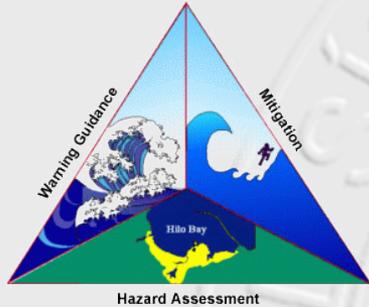


NATIONAL TSUNAMI HAZARD AND MITIGATION PROGRAM - NTHMP

PUERTO RICO REPORT



**Four Year Grant:
NA09NWS4670024
(Non cost extension)**

Victor Huérfano¹ and Wilfredo Ramos²

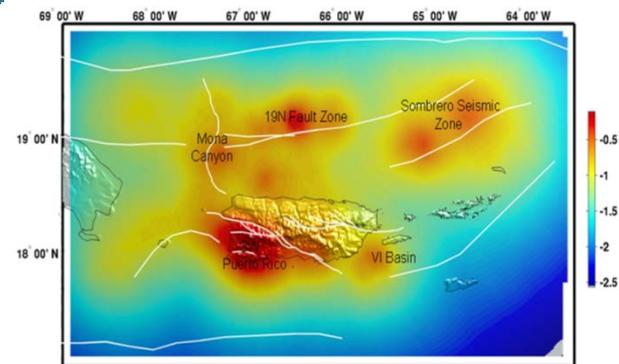
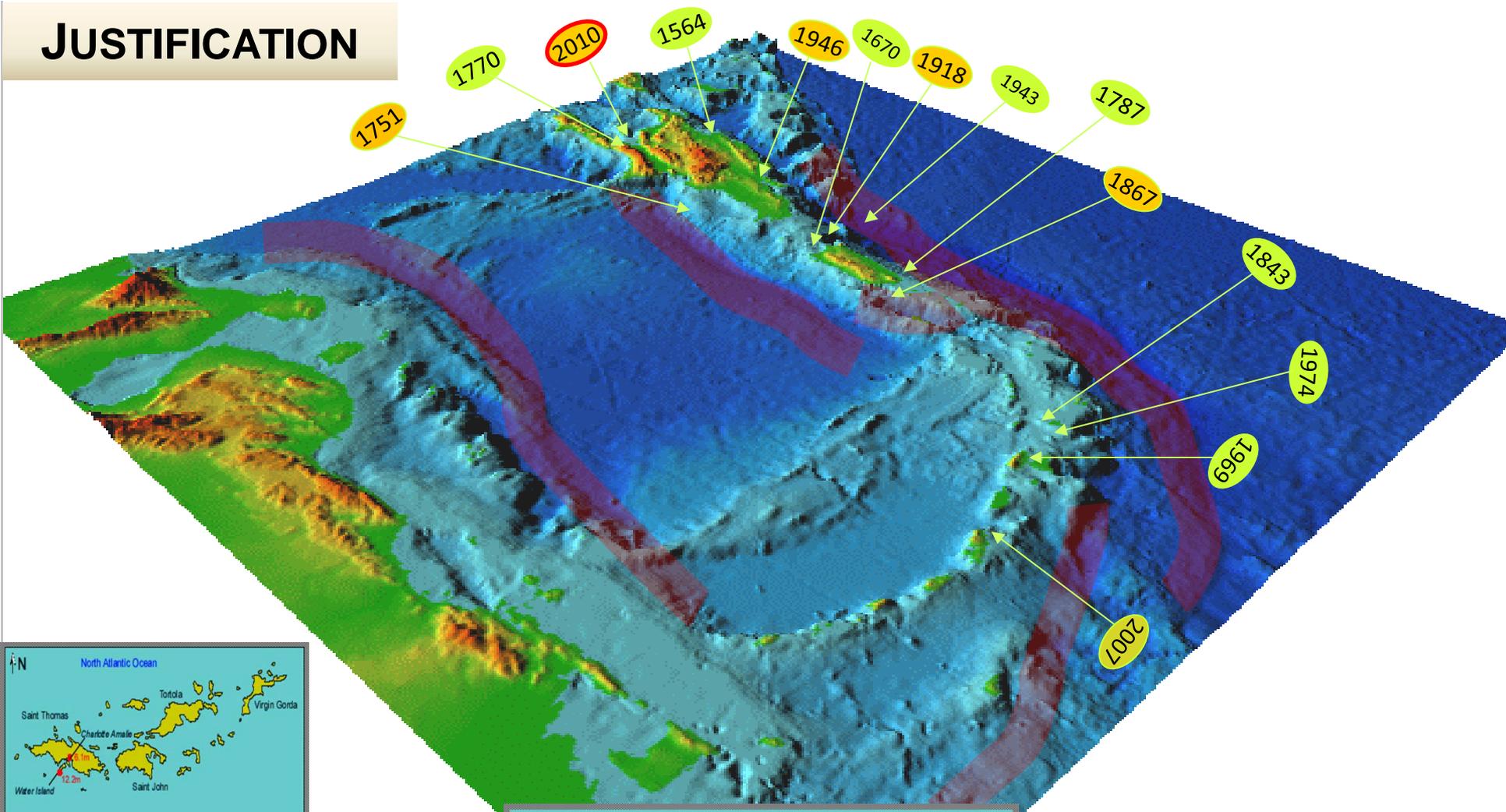
**¹PUERTO RICO SEISMIC NETWORK, UNIVERSITY
OF PUERTO RICO, MAYAGUEZ
GEOLOGY DEPARTMENT**

