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Quantification of the Water Balance across the United States

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A balanced water budget underscores our understanding of the hydrologic cycle and should drive our efforts to observe and simulate hydrology. The National Water Census, a current inter-agency collaboration in the United States' government, takes this water balance perspective to assess our ability to observe and simulate daily hydrology across the entire country. A simple, basin-scale water budget was described in terms of hydrologic processes: precipitation equaling the sum of discharge, evapotranspiration and changes in storage (including groundwater). Several observational datasets were then compiled for each component of this water budget. First, consistency was assessed for all datasets of each component (leaving aside direct questions of accuracy) to determine if the observational products actually agree for each component of the water budget. Each component was then iteratively represented with a different data product (e.g., one of the several different observations of precipitation) to understand the ability of these combinations of products to balance the water budget by observing the residual between water entering and leaving the basin. This residual was computed and compared across different temporal and spatial scales. For example: precipitation was highly inconsistent across the middle longitudes of the United States; evapotranspiration products varied most widely in northern latitudes, especially in the winter and spring months; streamflows were most difficult to precisely observe in the middle longitudes. Evapotranspiration was found to be the greatest driver of balanced water budgets over much of the country. Results show consistency of observational datasets was found to vary across the components as well as temporally and spatially. However, in the majority of the country, more precipitation is available than is leaving the basin through streamflow, evapotranspiration and changes in storage. The next phase of this work is (1) to evaluate our best models of simulated hydrology against these baseline water budgets, and (2) to use the information of these differing baselines to improve hydrologic models used for water resources management.