

SEARCHING FOR GEOLOGICAL SURFACE CHANGES AROUND THE INSIGHT LANDING SITE (MARS) FROM HIRISE SATELLITE IMAGES. C. Perrin¹, S. Rodriguez¹, A. Jacob¹, A. Lucas¹, B. Kenda¹, A. Spiga², C. Newman³, N. Murdoch⁴, R. F. Garcia⁴, R. D. Lorenz⁵, I. Daubar⁶, P. Lognonné¹, L. Ohja⁷, M. E. Banks⁸, L. Pan⁹, V. Ansan¹⁰, ¹Institut de Physique du Globe de Paris, Sorbonne Paris Cité, Université Paris Diderot, CNRS F-75005 Paris, France (rodriguez@ipgp.fr), ²Laboratoire de Météorologie Dynamique (LMD/IPSL), Sorbonne Université, CNRS, École Polytechnique, École Normale Supérieure, Paris, France, ³Aeolis Research, 600 N Rosemead Blvd, Pasadena, CA, USA, ⁴ISAE-SUPAERO, Toulouse, France, ⁵Space Exploration Sector, Johns Hopkins University Applied Physics Laboratory, Laurel, MD 20723, USA, ⁶Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, ⁷Department of Earth and Planetary Sciences, Johns Hopkins University, Baltimore, MD, USA, ⁸NASA Goddard Space Flight Center, Greenbelt, MD, ⁹Université de Lyon, UCBL, ENS Lyon, CNRS, Laboratoire de Géologie de Lyon, Terre, Planètes, Environnement, ¹⁰LPG-UMR CNRS 6112, University of Nantes, 2 rue de la houssinière, BP 92208, 44322 Nantes Cedex 3, France.

Introduction: The NASA Interior Exploration using Seismic Investigations, Geodesy and Heat Transport (InSight) mission to Mars successfully landed on November 26th, 2018 in Elysium Planitia. One of its goal is to characterize the seismic activity of Mars, which can be triggered by three main types of sources: tectonic, meteoritic, and atmospheric (e.g. turbulence). Prior to landing, there were extensive efforts to understand the atmospheric contributions to the seismic signal on Mars [1-6]. One atmospheric signal that was predicted to be potentially detectable by both the InSight atmospheric package, part of the Auxiliary Sensor Payload Suite (APSS) and seismometers (SEIS), as well as on orbital images was dust devils. [7] reported numerous dust devil tracks in the close vicinity of the InSight landing site, preceding the landing, denoting surface changes caused by the passage of dust devils in Elysium Planitia. Large-Eddy Simulations also indicated that large pressure drops caused by dust-devil-like convective vortices are expected to be ubiquitous at the InSight landing site [6]. In this study we analyze a preliminary set of images from the High Resolution Imaging Science Experiment (HiRISE) on board of the Mars Reconnaissance Orbiter (MRO) that have been acquired before (May and July 2014) and after (e.g., December 6th and 11th, 2018) the landing of InSight, to validate our methodology for dust devil tracks identification and characterization (see for example Figures 1 and 2).

Dust devil tracks in HiRISE images: Following the landing of InSight, we explore how the formation of new dust devil tracks can be evi-

denced in sets of successive HiRISE images acquired a couple of sols apart. Tracks are characterized by dark linear traces ranging from a few meters to more than ten meters wide and oriented in the ambient wind direction, that can be directly compared to wind direction recorded by the InSight lander's meteorological package. Detailed analyses are performed in order to determine the distribution of azimuths, sizes, and distances from the lander, for each dust devil passage identified in the HiRISE images.

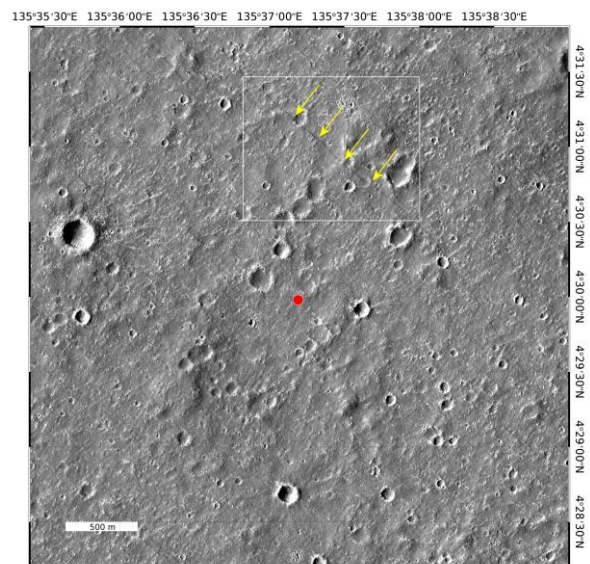


Figure 1. Example of a dust devil track (yellow arrows) observed on May 2014 (4.5 years before landing) in HiRISE image ESP_036761_1845_RED image, in the close vicinity of the future InSight landing site (red dot). White rectangle marks the location of Figure 2.

Assessing dust devil activity (and any surface changes) at the InSight landing site: Results will be used to better link dust devils with signals recorded by the pressure and seismic measurements carried out by the APSS and SEIS instruments on board InSight. Moreover, forthcoming HiRISE observations will be used to further characterize ongoing dust devil activity and improve the statistics of those events. Note that repeat of HiRISE images collected during the InSight mission will also be employed to detect potential wind-driven movement or migration of other aeolian features, such as ripples, that can more generally be compared with wind speed and direction measurements from InSight, as well as the detection of new meteoritic impact that could act as seismic sources.

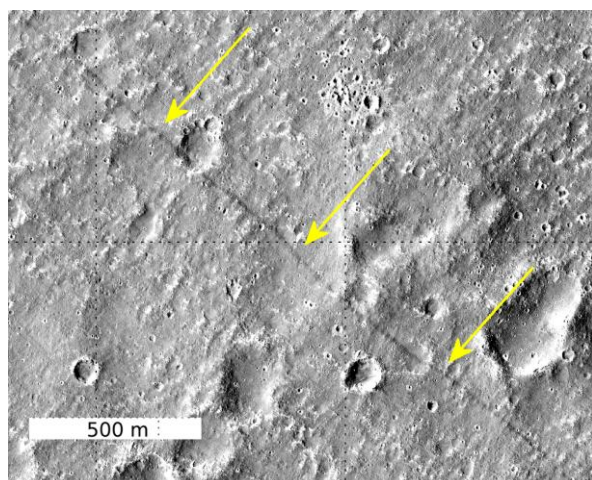


Figure 2. Close-up view from Figure 1 (see white rectangle in Figure 1) of the dust devil track (yellow arrows) seen in the HiRISE image ESP_036761_1845_RED (May 2014).

References: [1] Lorenz et al., BSSA, 2015, [2] Murdoch et al., SSR, 2017a, [3] Murdoch et al., SSR, 2017b, [4] Mimoun et al., SSR, 2017, [5] Kenda et al., SSR, 2017, [6] Spiga et al., SSR, 2018, [7] Reiss and Lorenz, Icarus, 2016.