CALIBRATION OF A GROUNDWATER MODEL IN LAS VEGAS VALLEY USING INSAR DATA

YAN, Tingting, Dept. of Geosciences, Virginia Tech, Blacksburg, VA 24061

Las Vegas Valley is one of the fastest growing metropolitan areas in the Nation. To meet the water-resources demand of this area, groundwater has been intensively pumped which has resulted in large water-level declines of more than 100 meters and land subsidence of nearly two meters for more than 60 years. Although alternative water sources have allowed groundwater levels to somewhat recover, the initiation and propagation of earth fissures continues to plague development. Subsidence and water-level declines do not always coincide, owing to the highly complex hydrogeological setting and lack of parameter data necessary for fissure prediction. Yet, a well-constrained groundwater flow model is critically important for managing the water resources and avoiding further damage from subsidence-related features. This can be accomplished through precise estimation of hydraulic parameters at the model grid scale. The impetus for this research is based on the work of Morgan and Dettinger (1994) and Jeng (1998) who were the latest to complete flow and subsidence modeling for Las Vegas Valley.

The objective of this study is to update and calibrate the groundwater and land subsidence model using MODFLOW based on the previous hydraulic model of Jeng (1998). New pumping data (from 1982 to 2005) has been acquired to make an integrated model from 1912 to 2005. High resolution vertical displacements from InSAR (Interferometric Synthetic Aperture Radar) interferograms and water-level measurements are combined to aid calibration of the new model. The InSAR data are statistically regressed to match the spatial resolution of the groundwater flow model. Interferograms from different time periods measure the surface changes (velocity), which correspond to the elastic and inelastic storage properties of the aquifer system at the local scale. UCODE, a nonlinear parameter estimation program, will be used to more accurately calibrate the hydraulic conductivity and storage property distribution throughout the valley. Hydraulic parameter zones can be constructed at the grid resolution of the model providing greater accuracy than has ever been done previously. We believe this approach will allow for a far superior water management tool that can be used by water managers to monitor and predict subsidence and potential areas of fissure development in Las Vegas Valley.

Advisor: Dr. T. J. Burbey