ABSTRACT

Title: "Analysis of the superficial movements of the area of Súria by means of Differential Radar Interferometry (DInSAR)"
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This research work consists of the use of the Differential Radar Interferometry (DInSAR) technique for monitoring superficial movements in the zone of the village of Súria. This area has been selected because it has a lot of possibilities to observe ground deformation due to the mining exploitation associated with a saline dome. The goal of this research is to study the characteristics, magnitude and causes of the observed movements.

To this purpose, a complete geological synthesis of the study area has been carried out, and 4 new geological cross-sections have been prepared in order to know the geometry of the saline dome and its depth. On the other hand, the technique DInSAR has been applied in a total of 50 SLC images, recorded between 1995 and 2007. From them, 120 interferograms have been generated and processed, allowing us to obtain vertical displacements maps of the study zone. At the same time, the different zones of exploitation have been located and geo-referenced. The observed superficial displacements obtained with DInSAR have been checked with the location of both the salt dome and the mining activity. As a result of all this work, three types of zones are identified in relation to the vertical movements:

Firstly, an affected zone by sudden ground collapses, of the order of meters, has been detected. These sudden collapses are provoked by the dissolution of soluble materials of the subsoil. The affected materials are the overlying beds of gypsum and limestones, coinciding with a zone of fault, or the carnalite layers capping the salt dome.

Secondly, an uplift area has been identified, with movements between 0,15 and 0,6 cm/year. The rate of movement is slow while the accumulated displacements are of small magnitude. These movements may be explained by the intrusion of the salt dome.

The third type of zone shows subsidence of the ground surface. Two non-urban areas showing similar behaviour have been detected. Both areas define subsidence cones with maximum observed settlements of about 9 cm/year in the inner part of the cone, which are gradually reduced towards the edge. The temporal evolution of both zones shows that the displacements increase and shift towards the northeast. This trend is related to the mining activities located underneath. In the short term great changes are not foreseen, but in the long term, the zone located southernmost should tend to the stabilization, since it is no longer being exploited.

In the urban zone of the village of Súria, subsidence only occurs locally, with a clear trend to the stabilization. The maximum observed movement is about 0,7 cm/year, and its origin is the closing of previously exploited galleries.

Finally, the method DInSAR has been evaluated from the point of view of its application in the detection of superficial deformations. On the one hand, it has great advantages compared to other classical techniques since it is more economic and it requires very little fieldwork. It also allows the observation of phenomena occurred in the past, since the images SLC are usually collected with independence of the study. Moreover, it allows knowing the behaviour of the area of the terrain in a global perspective, since the information is not restricted to the control points selected beforehand. However, this technique has restrictions. It is not appropriate for observing sudden collapses and the coherence of the interferograms outside the urban areas is low. At the same time, the period of observation must be long enough in order to obtain a minimum number of images to generate the interferograms.