Testing Different Techniques for Detection, Rapid Mapping and Monitoring of Landslides in the Barcelonnette Region Using Satellite and Airborne Optical Imagery

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Within SafeLand the Joint Research Centre (JRC) of the European Commission is involved in three research areas, i.e. Area 2 on "Quantitative risk assessment", Area 3 on "Quantifying global change scenarios (climatic and anthropogenic) and their impact on land-slide hazard and risk in the future" and Area 4 on "Development of monitoring technology, especially early warning systems and remote sensing techniques, and applications". This abstract focuses on the activities within Area 4. A short overview will be provided of the research planned by JRC. For more elaborate information on the techniques presented, reference is made to some clarifying research articles.

With the increasing spatial resolution of e.g. IKONOS (1999), QuickBird (2001), OrbView-3 (2003), now phased out, Worldview (2007; 0.44 m pan) or GeoEye (2008; 0.41 m pan) sensors, application fields which had previously been the domain of airborne remote sensing (ARS) could be tackled by satellite remote sensing (SRS [BLASCHKE, 2010]). Indeed, two of the three methods that will be tested and eventually improved by JRC within Area 4 have been originally designed with ARS images. JRC will test two techniques for detection and rapid mapping of landslides and one technique for long-term change detection of landslides. The techniques are planned to be applied to very high resolution (VHR) spaceborne optical sensors and airborne LiDAR. For this, the Barcelonnette test site (200 km²; Alpes-de-Haute-Provence, France) was selected, but probably also data from other SafeLand test sites will be used.

With regard to landslide detection and mapping, the first technique to be tested and eventually improved is a semi-automatic texture classification technique developed by HERVÁS & ROSIN (1996), HERVÁS et al. (1996) and HERVÁS & ROSIN (2001). These authors obtained good results with a discrimination method for landslide mapping in a semi-arid, sedimentary area in SE Spain from high resolution Daedalus ATM (3 m), IRS-1C Pan (5 m) and SPOT Pan (10 m) images. The second landslide identification technique will use LiDAR data in combination with optical images for Object Oriented Analysis (OOA; e.g. MARTHA et al., 2010). The possibilities of the Definiens Developer software for segmentation and classification of landslides are illustrated with results obtained from the exploration of the software.

For long-term detection of landslide activity, a method entailing automatic change detection of suitably pre-processed multitemporal images, followed by thresholding of pixel intensities into landslide-related change pixels was developed by HERVÁS et al. (2003). The method was previously applied to VHR (1 m) orthoimages of the Tessina landslide (Italy) and provided representative results on the pixel intensity changes related to the reactivation of the landslide in 1992 (Figure 1).

In agreement with SafeLand's objective to secure data exchange with other Areas, the results obtained from this study will be used as input data in Areas 2 and 3.

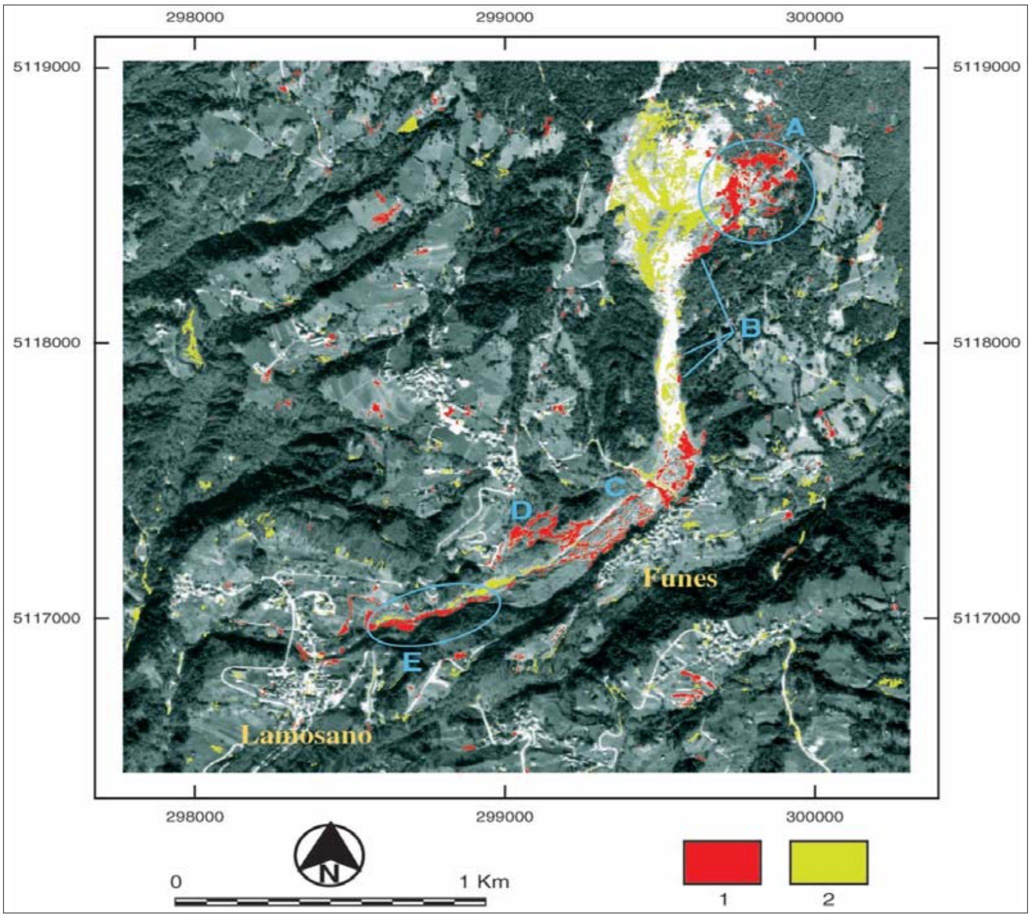

Fig. 1: Surface changes in the Tessina landslide between 1988 and 1994, illustrated on the 1994 orthophotograph. (1) within the landslide body, positive pixel intensity changes represent new soil outcrops and remobilised soil as a result of landslide reactivation; (2) negative pixel intensity changes are due to vegetation growth or soil moisture increase. Most changes outside the landslide correspond to land use change. Coordinates in UTM (HERVÁS et al., 2003).

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