

The Puerto Rico Seismic Network (PRSN) And The Puerto Rico Strong Motion Program (PRSMP)

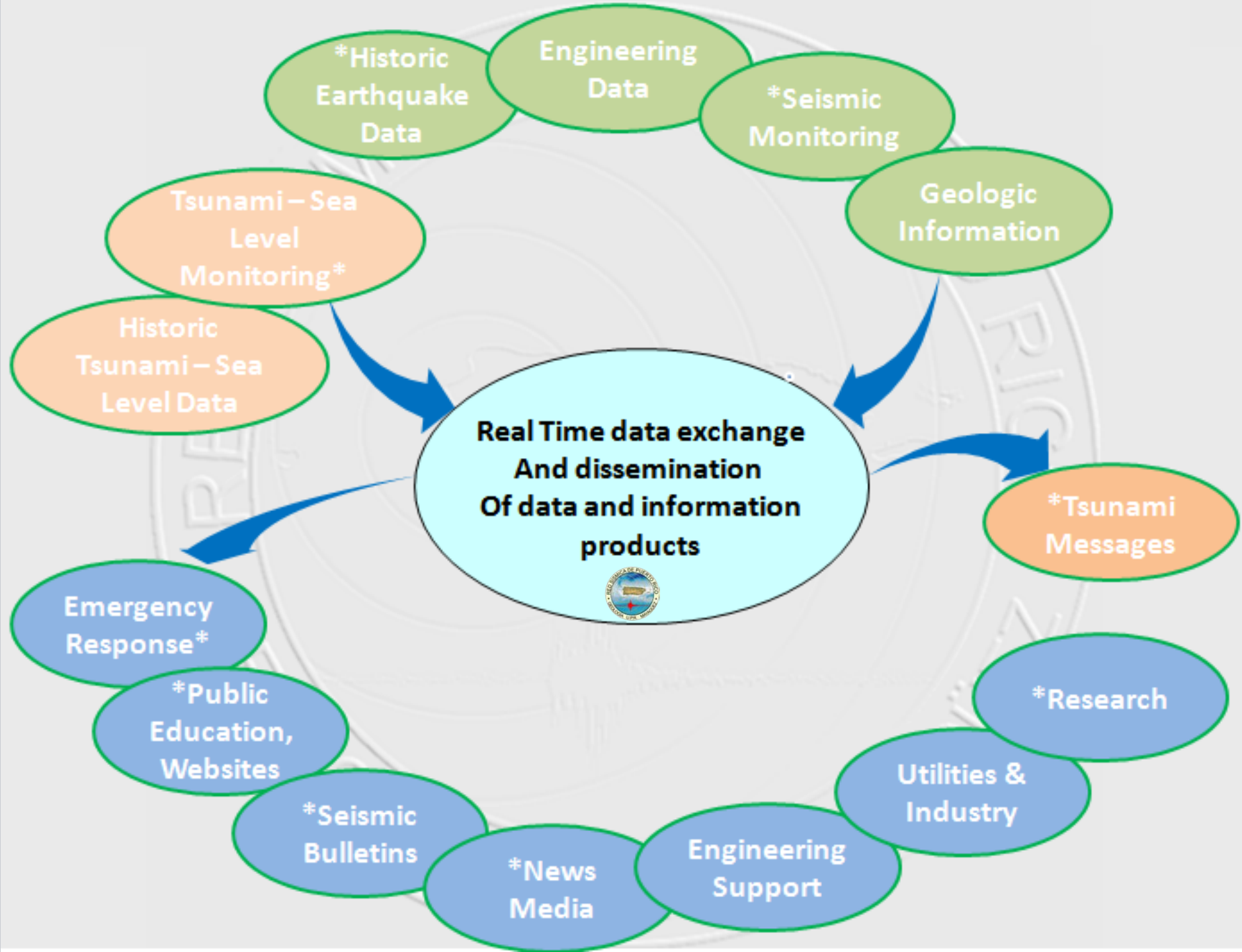


Dr. Victor Huérfano

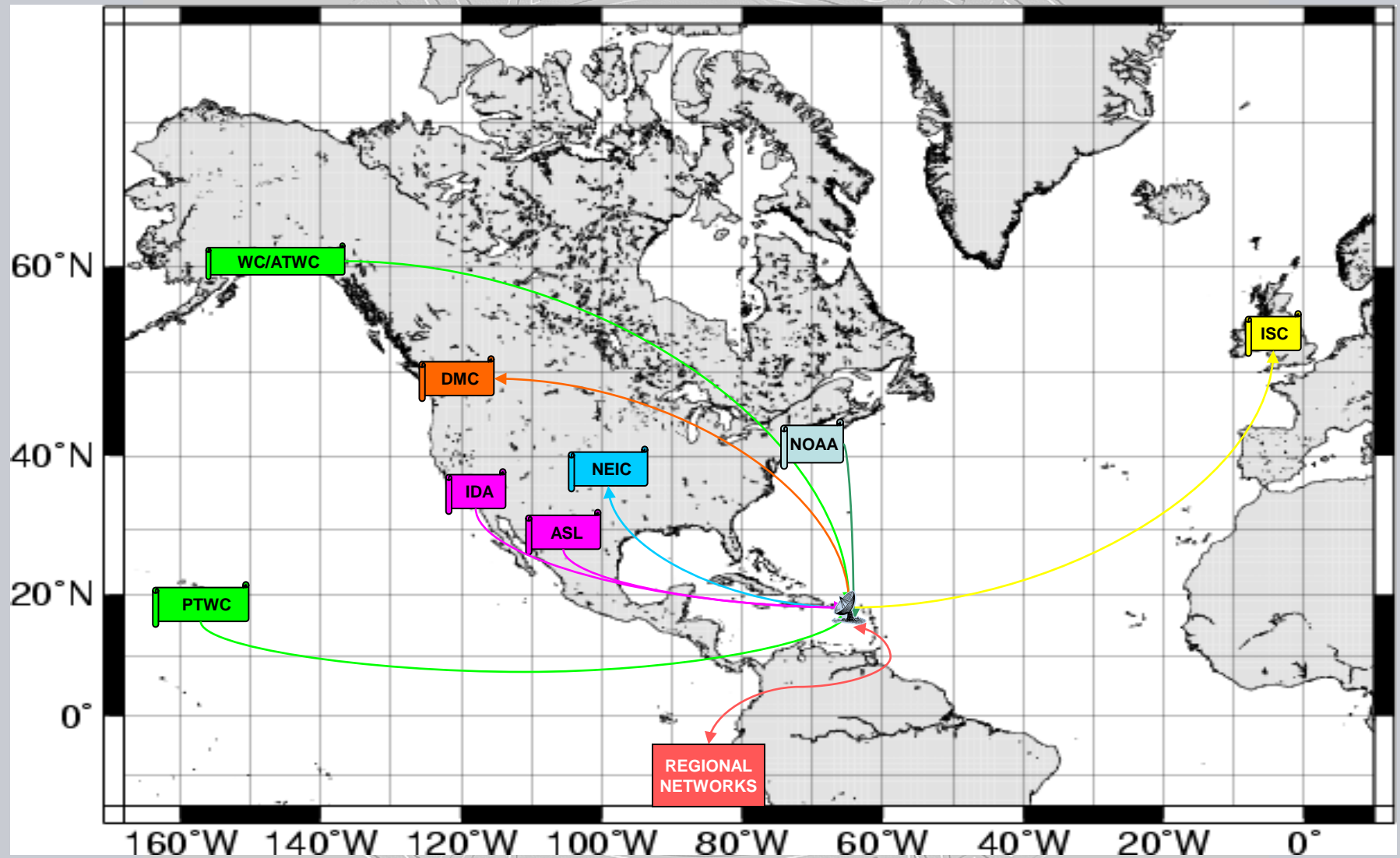
**UNIVERSITY PUERTO RICO
MAYAGUEZ CAMPUS
GEOLOGY DEPARTMENT**

