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New advances of the P-SBAS based automatic and unsupervised tool for the co-seismic Sentinel-1 DInSAR products generation

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Differential Synthetic Aperture Radar Interferometry (DInSAR) is a key method to estimate, with centimeter accuracy, the earth surface displacements caused by natural events or anthropogenic activities. Furthermore, since 2014 the scientific community can benefit from the huge spaceborne SAR data archives acquired by the Copernicus Sentinel-1 (S1) satellite constellation, which operationally provides SAR data with a free and open data access policy at nearly global scale. By using the S1 acquisitions, an automatic and unsupervised processing tool that generates co-seismic interferograms and LOS displacement maps has been developed. This tool routinely queries two different earthquake catalogs (USGS and INGV) to trigger, in automatic way, the S1 data download and the DInSAR processing through the Parallel Small BAseline Subsets (P-SBAS) algorithm. In particular, in order to guide the algorithm to only intercept the earthquakes which may produce ground displacements detectable through the DInSAR technology, the tool starts the SAR data processing for those events with a magnitude greater than 4.0 in Europe, and greater than 5.5 at a global scale.

We first remark that, in order to optimize the extension of the investigated area, thus reducing the processing time and effectively exploiting the available computing resources, an algorithm for the estimation of the co-seismically affected area has been integrated as first step of the workflow. More specifically, by considering the moment tensors provided by public catalogs (USGS, INGV, Global CMT project), a forward modelling procedure generates the predicted co-seismic displacement field, used by the P-SBAS algorithm to optimize some of the DInSAR processing steps. In particular, the phase unwrapping (PhU) algorithm is applied only to the part of the DInSAR interferograms delimited by the area identified through the predicted scenario and not to the whole S1 scene. In addition, the presented automatic and unsupervised tool has been migrated within a Cloud Computing (CC) environment, specifically the Amazon Web Service (AWS). This strategy allows us a more efficient management of the needed computing resources also in emergency scenario.

The adopted solutions allowed the creation of a worldwide co-seismic maps database. Indeed, by benefiting of the last seven years of Sentinel-1 operation, the tool has generated approximately

6500 interferograms and LOS displacement maps, corresponding to a total of 383 investigated earthquakes.

Note also that the generated interferograms and displacement maps have been made available for the scientific community through the EPOS infrastructure and the Geohazards Exploitation Platform, thus helping scientists and researchers to investigate the dynamics of surface deformation in the seismic zones around the Earth also in the case they have not available specific DInSAR processing capabilities and/or skills.