Status of Real Time Broadband Seismic Monitoring in the Caribbean and Adjacent Regions

Special presentation prepared by
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meeting, South Africa, 2009

Introductory Remarks

- In the Caribbean and Adjacent regions there are almost 30 organizations monitoring earthquake activity.
- Building upon the contacts and relationships established thru MIDAS consortium established in the late 80's and in response to the 2004 devastating Indian Ocean Tsunami, significant progress has been achieved in real time broad band seismic data availability.

- United Nations Education, Science and Cultural Organization (UNESCO) Intergovernmental Coordinating Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (Caribe EWS) thru its WG1 established the following minimum performance criteria for initial earthquake locations:
  - Earthquake detection within 1 minute,
  - Minimum magnitude threshold = M4.5
  - Initial hypocenter error of <30 km.

Seismic Station Requirements for CEWS

(Originally proposed at Seismic Network Operators Course, Trinidad and Tobago, 25-29 February 2008)

CHARACTERISTICS	MINIMUM REQUIREMENTS	OPTIMAL REQUIREMENTS
Sensor type	BB Seismometer	BB Seismometer and Accelerometer
Station type	Vertical Component	Three-component each instrument
Accuracy of Location of Sensor	<100 m, horizontal < 20 m, elevation	<10 m, horizontal < 10 m, elevation
Calibration	System gain know to 10%	Full –frequency response know to 10%
Sampling rate	20 sps (seismometer)	100 sps for both instruments
Frequency Range (flat response)	0.1 to 20 sec	0.02 to 240 seconds Dc to 50 Hz
Seismometer noise	≤5 dB below the low noise model (NLNM), between 0.2 and 5 Hz	≤10 dB below the low noise model (NLNM), between 0.1 and 10 Hz
Dynamic Range	>120dB	>136dB
Absolute Timing Accuracy	<10 ms	<10 ms
Delay in Transmission to Warning Centre	<30 seconds	<10 seconds
Timely Data Availability	>95%	>95%
Data transmission protocol	Compatible with the TWC, maximum data frame length 20s	Compatible with the TWC, maximum data frame length 10s
Data transmission	Continuous	Continuous
Communications Infrastructure	Internet or VSAT	VSAT, Internet

Working Group I Participants

- Christa von Hillebrandt-Andrade (US/PRSN, Chair), Gloria Romero (Venezuela/FUNVISIS, Vice-Chair), Lloyd Lynch (SRU), Christian Antenor-Habazac (France), Dan McNamara (US/ USGS), Marie-Paule Bouin (France-Observer), Belen Martin-Miguez (IOC), Gustavo Malave (ICG-Co Chair), Jean Marie Saurel (France-Observer), Alexander Nercessian (France-Observer), Gaetan Thierry Kitou (Observer-Guadeloupe)

- The following slides illustrate the status of seismic monitoring in the region.
- The final slides show an analysis performed by the USGS to determine the current detection time and Mw threshold.
- Pending is the determination of the error of the Caribe EWS.

