Geophysical Hazards and Plate Boundary Processes In Central America, Mexico and the Caribbean

Haiti: Earthquake on January 12, 2010

Situation, achievements and perspective.

Hotel La Condesa, Costa Rica
October 24-27, 2010.

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Presentation Summary

1. Investigations on earthquakes before January 12, 2010.
2. Scientific mission observations over the last 9 months.
3. Preliminary results of scientific observations.
4. Lessons learned regarding the earthquake.
5. Program for the next 20 years

1. Investigations on earthquakes before January 12, 2010

1.1 GPS measurements

In 2003, the Bureau of Mines and Energy in collaboration with Purdue University (Dr Eric Calais) deployed some GPS in Haiti in order to measure the inter-seismic displacements and fault slip rates.

1. Investigations on earthquakes before January 12, 2010

1.2 Educational seismometer deployed in Haiti by a French institution.

Only a single educational seismometer was operating in Haiti at the time of the 12 January 2010 earthquake.

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2. Scientific mission over the last 9 months.

2.1 Deployment of seismometers on land

- **USGS (US Geological Survey)**

▪ 18 temporary seismometers deployed from March to July 2010 (8 RefTek & 10 K2) to record aftershocks in order to identify areas of Port-au-Prince where hazard is high due to local geological conditions.

2. Scientific mission over the last 9 months.

2.2 Deployment of seismometers on land & offshore

- **French institutions: Geoazur Nice, Université Antilles Caraïbes, etc.**
  - Deployed offshore seismometers;
  - Educational seismometer at Catts Pressoir School
- **Ressources Naturelles du Canada**
  - 3 permanent stations :P-au-P, Jacmel & Léogane.

2. Scientific missions over the last 9 months.

2.3 Geological and geodetic observations

- **Columbia University & Institut de Physique du Globe de Paris:** collected samples of corals in areas affected by the earthquake in order to establish the history of seismic activity in the environment of the fault.

- **Univ. Texas at Austin and USGS:** Observations of coastal uplift, mapping of local tsunamis.

- **Purdue Univ., Univ. of Miami, Univ. Arkansas:** Measure coseismic displacements from GPS measurements, radar interferometry.

