Geophysical Research Abstracts
Vol. 17, EGU2015-10364-1, 2015
EGU General Assembly 2015

Comparison of the Structurally Controlled Landslides Numerical Model Results to the M 7.2 2013 Bohol Earthquake Co-seismic Landslides

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The M 7.2 October 15, 2013 Bohol earthquake is the most destructive earthquake to hit the Philippines since 2012. The epicenter was located in Sagbayan municipality, central Bohol and was generated by a previously unmapped reverse fault called the "Inabanga Fault". Its name, taken after the barangay (village) where the fault is best exposed and was first seen. The earthquake resulted in 209 fatalities and over 57 billion USD worth of damages. The earthquake generated co-seismic landslides most of which were related to fault structures. Unlike rainfall induced landslides, the trigger for co-seismic landslides happen without warning. Preparedness against this type of landslide therefore, relies heavily on the identification of fracture-related unstable slopes. To mitigate the impacts of co-seismic landslide hazards, morpho-structural orientations or discontinuity sets were mapped in the field with the aid of a 2012 IFSAR Digital Terrain Model (DTM) with 5-meter pixel resolution and < 0.5 meter vertical accuracy. Coltop 3D software was then used to identify similar structures including measurement of their dip and dip directions. The chosen discontinuity sets were then keyed into Matterocking software to identify potential rock slide zones due to planar or wedged discontinuities. After identifying the structurally-controlled unstable slopes, the rock mass propagation extent of the possible rock slides was simulated using Conefall. The results were compared to a post-earthquake landslide inventory of 456 landslides. Out the total number of landslides identified from post-earthquake high-resolution imagery, 366 or 80% intersect the structural-controlled hazard areas of Bohol. The results show the potential of this method to identify co-seismic landslide hazard areas for disaster mitigation. Along with computer methods to simulate shallow landslides, and debris flow paths, located structurally-controlled unstable zones can be used to mark unsafe areas for settlement. The method can be further improved with the use of Lidar DTMs, which has better accuracy than the IFSAR DTM. A nationwide effort under DOST-Project NOAH (DREAM-LIDAR) is underway, to map the Philippine archipelago using Lidar.