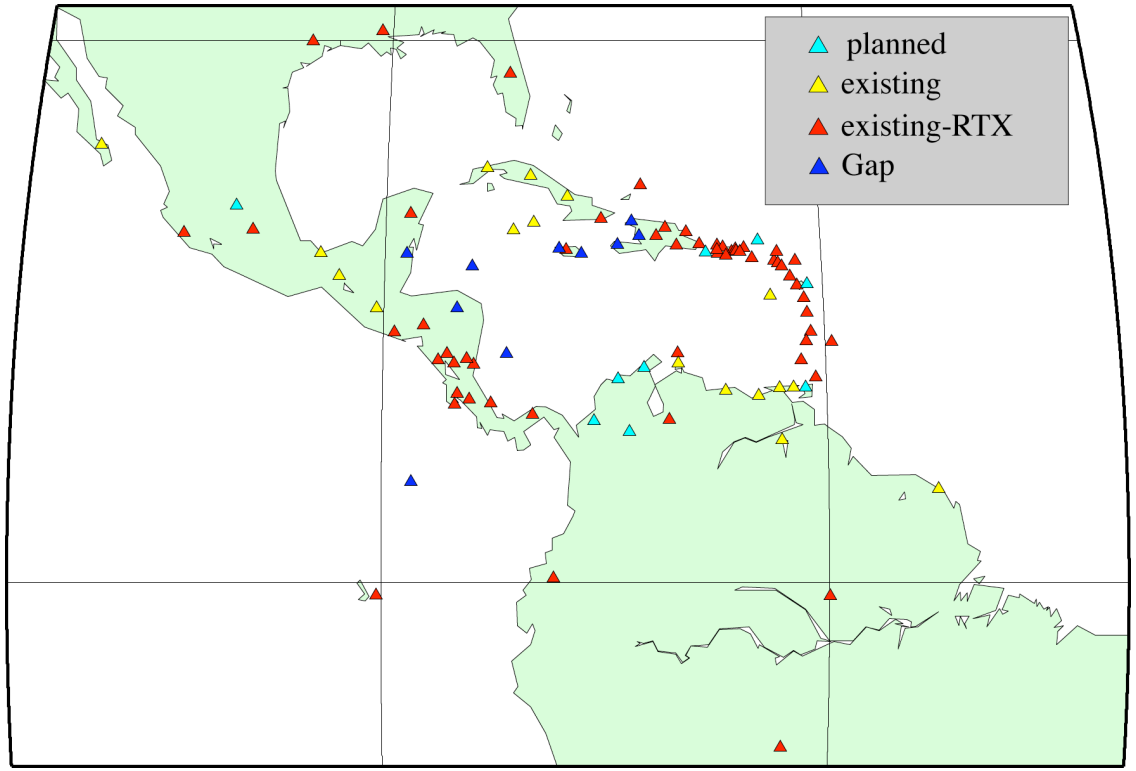
Networks Contributing to CEWS

- USGS Caribbean Seismic Network
- ANSS-USGS
- Global Seismographic Network
- Geoscope
- U. Colima, Mexico
- RS El Salvador
- INETER, Nicaragua
- OVSICORI, Costa Rica
- Baru Network, Panama
- Seismic Research Center, Trinidad and Tobago
- Montserrat Volcano Observatory
- Martinique Volcano Observatory
- KNMI, Dutch Antilles
- Puerto Rico Seismic Network, UPRM
- Seismological Institute, DR

