Persistent Scatterers analysis of InSAR time series

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Several examples of applications of space-borne Synthetic Aperture Radar Interferometry (InSAR) to terrain deformation investigations at a regional scale have been published in the literature. Robust techniques, such as the Persistent Scatterers (PS) or the small baseline (SBAS) approaches, have been developed and applied to the analysis of large datasets of interferometric SAR images.

In this work, we present the first results of a PS analysis of InSAR time series referred to the area of Lisbon, Portugal. In particular, the regions of Arruda dos Vinhos and Fanhões-Trancão/Lousa at north of Lisbon were chosen as test sites being characterized by a large number of known landslide phenomena. This application aims to study the feasibility of using InSAR time series as a tool to support the operations of landslide inventory at a regional scale.

The analysis was carried out on 28 ERS-1/2 SAR data both from spanning the time period from 1992 to 1997 and 30 ERS-1/2 from 1998 to 2002. Atmospheric artefacts in each SAR interferogram were mitigated by means of the numerical model Weather Research and Forecasting Model (WRF).

A recent (20 m cell size) Digital Elevation Model (DEM) with a nominal vertical accuracy of 2.5 m was used in the interferometric processing. InSAR measurements provides only the component of the real displacement vector along the satellite's line of sight (LOS). In order to estimate the mass movement direction compatible with the InSAR measurements, LOS information, different for the ascending and descending orbits, was combined with the terrain slope and aspect maps derived from the DEM.

As a support to the interpretation of the ground displacements provided by the PS analysis, Persistent Scatterers were overlaid to aerial orthophotos acquired respectively during 1995, 2005, within a GIS environment.

As expected, many Persistent Scatteres were found in urban areas were SAR data are less affected by phenomena of interferometric de-correlation. In particular, the presence of an important subsidence phenomenon in the area of Alverca, Lisbon, was confirmed by this analysis.

However, the density of Persistent Scatterers in the two rural areas of Arruda dos Vinhos and Fanhões-Trancão/Lousa chosen as a test-site was sufficiently high to compare the location of PS with the previously identified and mapped landslides and assess the potentiality of InSAR as a support for landslide inventory.