

Science and engineering research for sustainable earthquake safety in Haiti

Eric Calais

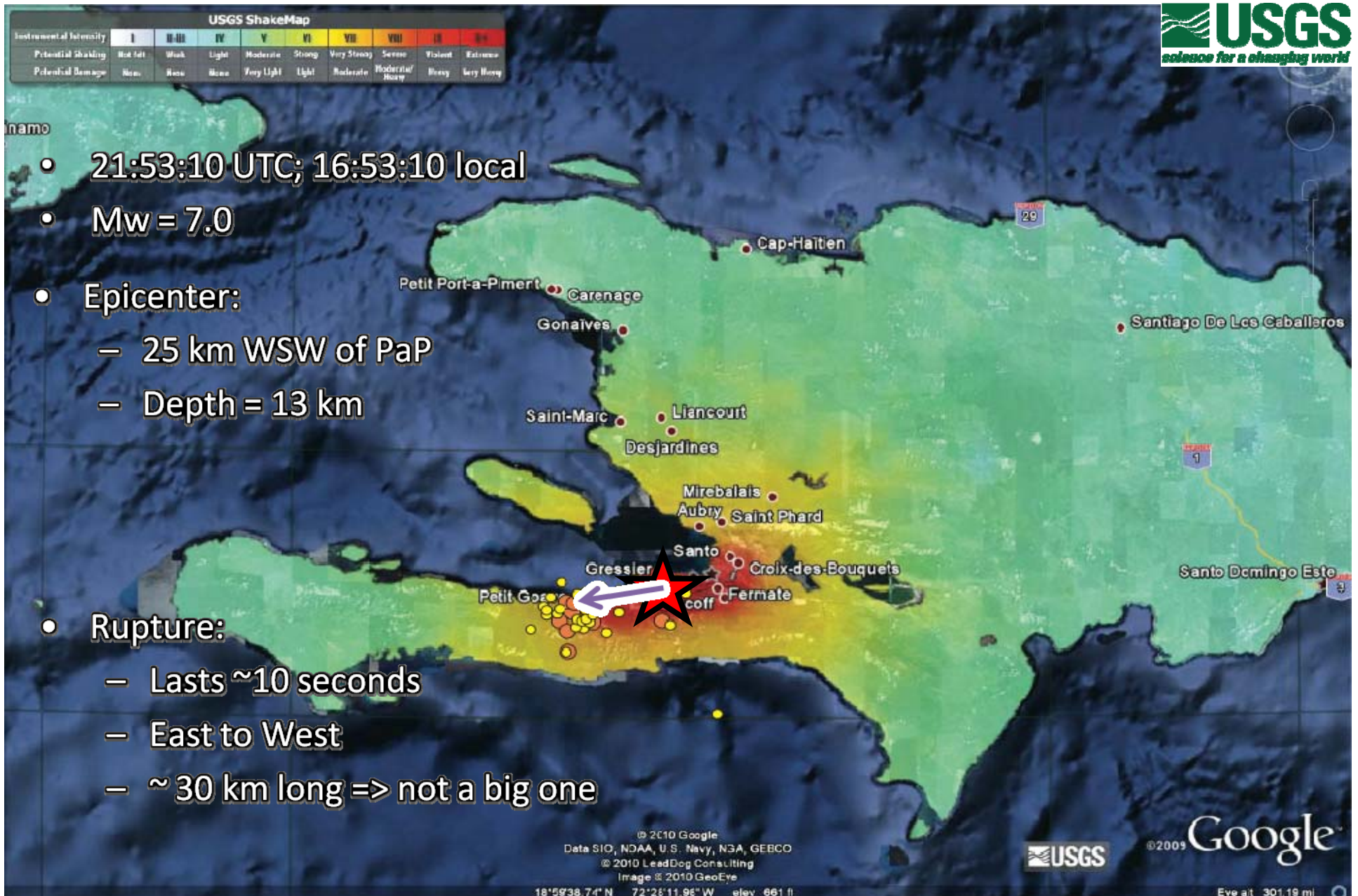
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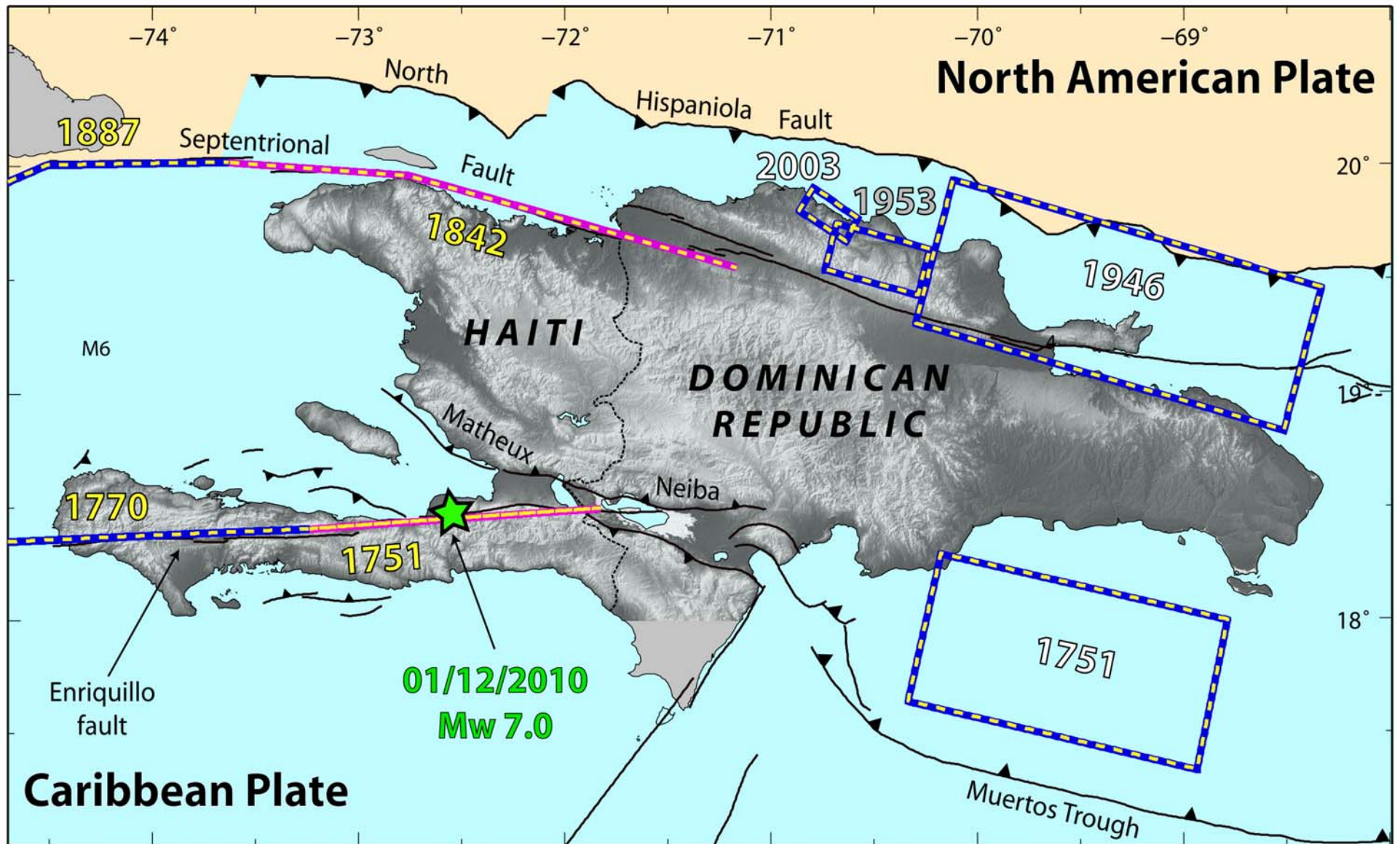
With the Bureau of Mines and Energy, Faculté des Sciences of the State Univ., National Lab. For Public Works, Civil Protection Agency, National System for Disaster Risk Reduction



