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Mars Science Laboratory (MSL) - First Results of Relative Humidity Observations

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The Mars Science laboratory (MSL) called Curiosity made a successful landing at Gale crater early August 2012. MSL has an environmental instrument package called the Rover Environmental Monitoring Station (REMS) as a part of its scientific payload. REMS comprises instrumentation for the observation of atmospheric pressure, temperature of the air, ground temperature, wind speed and direction, relative humidity, and UV measurements. The REMS instrument suite is described at length in [1]. We concentrate on describing the first results from the REMS relative humidity observations and comparison of the measurements with modeling results.

The REMS humidity device is provided by the Finnish Meteorological Institute. It is based on polymeric capacitive humidity sensors developed by Vaisala Inc. The humidity device makes use of one transducer electronics section placed in the vicinity of the three (3) humidity sensor heads. The humidity device is mounted on the REMS boom 2 providing ventilation with the ambient atmosphere through a filter protecting the device from airborne dust. The absolute accuracy of the humidity device is temperature dependent, and is of the order of 2% at the temperature range of -30 to -10 °C, and of the order of 10% at the temperature range of -80 to -60 °C. This enables the investigations of atmospheric humidity variations of both diurnal and seasonal scale.

The humidity device measurements will have a lag, when a step-wise change in humidity is taking place. This lag effect is increasing with decreasing temperature, and it is of the order of a few hours at the temperature of -75 °C. To compensate for the lag effect we used an algorithm developed by Mäkinen [2].

The humidity observations were validated after tedious efforts. This was needed to compensate for the artifacts of the transducer electronics. The compensation process includes an assumption that the relative humidity at Mars in the temperature range of 0 to -30 °C is about zero. The final relative humidity results appear to be convincing and are aligned with earlier observations of the total atmospheric precipitable water contents as well as with the modeling results. [3,4,5]

References:

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