15th International Congress of the Geological Society of Greece
Athens, 22-24 May, 2019 | Harokopio University of Athens, Greece
Bulletin of the Geological Society of Greece, Sp. Pub. 7 Ext. Abs. GSG2019-175

Ground Truth Validation of Land Subsidence Phenomena Identified by DinSAR Techniques at the Coastal Zone of N. Faliro, Moschato and Kallithea Municipalities

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Land subsidence is considered among the most frequent geological hazard that usually occurs as a consequence of a number of phenomena, namely: natural compaction of unconsolidated fine - grained deposits, groundwater over - exploitation, peat - oxidation and collapse of underground cavities (Ziaie *et al.*, 2009). The effects of the land subsidence include damages to building structures as well as loss of functionality of linear and point infrastructures (pipeline and road network deformations, well-casing failures and protrusion etc.) (Osmanoğlu *et al.*, 2011; Cigna *et al.*, 2012).

The main purpose of the current study is to investigate land subsidence in the coastal zone of the N. Faliro, Moschato and Kallithea municipalities, by means of advanced DinSAR techniques and to identify the main causes of the observed ground deformations that contribute to the development of the surface fractures affecting the site.

Detecting, measuring and monitoring land subsidence is important for the urban and infrastructures planning as well as for the risk management. Repeat-pass space-borne SAR interferometry (InSAR) is a unique tool for large-scale monitoring of surface deformation at a low cost and great precision (Massonnet & Feigl, 1998) and particularly for land subsidence regardless of its cause (Dixon *et al.*, 2006; Herrera *et al.*, 2009; Osmanoglu *et al.*, 2011; Chaussard *et al.*, 2013).

The application advanced DinSAR techniques for the detection of land motion phenomena revealed that the area extending between the outlets of the Kiffisos and Ilisos rivers is affected by subsidence with LOS deformation rates of -1.5 to -6.9 mm/yr during the period 1992 - 2001 and of -1.5 to -3mm/yr for the period 2002-2010 (Fig.1a,b).

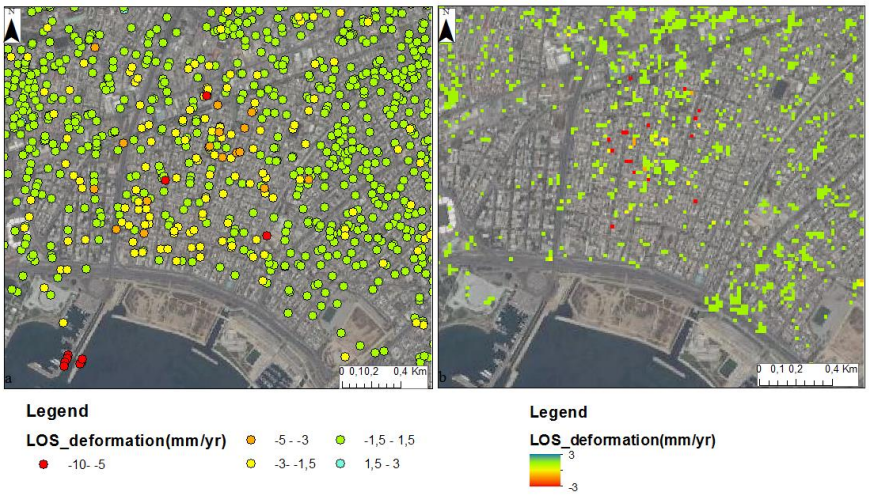

Figure 1. a) Velocities from 1992 to 2001 as derived by the PSI analysis of ERS1&2 data b) Velocities from 2002 to 2010 as derived by the SVD analysis of ENVISAT data.

In order to further validate and interpret these results, field observations have been conducted exploited. The surface ruptures extent mainly at the area between the riverbeds of Kiffisos and Ilissos Rivers, leading to differential displacements. The visible traces of subsidence affect pavements and numerous buildings (Fig.2).

Figure 2. Field evidence of ruptures in the study area. Coordinates are in UTM WGS84 (projected). Damages witnessed at building (point 1), pavement (point 2) and natural terrain (point 3).

The outcomes of the performed analysis indicated that the land subsidence phenomena in the study area could be attributed primarily to the natural compaction of the fine grained alluvial deposits. Furthermore, the overexploitation of groundwater reservoir cannot be entirely excluded.

Acknowledgments

The European Space Agency (ESA) through the Terrafirma project has funded the SAR imagery processing. The authors gratefully acknowledge the German Space Agency - DLR (German) for having processed SAR data for the area.

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