²PR SEMA

Menlo Park, CA, January / 2014

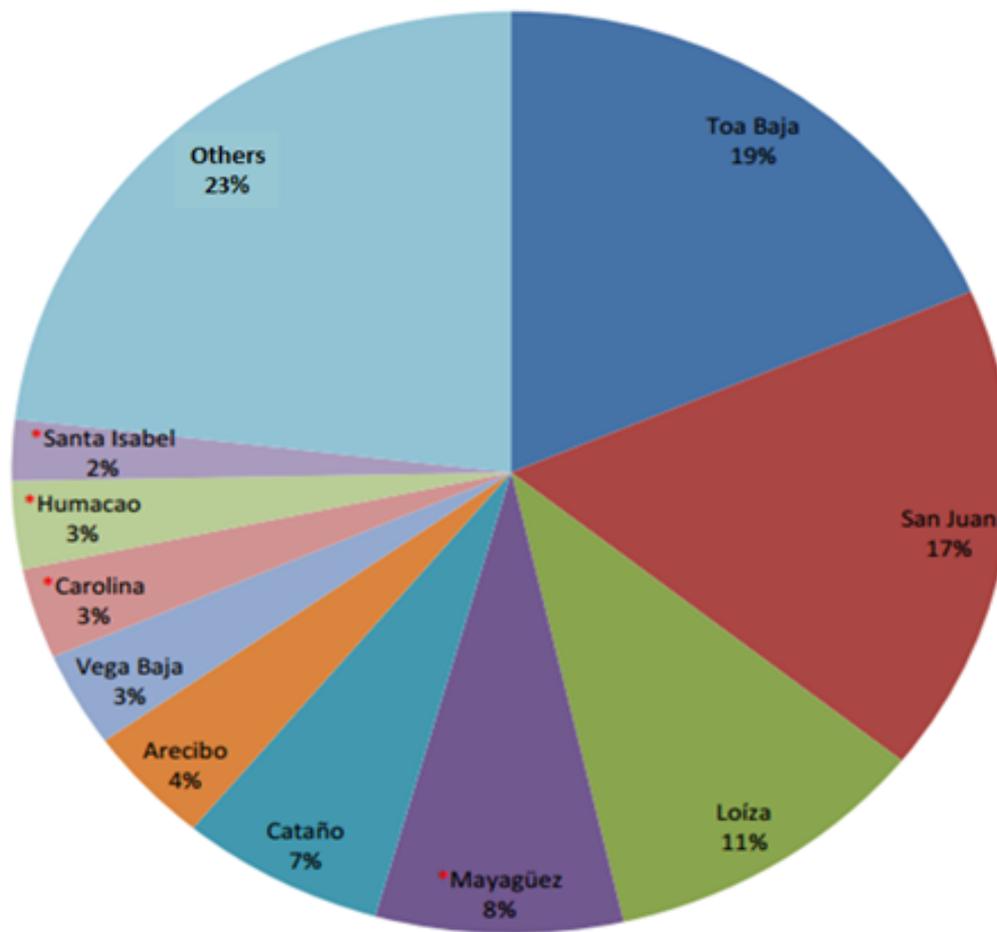


JUSTIFICATION



Vulnerability: Top 10 Tsunami Exposed Municipalities

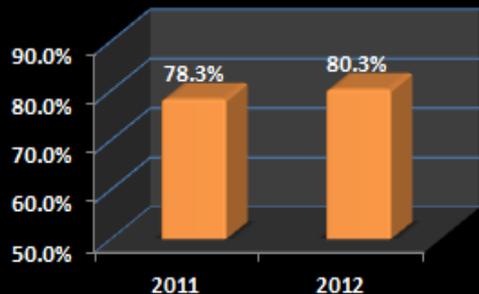
Percent of Exposed Population in Puerto Rico, top ten municipalities



Total Population in tsunami evacuation zone: 216,916
Census 2010

* Mapping model of 2002.

Occupancy % July 2012



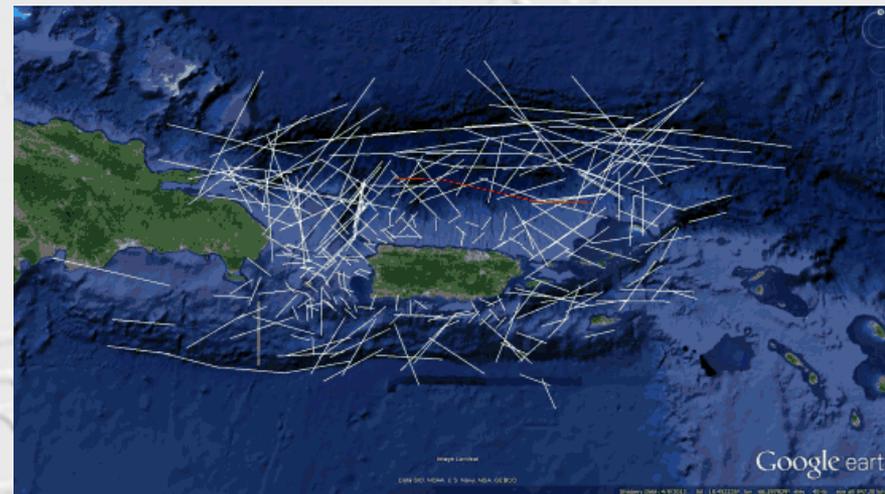
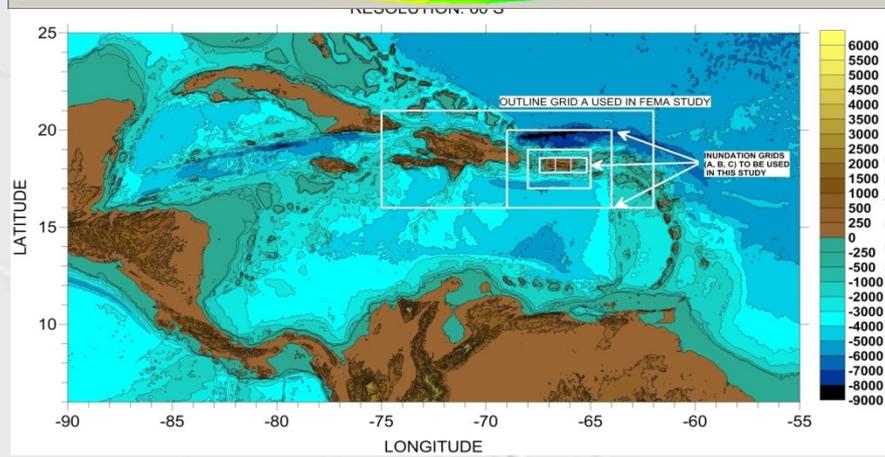
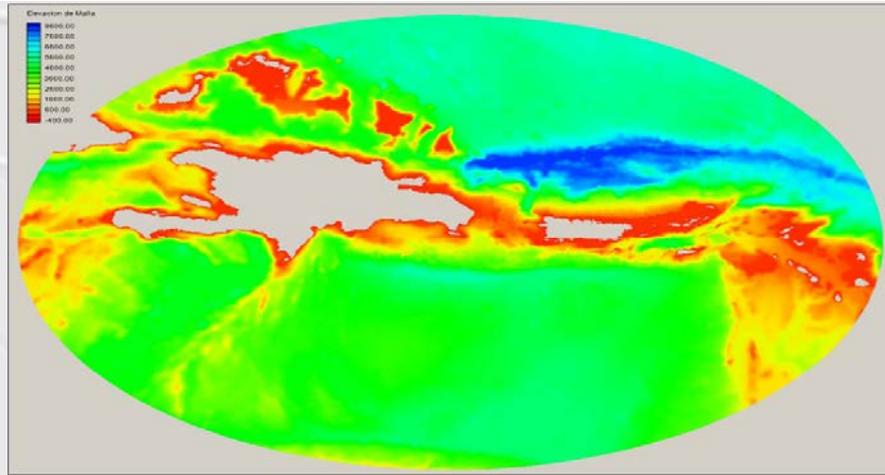


