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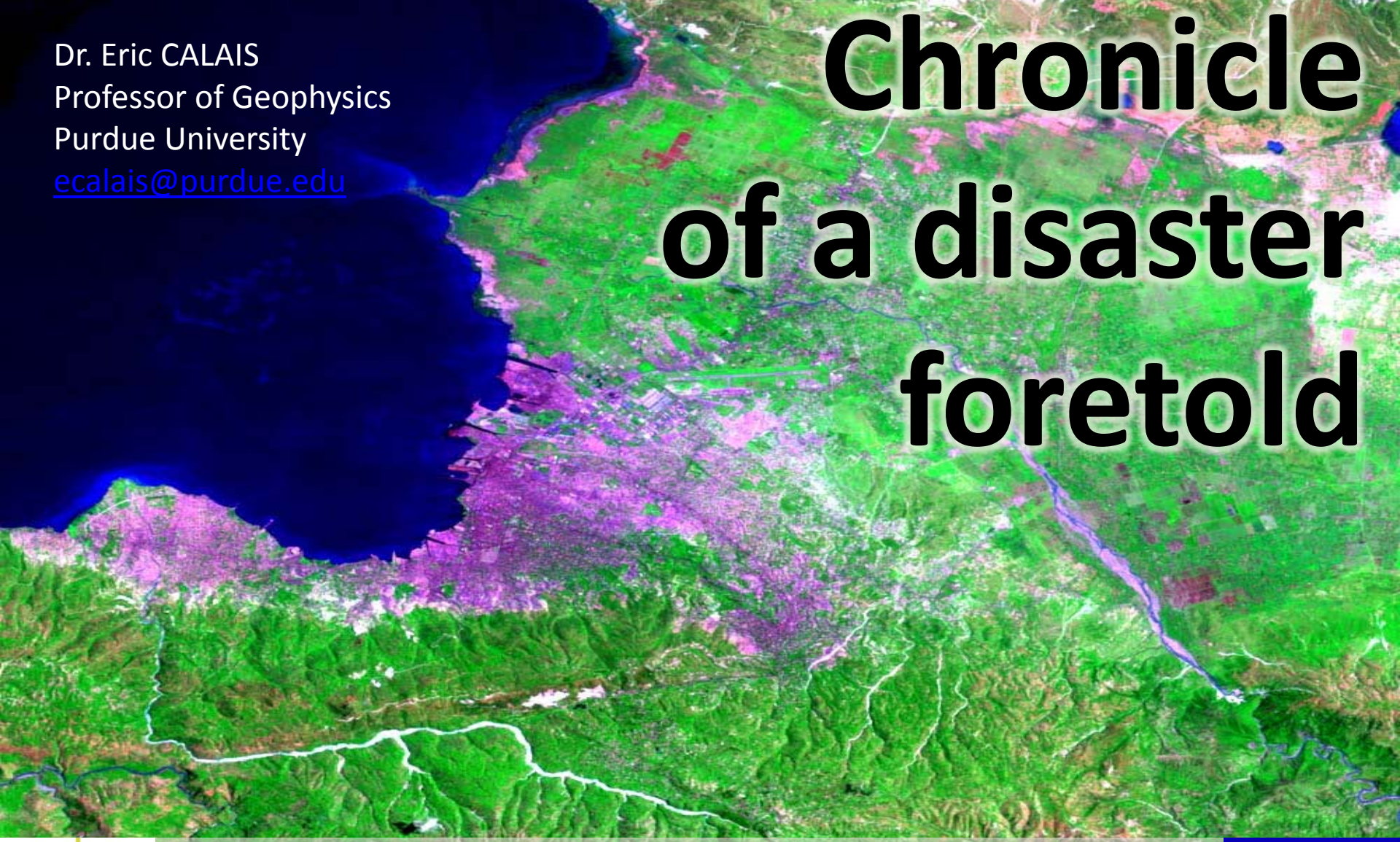
