EOLIAN CHARACTERIZATION OF THE 2016 EXOMARS LANDING SITE: IMPLICATIONS FOR THE DREAMS (DUST CHARACTERIZATION, RISK ASSESSMENT AND ENVIRONMENT ANALYZER ON THE MARTIAN SURFACE) EXPERIMENT. S. Silvestro[1], D. A. Vaz[2,3], G. Di Achille[4], F. Esposito[4], C. Popa[4], [1]Carl Sagan Center, SETI Institute, CA, USA (ssilvestro@seti.org), [2]Center for Geophysics, University of Coimbra, Observatório Astronómico da Universidade de Coimbra, Portugal, [3]CERENA, Instituto Superior Técnico, Lisboa, Portugal, [4]Istituto Nazionale di Astrofisica (INAF), Osservatorio Astronomico di Capodimonte, Napoli, Italy

Introduction: The European Space Agency (ESA) 2016 ExoMars mission includes an orbiter, the Trace Gas Orbiter (TGO), and an Entry Descent and Landing Demonstrator Module (EDM), that will land on Meridiani Planum. DREAMS (Dust characterization, Risk assessment and Environment Analyzer on the Martian Surface) will be onboard the EDM and will study the Martian environment.

DREAMS is a meteorological station with the additional capability to perform measurements of the electrical field close to the surface of Mars. It is an autonomous system that includes its own power supply and control system. It consists of the following subsystems: MarsTEM (thermometer), DREAMS-P (pressure sensors), DREAMS-H (humidity sensor), MetWind (2-D wind sensor), MicroARES (electrical field sensor), SIS (Solar Ir-radiance Sensor), a CEU (Central Electronic Unit) and a battery. The ExoMars 2016 EDM mission is foreseen to land on Mars during the time when dust storms are more likely to happen on the planet. Therefore, DREAMS might have the unique chance to make scientific measurements to characterize the Martian environment in a dusty scenario also performing the first ever measurements of electrical field on Mars.

Here, we present the results of a preliminary eolian characterization of the Exomars 2016 landing ellipse based on all available orbital data (imagery and topography). Our aim is to reconstruct the regional wind regime and to detect any evidence for recent eolian activity within the ellipse.

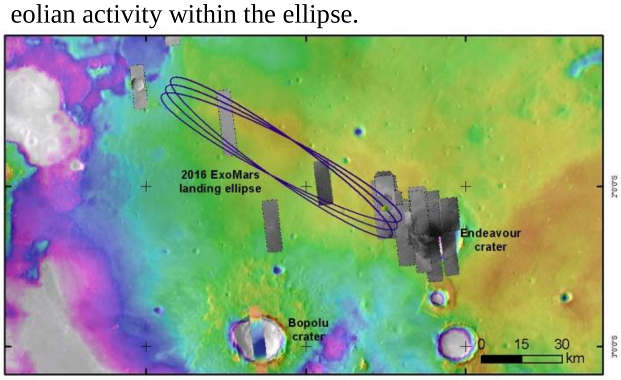

Figure 1 – The ExoMars 2016 landing ellipse shown on MOLA topography. Note that only a few HiRISE images are available for the ellipse

Data and methods: The ExoMars 2016 landing ellipse is located in the relatively flat plain of Meridiani Planum northwestward of Endeavour crater (Fig. 1). We use mainly Context camera (CTX) and HiRISE imagery and stereo derived topography to map eolian features, such as dunes and transverse eolian ridges (TARs) [1] within the landing ellipse and also in the surrounding regions. In fact, the HiRISE coverage of the landing ellipse is limited and thus we expanded the study area assuming that any wind regime reconstructed from images close to the ellipse would be applicable also to the landing site.

To reconstruct the regional wind regime we mapped TARs within the landing area using the same procedure developed to study aeolian ripples from HiRISE images [2]. By applying this technique we are able to evaluate the spatial distribution of the TARs, the main trends and also other morphometric parameters such as wavelength (Fig. 2).

Moreover, dark dunes crestlines and slip faces have been manually digitized in ArcGIS to reconstruct the present-day wind regime over two dune fields near the landing ellipse in Endeavour and Bopolu crater. Dune migration in Endeavour has been computed by comparing two overlapping HiRISE in the time span 2007-2013 (Fig. 3).

Observations: *TAR mapping.* TARs located inside the landing ellipse trend approximately North-South and present typical wavelengths of 2-4 meters. Similarly to the bedforms crossed by Opportunity [3,4,5], a large number of craters overlay the TARs proving that they are ancient aeolian features possibly not active today. Even so, we are trying to use their spatial distribution to study the relation between past and present wind regimes near the landing site.

Dark dunes. Conversely to the old TARs, dark dunes reflect the present-day wind regime. The active Endeavour dunes [6] have two main slip faces trending NE-SW and NW-SE (Fig. 3). Using new HiRISE data we were able to confirm the dune motion previously documented [6] and to track dune displacement in the time span 2007-2013 (Fig. 3). Dunes in Bopolu crater present a similar dune arrangement (Fig. 3) and future HiRISE acquisitions may help to track their rate of migration.