NTHMP PUERTO RICO GRANT ITEMS

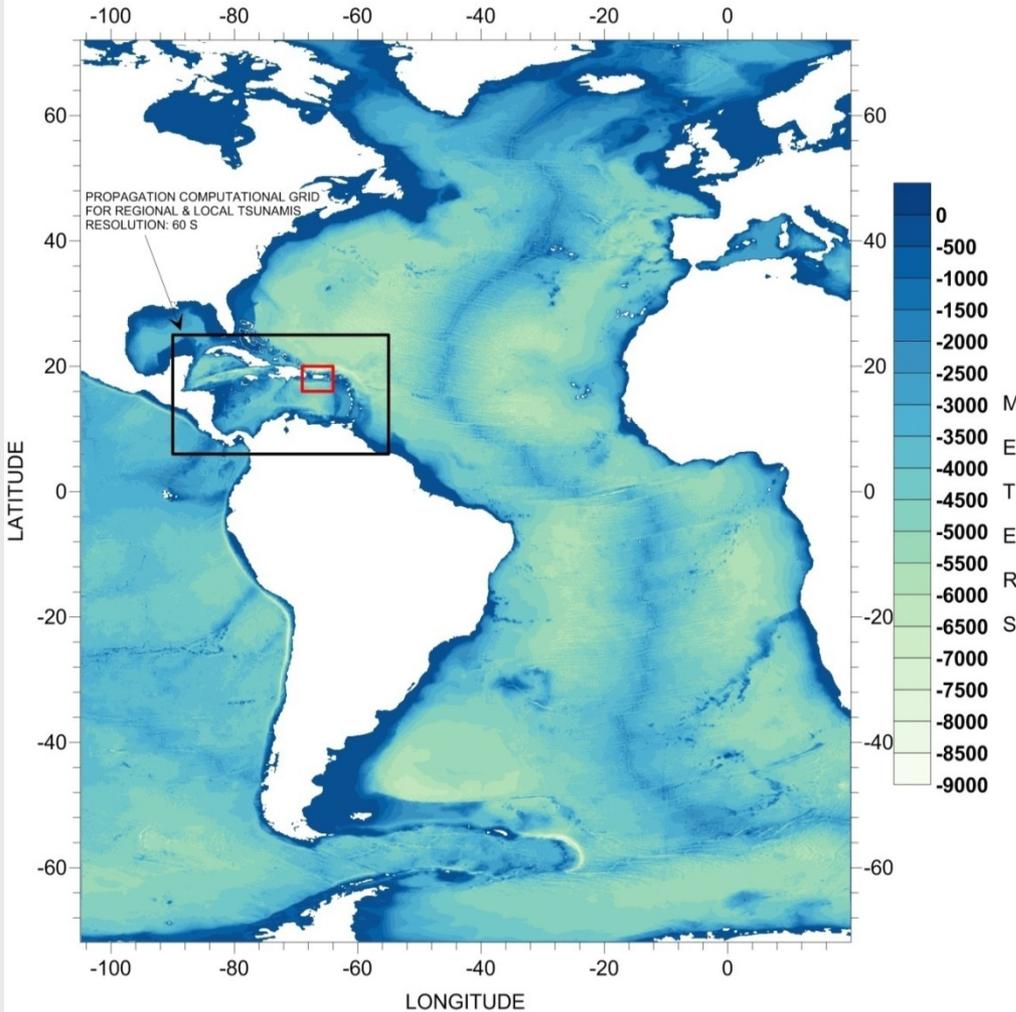
- ✓ 1. Full Participation of Puerto Rico in NTHMP, and **regional** activities.
- ✓ Regenerate tsunami inundation maps for Puerto Rico including local faults, landslides, regional and teleseismic sources. NGDC new DEM's must be used.
- ✓ 3. Improve the understanding of communities, emergency managers and operators of critical facilities in Puerto Rico to tsunami hazards, their associated risks and level of preparedness.
- ✓ 4. Improve planning, zoning, permitting and engineering practices to support tsunami resilient best practices.
- ✓ 5. Prepare and distribute tsunami evacuation maps for all tsunami threatened communities.
- ✓ 6. Increase and improve awareness of the tsunami hazard and appropriate response by people at risk in Puerto Rico.
- ✓ 7. Improve the capability of Puerto Rico to have reliable TWC product reception and the capability to distribute the message to those at risk.
- ✓ 8. The TsunamiReady Component: Maintain and strengthen the TR program in Puerto Rico

ITEM 2 (MMS)

Task 2.1 Re-determine maximum of maximum tsunami inundation limits for all of Puerto Rico from local sources.