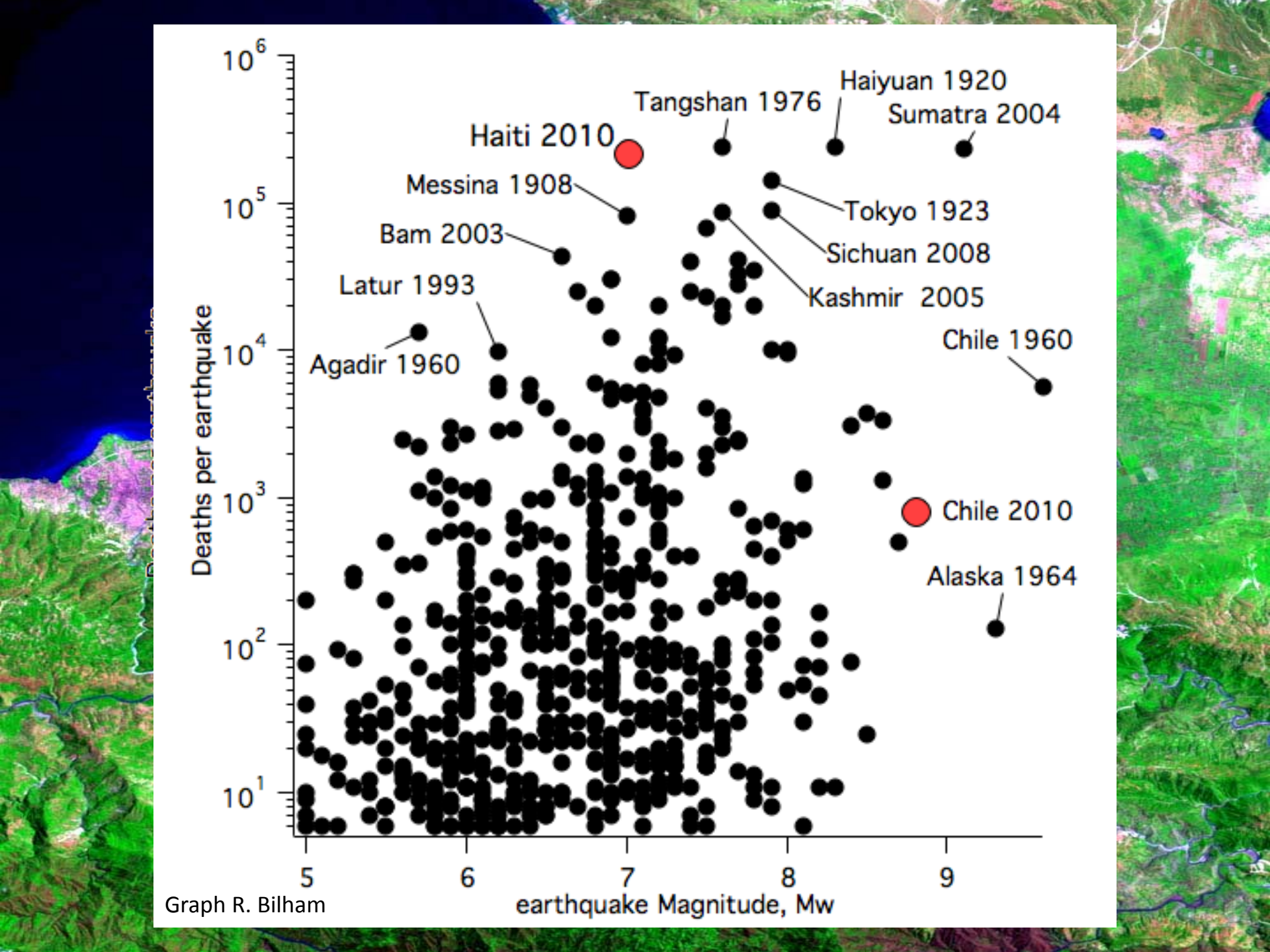
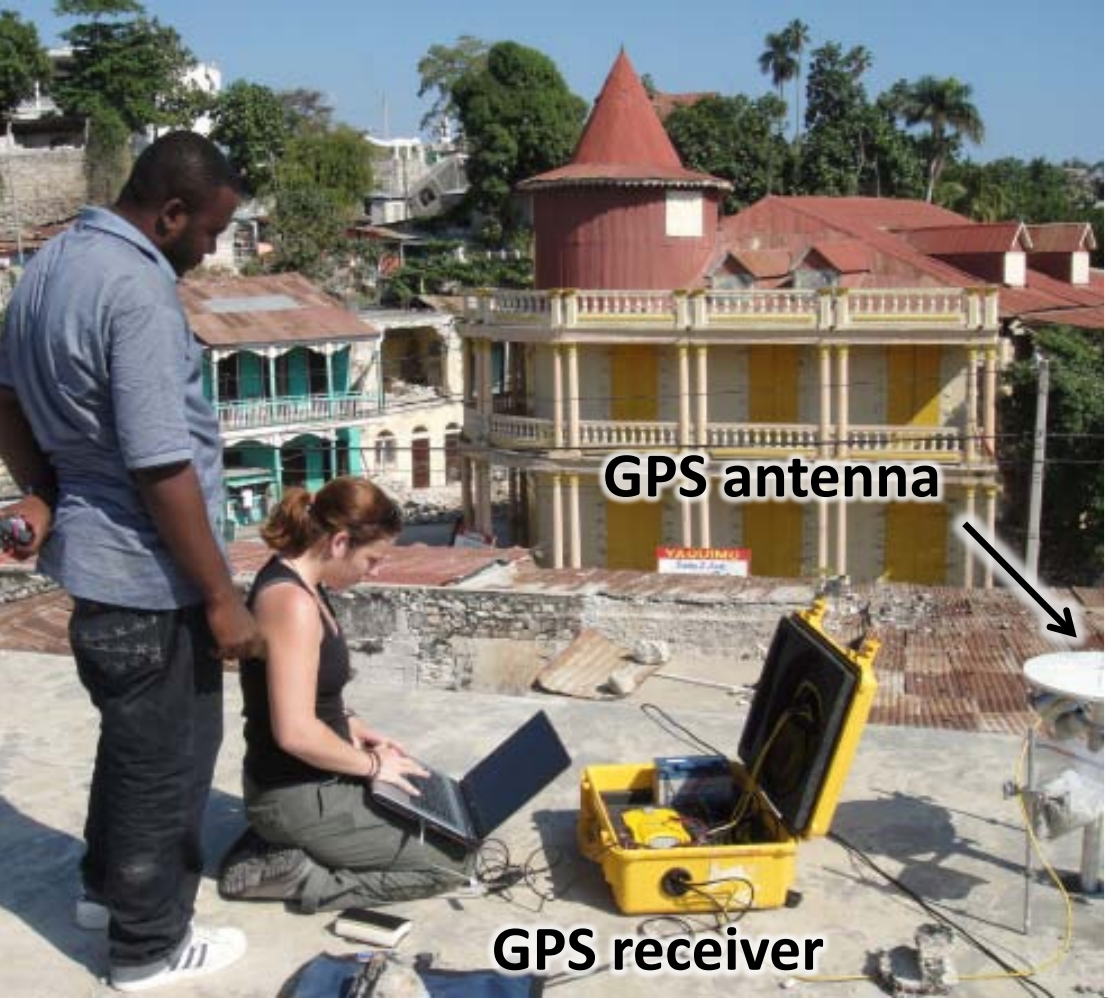
Chronicle of a disaster foretold



