EVIDENCES FOR SAND MOTION IN THE EQUATORIAL REGION OF MARS. M. Cardinale[1], S. Silvestro[2], G. Komatsu[1] , D. A. Vaz[3,4], T. I. Michaels[5], [1]International Research School of Planetary Sciences, Università D'Annunzio, Viale Pindaro 42, 65127 Pescara, Italy (cardinal@irsps.unich.it). [2]SETI Institute, Carl Sagan Center, 189 N Bernardo Avenue Suite 100 Mountain View, CA, USA. [3]Center for Geophysics, University of Coimbra. Av. Dr. Dias da Silva, 3000-134 Coimbra, Portugal. [4]CERENA, Instituto Superior Técnico, Av. Rovisco Pais, 1049-001 Lisboa, Portugal. [5]Southwest Research Institute, 1050 Walnut St., Suite 300, Boulder, CO, USA.

Introduction: Up until the MRO era, evidence of sand movement was limited to a few zones [1-2]. HiRISE images [3] have changed our approach to study aeolian processes on Mars. Using these high-resolution images (~25 cm/pixel), sand motion and dune changes have been detected [4-5] in diverse zones on Mars, including the north polar region [5], confirming the hypothesis of bedform migration under the current atmospheric wind conditions [6]. In this work we investigate several HiRISE images that allow multitemporal analysis of an erg consisting of barchan and barchanoid dunes in Herschel crater (Fig. 1). Furthermore, with the aid of a mesoscale atmospheric model (MRAMS), we compare the morphologic analysis with plausible atmospheric conditions.

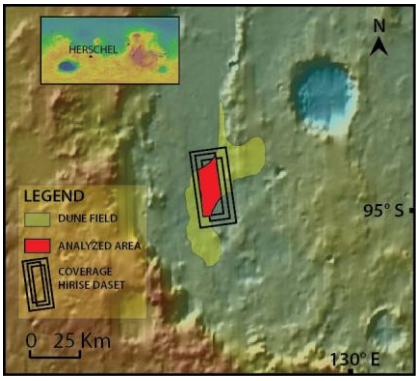
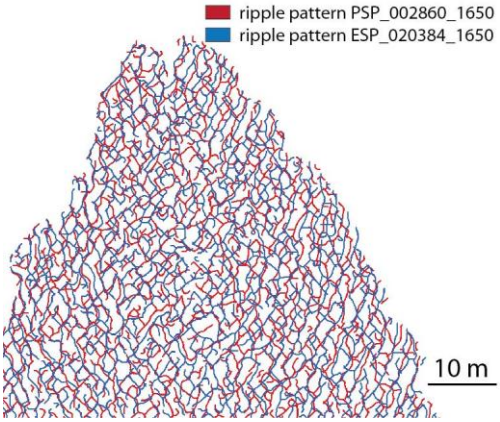


Fig. 1: Location map of the study area.

Methods: We analyzed three overlapping HiRISE images (PSP_002860_1650, PSP_003572_1650 and ESP_020384_1650) that were processed and co-registered with CTX image P05_002860_1650_XI_15S232W in a Geographic Information System (GIS) project. The first image was acquired on 07 March 2007 at Ls=195.8°, the second on 01 May 2007 at Ls=229.7° and the third on 01 December 2010 at Ls=190.9° We also utilized a semi-automatic algorithm to map dune edges and ripple patterns for detecting possible sand motion and changes in the ripple pattern [7, 8] (Fig. 2). Finally, we compared our results with modeled winds from the Mars Regional Atmospheric Modeling System (MRAMS) [9].

Fig. 2: Part of the ripple patterns extracted with the semi-automatic algorithm on the dune in Fig. 4.



Large Dark Dune (LDD) morphology: diverse types of aeolian modifications have been detected (Figs. 3-4).

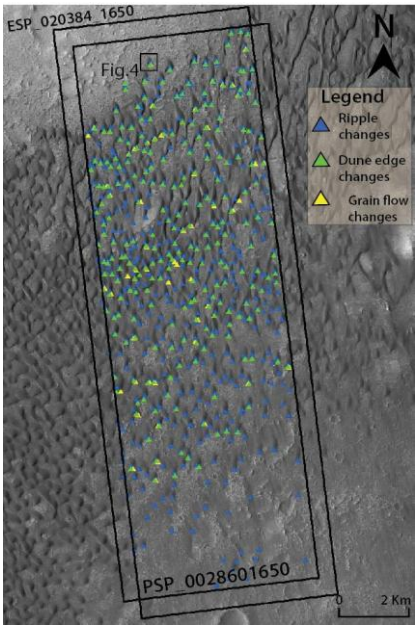


Fig. 3: Map produced from overlapping HiRISE images showing changes in aeolian bedforms.

