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Improving the extraction of crisis information in the context of flood, fire, and landslide rapid mapping using SAR and optical remote sensing data

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Optical and radar satellite remote sensing have proven to provide essential crisis information in case of natural disasters, humanitarian relief activities and civil security issues in a growing number of cases through mechanisms such as the Copernicus Emergency Management Service (EMS) of the European Commission or the International Charter 'Space and Major Disasters'.
The aforementioned programs and initiatives make use of satellite-based rapid mapping services aimed at delivering reliable and accurate crisis information after natural hazards.
Although these services are increasingly operational, they need to be continuously updated and improved through research and development (R&D) activities. The principal objective of ASAPTERRA (Advancing SAR and Optical Methods for Rapid Mapping), the ESA-funded R&D project being described here, is to improve, automate and, hence, speed-up geo-information extraction procedures in the context of natural hazards response. This is performed through the development, implementation, testing and validation of novel image processing methods using optical and Synthetic Aperture Radar (SAR) data. The methods are mainly developed based on data of the German radar satellites TerraSAR-X and TanDEM-X, the French satellite missions Pléiades-1A/1B as well as the ESA missions Sentinel-1/2 with the aim to better characterize the potential and limitations of these sensors and their synergy. The resulting algorithms and techniques are evaluated in real case applications during rapid mapping activities.
The project is focussed on three types of natural hazards: floods, landslides and fires. Within this presentation an overview of the main methodological developments in each topic is given and demonstrated in selected test areas. The following developments are presented in the context of flood mapping: a fully automated Sentinel-1 based processing chain for detecting open flood surfaces, a method for the improved detection of flooded vegetation in Sentinel-1data using Entropy/Alpha decomposition, unsupervised Wishart Classification, and object-based post-classification as well as semi-automatic approaches for extracting inundated areas and flood traces in rural and urban areas from VHR and HR optical imagery using machine learning techniques. Methodological developments related to fires are the implementation of fast and robust methods for mapping burnt scars using change detection procedures using SAR (Sentinel-1, TerraSAR-X) and HR optical (e.g. SPOT, Sentinel-2) data as well as the extraction of 3D surface and volume change information from Pléiades stereo-pairs. In the context of landslides, fast and transferable change detection procedures based on SAR (TerraSAR-X) and optical (SPOT) data as well methods for extracting the extent of landslides only based on polarimetric VHR SAR (TerraSAR-X) data are presented.