

Feedback and Recommendations

ASTARTE Final Meeting

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Mallorca



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Achievements of ASTARTE

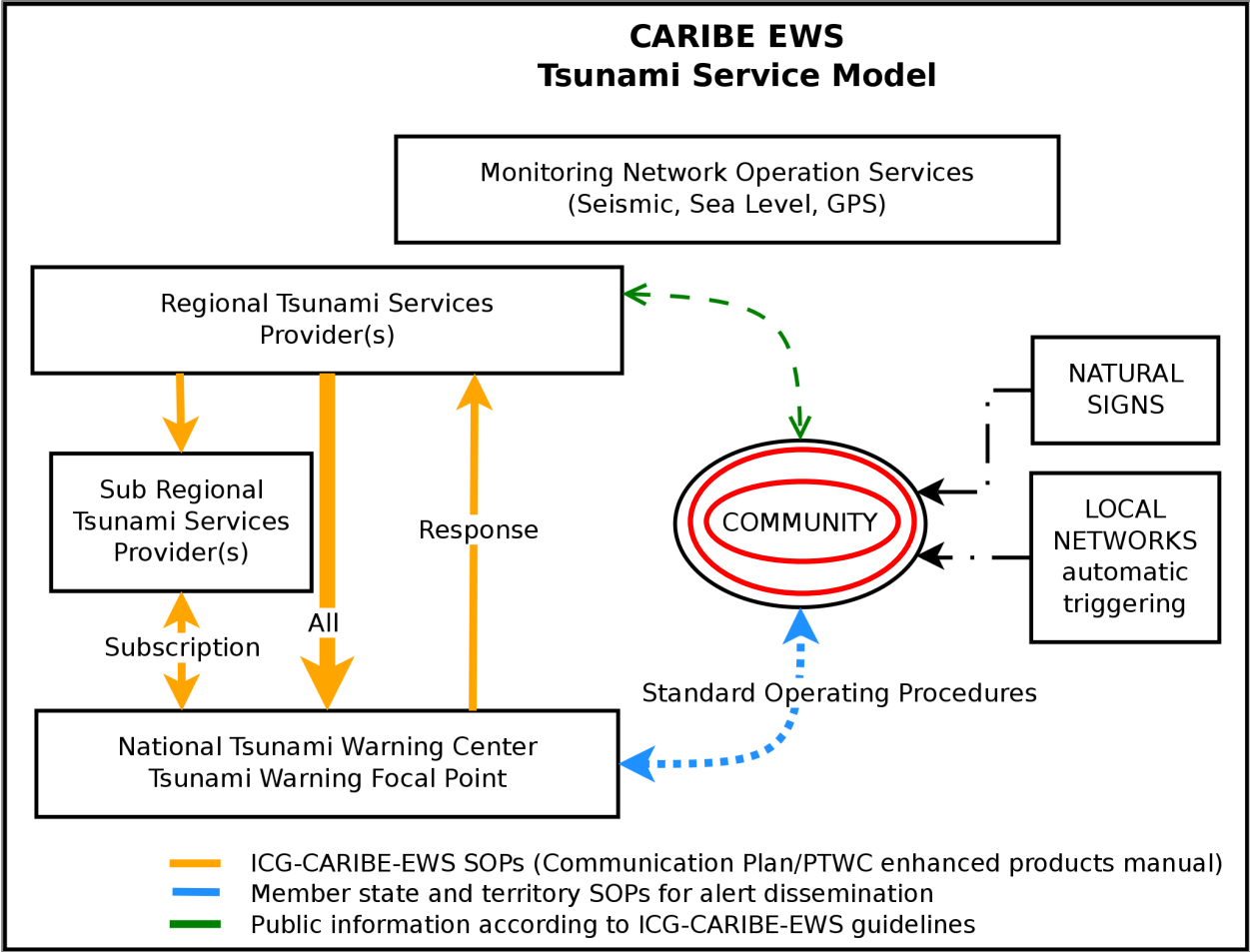
- ASTARTE has improved the knowledge of tsunamis and recurrence in the region and supports the enhancement of this knowledge through the establishment of databases. It is important to note that this understanding extends beyond the traditional earthquake generated tsunamis, but those of volcanic and landslide origin.
- Through ASTARTE there has been an advancement of numerical techniques and experimental data for tsunami simulation
- Through ASTARTE important data have been acquired to facilitate the assessment of hazard, vulnerability, and risk.
- The evaluation of codes and review of observational data can facilitate enhancements of forecasts and warnings by the Tsunami Service Providers and National Tsunami Warning Centers.
- Consideration has been given to the establishment of guidelines for decision makers to increase sustainability and resilience of coastal communities.
- The findings and advancement have the potential to foster tsunami ready and resilient communities.

