regular acquisition pattern of REMS will allow to estimate sistematically the opacity of these structures during the two years of nominal operation from the Martian surface.