SATELLITE REMOTE SENSING TECHNIQUES FOR EVALUATION AND ANALYSIS OF GEOLOGICAL HAZARDS ALONG LINEAR INFRASTRUCTURE NETWORKS

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ABSTRACT

Necessity of effective and rapid solutions for the analysis and monitoring of particular geological phenomena finds its expression in the application of modern techniques of remote sensing with a valid response in a good cost-benefit ratio. In particular, recent past, satellite SAR interferometry is one of the latest techniques for the detection and measurement of the Earth surface deformations produced by natural and anthropogenic events. The application of these techniques and the availability of updated ESA Sentinel mission’s data are prompting for the analysis and monitoring of geological hazards interacting with vulnerable elements such as linear infrastructures or active tectonic structures, active faults, coastal areas, urban formations, or cities. The research issue to evaluate the potentials of the new generation of satellites data for safe and effective analysis of geological hazards potentially interacting with linear infrastructure networks, especially in remote or challenging areas.

INTRODUCTION

The use of A-OnSAR (Advanced Differential Interferometric Synthetic Aperture Radar) techniques is considered an effective and valid tool for analyzing the evolution and seisms of geological phenomena since the early 1990s. The ESA Sentinel-1 A / B mission through Progressive Scans (TOPS) provide us frequently updated (6-12 days) high-quality SAR acquisitions with a large ground coverage (250 X 210 km). The differential SAR interferometry (D-InSAR) is a technique that estimates the interferometric phase related to small scale (centimeter or millimeter) ground movements happening within days, months or years means of multiple SAR acquisitions and processing. Today, there are well-known methodologies for A-OnSAR such PS-InSAR, PSI, StaMPS and SBAS. They differ mainly on the number of tracks used, processing and phase modeling. This poster presents two examples of SAR measurements (performed with Sentinel-1 sensor) that are related to land movements due to earthquake displacement (Visso 2016, M 6.5) and landslide displacement (Sasso area, Urbino, Italy). In both cases, the deformation affected linear infrastructures. The coseismic displacement damaged the Forca Canapine tunnel (4.9 km) while in the Sasso area the land movement threatens directly part of the main access road to the old town of Urbino (Italy).

OBJECTIVES & METHODS

The application of innovative remote sensing techniques is particularly promising for the analysis and monitoring of geological hazards that interact with linear infrastructure networks. The aim of my research is to evaluate the potential offered by new generation of satellites. The objective is also to develop techniques and new procedures for geological risk assessment on large areas. Attention is focused both on identifying possible impacts on infrastructures such pipelines and roads of soil deformations generated by seismic phenomena (active tectonic structures), subsidence and landslide. The methodology developed can also be extended to off-shore facilities monitoring (Platform, TopSide, Raiser, Fpso, SPM Single Point Mooring, etc.) or man-made subsidence induced by gas extraction or gas injection. The starting methodologies will be the classical ones of SAR (interferometry, amplitude analysis, change detection, temporal target...). The real research goal will be then to develop statistical methods (GIS platforms) to spread up analysis in large areas by creating integrated easy-to-read risk maps of geological hazards potentially interacting with linear infrastructure networks, especially in remote or challenging areas. This approach could reduce costs not only for the monitoring of existing infrastructures but also for the assessment of planning solutions for new constructions.

REFERENCES


