Geophysical Research Abstracts
Vol. 14, EGU2012-10099, 2012
EGU General Assembly 2012

Ground-motion monitoring in the Venice Lagoon using combined DInSAR and Persistent Scatterer Interferometry

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The Venice lagoon (Italy) constitutes a unique worldwide environment vulnerable to loss of surface elevation due to land subsidence and sea level rise. The lagoon covers an area of about 550 km2 and it is separated from the Adriatic Sea by small islands. In the city of Venice during the last century the relative elevation loss was about 23 cm (12 cm of land sinking and 11 cm of sea level rise). At regional scale, the central lagoon, including the city of Venice, shows a present general stability, while the northern and southern lagoon extremities and their related catchment sectors sink with rates averaging 3 to 10 mm/year. The observed land displacements were related to the geological features of the study region and to anthropogenic activities, such as land reclamation and groundwater withdrawal.
Differential SAR Interferometry (DInSAR) is a unique remote sensing tool and one of the most effective techniques for ground-motion monitoring used in a variety of applications (volcanoes, landslides etc). The principle of DInSAR is the phase difference of two SAR acquisitions which are gathered simultaneously at different time periods. It has the potential to detect ground displacements over large areas with high accuracy. In DInSAR multi-look interferometric phases are considered. Multi-look has the potential to reduce phase noise effectively in areas of intermediate coherence; e.g. areas with low vegetation. In the last years, Persistent Scatterers Interferometry (PSI), has been developed in order to overcome some limitations of the DInSAR technique. PSI aims to identify point targets which present high phase stability over the time period of the observation.
Natural environments, such as the Venice Lagoon with the presence of low vegetation are not considered optimal for the application of the PSI technique. Hence, the objective of the current study is to present a new approach that concerns the consideration of DInSAR multi-look interferometric phases into PSI technique. The reason of this synergy is the improvement of the interferometric results and to overcome the limitations that the PSI method has.