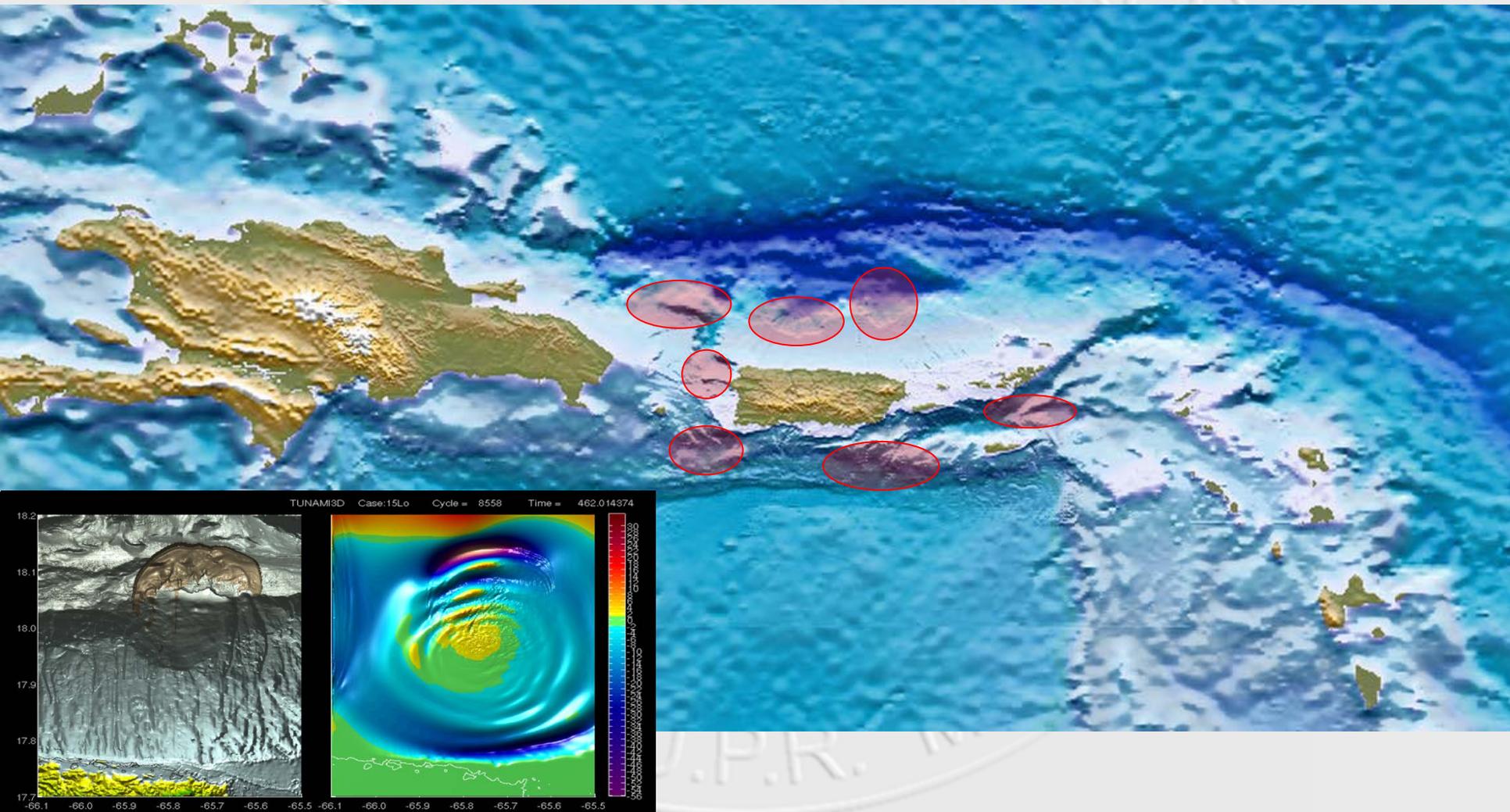


PROPAGATION COMPUTATIONAL GRID FOR FAR-FIELD TSUNAMIS
RESOLUTION: 4 MIN



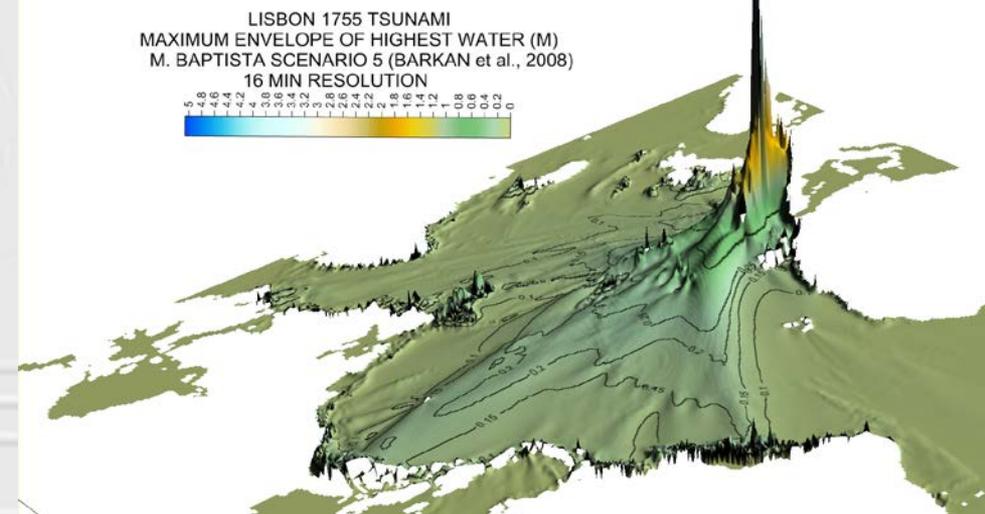
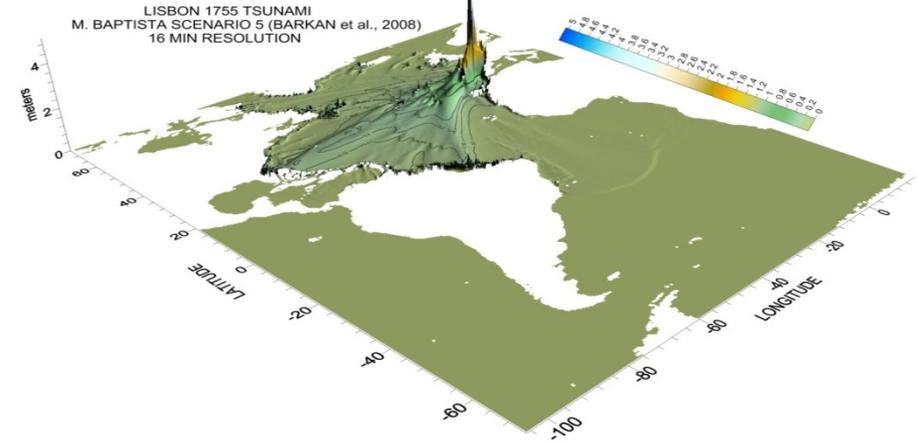
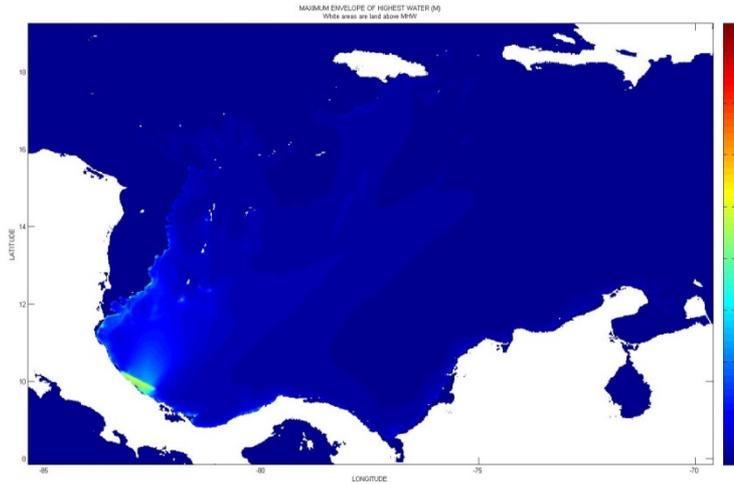
ITEM 2

Task 2.2 Run tsunami inundation models for local landslide sources affecting Puerto Rico, especially along the Puerto Rico Trench.