The Puerto Rico Seismic Network mission

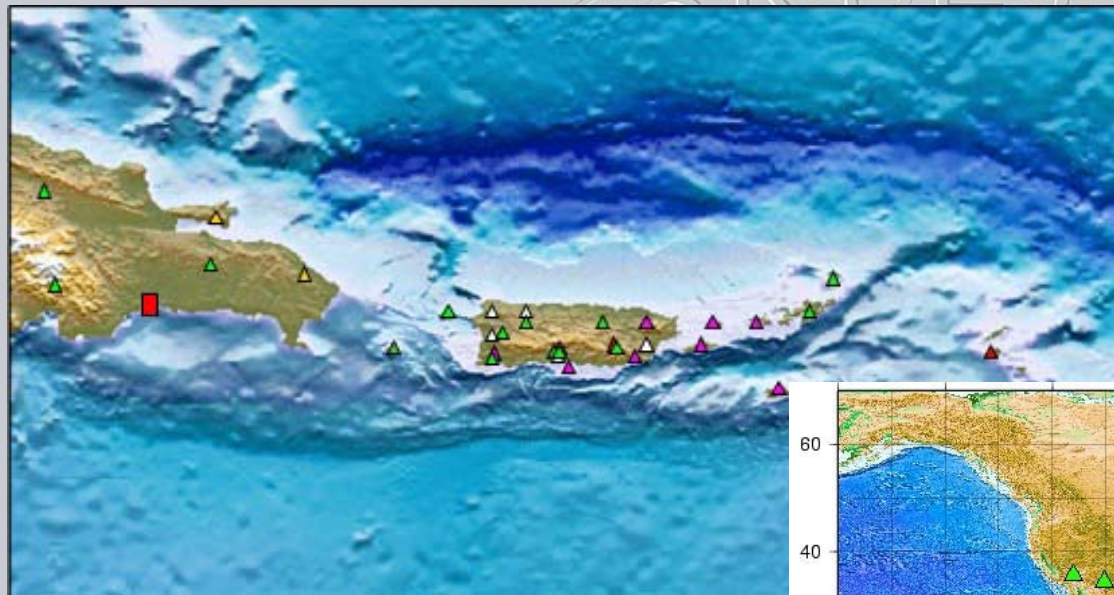
The mission of the Puerto Rico Seismic Network (PRSN) is to rapidly determine the location and size of all earthquakes and tsunamis in the Area of Responsibility (AOR) and to immediately disseminate this information to concerned agencies, scientists, and the general public. PRSN compiles and maintains an extensive seismic database on earthquake parameters, continuous waveforms (earthquakes and sea level) and their effects which serve as a solid foundation for basic and applied earth science/oceanography research in Puerto Rico and the Caribbean.



