Development of Rapid Seismic Monitoring Procedures for Incorporation into Caribbean Tsunami Warning System (II)

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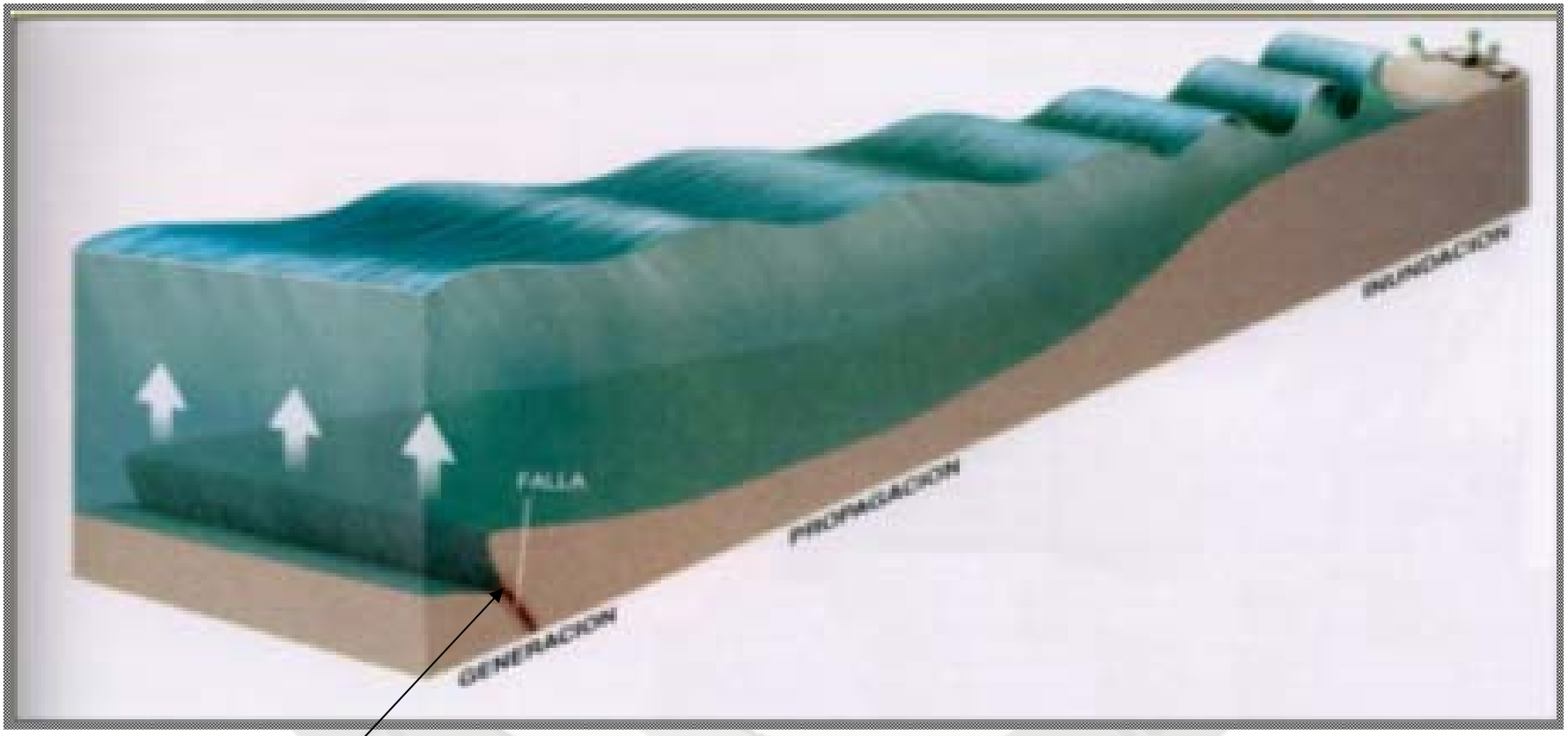
OBJECTIVES

- Apply RMT procedure to analyze earthquakes recorded by PRSN broadband stations
  - use 1 or more stations
  - test results using LMT/CMT inversion
- Incorporate RMT procedure in PRSN real-time earthquake location system for real time monitoring of NE Caribbean sources
- Automate methodology for (near) real time monitoring of Caribbean earthquakes to be used in development of emergent tsunami warning system for Puerto Rico – Virgin Islands region