Additional Comments

- The level of detail of the research and studies conducted in all WP is impressive, important for creating a level of confidence in the end users
- The integration of students and Early Career Scientists facilitates continuity ASTARTE and more innovations
- The expertise and interest developed can lead to enhancements of warning system beyond the ASTARTE program
- Transfer of knowledge and collaboration between work packages was important to optimize the resources available
- Resilience is more than just getting ready, ASTARTE assessments and tools provide a foundation to reduce vulnerability and increase resilience.

Foster tsunami resilient communities

Survival is Key



What does the Community want to know?

- Can a tsunami really happen?
- If it happens, what areas will be flooded, what will be impacted?
- Where do I need to go?
- Who and how will I be warned?

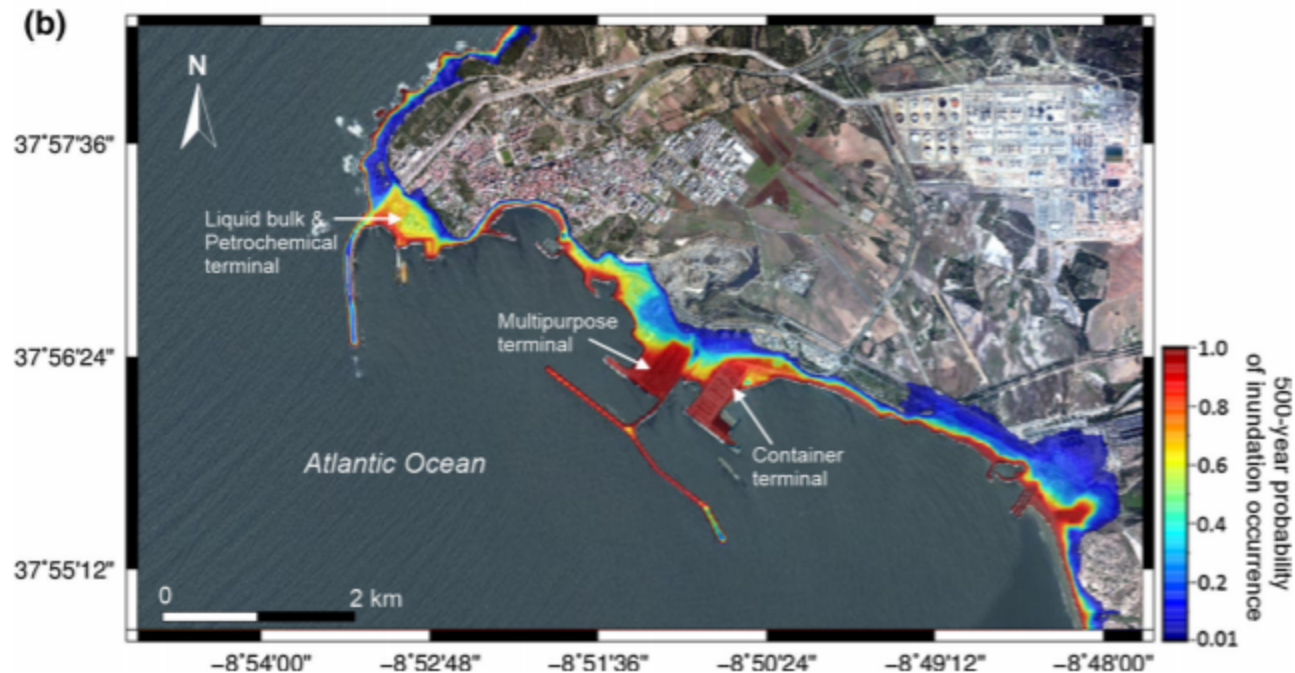
What does it take for a Community to be Ready for a Tsunami?