2. Scientific mission observations over the last 9 months.

2.4 Geotechnical and civil engineering surveys

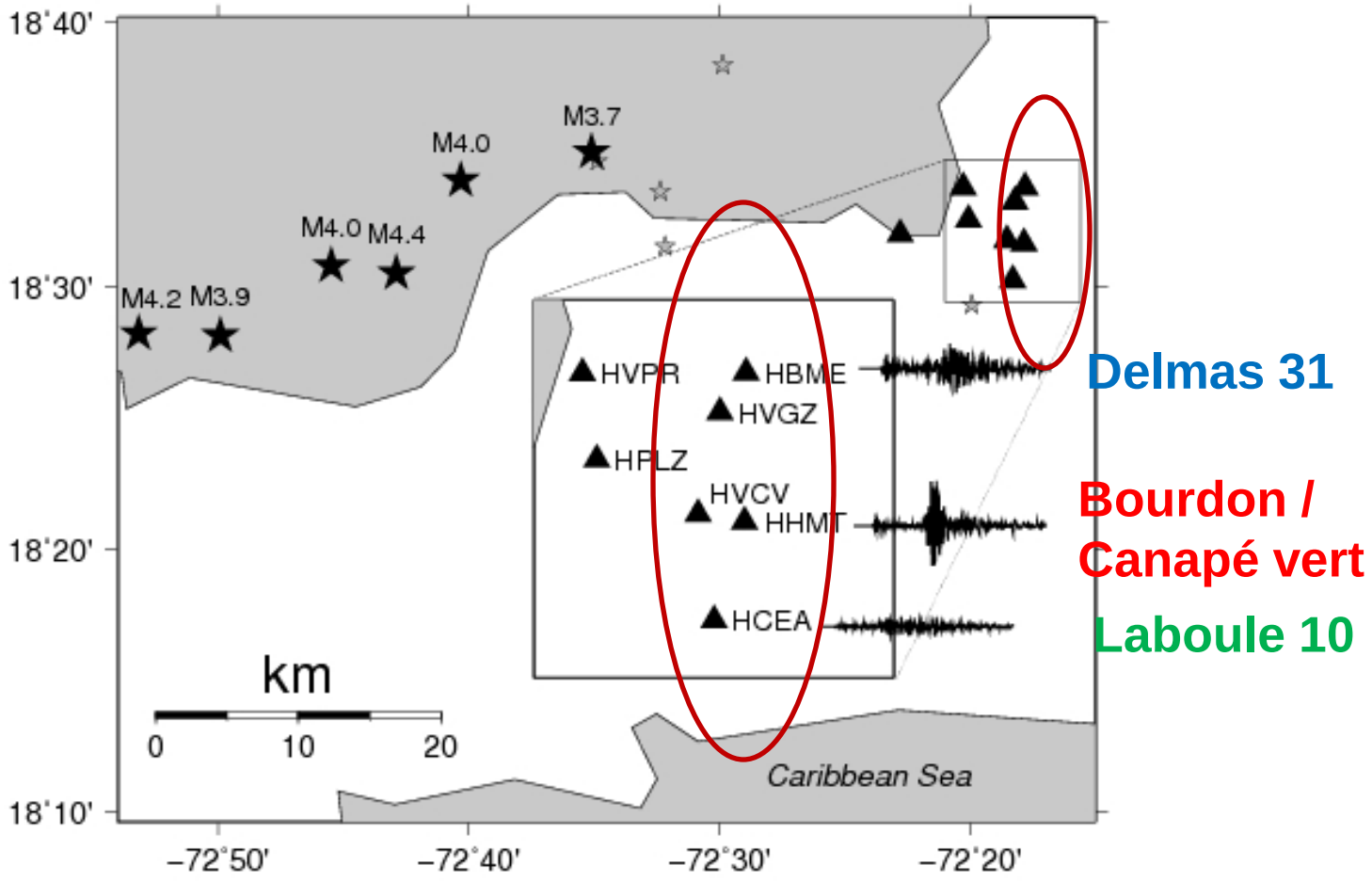
- **Purdue University :** Resilience of public buildings;
- **Texas University / Austin University:** They worked on micro zoning map in P-au-P (site effects).
- **Other scientific institutions such as:** Queens College, Bureau de Recherche Géologique et Minière (France), etc**.** have collaborated with Bureau of Mines and Energy.

3. Preliminary conclusion of scientific observations.

3.1 Strong motion results from USGS

The surveys reveals that local site effects contributed significantly to the damage in some neighborhoods of Port-au-Prince. However, in general, bad construction practices and high population density were the primary causes of the extent of the damage.

Aftershock Recordings:



<u>Results</u>

Strongest amplification at Bourdon and Canapé Vert (x3 amplification), Delmas (x2 amplification) (show epicenter of 3/20 aftershock)