THE PROBLEM



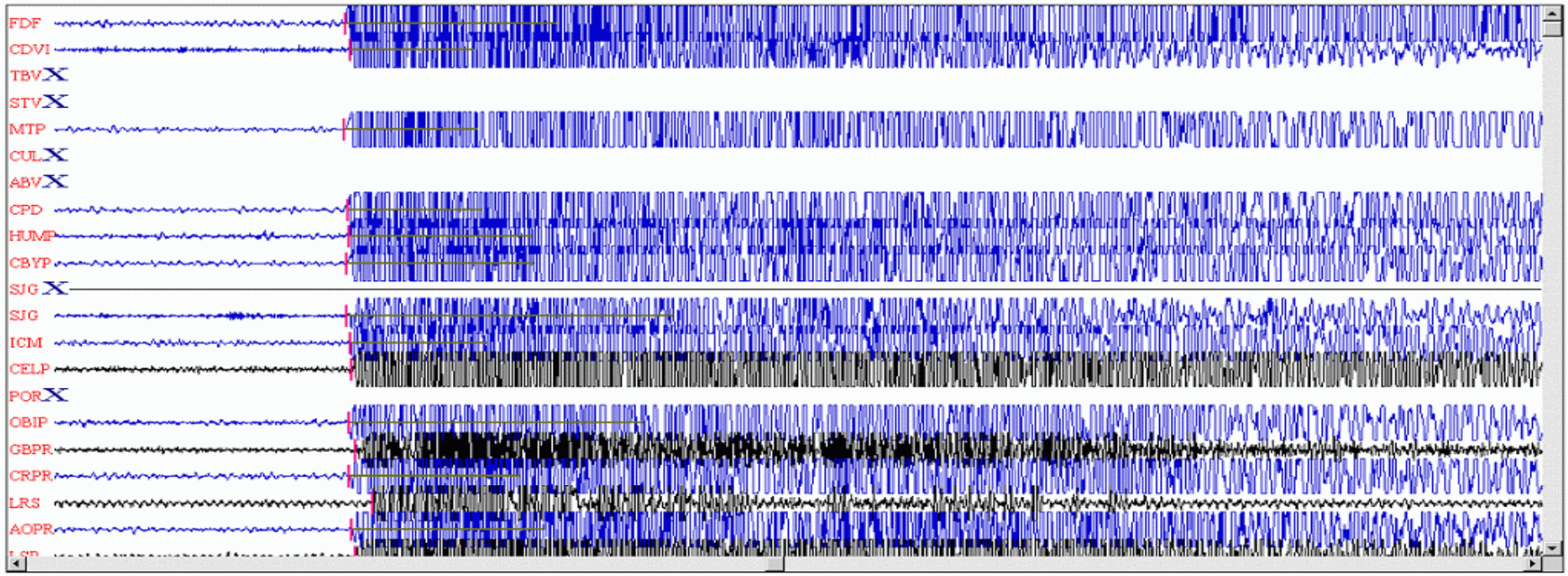
HYPOCENTER

Hypocenter Display

Force Location Mwp Display Recompute Mwp Refresh

Date	O-time	Lat.	Lon.	Dep	Res	Azm	#Stn	ID	Ms	Mw	Mwp	Mb	Ml
10/03	18:04:09	17.5S	169.1E	666	1.2	292	24	2684-19	5.5-10			6.2-19	
10/02	03:41:21	5.1S	133.4E	40	0.5	76	9	1995-04	5.3-19	5.7-12		6.4-08	
10/01	09:06:07	46.6N	153.6E	40	1.3	139	11	1752-13	6.4-29	6.7-11	6.5-04	5.9-11	
09/30	17:50:29	46.8N	153.3E	40	0.7	139	11	1572-11	6.5-32	6.7-12	6.7-04	5.8-09	
09/30	16:26:49	15.7S	73.3W	40	0.9	151	12	1539-09	5.0-14	6.1-11		5.5-11	6.2-01
09/30	12:47:36	9.5N	35.0W	40	0.4	122	19	1460-13	5.0-28	5.8-13	5.4-05	5.6-16	
09/29	18:23:10	10.8N	61.9W	81	1.3	281	32	1169-25	4.7-23		6.0-09	5.5-10	5.5-14
09/29	13:08:27	10.8N	61.6W	66	0.9	280	36	1062-29	5.3-22		6.2-14	6.0-12	5.8-10
09/28	06:22:12	16.3S	172.3W	40	1.2	273	17	0516-15	6.6-21	7.1-12	7.0-06	6.7-13	

Mwp = 6.2 **TRINIDAD**



First Automatic EarlyBird Location: 2006/09/29 13:13:25
ATWC P-Time MESSAGE : 2006/09/29 13:18:30
PTWC P-Time MESSAGE :2006/09/29 13:22:30

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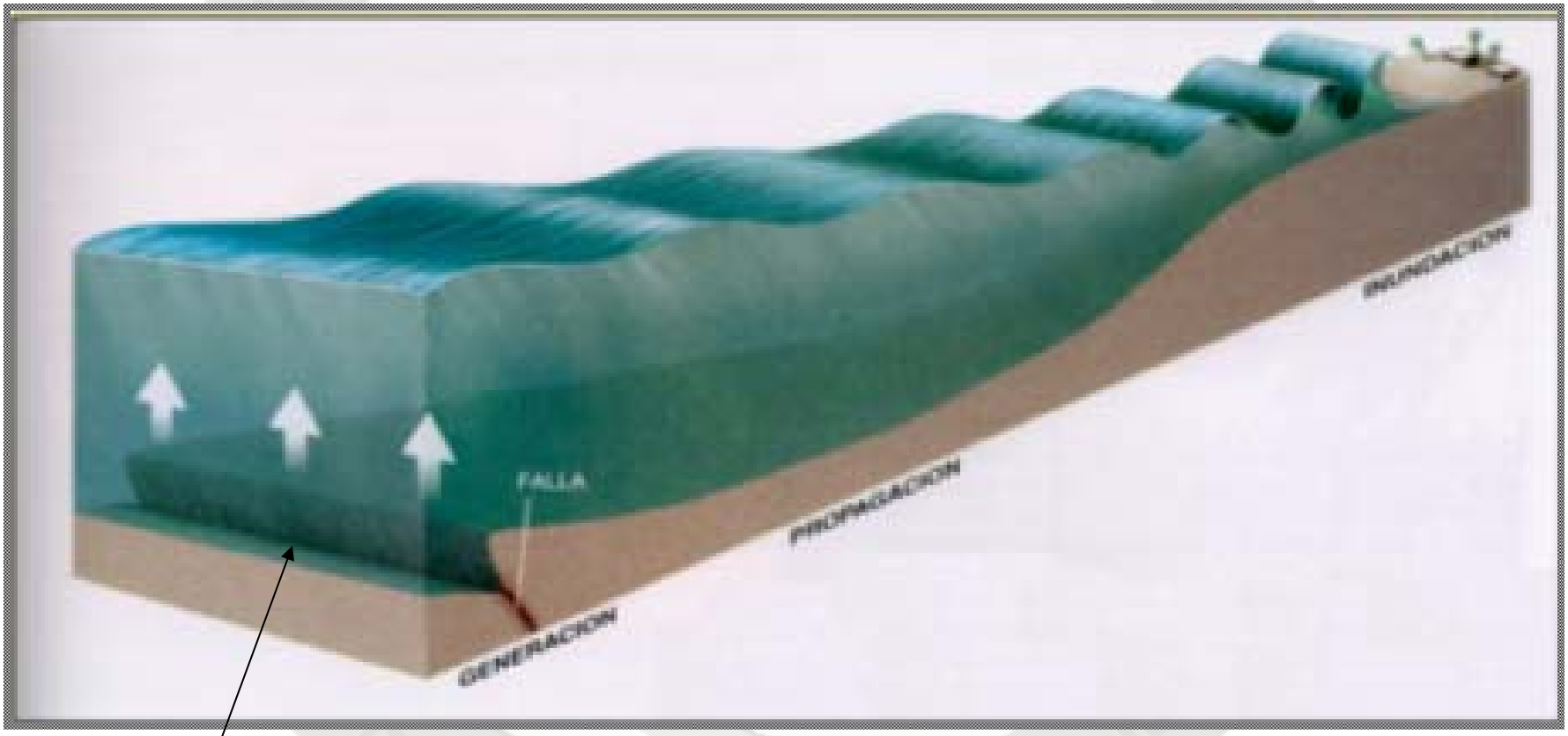
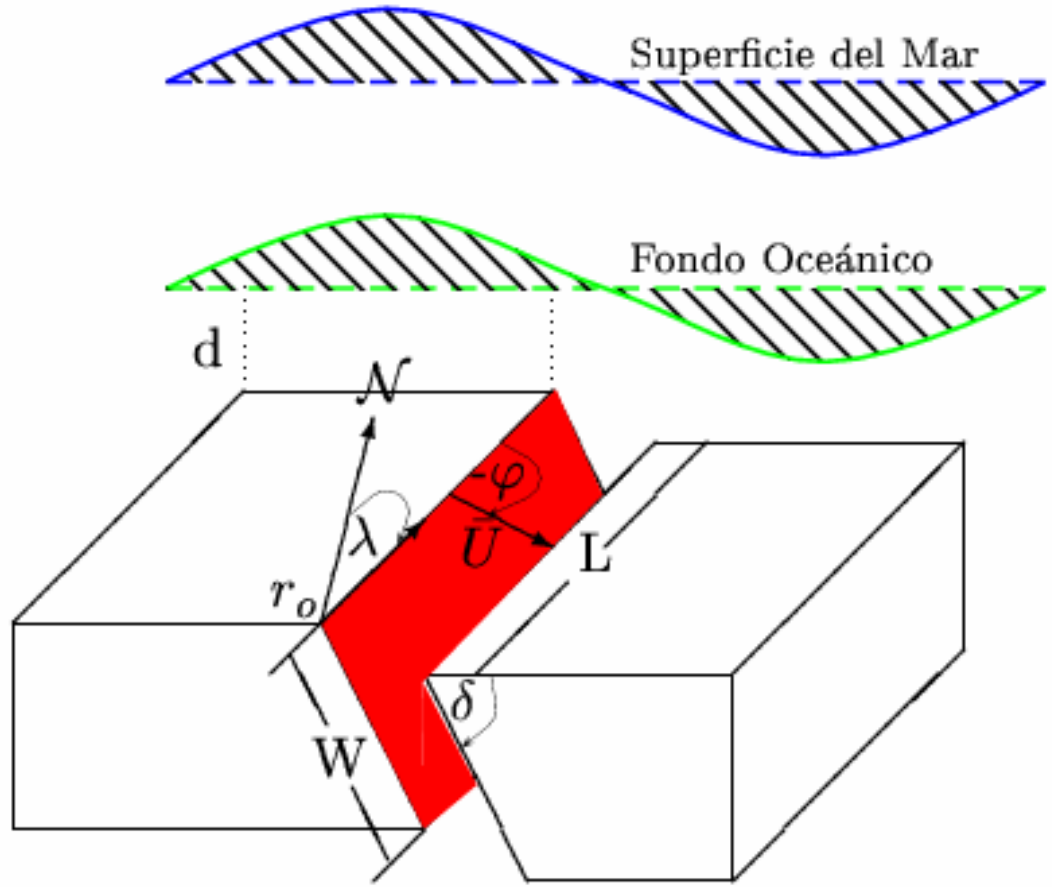
THE PROBLEM



