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Summary

On March 20, 2013 the second joint regional tsunami exercise, CARIBE WAVE/LANTEX 2013 was held. The exercise was conducted under the framework of the UNESCO IOC Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG CARIBE EWS) and the US National Tsunami Hazard Mitigation Program. 30 Members States and 15 of the territories\(^1\) in the Caribbean and Adjacent Regions participated in this exercise. This represents a participation rate of at least 94% (up from 75% in 2011) of all the countries and territories in the CARIBE EWS.

481 organizations and individuals (almost 200 more than in 2011) registered to receive the bulletins issued by the Pacific Tsunami Warning Center (PTWC), West Coast and Alaska Tsunami Warning Center (WC/ATWC), and/or the Puerto Rico Seismic Network. In 2011, 300 organizations registered for the special email services.

According to the registrations, 47,952 people were going to participate in the event throughout the Caribbean and Adjacent Regions; of these, 45,526 are from Puerto Rico where it was the 5\(^{th}\) Commonwealth wide tsunami exercise.

Registered participants included 46 UNESCO CARIBE EWS Tsunami Warming Focal Points (TWFP) and National Contacts, 131 International, State, Territorial and Local Emergency Management Organizations, 118 Schools and Universities (30,060 participants), 71 Governmental Agencies, 21 Private Organizations, 8 Health Facilities, 5 Members of the Media and 95 Individuals and Families.

The CARIBE WAVE/LANTEX 13 scenario simulated a tsunami generated by a M 8.5 earthquake originating 57 miles north of Oranjestad, Aruba in the Caribbean Sea. According to models, the whole Caribbean basin and parts of Western Atlantic would be impacted by the tsunami, with the largest waves expected from this scenario along the coasts of Aruba, Bonaire, Curacao, Venezuela and Colombia and the southern Coast of Hispaniola, with coastal wave forecasts of up to 17 meters.

The initial dummy message (“start of exercise”) was issued by the PTWC and WCATWC at 1302 UTC (9:02 AST) and disseminated over its standard broadcast channels to all its stakeholders and TWFP, irrespective of if they registered. The Puerto Rico Seismic Network (PRSN) and other national and regional organizations also issued messages for its areas of responsibility.

Sirens, emails, emergency alert systems, text messages, media outlets, NOAA weather radio, and social media were used by many TWFP to further disseminate the messages.

Thru the exercise it has been possible to:

1. Aruba, Antigua and Barbuda, Bahamas, Barbados, Belize, Colombia, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, France (Martinique, Guadeloupe, Guyane, St. Barthelemy, St Martin), Grenada, Guatemala, Haiti, Honduras, Jamaica, Mexico, Netherlands (Bonaire, Saba and Sint Eustatius), Nicaragua, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sint Maarten, Suriname, Trinidad and Tobago, United Kingdom (Anguilla, British Virgin Islands, Bermuda, Cayman Islands, Turks and Caicos), United States (Puerto Rico and the US Virgin Islands) and Venezuela (Bolivarian Republic of).
• Validate the issuance of tsunami products from the PTWC and WCATWC which currently serve the region. The message was issued according to schedule to the officially designated Tsunami Warning Focal Points.
• Validate the receipt and dissemination of tsunami products by Tsunami Warning Focal Points (TWFP). Few institutions reported issues with the reception of the message from the TWC.
• To begin a process of exposure to proposed enhanced PTWC products, which include graphics.
• To validate the readiness of the Caribbean and Adjacent Regions to respond to a local/regional source tsunami.

In addition to the communication tests, exercises were conducted at various additional levels of magnitudes and sophistication and included seminars, table top exercises, video/web conferencing and drills.

Planning for CARIBE WAVE took over a year and was coordinated by a task team led by the US NWS Caribbean Tsunami Warning Program and included the UNESCO IOC, CARIBE EWS officers, PTWC, WCATWC, the International Tsunami Information Center, regional emergency management organizations and Tsunami National Contacts and Tsunami Warning Focal Points.

The Exercise Handbook, which was distributed in December 2012, and other information and supporting documents for the exercise will remain posted on different websites including the CTWP (http://www.srh.noaa.gov/srh/ctwp/) and the PRSN (http://redsismica.uprm.edu).

To provide feedback on the exercise, the new PTWC products and state of preparedness, an online questionnaire was made available at https://www.surveymonkey.com/s/caribewave13_eval. Thirty five Tsunami National Contacts representing 43 of the 48 Member States and Territories of CARIBE EWS (90%) answered the online survey. The main observations and findings from this exercise were the following:

• 97% of the respondents were satisfied with the planning, conduct, format and style of the exercise
• 94% (up from 90% in 2011) of the Tsunami Warning Focal Points received in a timely fashion the “dummy” message sent by the Tsunami Warning Centers (TWC).
• 83% of the countries that responded also received the email messages that were issued to those who registered from the warning centers with the products.
• 17% of the countries that received the emails noted that they received them with delay, slight delay.
• 92% of the participants for whom the enhanced products would be applicable (those currently served by PTWC) noted that the information in the experimental products is understandable
• 100% of the participants for whom the enhanced products would be applicable (those currently served by PTWC) indicated the information contained in the experimental products would help with decision making
• 93% of the TWFP/NDMO indicated that they had an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.
• 59% (up from 50% in 2011) indicated that their country had an emergency response plan for tsunamis.
• 8 Member States or their territories indicated that they had tsunami inundation maps available for evacuated areas.
• 20% of the TWFP/NDMO indicated that they had tsunami mass coastal evacuation plan.
• 47% indicated that the news media participated and covered the exercise.
• 16 CARIBE EWS Member States and Organizations participated in the 2 webinars (each held in English and Spanish) and 96% of the respondents indicated that they were useful, but it was noted that they should also be conducted in French.
• 80% indicated that CARIBE WAVE should be conducted annually.

The countries and territories indicated thru the survey, despite gaps in communications and actions, the exercise helped to promote a better understanding of the responsibilities and roles in tsunami emergencies. There is an absolute need to reinforce preparedness, evacuation plans and inundation mapping. The fact that the population and press has a high interest and awareness on these matters is important.
1. Background

The CARIBE WAVE/LANTEX 13 tsunami exercise was conducted on March 20, 2013 to assist tsunami preparedness efforts throughout the Caribbean and Adjacent regions. 30 Members States and 15 of the territories\(^*\) of the CARIBE EWS participated in this second regional tsunami exercise. This represents a participation rate of at least 94% (up from 75% in 2011) of all the countries and territories in the region.

Historical tsunami records from sources such as the National Oceanic and Atmospheric Administration’s (NOAA) National Geophysical Data Center (NGDC) show that over 75 tsunamis with validity greater than 1 have been observed in the Caribbean over the past 500 years (Figure 1). These represent approximately 7-10 % of the world’s oceanic tsunamis. Earthquake, landslide, and volcanic tsunami sources have all impacted the region. Since 1842 at least 3,510 people have lost their lives to tsunamis in the Caribbean. In recent years, there has been an explosive population growth and influx of tourists along the Caribbean and Western Atlantic coasts increasing the tsunami vulnerability of the region. In addition to the tsunamis, the region also has a long history of destructive earthquakes.

Within the region there are multiple fault segments and submarine features that could be the source of earthquake and landslide generated tsunamis (Figure 2). The perimeter of the Caribbean plate is bordered by no fewer than four major plates (North America, South America, Nazca, and Cocos). Subduction occurs along the eastern and northeastern Atlantic margins of the Caribbean plate. Normal, transform and strike slip faulting characterize northern South America, eastern Central America, the Cayman Ridge and Trench and the northern plate boundary (Benz et al, 2011). With nearly 160 million people (Caribbean, Central America and Northern South America) now living in this tourist region and a major earthquake occurring about every 50 years, the question is not if another major tsunami will happen but when it happens will the region be prepared for the tsunami impact.

