



On the evolution of catchment hydrology and the hydrology of catchment evolution (John Dalton Medal Lecture)

Peter A. Troch

Department of Hydrology and Water Resources The University of Arizona, Tucson AZ, USA

While a lot is now known about catchment hydrologic behavior of many study sites around the world, the ability to generalize these findings for predictions in unmonitored sites remains difficult. This is largely due to the fact that the link between climate, hydrologic response and how the landscape is structured is poorly understood. Such understanding is fundamental to advancing new hydrological theory and to inform model structures that can be used in ungauged sites. In this lecture, I will first review the state-of-the-art of catchment hydrology and next explore the potential of a theoretical framework of watershed co-evolution to advance catchment hydrological modeling. Catchments are open non-linear dissipative systems that process mass, momentum and energy fluxes across their boundaries and exhibit an amazing amount of structure and organization. It is hypothesized that (i) landscape internal structure (e.g. soil and vegetation spatial organization) is predictably related to long-term climate forcing and initial and boundary conditions set by geology and tectonics, and (ii) this internal structure defines the hydrologic response across many space and time scales. Several examples from different research efforts will be discussed and synthesized into a research vision that embraces both experimental (laboratory and in-situ) and theoretical approaches to understand the hydrology of catchment evolution.