**Groundwater Storage Trends in San Luis Valley, CO: Combined In-situ and Remote Sensing Approach**

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**Abstract.** Groundwater is a critical freshwater source, but climate change-induced shifts in precipitation patterns and extreme droughts are leading to increased groundwater use in agriculture and municipalities. This overexploitation depletes groundwater sources worldwide, particularly in arid and semiarid regions. To ensure sustainable groundwater management, we need accurate estimations and a clear understanding of groundwater storage changes and their drivers. However, this is challenging due to limited spatiotemporal in-situ measurements and uncertainties in storativity estimates. To address this, we combined in-situ water level, pumping, and diversion data with Interferometric Synthetic Aperture Radar (InSAR) satellite data to estimate aquifer properties and groundwater storage changes. We also used gridded remote sensing products (such as PRISM precipitation and OpenET evapotranspiration) to assess the water balance for comparison. Our study focused on the San Luis Valley, Colorado, an agriculturally dependent region with quality temporal and spatial data on withdrawals and water levels. We estimated storativity values for subdistricts based on the relationship between pumping and water levels. Our study revealed a declining trend in groundwater storage, highlighting the need for immediate action to ensure the long-term stability of aquifers. This research provides water managers with valuable insights into how to stabilize groundwater storage by maintaining a balance between recharge rates and groundwater extraction. The knowledge gained from this study can be transferrable to regions with similar climatic and geological conditions.