Martian Surface Temperature and Spectral Response from the MSL REMS Ground Temperature Sensor

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The Rover Environmental Monitoring Station (REMS) on the Mars Science Laboratory (MSL) offers the opportunity to explore the near surface atmospheric conditions and, in particular will shed new light into the heat budget of the Martian surface. This is important for studies of the atmospheric boundary layer (ABL), as the ground and air temperatures measured directly by REMS control the coupling of the atmosphere with the surface [Zurek et al., 1992]. This coupling is driven by solar insolation. The ABL plays an important role in the general circulation and the local atmospheric dynamics of Mars.

One of the REMS sensors, the ground temperature sensor (GTS), provides the data needed to study the thermal inertia properties of the regolith and rocks beneath the MSL rover. The GTS includes thermopile detectors, with infrared bands of 8-14 μm and 16-20 μm [Gómez-Elvira et al., 2012]. These sensors are clustered in a single location on the MSL mast and the 8-14 μm thermopile sounds the surface temperature. The infrared radiation reaching the thermopile is proportional to the emissivity of the surface minerals across these thermal wavelengths.

We have developed a radiative transfer retrieval method for the REMS GTS using a database of thermal infrared laboratory spectra of analogue minerals and their mixtures. [Martín Redondo et al. 2009, Martínez-Frías et al. 2012 - FRISER-IRMIX database]. This method will be used to assess the perfomance of the REMS GTS as well as determine, through the error analysis, the surface temperature and emissivity values where MSL is operating. Comparisons with orbiter data will be performed.

References

Gómez-Elvira et al. [2012], REMS: The Environmental Sensor Suite for the Mars Science Laboratory Rover, Space Science Reviews, Volume 170, Issue 1-4, pp. 583-640.

Martín-Redondo et al. [2009] Journal of Environmental Monitoring 11:, pp. 1428-1432.

Martínez-Frías et al. [2012] FRISER-IRMIX database http://auditore.cab.inta-csic.es/friser-irmix/ (password-protected, inquires to jmfrias@cab.inta-csic.es))

Zureck et al. [1992], "Dynamics of the atmosphere of Mars", Mars (A93-27852 09-91), pp. 835-933.