Geophysical Research Abstracts
Vol. 16, EGU2014-11958-1, 2014
EGU General Assembly 2014

Landslide detectability with coarse resolution imagery: a Sentinel-2 emulation study to access spectral landslide discrimination.

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In this paper we explore landslide detectability using a simulation of course resolution (10 m) remote sensing imagery. During the last decade the increasing availability of Very High Resolution (VHR) imagery has significantly improved accuracies obtained by change detection classification algorithms. Still, one of the disadvantages is a spatial-temporal compromise, in that the VHR imagery is generally not taken frequently over the same region. The planed optical sensor aboard the two Sentinel-2 satellites will potentially overcome this limitation, as the sensor will be able to supply coarse resolution images (10 m) with a revisiting period of 5 days at the equator. This will potentially allow for quick assessments after groups of landslides are triggered (e.g., by an earthquake or heavy rainfall) anywhere in the world, soon after the landslides occurs. The scope of this study is to analyse the potential limitations supplied by this imagery for landslide detection. For the study, pre and post Sentinel-2 images were emulated by downgrading two Quickbird satellite images, taken on 2 September 2006 and on 8 October 2009, over the Messina province in Sicily, Italy, where on 1 October 2009 a rainfall storm triggered landslides, soil erosion and inundation. Spectral information, based on change detection indexes (NDVI difference, principal component analysis and spectral angle), were extracted for the stable and unstable areas according to an independent landslide inventory. The inventory was derived by aerial photo interpretation prepared at 1:10,000 scale covering three catchments with a total area of 15 km2 and characterized by soil slips and debris flows affecting 7.9% of the area. Stable and unstable spectral discrimination was determined by analysing their separability, and imposing different areal thresholds between stable and unstable areas, for both mass source and debris flow landslide types. Preliminary results show good agreement between the original and downgraded resolution fingerprints for both the stable and unstable areas. Smaller and sub-pixel size mass source landslides are highlight by lower spectral separability in opposition with the higher spectral separability from run-off debris flows. The results suggest size limitations for detectability and highlight the resolution benefits for the rapid production of intense rain landslide event inventories.