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Towards Management-Scale, Satellite-Based Estimates of Groundwater Depletion

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Abstract. Groundwater supplies drinking water for billions of people worldwide, and nearly half of all irrigation water. Many aquifers of the world are being depleted, but traditional methods for estimating storage loss can vary by up to an order of magnitude due to uncertainty in aquifer properties and spatio-temporal sparsity of in-situ measurements such as groundwater levels and withdrawals. Satellite observations such as Interferometric Synthetic Aperture Radar (InSAR) and estimates of ET provide high-resolution proxies that represent some elements of the water balance and could be leveraged for improved estimates of groundwater storage. However, gaps in the water balance challenge efforts to utilize these datasets for improved groundwater monitoring. In this talk, I will describe recent projects of my research group that explore new approaches to harness these data. The first makes use of satellite-derived ET estimates to estimate irrigation at ~ 1 km resolution over the western US and South America. The second employs a combination of in-situ groundwater measurements and InSAR data to disaggregate groundwater storage change estimates to confined and unconfined aquifers in several depleted aquifers of the western US, including California, Utah and Colorado. These approaches provide a path towards satellite-driven or satellite-supported methods for improved groundwater management.



Dr. Ryan Smith is an Associate Professor in the Civil and Environmental Engineering Department at Colorado State University. He earned his Ph.D. at Stanford University in Geophysics in 2018, and his B.S. in Geology at Brigham Young University, Utah in 2014. Dr. Smith is a remote sensing hydrologist. He studies groundwater resources and quality at regional and local scales by combining satellite, airborne and ground-based geophysical and in-situ datasets, using both process-based models and machine learning techniques. Dr. Smith's research is funded by NASA, ERDC, NGA, USGS, NIH and NSF.