Application of hyperspectral remote sensing in the longwave infrared region technology for assessing the influence of settled desert dust particles on soil surface

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Soil mineralogy holds important information on the soil origin and development. Most common minerals in soils—quartz, clay minerals and carbonates—present fundamental spectral features in the longwave infrared (LWIR) region (8.0–12 μm range), whereas quartz is featureless in the optical region (0.4–2.5 μm range). A procedure for determining the soil surface mineralogy from hyperspectral LWIR data was used to assess the interaction with desert dust particles that accumulate on the soil surface during dust storms. Ground- and field-based hyperspectral LWIR images of different types of Israeli soils, before and after dispersion of desert dust-like material on the surface, were acquired with the Telops Hyper-Cam sensor, to calculate the surface emissivity spectra of soils, representing the surface mineralogy. Identifying mineral-related emissivity features and calculating their relative intensities, using two created indices—SQCMI (Soil Quartz Clay Mineral Index) and SCI (Soil Carbonate Index)—enabled determining the content of quartz, clay minerals, and carbonates in the soil in a semi-quantitative manner—from more to less abundant, and identifying changes in their abundance resulting from the dispersion of dust on the surface. The dust affected the mineral-related spectral features of the soil surface, depending on the mineral composition of the dust compared to soil surface mineralogy, and its amount. The ability to detect minor mineralogical changes on the soil surface using high spectral resolution LWIR data was demonstrated.