

IDEAS-Watersheds: Partnership with the Watershed Function SFA

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Project Abstract: In this poster, we report progress on the two main IDEAS-Watersheds activities in support of the LBNL SFA Watershed Function Partnership. Specifically, we report on (1) the implementation of a general approach to generate multiresolution meshes for use in East River, CO, watershed simulations, and (2) the simulation of integrated-hydrology reactive transport processes in a hillslope and sub-catchment of the East River watershed. These activities combined set the stage for High Performance Computing (HPC) Scale-Aware simulations of flow and reactive transport at watershed scales in the second and third year of the project.

A wavelet-based local mesh refinement (wLMR) strategy was designed to generate multiresolution and unstructured triangular meshes from real digital elevation model (DEM) data, for efficient hydrological simulations at catchment-scale. The wLMR strategy was studied considering slope- and curvature-based refinement criteria derived from the DEM. Both criteria predicted outlet hydrographs with a close predictive accuracy to that on the uniform mesh, but the curvature-based criterion was found to slightly better the capture channeling patterns of real DEM data (Özgen-Xian et al, 2020, *Wavelet-based local mesh refinement for rainfall-runoff simulations*, Journal of Hydroinformatics, accepted March 2020)

Field observational data at the East River, CO watershed indicate that some aqueous geochemical components exhibit distinct characteristics under snowmelt and baseflow conditions. Geologic structure and mineral composition have a strong influence on the concentration-discharge (C-Q) response under different water infiltration and groundwater level scenarios. The Advanced Terrestrial Simulator (ATS) is used to simulate integrated surface- subsurface hydrology and reactive transport processes at an East River hillslope intensive site, and at the Copper Creek sub-catchment. The meteorological forcing combines the high- resolution PRISM precipitation reanalysis data, and the simulated evapotranspiration and snowpack from a land model. These simulations are used as a stepping stone in the use of the newly developed reactive transport capabilities of ATS, which were built upon the Alquimia interface and the concept of interoperable code development.