MEMpHIS

Multi Scale and Multi Hazard Mapping
Space based Solutions

Executive Summary

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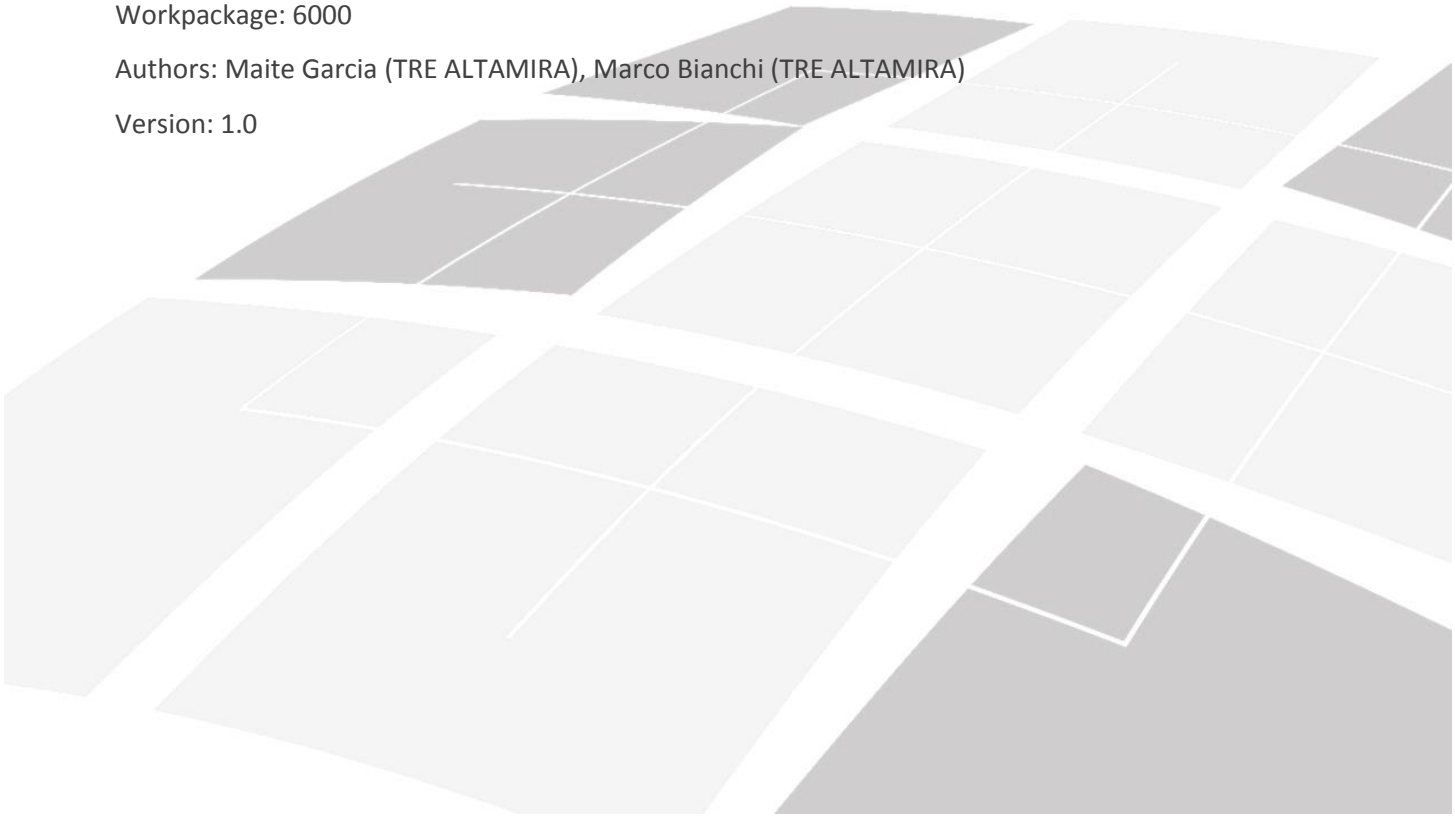

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Multi Scale and Multi Hazard Mapping Space based Solutions

The inexorable progress made in the past years in the field of Earth Observation (EO) technologies offers a huge potential for innovation in Disaster Risk Reduction (DRR) applications. Interferometry processing of SAR data is one of the standard techniques for the detection, detailed characterisation and monitoring of surface motion caused by natural disasters.

Yet the transfer of this technology progress to the user community needs to move forward in order to ensure that advancements in satellite technologies are transformed into services to be used by the community. One of the main challenges for the user community nowadays is the handling of the increasing volume of EO data generated daily and cloud infrastructure is a potential efficient solution to cope with it.

Most of the consolidated methodologies for hazard mapping use statistical approaches, geophysical data and modelling geological data. In this framework generating hazard maps from Sentinel-1 data processed on a cloud infrastructure clearly has great capabilities for the acceptance and uptake of procedures by the users.

MEMpHIS aimed at providing the user community with a Sentinel-1 solution to foster and accelerate the utilization on a cloud infrastructure of space assets and innovative data exploitation methods. The selected cloud infrastructure for developing the project methodologies was the ESA Geohazard Exploitation Platform (GEP).

Over the two and a half years of MEMpHIS, the project activity addressed two main geohazards, landslides and seismic with particular effort dedicated to the assessment of the portability of EO processing algorithms to the cloud infrastructure.

A first part of the project focused on obtaining the necessary information from Disaster Risk Management users to determine what their requirements were in terms of geo-information and what space technologies could do to meet those requirements.

The bulk of the project was concerned with developing and testing through five real trial cases different satellite-based methodologies for landslides and seismic hazards. Derived tools were run on the cloud to allow users to produce ground deformation measurements by themselves with the support of the project consortium.

A final element of the project was devoted to closing the space based solution implemented with a further gap analysis between the future space assets and the user needs for hazard mapping in Disaster Risk Reduction. EO data, processing methods, output products, Information and Communication Technology (ICT) storage and processing options were assessed and a requirement baseline report for current as well as future planned missions was produced.

For both landslide and seismic hazards, off-line PSI results processed with SqueeSAR™ were made available on the platform over the areas of interest of the trial cases, in ascending and descending mode. A Post-Processing service has been implemented in order to retrieve vertical and horizontal components, acceleration field, Line of Sight velocity vector projection along the slope direction, change of the reference point.

For the landslide hazard two different software were successfully integrated into the GEP platform: LAND-SE for the evaluation of landslide susceptibility and LAND-STAT for evaluation statistics of landslide size. They were both used on the platform in the three selected trial cases, in Italy, Greece and Myanmar. As a cross check of the Landslide Inventory Map, SqueeSAR results have been processed through the Post-Processing tool, for the Vertical/Horizontal component estimantion.

For the seismic hazard processing results were used to produce two different outputs: NAF and Active/Non-active Deep seated gravitational slope deformation Inventory (ANDI). The processing results were uploaded on the GEP platform and the Post Processing tool was run online to obtain the Up-Down and East-West components of motion. These procedures were tested in two trial cases, one in Italy and one in Greece. An additional experiment was performed to test the new P-SBAS (Parallel - Small BAseline Subset) service available for the seismic trial case. This new service allowed processing Sentinel-1 TOPSAR data to derive time series of ground deformation, based on the SBAS method.

MEMpHIS project, under ESA contract Nr. 4000113774/15/F/MOS, has supported DRR users in their capacity to handle full integration of multi-source data taking advantage of the latest developments of ICT on cloud and web-based platforms; it has hence contributed to the widening of the use of space technologies to extract meaning for an optimised landslide and seismic hazard mapping.