The January 12, 2010, Haiti earthquake

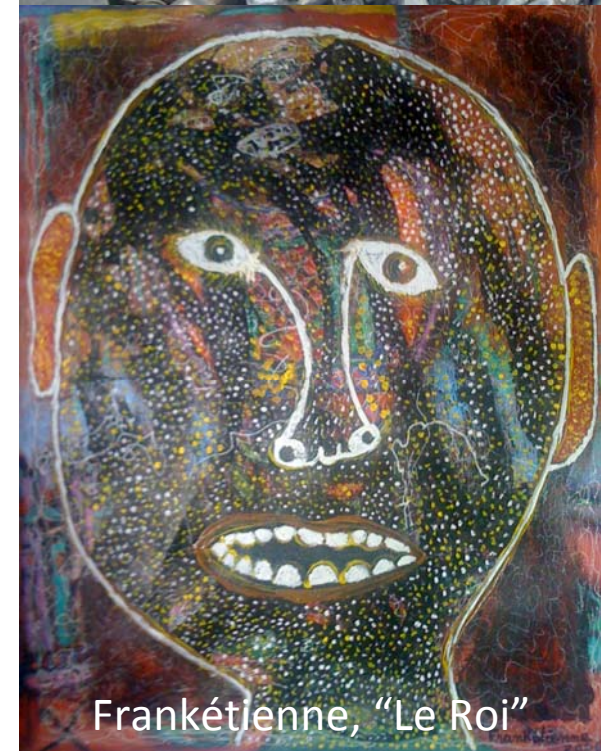
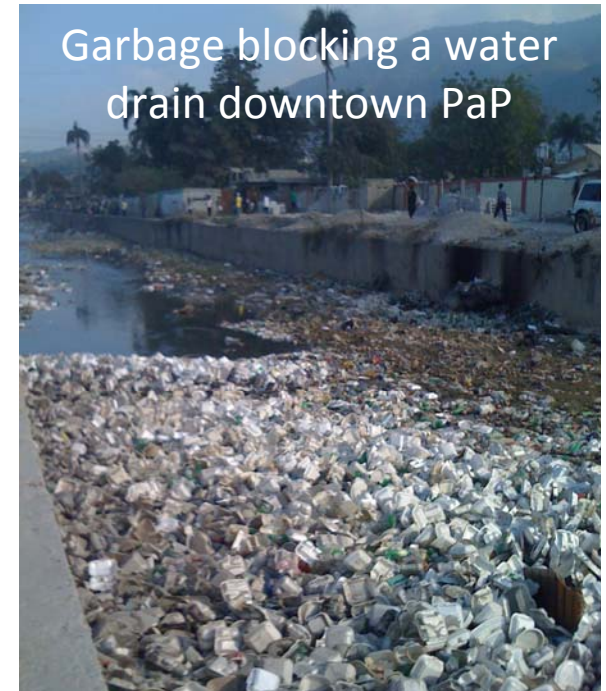


Only a small portion of a broad, seismically active plate boundary has ruptured...



The “other” context

- Human development index (1-0) = 0.532 => 149th place out of 182 countries ranked, lowest in Caribbean–Central America.
 - Human poverty index (HPI) = 31.5% => 97th out of 135 countries ranked in 2007.
 - 76% of population below poverty line (< 2\$/day), 56% below extreme poverty (< 1\$/day).
 - Literacy rate = 53%
 - ½ population “food insecure”
 - Life expectancy = 44 years
- ⇒ Priority: reduce poverty via development.
- ⇒ Opportunity/challenge: link earthquake safety (natural hazards) to sustainable development



Frankétienne, “Le Roi”

