WINDS AND AEOLIAN ACTIVITY IN GALE CRATER ON MARS: MODEL RESULTS AND COMPARISON WITH OBSERVATIONS. C. E. Newman[1], M.I. Richardson,[1] N. T. Bridges[2], K. W. Lewis[3], J. Gómez-Elvira[4], S. Navarro[4] and M. Marín Jiménez[4]; [1]Ashima Research, 600 S. Lake Ave., Pasadena, CA 91106 (claire@ashimaresearch.com); [2]Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723; [3]Johns Hopkins University, Baltimore, MD 21218; [4]Centro de Astrobiología, INTA, 28850 Torrejón de Ardoz, Madrid, Spain.

Introduction: The Mars Science Laboratory (MSL) Curiosity rover, has been operating in Gale Crater on Mars since August 2012. MSL carries a meteorology package (the Rover Environmental Monitoring Station, REMS [1]), as well as cameras capable of imaging aeolian features at a range of scales (Navcam [2], Mastcam [3], the ChemCam remote microimager, RMI [4], and the Mars Hand Lens Imager, MAHLI, on the rover arm [5]), and other instruments able to provide information on their surface and internal composition. The region of Gale being explored during the mission contains abundant aeolian features, from small-scale ripples and ventifacts to large-scale, active dune fields. Although some information can be obtained about the largest features from orbit [6,7], MSL observations provide invaluable structural and compositional information at far higher resolution. Also, unlike any previous rover mission, MSL measurements of the wind environment provide vital constraints on the aeolian processes behind these features' formation.

Types of study: There are numerous ways in which MSL's suite of instruments can be used to improve our understanding of Mars aeolian processes. Examples specifically related to simultanous measurements of aeolian features and winds include: (a) Measuring the diurnally- and seasonally-varying wind field (directions and speeds) throughout the mission. This dataset can (i) be used directly to understand the aeolian features observed by MSL along its traverse, but can also (ii) be used to constrain and validate models of Gale's wind field, which can then be applied to investigate aeolian features in other parts of the crater; (b) Measuring the wind field in the vicinity of large, active dunes that have been fully characterized by the suite of MSL instruments. A dune campaign, including comprehensive characterization of the wind field, is planned for MSL's closest approach to dunes on its way up Aeolis Mons; (c) Measuring upper or lower limits on the saltation threshold *in situ*, using the ambient winds and observations of particle motion (or lack thereof) for different surface types, grain sizes, etc.

Difficulties with the wind dataset: Because the two REMS wind sensor booms are located on the remote sensing mast (RSM) – the diameter of which is similar to the length of each boom – the wind reaching them from behind is strongly perturbed by the RSM. This motivated flying two booms with different orientation directions, and the original wind calibration/retrieval method began by selecting the least affected boom. However, one of the booms was damaged during landing, leaving only the forward-facing boom able to measure winds. This presents some difficulties in interpreting and analyzing the REMS wind data, as the wind sensor is largely 'blind' to winds from the rear of the rover in any given orientation. This problem can be mitigated by combining wind data with the rover facing in different directions, and we will demonstrate some of the process involved here.

Results to be presented: We will present observations of the measured wind field in Gale Crater at selected seasons, and show comparisons with Gale wind predictions from the MarsWRF multiscale atmospheric model [8-10]. We will examine how the measured wind field relates to aeolian features already examined along MSL's path. We will also use the model – constrained by existing meteorological data – to predict aeolian features (e.g. dune orientations) over the rest of Gale, focusing on the active dune fields now being approached by the rover. Figure 1 shows an example of dune predictions for two different assumed saltation thresholds. We will also look at the predicted seasonal change in dune transport rates based on the model, and where possible relate this to ground-based and remote observations of the Gale dunes.

References:

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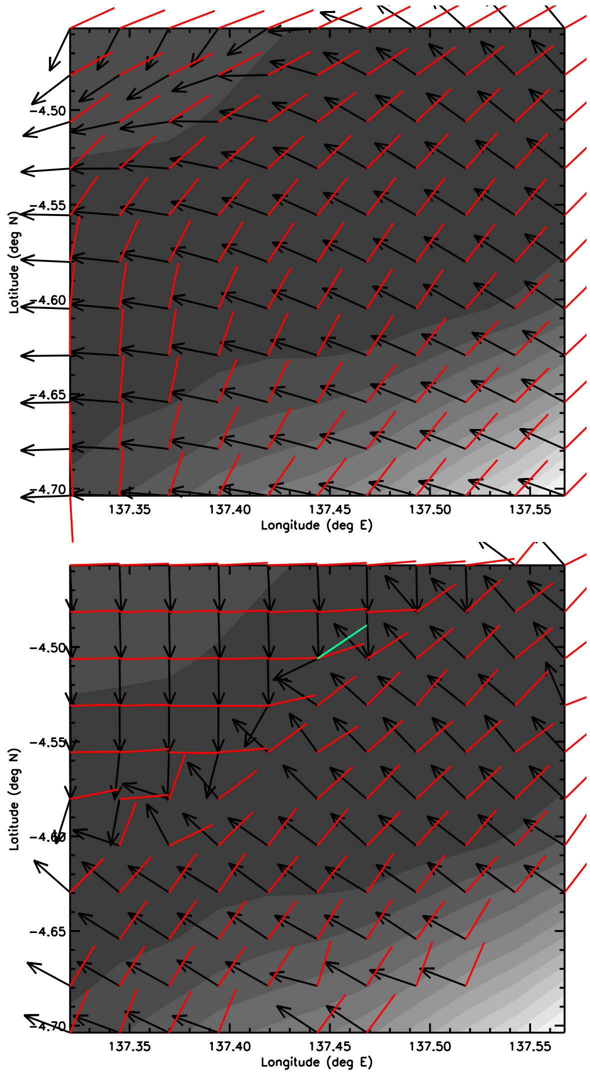

Figure 1: Resultant transport direction (black arrows) and dune crest orientations predicted using the Gross Bedform-Normal Transport model [11] (red and green lines) for a region of Gale Crater including the MSL landing site, using MarsWRF winds. The background shading is topography, and shows the slope from the crater floor (darkest color) up the side of Aeolis Mons (colors lightening at the bottom right). The upper plot shows predictions for a saltation threshold of zero, whereas the lower plot shows predictions for a saltation threshold of 0.05 Pa.