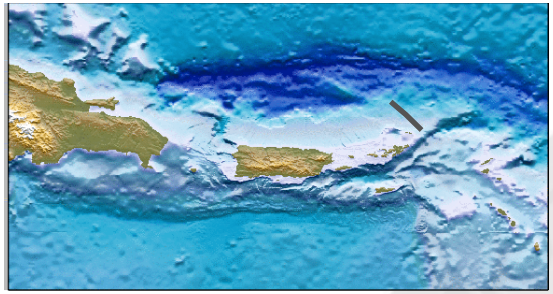
GEOMETRY AND SIZE

INITIAL CONDITIONS

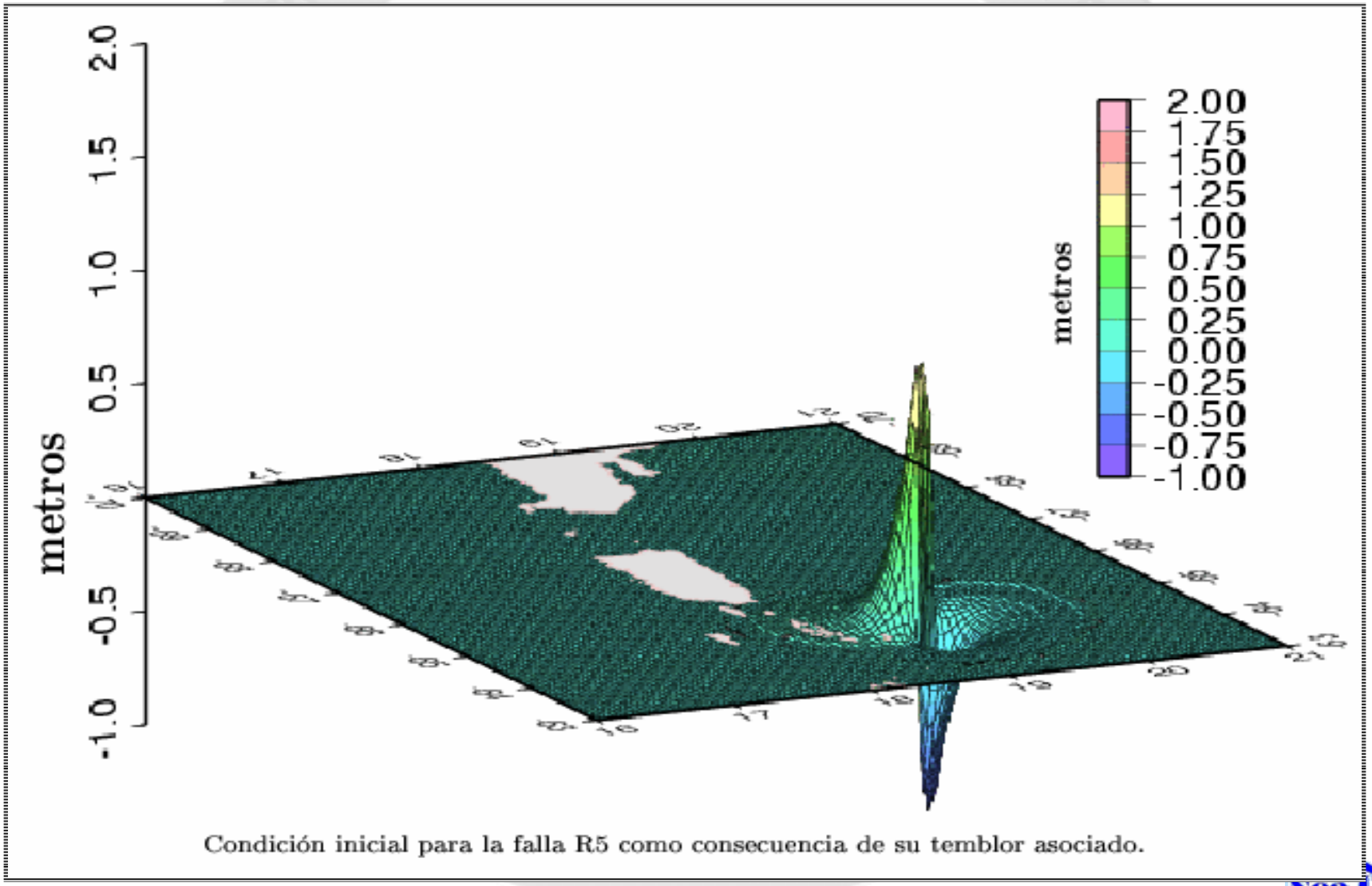


Mo = F(U,A)

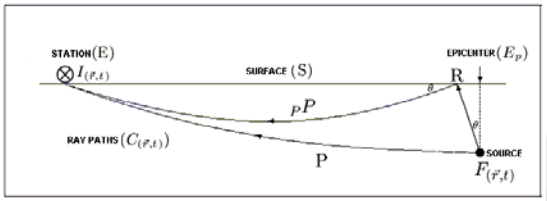
Diagrama esquemático de la falla ubicada a una profundidad **d**. La dislocación promedio es $\overline{U}$ y las dimensiones del segmento son: largo (L), ancho (W).