![Figure 1. Map of tsunami runups in the Caribbean 1493-2010](http://www.ngdc.noaa.gov/hazards/tsu.shtml)

\(^*\) Aruba, Antigua and Barbuda, Bahamas, Barbados, Belize, Colombia, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, France (Martinique, Guadeloupe, Guyane, St. Barthelemy, St Martin), Grenada, Guatemala, Haiti, Honduras, Jamaica, Mexico, Netherlands (Bonaire, Saba and Sint Eustatius), Nicaragua, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sint Maarten, Suriname, Trinidad and Tobago, United Kingdom (Anguilla, British Virgin Islands, Bermuda, Cayman Islands, Turks and Caicos), United States (Puerto Rico and the US Virgin Islands) and Venezuela (Bolivarian Republic of).
Tsunami warning services for the Caribbean are currently provided by the West Coast/Alaska Tsunami Warning Center (WCATWC) in Palmer, Alaska for Puerto Rico and the US and British Virgin Islands (referred to as Virgin Islands), the US mainland and Canada while the Pacific Tsunami Warning Center (PTWC) in Ewa Beach, Hawaii is providing services for the other member states of the CARIBE EWS. These Centers issue tsunami products to the region approximately two to ten minutes after an earthquake’s occurrence. The WCATWC products include warnings, advisories, watches, and information statements, while the PTWC products include tsunami information and watch messages. Primary recipients of Tsunami Warning Center (TWC) messages include national tsunami warning focal points, Weather Forecast Offices (WFO), national/state/territory warning points/emergency operation centers, national Coast Guards, and military contacts. These agencies disseminate the messages to people potentially impacted by a tsunami. The Puerto Rico Seismic Network (PRSN) of the University of Puerto Rico at Mayagüez, Instituto Nicaragüense de Estudios Territoriales (INETER) in Nicaragua, Fundación Venezolana de Investigaciones Sismológicas (FUNVISIS) in Venezuela, and other national and regional institutions also provide earthquake and tsunami alerts for their areas of responsibilities. Per recommendation of CARIBE EWS, as part of this exercise PTWC experimental products will also be distributed to the Tsunami National Contacts.

The United National Educational, Scientific, and Cultural Organization’s (UNESCO) Intergovernmental Coordination Group for Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS), the Caribbean Emergency Management Agency (CDEMA), the Centro de Coordinación para la Prevención de los Desastres Naturales en América Central (CEPREDENAC), NOAA, and the U.S. National Tsunami Hazard Mitigation Program (NTHMP) are providing the framework for this exercise as a means for emergency responders throughout the Caribbean to test and update tsunami response plans. High levels of vulnerability and threat in many Caribbean nations should provide a strong incentive for local jurisdictions to prepare for a tsunami.

The exercise provided a simulated tsunami warning and watch messages from the TWCs based on a hypothetical magnitude 8.5 earthquake located north of Venezuela, Aruba, Bonaire and Curacao (Figure 3). An evaluation of tsunami sources conducted by the USGS (ten Brink et al,
2008) considered the potential along the Evaluation of tsunami sources with the potential to impact the U.S. Atlantic and Gulf coasts, *USGS Administrative report to the U.S. Nuclear Regulatory Commission*, 300 pp.

1.1 Earthquake Impact Scenario

For many countries, in addition to knowing the potential impact from the tsunami, it is also important to consider the potential earthquake impact. This is especially important for those in the near earthquake source. In consideration of this, for the first time the USGS provided for CARIBE WAVE/LANTEX 2013 the scenario outputs of their ShakeMap and the Prompt Assessment of Global Earthquakes for Response (PAGER) products. These results provide emergency responders, government, aid agencies and the media the scope of the potential earthquake related disaster. ShakeMap illustrates the ground shaking levels close to the earthquake source depending on a set of parameters like distance to the source, rock and soil behaviour and seismic wave propagation through the crust ([http://earthquake.usgs.gov/research/shakemap/](http://earthquake.usgs.gov/research/shakemap/)). PAGER is based on the earthquake shaking (via ShakeMap) and analyses of the population exposed to each level of shaking intensity with models of economic and fatality losses based on past earthquakes in each country or region of the world ([http://earthquake.usgs.gov/research/pager/](http://earthquake.usgs.gov/research/pager/)). For the CARIBE WAVE/LANTEX 2013 scenario the U. S. Geological Survey estimated that significant casualties and damage were likely from the earthquake itself which in themselves would require regional or national level response. The countries that would be most significantly affected by the earthquake are Aruba, Curacao and Venezuela. Complete information about the PAGER output for the exercise scenario is available in the Appendix C of the manual.

![Figure 3. Caribe Wave 13/Lantex 13 earthquake epicenter location.](image)
2. Exercise Concept

2.1 Purpose

The purpose of the exercise was to improve Tsunami Warning System effectiveness along the Caribbean coasts. The exercise provided an opportunity for emergency management organizations throughout the Caribbean to exercise their operational lines of communications, review their tsunami response procedures, and promote tsunami preparedness. Regular exercising of response plans is critical to maintain readiness for an emergency. This is particularly true for tsunamis, which are infrequent but high impact events. Every Caribbean emergency management organization (EMO) was encouraged to participate.

2.2 Objectives

Each organization was asked to develop their objectives for the exercise depending on their level of involvement in the scenario. The following were the exercise’s overarching objectives.

1. To exercise and evaluate operations of the current Tsunami Warning System and in particular, the CARIBE EWS.
   A. Validate the issuance of tsunami products from the PTWC and WCATWC.
   B. Validate the receipt and dissemination of tsunami products by CARIBE EWS Tsunami Warning Focal Points (TWFP).

2. To begin a process of exposure to an initial test version of PTWC experimental (enhanced) products.
   A. Review and evaluate PTWC experimental products that will be available in parallel with existing PTWC products.
   B. Provide feedback on the staging, format and content of the experimental products

3. To validate the readiness to respond to a local/regional source tsunami.
   A. Validate the operational readiness of the Tsunami Warning Focal Point (TWFP, or like function) and/or the National Disaster Management Office (NDMO).
   B. To improve operational readiness. Before the exercise, ensure appropriate tools and response plan(s) have been developed, including public education materials
   C. Validate dissemination of warnings and information/advice by Tsunami Warning Focal Points to relevant in-country agencies and the public is accurate and timely.
   D. Validate the organisational decision-making process (tsunami response plans) about public warnings and evacuations.
   E. Validate the methods used to notify and instruct the public are accurate and timely.

2.3 Types of Exercise

The exercise was carried out such that communications and decision making at various organizational levels were exercised and conducted without disrupting or alarming the general public. Individual localities, however, elected to extend the exercise down to the level of testing local notification systems such as the Emergency Alert System (EAS), sirens and loudspeakers.
According to the registrations, 47,952 people were going to participate in the event throughout the Caribbean and Adjacent Regions; of these, 45,526 are from Puerto Rico where it was the 5th Commonwealth wide tsunami exercise. Registered participants included 46 UNESCO CARIBE EWS Tsunami Warming Focal Points (TWFP) and National Contacts, 131 International, State, Territorial and Local Emergency Management Organizations, 118 Schools and Universities (30,060 participants), 71 Governmental Agencies, 21 Private Organizations, 8 Health Facilities, 5 Members of the Media and 95 Individuals and Families.

Exercises were conducted at various scales of magnitude and sophistication. Exercises stimulated the development, training, testing, and evaluation of Disaster Plans and Standard Operating Procedures. The following are examples of types of exercises conducted by EMOs:

1. **Orientation Exercise (Seminar):** An Orientation Exercise lays the groundwork for a comprehensive exercise program. It is a planned event, developed to bring together individuals and officials with a role or interest in multi-hazard response planning, problem solving, development of standard operational procedures (SOPs), and resource integration and coordination. An Orientation Exercise had a specific goal and written objectives and result in an agreed upon Plan of Action.

   ![Figure 4 Orientation seminar in Venezuela](http://www.funvisis.gob.ve/noticia.php?id=797)

2. **Drill:** The Drill is a planned activity that tests, develops, and/or maintains skills in a single or limited emergency response procedure. Drills generally involve operational response of single departments or agencies and can involve internal notifications and/or field activities.

   ![Figure 5 Mayor of Toa Baja, Anibal Vega Borges leads tsunami drill as part of CARIBE WAVE/LANTEX 2013 exercise.](http://www.funvisis.gob.ve/noticia.php?id=797)
3. **Tabletop Exercise**: The Tabletop Exercise is a planned activity in which local officials, key staff, and organizations with disaster management responsibilities are presented with simulated emergency situations. It is usually informal, in a conference room environment, and is designed to elicit constructive discussion from the participants. Participants will examine and attempt to resolve problems, based on plans and procedures, if they exist. Individuals are encouraged to discuss decisions in depth with emphasis on slow-paced problem solving, rather than rapid, real time decision-making. A Tabletop Exercise should have specific goals, objectives, and a scenario narrative.

