



Advanced interpretation of ground motion using Persistent Scatterer Interferometry technique: the Alto Guadalentín Basin (Spain) case of study

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Subsidence related to fluid withdrawal has occurred in numerous regions of the world. The phenomena is an important hazard closely related to the development of urban areas. The analysis of the deformations requires an extensive and continuous spatial and temporal monitoring to prevent the negative effects of such risks on structures and infrastructures. Deformation measurements are fundamental in order to identify the affected area extension, to evaluate the temporal evolution of deformation velocities and to identify the main control mechanisms. Differential SAR interferometry represents an advanced remote sensing tool, which can map displacements at very high spatial resolution. The Persistent Scatterer Interferometry (PSI) technique is a class of SAR interferometry that uses point-wise radar targets (PS) on the ground whose phase is not interested by temporal and geometrical decorrelation. This technique generates starting from a set of images two main products: the displacement rate along line of sight (LOS) of single PS; and the LOS displacement time series of individual PS.

In this work SAR data with different spatio-temporal resolution were used to study the displacements that occur from 1992 to 2012 in the Alto Guadalentín Basin (southern Spain), where is located the city of Lorca. The area is affected by the highest rate of subsidence measured in Europe (>10 cm/yr-1) related to long-term exploitation of the aquifer (González et al. 2011).

The objectives of the work were 1) to analyse land subsidence evolution over a 20-year period with PSI technique; 2) to compare the spatial and temporal resolution of SAR data acquired by different sensors, 3) to investigate the causes that could explain this land motion.

The SAR data have been obtained with ERS-1/2 & ENVISAT (1992-2007), ALOS PALSAR (2007-2010) and COSMO-SkyMed (2011-2012) images, processed with the Stable Point Network (SPN) technique. The PSI data obtained from different satellite from 1992 to 2012 were compared with some predisposing and trigger factors as geological units, isobaths of Plio-Quaternary filling, soft soil thickness and piezometric level. The PSI data were compared with measurement obtained by two GPS station located near the Lorca city: the value of deformation detected by satellites and ground-based tools are well correlated.

The results are the following: a) the subsidence processes are related to soft soil thickness distribution; b) land subsidence rates shows that the area interested by the higher value is the same over the monitored period, a deceleration rate of subsidence has been recorded during the period 2011- 2012; c) the deformation rates are not correlated with the piezometric level trend, a delay time between piezometric level variations and ground deformations is evident.

References

González, P. J. & Fernández, J.,(2011) Drought-driven transient aquifer compaction imaged using multitemporal satellite radar interferometry. *Geology* 39, pp. 551–554.