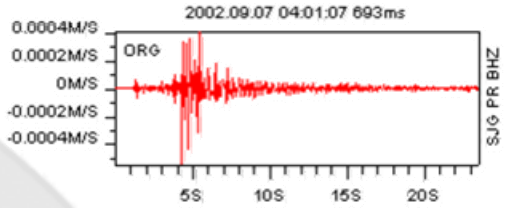
R5:
Strike = 122
Dip = 80
Rake = 90
Mw = 7.7



Condición inicial para la falla R5 como consecuencia de su temblor asociado.



$$TS(r,t) = F(r,t) \otimes C(r,t) \otimes I(r,t)$$



Raw BB Time Series

Instrumental Response

Rotation (x,y,z)→(r,t,z)

Epicenter

Crustal Model

Trial Depth

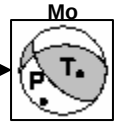
Frequency/Time Domain

~ f = 0.1 Hz (LMT)
~ f = 0.05 Hz (RMT)
~ f = 0.01 Hz (CMT)

LMT
RMT
CMT

Green's Functions
1. Discrete Wavenumber
2. Reflection-matrix
3. Normal Modes

Inversion/Error



Few BB Polarities

Synthetic

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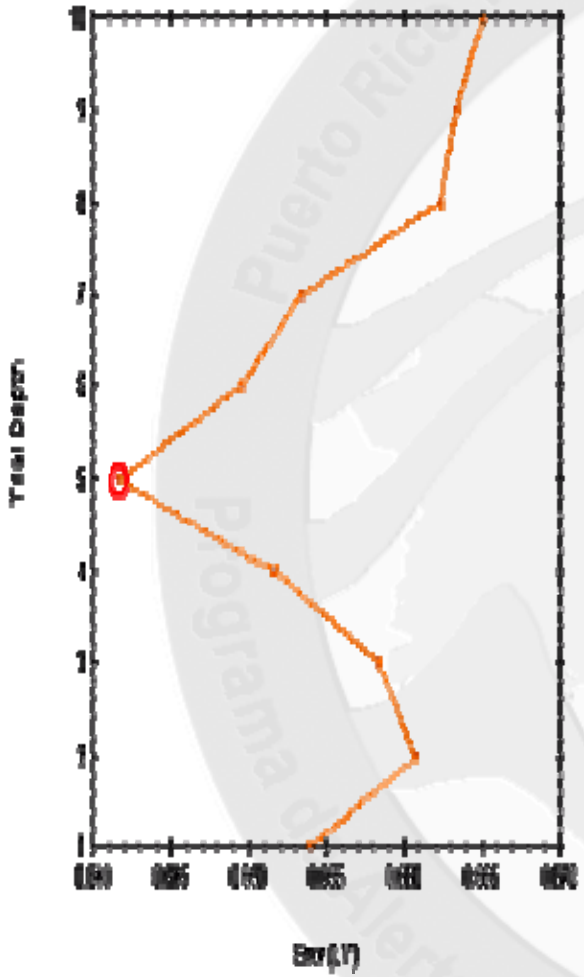
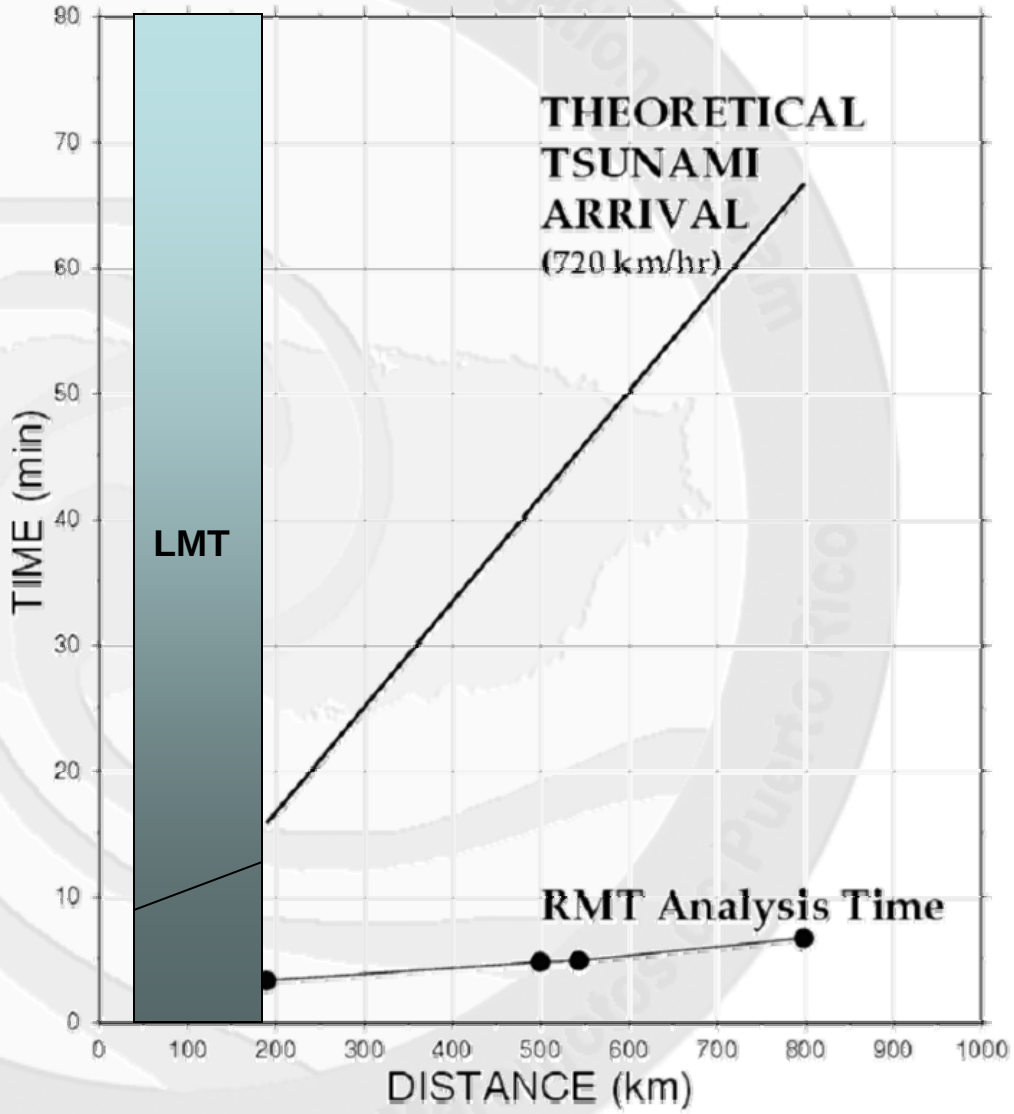
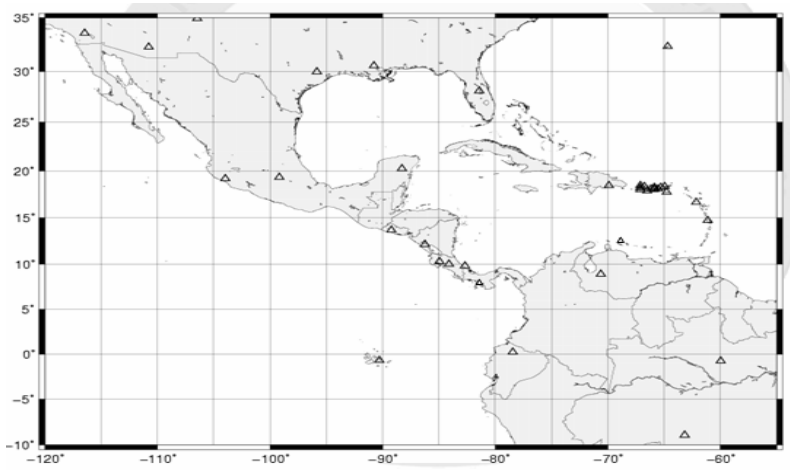
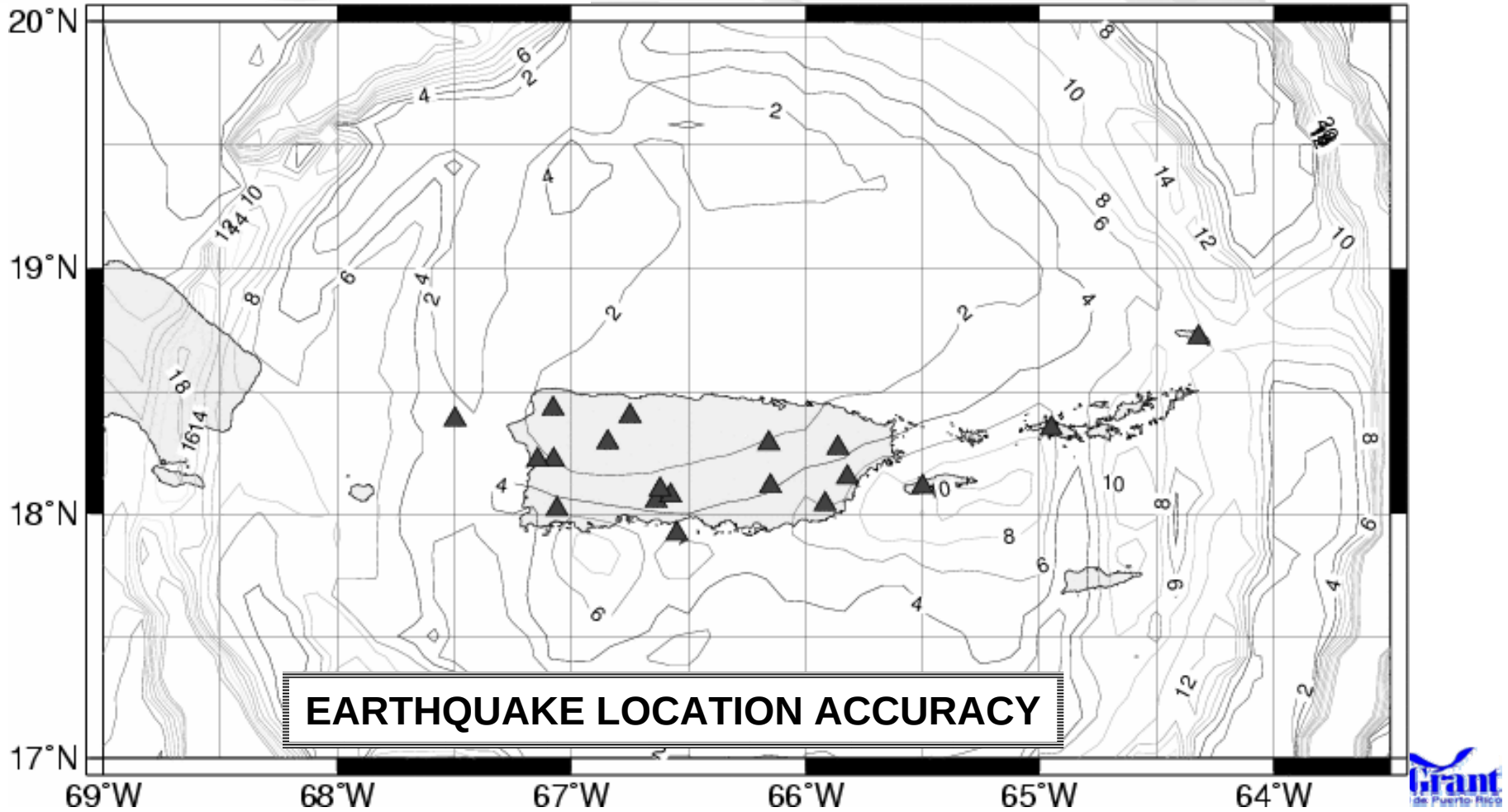
Inversion Method

