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Do Martian slopes with Recurring Slope Lineae (RSL) have a distinct topographic signature?

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Recurring Slope Lineae (RSL) are dynamic, low-albedo, slope-parallel surface features on Mars that occur mainly on steep (>25°) slopes. RSL typically display seasonal dynamics as they appear during late Martian spring, progressively grow during summer, and subsequently fade as summer ends. RSL formation mechanisms remain under debate with proposed mechanisms involving either water/brines ('wet theories') vs. dry granular flows within a surficial dust layer ('dry theories'). In an attempt to distinguish between plausible RSL mechanisms, this study compares the topographic and morphologic characteristics of hillslopes with and without RSL. We suggest that a distinct topographic signature for RSL hillslopes would argue against the 'dry' RSL mechanisms, as RSL dynamics within a thin dust layer are not expected to significantly impact the hillslope-scale topography. In contrast, the presence of fluids on RSL hillslopes could conceivably accelerate rock weathering rates, which in turn may impact the hillslope-scale topography. Our analyses are based on HiRISE, CTX and HRSC digital terrain models (DTMs) together with geomorphic mapping using high-resolution orbital images. We focus on inner crater hillslopes and compare the topographic characteristics of RSL vs. non-RSL slopes. In addition, in order to account for the potential influence of aspect-dependent solar irradiation on hillslope processes, we also applied our analysis on adjacent 'control' craters that are devoid of RSL activity. Preliminary results from Palikir (-41.6°/ 202.1°E) and Rauna (35.2°/ 328°E) craters reveal that the topographic slope distribution along crater walls with RSL activity is distinct from the slope distribution along crater walls which are devoid of RSL activity. Our results appear to support increased rock-weathering rates on crater walls that presently experience RSL activity.