![Tabletop Exercise in Nevis](image)

### Figure 6. Table top exercise in Nevis.

3. **Exercise Outline**

3.1 **General**

Tsunami Warning and Watch messages for this exercise were issued at 13h02 by the WCATWC and PTWC based on a hypothetical earthquake with the following hypocenter parameters:

- **Origin Time**: 13:00:00 UTC March 20, 2013
- **Latitude**: 13.35°N
- **Longitude**: 69.95°W
- **Magnitude**: 8.5 – Mw
- **Depth**: 10km

Expected tsunami impact for this event is determined from tsunami forecast models. The models indicate a significant tsunami in the eastern Caribbean with little impact outside the Caribbean. Based on the models, the exercise alert areas were limited to the Caribbean region, and did not include other TWC areas-of-responsibility in the Atlantic or Gulf of Mexico. Appendix B of the Participant Handbook provides model results.

Initially, a tsunami warning was issued by WCATWC which included Puerto Rico and the Virgin Islands, while PTWC issued a Regional Tsunami Watch. Definitions of the products that were issued by the TWCs during this exercise are provided below (Note that PTWC products differ from WCATWC products due to different requirements for the international products of the ICG/CARIBE-EWS):
West Coast Alaska Tsunami Warning Center:

*Tsunami Warning* - A tsunami warning is issued when a tsunami with the potential to generate widespread inundation is imminent, expected, or occurring. Warnings alert the public that dangerous coastal flooding accompanied by powerful currents is possible and may continue for several hours after initial arrival. Warnings alert emergency management officials to take action for the entire tsunami hazard zone. Appropriate actions to be taken by local officials may include the evacuation of low-lying coastal areas, and the repositioning of ships to deep waters when there is time to safely do so. Warnings may be updated, adjusted geographically, downgraded, or canceled. To provide the earliest possible alert, initial warnings are normally based only on seismic information.

Pacific Tsunami Warning Center:

*Tsunami Watch* – Watches are the highest level of alert issued by PTWC for the CARIBE-EWS. They are either based only on seismic information indicating a potential tsunami, or following confirmation that a tsunami with destructive potential is underway. The tsunami may be imminent, expected, or occurring. Watches alert the Tsunami Warning Focal Points of the CARIBE-EWS that dangerous coastal flooding accompanied by powerful currents is possible and may continue for several hours after initial arrival. Watches alert authoritative officials to take action for threatened coastal areas. Appropriate actions may include the evacuation of low-lying coastal areas, and the repositioning of ships to deep waters when there is time to safely do so. Watches may be updated, adjusted geographically, downgraded, or cancelled. They are updated at least hourly to continue them, expand their coverage, upgrade them to a Warning, or end the alert.

Pacific Tsunami Warning Center Enhanced Products:

A suite of new enhanced products and procedures for the CARIBE-EWS is under development by PTWC and the ICG/CARIBE-EWS based upon PTWC real-time and database-driven forecast modelling capabilities. The new products will provide a number of advantages over the existing ones including greatly reducing the area of coast that is over-warned and providing the possibility of distinguishing between tsunami waves that present only a marine threat versus ones that present a coastal flooding threat versus ones that present an extreme flooding threat. The new products will include a text message similar to what is now issued with a slightly different content and format. It will still include information about areas under threat, expected tsunami arrival times, and selected measurements of tsunami waves. In addition to the text product, several graphical products will also be issued. These include maps (Figures 4-6) show the pattern of tsunami energy crossing the ocean, a comprehensive forecast of maximum tsunami amplitudes along threatened coasts, and a kmz file of the forecast that can be used in conjunction with GoogleEarth.
Figure 7 Propagation and energy map of simulated CARIBE WAVE 2013 tsunami.

Figure 8 Predicted coastal amplitudes of tsunami at 1 m water depth for CARIBE WAVE 2013 scenario.
This exercise gave CARIBE-EWS Member States an opportunity to view and exercise with the new products if they chose to do so. They were made available along with a more detailed description of their content and how they should be used on the following website: http://www.caribewave.info

According to the survey, 92% of the participants for whom the enhanced products would be applicable (those currently served by PTWC) noted that the information in the experimental products is understandable while 100% indicated the information contained in the experimental products would help with decision making.

Staging of Messages

The TWCs did not issue live messages over broadcast dissemination channels other than to issue an initial dummy message to start the exercise at 1302 UTC on March 20, 2013. However, email messages from the TWCs were emailed to 495 recipients who registered to receive live dissemination throughout the event thru a special site that was set up by the Puerto Rico Seismic Network. The content of the dummy message which indicated that exercise had begun and tested the official communication systems was provided in the Participant Handbook. Table 1 is the timeline for when the dummy and email messages to those registered were issued by the TWCs. The warning messages covered a 5-hour period. The dummy message was sent out over all standard TWC broadcast channels as listed in Table 2 along with the World Meteorological Organization (WMO) and Advanced Weather Interactive Processing System (AWIPS) headers.

Some EMOs modified estimated arrival times and/or wave amplitudes to suit their exercise – for example, to have the tsunami arrive sooner and with larger amplitude. Other exercise injects, such as tsunami damage reports, were also encouraged and used.
3.2 Master Schedule (Exercise Script)

Tables 1 and 2 contain the scenario timeline for the exercise, as well as the product types that were disseminated for this exercise by the Tsunami Warning Centers.

Table 1: Scenario Timeline. Time, product and dissemination Method for messages issued by the Tsunami Warning Centers.

<table>
<thead>
<tr>
<th>Date (UTC)</th>
<th>Time (UTC)</th>
<th>WCATWC Message</th>
<th>PTWC Message</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>#</td>
<td>Type</td>
</tr>
<tr>
<td>03/20/2013</td>
<td>1300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03/20/2013</td>
<td>1302</td>
<td>01</td>
<td>Warn</td>
</tr>
<tr>
<td></td>
<td>1330</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03/20/2013</td>
<td>1337</td>
<td>02</td>
<td>Warn</td>
</tr>
<tr>
<td>03/20/2013</td>
<td>1402</td>
<td>03</td>
<td>Warn</td>
</tr>
<tr>
<td></td>
<td>1420</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03/20/2013</td>
<td>1432</td>
<td>04</td>
<td>Warn</td>
</tr>
<tr>
<td>03/20/2013</td>
<td>1502</td>
<td>05</td>
<td>Warn</td>
</tr>
<tr>
<td></td>
<td>1515</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03/20/2013</td>
<td>1604</td>
<td>06</td>
<td>Warn</td>
</tr>
<tr>
<td></td>
<td>1610</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03/20/2013</td>
<td>1704</td>
<td>07</td>
<td>Warn</td>
</tr>
<tr>
<td></td>
<td>1710</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03/20/2013</td>
<td>1803</td>
<td>08</td>
<td>Warn</td>
</tr>
<tr>
<td></td>
<td>1810</td>
<td></td>
<td></td>
</tr>
<tr>
<td>03/20/2013</td>
<td>1902</td>
<td>09</td>
<td>Can</td>
</tr>
<tr>
<td></td>
<td>1910</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TWC Message Types:
- Warn Tsunami Warning
- Watch Tsunami Watch
- Can Cancellation

Dummy:
- Yes Dummy Issued
- No Dummy Not Issued

Email:
- Yes Message disseminated via special email list
- No Message not disseminated via special email list

Table 2: Product Types. Product headers for Dummy Message with Transmission Methods for each Tsunami Warning Center.

<table>
<thead>
<tr>
<th>Center</th>
<th>WMO ID</th>
<th>AWIPS ID</th>
<th>NWWS</th>
<th>AFTN</th>
<th>GTS</th>
<th>EMWIN</th>
<th>Fax</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCATWC</td>
<td>WEXX30 PAAQ</td>
<td>TSUATE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>PTWC</td>
<td>WECA41 PHEB</td>
<td>TSUCAX</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

NWWS NOAA Weather Wire Service
GTS Global Telecommunications System
The TWFP reported using a variety of methods to receive the dummy message, with FAX and Email being the most common (Figure 6).

