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Volcano deformation analysis based an on-demand DInSAR-GRID system: the SBAS-GPOD solution

M. Manunta (1,2), F. Casu (1,2), R. Cossu (3), L. Fusco (3), S. Guarino (1), R. Lanari (1), G. Mazzarella (2), and E. Sansosti (1)

(1) IREA-CNR, Napoli, Italy (manunta.m@irea.cnr.it, +39 081 5705734), (2) DIEE, Università degli Studi di Cagliari, Cagliari, Italy, (3) ESA, Frascati (Roma), Italy

Differential SAR Interferometry (DInSAR) has already demonstrated to be an effective technique to detect and monitor ground displacements with centimeter accuracy. Moreover, the recent development of advanced DInSAR techniques, aimed at the generation of deformation time series, has led to the exploitation of the large archive of SAR data acquired all over the world, during the last 16 years, by the ERS, ENVISAT and RADARSAT satellites. Among these advanced approaches, we focus on the Small BAseline Subset (SBAS) algorithm that relies on the combination of DInSAR data pairs, characterized by a small separation between the acquisition orbits (baseline), in order to produce mean deformation velocity maps and the corresponding time series, maximizing the coherent pixel density of the investigated area. One of the main capabilities of the SBAS approach is the possibility to work at two spatial resolution scales, thus allowing us to investigate deformation phenomena affecting both extended areas (with resolution of about 100 by 100 m) and selected zones, in the latter case highlighting localized displacements that may affect single structures or buildings (at the full instrument resolution).
Similarly to other advanced DInSAR techniques, the SBAS approach requires extended data storage and processing capabilities due to the large amount of data exploited for the generation of the final products.
Accordingly, we present in this work the results of the first experiment to “plug” the robustness of the SBAS algorithm into the high computing capability provided by a GRID-based system. In particular, we have exploited the low-resolution SBAS algorithm [1] and the ESA Grid Processing-on-Demand (G-POD) system.
This environment is one of the results achieved by the ESA Science and Application Department of Earth Observation Programmes Directorate at ESRIN that focused, following the participation to the DATAGRID project (the first large European Commission funded Grid project), on the development of a dedicated Earth Science Grid infrastructure, under the name Earth Observation Grid Processing on-Demand, G-POD [2]. Coupled with high-performance and sizeable computing resources managed by Grid technologies, G-POD provides the necessary flexibility for building a virtual environment that gives transparent, fast, and easy access to data, computing resources, and results. Using a dedicated Web interface, each application has access to a catalogue like the ESA Multi-mission User Interface System (MUIS) [3-4] and storage elements. Furthermore, it communicates with the underlying Grid middleware, which coordinates all the necessary steps to retrieve, process, and display the requested products selected from the large database of ESA. This makes G-POD an ideal environment for processing large amounts of data, developing services which require fast production and delivery of results, comparing approaches and fully validating algorithms. In particular the G-POD concept and technology solves the following issues:
• to move processors close to the data in a flexible and controlled way, thus leaving the data wherever they are archived and reducing dissemination costs and effort;
• to share resources (data, tools, computing resources), thus reducing investments and running costs and reducing data flows to the minimum, with clear reliability and performance improvements.
The SBAS-GPOD solution has been tested by processing an ASAR-ENVISAT dataset (track 129, frame 809) formed by 39 images acquired from ascending orbits, on the Napoli bay area (Italy), during the 2002-2007 time period. The presented results provide a figure of the achieved performance of the implemented DInSAR processing system.

References

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