Geophysical Research Abstracts,
Vol. 11, EGU2009-7790, 2009
EGU General Assembly 2009

Use of a remote sensing approach to detect landslide thermal behaviour

A. Mondini (1), R. Carlà (2), P. Reichenbach (1), M. Cardinali (1), and F. Guzzetti (1)
(1) CNR, IRPI, Perugia, Italy (alessandro.mondini@irpi.cnr.it), (2) CNR, IFAC, Firenze, Italy

The type, abundance and distribution of landsides in an area are controlled by the morphological, lithological and land use settings, and by the intensity and frequency of the triggers. Knowing the location and abundance of landslides is important for scientific and societal reasons. Most commonly, geomorphologists map landslides in the field or through the interpretation of stereoscopic aerial photographs. These are expensive and time consuming operations that require experienced personnel. The possibility to detect and map landslides over large area using remote sensing technology will improve the current capability to predict landslides, and to evaluate the susceptibility of an area to slope instability phenomena. In this work, we exploit airborne and space borne optical (thermal) imagery to evaluate the possibility to detect and map landslides. For the experiment, we select the Collazzone study area, that extend for about 80 square kilometers in Umbria, central Italy. For this area, detailed geomorphological information exists, including a multi-temporal landslide inventory map at 1:10,000 scale. We make the hypothesis that a difference in surface temperature exists between landslide and stable areas, due to different soil moisture conditions. We verify the hypothesis at two geographical scales: (i) at the (large) "single landslide" scale, and (ii) at the (small) catchment scale. Both approaches require the measurement of surface temperature at multiple sites, and the production of Land Surface Temperature (LST) maps. For individual landslides, we use images obtained on 3 May 2004 by a Daedalus 1268 Airborne Thematic Mapper (ATM), flown onboard a Dornier 228-110 aircraft operated by the Airborne Research and Survey Facility (ARSF) of the UK National Environment Research Council (NERC). For our catchment scale analysis, we use a L1A satellite image obtained on 3 July 2004 and acquired by ASTER sensor onboard TERRA satellite and a L1G satellite image obtained on 3 August 2001 by ETM+ sensor onboard LANDSAT 7. For our large scale, individual landslide, analysis we perform a pixel by pixel comparison of the surface temperature measurements obtained by processing the ATM data inside individual landslides, and in the immediately surrounding stable areas. For our basin scale analysis, we overlay in a GIS a map of surface temperature, obtained by processing the ASTER and LANDSAT images, on the landslide inventory map. We then compare the statistical distributions of the surface temperature measured in landslide and in stable areas. Preliminary results indicate that the mean and the mode of the distribution of surface temperature in landslide areas are lower than in the stable areas. This is consistent with the observation that in the study area landslides are wetter than stable areas. When studying individual landslides the distinction is less clear, but pixels located inside landslides are, in general, colder (i.e., wetter) than those located in the immediately surrounding stable areas where land cover types are similar.