PRSN Earthquake/Tsunami Data Sharing

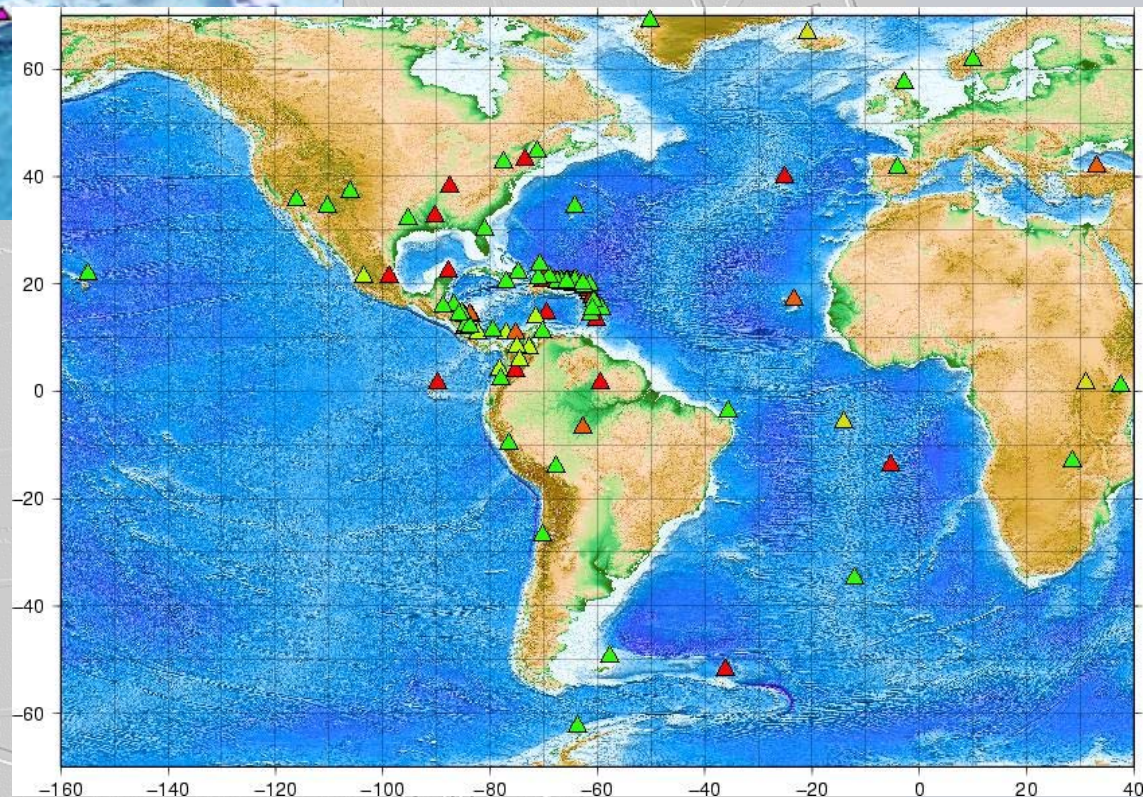


PRSN Earthquake/Tsunami Virtual Network

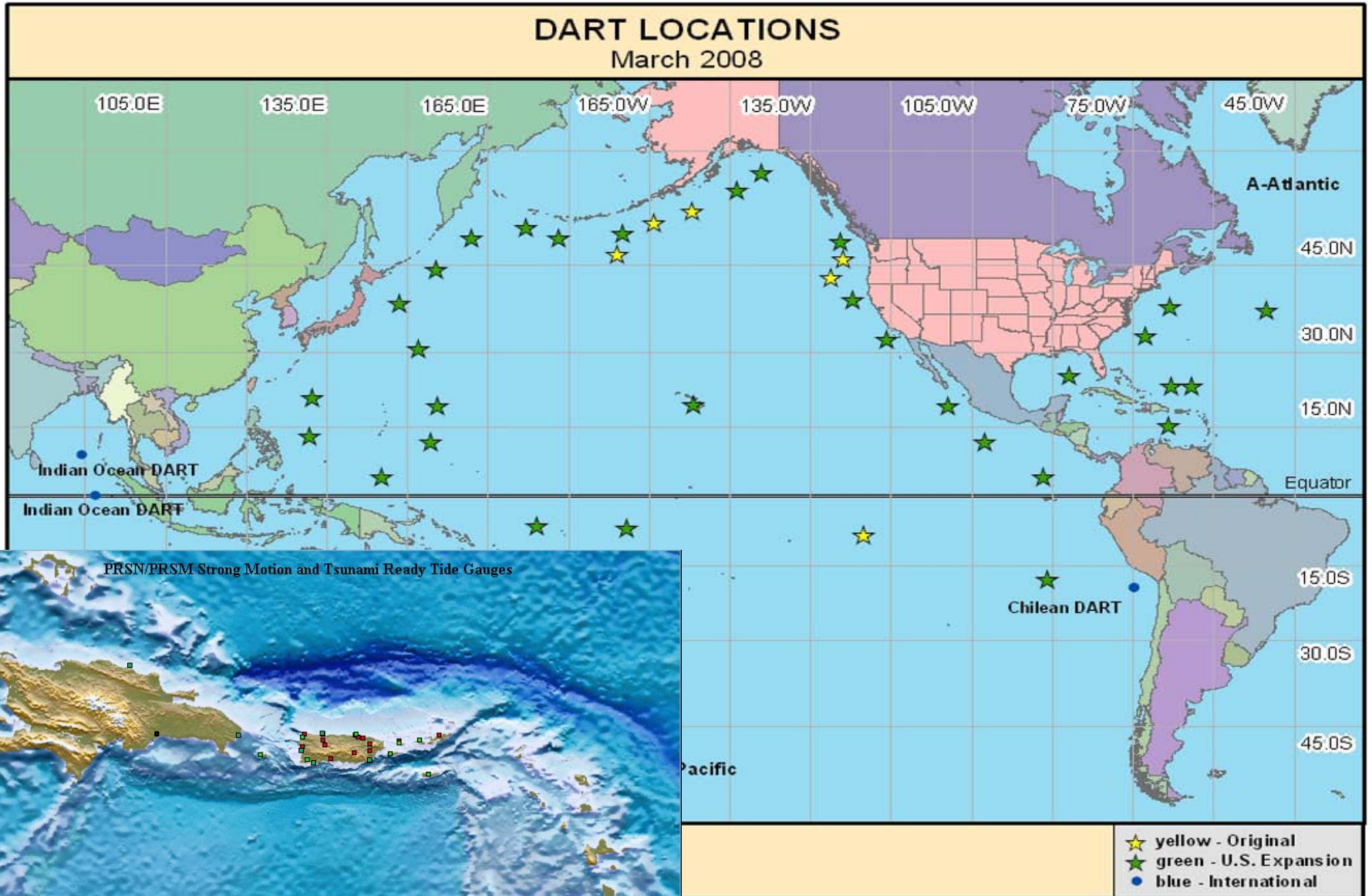


PRSN VIRTUAL NETWORK

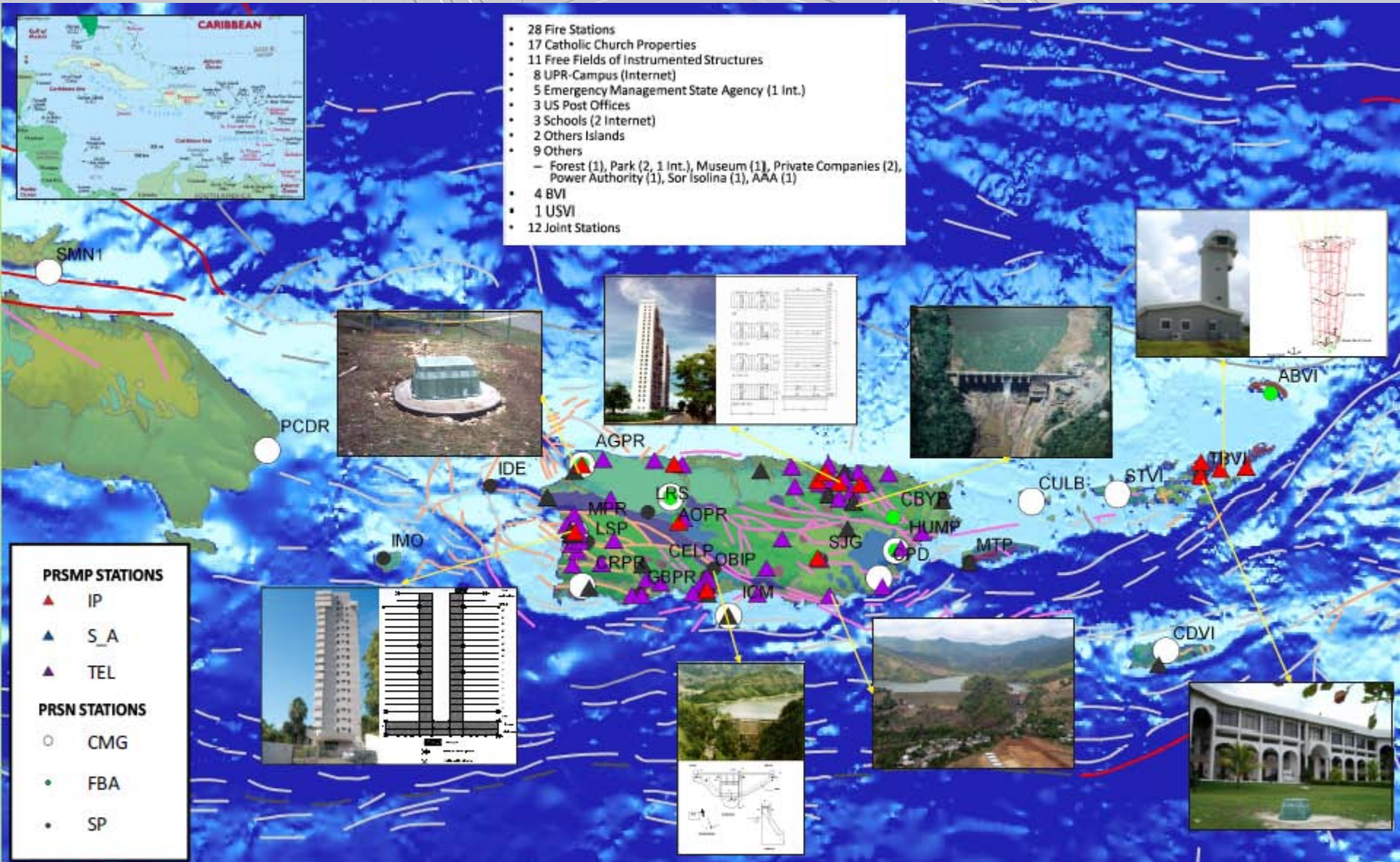
IU: IRIS/USGS
II : IRIS/IDA
CU: USGS Caribbean
PR: PRSN/PRSM, Puerto Rico
UA: Aruba Meteorological Agency
G : Geoscope
GE: Geofone
MO: Montserrat Volcano Observatory
NA: KMNI Antilles
DR: ISU Dominican Republic, UT
UC: Colima University, Mexico
SV: SNET, El Salvador
NI: INETER, Nicaragua
OV: OVSICORI, Costa Rica
PA: Volcan Baru Network, Panama
TR: West Indies Seismic Research Center
CM: Colombian National Seismological Network
CN: Canadian Seismic Network
BL : Brazii Seismic Network
CY: **Gayman Island**



Current Real Time Tsunami Monitoring



PR Strong Motion Network



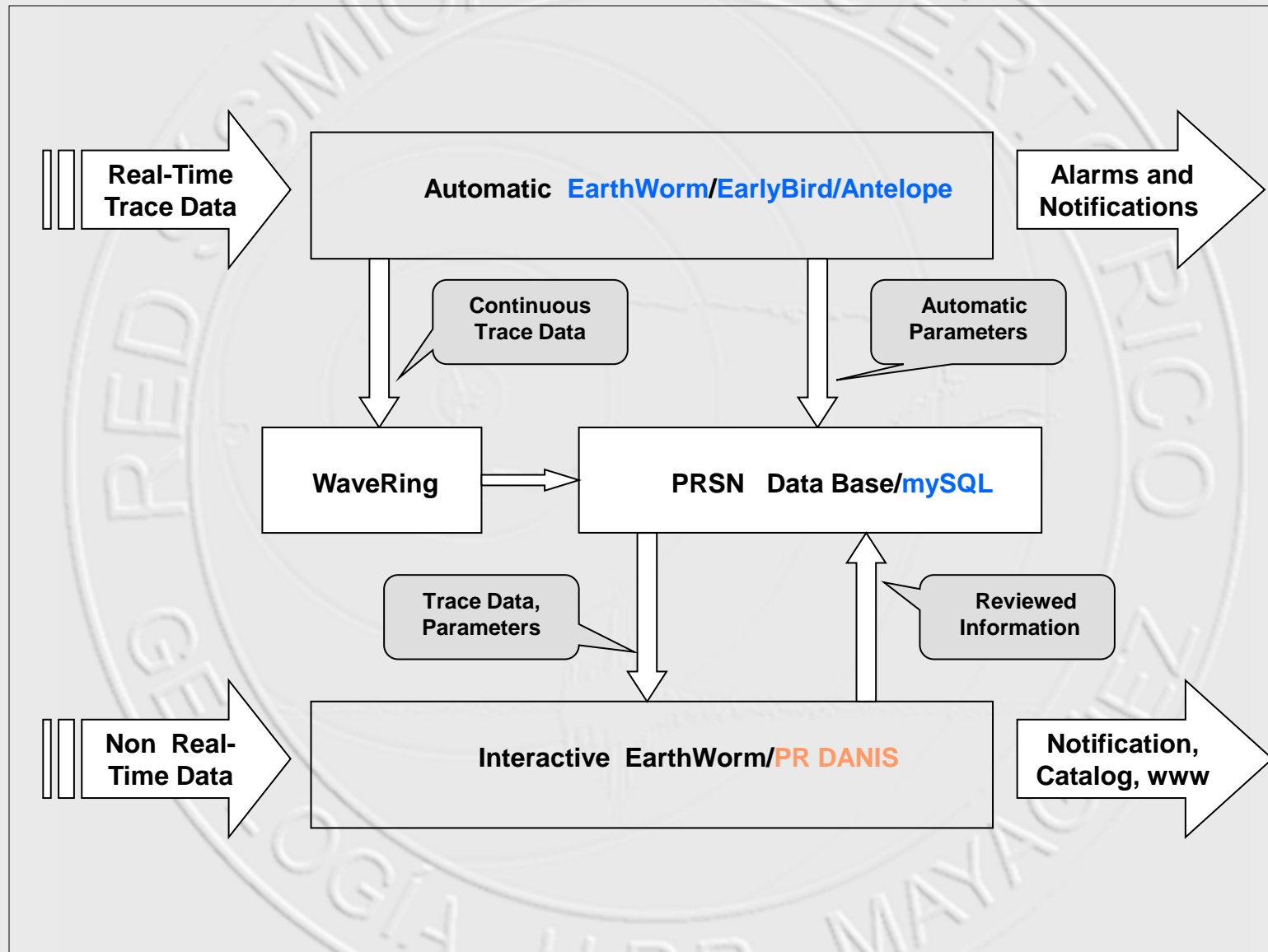
- 28 Fire Stations
- 17 Catholic Church Properties
- 11 Free Fields of Instrumented Structures
- 8 UPR-Campus (Internet)
- 5 Emergency Management State Agency (1 Int.)
- 3 US Post Offices
- 3 Schools (2 Internet)
- 2 Others Islands
- 9 Others
 - Forest (1), Park (2, 1 Int.), Museum (1), Private Companies (2), Power Authority (1), Sor Isolina (1), AAA (1)
- 4 BVI
- 1 USVI
- 12 Joint Stations



