



First outcomes from the challenge between conventional geomorphological techniques and Dif-Sar Interferometry: the application to mass movement investigations in peri-urban areas (Calabria, Italy)

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In the last decades the use of innovative and experimental techniques for studying geomorphological phenomena has obtained valid items for the control of landscape development, which is especially connected to different kind of landslide and subsidence affecting urban areas (Antonello et alii, 2004; Colombo et alii, 2004; Catani et alii, 2004; IRECE-CNR, 2004).

The study reported in this paper is focused in two different sites Acri and S. Luca (Calabria, Italy). These two different sites were choose for the morpho-evolutionary mechanisms and associated hazardous and risk levels, which are representative of typical geological contexts of the Calabrian Arc.

Acri City is located on the Sila Massif, where weathered paleozoic crystalline-metamorphic rocks outcrop. S. Luca City is located along the Ionian side of the Aspromonte Massif and clayey deposits are exposed on the urban area slopes. Important and hazardous processes and different lanforms have been identified in the studied areas. They are indeed related to both the peculiar characters of many landslides and Deep Seated Gravitational Slope Deformation (DSGSD) with an associated “large landslide” (Serra di Buda) next to Acri City and the numerous complex landslides (roto-traslative and slow flow movements) placed in S. Luca City.

Multi-disciplinary researches were started and a monitoring system was projected on

the geological-engineering reference models (Amaro et alii, 2004): an inclinometric, GPS and meteo stations are connected through a W-Lan structure.

In particular, this paper reviews the results obtained by means of conventional and innovative methods, which are based on Aerial-photo analysis, historical data about mass movement collapse, monitoring techniques for investigating unstable slopes and DIF-SAR Interferometry (Caracciolo et alii, 2005; 2007).

Aerial-photos analysis was carried out through different chronometric high resolution photographs, as IGM, SCAME and Regional flights of 1954, 1978, 1991, 2001.

Radar imagery, due to Differential Interferometry technique (DIF-SAR), has provided multi-year data sets of ERS SAR, with high resolution and long temporal coverage, for detecting and monitoring the mass movements of the investigated unstable slopes. DIF-SAR technique has in fact allowed observing mass movements over annual intervals from 1993 to 2000. It has contemporaneously measured the typical displacements on the order of a few millimetres to several centimetres within these time periods by means of displacement and rate maps.

Firstly, the whole collected data has provided an overview of the geological-evolutionary setting of the investigated mass movements.

Secondly, the complex methodology applied in the study focuses on data integration issues and development of cross-validation methods. In particular, the methodology has tested and validated Dif-Sar data through the challenge with the conventional analysis methods. Paper reviews first outcomes for the assessment of the practical advantages and limitations of this experimental Earth Observation technique in connection with two different geological-evolutionary settings in peri-urban areas.

Key words: landslides; Conventional Analysis Techniques; Dif-Sar Interferometry; Calabria.

1. Amaro O., Caracciolo T, La Pietra T., Mollica L. M. & Pellegrino A.-Analysis of different evolutionary-geological settings through a complex monitoring network: the case of Acri and S. Luca (Calabria, Italy). FIST 32nd International Geological Congress to be held from August 20 to 28, 2004 in Florence, Italy.
2. Antonello G., Casagli N., Farina P., Guerri L., Leva D., Nico G. & Tarchi D. - Ten months of monitoring the Stromboli Volcano with Ground-Based INSAR. Geophysical Research Abstracts, Vol. 6, 2004
3. Colombo D., Farina P., Fumagalli A., Gontier E., Manunta P. & Moretti S. - Remote Sensing Techniques for Landslide Risk Analysis: first outcomes from The

Esa/Slam Project. Geophysical Research Abstracts, Vol. 6, 03910, 2004SRef-ID: 1607-7962/gra/EGU04-A-03910

4. Catani F., Farina P., Moretti S. Nico G. & Strozzi T.-On the application of SAR interferometry to geomorphological studies: estimation of landforms attributes and mass movements. *Geomorphology*, XX, in press
5. IRECE-CNR (2004)- Risultati di Interferometria Sar Differenziale nell'area urbana napoletana. <http://www.irece.na.cnr.it/risultati/interferometria/>.
6. Caracciolo T., La Pietra T & Pellegrino A.- Primi risultati dal confronto tra tecniche geomorfologiche convenzionali e l'interferometria DIFSAR: applicazione per l'analisi di movimenti in massa in aree peri-urbane (CALABRIA, ITALY) . *Giornale di Geologia Applicata* 2 (2005) 217–226, doi: 10.1474/GGA.2005–02.0–31.0057
7. Caracciolo T., La Pietra T & Pellegrino A.-Trattamento dei data base ottenuti da rilevamento geomorfologico e da interferometria DIF- SAR per la valutazione della pericolosità e di rischio da frana: il caso di Acri E S. Luca, Calabria (ITALY). Proc. "Rilevamento Geomorfologico di Terreno e da Remote Sensing, Trattamento dei Dati tramite GIS per la Gestione del Territorio e la Mitigazione dei Rischi Geo-Ambientali" (19-21 maggio 2005), organizzato dall'AIGEO a Rossano, Special Issue in corso di revisione su rivista APAT