MESOSCALE METEOROLOGICAL MODELING AT GALE CRATER. C. W. S. Leung[1], [1]Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85712, USA. (cwsleung@lpl.arizona.edu)

Introduction: Gale Crater, the landing site of the Curiosity rover, is situated at 5.4°S, 137.7°E directly on the Martian dichotomy, such that the southern rim of the crater is elevated towards the highlands [1]. The crater center is filled with a large central mound named Aeolis Mons rising approximately 5.5 km in vertical extent [2]. The complicated topographic differentials in and around Gale Crater greatly affect the regional atmospheric circulation, resulting in a dynamic region of mesoscale meteorological interactions.

Mesoscale Model: We used the 3-D, finite difference Mars Regional Atmospheric Modeling System (MRAMS) [3] to investigate the effects of atmospheric forcing due to local topographic barriers. In addition to variations in winds, temperature, and pressure, the model allows us to analyze the water vapor column abundances in an effort to determine trends in volatile transport pathways, and to identify processes that contribute most significantly to the atmospheric vapor budget.

Due to the physical limitations of landers and rovers, *in situ* measurements alone are insufficient to uniquely constrain the relationships between atmospheric forcing and response [4]. Regional atmospheric simulations play an important role in support of the rovers' location specific snapshots by providing the regional context to understand diurnal and seasonal changes. This wider-angle perspective is necessary for constraining the relationships between atmospheric and topographical forcing as well as behavior at the surface-atmosphere boundary.

Modeled Results: Simulations of the near-surface wind pattern in the Gale Crater region show that the large-scale mean flow is highly influenced by circulation forced by thermal heating and cooling of the local terrain. Overnight when temperature is minimum at the crater bottom, winds flow downslope towards the crater floor in the highly stable nocturnal boundary layer. As the sun rises, a shallow but unstable convective boundary layer develops due to differential heating along the crater walls, triggering the atmosphere to become more turbulent. Low-level wind fields are quickly modulated by topographically induced thermal circulations, resulting in strong upslope winds during the day.

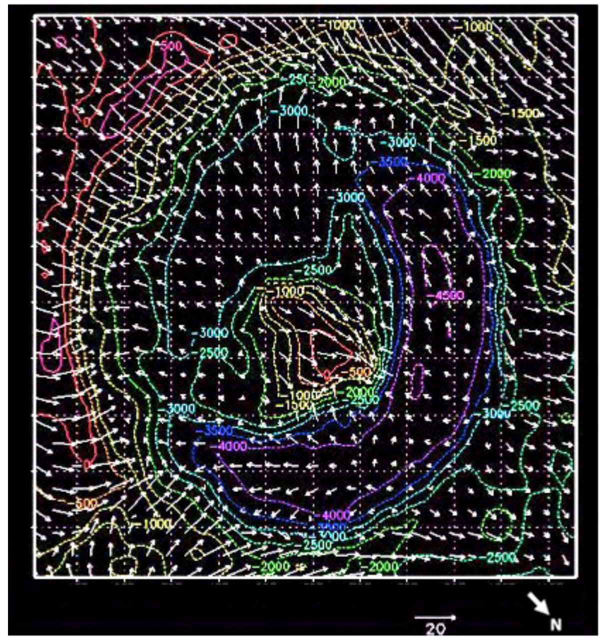

Figure 1. Snapshot of the MRAMS surface wind circulation pattern centered over Gale Crater (5.4°S, 137.7°E) at L_s= ~150°. Coloured contours show topography. White vectors indicate wind magnitude and direction. The expected upslope daytime winds are complicated by the intricate regional topographic relief. Winds diverge from the crater floor flowing upslope over the crater walls as well as up the sides of Aeolis Mons, creating a complex circulation pattern inside the crater.

References: [1] Rafkin S.C.R. and Rothchild A. (2011) *Mars Atmosphere: Modelling and Observation*, 1, 279-281. [2] Anderson R. B. and Bell J. F. (2010) *International Journal of Mars Science and Exploration,* 5, 76–128. [3] Rafkin S. C. R. et al. (2001) *Icarus*, 151, 228-256. [4] McCleese, Daniel J., ed. (2006) NASA Robotic Mars Exploration Strategy 2007-2016. JPL 400-1276.

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