Integrating InSAR and Ground-based Geophysical Data to Inform Groundwater Management

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Groundwater resources are being increasingly depleted due to intense droughts in a warming climate, as well as irrigation decisions that are made without considering long-term effects of over-use. In response to this, many regions of the western United States are beginning to enforce some element of sustainable groundwater use. One significant challenge with this effort is the lack of monitoring data on current and historical groundwater storage change and use. In other words, how can sound policy on the appropriate amount of groundwater pumping be produced without knowledge of the current amount being pumped or the effect this has on groundwater storage? Interferometric Synthetic Aperture Radar (InSAR) provides satellite-based estimates of ground deformation that is related to changes in aquifer system storage. Quantifying this relationship is challenging, however, because deformation can take years to decades to respond to changes in storage within the aquifer. Relating deformation to aquifer storage also requires knowledge of the subsurface geomechanical properties, which are typically not well known. Ground-based and airborne electromagnetic data, which provide detailed information about subsurface resistivity, can be used to infer lithologic properties, which in turn relate to geomechanical and hydrologic characteristics. Integrating these datasets offers immense potential for improved characterization of groundwater systems. However, assimilating these disparate datasets into a common process-based model also presents many challenges. This talk will discuss recent and ongoing efforts that use these datasets to improve groundwater models and water budgets in several basins of the western United States including the San Luis Valley, Colorado; the San Joaquin Valley, California; and the Parowan Valley, Utah. It will also discuss the implications of recent findings on groundwater management in these basins.