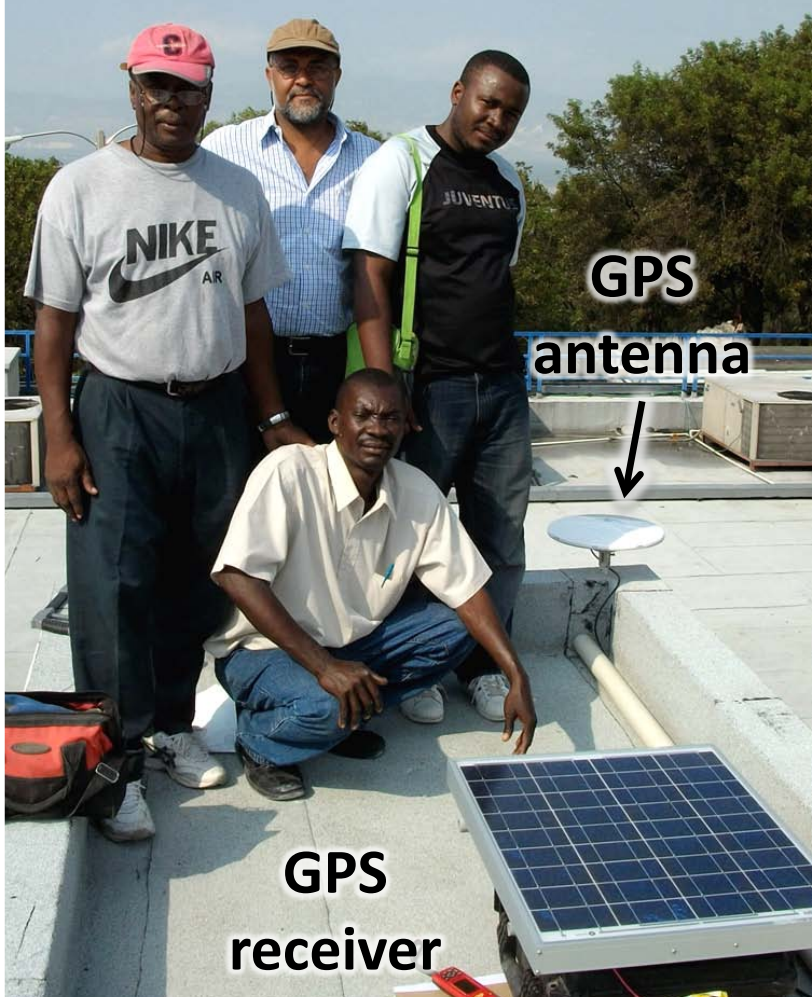
Bureau des Mines et de l'Energie (BME), Dir. Protection Civile (DPC)
Centre National pour l'Information Geospatiale (CNIGS)
Observatoire National pour l'Environnement et la Vulnerabiilté (ONEV)
Université d'Etat d'Haiti (Faculté des Sciences)
Programme des Nations Unies pour le Développement (UNDP)
Voila (Trilogy International), Trimble, Inc.