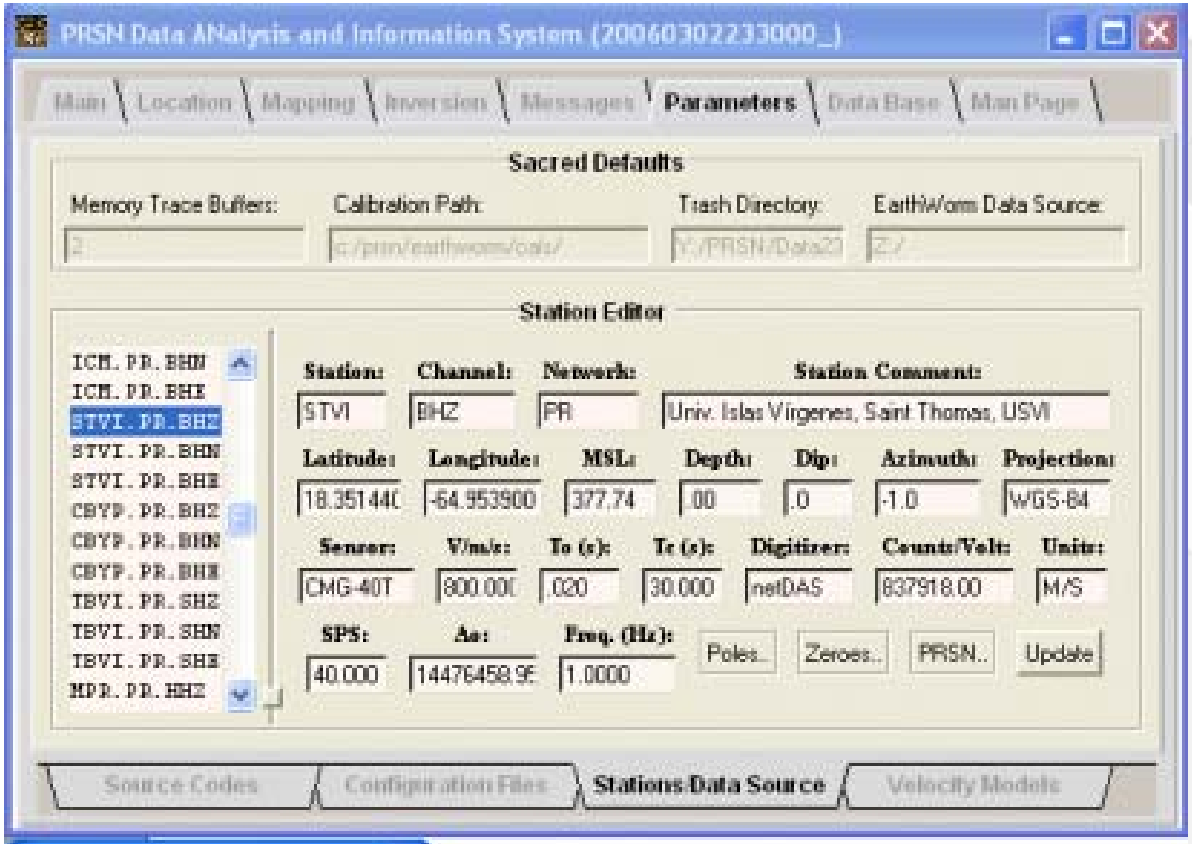


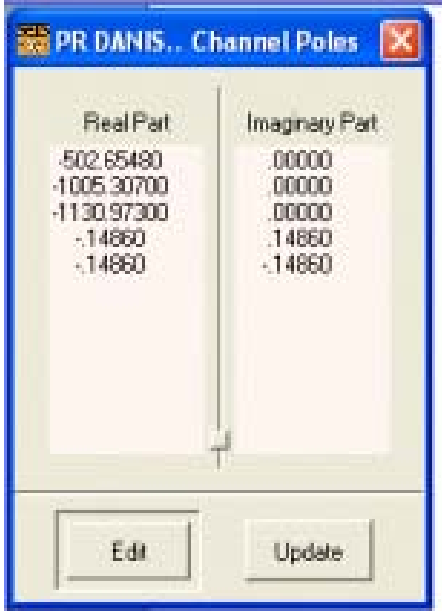
Error Vs Focal Depth

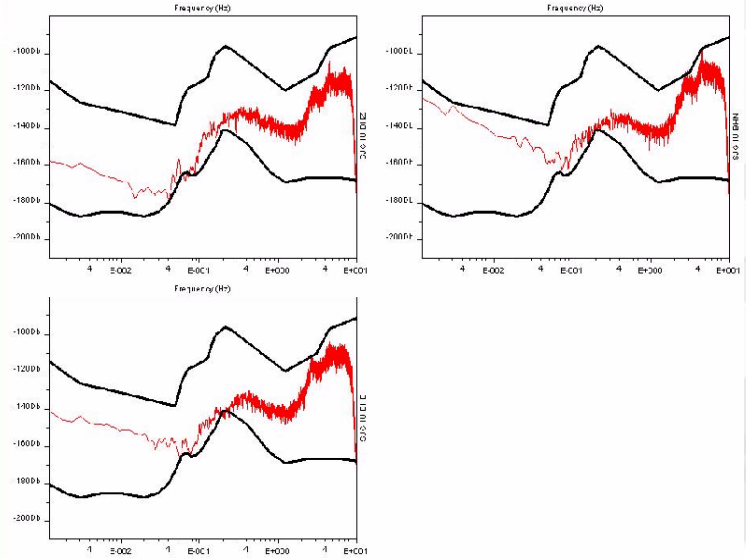


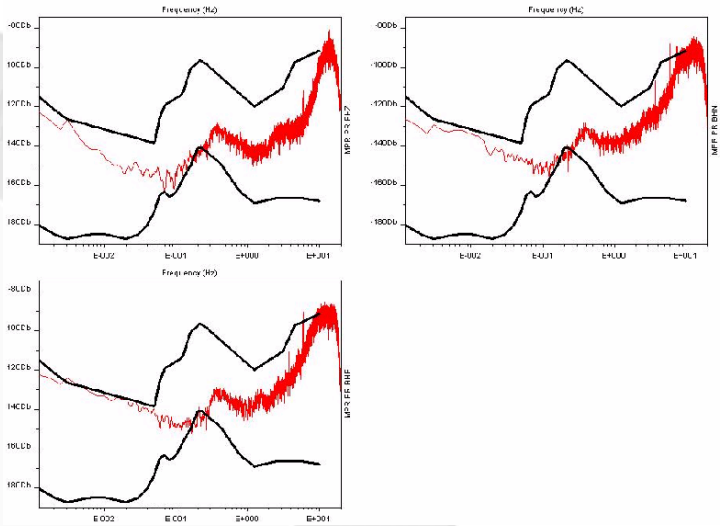

35°
30°
25°
20°
15°
10°
5°
0°
−5°
−10°
−120°
−110°
−100°
−90°
−80°
−70°
−60°