Natural hazards are major set back to the development process

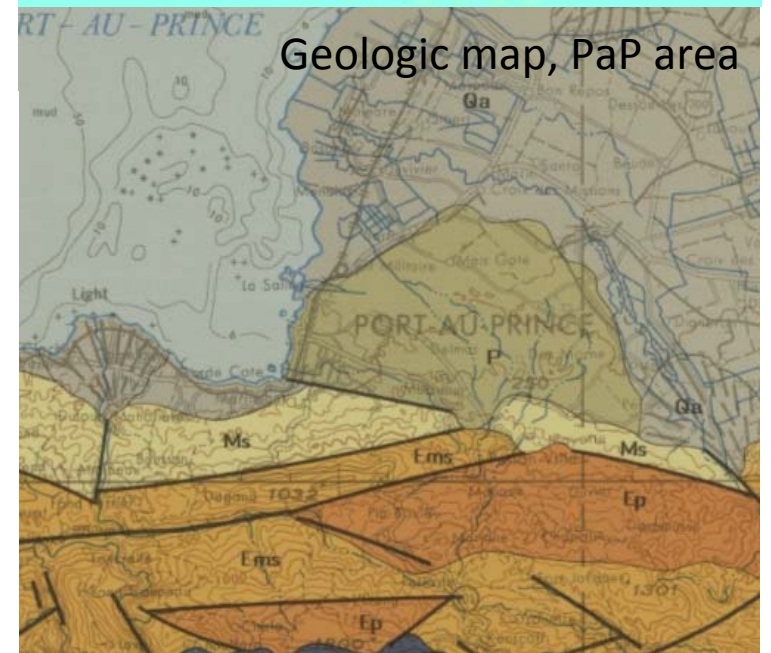
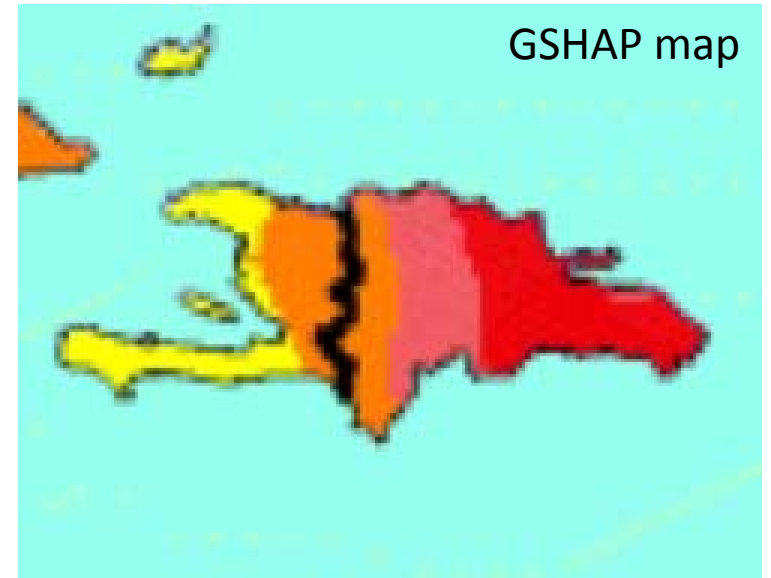
Hazard	GDP affected	People affected	Fatalities
2004 hurricane Jeanne	7%	300 000	5 000
2007 hurricanes Dean+Noel	2%	194 000	330
2008 hurricanes FGHI	15%	1 000 000	800
2010 earthquake	100%	2 000 000	222 500
Total		3 494 000	228 600