Key Networks Pending to have Data Integrated into CEWS

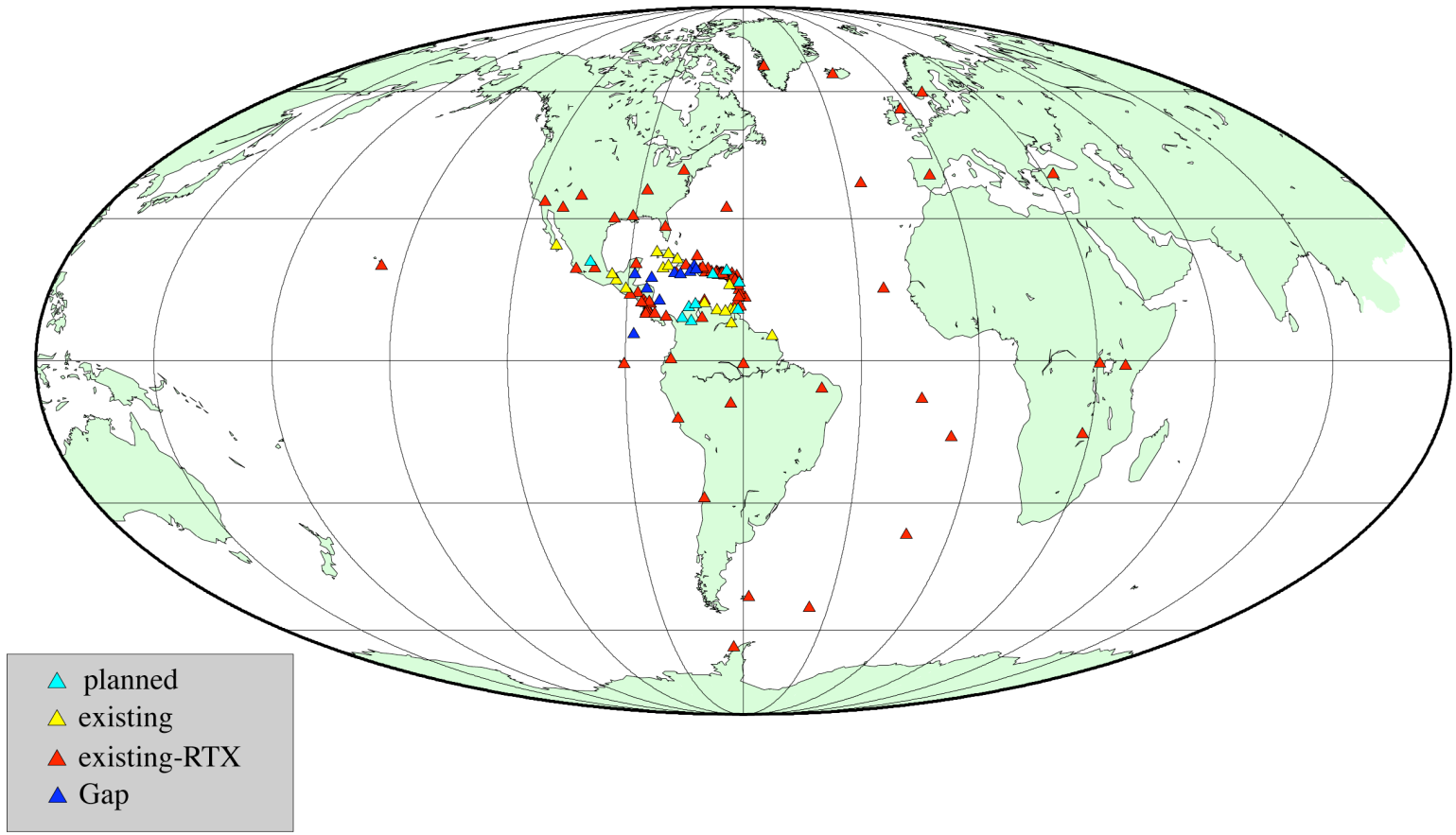
- CTBTO
- INGEOMINAS, Colombia
- RSN, UNAM, Mexico
- FUNVISIS, Venezuela
- National Seismological Research Center (CENAIS), Cuba
- Cayman Islands