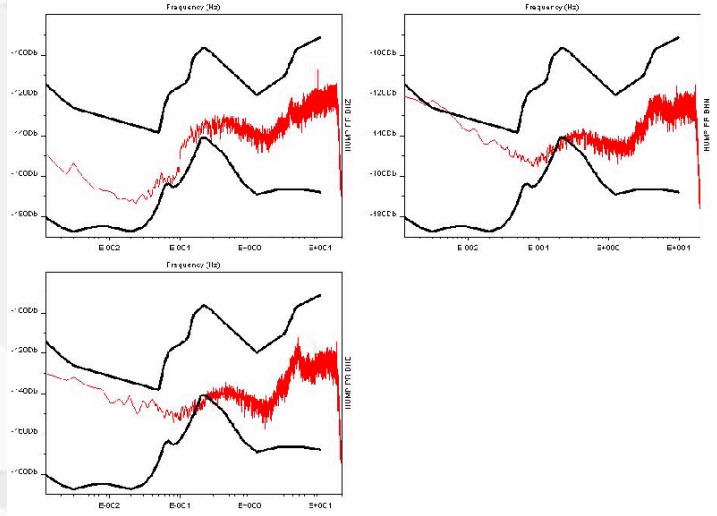

20°N
19°N
18°N
17°N
69°W
68°W
67°W
66°W
65°W
64°W
EARTHQUAKE LOCATION ACCURACY











Calibration and NNL

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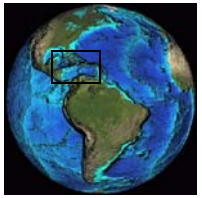
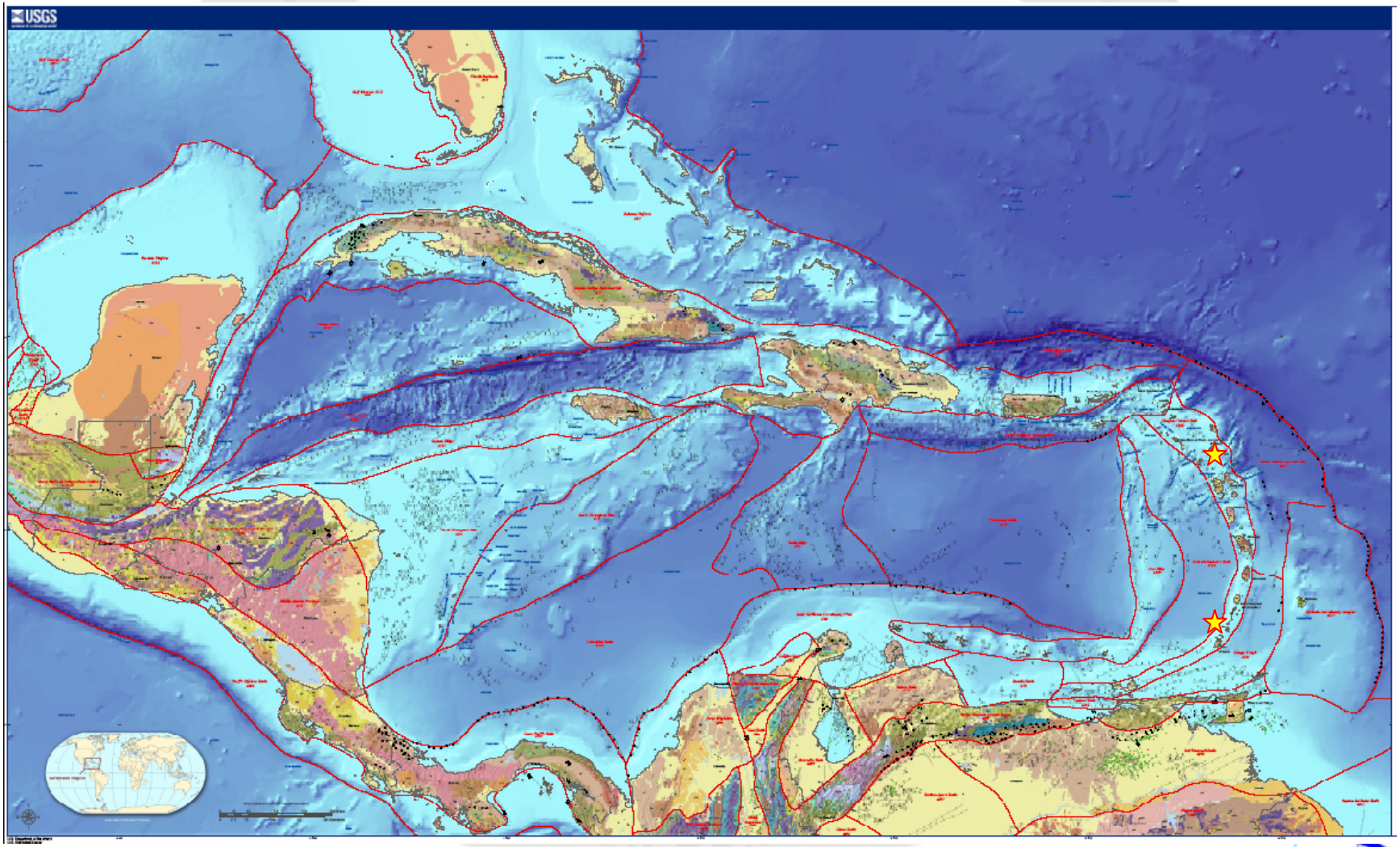


