Geophysical Research Abstracts
Vol. 12, EGU2010-12414, 2010
EGU General Assembly 2010

Surface deformation analysis of the Istanbul (Turkey) city retrieved via the SBAS-DInSAR technique

Mariarosaria Manzo (1), Riccardo Lanari (1), Andrea Manconi (1), Giuseppe Solaro (1,2), Thomas R. Walter (3), and Jochen Zschau (3)

(1) IREA-CNR, Napoli, Italy (manzo.mr@irea.cnr.it), (2) INGV-Osservatorio Vesuviano, Napoli, Italy , (3) Dept. Physics of the Earth, GFZ German Research Centre for Geosciences, Potsdam, Germany

Abstract

Remote sensing techniques make possible to collect information on dangerous or inaccessible areas. In this context, space-based geodetic techniques as Differential SAR Interferometry (DInSAR) have been used in several areas in order to obtain co-seismic surface deformation maps in a few days or even hours following large earthquakes. The retrieved surface deformation can be used to constrain analytical and/or numerical models to derive parameters such as depth, dimension, orientation, and slip occurred on the fault plane. Moreover, advanced DInSAR techniques allow observing the temporal evolution of the surface displacements, and are thus able to furnish a picture of the pre-seismic state as well as of the post-seismic effects.

In this work, we present DInSAR analyses of the deformation patterns in areas that are affected by seismic hazard. In particular, we focus on ground displacements occurred in the greater city area of Istanbul (Turkey) in the last 17 years. To this aim, we exploited the advanced DInSAR algorithm, referred to as Small BAseline Subset (SBAS) technique (Berardino et al., 2002). Displacement time series are retrieved from data acquired by the ERS-1/2 and ENVISAT (Pepe et al., 2005) satellites of the European Space Agency (ESA) between 1992 and 2009. First, we show the results of an analysis carried out at a spatial resolution of about 100 x 100 m. This shows, in addition to the co-seismic displacement caused by the Izmit earthquake (17 August 1999) and associated events, several areas that are subject to subsidence (often in excess of 10 cm per decade) within the city of Istanbul. Moreover, in selected case studies, we further exploited localized phenomena by "zooming" in the areas of interest and carrying out analyses at full spatial resolution scale (10 x 10 m) (Lanari et al., 2004). This additional effort allowed us to discriminate among deformation phenomena occurring at regional and at the building scale.

This study provides an updated "picture" of the ongoing deformation that affected the greater Istanbul area in the last 17 years, and also several hints for the further analysis and understanding of the geophysical processes affecting this high-risk area.

The advanced InSAR time series techniques, combined with the existing geophysical and geotechnical knowledge of the complex investigated scenario, can afford new insights about the physical processes behind the deformation phenomena at different time scales, and can be also used in support of future hazard assessment strategies for the Istanbul area.

References:

Berardino, P., Fornaro, G., Lanari, R., Sansosti, E. (2002). A new Algorithm for Surface Deformation Monitoring based on Small Baseline Differential SAR Interferograms, IEEE Trans.Geosci. Remote Sens., Vol. 40, No 11, pp. 2375-2383.

Pepe, A., Sansosti, E., Berardino, P., Lanari, R. (2005). On the Generation of ERS/ENVISAT DInSAR Time-Series Via the SBAS Technique, IEEE Geoscience and Remote Sensing Letters, Vol. 2, No 3, pp. 265-269.

Lanari, R., Mora, O., Manunta, M., Mallorqui, J.J., Berardino, P., Sansosti, E. (2004). A Small-Baseline Approach for Investigating Deformations on Full-Resolution Differential SAR Interferograms, IEEE Trans. Geosci. Remote Sens., Vol. 42, No 7, pp. 1377 -1386.