Figure 10. Methods that CARIBE EWS TWFP used to receive the dummy message sent by the US TWC.

3.3 Actions in Case of a Real Event

In the case of a real event occurring during the exercise, it was agreed that the TWCs would issue their normal messages for the event, but smaller earthquakes that only trigger a Tsunami Information Statement will not disrupt the exercise. During the exercise there were no real events or smaller earthquakes for which the TWC had to issue a message.

3.4 Procedure for False Alarm

Any time disaster response exercises are conducted, the potential exists for the public or media to interpret the event as real. There were no reports of false alarms received as a result of the exercise.

3.5 Resources

The CARIBE EWS ICG and the US NTHMP established task teams for the organization, conduct and evaluation of the exercise. Table 3 below contains a list of the contact people for the exercise.
Table 3. Contacts for organization and conduct of CARIBE WAVE/LANTEX 2013.

3.6 Media Arrangements

One advantage in conducting exercises is that it provides a venue to promote awareness of the exercise topic. Many residents along the Caribbean coasts may not realize that a tsunami warning system exists for their region, let alone the proper response. 47% of the CARIBE EWS Member States and Territories indicated that the news media participated and covered the exercise (copies of the press releases and media outputs is in CARIBE WAVE 13/LANTEX 13 Volume 3 Media report.

Figure 11. Press conference at Puerto Rico State Emergency and Management Agency announcing CARIBE WAVE/LANTEX 2013 (http://www.elnuevodia.com/operaciontsunamienlaisla-1469455.html)
4 Post-Exercise Evaluation

All participating agencies are requested to provide brief feedback on the exercise. This feedback was to assist the ICG/CARIBE-EWS, NTHMP, and NOAA in the evaluation of CARIBE WAVE 13/LANTEX 13 and the development of subsequent exercises, and help response agencies document lessons learned. The survey was conducted by the IOC UNESCO using Survey Monkey. It contained 80 questions. Thirty six Tsunami National Contacts representing 43 of the 48 Member States and Territories³ of CARIBE EWS (90%) answered the online survey. The questions as well as the answers and comments are contained in Appendix B. This questionnaire has a wealth of information that is important for the evaluation and planning of tsunami exercises but reflects the level of tsunami preparedness in the region.

5 References


Intergovernmental Oceanographic Commission. Exercise Caribe Wave/Lantex 13. A

³ Aruba, Bahamas, Barbados, Belize, Colombia, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, France (Martinique, Guadeloupe, Guyane, St. Barthelemy, St Martin), Grenada, Guatemala, Guyana, Haiti, Honduras, Mexico, Netherlands (Bonaire, Saba and Sint Eustatius), Nicaragua, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sint Maarten, Trinidad and Tobago, United Kingdom (Anguilla, British Virgin Islands, Bermuda, Cayman Islands, Turks and Caicos), United States (Puerto Rico and the US Virgin Islands) and Venezuela (Bolivarian Republic of).


## Appendix A. List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ATFM</td>
<td>Alaska Tsunami Forecast Model</td>
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<tr>
<td>AWIPS</td>
<td>Advanced Weather Interactive Processing System</td>
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<tr>
<td>CDEMA</td>
<td>Caribbean Emergency Management Agency</td>
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<tr>
<td>CEPREDENAC</td>
<td>Centro de Coordinación para la Prevención de los Desastres Naturales en América Central</td>
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<tr>
<td>CTWP</td>
<td>US National Weather Service Caribbean Tsunami Warning Program</td>
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<tr>
<td>EAS</td>
<td>Emergency Alert System</td>
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<tr>
<td>EMO</td>
<td>Emergency Management Organization</td>
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<tr>
<td>EMWIN</td>
<td>Emergency Management Weather Information Network</td>
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<tr>
<td>FUNVISIS</td>
<td>Fundación Venezolana de Investigaciones Sismológicas</td>
</tr>
<tr>
<td>GTS</td>
<td>Global Telecommunication System</td>
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<tr>
<td>ICG CARIBE EWS</td>
<td>Intergovernmental Coordination Group for the Tsunamis and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions</td>
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<tr>
<td>INETER</td>
<td>Instituto Nicaragüense de Estudios Territoriales</td>
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<tr>
<td>IOC</td>
<td>Intergovernmental Oceanographic Commission</td>
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<tr>
<td>NGDC</td>
<td>National Geophysical Data Center</td>
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<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
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<tr>
<td>NTHMP</td>
<td>National Tsunami Hazard Mitigation Program</td>
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<tr>
<td>NWS</td>
<td>National Weather Service</td>
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<tr>
<td>PRSN</td>
<td>Puerto Rico Seismic Network</td>
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<tr>
<td>PTWC</td>
<td>Pacific Tsunami Warning Center</td>
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<tr>
<td>RIFT</td>
<td>Rapid Inundation and Forecasting of Tsunamis</td>
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<tr>
<td>TIB</td>
<td>Tsunami Information Bulletin</td>
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<tr>
<td>TWC</td>
<td>Tsunami Warning Center</td>
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<tr>
<td>TWFP</td>
<td>Tsunami Warning Forecast/Focal Point</td>
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<tr>
<td>UNESCO</td>
<td>United National Educational, Scientific, and Cultural Organization</td>
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<tr>
<td>WC/ATWC</td>
<td>West Coast and Alaska Tsunami Warning Center</td>
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<tr>
<td>WFO</td>
<td>Weather Forecast Office</td>
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<tr>
<td>WMO</td>
<td>World Meteorological Organization</td>
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</table>
Appendix B CARIBE WAVE/LANTEX 13 Survey Results

Caribe Wave/LANTEX 2013 Survey Report from TNC

The member states and territories that participated in the survey were:

1. Aruba
2. Bahamas
3. Barbados
4. Colombia (2)
5. Costa Rica
6. Cuba
7. Curacao
8. Dominica
9. Dominican Republic
10. France (Martinique, Guadaloupe, St. Martin, Guyane, Saint Bartholomey) (2)
11. Grenada (Incomplete)
12. Guatemala
13. Guyana
14. Haiti
15. Honduras (Incomplete)
16. Mexico (2)
17. Netherlands (Bonaire, Saba, Sint Eustatius-Answered by Curacao)
18. Nicaragua
19. Panama (2)
20. Saint Kitts and Nevis
21. Saint Lucia
22. Saint Vincent and the Grenadines
23. Sint Maarten
24. Trinidad and Tobago
25. United Kingdom (Anguilla, Bermuda, British Virgin Islands, Cayman Islands and Turks and Caicos)
26. United States (Puerto Rico and US Virgin Islands)
27. Venezuela
The countries that did not participate were Grenada and Guyana. The comments received from the participant Tsunami National Contacts (TNC) were:

**Dominican Republic:** Participation as a focal point to a tsunami in the Dominican Republic and in coordination with the Emergency Operations Center.

**Grenada:** Grenada regrets that it was not able to participate fully in the exercise, but due to circumstances at the office which were beyond our control, we were unable to participate. However the office did receive the messages that were issued.

**Guatemala:** Se realizó un simulacro de escritorio pruebas de comunicación.

**Guyana:** We didn’t receive any warning alert on the 20th.

**Nicaragua:** En Nicaragua participamos tres instituciones gubernamentales: INETER, Secretaría Ejecutiva del Sistema Nacional de Atención y Prevención del Desastre (SE - SINAPRED) y Defensa Civil. Participaron alrededor de 30 personas en el marco del ejercicio.


**St. Kitts and Nevis:** St. Kitts and Nevis participated in the Exercise in the form.

**Saint Lucia:** Saint Lucia evacuated eight schools in the southern community of Vieux Fort. The exercise was a collaboration between the Ministry of Education, the Fire Service, the Police, the MET Office and NEMO.

**Turks and Caicos:** The Turks and Caicos Islands conducted an Orientation Exercise and tested the Tsunami Warning Notification process through the Tsunami Warning Focal Point, Police 911 Communications System.
The comments received from the participant Tsunami National Contacts (TNC) were:

**Colombia:** TNC.

**Costa Rica:** La evaluación está siendo contestada por dos personas: Alejandro Gutierrez (coordinador del Comité Asesor Técnico Marino Costero -CAT MARINO y funcionario del IOI Universidad Nacional) y Lidier Esquivel (Representante de la CNE ante el CAT Marino).

