Analysis of the spatial and temporal variability of mountain snowpack and terrestrial water storage in the Upper Snake River, USA

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The spatial and temporal relationships of winter snowpack and terrestrial water storage (TWS) in the Upper Snake River were analyzed for water years 2001–2010 at a monthly time step. We coupled a regionally validated snow model with gravimetric measurements of the Earth's water storage from NASA's Gravity Recovery and Climate Experiment (GRACE) in this analytic and statistical assessment. An improved understanding of the connections between snow and TWS in this region is important since roughly 65-80% of annual precipitation falls as snow during the winter and early spring months. Here snow accumulates primarily in the mountains, and melts in the late spring and summer months. This melt is a key component of the hydrologic cycle because it recharges the valley aquifers that help sustain streamflows and provides water for irrigation during the drier summer months when the demand for water is high. The coupling of snow model and GRACE measurements provides a novel approach to understanding the spatial-temporal patterns and processes governing the movement of water from source areas (mountain snowpack) to sinks (valley aquifers). Initial results show distinct spatial patterns of intra-annual TWS variability moving from the local mountain ranges in the Upper Snake Basin to the valley floor, and suggest the influence of seasonal snow water storage. Comprehensive analysis will identify snowpack characteristics indicative of potential water scarcity in this watershed and augment a hydrologic classification framework for the region.