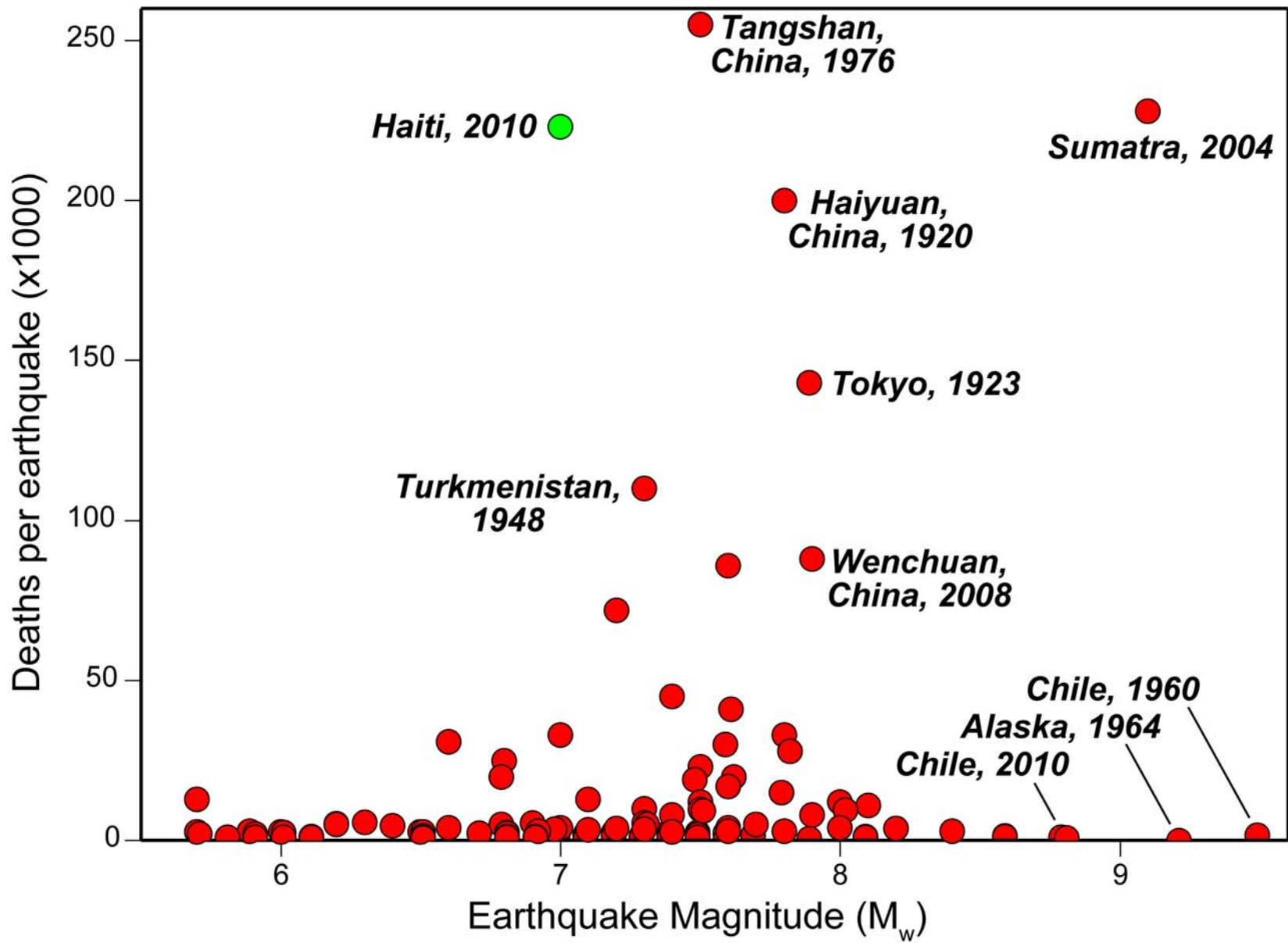
Source PDNA, 2010

“The most destructive event a country has ever experienced when measured in terms of the number of people killed as a share of the country’s population.” IDB, 2010

Haiti, pre-earthquake status

- No seismologist, no seismic network
- Only hazard map available = GSHAP (1999)
- Best geol. map from 1980, 1/250,000
- No construction code
- No earthquake preparedness
- No contingency plan for earthquakes
- No geoscience or geohazard curriculum in schools or universities





Compilation R. Bilham (U. Colorado), figure A. Freed (Purdue)

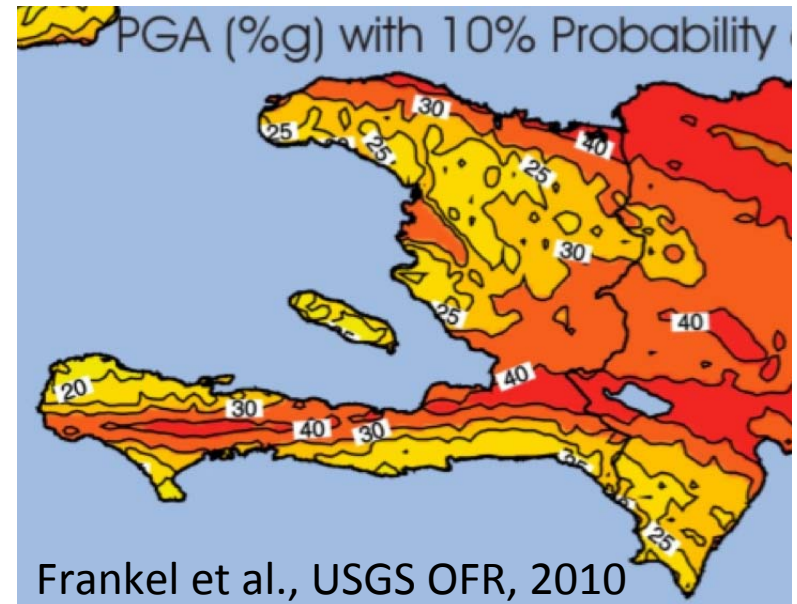
Urgency needs (response)

- Filter fast coming information: reality checks and briefings
- Inform on hazard level: relocation and safe heavens
- Explain what happened and why (use the media)
- Challenge: deliver the right information to the right people
- Most pressing questions:
 - What are estimates of casualties and damage?
 - How much shaking has occurred, and where?
 - Where should humanitarian aid efforts be focused?
 - How long will aftershocks last?
 - **Will there be triggered earthquakes?**
 - What precautions should search and rescue crews take?
 - **Where will survivors be safe?**
 - Are standing structures still safe?
 - Where should aid headquarters be located?
 - **Who are the authoritative sources of information?**