- PRSMMP STATIONS**
- ▲ IP
 - ▲ S_A
 - ▲ TEL
- PRSN STATIONS**
- CMG
 - FBA
 - SP

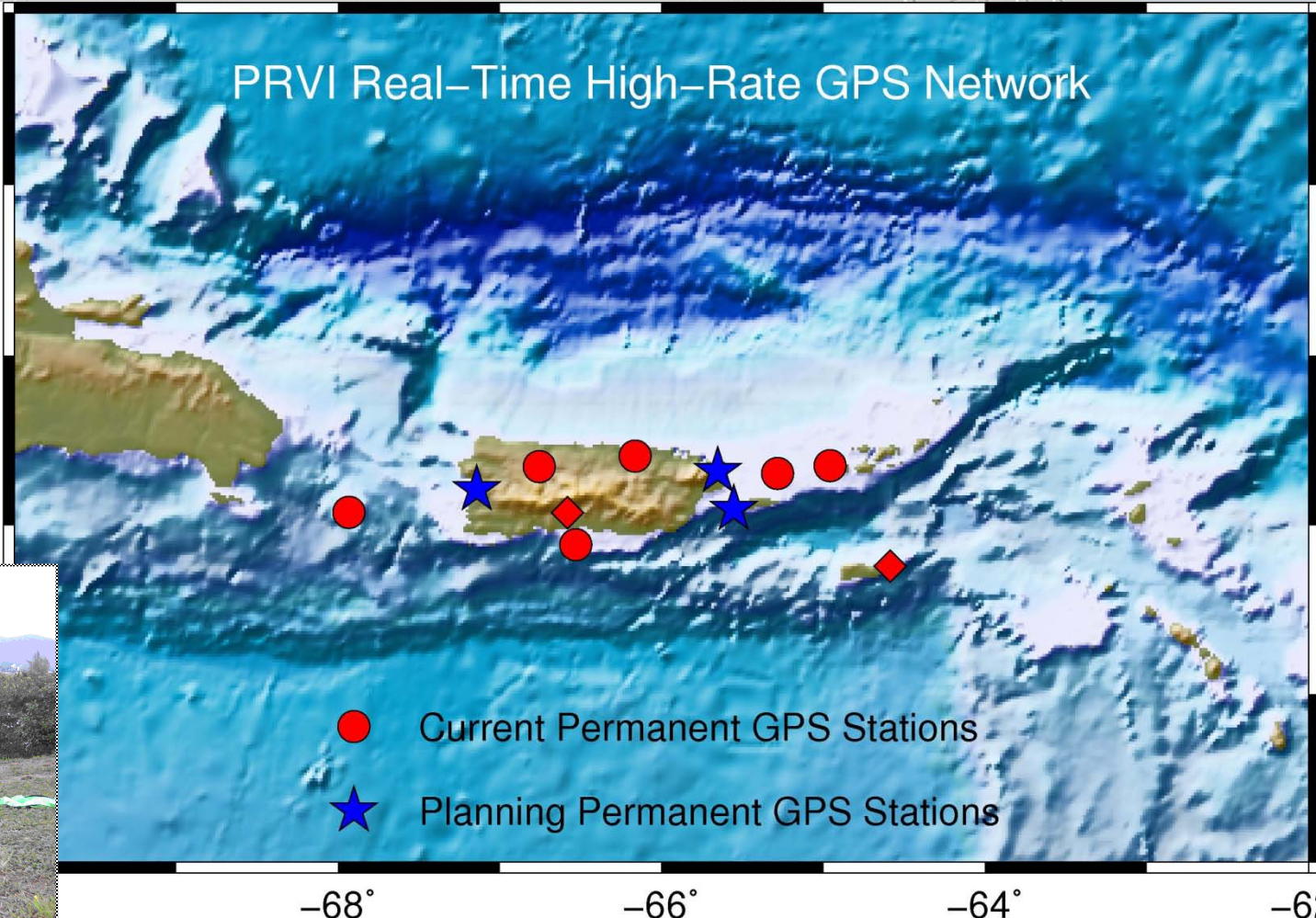
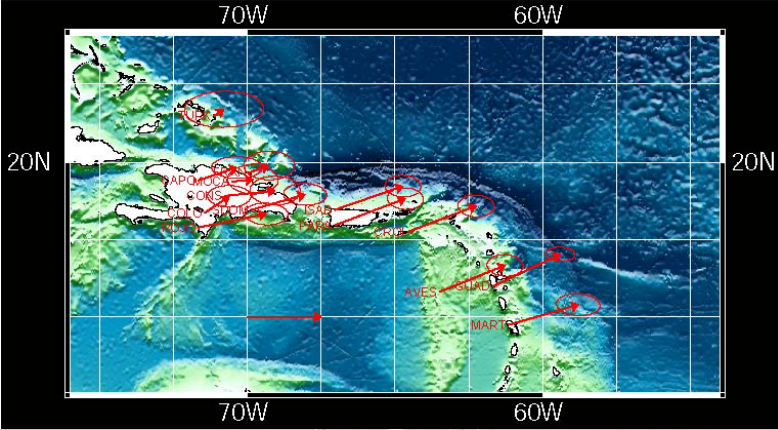


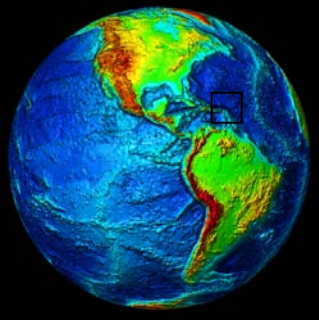
PRSN Real Time System



EarthWorm/EarlyBid/PR DANIS architecture (based on Earle, 2003)

