Integrated Approach for Subsidence Monitoring and Sinkhole Formation in the Karst Terrain of Dougherty County, Georgia

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Abstract. The Upper Floridan Aquifer (UFA) is an important water source for agricultural and municipal purposes in Dougherty County. However, prolonged water demand, dissolution of the carbonate aquifer (Ocala Limestone), and short and long-term fluctuations in precipitation, surface water discharge, and groundwater levels have placed many areas at risk for sinkhole formation and broader scale land deformation (i.e., subsidence) in the covered karst terrain. Evaluating the causes of sinkhole formation and subsidence is essential for reducing risk within karst settings. We evaluate sinkhole development in Dougherty County by applying a sinkhole delineation and regression analysis procedure utilizing digital elevation models (DEMs) from 1979, 1999, 2010, and 2011. After sinkholes were accurately mapped, a regression analysis was utilized to determine the hydrogeologic (e.g. fracture traces, aquifer levels), climatic (e.g. precipitation), and land use variables that are most influential in sinkhole development. Preliminary regression results indicate aquifer levels and distance to fracture traces are the strongest explanatory variables for sinkhole formation ($R2 = 0.74$ for the 2010 DEM). Furthermore, DEM analysis results show a 77.2% ±5% increase in number of depressions from 1979 - 1999 and a 9.8% ±5% increase from 1999 - 2010. A 5% error was estimated due to variations in DEM resolution, source, and processing techniques. Persistent scatterer interferometry (PSI) will measure the temporal evolution of subsidence in Dougherty County using 125 ERS 1-2 satellite scenes from 1992 - 2010 within ENVI's SARscape program. These results will be compared with sinkhole location and development through time.