A Showcase of Integrated Atmosphere-to-Bedrock Science Activities in the East River Watershed to Advance Mountainous Hydrology

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Abstract:

The East River watershed of the Upper Colorado River is now one of the most heavily-instrumented headwater basins in the world through cross-scale investments in scientific activities using measurements, modeling, and analysis of processes that dominate mountainous hydrology from the atmosphere through the bedrock. Established subsurface through canopy observations and models of water, metals, and nutrients via support from the U.S. Department of Energy's Watershed Function Scientific Focus Area project (WF-SFA) are being contextualized with atmospheric measurements obtained from the new Surface Atmosphere Integrated Field Laboratory (SAIL) campaign and partner campaigns including NOAA's Study of Precipitation, the Lower Atmosphere, and Surface for Hydrometeorology (SPLASH). With preliminary data from SAIL and SPLASH and accelerating activities connecting those data to WF-SFA activities, we present a number of examples highlighting the nature of the interdisciplinary research work, in its current working state, that is advancing the science of mountainous hydrology. These include: (1) validating precipitation radar measurements, (2) using these measurements to explore surface

and subsurface water partitioning, (3) improving the mechanistic understanding of connections between atmospheric, surface, and subsurface processes with observationally-constrained integrated process models, (4) constraining snowpack and blowing-snow sublimation using in situ measurements, wind and precipitation measurements, and LiDAR-based snowpack surveys, and (5) exploring how radiation and atmospheric aerosol processes impact nutrient delivery via airborne deposition that, in turn, impact surface and below ground hydro-biogeochemical processes. These advances are critical for strengthening the predictive understanding of water and energy budgets, as well as fluxes of nutrients and metals in the Anthropocene. These examples represent only a subset of those enabled through creation of the Nation's first atmosphere-to-bedrock field observatory. This presentation is intended to spark discussion as to additional interdisciplinary research needed to establish the minimum but sufficient observational datasets required for developing a predictive understanding of watershed system functionality in the Upper Colorado River Basin and other snow-dominated mountainous systems worldwide.