

Soil and surface layer type affect non-rainfall water inputs

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Non-rainfall water inputs (NRWIs), which include fog deposition, dew formation, and direct water vapor adsorption by the soil, play a vital role in arid and semiarid regions. Environmental conditions, namely radiation, air temperature, air humidity, and wind speed, largely affect the water cycle driven by NRWIs. The substrate type (soil type and the existence/absence of a crust layer) may as well play a major role. Our objective was to quantify the effects of soil type (loess vs. sand) and surface layer (bare vs. crusted) on the gain and posterior evaporation of NRWIs in the Negev Highlands throughout the dry summer season.

Four undisturbed soil samples (20 cm diameter and 50 cm depth) were excavated and simultaneously introduced into a PVC tube. Two samples were obtained in the Negev's Boker plain (loess soil) and two in the Nizzana sand dunes in the Western Negev. On one sample from each site the crust was removed while on the remaining one the natural crust was left in place. The samples were brought to the research site at the Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Israel (31°08' N, 34°53' E, 400 meter above the sea level) where they were exposed to the same environmental conditions. The four samples in their PVC tubes were placed on top of scales and the samples mass was continuously monitored. Soil temperatures were monitored at depths of 1, 2, 3, 5 and 10 cm in each microlysimeter (ML) using Copper-Constantan thermocouples.

The results of particle size distribution indicated that the crust of the loess soil is probably a physical crust, i.e. a crust that forms due to raindroplets impact; while the crust on the sand soil is biological. On most days, the loess soils adsorbed more water than their corresponding sand soil samples. For both soils, the samples for which the crust was removed adsorbed more water than the samples for which it was intact. The difference in daily water adsorption amount between crusted and non-crusted sandy soils often exceeded that between crusted and non-crusted loess soils.