VULNERABILITY
HAZARD
5 km


Deaths per earthquake
10^6
10^5
10^4
10^3
10^2
10^1
Haiti 2010
Tangshan 1976
Haiyuan 1920
Sumatra 2004
Messina 1908
Tokyo 1923
Bam 2003
Sichuan 2008
Latur 1993
Kashmir 2005
Agadir 1960
Chile 1960
Chile 2010
Alaska 1964
5
6
7
8
9
earthquake Magnitude, Mw
Graph R. Bilham

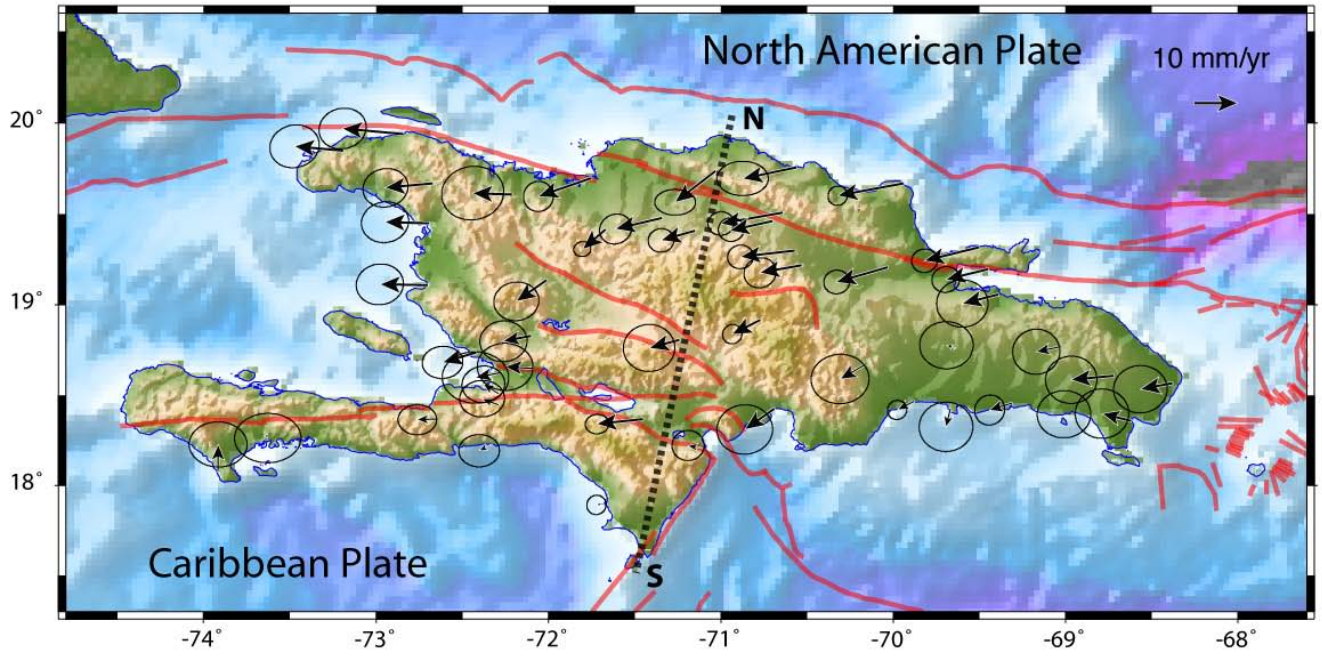


Episodic GPS measurement site, Jacmel, Haiti



Continuous GPS measurement site, Port-au-Prince, Haiti

Geodetic monitoring with GPS: tracking the earth's crust in motion (millimeters per year…!)

