Geophysical Research Abstracts
Vol. 19, EGU2017-11753, 2017
EGU General Assembly 2017

Joint Assimilation of InSAR and Water-level Data for Aquifer Parameter Estimation and Groundwater State Forecasting in Santa Clara Valley, California

Ayrat Abdullin and Sigurjon Jonsson
King Abdullah University of Science and Technology, Thuwal, Saudi Arabia (ayrat.abdullin@gmail.com)

Ground subsidence induced by groundwater withdrawal is a widespread problem and can cause damage to buildings and infrastructure. The challenge is to forecast, accurately and in a cost effective way, when water extraction may threaten infrastructure, so that procedures can be applied to avoid unacceptable levels of ground deformation beyond construction engineering criteria. However, many characteristics of the heterogeneity of aquifer parameters, such as hydraulic conductivity and storage coefficients, are usually uncertain. Monitoring data, such as water-level data in monitoring wells, can be used to reduce these uncertainties, but the difficulty is that they usually only provide spatially limited information about the groundwater system. To take on these problems, we use an ensemble-based assimilation framework that efficiently integrates InSAR-derived displacements and hydraulic head data for improved understanding of groundwater reservoir behavior. We apply this framework for aquifer parameter estimation of the basin-wide Santa Clara Valley groundwater system in northern California. To study the deformation patterns in the area, we use time-series analysis of InSAR data, based on more than 150 images from the ERS, Envisat and ALOS satellites from 1992-2012. Using the InSAR observations, in addition to approximate data on pumping, managed recharge and rainfall amounts, we are able to advance our understanding of the ongoing hydrogeological processes within the aquifer system. We find that including both InSAR and well water-level data as observations improves the properties estimation compared to basic statistical interpolation between the available well data. We also compare the performance of our hydraulic head predictions with previous groundwater studies in Santa Clara Valley, such as those of Chaussard et al. (2014). The results suggest that the high spatial resolution subsidence observations from InSAR are useful for accurately quantifying hydraulic parameters.