Renewed Rapid Subsidence in the San Joaquin Valley, California

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Abstract. Extensive groundwater withdrawal in the San Joaquin Valley (SJV) caused widespread aquifer-system compaction and resultant land subsidence that locally exceeded 8 m during 1926–70. Surface-water importation in the early 1970s resulted in decreased pumping, recovery of water levels, and a reduced rate of subsidence in some areas. However, reduced surface-water availability during subsequent droughts resulted in increased pumping, causing groundwater-level declines and renewed subsidence, which has reduced freeboard and flow capacity of the Delta-Mendota Canal, the California Aqueduct, and other canals that deliver irrigation water and transport floodwater.

The location and magnitude of land subsidence during 2006–10 in parts of the SJV were determined by using an integration of Interferometric Synthetic Aperture Radar (InSAR), Global Positioning System (GPS), and borehole extensometer techniques. Results of the InSAR measurements indicate that a 3,200-km^2 area was affected by at least 20 mm of subsidence during 2008–10, with a localized maximum subsidence of at least 540 mm. Furthermore, InSAR results indicate subsidence rates doubled during 2008. Results of a comparison of GPS, extensometer, and groundwater-level data suggest that most of the compaction occurred in the deep aquifer system, that the critical head in some parts of the deep system was exceeded in 2008, and that the subsidence measured during 2008–10 was largely permanent. The information derived from these integrated measurements is being used to improve coupled numerical models of groundwater flow and land subsidence, which are being used to evaluate water-resource management strategies.