



Monitoring and analysis of land subsidence caused by groundwater withdrawal in Madrid (Spain)

Pablo Ezquerro (1,2), Gerardo Herrera (1), Marta Bejar (1), Miguel Marchamalo (2), Ruben Martinez (2), and Roberto Tomás (3)

(1) Instituto Geológico y Minero de España, Geohazards InSAR laboratory and modeling group, Madrid, Spain (g.herrera@igme.es), (2) Escuela de Ingenieros de Caminos, Universidad Politécnica de Madrid (miguel.marchamalo@upm.es), (3) Departamento de Ingeniería Civil, Universidad de Alicante (roberto.tomas@ua.es)

The purpose of this paper is to analyze the land subsidence induced by groundwater withdrawal affecting the North area of Madrid City (Spain) using Persistent Scatterers Interferometry technique (PSI), in particular the so-called PSP-IFSAR. This technique is capable of estimating deformation velocity maps of the ground surface and displacement time series from Synthetic Aperture Radar (SAR) images. Two datasets acquired between April 1992 and November 2000 from ERS-1 and ERS-2 and between August 2002 and September 2010 from ENVISAT sensors have been processed. Maximum measured subsidence displacements are about 80 mm in the nearest well field area being negligible from 7 Km. PSI timeseries analysis shows a close relationship between subsidence and piezometric level evolution and a perfect elastic behavior in which soil practically recovers the negative displacements (subsidence) accumulated during extraction. Furthermore displacements and piezometer timeseries corresponding to the 1998–2000 period have been used to calibrate an elastic one-dimensional model. This model has been used to predict the ground surface movements during the 1997–2010 period. Despite the simplicity of the model, it shows a great accuracy with only a 13% of average error.