Preliminary earthquake-triggered landslide map for the Haiti earthquake (12-1-2010)

Introduction

This study presents the first results on an analysis of the landslides triggered by the Ms 7.0 Haiti earthquake that occurred on January 12, 2010 in the boundary region of the Pacific Plate and the North American plate. The fault is a left lateral strike slip fault with a clear surface expression. According to the USGS earthquake information the Enriquillo-Plantain Garden fault system has not produced any major earthquake in the last 100 years, and historical earthquakes are known from 1860, 1770, 1761, 1751, 1684, 1673, and 1618, though none of these has been confirmed in the field as associated with this fault.
We used high resolution satellite imagery available for the pre and post earthquake situations, which were made freely available for the response and rescue operations.
We made an interpretation of all co-seismic landslides in the epicentral area. We conclude that the earthquake mainly triggered landslide in the northern slope of the fault-related valley and in a number of isolated area. The earthquake apparently didn't trigger many visible landslides within the slum areas on the slopes in the southern part of Port-au-Prince and Carrefour. We also used ASTER DEM information to relate the landslide occurrences with DEM derivatives.

Data

All data are available from internet:

* Google Earth: GeoEye imagery acquired on January 13-24 2010 as post imagery and August 26, 2009
* SRTM data, and contour line derived from SRTM, by NASA and USGS.
* ASTER Digital Elevation Model . ASTER G-DEM. Include the link: ….
* Drainage network, administrative boundaries and road network shape files made available through a clearing house (http://Mississippi.deltastate.edu/data/haiti, http://Openstreetmap.org)
* Fault and aftershock information from USGS

Procedure:

* Downloading satellite imagery from Google Earth with a special programme that glues all tiles and automatically georeferences them
* Satellite imagery was imported in ILWIS & ARCGIS, and on screen digitizing was carried out while comparing the temporal information in Google Earth Pro of imagery before and after the earthquake
* Landslides were mapped as polygons, with the following information: Landslide ID, Type, Part.

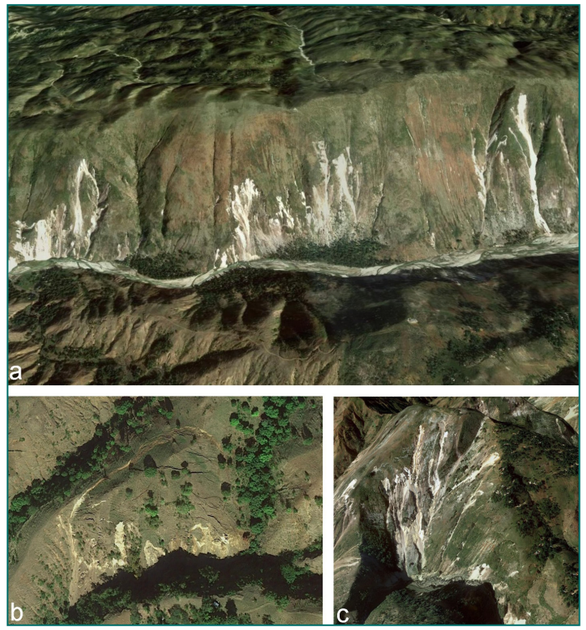

Fig.1: Examples of landslides triggered by the Haiti Earthquake. a: Rock-debris avalanches and debris slides on steep (40-50o) slopes near to epicenteral area. b: Deep seated landslide on southern part of the surface rupture. c: Multiple shallow rock avalanches.

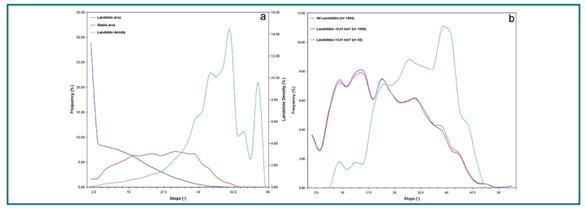

*Fig.3: a: Graph shows dependence of landslide abundance on terrain slope. Blue and red lines are percentages of landslide areas and of stable areas. Green line shows landslide area in each slope category, compared to the area extent of the slope category.
b: Frequency distributions of slope category stratified by landslide area. (In this figure I determined a specific area (<0.01 km2>) for landslides and I also calculated for all landslides. But the point is in here I used the initiation points for to get the slope category information).*

