Geophysical Research Abstracts
Vol. 20, EGU2018-5578, 2018
EGU General Assembly 2018

Biophysical Model of Soil Aggregation: from root residues to microbial and physical hotspots

Teamrat Ghezzehei (1) and Dani Or (2)

(1) University of California, Merced, Merced, United States (taghezzehei@ucmerced.edu), (2) ETH Zurich, Zurich, Switzerland (dani.or@env.ethz.ch)

Soil aggregation plays important role in storage and movement of water and essential gases, nutrient cycling, and ultimately supporting microbial and plant life. Microhabitats within aggregates have been shown to support the greatest microbial diversity as well. It is one of the most dynamic and sensitive soil qualities, which readily responds to disturbances such as cultivation, fire, drought, flooding, and changes in vegetation. Soil aggregation that is primarily controlled by organic matter generally exhibits hierarchical organization of soil constituents into stable units that range in size from a few microns to centimeters. However, this conceptual model of soil aggregation as the key unifying mechanism remains poorly quantified and is rarely included in predictive soil models. Here we introduce a biophysical framework for modeling soil aggregation from life cycle of individual aggregates to pedon-scale aggregation. Individual aggregates are treated as hotspots of biological, chemical and physical processes centered on roots and root residues. At the pedon scale, soil aggregation is primarily controlled by root architecture and hydration state. The framework synthesizes current understanding of microbial life in porous media; water holding and soil binding capacity of biopolymers; and environmental controls on soil organic matter dynamics. The framework paves a way for integration of processes that are presently modeled as disparate or poorly coupled processes, including storage and protection of carbon, microbial activity, greenhouse gas fluxes, movement and storage of water, resistance of soils against erosion.