**Grenada:** The National Disaster Management Agency and the Meteorological Officer are Grenada's Focal Points.

**Saint Lucia:** This evaluation is being filled out on behalf of the Tsunami National Contact Point, the National Emergency Management Organization.

**Turks and Caicos:** The Department of Disaster Management is the Tsunami National Contact for the Turks and Caicos Government. 911 is the Tsunami Warning Focal Point.

**US Virgin Islands:** As the Designated Agency; the Virgin Islands Territorial Emergency Management Agency.
Objective 1: To exercise and evaluate operations of the current Tsunami Warning System and in particular, the CARIBE EWS.
Sub-Objective 1A: Validate the issuance of tsunami advice from the PTWC and WCATWC.

The countries who answered no to the above question were: Dominica and Dominican Republic. The country who answered not applicable to the above question was: none.

The comments received from the participant Tsunami National Contacts (TNC) were:

Costa Rica: La información fue enviada a tiempo, se sugiere su traducción al español por el perfil de muchos de los primeros que reciben y transmiten la información. Además se debe indicar en los sucesivos boletines que información es nueva.

Cuba: I do not know the standard operating procedure.

Curacao: Through the different communication channels the message was received as test and not the dummy message itself. This caused some confusion.

Dominica: Messages were not received via sms only fax and email.

Sint Maarten: The messages were difficult to decipher, but they did arrive and on time.

Turks and Caicos: The message was received at 9:02 a.m. and the Standard Operating Procedures were adhered to.

US Virgin Islands: Absolutely.
The countries who answered no to the above question were: Guyana and British Virgin Islands. The country who answered not applicable to the above question was: none.

The comments received from the participant Tsunami National Contacts (TNC) were:

**Anguilla:** slightly delayed.

**Barbados:** Message from PTWC was received at 1303 hrs.

**Cuba:** I did not have the manual.

**Curacao:** Message arrived at 09:06 LT.

**Dominica:** We did not receive the message until 12 minutes after messages were sent as data over mobile network is slow and we were not in the office with the fax machine. No SMS was received prompting us to find faster internet connection to look at the full information in the messages.

**Dominican Republic:** That's right; you start with the manual exercise.

**Nicaragua:** Aunque en la suscripción se solicitó recibir mensajes del PTWC, también fueron recibidos todos los mensajes del WCATWC.

**Puerto Rico:** WCATWC.

**Saint Lucia:** The initial email message arrived on time.
The comments received from the participant Tsunami National Contacts (TNC) were:

**Bermuda:** Message also received on our AIS-R (Aeronautical Information System Replacement).

**Costa Rica:** El sistema de email de la CNE tuvo problemas al inicio del ejercicio, durante los primeros 30-40 minutos del mismo.

**Dominica:** We were relying heavily on sms to alert us as email on mobile network is slow.

**France:** WMO + INMARSATC.

**US Virgin Islands:** During registration requested email notification.
The countries who answered no to the above question were: Barbados, Bermuda, Cayman Islands, Colombia, Cuba, Curacao, France, Guatemala, Guyana, Mexico, Nicaragua, Saint Lucia, Saint Vincent and the Grenadines, Sint Maarten and, Trinidad and Tobago.

The country who answered not applicable to the above question was: Aruba

The comments received from the participant Tsunami National Contacts (TNC) were:

**Anguilla:** Antigua and Barbuda Meteorological Office.

**British Virgin Islands:** The DDM received the message from the Royal Virgin Islands Police Force, the tsunami focal point.

**Colombia:** email - tsunami-information-ioc@lists.unesco.org.

**Dominica:** Message received from PSRN due to subscription.

**Dominican Republic:** Red Sismica de Puerto Rico (RSPR).

**Haiti:** PRSN.

**Honduras:** Ineter, USGS, Pantalla Sismica.

**Panama:** FUNVISIS, Venezuela. NWS-WCATWC Y PTWC.

**Puerto Rico:** Puerto Rico Seismic Network (PRSN).

**St. Kitts and Nevis:** Messages were received from Antigua and Barbuda MET services.

**Turks and Caicos:** Dominican Republic Seismic Institute.

**US Virgin Islands:** PRSN

**Venezuela:** Funvisis.
Sub-Objective 1B: Validate the receipt and issuance of tsunami advice by CARIBE EWS Tsunami Warning Focal Points (TWFP).

The countries who answered no to the above question were: Curacao and Guyana. The country who answered not applicable to the above question was: Colombia. The comments received from the participant Tsunami National Contacts (TNC) were:

**Curacao**: We received a message indicating test, and not the dummy message in the format of the participant handbook.

**Dominica**: Only because we knew the time that the exercise was taking place, a call to the office to check the fax machine alerted us to the content of the message.

**Dominican Republic**: PTWC.

**Haiti**: TNC and Directorate for Civil Protection.

**Panama**: We had sent all the respective messages.

**Puerto Rico**: WCATWC.

**Turks and Caicos**: Was received by 911 the Tsunami Warning Focal Point.
The country who answered no to the above question was: Guyana
The country who answered not applicable to the above question was: Colombia
The comments received from the participant Tsunami National Contacts (TNC) were:

**Anguilla:** PTWC alternate at 1311 UTC.
**Aruba:** Fax 1304UTC Email 1303UTC Emwin 1303UTC.
**Barbados:** PTWC 1303 hrs WCATWC: 1301 hrs.
**Bermuda:** 13:02 UTC.
**British Virgin Islands:** The fax from WCATWC was received at 13:02 and followed by that of PTWC at 13:10.
**Cayman Islands:** 13:04 UTC.
**Colombia:** PTWC: 13:03 UTC WCATWC: 13:04 UTC.
**Costa Rica:** Se recibió el primer mensaje a las 13:06 aproximadamente.
**Cuba:** I do not have the information here now.
**Curacao:** 13:06 UTC.
**Dominica:** A call from the TWFP to the Office of Disaster Management at UTC 1312 was made to confirm the presence of the exercise fax.
**Dominican Republic:** 13:03 UTC (AFTN) 13:04 UTC (MAIL).
**France:** 13:03 UTC – PTWC.
**Guatemala:** PTWC 13:03 UTC WCATWC 13:04 UTC.
**Haiti:** PTWC: 13:05 UTC WCATWC: 13:03 UTC.
**Mexico:** PTWC 13:04 UTC WCATWC 13:04 UTC.
**Nicaragua:** Initial dummy message -PTWC 13:03 UTC Messages: -PTWC 13:04 UTC Message #1 13:30 UTC Message #2 14:20 UTC Message #3 15:15 UTC Message #4 16:10 UTC Message #5 17:10 UTC Message #6 18:10 UTC Message #7 19:10 UTC Message #8 CANCELLATION - WCATWC 13:04 UTC Message #1 13:37 UTC Message #2 14:02 UTC Message #3 14:32 UTC Message #4 15:02 UTC Message #5 16:04 UTC Message #6 17:04 UTC Message 7 18:03 UTC Message #8 19:02 UTC Message #9 CANCELLATION.
**Panama:** email at 13:00 Fax at 13:04. 08:03 Panama City Time
Puerto Rico: WCATWC 13:03 UTC.
Sain Kitts and Nevis: 14:05 UTC.
Saint Lucia: PTWC: 13:04 UTC. 1301 UTC
Saint Vincent and the Grenadines: Messages received by both PTWC and WCATWC at 1303 UTC.
Sint Maarten: 09:05 AST = 13:05 UTC.
Trinidad and Tobago: 1300 hrs UTC.
Turks and Caicos: The message was received at 2:02 UTC time.
US Virgin Islands: 10:10 UTC.

