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SPACE DATA EXPLOITATION AND GIS MODELING AS TOOLS FOR INFRASTRUCTURE
MANAGEMENT

Abstract

The European Space Agency (ESA) centre for Earth Observation (EO), ESRIN, is located in Frascati, near Rome (Italy). In its Data Centres ESA EO satellite data is recorded and processed, jointly with Third Party Missions data.

The unceasing space technology development permits the constant evolution of accuracy of Synthetic Aperture Radar (SAR) imagery, and consequently the progress in remote sensing applications. These include proven techniques such as high accuracy models for building features extraction in urban areas, and also new applications for precision farming or for monitoring cutting practices in grassland areas, as shown in the literature.

The objective of this study is the use of SAR data to create a very accurate Digital Elevation Model (DEM) of the ESRIN establishment and its neighbourhood. This will support the planning and evolution of infrastructures on site, including the evaluation of the renewable energies potential and the interaction with the surrounding areas for hydrogeological and seismic aspects.

Thanks to the cooperation with the Italian Space Agency (ASI) we had the possibility to access the COSMO SkyMed X-Band database included in the Map-Italy Project. The SAR interferometric data processing and the creation of the DEM were performed using several interferometric processors. The results are being validated against other available data, such as DEMs obtained by high resolution optical data, or other complementary data sources. In addition, in situ GPS data is being collected and integrated in order to improve the accuracy of the results.

The finalisation of the DEM allows to perform the planned environmental analysis with a Geographical Information System software, in particular mapping potential water flow in case of heavy precipitation events. Moreover, the availability of a large SAR archive over the site (e.g. exploitation of the ENVISAT ASAR archive, and soon of the SENTINEL-1 data archive) allows the analysis of the ground stability, by means of the permanent scatterers technique, creating an additional layer for the GIS model.

The analysis of extreme environmental and hydrogeological events allows the quantitative risk assessments and the classification of the exposure value of the critical infrastructure on the ESRIN site.

The application of this model allows the implementation of predictive analysis related to the natural impacts on ESRIN infrastructures, and therefore the identification of the best actions voted to protect ESRIN Data Centres, increasing their resilience and ensuring ESA business continuity.