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THE WIND SENSOR OF THE HABIT (HABITABILITY: BRINES, IRRADIATION AND TEMPERATURE) INSTRUMENT ON BOARD THE EXOMARS 2020 MISSION

Abstract

A complete understanding of the winds at the surface of Mars is extremely relevant to: (i) validate and refine global and mesoscale circulation models; (ii) provide ground-truth to the profiles predicted for Entry-Descent-Landing phases (critical for Mars exploration); (iii) provide contextual support to the daily operation of instruments on landed spacecraft; and (iv) assess the role of winds on infrastructures, dust transport or dust electrification by triboelectric charging, which may also affect the future Mars human exploration.

The instrument HABIT (HAbitability: Brines, Irradiantion and Temperature) on-board ESA-Roscosmos ExoMars 2020 Surface Platform, designed between other purposes to characterize the habitability of its landing site in terms of UV radiation, air and ground temperature, and liquid water availability, includes a Wind Sensor (WS) that can be used to understand winds in the ExoMars 2020 Landing Site. The WS core technology is based on an upgrade of the existing Air Temperature Sensors (ATS) of the Rover Environmental Monitoring Station (REMS) instrument, currently operating on Mars on-board the Curiosity rover [Martín-Torres, J. et al., 'Transient liquid water and water activity at Gale crater on Mars'. Nature Geoscience 8: 357-361, 2015].

The purpose of this work is to present the validation of the ExoMars wind retrieval algorithm on Earth conditions, its operational limits and the expected outputs. This work summarizes the results of: 1) the calibration and validation of the ATS and WS on the HABIT Engineering Model (EM) in a wind tunnel facility, and under uncontrolled outdoors conditions; 2) a comparative analysis with existing REMS measurements at Gale, Mars, during more than 2.5 Martian years, as an engineering operational requirement validation; and 3) the validation of the HABIT WS retrieval algorithm in the stratosphere of the Earth, a region with similar temperature, pressure and density than on the surface of Mars.