Geophysical Research Abstracts
Vol. 13, EGU2011-5962-1, 2011
EGU General Assembly 2011

Comparison of new methods for regional landslide detection and mapping

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Landslides mapping is essential for geomorphological and ecological studies, and for quantitative landslide hazard and risk assessments. Landslide maps, including geomorphological, event based, and multi-temporal inventory maps, are most commonly prepared through the visual interpretation of stereoscopic aerial photographs, aided by more or less extensive field surveys, and by the compilation and analysis of chronicle and archive information on historical landslide events. These methods are time consuming and resource demanding, limiting the possibility to prepare accurate and repeated landslide inventories covering large areas. New remote sensing information and technologies that can help with the detection and mapping of landslides and the production of landslide inventory maps have become available. These technologies comprise: (i) visual, digital, and combined analysis of high-resolution and very-high resolution optical satellite images, including monoscopic and stereoscopic images, and panchromatic, multi-spectral, and "fused" (pan-sharpened) images, (ii) visual or digital analysis of high resolution DEMs obtained from airborne LiDAR sensors, and derivative maps, and (iii) remote landslide mapping using laser rangefinder binoculars and a GPS receiver. These new technologies for landslide detection and mapping have distinct advantages and clear limitations, which are not fully understood. We have tested and compared traditional and new techniques to prepare regional landslide event-inventory maps. Specifically, we have compared landslide event maps obtained through reconnaissance field surveys with maps (i) obtained through the visual analysis of high resolution DEMs and derivative maps, (ii) prepared through the visual interpretation of very-high-resolution, monoscopic and stereoscopic images taken by optical satellite sensors shortly after the landslide triggering events, (iii) obtained by constructing a multivariate classification model based on variables describing changes between pre-event and the post-event satellite images, and (iv) compiled in the field using a laser rangefinder binocular coupled to a GPS receiver. Results indicate that the completeness and accuracy of the obtained inventories depends on the technique used to prepare the inventory. This suggests that adequate information on the techniques and tools used to detect and map landslides should always accompany a landslide inventory map.