More and more coastal communities are realizing that they need to take specific actions to protect their lives and livelihoods from tsunamis. In the Caribbean, and more recently in the Pacific and Indian Ocean, voluntary UNESCO CARIBE EWS Tsunami Ready guidelines are being piloted. These guidelines, while focusing on the actions to save lives during a tsunami, can also lead to communities more resilient to tsunamis. Thru ASTARTE knowledge and tools have been developed that can underpin tsunami readiness in the NEAM region.

Categories
MITIGATION
Mit-1. Have designated and mapped tsunami hazard zones
Mit-2. Have a public display of tsunami information
PREPAREDNESS
Prep-1. Produce easily understood tsunami evacuation maps as determined to be appropriate by local authorities in collaboration with communities
Prep-2. Develop and distribute outreach and public education materials
Prep-3. Hold at least three outreach or educational activities <u>annually</u>
Prep-4. Conduct an annual tsunami community exercise
RESPONSE
Resp-1. Address tsunami hazards in the community's emergency operations plan (EOP)
Resp-2. Commit to supporting the emergency operations center (EOC) during a tsunami incident if an EOC is opened and activated
Resp-3. Have redundant and reliable means for a 24-hour warning point (and EOC if activated) <u>to receive</u> official tsunami threats
Resp-4. Have redundant and reliable means for 24-hour warning point and/or EOC <u>to disseminate</u> official tsunami alerts to the public

1. Define Tsunami Hazard Zone

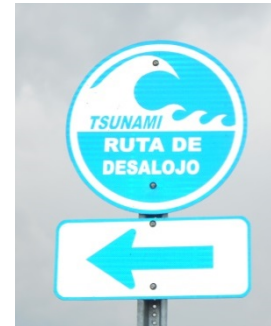
- Sources
 - Seismic
 - Volcanic
 - Landslides
- Methods
 - SPTHA
 - SBTHA
- DEM/DTM
- Tsunami Models
 - Probabilistic
 - Deterministic



Sines, Portugal, PTHA from Omira, Baptista and Matias, 2016

ASTARTE WP 2, 3, 5, 8, 9 and 10

2. Signs



3. Tsunami Evacuation Maps and Guidance...



- Run to a high place, away from the shore.
- Go to a fourth floor or higher in a sturdy building (that has survived the earthquake)



ASTARTE WP 8 and 9

Boating and Maritime Community

US Maritime Guidance - DRAFT

TABLE 1: Specific regional guidance for minimum offshore safe depths for maritime vessel evacuation prior to the arrival of tsunamis.