CARIBBEAN TECTONIC SETTING



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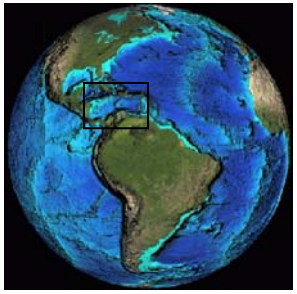
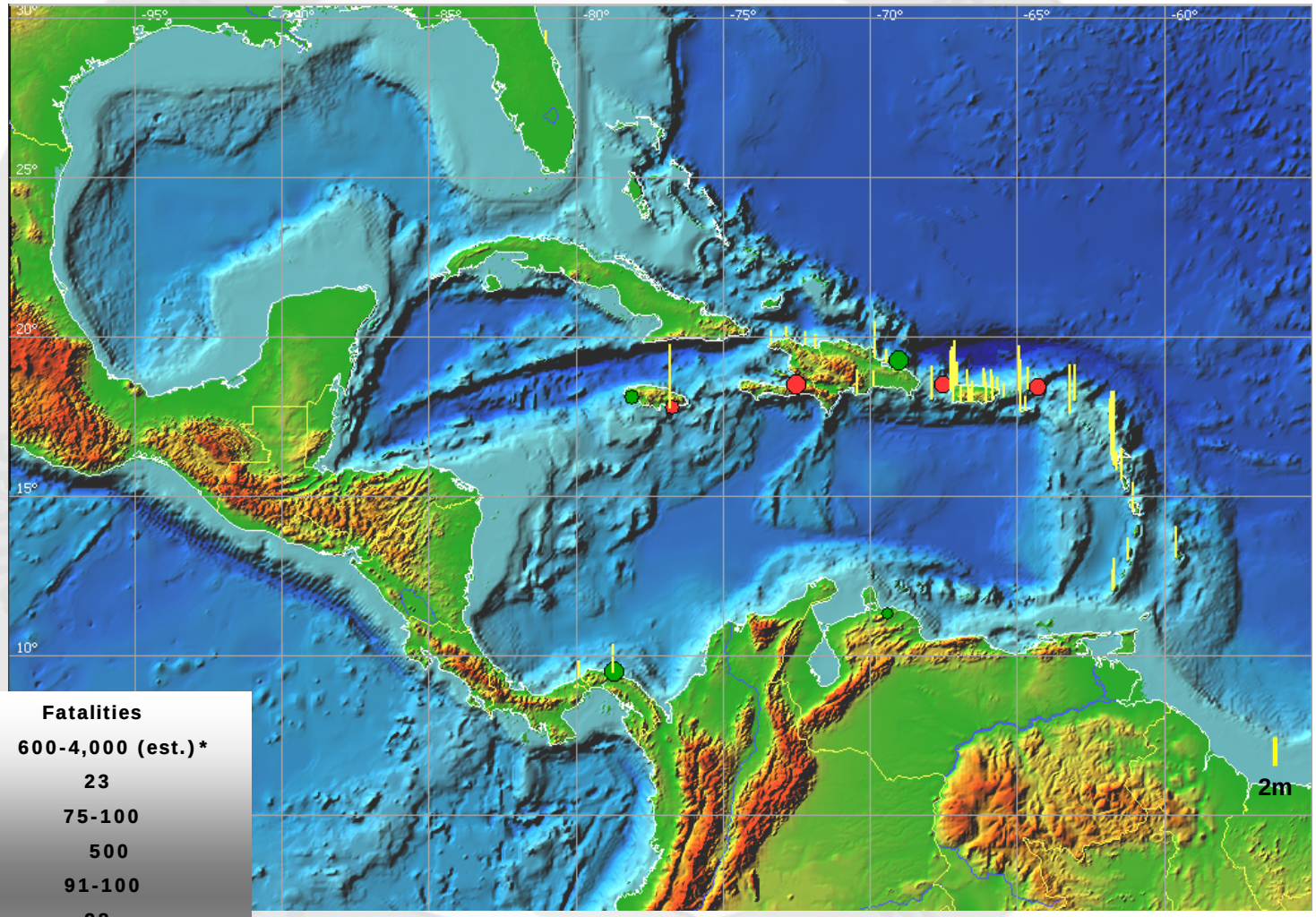


NOAA Tsunami Catalogue



Date	Place	Fatalities
1853	Venezuela	600-4,000 (est.)*
1867	Virgin Islands	23
1882	Panama	75-100
1907	Jamaica	500
1918	Puerto Rico	91-100
1929	Canada	28
1946	Dominican Republic	1,790; 75
1991	Costa Rica	2
		2,584 TOTAL

