NEW INSIGHTS FOR THE FORMATION OF SLOPE STREAKS ON MARS FROM A SYSTEMATIC MAPPING USING MARS EXPRESS HRSC DATA: A DRY GRANULAR AVALANCHE CONTROLLED BY WIND-TRANSPORTED DUST. D. Baratoux1, N. Mangold2, P. Pinet1, F. Forget1, P. Masson2, S. Chevrel1, Y. Daydou1, A. Jehl1, R. Greeley4, G. Neukum5 and the HRSC Co-investigator Team, 1Observatoire Midi-Pyrénées, UMR5562, Toulouse, France, david.baratoux@cnes.fr, 2Interactions et dynamique des environnements de surface, UMR 8146, Orsay, France, 3Laboratoire de Météorologie Dynamique, UMR 8539, Paris, France, 4Arizona State University, Planetary geology group, Tempe, Arizona, USA, 5Institute of Geosciences, Remote Sensing of the Earth and Planets, Freie Universität, Berlin, Germany.

**Introduction:** Formation of slope streaks are among the only known processes which are active at the present time on Mars. While their mechanism of formation and triggering is still debated, they may involve liquid water. The HRSC experiment (Mars Express) provides new data for the study of their formation of these objects. While MOC and THEMIS-VIS data had a suitable resolution for slope streaks identification the coverage of these data set does not allow a systematic mapping for a given region. We thus present a systematic mapping of widths, lengths and orientations of slope streaks using HRSC data in a region north of Olympus Mons. This area extends from 28°N to 38°N and from 220°E to 224°E. 800 slope streaks were identified and measured. Their geometric properties are similar to previous results [1] and seem to be independent of the region investigated. This observation suggests that the same physical process and probably the same geological materials are involved in slope streaks formation on Mars.

**Slope streaks density:** We first discuss the density of slope streaks and the parameters which could constrain the slope streaks activity (roughness, thermal properties, surface temperature). We observe that slope streaks density decreases sharply at about 33°N and are thus absent at higher latitude. This correlation has been already reported at the planetary scale from the MOC data set [1] and correlates with a maximum surface temperature close to the triple point of water. This observation supports the role of water in the process of formation (sublimation of ground ice, and/or flow of liquid water). We argue that the role of the ground ice is to stabilize dust at higher latitude, while the absence of ice at lower latitude would allow the formation of slope streaks in slopes covered by dry dust. The density of slope streaks varies also with longitude. These variations can be related to surface roughness properties (at the km scale) and surface thermal properties.

**Slope streaks orientation:** The orientations of slope streaks have been systematically mapped from the mapping of the source to the termination of each feature (Figure 1). The slope streaks in the northern part of the region investigated (30°N – 33°N) are preferentially oriented on south facing slopes.

![Fig 1. Map of slope streaks orientations.](image-url)
In order to further test our hypothesis, we compared the preferential orientation of slope streaks with winds preferential directions estimated in different season, and especially in the dusty season from a Global Circulation Model of Mars. While the wind directions pattern is not simple in this region, given the complexity of the topography, we propose to explain the preferential slope streaks occurrence on west facing slope by wind transported dust and deposition processes. Other regions of slope streaks activities are planned to be studied in order to confirm our hypothesis.

**Rate of formation:** Slope streaks formation is an active process on Mars. Given the mechanism of formation proposed in this study, the study of slope streaks formation in the last few years has implications for our understanding of dust cycle and dust accumulation rate on Mars. We demonstrate that the comparison of THEMIS-VIS images and HRSC is adapted to the identification and mapping of new slope streaks. These observations are promising for the estimation of geographic variations of formation rates.

**Conclusion:** Slope streaks mapping from HRSC demonstrates preferential orientations at Olympus Aureole. MOC images demonstrates a relationship between the absence of dust mantling at the local scale and the occurrence of slope streaks. These observations are consistent with a dust avalanche model for slope streaks formation. The avalanche could be triggered by the preferential accumulation of dust on hill crests in the downstream side of wind flow, as illustrated by snow avalanches. They can also be triggered at heterogeneities such as boulders or small scarps. Our hypothesis is supported by the wind directions obtained from GCM for the dusty season. The difference in soil nature on west and east facing slopes will be assessed by photometric inversion using multi-angular HRSC data. The results produced so far for the Gusev crater floor demonstrate that the new orbital information can be used to study variations of surface scattering properties [3,4]. The derived optical properties will be used to evaluate the relative importance of physical properties (grains size, surface roughness) and composition in the observed contrast of bright or dark slope streaks.