ITEM 2

Task 2.3 Run tsunami inundation models for regional and teleseismic sources affecting Puerto Rico.



ITEM 2

Task 2.4 Generate worst case composite scenario tsunami inundation maps for Puerto Rico.



- Pilot study in the San Juan port
- Currents

ITEM 3

Task 3.1 Empower communities and their emergency managers to prepare and strengthen their tsunami and emergency response plans

- 38 (44) municipalities have already approved tsunami response plans,
- 6 municipalities to be approved
- **State laws to require mandatory plans.**
- **Tsunami Technical Review Committee (2 meetings)**
- **State Tsunami Preparedness week proclamation**

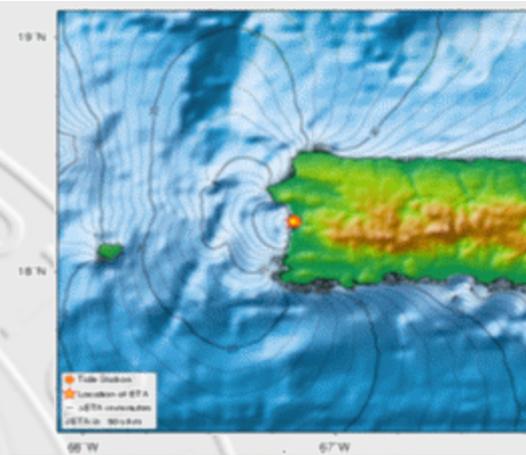
Task 3.2. Facilitate the inclusion of tsunamis in critical facilities' emergency response plans (EPA).

	A	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY
	Facilities	Peñuelas		Ponce		Quebradillas		Rincón		Río Grande		Salinas		San Juan		Santa Isabel	
		Total	Tsunami	Total	Tsunami	Total	Tsunami	Total	Tsunami	Total	Tsunami	Total	Tsunami	Total	Tsunami	Total	Tsunami
3	Dam					1	0										
4	Regional Emergency Operation Centers (EOC)			1	0									1	0		
5	Policía Police Station	1	0	2	0	1	0	1	0	2	0			5	1	1	0
6	Airports			1	0									1	0		
7	Shelters	4	0	16	0	3	0	1	0	7	0	5	0	21	0	2	0
8	Sub Power Plants			2	0									7	0		
9	Water Sources	4	0	3	0	1	0			6	0						
10	Water Filtration Plants	2	0			1	0	1	0	6	0	1	0	1	0	1	0
11	Hospitals	1	0	20	1	1	0	1	0					61	1	1	0
12	Wastewater Treatment Plants	2	0	8	0	1	0			3	0						
13	Main Power Plants											1	0	1	0		
14	Governmental Complex													3	0		

ITEM 4

Task 4.1 Engage planners, building and permitting officials and engineers to support tsunami resilient best practices.

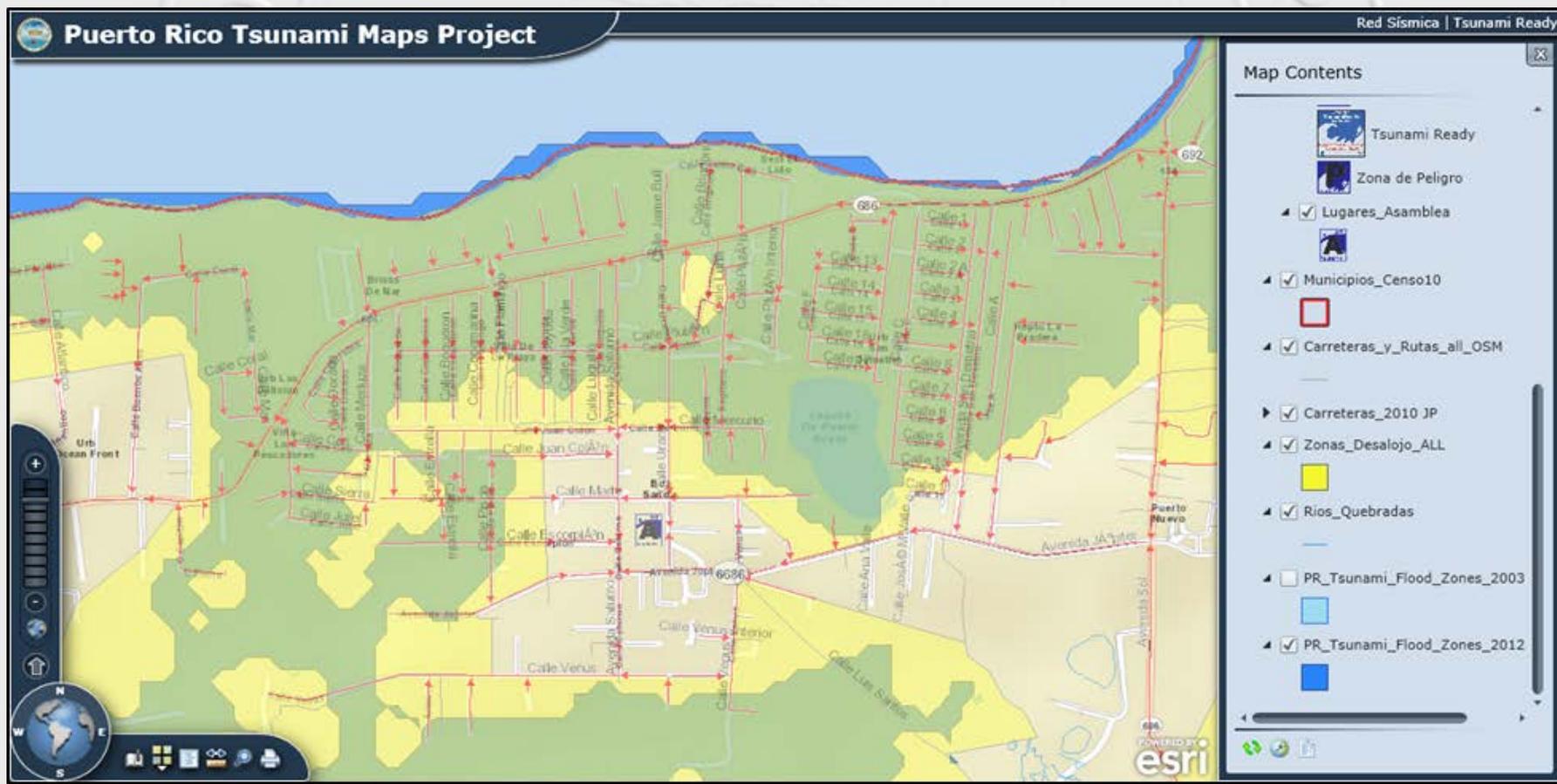
- “Puerto Rico Tsunami Resilient Planning and Construction Practices Workshop” summer 2012, Vertical Evacuation.



