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Exploring trends of landslide distribution and mechanics of flow with a new database for landslides on Mars

Fabio Vittorio De Blasio, Giovanni Battista Crosta, Elena Valbuzzi, and Paolo Frattini
Dept. of Earth and Environmental Sciences, University of Milano Bicocca, P.zza Scienza 4, Milano, Italy

On Mars, landslides are often extremely well preserved after billions of years and thus their examination can shed light on the ancient climatic conditions on the surface of the planet. During a two years-project, we have produced a set of data for landslides on Mars. Data encompass the runout, the fall height, the H/R ratio (Fahrbosching) and other characteristics; landslides are classified depending on their typology, location, latitude, setting (e.g., landslides inside craters, landslides in the outflow channels). In contrast to most of the previous studies, focusing on selected areas of Mars, we have considered the whole planet. After the database was constructed, a systematic study was undertaken based on different criteria, some of which being:

Geographical position: landslides in upper Valles Marineris (VM), lower Eastern and Western VM, northern water excavated valleys (Juventae, Shalbatana, Kasei), Noctis Labyrinthus, Chaos, northern territories – Martian Dichotomy, Olympus Mons. These areas could control the local geological or environmental conditions like water availability or ice melting. This could change the mobility of the landslides like evidenced in Chaos regions where mobility seems much larger with respect to the Martian landslide population.
Impact induced landslides: these landslides are triggered by the impact of a meteoroid on the sloping ground or valley flank or just at the upper crest. They are much more mobile than the other landslides, the other conditions being similar.
Landslides characterized by the presence of Toreva blocks can suggest unique triggering and deposition processes. In particular, rock avalanches at the front of Toreva blocks exhibit low thickness and extremely low apparent friction angles with respect to other landslides. This can be associated to the different properties of the material located at the front/superficial slope sectors with respect to the deeper zones.
Northern Valles Marineris seems to be characterized by large slumps and avalanches that could result from different properties and mechanisms as well as by the stronger confinement which hamper the flow and thinning of the mass
Landslide multiple collapse at the same location could be indicative of predisposing factors, ice water or weak lithologies. At the same time mobility and flow style remain almost unchanged. What controlled the time interval between successive failures?
Dynamics of the landslides: We developed a series of numerical simulations to explain the long run-out and the noticeable stretching. Simulations are based on the presence of ice as a lubricating medium either at the base of the landslide, or inside the regolith.