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Geophysical Research Abstracts
Vol. 21, EGU2019-3567, 2019
EGU General Assembly 2019

A new generation of pedotransfer functions – vegetation and soil structure effects on infiltration-runoff partitioning

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Land surface models (LSMs) for climatological and hydrological applications require spatially distributed soil hydraulic properties often derived from readily available soil properties (e.g., texture, bulk density, organic matter) by means of pedotransfer functions (PTFs). Present PTFs are limited due to reliance on soil sample information and only a few data sets for training. In particular, none of the PTFs consider the effects of soil structure, thus limiting their applicability in vegetated areas in which macropores are expected to significantly increase soil saturated hydraulic conductivity. Considering the strong links between vegetation and soil structure, we propose a systematic approach for incorporating structural effects on PTF-derived soil hydraulic properties. We gauge the hydrologic impact of soil structure using infiltration-runoff partitioning across a wide range of vegetation covers, soil types, and climatic conditions. The analysis considers both point scale and areal average responses relevant to LSMs. Strategies for the derivation of upscaled parameterizations accounting for the combined effects of sub-pixel variability in soil type and vegetation are proposed, together with the definition of physically-based constraints to develop new PTFs incorporating soil structural effects.