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Terrestrial Water Storage Dynamics and Hydrologic Prediction: The Colorado River Basin Test Case

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Terrestrial water storage (TWS) in a river basin is an important hydrologic variable that affects the partitioning of incoming precipitation and radiation. The evolution of TWS at seasonal and annual time scales defines the elasticity of the basin to climate variability. Estimation of TWS dynamics, however, is difficult due to insufficient in-situ data on space-time variability of hydrologic stores, such as snow, soil moisture and groundwater. Accurate estimates of terrestrial water storage dynamics at river basin scales can however be obtained using a suite of methods that take advantage of new data sets (GRACE gravity anomalies, remotely sensed snow water equivalent maps, atmospheric reanalysis data and gridded hydro-meteorological forcing fields). Our research efforts focus on the Colorado River basin. Semi-arid river basins in general (and the Colorado River in particular) are very susceptible to intra- and inter-annual climate variability and long-term climate change and TWS plays a crucial role in determining the basin's response to climate forcing. Improving knowledge of the response of terrestrial water storage to variability in snow accumulation and melt is particularly important in semi-arid systems, since the timing of melt and proportion of rain versus snow are highly sensitive to changes in regional air temperature.