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# Humidity cycle at Gale crater through MSL/REMS observations

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Since early August 2012 the Mars Science laboratory (MSL) has been operating successfully with the REMS instrument providing extremely valuable atmospheric observations of atmospheric pressure, temperature of the air, ground temperature, wind speed and direction, relative humidity (REMS-H), and UV measurements.

The REMS-H relative humidity device is based on polymeric capacitive humidity sensors developed by Vaisala Inc. and it makes use of three (3) humidity sensor heads. The humidity device is mounted on the REMS boom providing ventilation with the ambient atmosphere through a filter protecting the device from airborne dust. The REMS-H humidity instrument has created an unprecedented data record of more than two full Martian years. It has measured the relative humidity and temperature at 1.6 m height for a period of 5 minutes every hour as part of the MSL/REMS instrument package.

We focus on describing the annual in situ water cycle with the new REMS-H instrument calibration for the period of two Martian years. The results will be constrained through comparison with independent indirect observations and through modeling efforts. We inferred the hourly atmospheric VMR from the REMS-H observations and compared these VMR measurements with predictions of VMR from our 1D column Martian atmospheric model and regolith to investigate the local water cycle, exchange processes and the local climate in Gale Crater. The strong diurnal variation suggests there are surface-atmosphere exchange processes at Gale Crater during all seasons, which depletes moisture to the ground in the evening and nighttime and release the moisture back to the atmosphere during the daytime. On the other hand, these processes do not result in significant water deposition on the ground, because frost has not been detected in Gale Crater by any of the MSL observations. Hence, our modelling results presumably indicate that adsorption processes take place during the nighttime and desorption during the daytime. Other processes, e.g. convective turbulence play a significant role in the daytime in conveying the moisture into the atmosphere.