Geophysical Research Abstracts
Vol. 16, EGU2014-2294, 2014
EGU General Assembly 2014

Four-dimensional soil moisture response during an extreme rainfall event at the Landscape Evolution Observatory

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The Landscape Evolution Observatory (LEO) at Biosphere 2-The University of Arizona consists of three identical, sloping, 333 m2 convergent landscapes inside a 5,000 m2 environmentally controlled facility. These engineered landscapes contain 1-meter depth of basaltic tephra, ground to homogenous loamy sand. Each landscape contains a spatially dense sensor and sampler network capable of resolving meter-scale lateral heterogeneity and sub-meter scale vertical heterogeneity in moisture, energy and carbon states and fluxes. The density of sensors and frequency at which they can be polled allows for data collection at spatial and temporal scales that are impossible in natural field settings. Each $\sim$600 metric ton landscape has load cells embedded into the structure to measure changes in total system mass with 0.05% full-scale repeatability (equivalent to less than 1 cm of precipitation). This facilitates the real time accounting of hydrological partitioning at the hillslope scale. Each hillslope is equipped with an engineered rain system capable of raining at rates between 3 and 45 mm/hr in a range of spatial patterns. We observed the spatial and temporal evolution of the soil moisture content at 496 5-TM Decagon sensors distributed over 5 different depths during a low-intensity long-duration rainfall experiment in February 2013. This presentation will focus on our modeling efforts to reveal subsurface hydraulic heterogeneity required to explain observed rainfall-runoff dynamics at the hillslope scale.