Supplemental Information

- Studies indicate that silica-rich deposits occurring on Mars, which included those that may be covered by the investigated regoliths, were formed from the remnants of basaltic precursor materials after extensive weathering processes [1, 2]. Accordingly, we considered that the core (parent) material of the mixed particles forming the examined regoliths corresponds to a rich-silica basaltic composition. Due to the estimated high silica content of this composition, we assumed that its extinction coefficient is negligible like in the quartz (silica) case. However, since this composition is likely to have a higher density than that of quartz due to the presence of the basaltic precursor materials with a density closer to that of basalt, it is also expected that it may have a higher refractive index than that of quartz. Since the actual spectral values for this refractive index are unknown at this time, we have assigned to them the spectral values employed for basalt, which may be regarded as upper bounds for this spectral quantity. Although our choice of values for the basaltic composition's refractive index and extinction coefficient may not find an exact correspondence in materials commonly found on Earth, it is worth noting that the optical properties of silica-rich materials on Mars may not be the same as those obtained in terrestrial settings under ambient conditions [2].

- Note that the geometric mean particle diameters and standard deviations provided in Table II correspond in fact to statistical parameters incorporated into the particle size distribution provided by Shirazi et al. [3, 4] to obtain the dimensions of the grains. In our simulations, we considered sand-textured soils composed of a large fraction (denoted s_1) of sand-sized grains (particles with dimensions between 0.05 to 2.0 mm) along with a small fraction (denoted s_2) of silt-sized grains (particles with dimensions between 0.002 to 0.05 mm). In the table below, we provide the average dimensions (given in mm) of the major axes m_a and m_i that respectively define the ellipsoids used to represent the sand-sized and the silt-sized particles forming the soil samples considered in our simulations.

s_1	s_2	m_a	m_i
85%	15%	0.2362	0.0452
95%	5%	0.2824	0.0429

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