Caribbean Stations Monitored for Caribe EWS



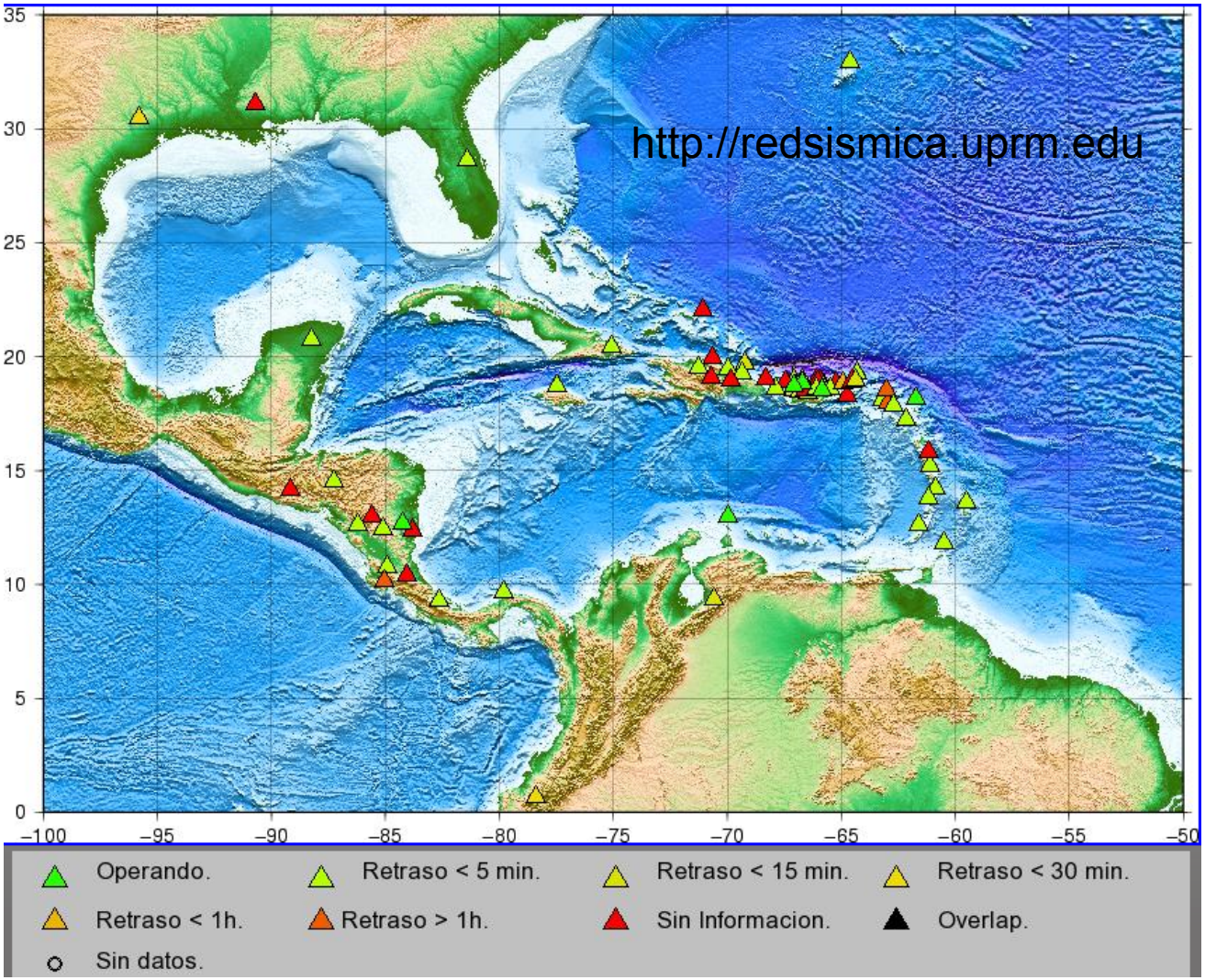
Planned stations are stations which have been funded and installation is pending
Existing stations are stations which are operational but data are not available in RT to other institutions
Existing RTX are stations whose data are shared among institutions in RT
Gap stations represent localities for where Caribe EWS recommends stations to be installed