State/Territory	Distant Source (ships in harbor)*	Local Source (ships at sea)*	Notes on this Update
California	30 fathoms	100 fathoms	Evaluated; evaluating potential safe areas within large bays and ports
Oregon	30 fathoms	100 fathoms	Evaluated; also evaluating Columbia River
Alaska	30 fathoms	100 fathoms	Evaluated; ships should be at least 1/2 mile from shore for all scenarios
Washington	30 fathoms	100 fathoms	Evaluated; evaluating special conditions exist inside Puget Sound
Hawaii	50 fathoms	50 fathoms	Evaluated; implemented in Coast Guard response plans at some locations
American Samoa	50 fathoms	50 fathoms	Evaluating, guidance from others
Puerto Rico	50 fathoms	100 fathoms	Evaluated
USVI	50 fathoms	100 fathoms	Evaluating; possibly follow PR
Guam	50 fathoms	100 fathoms	Coordinated with USCG Guam Sector
CNMI	50 fathoms	100 fathoms	Coordinated with USCG Guam Sector
Gulf Coast States		100 fathoms	Evaluating; issues with long, shallow shelf complicate getting beyond safe depth
East Coast States		100 fathoms	Evaluating; issues with long, shallow shelf complicate getting beyond safe depth

* Ships also recommended to be a minimum of 1/2 mile from shore or fringing reef

**ASTARTE
WP 2, 3, 5
and 8**

4/5. Public Education and Outreach Materials

TSUNAMI SAFETY RULES

- ALWAYS BE PREPARED, A TSUNAMI MAY OCCUR ANY TIME**
 - Prepare a family emergency plan
 - Practice a family meeting procedure and first aid kit
 - Identify major roads, secondary routes, designated evacuation routes or the general way to reach higher ground quickly with the least amount of time
- IN CASE OF AN EARTHQUAKE, PROTECT YOURSELF**
 - Drop
 - Cover
 - Hold
- BEHOLD THESE SIGNS OR FEEL THESE WARNING SIGNS OCCUR AT THE COAST**
 - FEEL a wall strong or long earthquake 6 or more in length
 - FEEL a wall strong or long earthquake 6 or more in length
 - SEE a receding or surging of the ocean, beach and rocks
 - HEAR a change in sound coming from the sea, such as, bubbles, underwater air, emergency siren, etc.
- DO NOT LEAVE FROM HAZARDOUS AREAS (IN PRESENCE UNDER DEPENDENT OR YOUR LOCATION OR SITUATION)**
 - Stay away from the coast to an assembly point or higher ground
 - Stay in the best part of a building or higher ground
 - If you are in a car, avoid bridges, overpasses or tunnels
 - Do not return home
- STAY IN THE SAFE AREA UNTIL LOCAL AUTHORITIES INDICATE THAT THE DANGER HAS PASSED. THIS MAY TAKE MANY HOURS**

Coordinating Agencies: USMCM, Caribbean Tsunami Warning Program, Caribbean Sea Seismicity, AICM, Caribbean Seismological and Historical Tsunami Information Center

BE TSUNAMI SMART

WHEN AT THE BEACH, IF YOU

- FEEL STRONG SHAKING...**
- HEAR A STRANGE ROAR FROM THE SEA...**
- SEE CHANGES WITHIN AN EARTHQUAKE...**

...DON'T WAIT! RUN! TO HIGHER GROUND!

TSUNAMI SAFETY

A tsunami consists of a series of waves, when they reach the coast they can cause serious damage and also death. In Puerto Rico tsunamis are very infrequent but they have occurred in the past (1867, 1918, 1946) and could affect us again. For your safety, consider the following tips:

- Protect yourself** During an earthquake drop, cover and hold (if possible under a sturdy furniture). Take into account natural tsunami warning signs: when the shaking is so strong you can barely stand, see a drastic change in sea level, hear a loud noise from the sea and/or the official agency has issued a tsunami alert.
- Activate your emergency plan immediately.** Run inland away from the coast. If you do not have enough time to move out of the evacuation zone, go to the highest place you can find: the top floor of a building, the roof of a house, up a tree, etc. Getting out of harm's way should be your priority.
- Walk, don't drive.** There will be traffic jams and roads will be blocked.
- Stay outside of the evacuation zone.** Wait for the emergency officials to declare it is safe before returning to the evacuated areas. Stay tuned to local radio or TV.

Be prepared and enjoy your stay!