Medium-term needs (recovery)

- Advise on best practices:
 - Good: building assessment
 - Good: train masons, "bosses", engineers
 - Bad: train enough masons, etc...
 - Bad: seismic hazard not accounted for in urban planning
- Think ahead to avoid missing opportunities - reconstruction starts fast:
 - Good: Haiti seismic hazard maps (USGS)
 - Bad: seismic microzonation (almost) forgotten
- Advocate earthquake safety:
 - Good: President Preval wants a "seismic risk reduction agency"
 - Bad: ICRH approves infrastructure projects w/o seismic safety.
- Challenge: reach the proper level, competing issues (livelihood, elections, etc) – attention has already shifted...

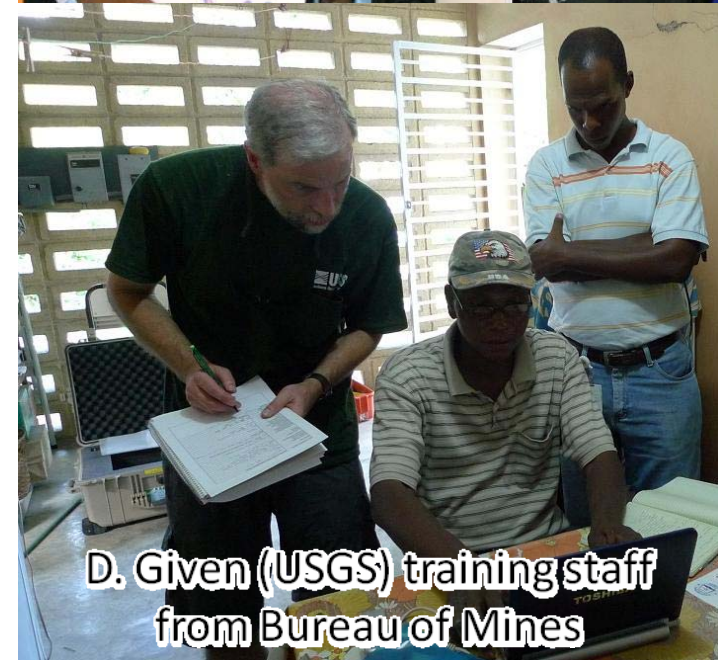


Long-term needs (reconstruction)

- Identify and quantify hazard.
- Build capacity, particular high-level.
- Reduce risk -- build better, seismic code, etc.
- Educate.
- Advocate – link earthquake safety to sustainable development.
- Challenge: trigger – and maintain – political will (what is the political gain?)



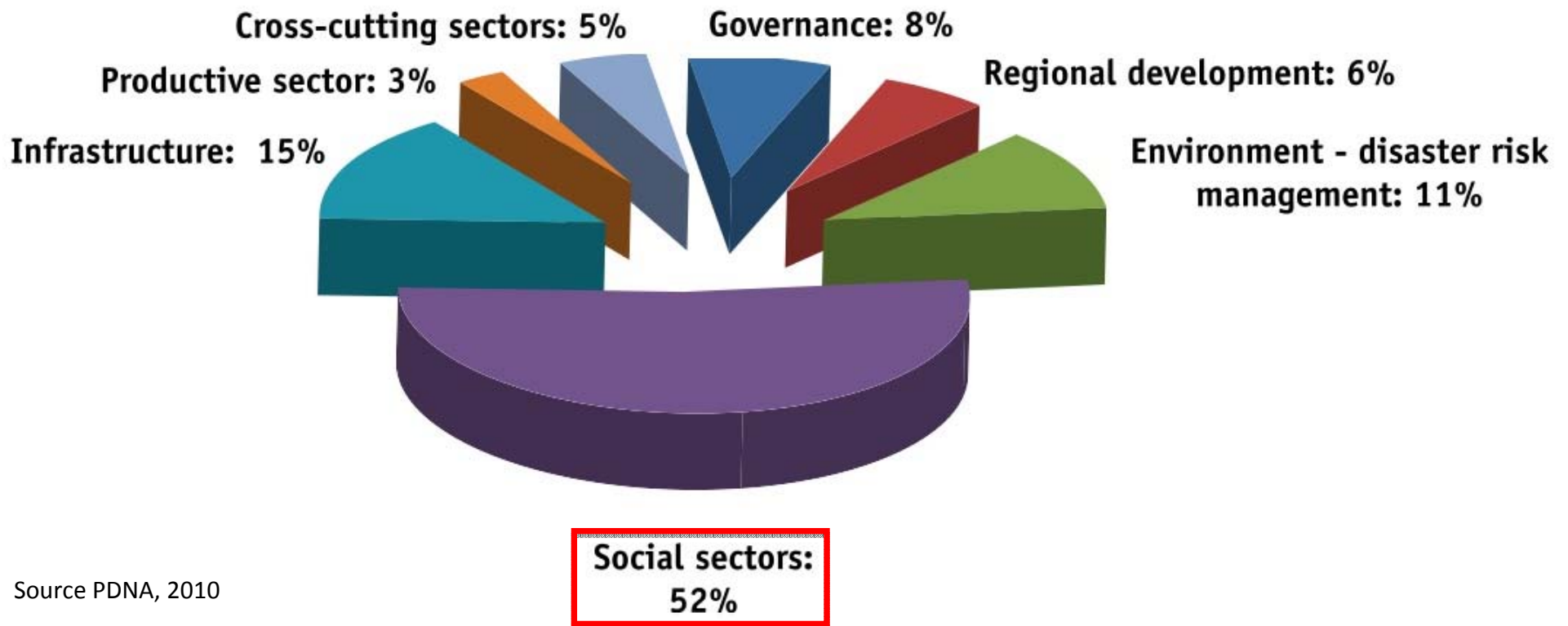
Two graduate students funded by private foundation



