Geophysical Research Abstracts
Vol. 13, EGU2011-5196, 2011
EGU General Assembly 2011

Upscaling tree-scale canopy and soil water heterogeneity for a temperate deciduous forest of Northern Michigan

Valeriy Y. Ivanov (1), Lingli He (1), Gil Bohrer (2), Christoph S. Vogel (3), and Mahta Moghaddam (4)

(1) University of Michigan, Civil and Environmental Engineering, Ann Arbor, MI, U.S.A. (ivanov@umich.edu), (2) Department of Civil and Environmental Engineering and Geodetic Science, Ohio State University, Columbus, OH, U.S.A. (bohrer.17@osu.edu), (3) University of Michigan Biological Station, University of Michigan, Pellston, MI, U.S.A. (csvogel@umich.edu), (4) Department of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, U.S.A. (mmoghadd@umich.edu)

Current watershed models and land-surface parameterizations use simplified representations of the interactions between vegetation and soil moisture, typically neglecting small-scale heterogeneities. The implications of such assumptions are unclear. They need to be addressed, particularly, in the light of large-scale transient changes of land-surface, such as a forest succession taking place in the Northeast of U.S.A. Succession can result in changes to both the vertical and horizontal canopy structure and increase its heterogeneity; such changes may strongly impact spatial heterogeneity of soil moisture, evapotranspiration, and, possibly, the dynamics of the atmospheric boundary layer. A small, 2 sq. km, watershed located in a heterogeneous deciduous forest environment of Northern Michigan, near the University of Michigan Biological Station (UMBS) is used as a case study. Multiple monitoring programs are ongoing within the delineated domain, including flux observations of the Ameriflux network, an accelerated forest succession experiment, and a number of small-scale ecological observations. Deep-profile, point-scale continuous monitoring of soil moisture as well as periodic measurements of spatial distribution of soil water were recently added to the monitoring program. This study uses a high-resolution, physically-based ecohydrological model (tRIBS+VEGGIE) as a data integration tool to upscale heterogeneity of canopy structure resolved at a few meters to the watershed and larger scales and investigate the properties of such upscaling. Parameterization of soil hydraulic properties has been inferred by using soil moisture data sets from the monitoring network and a stochastic inverse routine. Energy and soil water dynamics simulated with tRIBS+VEGGIE are validated against observational data. Canopy and soil moisture observations permit the inference of statistical properties of fine-scale canopy and root zone soil water heterogeneity. Several scenarios of spatially distributed canopy and soil water state are contrasted with the scenario of homogeneous canopy and soil water state and are discussed in this presentation.