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Quantifying Watershed Storage Dynamics using long duration high frequency measurements of Precipitation, Runoff, and Evapotranspiration

Understanding mountain water storage and redistribution is critical to understanding water availability. Climate change has the potential to change these important storage and redistribution dynamics. Previous studies have estimated watershed storage, but all have relied on modeled evapotranspiration (ET) for calculation. Vegetation and landscape heterogeneity make modeling of ET complex and imprecise. In this study we propose to calculate dynamic catchment water storage using a water balance approach. We will utilize ET measured on an eddy flux covariance tower located in the Stringer Creek watershed in the Tenderfoot Creek Experimental Forest. Measured ET will be combined with measured precipitation (P) and runoff (Q) to calculate ΔS , using the mass balance equation $\Delta S = P - (Q + ET)$. We will then compute the relative amount of water stored in the watershed through time via a data based direct observation approach further corroborated by data from soil moisture probes, groundwater wells, and data from a novel COSMOS neutron scattering sensor, to find the absolute amount of water stored in the watershed (S) through time. Comparisons made between S, ET, and Q measurements will elucidate the relative influences of vegetation and soil water redistribution on Q and changes in watershed S across time. This study seeks new insights into the interplay between vegetation and soil water redistribution and their influence on catchment scale water budgets. This will provide a better understanding of factors affecting water availability in the Rocky Mountain West and for the first time accurately calculate watershed scale storage - discharge relationships and storage - ET relationships.