Geophysical Research Abstracts
Vol. 16, EGU2014-15551, 2014
EGU General Assembly 2014

Microbial effect on soil hydraulic properties

Alex Furman (1), Ravid Rosenzweig (2), Elazar Volk (1), Hella Rosenkranz (3), Sascha Iden (3), and Wolfgang Durner (3)

(1) Technion, Civil & Environmental Engineering, Haifa, Israel (afurman@technion.ac.il, +972-4-8228898), (2) Geological Survey of Israel, Jerusalem, Israel, (3) TU Braunschweig, Institute of Geoecology, Soil Physics, Braunschweig, Germany

Although largely ignored, the soil contains large amount of biofilms (attached microbes) that can affect many processes. While biochemical processes are studied, biophysical processes receive only little attention. Biofilms may occupy some of the pore space, and by that affect the soil hydraulic properties. This effect on unsaturated soils, however, was not intensively studied.

In this research we directly measure the hydraulic properties, namely the soil's unsaturated hydraulic conductivity function and retention curve, for soils containing real biofilm. To do that we inoculate soil with biofilm-forming bacteria and incubate it with sufficient amounts of nutrient until biofilm is formed. The hydraulic properties of the incubated soil are then measured using several techniques, including multi-step outflow and evaporation method. The longer measurements (evaporation method) are conducted under refrigeration conditions to minimize microbial activity during the experiment.

The results show a clear effect of the biofilm, where the biofilm-affected soil (sandy loam in our case) behaves like a much finer soil. This qualitatively makes sense as the biofilm generates an effective pore size distribution that is characterized by smaller pores. However, the effect is much more complex and needs to be studied carefully considering (for example) dual porosity models. We compare our preliminary results with other experiments, including flow-through column experiments and experiments with biofilm analogues. Clearly a better understanding of the way microbial activity alters the hydraulic properties may help designing more efficient bioremediation, irrigation, and other soil-related processes.