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Tracking the storage and dissipation of atmospheric river storm water in the Russian River watershed using GPS elastic displacements

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GPS is emerging as an effective technique to estimate changes in total water storage at Earth's surface. In California's mountains, GPS indicates that more subsurface storage is lost during drought and gained during years of heavy precipitation than predicted by hydrology models [Argus et al. 2017]. Atmospheric rivers provide a majority of the annual precipitation in coastal environments across North America. The Russian River watershed is often affected by these large storms, which can produce extensive flooding events. In this study, we estimate changes in water storage for the 2017 water year (October 2016 – September 2017), a historically wet year in California, in which more than 20 atmospheric rivers impacted the Russian River watershed. Using GPS displacements, we quantify the water gained during higher intensity atmospheric rivers. We further resolve the time it takes for the storm water to dissipate: that is, we distinguish between water that runs off into rivers and water that is stored in the ground as soil moisture. Finally, we investigate the empirical relationships between GPS displacement and precipitation, evapotranspiration, and soil moisture estimates with the aim of improving constraints to hydrologic models.