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Monitoring of land subsidence in Ravenna Municipality using two different DInSAR techniques: comparison and discussion of the results.

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Land subsidence affecting the Ravenna Municipality (Emilia Romagna Region, NE Italy) is one of the best example on how the exploitation of natural resources can affect the environment and the territory. In fact, the pumping of groundwater and the extraction of gas from both on and off-shore reservoirs, started in the 1950s, have caused a strong land subsidence affecting most of the Emilia Romagna territory but in particular the Adriatic Sea coastline near Ravenna. In such area the current subsidence rate, even if lower than in the past, can reach the -2cm/y. Local Authorities have monitored this phenomenon over the years with different techniques: spirit levelling, GPS surveys and, more recently, Interferometric Synthetic Aperture Radar (InSAR) techniques, confirming the critical situation of land subsidence risk.
In this work, we present the comparison between the results obtained with two different DInSAR techniques applied to the study of the land subsidence in the Ravenna territory: the Small Baseline Subset (SBAS) and the Coherent Pixel Technique (CPT) techniques.
The SBAS works on SARscape software and is based on the Berardino et al., 2002 algorithm. This technique relies on the combination of differential interferograms created from stacks of SAR image pairs that have small temporal and perpendicular baselines. Thanks to the application of several interferograms for every single image, it is possible to obtain high spatial coherence, high data density and more effective error reduction. This allows us to obtain mean velocity maps with good data density even over non-urbanized territories.
For the CPT we used the SUBsoft processor based on the algorithm implemented by Mora et al., 2003. CPT is able to extract from a stack of differential interferograms the deformation evolution over wide areas during large time spans. The processing scheme is composed of three main steps: a) the generation of the best interferogram set among all the available images of the zone under study; b) the selection of the pixels with reliable phase within the employed interferograms and, c) their phase analysis to calculate, as the main result, their deformation time series within the observation period.
For this study, different SAR images have been used: 25 meters ground resolution ERS 1/2 (1992-2000) and ENVISAT (2003-2010), and 3 meters ground resolution TerraSAR-X (2012-2014). The results obtained for each stack of images with the two techniques are validated and compared with the C-GPS time series of more than three benchmarks stations. The aim is to test the two InSAR techniques in the monitoring of ground settlements in low urbanized territories. Furthermore, we have investigated the advantages (data accuracy and density) of using SAR images with higher ground resolution.