Analysis of the spatial and temporal variability of terrestrial water storage and snowpack in the Pacific Northwestern United States

Sproles, Eric A; Leibowitz, Scott G; Wigington, Parker J; Patil, Sopan; Comeleo, Randy

sproles.eric@epa.gov; leibowitz.scott@epa.gov; wigington.jim@epa.gov; sopan.patil@@epa.gov; comeleo.randy@epa.gov

The spatial and temporal variability of terrestrial water storage and snowpack in the Pacific Northwest (PNW) was analyzed for water years 2001–2010 using measurements from the Gravity Recovery and Climate Experiment (GRACE) instrument. GRACE provides remotely-sensed measurements of monthly fluxes in terrestrial water storage (TWS). In the PNW between 50-60% of annual precipitation falls as snow during the winter and spring months. Melt water from this snowpack is a key component of the hydrologic cycle that recharges aquifers and sustains streams during the more arid summer months, when demand for water is high. The motivation for this research is to improve our understanding of the spatial and temporal connections between variability in winter snowpack and TWS in the PNW. Initial results show distinct spatial patterns of intra-annual TWS variability running both North-to-South and West-to-East, and partially suggest the influence of seasonal snow water storage. The influence of fluxes in snow storage was removed from the GRACE data using a regionally validated temperature-precipitation-based snow model. Analytic and statistical assessment of snow water and GRACE data are presented. Future work including soil moisture, surface water and human consumptive use will further improve our understanding of groundwater variability in the region. These methods and initial results provide a novel approach to understanding the timing and location of regional storage patterns of TWS. This in turn will be applied to hydrologic classification frameworks for the region and used to identify snowpack characteristics indicative of potential water scarcity in the PNW.