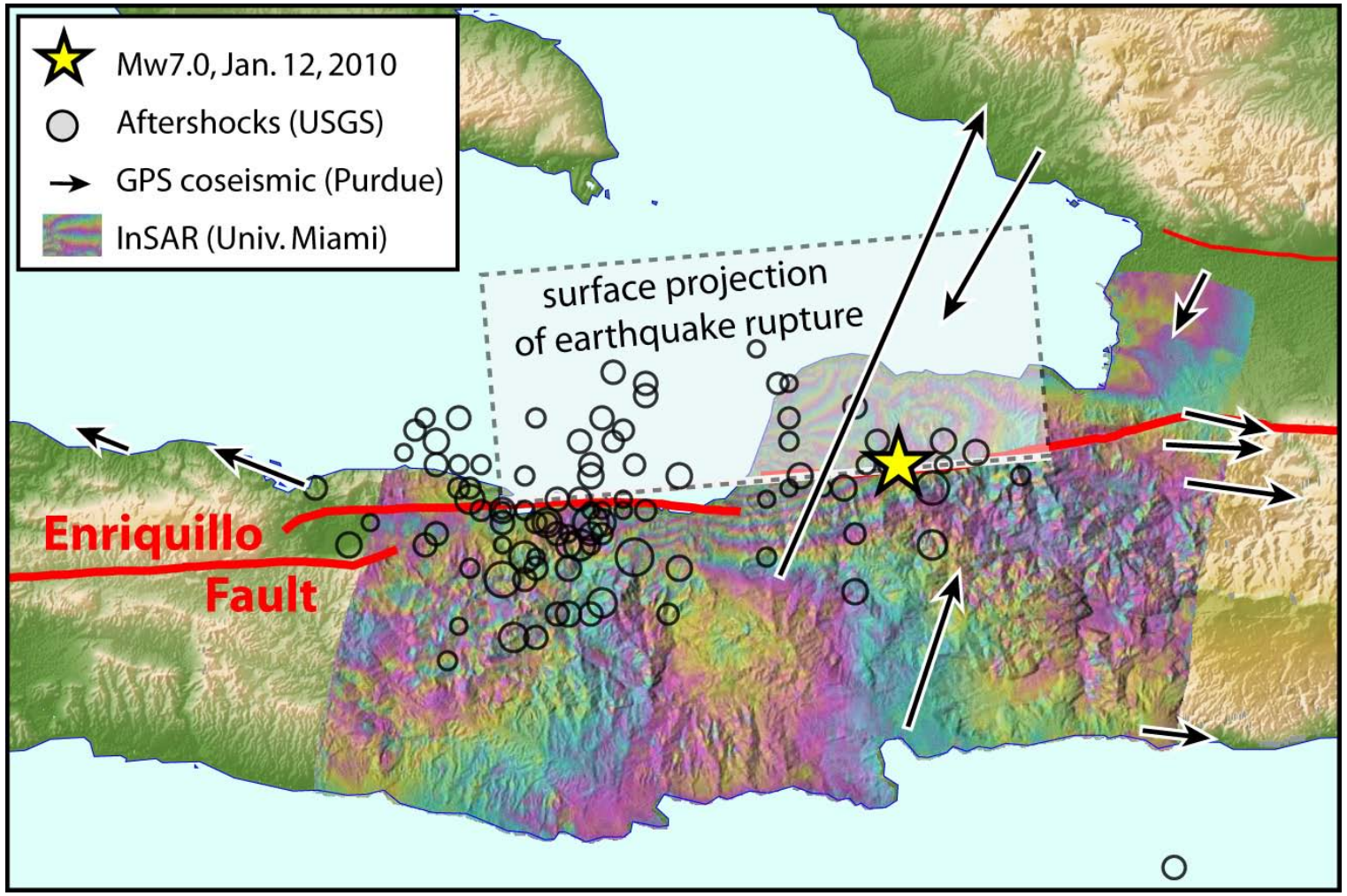


Each arrow represents the direction and speed of motion of a geodetic point – notice that Hispaniola is sheared at ~20 mm/yr.

