

IMPACT OF X-BAND INTERFEROMETRIC RADAR DATA ON HYDROGEOLOGICAL RISK MANAGEMENT

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ABSTRACT:

The use of satellite radar interferometry (InSAR) for measuring surface deformation has proven to be quite effective, thanks to the to its high precision, and to the availability of satellite data archives covering more than one decade. Moreover, the Permanent Scatterer technique (PSInSAR), developed by Politecnico di Milano, enables to overcome most of the limitations related to conventional InSAR.

During the last decade, several applications of C-band data (~6 cm wavelength), related to both landslide inventories at regional scale and surface displacement monitoring (landslides, fault reactivation in mining areas, subsiding areas, sinkholes, single buildings, etc.) at local scale, have been discussed in a growing number of publications based on this kind of remote sensed information. The Italian Ministry of the Environment has recently awarded a contract for the processing of more than 12,000 radar scenes acquired during the last over Italy by the ERS and ENVISAT satellites, aimed at creating the first database of interferometric information on a national level for mapping unstable areas. This is somewhat an evidence of the fact that, in less than ten years from its development, this technology has become a standard monitoring tool.

One of the main limitation to the application of satellite radar interferometry in the field of Civil Protection, is represented by the quite long revisiting time (24 or 35 days) of the previous generation C-band satellites (ERS1-2, Envisat, Radarsat-1). This problem is presently being overcome by a new generation of radar satellites operating in X-band (namely, TerraSAR-X and COSMO-SkyMed), which started the operations last year. Compared to the C-band satellites, the main advantages of X-band sensors are represented by: (a) higher sensitivity to any target displacement; (b) higher spatial resolution and (c) shorter revisiting time.

TerraSAR-X has a repeat cycle of 11 days while the two sensors of the COSMO-SkyMed constellation have an effective repeat cycle of just 8 days (the third sensor, successfully launched, is presently in the calibration phase). It should be noted that, as soon as the completed, the Italian COSMO-SkyMed constellation will have an effective revisiting time of just 4 days, which will allow "near real time" applications, possibly supporting Civil Protection activities.

The technical features of the new radar X-band sensors and their impact on space geodesy, highlighting the importance of data continuity and standardized acquisition policies for almost all InSAR applications will be presented. In addition, some applications of X-band satellites to the control of building stability, landslide evolution and mining areas monitoring will be discussed as well.