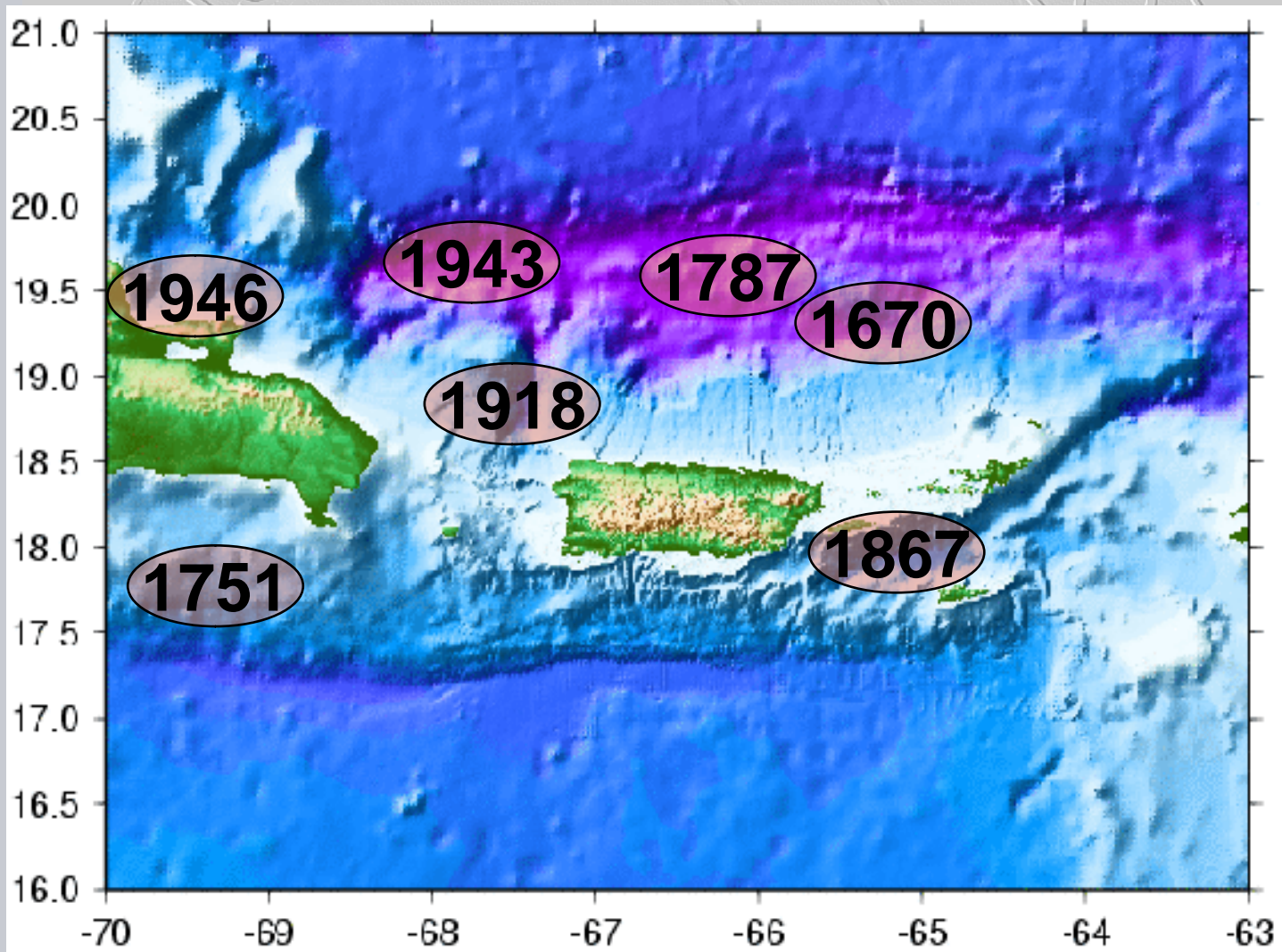
PR GPS Network



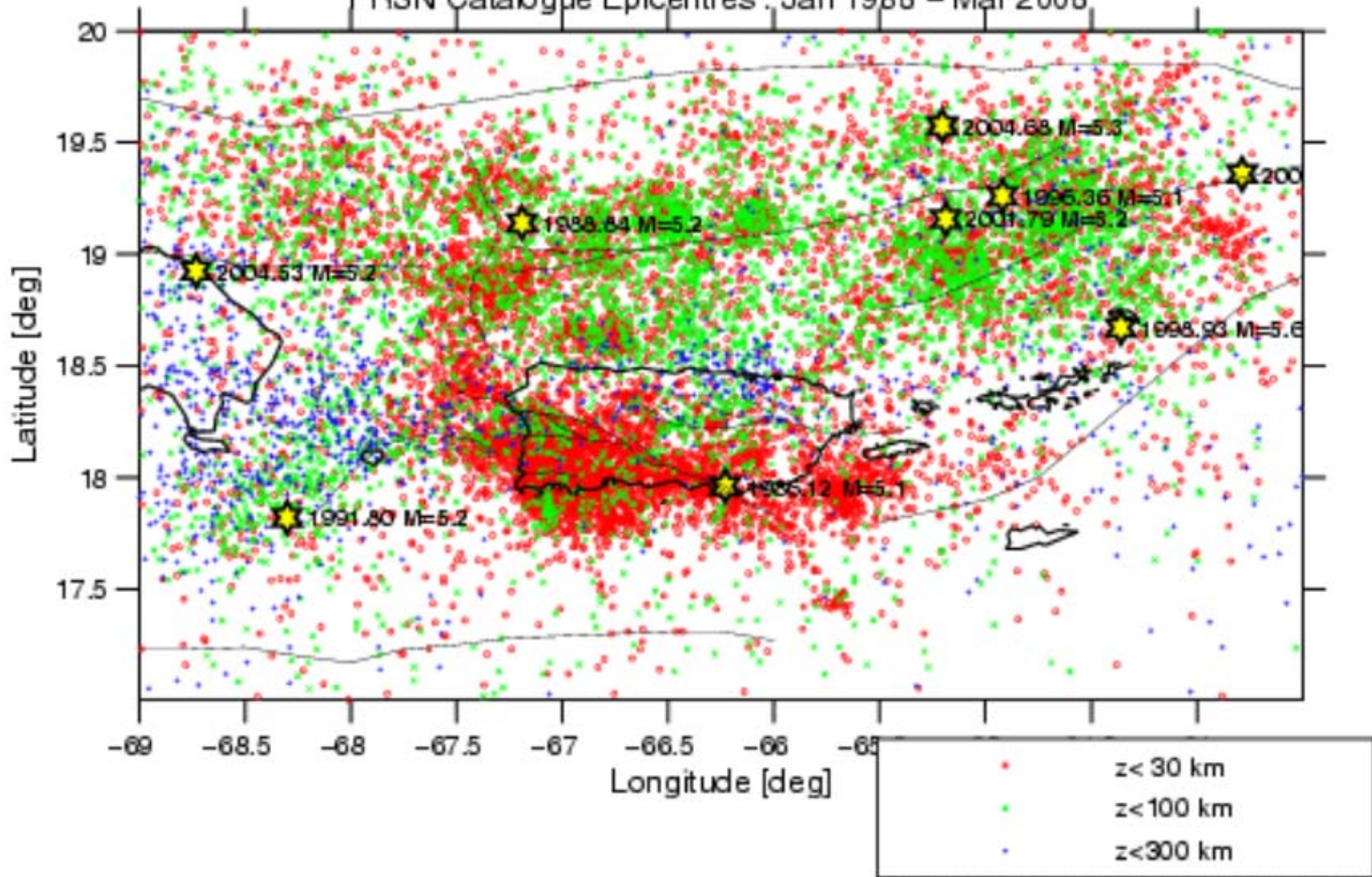


PR/VI SEISMIC HISTORY

- 1670 MM = VII, San Germán y San Juan
- 1787 M @7-8, MM = VII-VIII, Costa Norte, Este y Oeste
- 1867 M = 7.3, MM = VIII, Islas Vírgenes, Tsunami 20'
- 1918 M = 7.3, MM = VIII, Área Oeste de PR, Tsunami 20'
- 1943 M = 7.5, MM = V, Noreste de Puerto Rico



PRSN Catalogue Epicentres : Jan 1986 - Mar 2006



PR EARTHQUAKE SCENARIOS

(Huerfano, et al 2008)

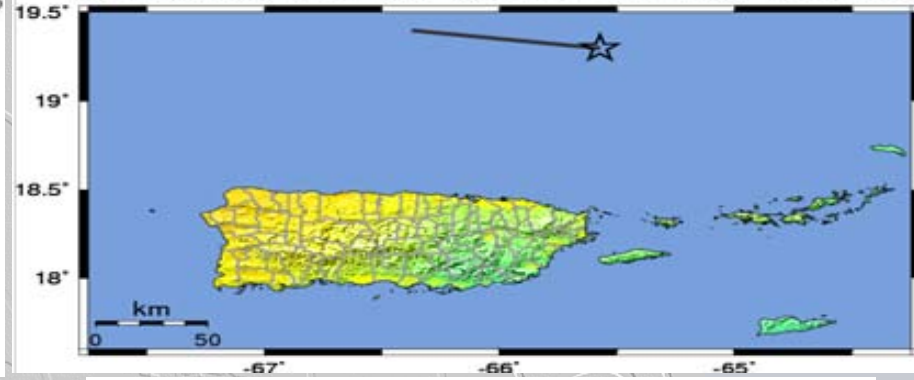
PRSN/PRSMP ShakeMap : Mona Canyon, Scenario