*not included

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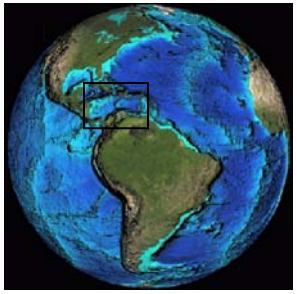
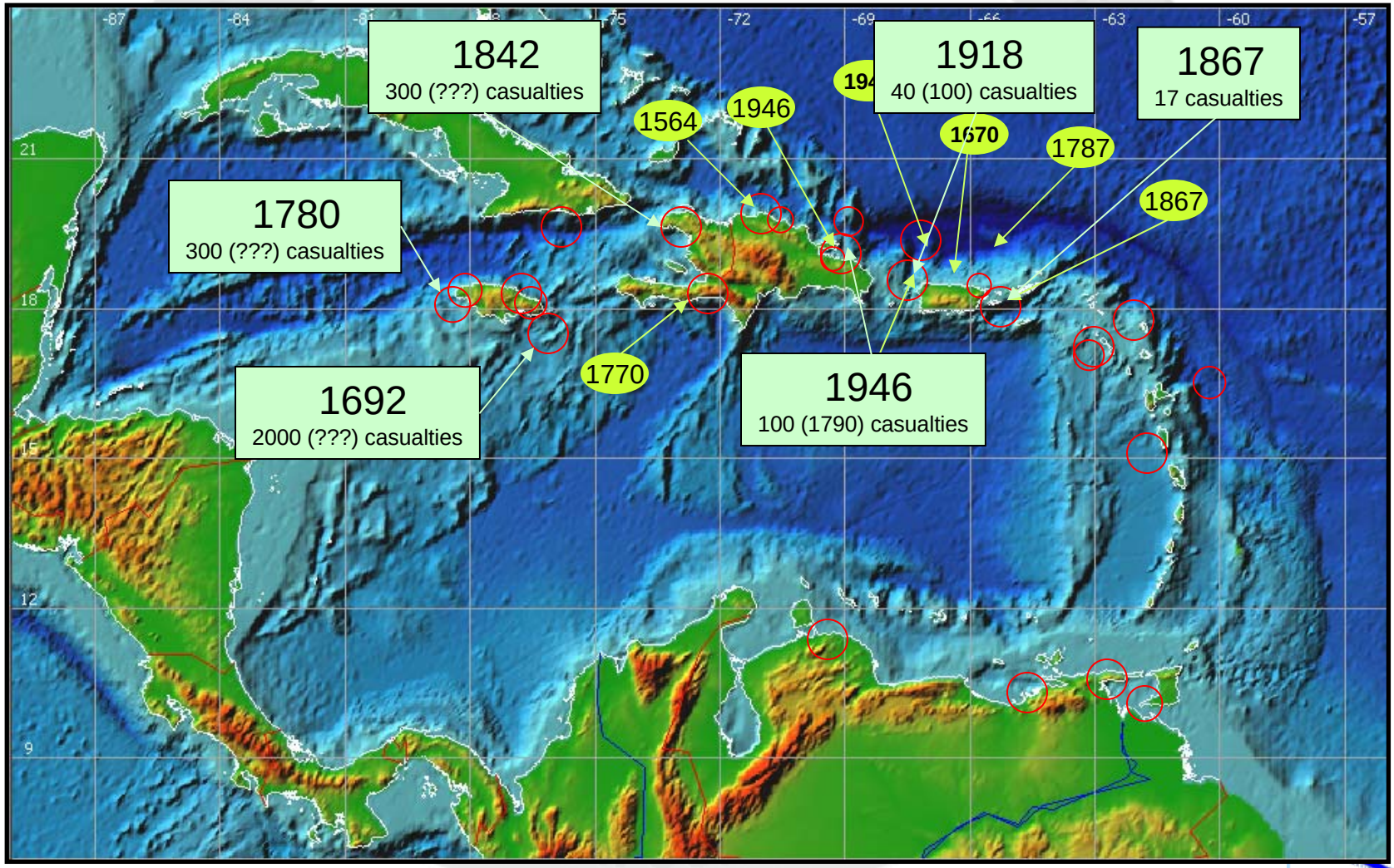


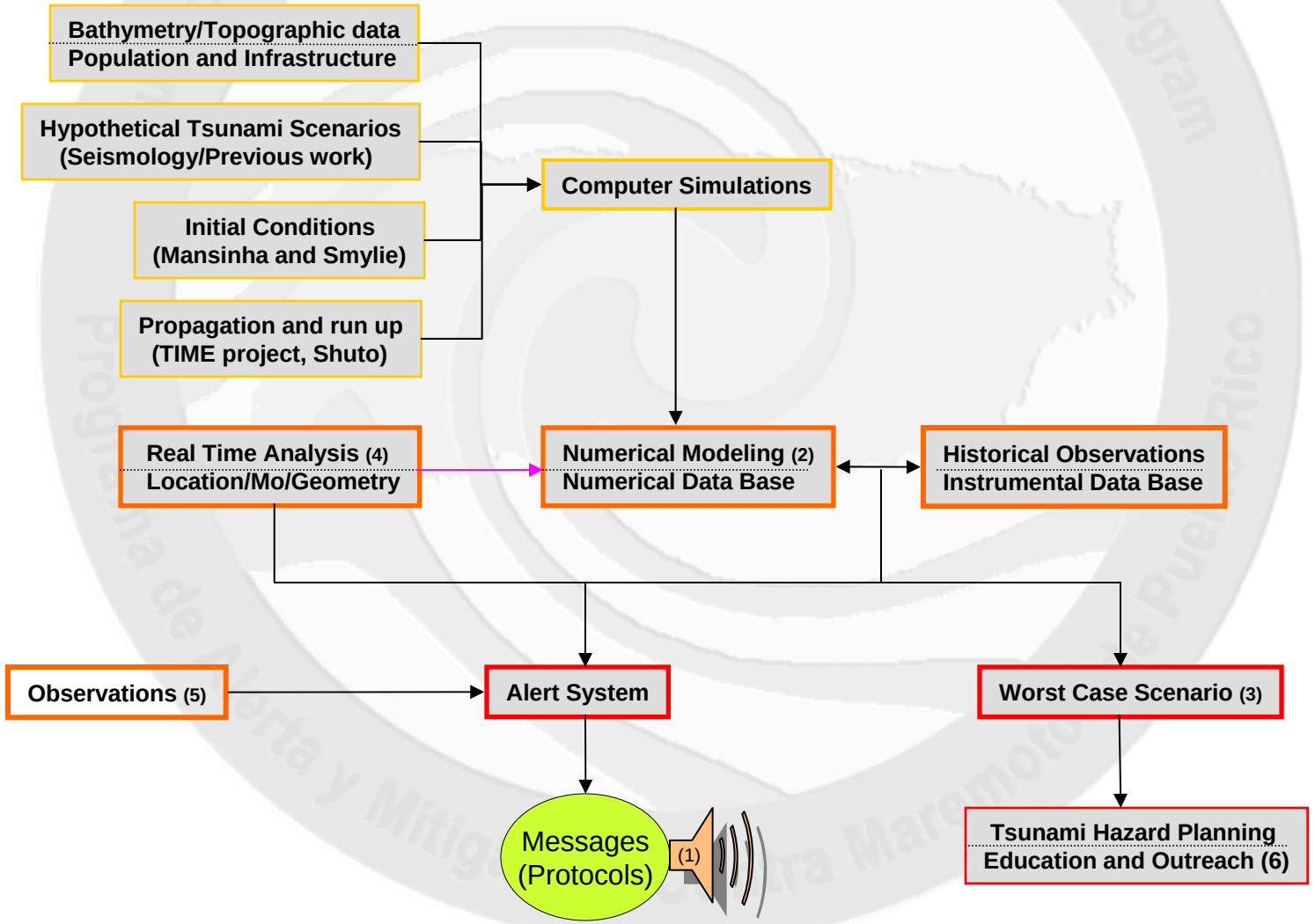
NORTHEASTERN CARIBBEAN HISTORY



The PR-TWS Schema

Saving lives and property depends on how well the community is prepared

AEIC



RECOMENDATIONS

TsunamiReady
NATIONAL WEATHER SERVICE

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