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MULTI-TEMPORAL SAR INTERFEROMETRY SERVICE FOR THE MONITORING OF SEISMIC WIDE AREAS

Abstract

One of the pivotal aspects of the Italian government's National Recovery and Resilience Plan (PNRR) concerns the allocation of resources to space activities for Earth Observation, leading to the establishment of the International Report for Innovative Defence of Earth (IRIDE) program. IRIDE adopts a comprehensive approach to Earth Observation, featuring an End-to-End System comprising distinct segments: Upstream, Downstream, and Services. At the core of IRIDE lies the Service Value Chain (SVC) concept, facilitating the provision of geospatial-based services at national and European levels. In this paper, we describe the architecture and initial findings of a specific SVC aimed at monitoring of active seismic regions during different seismic phases. Leveraging advanced analysis techniques, the proposed SVC aims at providing detailed monitoring during co-seismic, post-seismic, and inter-seismic periods, shedding light

on regional geodynamic processes. The monitoring approach relies on the analysis of Persistent Scatterer (PS) and Distributed Scatterer (DS) displacement time series derived from the multi-temporal interferometric analysis of SAR data acquired by the Sentinel-1, COSMO-SkyMed and SAOCOM missions, respectively in C-, X- and L-band, and calibrated with data from regional GNSS networks. By employing spatial clustering and fitting temporal displacement models, the proposed SVC distinguishes between exponential decay indicative of post-seismic activity and linear trends associated with inter-seismic phases, also identifying temporal anomalies in PS/DS time series for selected strategic assets characterized by velocity changes or cumulative displacement steps exceeding predefined thresholds. The investigated areas of interest include Italian seismic regions characterized by significant crustal strain, such as the Norcia seismic area for co- and post-seismic phases analysis and the Mattinata seismic fault for inter-seismic phase investigation, taking into account the position of active faults and seismogenic sources classified by the INGV DISS working group (https://doi.org/10.13127/diss3.3.0). Through this SVC, we show how stakeholders gain valuable insights into ground motion dynamics, contributing to improved seismic phenomena characterization.