3. Preliminary conclusion of scientific observations.

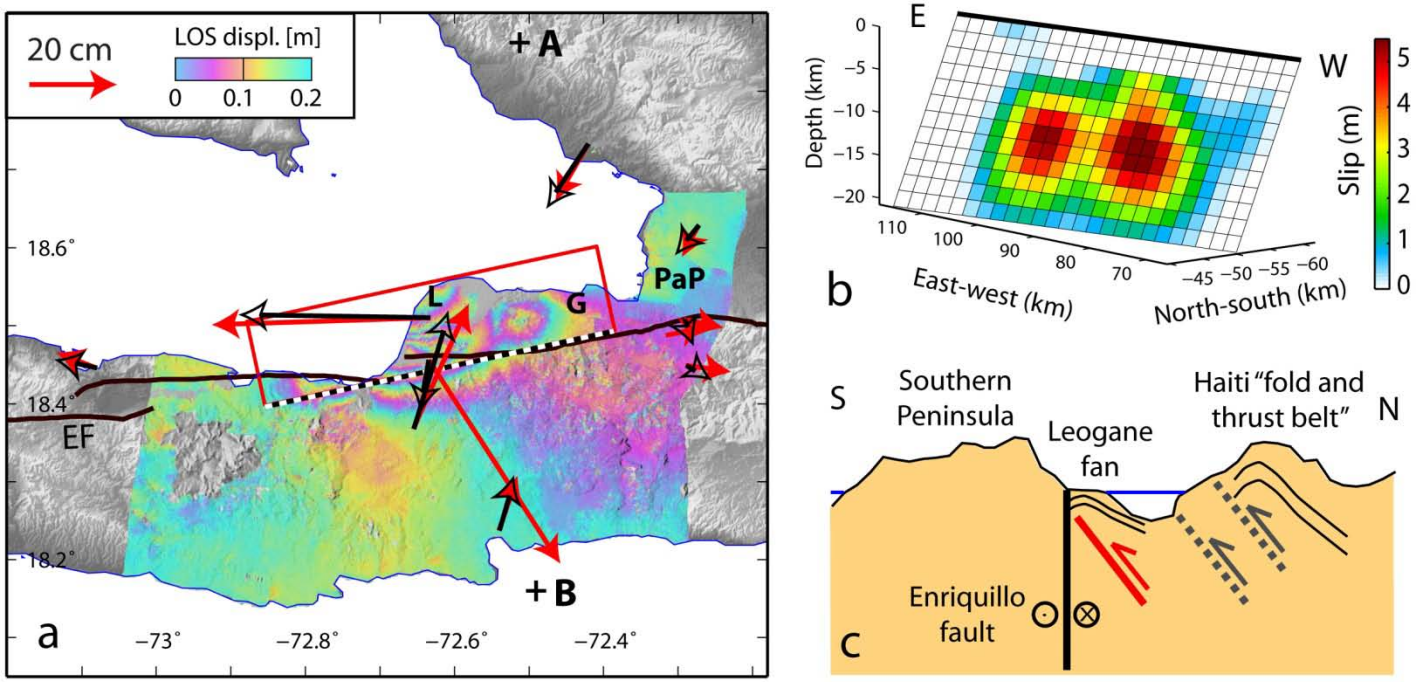
3.2 National Laboratory of Building and Publics Works (LNBTP).

Besides the site effects, use of poor materials, and the practice of inappropriate constructive disposals, open space non-braced “non-contreventés” on the ground floor of buildings (bank, school, hotel, supermarket, etc.) have been almost all collapsed and caused significant loss of life.

3. Preliminary conclusion of scientific observations.

3.3 Post-earthquake geodetic and geologic observations (BME, Purdue, UT Austin)

The geodetic surveys and geological observations reveal that the earthquake was caused by a previously unmapped fault (“Leogane fault”)



4. Lessons learned regarding the earthquake.

- Lack of professionals trained of earth sciences;
- Geology is not considered as tools of development
- Absence of micro zoning maps
- Geotechnical map absent for main cities
- Poor knowledge of all active faults in Haiti
- Induced effects observed (slide land, soil liquefaction)
- Lack of a network seismic monitoring ;
- GPS measurement started only 2003
- Lack of interest for study of seismology (absence of professionals trained)

4. Lessons learned regarding the earthquake.

- No application of conventional building codes (non-controlled use of steels, concrete dosage only for important buildings, etc);
- Lack of an urban plan
- Anarchic construction (no construction plan)
- Seism hazards non priority due problems of the country;
- Population density (vulnerability of the country)

5. Program for the next 20 years

- Capacity building: training and education the Haitian professionals at short, medium or long term in the seismic field.

  - Purdue University and USGS have already started: 2 students preparing a master degree in geophysics at Purdue funded by a private institution (Voila foundation) . USGS has given lectures in Haiti to the Haitian professionals;

- Develop a permanent seismic and geodetic monitoring network;
- Follow the repeated campaign GPS measurements;
- Develop microzonation map at 1/25000 and edit at 1/50 000;
- Education and awareness of the population;
- Establish a database from studies carried out by the scientific mission observations.
- Work with the media to filter the information before diffusing.

Thanks for your attention!

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