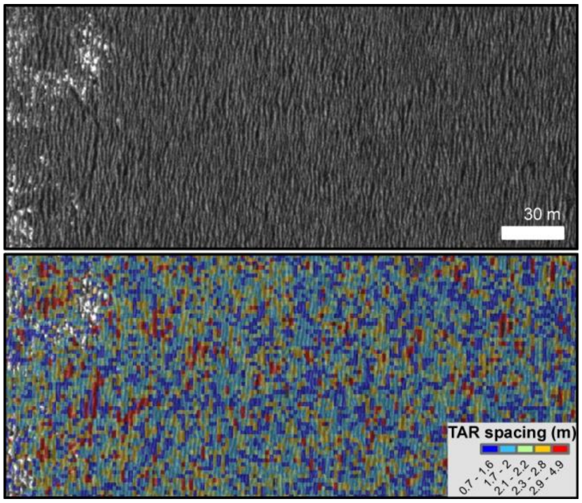

Figure 2 – Example of one of the parameters used for the spatial characterization of the TARs

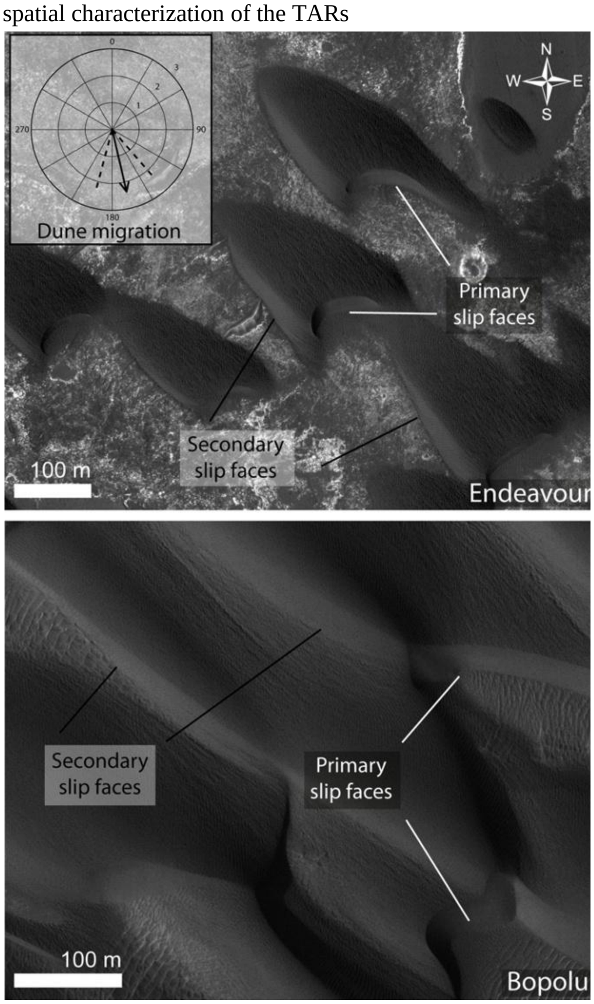

Figure 3 – Dark active dunes in Endeavour and Bopolu crater. The polar diagram shows the direction and rate of migration in the time span 2007-2013 for the Endeavour dunes (HiRISE PSP_005779_1775 - ESP_032006_1775).

Summary and conclusions: A preliminary eolian survey of the ExoMars 2016 landing ellipse allowed us to identify relict and active aeolian features. The observed TARs are similar to the granule ripples crossed by Opportunity [3,4,5] suggesting they might belong to the same TAR population which was emplaced in a past wind environment by strong easterlies [4,5]. However, the sparse HiRISE coverage (Fig. 1) prevents us to go further in our interpretation and a better statistical analysis [7] is necessary to understand the nature of the TARs in the landing ellipse.

The similar dune arrangements in Endeavour and Bopolu, together with the Endeavour dune migrations, suggest dominant regional winds coming from the NNW (Fig. 3). A similar conclusion has been reached to justify the bright streak orientations found in the Opportunity landing area [3]. However, secondary dune slip faces as well as sand streak orientations in the vicinity of Endeavour [3,6], indicate a more complex wind environment.

These results suggest that Meridiani Planum is subject to a complex wind regime confirming previous observations made from Opportunity [5]. We also reported new evidences of eolian activity in Endeavour Crater which indicate that sand movement is common under current atmospheric conditions. Therefore, DREAMS will most probably have the opportunity to operate under an active eolian environment maximizing its scientific return. Finally, the DREAMS experiment will perform first ever measurements of electrical field on Mars and might be able to assess whether dust lifting and electrical field are correlated as suggested by theoretical and terrestrial studies [e.g. 8].

References: [1] Balme M. et al. (2008), *Geomor*. 101, 703-720. [2] Vaz D.A. & Silvestro S., *Icarus*, in press. [3] Sullivan R. et al. (2005), *Nature*, 436. [4] Golombek M. et al. (2010), *JGR*, 115, E00F08. [5] Arvidson R. E. et al. (2011), *JGR*, 116, E00F15. [6] Chojnacki M. et al. (2011), *JGR*, 116, E00F19. [7] Ewing R. C. et al. (2006), *ESP&L*, 31, 1176-1191. [8] Renno N. O. and Kok J. F. (2008), *Space Sci. Rev.*, *137*, 419-434.