Two-dimensional coupled numerical modelling of subsidence due to water extraction at the Lower Llobregat River, Spain

A. CONCHA, J. RIPOLL, J. PIÑA, A. GABÀS & P. PIÑA

Abstract A Differential Interferometry of Satellite Radar (DinSAR) analysis has detected relatively strong subsidence at the St Feliu del Llobregat municipality west of Barcelona City (average maximum velocity of 0.7 cm/year for the period 1993–2006). Compilation of geological information and geotechnical logs, well piezometric measurements, and the performing of two electrical resistivity tomography (ERT) surveys allowed us to establish a geological–hydrogeological model of the site. A shallow saturated compressible clay layer (thicker where the most intense terrain deformation occurs), overlays sandy-silty gravels. Both units contain the unconfined Llobregat River upper aquifer. A simplified numerical coupled 2D-FLAC model, with the existing conditions at the site, permitted simulation of the surface deformation measured by DinSAR. Although refinements to the model, by changes in the clay layer geometry and water volume extraction rates, are still needed, the calibration of the numerical model allows the prediction of deformation under one specific water extraction rate.

Key words SAR Differential Interferometry; subsidence; Lower Llobregat River, Spain; water flow and strain-stress coupled models; FLAC-2D