Groundwater-Surface Water Modeling in an Evolving Environment: Integrated Risk Analysis Approaches and Applications in Hawai‘i

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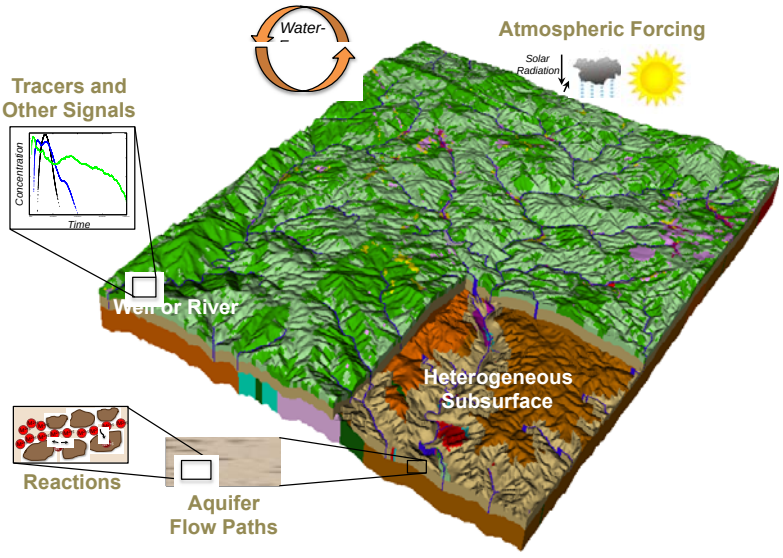
Holmes Hall 244



Increasingly resource-intensive lifestyles create strains on surface and subsurface water resources via demands for food, raw materials, and energy. Hydrologic modeling can be used as a tool to better understand the movement and partitioning of water, and the implications on contaminant transport, water resource management, ecosystem function, and recreation. An overview of my past and current research topics will be presented ranging from flow and transport in saturated porous media to hydrologic topics spanning across the critical zone (i.e., the region from bedrock to vegetation canopy). Example topics include the impact of spatial persistence patterns of subsurface heterogeneity and the effect of different geostatistical models used to characterize this heterogeneity, the impact on anomalous transport and solute breakthrough curves at an observation point (e.g., at a groundwater well or in a river), and the up-scaled effect of pore-scale processes at the watershed scale. Analyses using integrated hydrologic modeling, which explicitly couple different water-energy budget processes, will also be presented. Examples of high-resolution watershed models that explicitly simulate groundwater-surface water interaction with state of the art parallel high performance computing techniques will be shown. Finally, an extension of this work focusing on applications in Hawaiian hydrology will be discussed. The pairing of physically based integrated hydrologic models with field characterization such as geophysical subsurface data and tracer tests can serve as a test bed to understand how subsurface heterogeneity of geologic structures influence water resources in the island environments of Hawai‘i.