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First Sentinel-1 results achieved through the SBAS-DInSAR approach

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The new European C-Band SAR Sentinel-1A (S1-A) satellite, launched on April 2014, has opened new challenges in the context of Earth's surface displacement analyses and monitoring. Indeed S1-A, thanks to its capability to acquire large SAR dataset in short time interval with a global coverage strategy, allows performing advanced deformation analyses over very large areas, to mainly investigate seismic, tectonic and volcanic phenomena. In this framework, Differential SAR Interferometry (DInSAR) technique plays a key role since it allows us to map and measure deformation phenomena due to several causes. DInSAR is based on the exploitation of the phase difference (interferogram) between two temporally separated SAR images, to measure the displacements occurred between the two acquisitions. Furthermore, the use of advanced DInSAR approaches, based on the exploitation of large multi-temporal SAR datasets, allows providing useful information on the spatial and temporal patterns of the detected displacements through the generation of deformation time series, with centimeter to millimeter accuracy. Since S1-A SAR data are acquired, over land, with the innovative mode referred to as Terrain Observation by Progressive Scans (TOPS), by means of which Interferometric Wide Swath (IWS) mode is implemented, DInSAR processing chains have to be properly adapted with original and innovative procedures to properly manage the peculiarities of S1-A data.

This work is aimed at showing the first S1-A DInSAR results achieved through an advanced and efficient interferometric processing chain, based on the well-known DInSAR approach referred to as Small BAseline Subset (SBAS), developed to handle IWS S1-A data. In this framework, the pursued strategy strongly takes into account the acquisition characteristics of the S1-A Interferometric Wide Swath images. This permits to develop an inherently parallel DInSAR processing chain, which can be of benefit also in operational contexts, when processing large amounts of data in short time represents a challenging task.

The developed SBAS-DInSAR chain has been tested on S1-A single interferometric pairs. In particular, several deformation phenomena affecting active volcanic areas have been retrieved. Furthermore, by exploiting the TOPS RADARSAT-2 interferometric campaign, the Mexico City displacements occurred between April to November 2013 have been detected and deformation time series have been generated. The achieved results clearly demonstrate the capability of the developed SBAS-DInSAR processing chain to effectively generate deformation maps relevant to wide areas by exploiting SAR data acquired with TOPS mode.