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GTR-05 Microwave remote sensing - Part 1

Ground deformation analysis in Umbria region, central Italy using the SBAS-DInSAR technique

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We investigate ground deformation affecting the Umbria region (central Italy) in the 1992-2000 period by applying the multi-temporal Differential Synthetic Aperture Radar Interferometry (DInSAR) technology to a set of ascending and descending SAR data acquired by the European Remote Sensing (ERS-1/2) satellites. In particular, we apply the Small BAseline Subset (SBAS) DInSAR technique [Berardino et al. 2002] which allows us studying the temporal evolution of the detected deformation both at low (regional) and full (local) spatial resolution scale, by exploiting the phase difference (interferogram) between SAR image pairs of the same area acquired at different times and from sufficiently close flight tracks (small baselines). At the regional scale, averaged interferograms are used to obtain mean deformation velocity maps and associated time series with a coarse ground resolution of approximately 80x80 metres and over large areas extending up to several thousand of square kilometres. Indeed, full-resolution interferograms are exploited to analyze localized deformation even at the scale of a single building or man-made structure.
In this study the retrieved displacement information are analyzed to investigate their relevance to geophysical, geomorphologic, and human induced processes that may result in hazardous conditions to the population of Umbria.
In particular, the low-resolution deformation maps are used (i) to find out the amount of displacement caused by the Umbria-Marche earthquake sequence from September 1997 to April 1998 in the Foligno area, (ii) to evaluate the number and percentage of the known landslides that can be monitored through the DInSAR technology in the investigated area, and, finally, (iii) to identify and measure the Valle Umbra subsidence phenomena caused by the exploitation of a deep aquifer.
The full-resolution analysis is focused on the mass movement of the Ivancich deep-seated landslide, in the Assisi Municipality, in order to formulate an hypothesis on the landslide geometry and deformation pattern.

References:
Berardino, P., Fornaro, G., Lanari, R., and Sansosti, E. (2002) A new Algorithm for Surface Deformation Monitoring based on Small Baseline Differential SAR Interferograms. IEEE Transactions on Geoscience and Remote Sensing 40:11, 2375-2383

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