Thu Oct 11, 2018 11:00:00 AM AST M 7.3 N18.44 W67.50 Depth: 5.0km ID:1918 Scenario



PRSN/PRSMP ShakeMap : Puerto Rico Trench, Scenario

May 2, 1787 01:00:00 AM AST M 8.0 N19.30 W65.57 Depth: 20.0km ID:1787 Scenario



PRSN/PRSMP ShakeMap : Lajas Valley Scenario

XXXX XX:XX:XX XX AST M 7.0 N18.01 W66.95 Depth: 5.0km ID:Lajas M7 Scenario



PRSN/PRSMP ShakeMap : Virgin Islands, Scenario

Sat Nov 18, 1967 02:45:00 PM AST M 7.5 N18.00 W65.00 Depth: 5.0km ID:1967 Scenario



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-9.1	9.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

I	No se siente.
II	Sentido por personas en reposo, especialmente en sitios altos
III	Sentido en el interior, duración apreciable. Vibraciones similares al paso de un camion pequeño
IV	Sentido en el interior por muchos y poco en el exterior. Vibración similar al paso de un camion pesado.
V	Sentido por casi todos. Objetos inestables volcados. Arboles y arbustos sacudidos visiblemente.
VI	Sentido por todos, algo de panico. Aobjetos pesados se mueven. Daños leves.
VII	Daños considerables en estructuras de mal diseño. Daños leves en edificios bien diseñados.
VIII	Colapsos parciales de edificios. Algunos efectos secundarios.
IX	Daños considerables, tuberías subterráneas rotas.
X	Puentes destruidos, grietas grandes y deslizamientos.
XI	Colapso de la mayoría de las estructuras de cemento y hormigón. Puentes y otras vías de transporte seriamente afectadas.
XII	Perdida total en la infraestructura.

PRSN OFICIAL BULLETIN

University of Puerto Rico
Mayagüez Campus
Geology Department

PUERTO RICO SEISMIC NETWORK

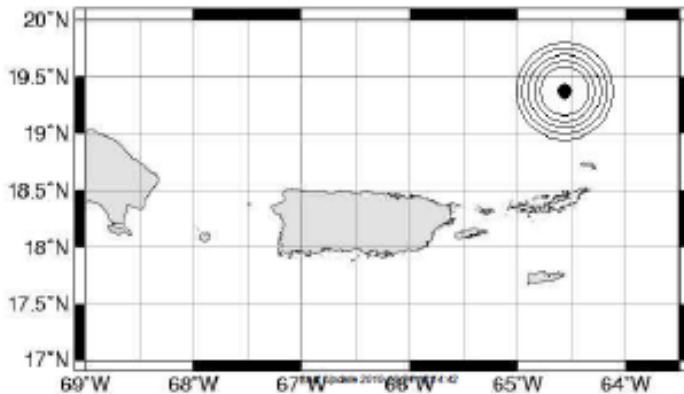


MEMO 2

SEISMIC EVENT/Tsunami

DATE:	Octubre 23 2010
LOCAL TIME:	22:17:52
LATITUDE:	19.38 North
LONGITUDE:	64.58 West
LOCATION:	75.6 Km North-Northwest of Anegada, BVI 196.2 Km Northeast of San Juan, PR
DEPTH:	10 Km
MAGNITUDE:	4.61 Md
ESTIMATED MAXIMUM INTENSITY:	IV in San Juan, PR
TSUNAMI WARNING LEVEL:	NO tsunami THREAT for Puerto Rico and Virgin Islands.
ISSUED DATE:	2010-10-23 23:17:27

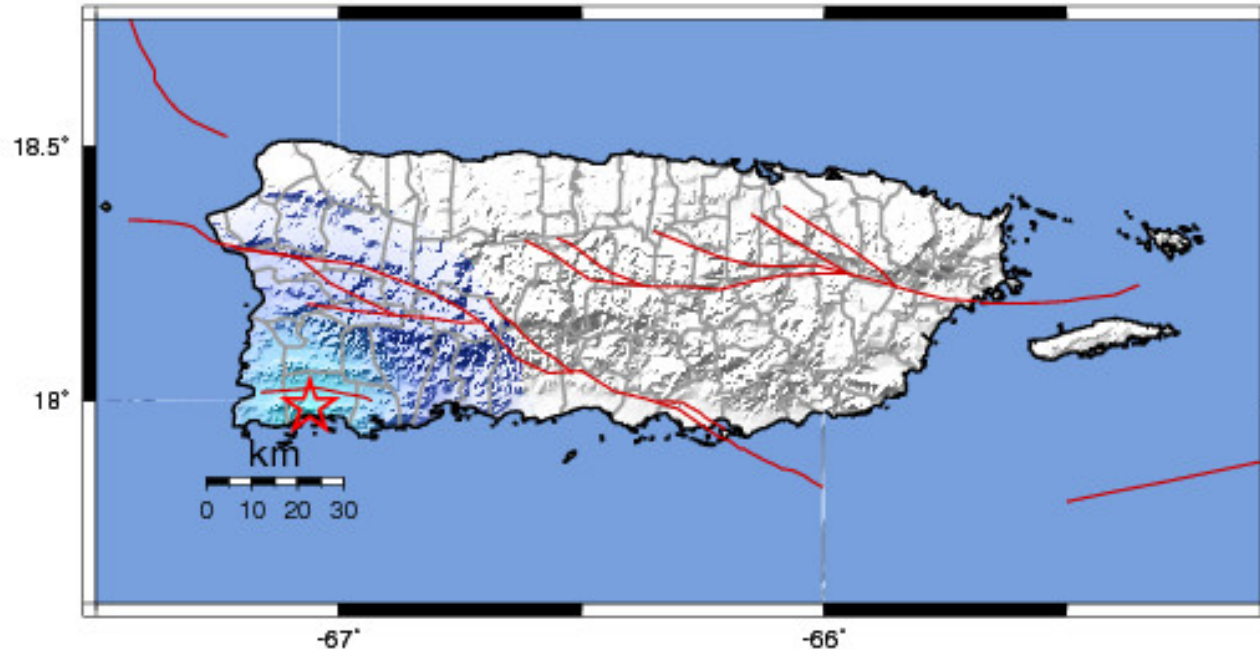
The Puerto Rico Seismic Network (PRSN) received reports that this leve earthquake was reported as felt in el area Este, with a maximum intensity of IV (Modified Mercalli Scale, MM). At the moment of generating this bulletin - NO tsunami threat for Puerto Rico and Virgin Islands



- **Tiempo de Origen**
- **Donde se originó?**
 - Hipocentro
 - Epicentro
 - Distancias
- **Que tan grande fué?**
 - Magnitud
 - Movimiento del suelo
- **Cuales fueron sus efectos?**
 - Intensidad
 - Lugar
- **Mensaje de Tsunami?**
 - Aviso
 - Vigilancia
 - Advertencia
 - Boletín Informativo
 - Parte de Normalidad
 - Fecha de Emisión
- **Comentarios?**
 - Generales
 - Específicos
- **Mapa?**
 - Ultima Actualización

PRSN ShakeMap Tool

PRSN/PRSMP ShakeMap : Felt in Western and Southwestern Puerto Rico
 Wed Mar 14, 2007 11:21:00 PM GST M 3.5 N17.99 W67.06 Depth: 5.1km ID:2007.03.14