Stations Monitored for Caribe EWS

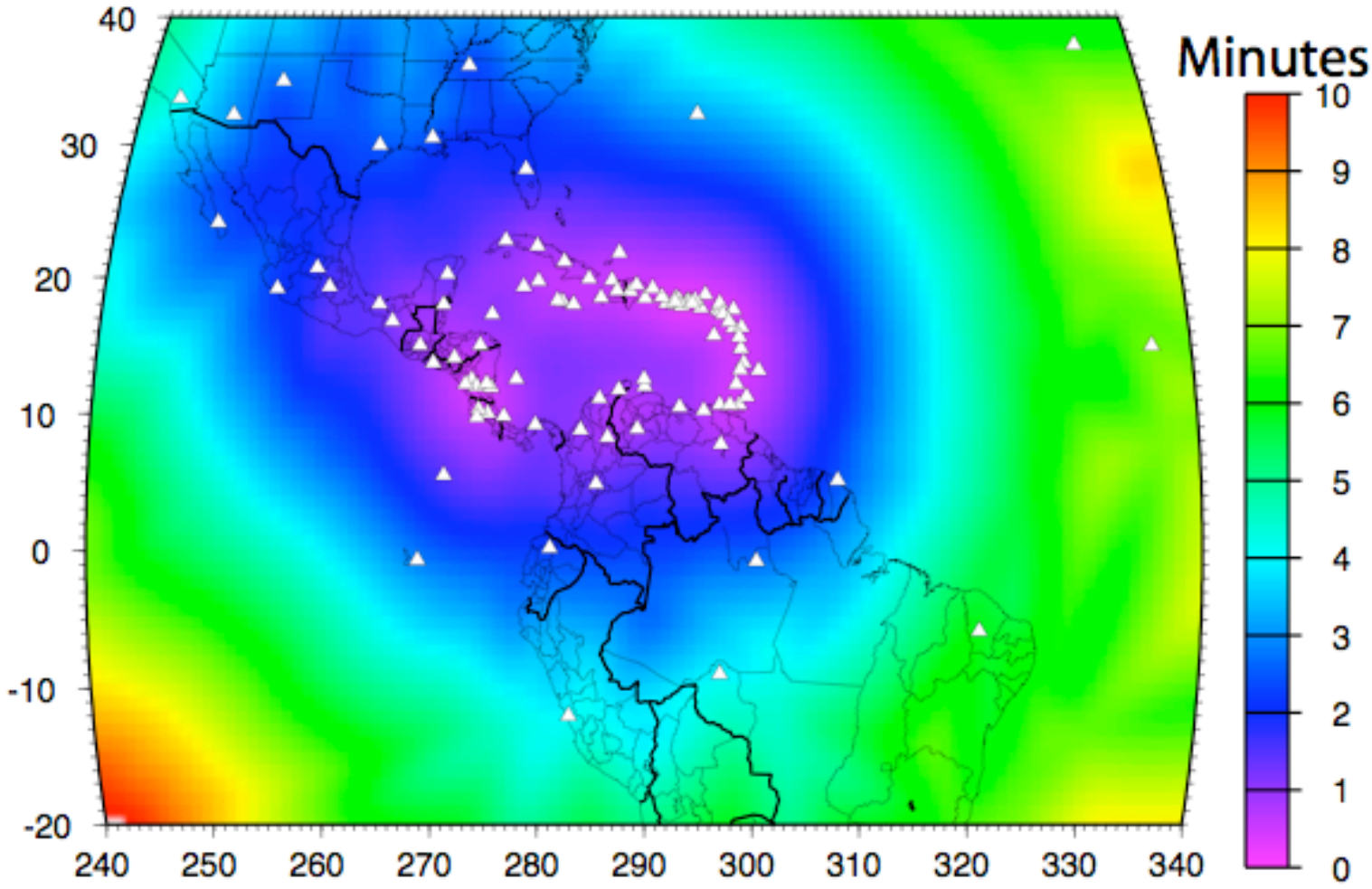


Status Seismic Stations in Real Time for the CEWS