For more information:

Puerto Rico State Emergency Management Agency
787-724-0124 (San Juan) • <http://www.manedodeneemergencias.gobierno.pr>

Puerto Rico Seismic Network, UPRM • 787-833-8433 ext. 5452
787-265-5452 • <http://redosismica.uprm.edu>

National Weather Service (NOAA) • 787-253-4596 (San Juan)
787-832-4040 ext. 5787 (Mayaguez) • <http://www.tsunami.gov>

Mensajes Oficiales de Tsunami para Honduras

En Honduras Sí Ocurren Tsunamis

Alerta Roja

- Impacto de Tsunami Confirmado
- Monitorear en los puertos de reunión
- Seguir las instrucciones de los encargados de emergencias

Alerta Amarilla

- Peligro de Inundación!
- Si está en la zona de evacuación, salir del agua, playa, puertos marinos
- Estar en Observancia
- Seguir las instrucciones de los encargados de emergencias

Alerta Verde

- Possibles corrientes peligrosas
- Salir del agua, playa, puertos marinos
- Estar en Observancia
- Seguir las instrucciones de los encargados de emergencias

No hay peligro

- Estar atento a información oficial

Boletín Informativo

Para Más Información
Comisión Permanente de Geodinámica (COPRED)
<http://copred.gub.hn/>
y CCMH, Cadeha
En caso de Emergencia llamar 911

Alerta Personal Para Terremotos y Tsunamis LOCALES

Los Terremotos ocurren de forma súbita, y en el caso que sean cercanos y generen tsunamis, las olas pueden llegar antes que llegue una alerta oficial. Siga estas recomendaciones:

Uno de los tsunamis que afectó las costas hondureñas ocurrió el 4 de agosto de 1856. El mismo se generó en el Golfo de Honduras cerca de Belice y bañó toda la costa norte: Tela, La Ceiba, Trujillo y llegó hasta Gracias a Dios.

También se han registrado tsunamis en la parte sur, en el Golfo de Fonseca.

¿Qué es un Tsunami?

- Un tsunami es una serie de olas causada por una fuerte perturbación de un cuerpo de agua.
- Esas olas pueden llegar en unos minutos, pero continúan por horas. Las olas avanzan con todo lo que encuentran a su paso ya sea cuando inundan la costa o cuando retroceden.
- Los tsunamis pueden ser producidos por grandes terremotos localizados en la costa o en el fondo marino, un deslizamiento o una erupción volcánica.
- En Honduras se encuentran fuertes potenciales de tsunamis que se pueden generar localmente y también existen fuertes regionales y distantes, al otro lado del océano.

¡PROTÉJASE, VIVA PARA CONTARLO!!!

ZONA DE TSUNAMI

PLAN DE ACCIÓN DE EMERGENCIA

TSUNAMI

Warning Information

Tsunami Warning Centers issue tsunami alert messages in order to designate Tsunami Warning Facilities.

These messages provide preliminary earthquake information and indicate whether or not there is a tsunami threat.

When tsunami waves are expected, the bulletin also include information on the countries that could be impacted, the expected arrival times and tsunami observations that have been made.

Only national and local government agencies have the authority to make decisions regarding the official state of alert in their area and any actions to be taken in response.

Messages may be updated, adjusted geographically, downgraded, or cancelled so you MUST monitor and follow the advice of your national and local authorities, but also be on alert for the natural tsunami warning signs. Local authorities may issue evacuation orders, but these may not be enough time, so EVACUATE if you recognize the natural warning signs.

Getting Ready For TSUNAMIS

What is a Tsunami?

A tsunami (tsou NAH mee) is a series of waves caused by a major disturbance of a body of water. These waves can arrive in minutes, but may continue for hours. Tsunamis can be generated by a large coastal or underwater earthquake, landslide or volcanic eruption. Large meteorite impacts may also trigger tsunamis. All known sources capable of causing tsunamis are found within the Caribbean and its adjacent regions, and there are also distant sources across the Atlantic. Some countries within the region are also exposed to tsunamis along their PACIFIC coastlines.

