Close Window

2010 AGU Fall Meeting

You may print by clicking on this Print *button. To return to the previous page, close this browser window or click the 'X' button in the top right corner of the page.*

ID# NH32A-01
Location: MW-3010 (Moscone West)
Time of Presentation: Dec 15 10:20 AM - 10:35 AM

Semi-automatic mapping of rainfall-induced landslides exploiting VHR optical images: the Messina, Sicily, 1 October 2009 landslide event (*Invited*)

P. Reichenbach[1]; *A. Mondini*[1, 2]; *F. Ardizzone*[1]; *M. Cardinali*[1]; *F. Fiorucci*[1, 2]; *F. Guzzetti*[1]; *M. Rossi*[1]
1. IRPI-CNR, Perugia, Italy.
2. Università degli Studi di Perugia, Dipartimento di Scienze della Terra, Perugia, Italy.

A landslide inventory map shows the location and extent of landslides that have left discernable signs in an area. An event-inventory shows landslides caused by a single trigger, such as an earthquake, a rainfall event, or a rapid snowmelt event. Event-inventories are important to document the extent of a landslide disaster, for erosion studies, and to validate landslide susceptibility models. Most commonly, landslide event-inventories are obtained through the interpretation of stereoscopic aerial photographs taken shortly after an event, aided by field surveys. Investigators have attempted to use very-high-resolution (VHR) satellite images to map event landslides. Most of the attempts exploit basic change detection techniques to identify the landslides. For the purpose, pre- and post-event optical images of similar characteristics are required. Mapping obtained using these methods can be imprecise, it can over overestimate or underestimate the true landslide extent, and – in general – it lacks geographic accuracy.
In this work, we present a new method to identify recent rainfall induced landslides using pre- and post-event VHR satellite images. The method was tested along the Ionian coast of Sicily, southern Italy, where on 1 October 2009 a high-intensity rainfall (200 mm of cumulated rain in 6 hours) triggered more than 500 shallow soil slides and debris flows in an area of about 40 km2. For the area, a landslide event-inventory was prepared at 1:10,000 scale through a combination of: (i) field surveys, (ii) visual interpretation of pre- and post-event aerial photographs, (iii) analysis of VHR satellite images, and (iv) analysis of a post-event, high-resolution DEM.
Semi-automatic recognition and mapping of the rainfall-induced landslides was performed in steps, using a pre-event image taken by the QuickBird satellite on 2 September 2006, and a post-event image taken by the same satellite on 8 October 2009, 7 days after the event. First, a set of derivative maps showing changes in the optical properties of the two images was prepared. The derivative maps showed changes in: (i) the Normalized Difference Vegetation Index (NDVI), (ii) the spectral angle, (iii) the first (strongest) principal component, and (iv) the first (strongest) independent component. Next, the derivative maps and the landslide information shown in the existing inventory map were used to construct and calibrate a set of three multivariate terrain classification models. Each model categorized the terrain as being (i) a landslide, or (ii) free of landslides, with a given probability. Next, the single models were combined to obtain an “optimal” terrain zonation, which classified successfully > 80% of the landslide areas shown in the existing inventory map.
We expect the method to achieve similar high classification skills in other areas, provided that pre- and post-event VHR satellite images of adequate characteristics are available, and that the event-landslides have left discernable features on the terrain that are captured by the post-event satellite image.

Contact Information

Paola Reichenbach, Perugia, Italy, 06128, click here to send an email