AEOLIAN PHENOMENA AT NILI AND MEROE PATERAE. T. I. Michaels[1], [1]Southwest Research Institute (Boulder, Colorado office; tmichael@boulder.swri.edu).

Introduction: Although Mars has been observed for several decades by orbital and *in situ* assets, yielding abundant general evidence of the aeolian transport of sand-sized particles at some unknown prior time(s) (*e.g.*, north polar erg dunes, intracrater dunes, small-scale sand ripples, yardangs), conclusive contemporary evidence of such a process acting on a surface undisturbed by artificial means was lacking until quite recently. For example, [1] and [2] examined images from Mars Global Surveyor's (MGS) Mars Orbiter Camera (MOC), looking for obvious dune migration (*i.e.*, sand-sized particle transport) that may have occurred between the time of the Viking and MGS missions (~14 Mars-years), but found no obvious evidence of such change.

The initial (unsuccessful) search results from Viking and MGS strongly suggested that if aeolian sediment transport were occurring in the contemporary era, it was likely to be localized (versus regional or global) and/or of a magnitude only able to produce orbitally-measurable changes at a scale of meters (over a Mars-decade). In the past several years, *in situ* observations ([3], [4]) and further detailed searches of the ever-increasing number of high-resolution orbital images ([5], [6], [7]) have begun yielding important clues regarding the contemporary nature/state of Mars aeolian sediment transport.

Early comparisons of wind streak orientation with Mars general circulation model (GCM) large-scale wind fields (*e.g.*, [8]) show some satisfactory agreement, but also many problematic observations, suggesting that the atmospheric structure and flows that contribute to the formation of wind streaks may be primarily mesoscale. Studies of high-latitude dune fields using mesoscale atmospheric modeling (*e.g.*, [9], [10]) resulted in mixed degrees of correlation between wind directions (inferred from aeolian features and modeled) and the estimated aeolian effectiveness (directly proportional to the aerodynamic surface stress) of the model-predicted winds.

Nili/Meroe Paterae Mesoscale Modeling: One piece of orbital evidence for contemporary sediment transport processes in the lower latitudes of Mars was discovered in an overlapping pair of HiRISE images (taken less than one martian season apart) of Nili Patera dunes, with meter-scale modification/movement of ripples (superimposed on dunes) and dune edges [7]. The Mars Regional Atmospheric Modeling System (MRAMS; [11]) was used to investigate the nature of the atmospheric forcing responsible for these changes.

Figure 1: Nili and Meroe Paterae region of the colorized Viking-derived MC-13 (Syrtis Major) visible wavelength quadrangle [NASA/JPL/USGS] of Mars. White outlines indicate the approximate boundaries of both the lower albedo Syrtis Major terrain (left) and a relatively discrete bright area (right).

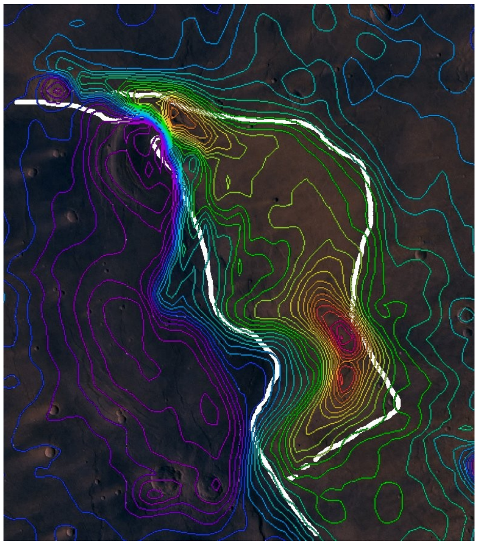

Figure 2: Aerodynamic surface stress contours from mesoscale modeling (MRAMS, ~6.7 km grid-spacing; L_s~300°, an evening snapshot) contoured atop Fig. 1. Red contours indicate surface stress in excess of 55 mN/m^2 (near or exceeding the saltation threshold for basaltic sediment), purple contours indicate minimal surface stress (far from the saltation threshold), and the contour interval is 2 mN/m^2.

Figure 1 illustrates the approximate region of interest, which includes Nili and Meroe Paterae and the surrounding region. Approximately outlined in Figure 1 are two interesting surface albedo boundaries that appear to define an area of relatively bright albedo (not directly correlated with topography) – a more distinct one that runs through both paterae, and another, less distinct, to the east and northeast towards Isidis Planitia. The albedo boundary within Nili Patera contains the small-scale aeolian sand features that [7] observed to be active. If the albedo contrasts were due to differing exposed geologic units, why should the boundary cut through the paterae? Perhaps differing surface covers of dust and/or sand can explain the albedo patterns – but if that is the case, why/how was it emplaced in such a pattern?

MRAMS was run at each of the four canonical seasons (L_s of 30°, 120°, 210°, and 300°; 5 sol run duration) to assess both the diurnal and seasonal effects on the aeolian processes in the Nili/Meroe Paterae region. Very strong evening winds (1-2 Mars-hours duration) from the northeast were present at L_s 210° and 300° whose associated surface aerodynamic shear stresses both exceeded the threshold for the initiation of basaltic sand saltation and aligned strikingly well with the albedo boundaries discussed above (see Figure 2). The local topography interacts with regional winds to strongly enhance the flow over a relatively small area. These flows are also likely very turbulent (forced by vertical wind shear), further adding to the erosive power of these winds. Additionally, the maximum westward extent of the strong winds vacillates stochastically by several kilometers on a daily basis.

These modeling results suggest that the relatively low albedo in the western portions of the Nili and Meroe Paterae region may be due to a net accumulation of dark sand, and that the relatively bright area outlined in Figure 1 may be due to a scarcity of such sand because of repeated and focused scouring by the winds discussed above. This exemplifies the potential powerful predictive and interpretive capability of such modeling, even in the absence of abundant observations of relevance. Further illustration, analysis, and discussion of this phenomenon and others in the study region will be presented.

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