Can Tsunamis occur in the Caribbean and Adjacent Regions?

At least 75 tsunamis have impacted the Caribbean and adjacent regions in the past 5000 years. Of these, almost 20 have caused deaths, and since 1862 it is estimated that more than 3000 people have been killed by these events. In the 2010 tsunami in Haiti, reports indicate that at least 7 lives were lost. Based on this historical evidence, the region can expect to experience approximately 4 destructive tsunamis per century. It is estimated that over 100,000 residents and visitors are exposed daily along the shores to this threat.

A Guide for the Caribbean and Adjacent Regions

AFTER A STRONG OR LONG EARTHQUAKE, A TSUNAMI MAY FOLLOW

HOW TO ESCAPE A TSUNAMI

- Drop, cover and hold during earthquake
- Move quickly outside the tsunami evacuation zone
- Wait for official instructions

FAMILY EMERGENCY PLAN

In Case of Emergency, call 911

Assembly Point _____

Assembly Point Location _____

Out-of-Town Contact _____

E-mail _____

Phone () _____ Phone () _____

Comisión Permanente de Geodinámica (COPRED) • copred.gub.hn • IMESD: DDC, DCE • tsunamis.gov

16 de febrero 2017

SIMULACRO POR TSUNAMI

Posibles durante un Simulacro

6. Community Exercise

eg. **CARIBE WAVE 17** held on March 21, 2017

- 470,312 participants
- 3 Scenarios
- Communications and response plans tested
- Communications, table top, drills and full scale exercises
- Developing and promoting a **culture of evacuation**

WP 2, 3, 4, 5, 6, 7, 8, 9 and 10



Haiti



Saint Kitts and Nevis



Venezuela



Panama



Guadalupe



British Virgin Islands



Puerto Rico

7. Tsunami Response Plan - Governance

Draft Tsunami Warning Information
Dissemination Protocol & SOP
For St. Kitts & Nevis



2014

Mitigation & Preparedness Specialist
Roving Technical Support Team (RTST)
Caribbean Disaster Emergency Management
Agency
2/1/2014

Aviso Warning

- ¡Peligro! / *Danger!*
- ¡Corra a tierras altas! / *Run for high ground!*
- Siga las instrucciones de emergencia / *Follow emergency instructions.*

Advertencia Advisory

- Posibles corrientes locales fuertes y peligrosas / *Possible strong and dangerous local currents.*
- Esté pendiente para más información oficial / *Stay tuned for local emergency guidance.*

Vigilancia Watch

- Peligro potencial / *Potential danger.*
- Permanezca alerta para más información / *Stayed tuned for more information.*

Boletín Informativo Information Statement

- Esté tranquilo / *Relax.*
- No hay peligro / *No danger.*
- Una cuenca oceánica distante puede estar en riesgo / *A distant ocean basin may be in danger.*

