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THERMAL AND HEAT TRANSFER STUDIES USING THE HABIT INSTRUMENT ON THE EXOMARS 2018 SURFACE PLATFORM.

Abstract

The quest about the habitability of present day Mars is still an open challenge. To tackle this, the instrument HABIT (HabitAbility: Brines, Irradiance and Temperature), that will be part of the ExoMars 2018 Surface Platform, will characterize the habitability of the landing site in terms of UV radiation, air and ground temperature, as well as liquid water availability.

The thermal range and the heat fluxes are critical parameters for establishing the habitability of the near surface of Mars. These parameters will be investigated using the air and ground temperatures that HABIT will monitor simultaneously. In fact HABIT will have three Air Temperature Sensors (ATS) to measure the air temperature and the heat transfer coefficient in the near environment of the HABIT instrument; and an infrared Ground Temperature Sensor (GTS). The design of both ATS and GTS is based on the heritage of the Rover Environmental Monitoring Station (REMS) (Gómez-Elvira, J. et al., 2012) currently operating on-board the Curiosity rover at Gale crater, on Mars. The measurements from the ATS and GTS will serve as a proxy for the speed and orientation of the wind, and together with the air and ground temperature, will provide information about the heat flux between the surface and the atmosphere.

In this work we shall describe a novel retrieval procedure conceived to obtain the heat transfer coefficient h and vertical heat fluxes in the near environment of HABIT, and to obtain the wind orientation and speed, through the ATS and GTS measurements. To illustrate this procedure we will present:

1. Computational fluid dynamics and heat transfer simulations on a 3D HABIT model in its location at the Surface Platform.
2. Comparative analysis of examples from data analysis of the REMS instrument measurements on Mars.
3. Comparative studies of the observations made in the HABIT field-site testing measurements at the NASA Spaceward Bound India 2016 campaign in Ladakh, in order to demonstrate how the thermal environment can constraint the habitability of a Martian analogue site.