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On the variability of lunar soil properties – bearing capacity

Urs Mall (1), Daniel Kloskowski (1), Henrik Schmidt (1), Valentin Tertius Bickel (1,2), Alexander Basilevsky (3), and Roberto Bugiolacchi (4)

(1) Max-Planck-Institut für Sonnensystemforschung, Göttingen, Germany (mall@mps.mpg.de), (2) ETH Zurich, Zurich, Switzerland, (3) Vernadsky Institute of Geochemistry and Analytical Chemistry, Moscow, Russia, (4) Space Science Laboratory Macau University of Science and Technology, Macau – China

Studies of the physical and mechanical properties of the lunar surface regolith, and its soil fraction, have allowed a deeper understanding of the formation of the loose unconsolidated rock and dust layer, which represents the interface between most airless rocky planetary bodies and space. As space exploration is steadily progressing from remote sensing to in-situ exploration of celestial bodies, the Moon represents the natural candidate as a first-step laboratory where new technologies and know-how can be developed before taking further, and farther leaps into the Solar System. In this context, plans are afoot for creating habitable and working environments on the lunar surface; however, their selection based on a wide range of stringent requirements (from safety to proximity to water/ore sources) demands a better understanding of the variability of the physical parameters of planetary regolith. Our present knowledge is marred by uncertainties relating to spatial distribution and variability for instance, or measurement and statistical errors (due to small sample sizes). Confidence in the values of soil properties is of paramount importance for any design purpose at remote locations. Consequently, we have started to look at selected properties with the goal to investigate and assess the variability of the associated parameters using different methods and to compare those methods to one another. Our interest is focused on quantifying the spatial variability of the mechanical properties of regoliths at different scales and understanding the factors influencing it on a range of very different celestial surfaces. For instance, cohesion, originating from electrostatic and surface-energy forces, plays a different role in the physical behaviour of soils on different planetary surfaces as both the particle size distribution and particle shape influence when these forces become relevant in varying (low) gravitational environments. We started by looking at the bearing capacity of lunar regolith, a parameter which is important for understanding various phenomena ranging from terrain trafficability to the mobility of mass wasting features. In this work, we investigate the vertical and spatial variability of the bearing capacity of lunar soils for selected lunar regions (Schrödinger basin and the Taurus-Littrow valley) using the classical method of boulder track analysis (Hovland,1972) taking advantage of the high-resolution images from the LROC mission.

References:
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