ASTARTE WP 6, 7, 8 and 9

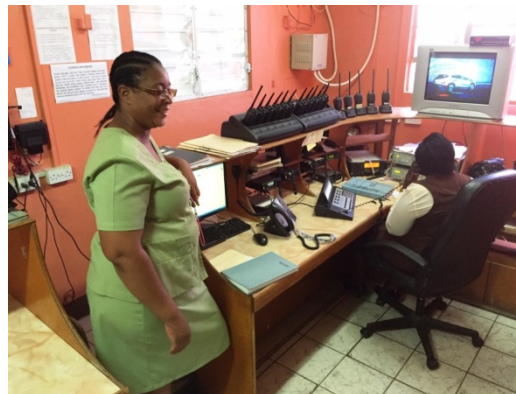
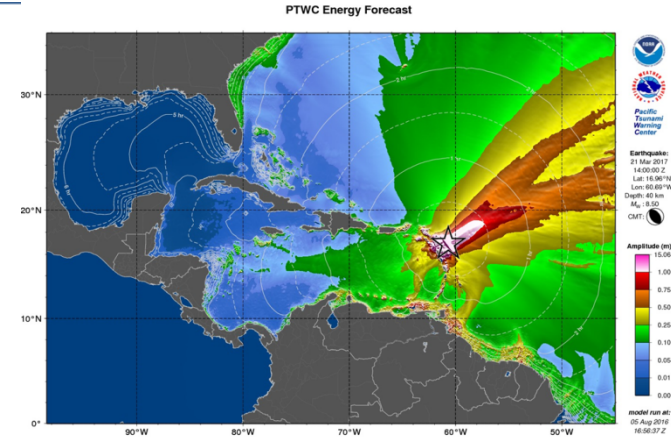
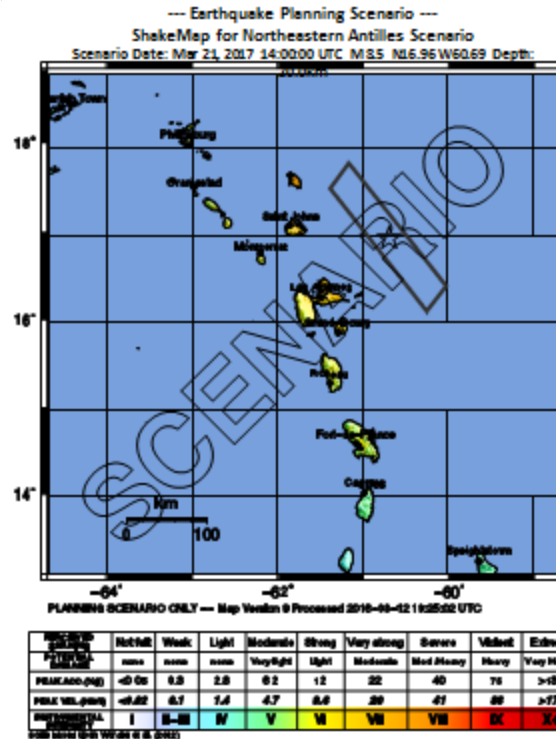
8. EOC Warning Operations – Governance EOC Authorities and Standup



ASTARTE WP 6, 7, 8 and 9

9. Multiple Methods to Receive Tsunami Alerts

- EMWIN
- FAX
- GTS
- EMAILS
- Telephone Call
- WhatsApp
- Text Message
- Police Radio
- Ground Shaking



ASTARTE WP 3, 6, 8 and 9

10. Public Dissemination of Alerts



ASTARTE WP 3, 6, 8 and 9

ASTARTE outputs/future work

- Reports
- Scientific and Technical Publications
 - Seismology, Geophysical, Geology, Science Journals
 - Also... Engineering, Civil Protection, Land Use Planning, Technology
- Database maintenance and expansion, considerations of open access
- NEAMTWS
 - Monitoring enhancements
 - Decision Matrix updates
 - Tsunami Planning – Education, Resilience, Readiness
 - Communication Exercises and NEAMWAVE

Cont.

- SEVENTH FRAMEWORK Programme
- UNISDR – Sendai Framework – Targets:
 - Reduce Mortality , numbers of affected people, economic losses and damage to critical infrastructure and disruption of basic services
 - Increase number of countries with DRR strategies, international cooperation to developing countries and access to multi hazard warning systems and disaster risk reduction
- National
 - Communication systems – observations, products
 - National protocols, alert levels
- Other Projects – GTM, TSUMAPS...

The infrequency of tsunamis in the NEAM region can be disarming, a challenge. The findings and results of ASTARTE should contribute to the development of a comprehensive strategy to mitigate tsunami impact in the region which empowers communities to reduce risk, save lives and protect livelihoods from tsunamis, become resilient.