Other methods received from the participant Tsunami National Contacts (TNC) were:
Anguilla: weather radio, Blackberry application, Bambox.
Cayman Islands: SMS from the 9-1-1 Centre.
Costa Rica: La relacion especialistas en oceanografia y sismologia fue relevante sobre todo en los primeros minutos para establecer un primer escenario.
Dominica: A phone call was made from Police headquarters to local police station. Due to delays in initial receipt of information the time to call local police was delayed.
France: Other: WMO + INMARSATC.
Nicaragua: Hubo comunicacion fluida vía radio con defensa civil y Sinapred desde el INETER.
Panama: radio and telephone.
Saint Kitts Nevis: Saint Kitts Nevis held an orientation exercise so this question was not applicable.
Saint Lucia: SMS.
Saint Vincent and the Grenadines: Amateur Radio Frequency was also used.
**Trinidad and Tobago:** SMS messaging. Was not as timely as it should have been.

**US Virgin Islands:** Phone and fax.

The countries who answered no to the above question were:

The country who answered not applicable to the above question were: Saint Vincent and the Grenadines.

The comments received from the participant Tsunami National Contacts (TNC) were:

**Costa Rica:** ambas figuras convergen en el seno del COMITE ASESOR TECNICO MARINO COSTERO, el cual fue convocado de forma permanente durante el ejercicio.

**Guatemala:** SON DIFERENTES PERO SE INFORMO INMEDIATAMENTE.

**Nicaragua:** Recibimos la información del CODE a través de radios.

**Saint Vincent and the Grenadines:** TWFP and Public Safety Organization is the same.

**Turks and Caicos:** The TWFP sent the message in ten minutes to the Tsunami Country Disaster Management Organization.
The other systems received from the participant Tsunami National Contacts (TNC) were:

**Dominica:** The office requested information prior to the exercise to sign up for SMS and we were told that no SMS would be sent.

**France:** Governmental emergency information sharing system.

**Nicaragua:** Recibimos información del PTWC y WCATWC, aunque nos suscribimos solamente para recibir mensajes del PTWC. Hubo problemas con la recepción de los mensajes. No todas las direcciones de correos que solicitaron recibir la información, lo recibieron.

**Bermuda:** AIS-R.
The countries who answered yes to the above question were: Cayman Islands, Costa Rica, Dominica, Dominican Republic, Guyana and Honduras.
The country who answered not applicable to the above question was: Colombia
The comments received from the participant Tsunami National Contacts (TNC) were:
**Cayman Islands:** There was a minimal delay in the receipt of the message. 2 minute delay at most.
**Costa Rica:** el sistema de email en esta ocasion sufrió un atraso debido a problemas tecnologicos del organismos de proteccion civil, sin embargo la informacion fluyo a traves de otras vias alternas, como por ejemplo el punto focal
**Dominica:** No SMS, poor data connection for email onto mobile phone. Message only received due to call to office to check fax.
**Dominican Republic:** With the fax machine Forecast Center
**Guyana:** We didn’t get any, not certain why.
**Saint Lucia:** The emails were received by mobile phones. Persons in the field received their email messages via mobile phones.
The countries who answered no to the above question were: Nicaragua, British Virgin Islands, Colombia and US Virgin Islands.
The countries who answered no to the above question were: Anguilla, British Virgin Islands, Cayman Islands, Guyana and US Virgin Islands.

The comments received from the participant Tsunami National Contacts (TNC) were:

**Anguilla:** slightly delayed.

**Cayman Islands:** 2 minute delay

**Dominica:** slow mobile data connection meant that the time of message was correct however the connection meant the message was late.

**US Virgin Islands:** TWFP did not see Exercise Manual.
1B.9: The information issued by your country national Tsunami Warning Focal Point was according to standard operating procedures.

1B.10: The information issued by your Tsunami Warning Focal Point was timely.
1B.11: The information issued by your national public-safety, decision-making and dissemination point was timely.

- Yes: 70.6% (24)
- No: 14.7% (5)
- Comment: 20.0% (7)
- Not Applicable: 14.7% (5)

1B.12: Is the national public-safety, decision-making and dissemination point different to the national tsunami warning focal point?

- Yes: 57.6% (19)
- No: 33.3% (11)
- Comment: 24.2% (8)
- Not Applicable: 6.1% (2)
1B.13: Information provided in the relevant international warning centre messages was understood by the Tsunami Warning Focal Point.

1B.14: The information provided in the relevant international warning centre messages assisted with decision making, e.g., warning levels, earthquake parameters, estimated arrival times, forecast wave heights, etc.
1B.15: The information provided was fully utilised by TWFP.

1B.16: Existing in-country hazard information/local data was utilised.
1B.17: Additional in-country local/regional expert advice was utilised.

- Yes: 52.9% (18)
- No: 35.3% (12)
- Comment: 17.6% (6)
- Not Applicable: 11.6% (4)
Objective 2: To begin a process of exposure to an initial test version of PTWC experimental products.
Sub-Objective 2A: Review and evaluate PTWC experimental products that will be posted one month before the exercise at [http://www.caribewave.info](http://www.caribewave.info) with existing PTWC products for the exercise scenario.

The country who answered no to the above question was: Dominica and Sint Maarten. The comments received from the participant Tsunami National Contacts (TNC) were:
- **Dominica**: No experimental products were received during the exercise.
- **Turks and Caicos**: We found the experimental products showcased very useful. The challenge that we found however is whether the country were to receive a tsunami warning tomorrow whether or not these products would accompany the alerts to help to guide decision makers.
- **Venezuela**: But only in English language and we had to translate in Spanish for his better understanding.
The comments received from the participant Tsunami National Contacts (TNC) were:

**Guatemala:** Fue de mucha ayuda aunque el ejercicio fue de mesa, se puede establecer o evaluar el tipo de peligro que pueda tener nuestras costas.

**Sint Maarten:** Once it was understood we tried to work with it.

**Turks and Caicos:** The products for example allowed the country to make an informed decision. Based on the scenario the wave’s heights throughout the territory would be minimal. It meant that evacuation of the territory's beaches would be necessary but would not necessitate a wide scale evacuation.
Sub-Objective 2B: Provide feedback on the staging, format and content of the experimental products.

**2B.1: Staging:** Should forecast threat levels be included in the initial first product, knowing that forecasts are likely to change over the first hour as seismic data and sea level data are received and analyzed?

- **Yes:** 75.4% (27)
- **No:** 2.8% (1)
- **Comment:** 35.3% (12)
- **Not Applicable:** 14.7% (5)

**2B.2: Staging:** Should forecast threat levels be given only for coast within 6 hours of the estimated tsunami arrival time in initial products, knowing that initial forecasts will be based only upon the seismic parameters?

- **Yes:** 58.3% (28)
- **No:** 23.5% (9)
- **Comment:** 11.8% (6)
- **Not Applicable:** 11.8% (6)
2B.3: Format: Does the primary text product contain the right information?

Yes: 72.7% (24)
No: 27.3% (9)
Comment: 33.3% (11)
Not Applicable: 15.2% (5)

2B.4: Format: Does the proposed suite of products—primary text product, energy map, threat map, table of threat levels, table of arrival times—provide all the necessary information? Please note in Comments section.

Yes: 73.5% (25)
No: 26.5% (9)
Comment: 47.1% (16)
Not Applicable: 11.8% (4)
2B.5: Content: Are there other information or products that should be included in the suite of products? Consider earthquake and tsunami information, and/or threat assessment products. Please provide comments.

2B.6: Content: Are the proposed forecast zones appropriate? If not, please suggest better zonations.
2B.7: Content: Are the proposed forecast levels: 0–0.3m, >= 0.3–1m, >= 1–3m, 3-10m and >10m adequate?

- Yes: 52.4% (28)
- No: 5.3% (2)
- Comment: 20.5% (7)
- Not Applicable: 11.6% (4)
Objective 3: To validate the readiness of Member States to respond to a local/regional source tsunami.
Sub-Objective 3A: Validate the operational readiness of the Tsunami Warning Focal Point (TWFP, or like function) and/or the National Disaster Management Office (NDMO).

3A.1: The TWFP/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.

The country who answered no to the above question was: Dominica and Saint Kitts and Nevis. The comments received from the participant Tsunami National Contacts (TNC) were:
Dominica: Still in draft. Exercise tested the SOP.
Nicaragua: Se está mejorando el Plan de respuesta.
Saint Lucia: It is part of tsunami response plan and Met Services emergency procedures.
Turks and Caicos: The Turks and Caicos as a Tsunami Warning Protocol for dissemination to the media. There is also a standard protocol for call out/notification at the national, island and community levels.
3A.2: The TWFP/NDMO knows its specific response role in the event of a tsunami.