(1998-2008 = 10 years of efforts => long-term observations are key)

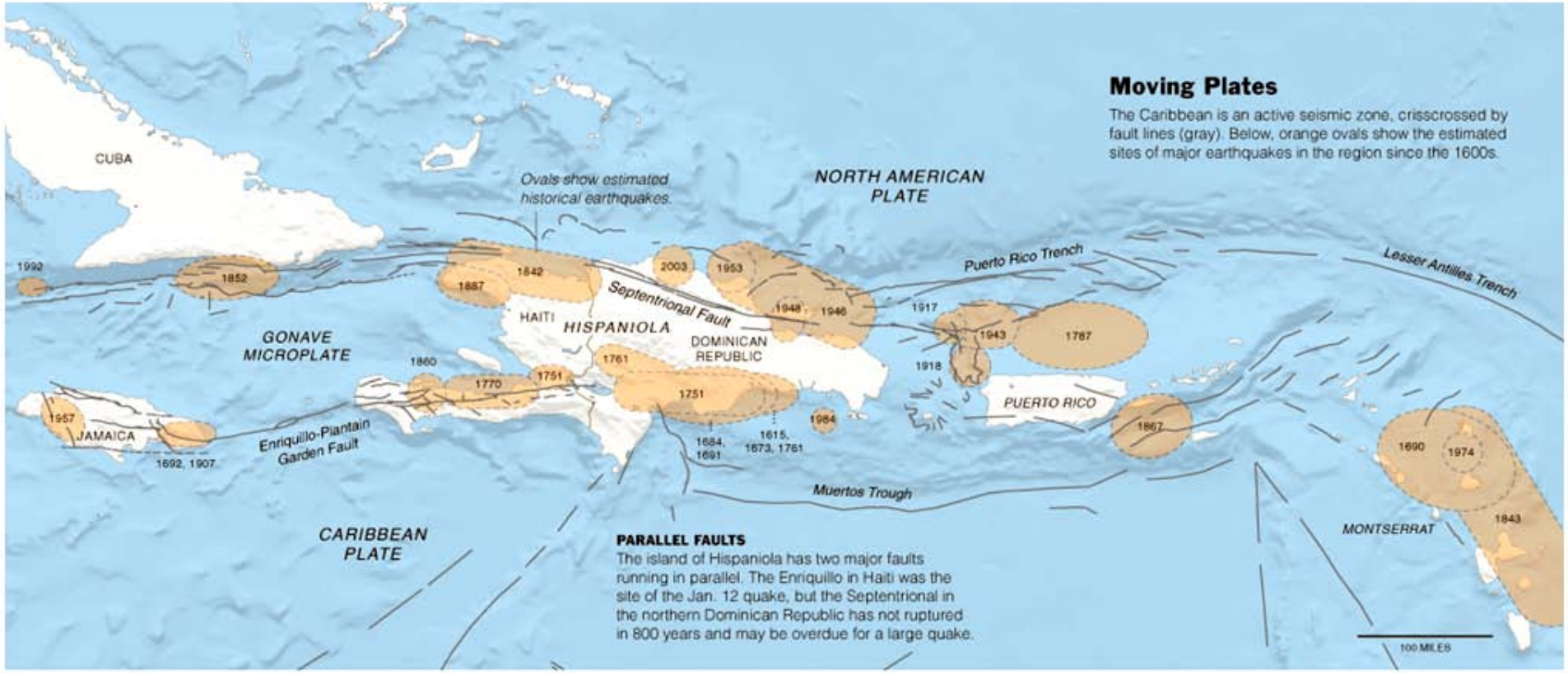
Simple math:

- Slip deficit accumulates at 7 mm/yr
- Last release 250 years ago (M7.5 earthquake)
- 250 x 7 = 1.75 m
- If sudden fault slip of 1.75 m = M7.2



