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Sentinel-1 DInSAR processing chain within Geohazard Exploitation Platform

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The Sentinel-1A (S1A) satellite has been launched on April 2014 to acquire SAR data in continuity with the ERS-1/2 and ENVISAT missions. It presents advanced characteristics in terms of revisit time, spatial coverage and service reliability. Such a satellite will be paired during 2016 with the Sentinel-1B twin system that will reduce the constellation revisit time from 12 to 6 days. Accordingly, a huge and ever-increasing data flow relevant to extended areas on Earth will be delivered with a "free and open access" data policy.
The S1-A sensor is equipped with a C-band SAR instrument that is conceived for interferometric applications, thus allowing us to analyze Earth's surface displacements through the Differential SAR Interferometry (DInSAR) technique. In particular, S1A SAR data are collected through the Terrain Observation by Progressive Scans (TOPS) mode, which generates Interferometric Wide Swath (IWS) acquisitions. To properly handle S1A TOPS data, the existing DInSAR processing chains have to be adapted with new procedures, which properly take into account the characteristics of this new acquisition mode.
Furthermore, another critical point to be taken into account in designing a S1A DInSAR processing chain is the achievement of a good computational efficiency. Indeed, the capability to process in reduced time frames the huge data stream expected by S1A (and, very soon, also by S1B) is a key aspect to fully exploit S1 data archives.
In this work we present an efficient interferometric processing chain, based on the advanced DInSAR algorithm referred to as Parallel Small BAseline Subset (P-SBAS), for the generation of S1A IWS surface deformation time-series. It ingests the Single Look Complex data and generates, in unsupervised way, interferograms and displacement time-series. This processing chain is able to exploit distributed computing architectures taking advantage of both multi-node and multi-threading programming techniques.
The proposed S1A P-SBAS processing chain has been implemented within the Geohazards Exploitation Platform (GEP), an ESA initiative aimed at creating a dynamic scientific environment where data, computing facilities and processing tools are made available for the scientific community. Within the GEP, the S1A P-SBAS processing chain is provided as an automatic service for the generation and update of SBAS-DInSAR displacement time series originated from S1A data. In order to demonstrate the effectiveness of the implemented service we present some significant results. We will show both a large-scale interferomeric analysis conducted by processing 226 S1A 12-days interferometric pairs acquired over Europe, and the S1A time series relevant to some Italian sites of interest generated through the GEP platform.

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