ITEM 5

Task 5.1 Development, printing and distribution of GIS based bilingual Spanish/English evacuation maps for all 44 tsunami threatened municipalities.

- 41 approved and 3 in process
- On line / **App**
- 2000/Map hard copies
- **Google overlays**



ITEM 6

Task 6.1 Organize and participate in educational events throughout Puerto Rico at schools, local, state and federal government agencies, faith based organizations, industry, among others.



**Direct people impacted:
250000+**

**Conferences:
1000+**

**Interviews:
250+**

**Webinars:
5+**

**PR Tsunami Curriculum,
Media kit, TDST.**

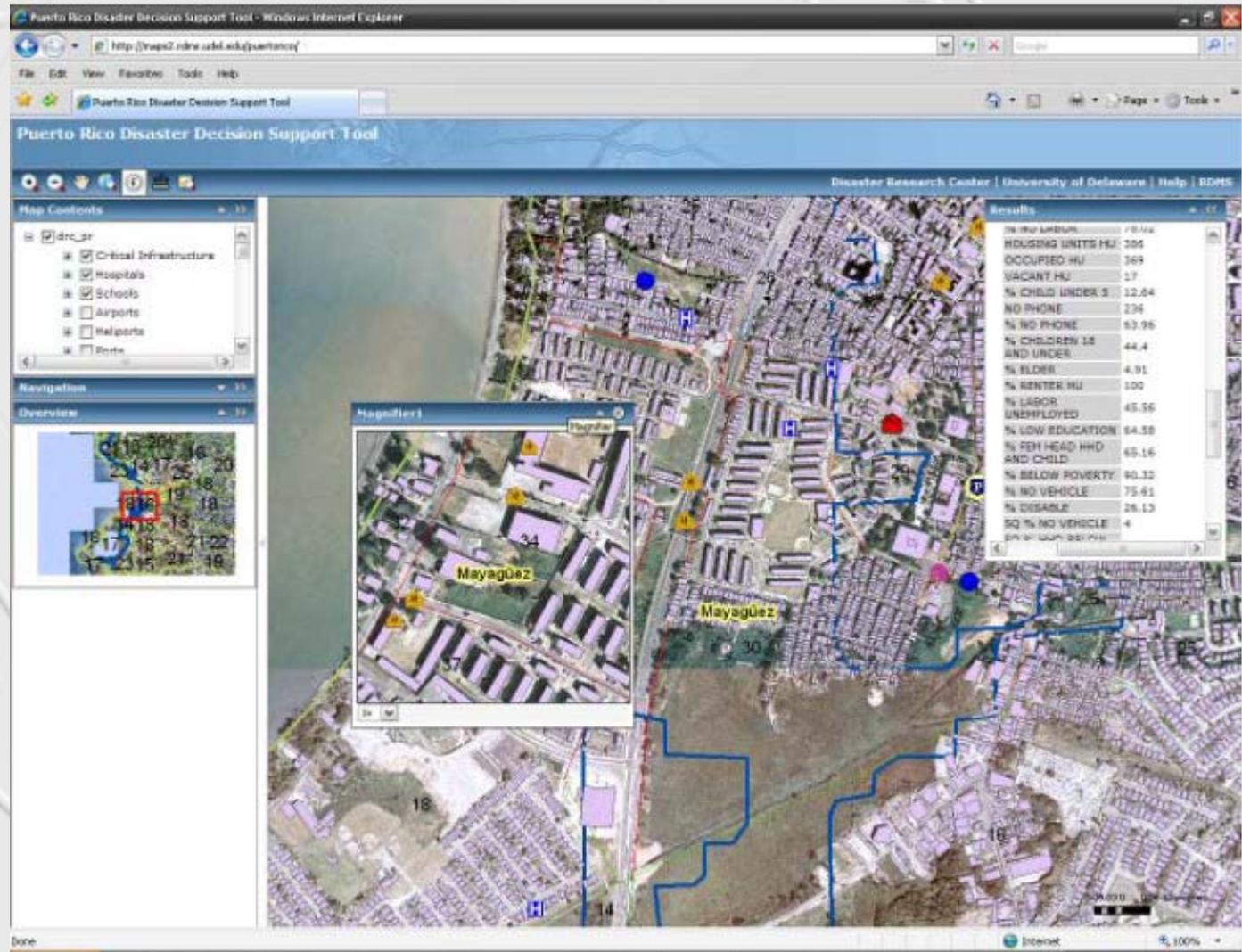
**Flyers, Brochures, DVD's,
Cartoon Booklets, mugs,
Coloring booklets, pens,
Stickers, pencils,
Back packs, Emergency kits**

PRSN + PRSEMA + FEMA

ITEM 6

Task 6.2. Conduct an annual full day workshop for emergency managers on the Disaster Decision Support Tool for PR.

