Geophysical Research Abstracts
Vol. 14, EGU2012-8993-2, 2012
EGU General Assembly 2012
© Author(s) 2012

A biophysical index for predicting hydration-mediated microbial diversity in soils

G. Wang and D. Or

ETH Zurich, Institute of Terrestrial Ecosystems (ITES), Department of Environmental Sciences (D-UWIS), Zurich, Switzerland (gang.wang@env.ethz.ch)

Exploring the origins of soil microbial diversity represents an immense and uncharted scientific frontier. Progress in resolving mechanisms that promote and sustain the unparalleled soil microbial diversity found in soil requires development of process-based predictive tools that consider dynamic biophysical interactions at highly resolved spatial and temporal scales. We report a novel biophysical metric for hydration-mediated microbial coexistence in soils by integrating key biophysical variables, such as aquatic habitat size and connectivity, nutrient diffusion affecting microbial growth, and aqueous films controlling motility and dispersal, into a predictive index. Results show a surprisingly narrow range of hydration conditions (a few kPa) that mark a sharp transition from suppression (wet) to promotion (dry) of microbial diversity in unsaturated soils in agreement with limited observations and with simulation results based on individual-based models of competing populations. The framework enables systematic hypothesis testing for key factors that regulate microbial populations and affect soil bio-geochemical functions, and represents a step towards deciphering key mechanisms that support soil microbial diversity. New insights into the different roles of biophysical mechanisms in promoting soil microbial diversity enable predictions concerning microbial consortia function and bioremediation activities in soils, and may shape how we quantify microbial diversity within the context of land resources and biogeochemical cycling.