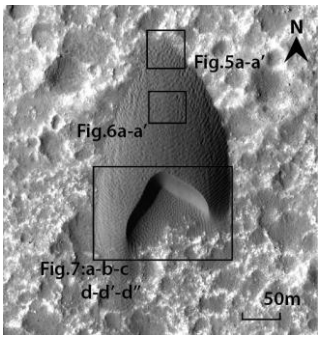


Fig. 4: The studied dune. HiRISE image PSP_002860_1650.

Modifications in the dune edge are visible in Fig. 5a-a', and we measured a displacement of ~3 m towards the south. This movement direction is also evident in other dunes in the same erg suggesting active sand saltation in the study area.

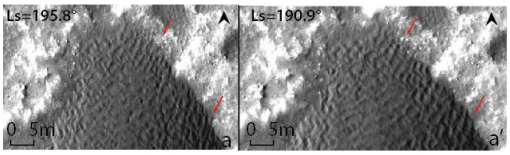


Fig. 5: Changes in the dune edge. HiRISE images PSP_002860_1650 and ESP_020384_1650.

In Figs. 6a-a', we can observe consistent modifications in the ripple pattern, accompanied by dune advancement (Fig. 7) and changes in the slip face structures (grainflows) .

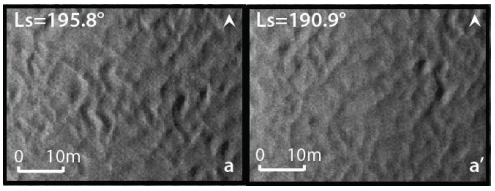


Fig. 6: changes in ripple patterns in the studied dune HiRISE images PSP_002860_1650 and ESP_020384_1650.

Grainflow activity seems to have occurred continuously on an example dune slip face (Figs. 7d, d', d'') suggesting consistent sand motion during the investigated time interval.

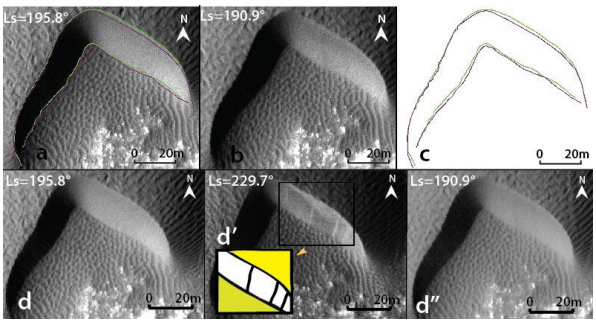


Fig. 7: a, b, c) Dune margin in the image PSP_002860_1650 is compared with the other ESP_020384_1650. **d, d', d'')** Changes occurred over the dune slip face. Diverse grainflows took place over the dune slip face. **d)** PSP_002860_1650. **d'')** PSP_003572_1650. **d'')** ESP_020384_1650.

Modeled winds: The winds computed from the meso-scale model MRAMS are compared with a stress over a large-scale model-derived threshold (0.0225 Pa) for sand motion as discussed by [10] and the predicted wind regime is evaluated for explaining the dune movements detected in this study.

Conclusion: In this report we observed ripple displacements, changes in grainflow scars over dune slip faces and dune advancement over most of the dunes suggesting that the dark dunes in the Herschel basin are movable under the present-day wind conditions. Currently we are in the process of evaluating the MRAMS model results in order to study the effects of local topography, and how they are consistent with the observed dune movements.

References: [1] Bridges N. T. et al. (2007) *GRL, 34* L23205. [2] Fenton L. K. et al. (2005) *JGR*, 110, E06005. [3] McEwen A. S. et al. (2007) *JGR, 112*, E05S02. [4] Silvestro S. et al. (2010) *GRL, 37*, L20203. [5] Hansen C. J. et al. (2011) *Science, 331(6017)*, 575–578. [6] Fenton L. K. (2006), *GRL, 33*, L20201. [7] Silvestro S. et al. (2011) *GRL*, 38, L20201. [8] Vaz D. A. (2011) Planet. Space Sci., 59, 1210-1221. [9] Rafkin S. C. R. et al. (2001). [10] Haberle R. M. (2002) *Icarus, 161*, 66-89, doi:10.1029/2006GL027133.