USING COSMO-SKYMED DATA FOR FLOOD MAPPING: SOME CASE-STUDIES

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ABSTRACT

Several investigations proved the potentiality of spaceborne Synthetic Aperture Radar (SAR) for flood mapping, thanks to the synoptic view, important for monitoring events occurring in remote regions, as well as the capability to operate in almost all-weather conditions, which is a distinctive requirement for managing this kind of events. Moreover, the new very high spatial resolution SAR sensors make possible to carry out a fairly accurate delineation of the flood extent. However, until now the temporal repetitiveness of SAR measurements has been a critical issue for their operational use. From this point of view, the COSMO-SkyMed costellation can yield a fundamental contribution, since the images are acquired with a short revisit time, thanks to three of four satellites already orbiting..

Several inundations occurred in Italy in the recent years, so that the Italian Space Agency (ASI) funded some studies concerning civil protection from floods. In this context, ASI made available some COSMO-SkyMed observations of recent flood events, namely the catastrophic inundation occurred in Myanmar in May 2008 and the event that took place in Sardinia (Italy) in October 2008. This paper presents the preliminary results derived from the analysis of these data.

While most of the algorithms for inundation mapping from SAR data are based on fixed thresholds applied on a image temporarily close to the event, or use heuristic segmentation techniques, an analysis accounting for the diverse electromagnetic mechanisms that determine the radar return in the presence of water surfaces is required for an accurate mapping. In fact, both specular reflection, characteristic bare soil, and double bounce backscattering, typical of forested and urban areas may occur in the presence of surface water. A specular surface is characterized by a low radar backscattering, whereas double bounce backscattering involving trunks (forests) or buildings (urban areas) is generally increased by the underlying water.

To accomplish an accurate map of an inundation, the variations of the radar return caused by the presence of water surfaces should be identified. This implies the need to analyze not only a SAR observation of the event, but also an image of the monitored area without the presence of water surfaces, i.e., preceding the flood, or following it with a sufficiently large temporal interval.

For each event we analyzed a couple of SAR images, one observation of the flood and one image following it. We used two kinds of Cosmo-SkyMed products: Single-look Complex (SLC) Slant range data (Level 1A), and the Geocoded image of level 1C, in which the 1A product is projected onto the earth ellipsoid. The SLC images have been automatically geocoded and co-registered, while the 1C data have been co-registered using a ground control points based technique.

The results of our analysis will be presented, pointing out both the encouraging aspects of our study and the critical points, generally related to the temporal mismatch between the SAR observation of the flood and the actual occurrence and to the need of image pairs acquired with the same geometry. Guidelines for further developments of a flood mapping procedure using an X band SAR are drawn in the conclusions.