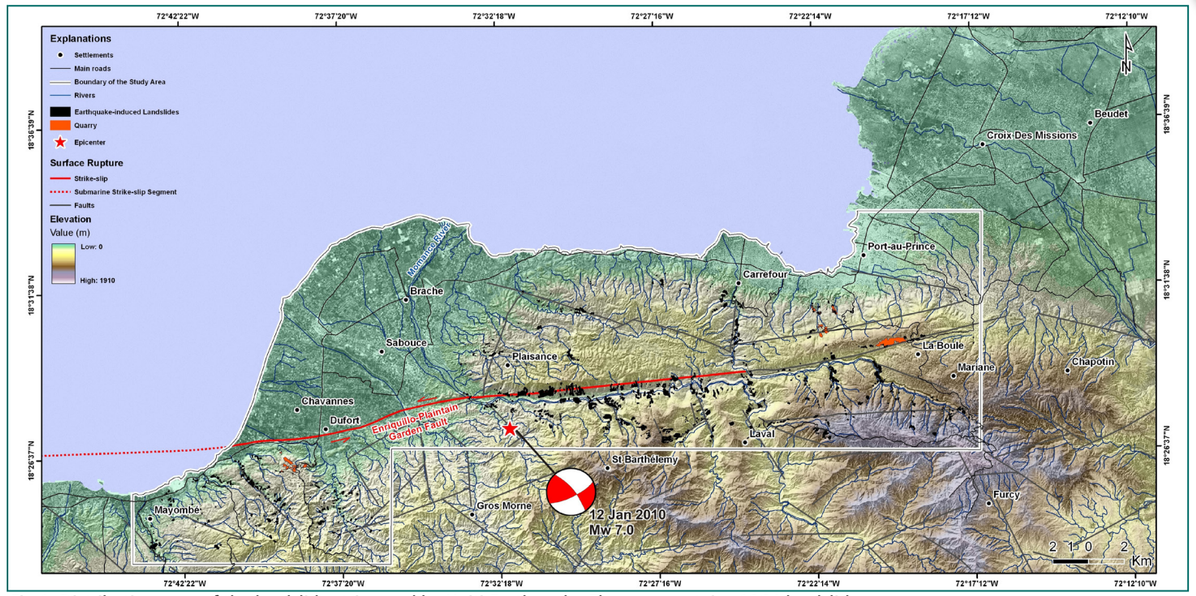

Fig.1: Distribution map of the landslides triggered by Haiti Earthquake. The map contains 1864 landslides.

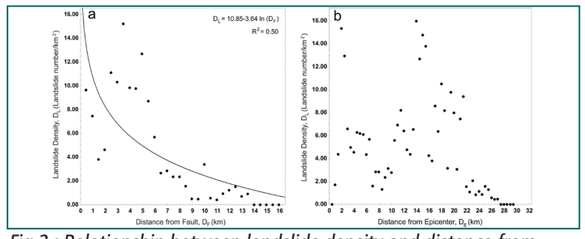

Fig.2 : Relationship between landslide density and distance from epicenter and surface rupture. a: Distance from surface rupture, b: Distance from epicenter.

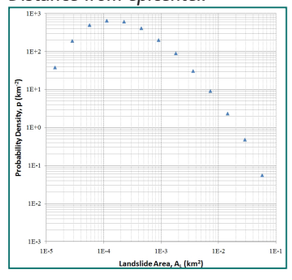

Fig. 3: Frequency size distribution of landslides triggered by 12 Jan 2010 Haiti Earthquake.

Results:

* Total number of landslides: 1864
* Total landslide area: 3.36 km2
* Mapped area (In figure 1 : Boundary of the study area): 550.30 km2
* Min. Landslide size : 0.000014
* Max. Landslide size : 0.057544
* Landslide density (DL) for studied area = landslide number/area
* 1864 landslides/550.30 km2 = 3.38 landslide/km2
* Percentage of the area affected by landslides: landslide area/study area
* 100 = 0.0061 %

Lithology (Relationship between co-seismic landslides and lithologies)

* Cretaceous volcanic rocks: 31.86 %
* Paleocene Sedimentary rocks: 20.87 %
* Eocene Sedimentary rocks: 26.93 %
* Plio-Quaternary deposits: 14.3 %

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