The Department of Civil and Environmental Engineering at the University of Houston presents...

CIVE 6111 Graduate Seminar

Multi-Scale Links Between Catchment Water Balance and Vegetation Dynamics

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Abstract
Ecohydrologic systems are a complex adaptive system that represents time-dependent land-atmosphere interactions. The propagation of climatic signals through this system is non-stationary and generates heterogeneous feedback. A finite memory drives the systems' multi-temporal scale characteristics. Like any adaptive system, it can converge towards states where all stimulation ceases. Its feedback results from a climate-induced ripple-effect phenomenon moving through the system's components(i.e., soil, water, and vegetation). This creates many nonlinear interactions between climate, soil, water, and vegetation at long-term, inter-annual and intra-annual scales. The interplays between the components are responsible for some fundamental differences in space-time patterns and processes of various terrestrial ecosystems. The multi-scale links between these components can be synthesized by focusing on individual systems in isolation with a physics-based representation or based on emerging spatiotemporal patterns/laws among a population of systems with varying characteristics. However, the self-organizing behaviors of the systems often do not fully manifest themselves in mathematical forms. Hence, embracing the science of places is essential rather than investigating a single system in isolation. Here we present methods for linking catchment water balance and vegetation dynamics at multi-scales based on a population of catchments. We develop and validate macroscopic functional frameworks that are simple enough and yet sufficiently exact in revealing the mechanisms at work. These frameworks can be used for understanding the vegetation-water co-dynamics or as a first-order behavioral constraint in hydrological, land surface, and earth system models.

Bio
Guta Wakbulcho Abeshu is a Ph.D. candidate in the Civil Engineering Department at the University of Houston. He works under the supervision of Dr. Hongyi Li. Guta's research interests are natural and built environment ecohydrology, global hydrological modeling, and sustainable water resources management.