3A.3: The TWFP/NDMO has, prior to the exercise, engaged in tsunami response planning.
3A.4: The TWFP/NDMO has undertaken activity to increase its capacity and capability to support a national tsunami response (for example, training, exercise, etc). Note activities in Comments section.

3A.5: The TWFP/NDMO has an appropriate management structure identified and documented to support tsunami response.
The country who answered no to the above question was: France, Cuba, Barbados, Sint Maarten, Cayman Islands, British Virgin Islands, Aruba, Mexico, Trinidad and Tobago, Colombia, St. Vincent and the Grenadines, Panama, Anguilla, Curacao, Dominica, US Virgin Islands, Turks and Caicos, Dominican Republic, Guyana, Guatemala, St. Kitts and Nevis and Bermuda.

The countries who said yes were: Puerto Rico, Saint Lucia, Anguilla, Costa Rica, Haiti

The comments received from the participant Tsunami National Contacts (TNC) were:

- Anguilla: Tsunami hazard map available for island with road signs, and notification procedures
- Guatemala: Los planes de evacuación los maneja la agencia de respuesta.
- Puerto Rico: PREMA is responsible for coordinating the activation of the Emergency Response Plan for each coastal community, which includes the mass coastal evacuation as established by the TsunamiReady Program.
- Saint Lucia: To be developed. The NDMO has evacuation plans for coastal communities.
- US Virgin Islands: We are in the process of installing tsunami signs, and maps are being developed.
- Trinidad and Tobago: In development.
- Costa Rica: si tienen planes de contingencia generales, que se han utilizado en casos reales sobre todo inundaciones y sismos.
- Haiti: The National Risk and Disaster Management System tsunami has mass coastal evacuation plan for two cities in the North Department: Cap-Haïtien and Port-de-Paix.
- Mexico: No. Nowadays twpf and ndmo are coordinating different governmental agencies to perform a coastal evacuation plan.
Sub-Objective 3B: To improve operational readiness. Before the exercise, ensure appropriate tools and response plan(s) have been developed, including public education materials.

3B.1: Arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response exist.

3B.2: A country tsunami emergency response plan (standard operating procedures) for interregional/local tsunamis exists.

The countries who answered no to the above question were: France, Cuba, Mexico, Panama, Venezuela, Dominica, Costa Rica, Turks and Caicos, St. Kitts and Nevis and Bermuda. The country who answered not applicable to the above question was: Dominican Republic. The comments received from the participant Tsunami National Contacts (TNC) were:
Aruba: Note though that only the met office has a SOP on tsunami.
Bermuda: Trying to develop one in conjunction with other government agencies.
Cayman Islands: exercise generated areas for plan improvements.
Colombia: El plan no se encuentra implementado al 100% pero existe el protocolo nacional.
Costa Rica: existen planes genéricos para eventos frecuentes, que pueden ser adaptados o servir como puntos de partida para elaborarlos.
Curacao: Adaptations needed.
Dominica: In draft.
Guyana: Civil Defense Commissions in Guyana deals with all disaster response.
Haiti: To be validated.
Puerto Rico: The emergency response plan for each coastal community sets the action to take for each event type: tele / regional / local tsunami.
St. Vincent and the Grenadines: Use national response mechanism.
Trinidad and Tobago: In draft form.
Venezuela: No yet, we are planning his production at this moment.

38.3: The response plan includes processes to issue all-clear (safe to return) notices.
3B.4: Public education materials have been developed and disseminated.

- Yes: 72.7% (24)
- No: 21.2% (7)
- Comment: 42.4% (14)
- Not Applicable: 30% (10)
3B.5: Are tsunami exercises routinely conducted in the country. Note date of most recent exercise (before CARIBE WAVE/LANTEX 13) in Comments section.

3B.6: Tsunami-related curriculum programmes are in place for all levels of education. Note which levels in Comments section.
3B.7: Are there other preparedness and education tools and products? Please list.
Sub-Objective 3C: Validate dissemination of warnings and information/advice by Tsunami Warning Focal Point to relevant in-country agencies and the public is accurate and timely.
3C.3: Did the TWFP send the PTWC and/or WCATWC Exercise CARIBE WAVE/LANTEX 13 scenario initial dummy message to the agency or agencies listed in Q3.C2?

3C.4: Was PTWC and/or WCATWC Exercise CARIBE WAVE/LANTEX 13 scenario initial dummy message sent to the agency or agencies listed in Q3.C2 within 2 minutes?
3C.5: The method of communication from your public-safety, national decision-making and dissemination point to agencies was sufficient (timely, clear, accurate) to support decision-making.

3C.6: The method of communication between our public safety, national decision making and dissemination point and individual response agencies and provinces/local jurisdictions was sufficient to support national information requirements and decision-making.
3C.7: Did a management group responsible for decision-making on tsunami warning and response assemble during the exercise?

- Yes: 68.8% (22)
- No: 21.9% (7)
- Comment: 31.3% (10)
- Not Applicable: 94% (3)

3C.8: If you answered yes to Q 3C.7 (above), was this timely to facilitate good decision-making?

- Yes: 72.0% (10)
- No: 5.0% (2)
- Comment: 32.0% (6)
- Not Applicable: 16.0% (4)
Sub-Objective 3D: Validate the organizational decision-making process about public warnings and evacuations.
The countries who answered no to the above question were: Mexico, France, Haiti, Sint Maarten, Nicaragua, Trinidad and Tobago, St. Vincent and the Grenadines, Panama, US Virgin Islands, Dominican Republic and Guyana.

The country who answered not applicable to the above question was: Cayman Islands, British Virgin Islands, Panama, Curacao, Guatemala, St. Kitts and Nevis and Bermuda.

The comments received from the participant Tsunami National Contacts (TNC) were:

Aruba: Although still in development.
Barbados: Maps are being developed under the Coastal Risk Management Project (CRMP) conducted by the Coastal Zone Management Unit.
Cayman Islands: technical assistance needed in this area.
Colombia: Se realizaron unos mapas para el ejercicio.
Costa Rica: se tienen mapas de inundación costera, pero no necesariamente por tsunamis.
Haiti: Tsunami evacuation maps are available for only two cities in the North of the country.
Puerto Rico: We have inundation maps for all 44 coastal communities.
Saint Lucia: yes, the maps were produced and the information taken into consideration in siting the assembly points for the evacuated students.
St. Kitts and Nevis: These are yet to be developed.
Turks and Caicos: Maps were available but used as part of the table top exercise.
Venezuela: were available only for the institutions that participated in the exercise.
3D.6: Did your country assess the tsunami threat during the exercise?
Select from the following list.
Sub-Objective 3E: Validate the methods used to notify and instruct the public are accurate and timely.
3E.3: If you answered yes to Q3E.1, how was the warning/information communicated to the public? Please check as many that apply:

- Radio: 66.7% (10)
- TV: 44.7% (7)
- Telegram: 40.0% (6)
- Print Media: 40.0% (6)
- Internet: 33.3% (5)
- Email: 33.3% (5)
- Post: 33.3% (5)
- Text message: 26.7% (4)
- Voice: 20.0% (3)
- Fax: 13.3% (2)
- Cell phone: 13.3% (2)
- Other: 6.7% (1)
Sub-Objective 3F: Validate the elapsed time until the public would be notified and instructed/advised.

3F.1: The public was officially notified prior to the scenario wave arrival time.

3F.2: In addition to the TWFP/NDMO, did other government and private sector participate? If yes, please list in comments section.
General Observations

4.1. The Country (TNC/TWFP/NDMO) has a better understanding of the responsibilities and roles in tsunami emergencies.

4.2. Gaps in capability and capacity have been identified.
The media coverage reported by the Tsunami National Contacts (TNC) were:


Bermuda: http://bernews.com/2013/03/bermuda-to-participate-in-tsunami-exercise/

Cayman Islands: http://compasscayman.com/caycompass/2013/03/20/Tsunami-exercise-underway/


Dominica: After the exercise the local Government Information Service (television) conducted an interview. Media was briefed prior to the exercise and asked not to broadcast.

