Advanced differential interferometry techniques applied to geo-hazards analysis and assessment

(Proposer: Mario Floris)

High-resolution earth observation technology is a critical tool related to national security, economic construction and social development. Interferometric Synthetic Aperture RADAR (InSAR) can provide abundant earth observations with high spatial resolution and precision, and has been widely applied to identify and measure ground deformation. In the last two decades, with the increasing quantity and quality of the imagery available from a growing number of SAR satellites and the improved processing algorithms, multi-temporal differential InSAR (DInSAR) techniques have been extensively applied to many topics of Geosciences, especially in geohazard analysis and risks assessment. Multi-temporal DInSAR can now provide long-term (years), regular (weekly-monthly), precise (mm) measurements of ground displacements over large areas (thousands of km^2), at medium (~20 m) to high (up to 1-3 m) spatial resolutions, combined with the possibility of multi-scale (regional to local) investigations, using the same series of radar images.

The main aim of the research is to compare satellite and ground-based data in order to evaluate the role of different geo-environmental conditioning factors in areas naturally prone to geo-hazards (i.e. landslides and subsidence). Ground deformations due to these phenomena are often caused by anthropic and natural factors which work at different spatial and temporal scales. An innovative aspect of the research regards the quantitative estimation of each related factors by implementing a geotechnical model of the subsurface and combining in situ data with SAR images processed by different advanced techniques (SBAS and PS).

During the research the following tasks will be performed:

- geological and geomorphological surveys;
- processing of satellite SAR data and validation by ground-based surveys (GPS);
- evaluation of horizontal and vertical components of displacements;
- quantitative analysis of displacement rate and delimitation of most affected areas;
- classification of displacement time series;
- identification of displacement trends;
- interpretation of conditioning and triggering factors;
- development of a geotechnical model which will allow to quantify anthropic and natural related factors.

The research will be carried out with the collaboration of experts from University of Padua (Geosciences, DICEA), China University of Geosciences (Beijing, China), Research Institute for Geo-Hydrological Protection - Italian National Research Council (CNR-IRPI Padova), University of Pavia and SARmap sa (Switzerland).

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