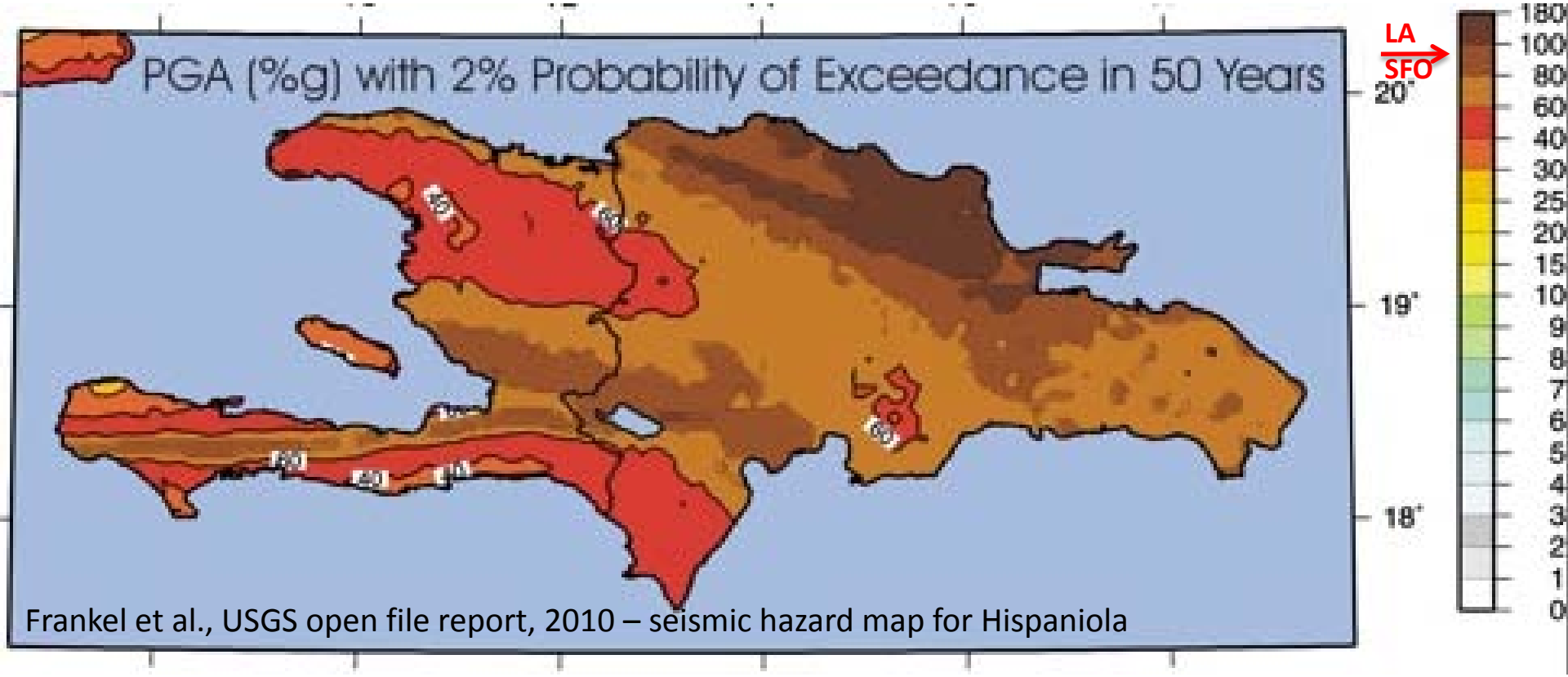
Rapid scientific response is essential =
"crime scene investigation"