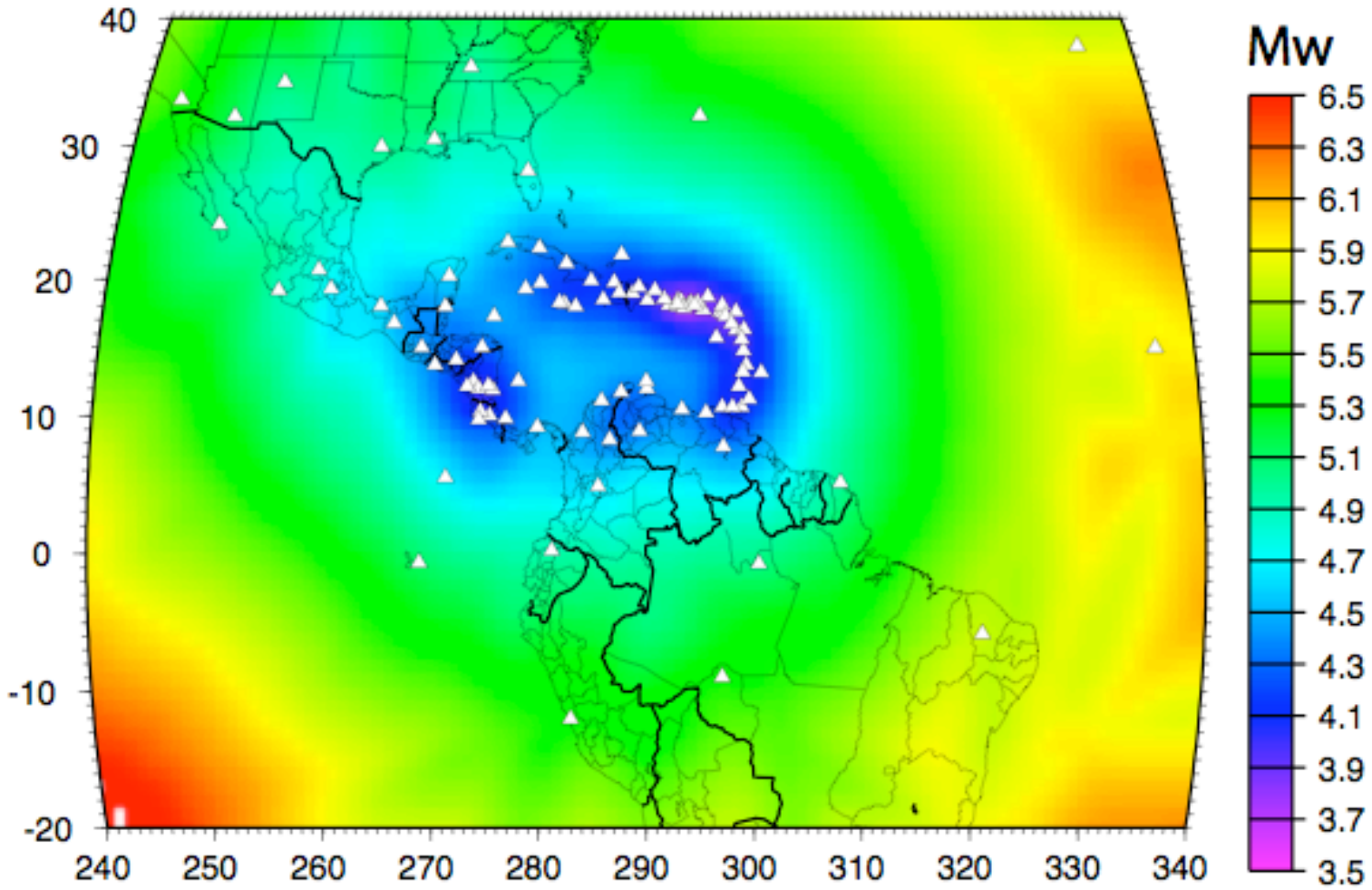
per PRSN Monitoring Tool (http://redsismica.uprm.edu)