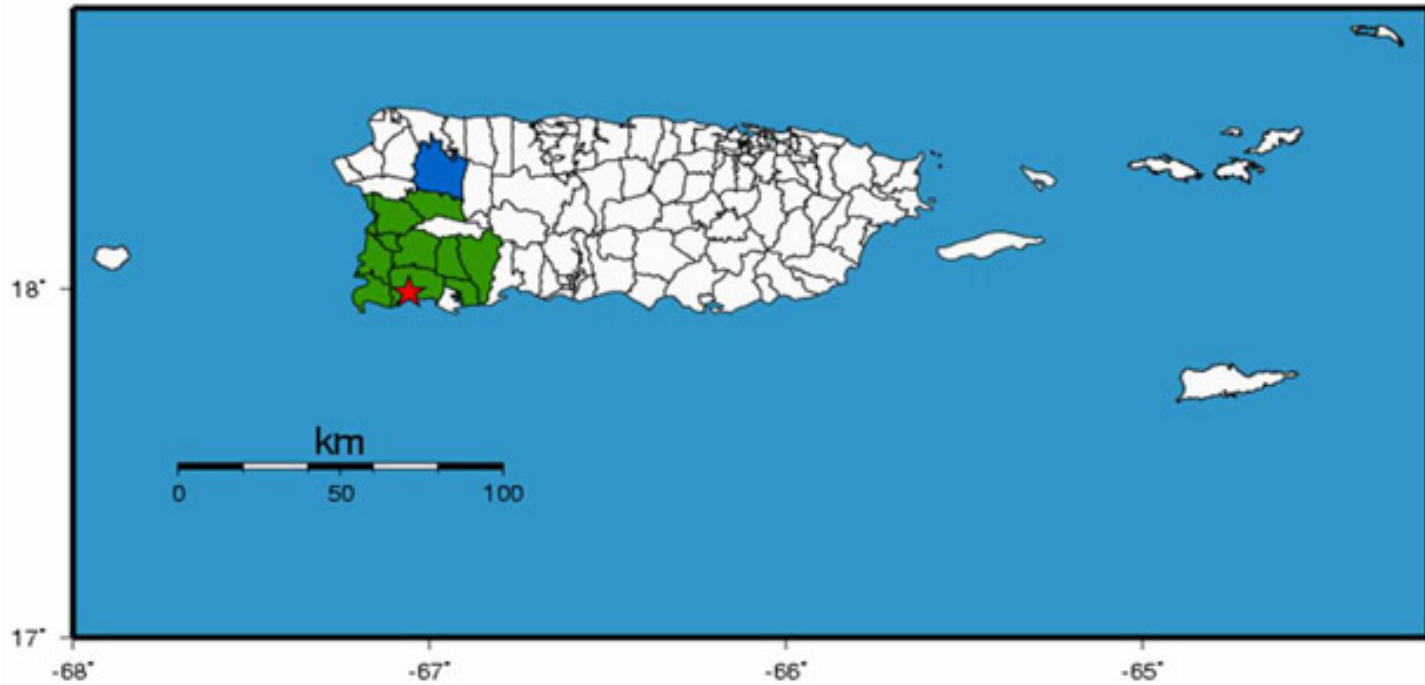
Map Version 1 Processed Thu Mar 15, 2007 12:07:24 PM GST, -- NOT REVIEWED BY HUMAN

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

PRSN CIIM Tool

PRSN Community Intensity Map (Felt in Western and Southwestern Puerto Rico)

ID: 2007.03.14 23:21:59 March 14, 2007 Mag=3.5 Lat 17.988N Long=67.059W Depth 5 Km



INTENSITY	I	II	III	IV	V	VI	VII	VIII	IX	X+
SHAKING	NOT FELT	WEAK	LIGHT	MODERATE	STRONG	VERY STRONG	SEVERE	VIOLENT	EXTREME	
DAMAGE	NONE	NONE	NONE	VERY LIGHT	LIGHT	MODERATE	MODERATE HEAVY	HEAVY	VERY HEAVY	

PRSN Current Real Time Earthquake Information



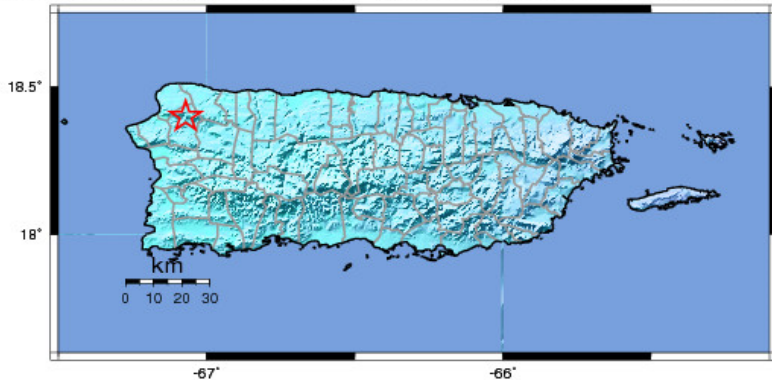
Post earthquake

1. 1/2 minutes Location and Size
2. 3/5 minutes ShakeMaps

Map of observed ground shaking available within minutes after an event.. **Real time loss estimation**

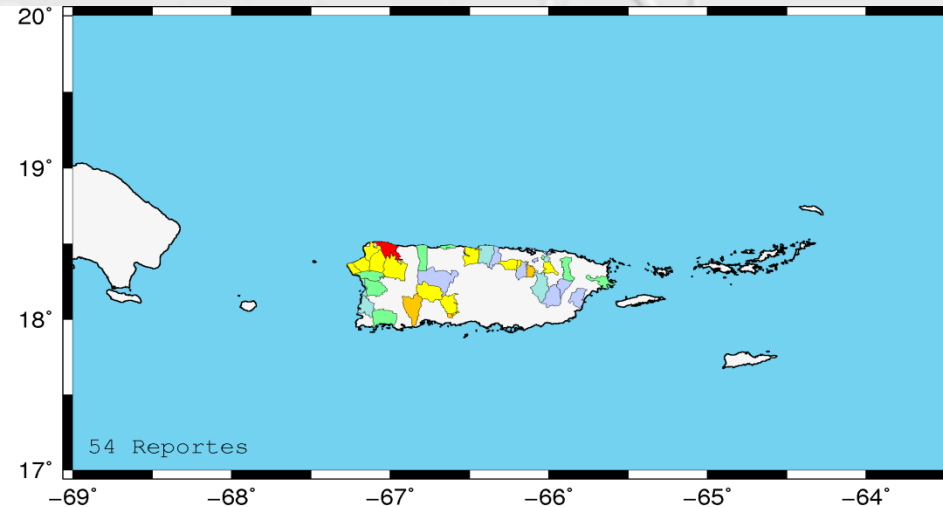
3. 3/5 minutes Tsunami Messages... **Forecasting**

PRSN/PRSNP ShakeMap : Moca, PR
Sun May 16, 2010 01:16:10 AM AST M 5.8 N18.40 W67.07 Depth: 113.1km ID:20100516051610



Map Version 9 Processed Sun May 16, 2010 06:51:07 AM AST, -- NOT REVIEWED BY HUMAN

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/seg)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

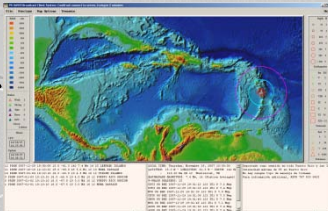
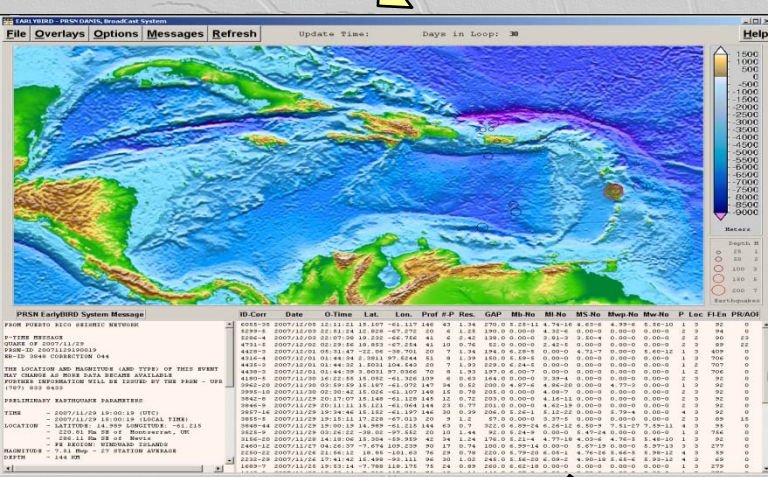
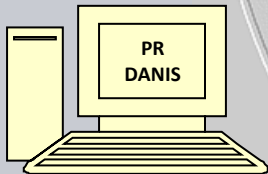
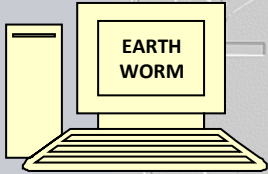
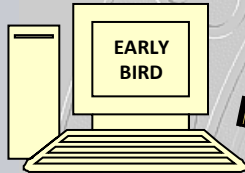