The New York Times January 26, 2010



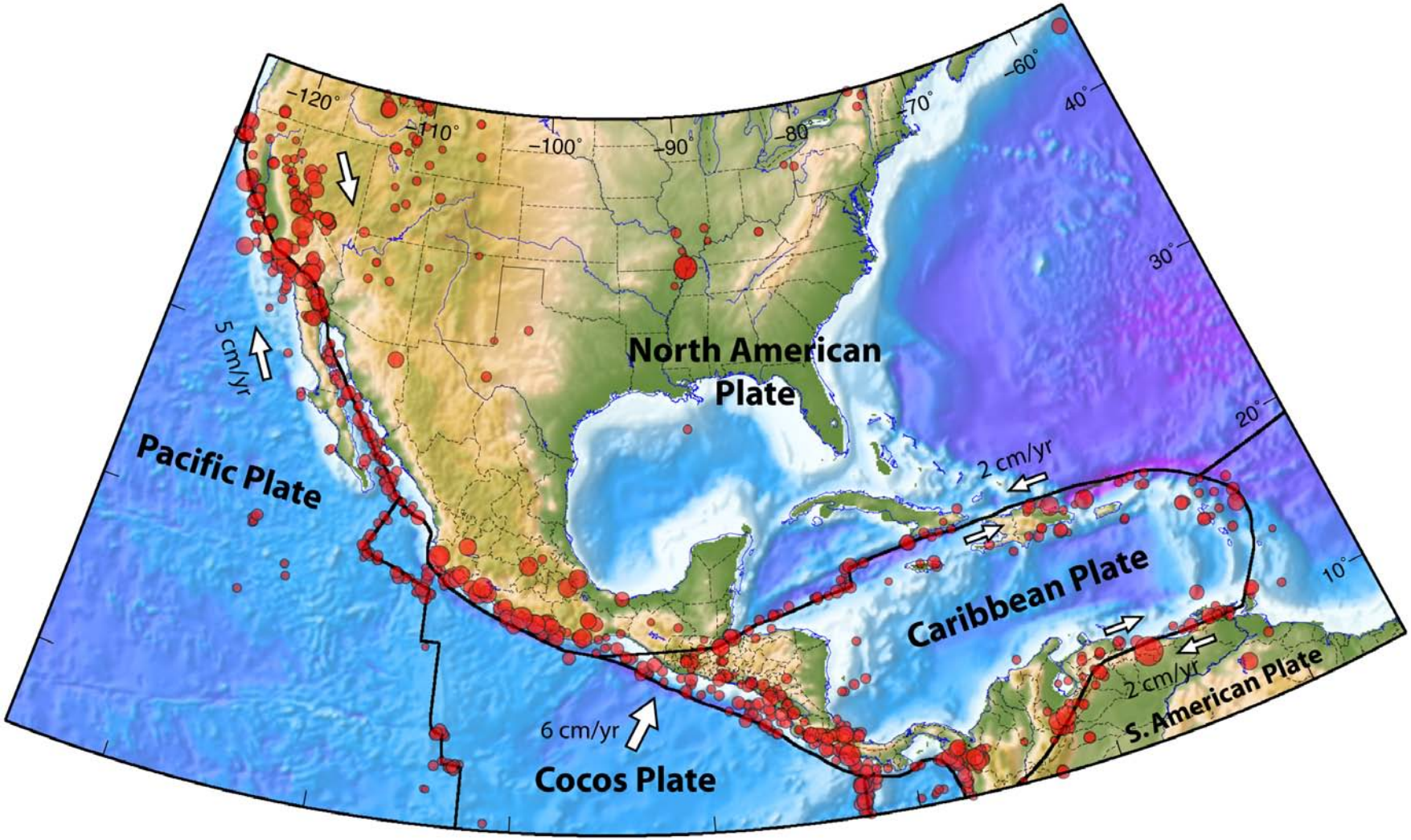
Available information:

- Previous large earthquakes (only past 250 years known!)
- Geodetic measurements (sparse)
- Very limited seismological monitoring (no seismic network in Haiti…)



Frankel et al., USGS open file report, 2010 – seismic hazard map for Hispaniola

- Sources (potential seismic faults) + rate of seismic energy accumulation (form GPS) + nature of soil (amplification of seismic waves) => first seismic hazard map.
- Hazard level similar to San Andreas fault in California.
- Other earthquakes are likely:
  - On same fault.
  - On other faults in Haiti/Dominican Republic (North DR particular concern).
- Seismic hazard map = guide for earthquake-safe designs.



- Other earthquakes are likely on other faults in the Caribbean (the 100 km rule…) and Central America.
- Some of these faults have tsunamogenic potential (Puerto Rico, Lesser Antilles)
- The “other” north American plate boundary: vastly understudied.

Hazard	GDP affected	People affected	Fatalities
2004 hurricane Jeanne	7%	300 000	5 000
2007 hurricanes Dean+Noel	2%	194 000	330
2008 hurricanes FGH	15%	1 000 000	800
2010 earthquake	120%	2 000 000	217 000
Total		**3 494 000**	**223 100**

Source PDNA, 2010

Earthquakes in the Caribbean are less common than hurricanes…

…but when they hit an unprepared country they are devastating.

Concluding remarks

- Reconstruction with sustainable seismic safety built-in:
  - Short-term: buildings, infrastructures, individual houses.
  - Long term: build science, communicate, educate – capacity building.

  => Not only build better, but build better prepared.
- Risk reduction must start together with reconstruction – shift emphasis from disaster management only to disaster + risk.
- We cannot (should not) do it all for Haiti – one should (1) train their next generation of scientists, (2) help build a sustainable risk reduction strategy for Haiti – multilateral effort.
- “Science works” – but scientific efforts in Caribbean not up to the challenge: wake up call for Caribbean and central America, need to be proactive with science + capacity building projects.