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Satellite SAR interferometric techniques applied to emergency mapping

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This paper aim to investigate the capabilities of the currently available SAR interferometric algorithms in the field of emergency mapping. Several tests have been performed exploiting the Copernicus Sentinel-1 data using the COTS software ENVI/SARscape 5.3.
Emergency Mapping can be defined as “creation of maps, geo-information products and spatial analyses dedicated to providing situational awareness emergency management and immediate crisis information for response by means of extraction of reference (pre-event) and crisis (post-event) geographic information/data from satellite or aerial imagery”. The conventional differential SAR interferometric technique (DInSAR) and the two currently available multi-temporal SAR interferometric approaches, i.e. Permanent Scatterer Interferometry (PSI) and Small BAseline Subset (SBAS), have been applied to provide crisis information useful for the emergency management activities. Depending on the considered Emergency Management phase, it may be distinguished between rapid mapping, i.e. fast provision of geospatial data regarding the area affected for the immediate emergency response, and monitoring mapping, i.e. detection of phenomena for risk prevention and mitigation activities.
In order to evaluate the potential and limitations of the aforementioned SAR interferometric approaches for the specific rapid and monitoring mapping application, five main factors have been taken into account: crisis information extracted, input data required, processing time and expected accuracy.
The results highlight that DInSAR has the capacity to delineate areas affected by large and sudden deformations and fulfills most of the immediate response requirements. The main limiting factor of interferometry is the availability of suitable SAR acquisition immediately after the event (e.g. Sentinel-1 mission characterized by 6-day revisiting time may not always satisfy the immediate emergency request).
PSI and SBAS techniques are suitable to produce monitoring maps for risk prevention and mitigation purposes. Nevertheless, multi-temporal techniques require large SAR temporal datasets, i.e. 20 and more images. Being the Sentinel-1 missions operational only since April 2014, multi-mission SAR datasets should be therefore exploited to carry out historical analysis.