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Measuring the Link Between Energy and Water: Latent Heat Flux in Heterogeneous Mountain Environments

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Snowpack in high elevation regions of the Colorado River basin contributes to seventy percent of the Colorado River streamflow, which provides water to thirty million people. Despite the importance of these regions for downstream water delivery, water availability from these mountain sources is vulnerable to the changing climate. However, the effect of climate change on these regions is difficult to characterize given Earth System Models' poor representation of high-elevation, mountainous regions. These regions are difficult to represent in large-scale models due to their large topographic gradients, heterogeneous land cover, and complex atmospheric patterns. Our DOE SBR Exploratory Project has combined observations and models to better characterize water, energy and CO2 fluxes in a headwaters system. A combination of point observations and high-resolution models are used to estimate these hydrologic fluxes in a Colorado River headwaters region, near Crested Butte, Colorado. Using data from an eddy flux tower collocated with a metrological station in the East River basin, this study has collected almost two years of observations that include latent and sensible heat fluxes. Initial observations are consistent with expected results and within reasonable bounds; latent heat is greatest in the spring as vegetation begins growing and lowest in the winter due to snow cover. Conversely, sensible heat peaks before total snow melt and decreases as latent heat increases. These initial results show promise for accurately modeling energy fluxes and plant water use in this heterogeneous mountain region.