Geophysical Research Abstracts,
Vol. 11, EGU2009-6496-3, 2009
EGU General Assembly 2009

Artificial Hillslopes at Biosphere 2: Exploring Soil-Water-Atmosphere-Plant Interactions in a Changing Environment

L. Hopp (1), P. Troch (2), T. Huxman (3), C. Harman (4), S. Desilets (2), K. Dontsova (5), J. Chorover (6), S. Kling (2), J. Pelletier (7), C. Paniconi (8), V. Ivanov (9), D. Jenerette (10), M. Sivapalan (11), and J. McDonnell (1)

(1) Oregon State University, Department of Forest Engineering, Resources and Management, Corvallis, United States (luisa.hopp@oregonstate.edu), (2) Department of Hydrology and Water Resources, The University of Arizona, Tucson, USA, (3) Department of Ecology & Evolutionary Biology, The University of Arizona, Tucson, USA, (4) Department of Geography, University of Illinois at Urbana-Champaign, USA, (5) Biosphere 2, The University of Arizona, Tucson, USA, (6) Department of Soil, Water and Environmental Science, The University of Arizona, Tucson, USA, (7) Department of Geosciences, The University of Arizona, Tucson, USA, (8) INRS-ETE, Université du Québec, Québec, Canada, (9) Department of Civil and Environmental Engineering, University of Michigan, Ann Arbor, USA, (10) Department of Botany and Plant Sciences, University of California, Riverside, USA, (11) Department of Geography and Department of Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, USA

The partitioning of precipitation upon the land surface into evaporation, transpiration, infiltration, recharge, runoff and stream flow and subsequent controls on hydrologic storages and flow paths remains an open research question. Experimental studies to date have suffered from scale issues and uncertain boundary conditions. The Biosphere 2 Experimental Biome's unique spatial scale provides the opportunity for controlled experiments at a relevant scale, bridging the gap between controlled, laboratory-scale experiments and field experiments under natural conditions. The B2 Artificial Hillslopes Experiment is designed as a community effort. The objective of the experiment is to explore how climate, soil and vegetation interact and drive the geomorphological and biogeochemical evolution of the hydrologic system in a hillslope.

Hillslopes were chosen as flow domains because they represent a fundamental landscape unit, controlling the hydrologic response of catchments. Three replications of a hillslope template with evolving vegetation cover will be exposed to controlled perturbations of climate, simulating the impact of a changing future climate. Experiments are planned to run for at least 10 years.

The first phase of the experiment has included pre-construction modeling efforts in hydrology, ecology, geomorphology and geochemistry that aim at supporting the design and construction process of the artificial hillslopes as well as providing initial model predictions of the anticipated evolution of the vegetation-hillslope systems.

Based on hydrologic modeling results, a zero-order watershed geometry and loamy sand texture of the soil material on a 10 deg hillslope were determined to generate a variety of hydrologic conditions favorable for geochemical weathering, plant and soil ecology. Using this hillslope configuration, the expected evolution of the hillslopes over the course of the experimental time and resulting modification of the hydrologic behavior were assessed in numerical experiments. These modeling results will be compared to future experimental data. Using artificial hillslopes in a climate-controlled environment offers exciting research opportunities to test hypotheses, validate models and observe emergent behavior, thereby advancing our understanding of critical zone processes in a changing environment.