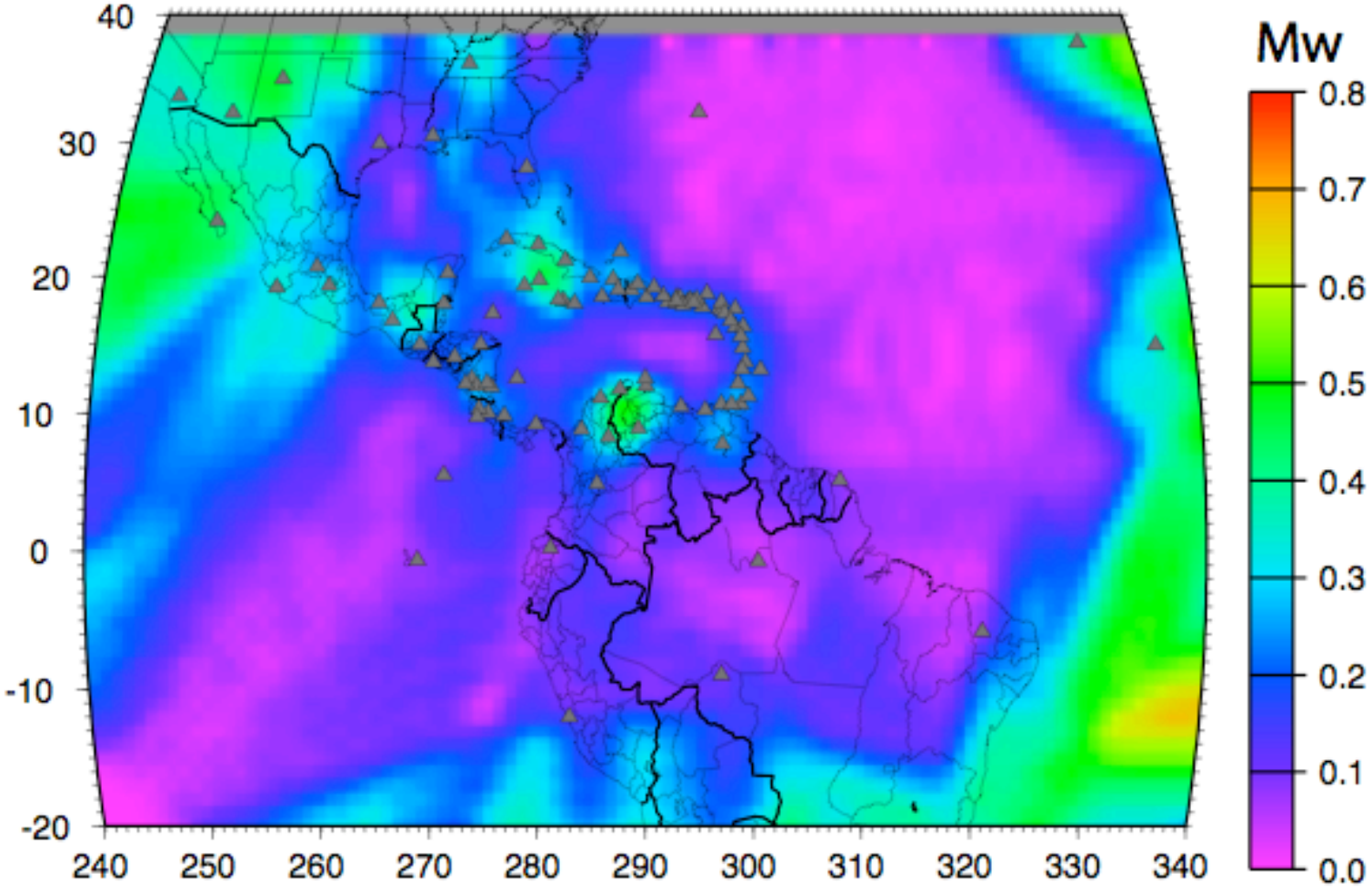
5 Station P-wave detection time
for 121 CORE stations of Caribe EWS
. (analysis performed by D. McNamara, USGS)



5 Station Minimum Mw Detection Threshold
for 121 CORE stations of Caribe EWS
(analysis performed by D. McNamara, USGS)



Mw Variance in 100 different Models
For each model:
- CORE station list of Caribe EWS randomly reduced by 25%
Range of Mw over 100 models plotted at each grid point
(analysis performed by D. McNamara, USGS)



Concluding Remarks

- Significant improvements in data availability and cooperation are noted
- Tsunami warning capabilities dramatically improved.
- Capabilities exist for early warning
- Seismic network coverage should facilitate improved seismological research and understanding.
- In addition to pending stations to be installed and or integrated, OBS capabilities need to be explored