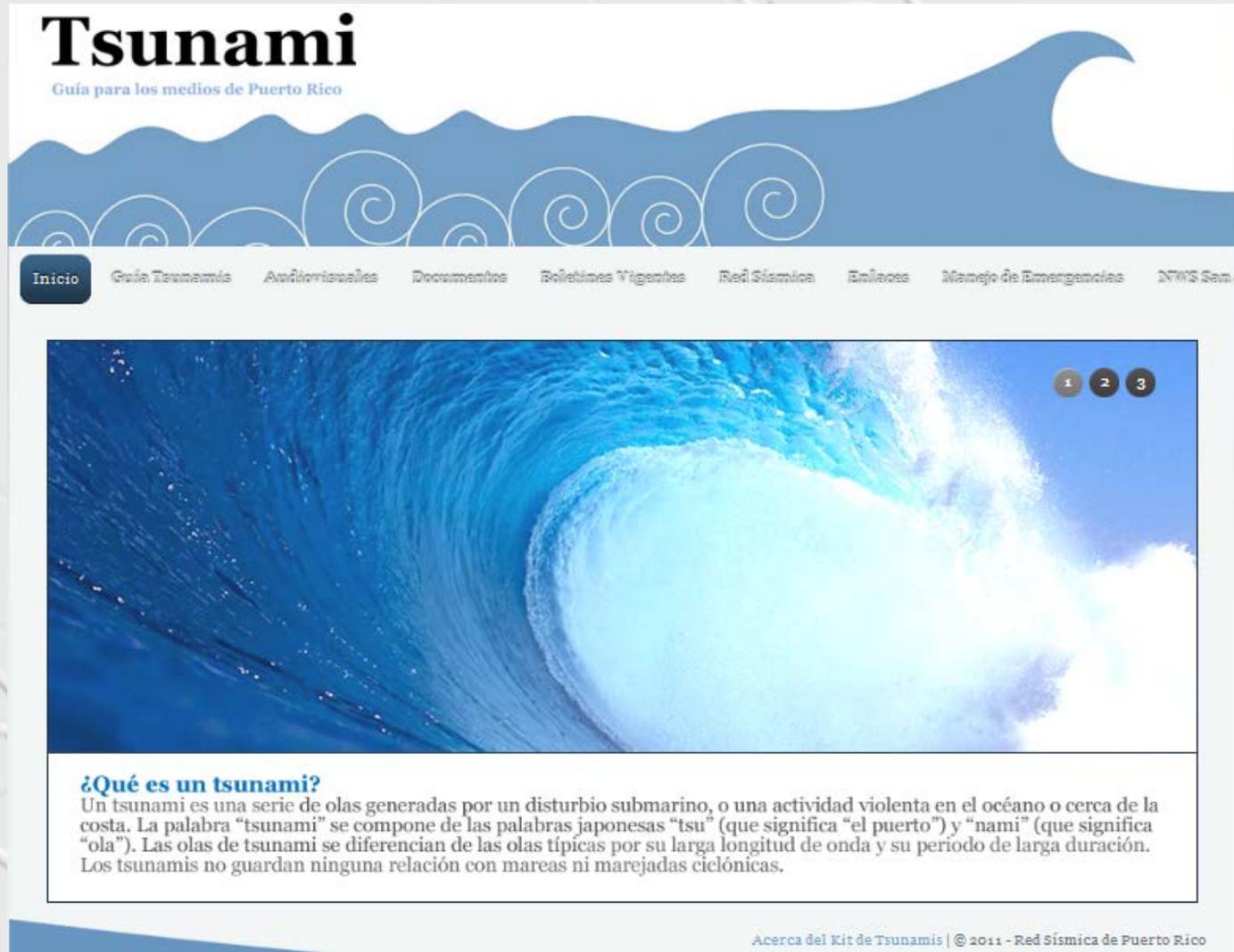
- Spanish manual
- Summer training
- Summers



ITEM 6

Task 6.3. Development, reproduction, presentation and distribution of PR tsunami media toolkit in print, electronic and place on line.

- V1.0
- V1.5
- V2.0
- Four workshops
- App
- English version



Tsunami

Guía para los medios de Puerto Rico

Inicio Guía Tsunamiis Audiovisuales Documentos Boletines Vigentes Red Sísmica Enlaces Manejo de Emergencias D70S San



1 2 3

¿Qué es un tsunami?

Un tsunami es una serie de olas generadas por un disturbio submarino, o una actividad violenta en el océano o cerca de la costa. La palabra "tsunami" se compone de las palabras japonesas "tsu" (que significa "el puerto") y "nami" (que significa "ola"). Las olas de tsunami se diferencian de las olas típicas por su larga longitud de onda y su periodo de larga duración. Los tsunamis no guardan ninguna relación con mareas ni marejadas ciclónicas.

Acerca del Kit de Tsunamiis | © 2011 - Red Sísmica de Puerto Rico

ITEM 6

Task 6.4. Conduct an island wide survey of tsunami preparedness.

- Two Island wide public survey
- Pre/Post Latex Surveys

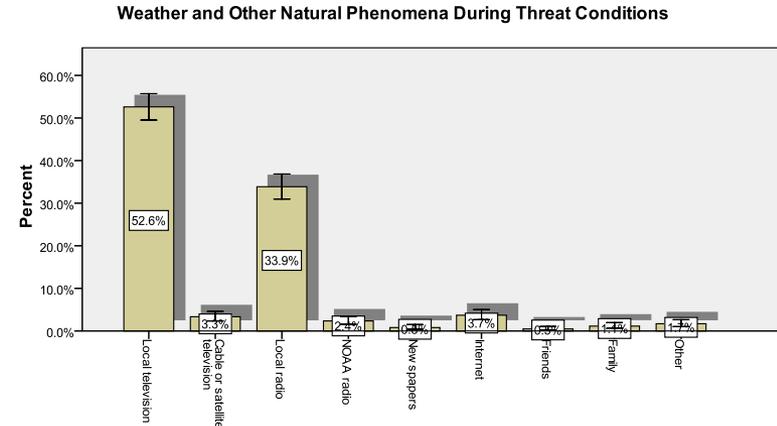
➤ TR efforts appear to have been largely successful in terms of communicating knowledge about tsunami risks to the exposed population of PR.

● However, findings suggest that more direct efforts to contact and inform the public within the exposed area by distributing maps and brochures and placing tsunami signage are at least somewhat effective in increasing public knowledge about the tsunami threat.

● The LANTEX exercise itself had an effect on knowledge. However, this effect seems to decay rapidly with the passage of time.

