EGU22-12444
https://doi.org/10.5194/egusphere-egu22-12444
EGU General Assembly 2022

New advances of the P-SBAS algorithm for the efficient generation of full resolution DInSAR products through scalable HPC infrastructures

Riccardo Lanari[1], Manuela Bonano[1], Sabatino Buonanno[1], Michele Manunta[1], Pasquale Striano[1], Muhammad Yasir[1,2], and Ivana Zinno[1]

[1]IREA, CNR, Napoli, Italy (lanari.r@irea.cnr.it)

[2]Università degli Studi di Napoli "Parthenope", Napoli, Italy

The widespread availability of large SAR data volumes systematically acquired during the last 3 decades by several space-borne sensors, operating with different spatial resolutions, footprint extensions, revisit times and bandwidths (typically X-, C-, or L-band), has promoted the development of advanced Differential Interferometric SAR (DInSAR) techniques providing displacement time series relevant to wide areas with rather limited costs. These techniques allow us to carry out detailed analyses of the Earth surface deformation effects caused by various natural and anthropic phenomena and also to investigate the displacements affecting man-made structures. In particular, with reference to the latter issue, the increasing need to assess, preserve and mitigate the health conditions of buildings and infrastructures, due to the high vulnerability of the built-up environment, has fostered over the last decades an intense exploitation of the advanced DInSAR techniques. In this context, a new frontier for the development of these methodologies is related to their effective exploitation in operational contexts, requiring the use of up-to-date interferometric processing techniques and advanced HPC infrastructures to precisely and efficiently generate value-added information from the available, multi-temporal large SAR data stacks.

Among several advanced DInSAR algorithms, a widely used approach is the Small BAseline Subset (SBAS) technique which has largely demonstrated its effectiveness to retrieve deformations relevant to natural and anthropic hazard scenarios, through the generation of spatially dense mean velocity maps and displacement time series with millimetric accuracy, at different spatial resolution scales (both regional and local ones). Moreover, a parallel algorithmic solution for the SBAS approach, referred to as the parallel Small BAseline Subset (P-SBAS) technique, has been recently developed.

In this work, we present some new advances of the full resolution P-SBAS DInSAR processing chain that allow us to effectively retrieve, in reasonable time frames (less than 24 hours), the spatial and temporal patterns of the deformation signals associated to the built-up heritage. This is achieved through a dedicated implementation of the full resolution P-SBAS processing chain permitting to efficiently exploit HPC resources, also accessible through Cloud Computing environments. In

particular, we make an extensive use of innovative hardware and software parallel solutions based on GPUs, which are able to efficiently store, retrieve and process huge amounts of full resolution DInSAR products, with high scalability performance.

To demonstrate the capability of the implemented solution we show the results of the massive full resolution P-SBAS processing relevant to several urban areas of the Italian territory. This is done by exploiting the overall, full frame SAR image stacks of ascending and descending X-band SAR data acquired by the sensors of the Italian COSMO-SkyMed (CSK) constellation, operated through the Stripmap mode (with about 3m x 3 m spatial resolution), and those of the C-band Sentinel-1 twin sensors of the Copernicus Programme, exploiting the Interferometric Wide Swath TOPS mode (with about 15 m x 4 m spatial resolution). Moreover, we also benefit from the availability of the first data acquired by the second generation COSMO-SkyMed constellation (CSG), which allows continuity with the CSK data in the monitoring of the detected deformation phenomena.