Geophysical Research Abstracts
Vol. 15, EGU2013-12358, 2013
EGU General Assembly 2013

Effects of Phobos and Deimos Eclipses on Mars UV surface radiation

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UV fluxes on the Martian surface are critical information to estimate the habitability of its surface and subsurface. The Rover Environmental Monitoring Station (REMS) at the Mars Science Laboratory (MSL) is measuring for the first time ever the ultraviolet (UV) radiation in the range 200 nm to 400 nm on the surface of Mars. Here we report the first UV measurements ever recorded from another planet during a solar eclipse. Within 5 sols, the REMS UV sensor (UVS) monitored the eclipse of the Sun by the two Martian moons: a Phobos partial solar eclipse (September 17, 2012) and a total Deimos eclipse (September 22, 2012), as a drop in the UV signal during the time of their transits. The UVS observation of the Phobos eclipse took place under the shadow of the MSL mast. This configuration allowed the UVS to measure the impact of the transit on the UV diffuse sky irradiance alone. A few sols later, the UVS monitored the drop of the direct beam irradiance induced by the total Deimos eclipse. REMS UVS and concurrent images by Mastcam have been used to investigate the impact of the sun flux occultated by the satellites on the direct and direct sunlight relative contribution to the UV radiation reaching Mars surface. These observations took place under the maximal irradiance conditions (equatorial and summer equinox, prior to the dust season). Comparisons to detailed simulations indicate that diffuse UV radiation reaching the surface is best explained by an atmosphere covered by thin clouds or a particle-loaded atmosphere. On Mars the solar transits are quick and the moons very small, their transits left no distinguishable signal on the other environmental parameters measured by REMS such as surface pressure and temperature and near-surface air temperature.