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The contribution of HRSC data to the determination of the slope streaks formation mechanism

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The formation of slope streaks is among the only known processes which are active at the present time on Mars. Slope streaks mechanisms of triggering, formation and evolution are still debated. While MOC and THEMIS-VIS data had a suitable resolution for slope streaks identification, the coverage of these data sets does not allow a systematic mapping for a given region. We thus present a statistical analysis of widths, lengths and orientations of slope streaks using HRSC data in a region north of Olympus Mons. This area extends from 28^{o}N to 38^{o}N and from 220^{o}E to 224^{o}E. 800 slope streaks were identified and measured.

First, their geometric properties are similar to those indicated in previous studies [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. Then, we confirm the latitudinal dependence of slope streaks occurrence mentioned in [1]. Finally, we evidence clear trends in the orientations patterns. The slope streaks in the northern part of the region investigated (30˚N – 33˚N) are preferentially oriented on south facing slopes. In the southern part of the region investigated (29˚- 31˚N), the orientation of slope streaks becomes progressively more randomly distributed (higher dispersion around the average orientation). However, a population of slope streaks is emplaced preferentially on west facing slopes. Taken together, these observations are consistent with a dust-avalanche model. Our observations indicate that winds are involved in the formation of slope streaks which are triggered on the downstream side of the flow by the accumulation of dust particles at hill crests. Indeed, morphologic analysis of MOC images of this region demonstrates a difference in the dust mantling on the east and west facing slopes. Preferential wind directions were estimated in different seasons from a GCM. 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.The latitudinal dependence and the orientation on south facing slope suggest that maximum surface temperatures relatively to the triple point of water are important in the rate of formation. We think that the ice present at northern latitudes can stabilize the dust. Conversely, the absence of ice at lower latitude, or sublimated on south facing slope allows the formation of slope streaks.

Multi-angular observations from HRSC are essential to characterise the properties of the granular materials involved in slope streaks formation. 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.

References : [1] Sullivan, R.J., et al. (2001), J. Geophys. Res., 106(E10), 23607-23634. [2] Schorghofer, N., et al. (2002), Geoph. Res. Let., 29(23), 41-1,41-4. [3] Pinet, P.C. et al. (2005), LPSC XXXVI, #1721. [4] Pinet et al., this issue.