D. Given (USGS) training staff from Bureau of Mines

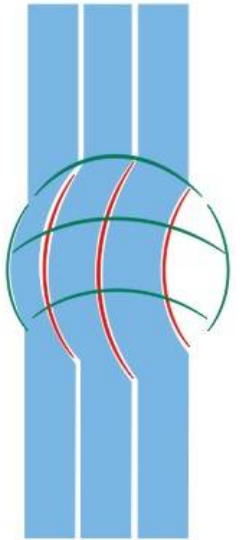
Haiti's reconstruction, needs identified

Proposed needs by sector (up to 3 years)



Source PDNA, 2010

**Pie chart of science/engineering research needs?
How can scientists inform the post-earthquake stages (RRR)?**



UN International Strategy
for Disaster Reduction

World Conference on Disaster Reduction

18-22 January 2005, Kobe, Hyogo, Japan

Hyogo Framework for Action 2005-2015

Building the Resilience of Nations and communities to disaster

- Goal: *“The substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and countries.”*
1. Ensure that disaster risk reduction is a national and a local priority with a strong institutional basis for implementation (*institutional*).
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 5. Strengthen disaster preparedness for effective response at all levels (*civil protection*).

“Research” within the HFA

- **HFA 2:** Support the development and sustainability of the infrastructure and scientific, technological, technical and institutional capacities needed to research, observe, analyse, map and where possible **forecast natural and related hazards**, vulnerabilities and disaster impacts.
- **HFA 2:** Support the improvement of scientific and technical methods and capacities for risk assessment, **monitoring and early warning**, through research, partnerships, training and technical capacity- building.
- **HFA 2:** Research, analyse and report on long-term changes and emerging issues that might **increase vulnerabilities and risks** or the capacity of authorities and communities to respond to disasters.
- **HFA 3:** Develop improved methods for predictive multi-risk assessments and **socioeconomic cost–benefit analysis of risk reduction actions** at all levels; incorporate these methods into decision-making processes at regional, national and local levels.
- **HFA 3:** **Strengthen the technical and scientific capacity to develop and apply methodologies**, studies and models to assess vulnerabilities to and the impact of geological, weather, water and climate-related hazards, including the improvement of regional monitoring capacities and assessments.

Conclusions

- The Haiti earthquake:
 - Earth put under stress + society put under stress
 - Geological/engineering + socio/econo/policy experiment
- An opportunity to gain:
 - Understanding of earthquake processes.
 - Understanding of best engineering practices.
 - Understanding of social/institutional reconstruction.
- An opportunity to provide:
 - Build capacity.
 - Deliver to Haiti.
- An opportunity to embed (the value of) scientific research into DRR programs (govts, NGOs, UN)
 - => Need for partnerships (scientists from different fields, agencies with different/complementary missions).