GM 2010 Oct 19 05:53:51

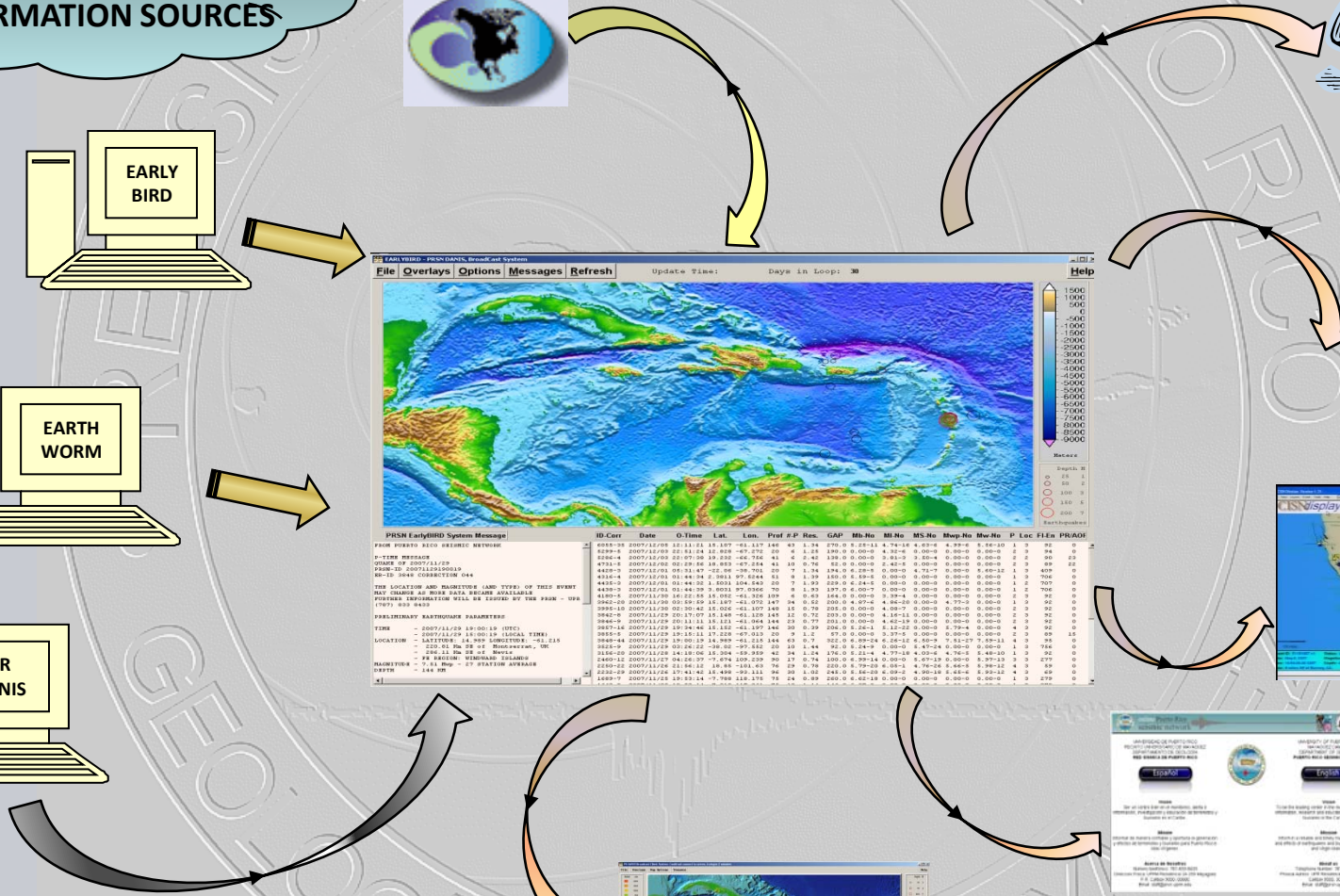
RED SISMICA DE PUERTO RICO - ESCALA DE MERCALLI MODIFICADA									
MOVIMIENTO PERCIBIDO	Ninguno	Debil	Ligero	Moderado	Fuerte	Muy Fuerte	Severo	Violento	Extremo
EFFECTOS ASOCIADOS	Ninguno	Ninguno	Ninguno	Minimos	Ligeros	Apreciables	Significativos	Mayores	Muy Fuertes
INTENSIDAD	I	II - III	IV	V	VI	VII	VIII	IX	X+

PR 24/7 Warning Center Procedures: BroadCast System

EARTHQUAKE/Tsunami INFORMATION SOURCES



EARTHQUAKE/Tsunami DISPLAY CLIENTS



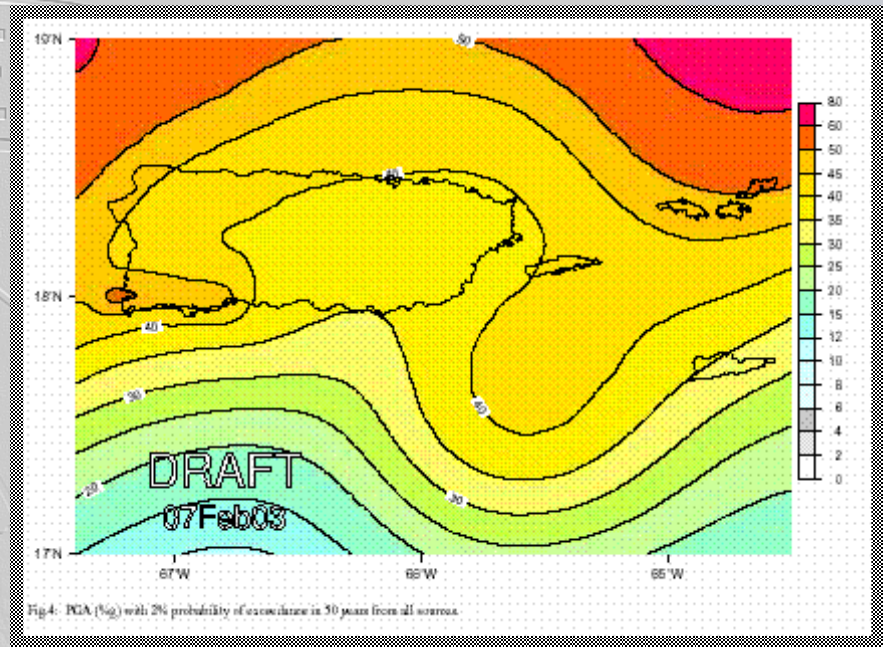
Projects

1. **24/7 Service: Local Government**
2. **Network Operations and data Sharing: NOAA**
3. **TsunamiReady program: NOAA**
4. **3D Tomography: USGS**
5. **Dam Monitoring: US Corps of Engineers**
6. **Southwestern PR study: FEMA**
7. **PR SMP: Local Government**
8. **H-GPS: COCO-net (NSF)**
9. **PRSN – UH: Caribbean Tsunami Ready Tide Gauges Network**
10. **PRSN – UNESCO: Caribbean Tide Stations**
11. **Education and Outreach; Local Government**
12. **British Virgin Island Seismic Monitoring: DDM**

Coming Soon

1. **Ten broadband (120 sec) permanent Stations: PRSN - USGS**
2. **Improve the real time strong motion monitoring**
3. **Four H-GPS permanent stations: PRSN - USGS**
4. **Rapid deployment network (five full temporary stations, 120 sec.)**
5. **Ten Caribbean Tsunami Ready Tide gauges**
6. **HF CODAR radar tsunami detection**
7. **Software developments: PR DANIS – III, HAZUS loss estimator, Tide Alarms, WCS next generation.**

Questions?



PR Seismic Network:

<http://redsismica.uprm.edu>

Tel. 787-833-8433

PR Tsunami Portal

<http://poseidon.uprm.edu>

PR Strong Motion Program

<http://aki.uprm.edu>

Tel: 787 832 4040 x 3401