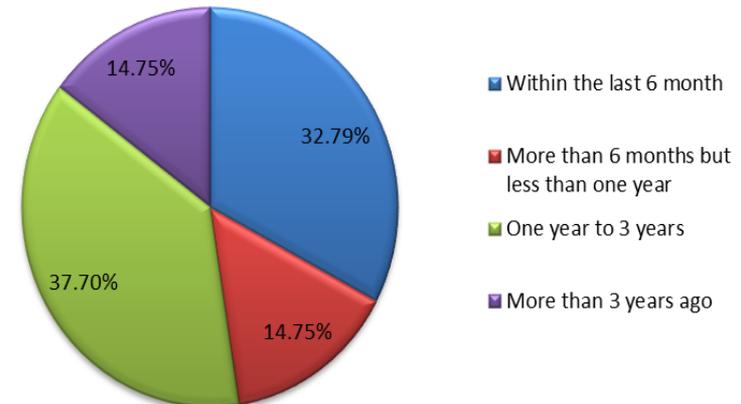
● However, as to be expected from the literature on the topic, though respondents who recall receiving information are better informed, this knowledge does not necessarily translate into substantially increased preparedness for a tsunami event.

Most Trusted Source of Information on



15. Of those you mentioned, which do you most trust if you are under threat from...
n=1,000 (weighted)

Error bars: 95% CI



ITEM 7

Task 7.1 Maintain and improve protocol for the participation of Puerto Rico in monthly communication tests of the Tsunami Warning and create awareness of tsunami protocol for Puerto Rico.

- PR Tsunami Warning Points
- **State Protocol**

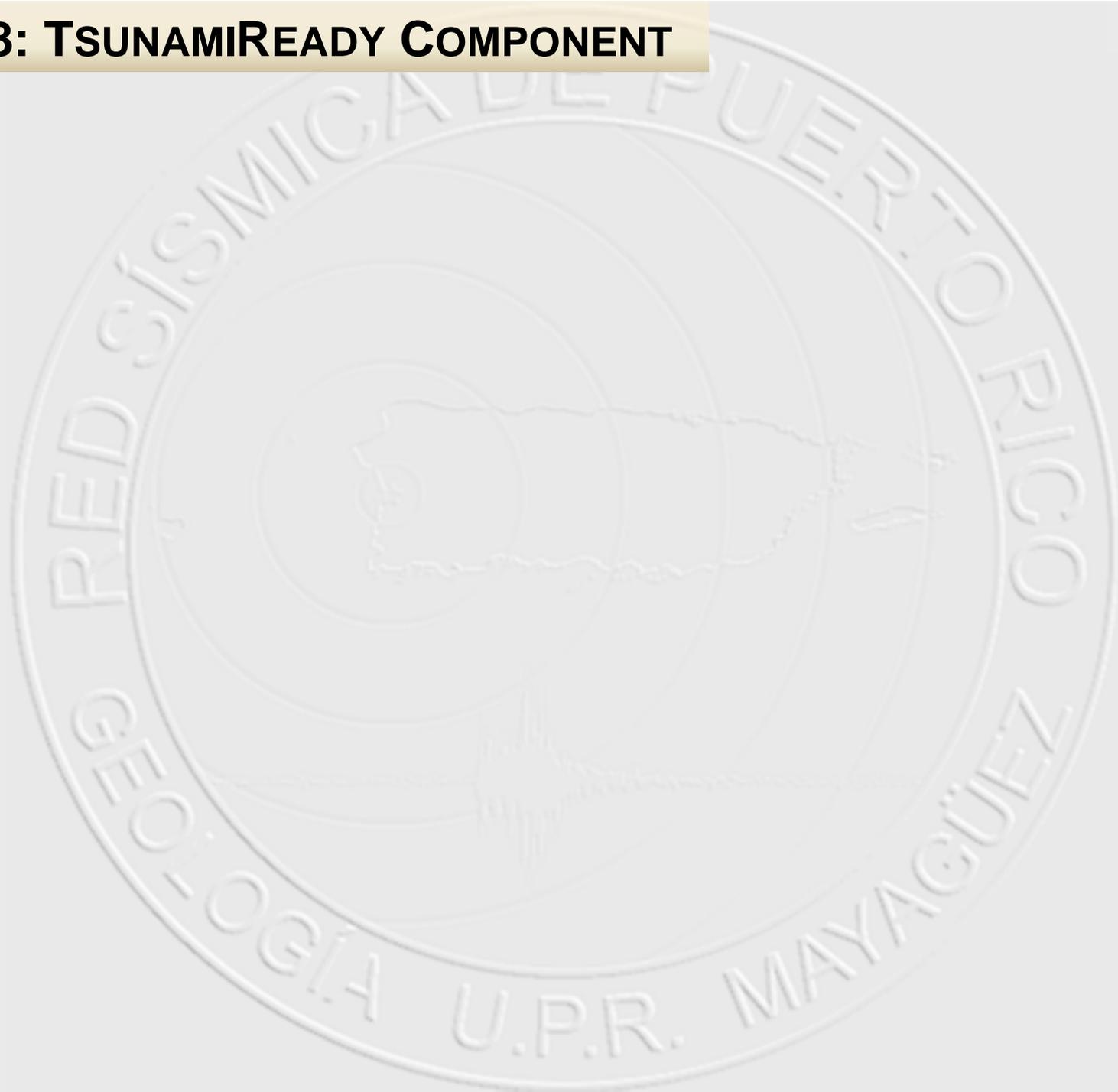
Task 7.2. Participate in annual end to end communication tests. Organize/participate/conduct state and local planning meetings/activities, table top and full scale exercises as part of the NTHMP communication test and other local tests.

- LANTEX/Caribe Wave
- TOPPOF (Earthquake/Tsunami Top Officials Exercise)
- Local EAS/**CMAS/IPAWS** exercise
- Vigilant Guard Exercise
- FEMA Catastrophic
- The Great Puerto Rico ShakeOut (October, 2013)
- PORT, National Parks and Tourist Authority,
- IOC/UNESCO

Task 7.3 Maintain and improve local tsunami warning and reception capabilities.

- 71 all hazard Sirens (DHS)
- 50 EMWIN Systems Installed or in process
- PRSN EMWIN Workshops
- 1000+ NOAA Radios
- EMNet + CAP, SMS, RSS
- 5 PRSN BroadCast Systems and EWS.

ITEM 8: TSUNAMI READY COMPONENT



ITEM 8: TSUNAMI READY COMPONENT

Task 8.2. Organize and Convene Puerto Rico first Tsunami Ready Summit with participation local, national and Caribbean stakeholders (May 2010, Mayaguez).