Haiti: But they released information on the exercise:


St. Lucia: the exercise was covered by a number of local southern stations. Unfortunately due to strike action the Government Information Service was not able to cover the activity.

St. Vincent and the Grenadines: Agency for Public Information

Sint Maarten: A press release about the exercise was issued by the Department of Communications after the exercise.

Venezuela: http://www.elperiodiquito.com/article/91962/Venezuela-evaluara-capacidad-comunicacional-ante-tsunamis http://www.radiomundial.gob.ve/article/funvisi-coordin%C3%B3-exitosamente-ejercicio-de-respuesta-comunicacional-ante-tsunami http://www.vtv.gob.ve/articulos/2013/03/20/funvisi-coordino-exitosamente-ejercicio-de-
The country who answered no to the above question was: Guyana
The country who answered not applicable to the above question was: Panama
The comments received from the participant Tsunami National Contacts (TNC) were:

**Guatemala:** The information was excellent.

**Mexico:** Yes, we improved communications and detected errors. Also engage more institutions in the exercise.

**Saint Lucia:** Saint Lucia established a planning team about six months ago. That team met regularly to ensure that all systems were in place before the exercise.
4.6: Exercise planning at the international level went well.

4.7: Exercise planning at the national level went well.
4.8: Exercise planning at the provincial/local level went well.

- Yes: 50.0% (16)
- No: 12.5% (4)
- Comment: 15.5% (5)
- Not Applicable: 37.5% (12)

4.9: The CARIBE WAVE/LANTEX 13 exercise website pages were useful.

- Yes: 93.9% (31)
- No: 3.0% (1)
- Comment: 15.2% (5)
- Not Applicable: 30% (1)
4.10: This evaluation form was appropriate.

4.11: CARIBE WAVE/LANTEX 13 Exercise Manual provided an appropriate level of detail.
The countries who answered no to the above question were: Haiti, Sint Maarten, British Virgin Islands, Aruba, Anguilla and Curacao.

The comments received from the participant Tsunami National Contacts (TNC) were:

**Curacao**: At our current level of preparedness we see that exercising every two years gives us sufficient time to adapt procedures and work on the necessary. Plus from a budgetary perspective and taking into account the other types of hazards that need to be addressed we see think that every two years is better.
France: An Exercise CARIBE WAVE would be interesting annually provided alternate scenarios.

Nicaragua: Es una manera permanente de evaluar los Sistemas de Alerta que se tienen instalados en cada uno de los países y fortalecer actualizar permanentemente los planes de respuesta ante tsunami.

Puerto Rico: It is important that the exercise manual is available in other languages for the countries of the Caribbean. The language is an important factor to consider. The lives of many people are at stake in a tsunami. Should consider establishing a Tsunami Warning Center in the Caribbean.

St. Vincent and the Grenadines: That should be a decision at the national level.
General Statements from Caribe Wave/ Lantex 2013

Anguilla: The exercise went well. The message was received and disseminated in a timely manner. Evacuations were done efficiently. More work to be done for persons to believe that the Tsunami threat is real and should be taken seriously.

Aruba: All went well except we noticed that on Aruba all lines of communications with EOC and other departments depends on local telephone provider. We need to find a different way of sending messages or broadcasting it. The local EOC has a very expensive donation by UNDP for early warning, but it is not linked directly to the Met Office (TWFP) and it depends on the local telephone provider, so pretty much a waste on donated money by UNDP. Internet falls many times at Aruba and cellular messages also. From our point of view and years of experience on issuing warning messages neither internet, nor cell phones are a reliable source of sending warning messages to the public on Aruba. During the CaribeWave2013 when the dummy message came out the internet was flooded and crashed on Aruba. The whole Caribbean Risk Management Initiative (CRMI) UNDP R3I initiative is from the Met Office of Aruba point of view a waste. Were at the end the Met Office of Aruba did not get any tools to provide advance warnings to the general public.

Bahamas: I think that the message of the tsunami warning got out well but there could have been better coordination between relevant agencies before the exercise started, so everyone would know what is going on (less panic by agencies that did not know it was an exercise). I think relevant personal should be available for this type of training and not last minute replacements as I am considered to be. Otherwise, I think the exercise is a timely one that is important to our region and my country. I hope that it is not the last one and look forward to further training to help my country make the best decisions. One thing I believe could have been better done was the inclusion of the press both media and print. Maybe when we do a full blown exercise this could be included so the entire public could appreciate what is required in these types of emergencies. The National Emergency Management Agency of the Bahamas does its best to coordinate the proper personal and training for emergencies in the country. I think that exercises such as the CARIBE WAVE/LANTEX 13 can only help to better prepare NEMA's staff and relevant agencies for the unforeseen disasters of the future.

Barbados: The objectives of both the table top and functional exercises were met. The exercises revealed deficiencies in the national alert and warning system and the communication system. Recommendations coming out in the debriefing sessions were very valuable and will assist in the improving the current measures in place.

Bermuda: The general set up at BWS (Bermuda Weather Service) was adequate for the drill exercise we performed. Almost all relevant alarms/notifications went off or were received in a timely fashion for the start of the exercise. The only notification channel that did not initially work was our AIS-R - this was due to the AISR Message Window being closed, so the alert message could not be received. This was soon rectified by our IT administrator though. As mentioned the delay in contacting the NDC (National Disaster Coordinator) was not adequate, and ways of improving this are being investigated such as alternative numbers and points of contact. The data laid out in the PTWC messages could have been better formatted in the emails (not in clear columns, unlike the original exercise documentation which was clear). This could potentially cause some delay in digesting the data provided by PTWC. The other major point noted was the lack of data specific for Bermuda, especially buoy data to the south of the Island,
which could be useful. With regards to the graphical products, a figure for the tsunami wave height expected in Bermuda would have been useful too. Bearing these two points in mind, a decision to upgrade a Watch to a Warning locally would be very difficult, based on the lack of relevant data. Finally, this year Bermuda Weather Service performed the exercise (LANTEX13) at a lower level than in previous years. We are hopeful of performing to table top level with the next exercise. In the meantime, based on the outcome of this exercise, we will liaise with government and other agencies to improve our Tsunami preparedness plans.

Cayman Islands: Overall it was a useful exercise that allows wide participation of the countries in the Caribbean. It also allowed for sharing of knowledge amongst the countries. In Cayman it provided the opportunity for a number of safety and response agencies to have a greater appreciation of the threat and response required for tsunamis. It has led to an overall review of our Tsunami plan and public education strategy. It has generated substantial discussion on the hazard and renewed focus which will lead to greater participation of all government and private agencies in the planning process.

Colombia: La opción de ejercitarse para un altamente improbable y extremo evento puede merecer discusiones futuras. El ejercicio permitió identificar puntos a mejorar en los procedimientos y protocolos del sistema nacional de detección de alerta de tsunamis de Colombia así como la importancia de trabajar de cerca con los medios de comunicación para evitar especulaciones.

Costa Rica: La realización de estos ejercicios permite una mejor contextualización de la realidad de nuestro país en este tipo de escenarios, sus fortalezas y debilidades. Es necesario que los organizadores realicen visitas a la mayoría de los países para incitar a una mejor participación y llevarlo incluso a involucrar directamente a algunas comunidades vulnerables.

Curacao: All went well, except next time we can plan something much bigger.

Dominica: *Prime Ministers ability to declare an incident needs to have some specific rules around notification down to ensure all know the official nature of declaration *Technical input to validate tsunami warning for PM office (confused messaging from WCATWC and PTWC) *Clear evacuation orders passed down in timely manner *Full information received by Commissioner of Police and NDC immediately after broadcast for interpretation *Limited support staff trained in interpreting message or understanding importance of message clear roles and responsibilities for all responding agencies, NGO's, committees *Clear communication with all participating in the exercise that it is an EXERCISE, a number of school students were confused who were assisting with the timing of evacuation routes *Heavy reliance on mobile phones. *Communications between police limited to mobiles *No system for verbal broadcasting *Was notification given to Portsmouth Harbour Master to evacuate and move ships in Port? *Education about warning systems to be used *Education about warning signs of an incoming Tsunami and what to expect *Mayor suggested the students involved in the exercise should be given a present (small token) to show appreciation for participating and raise awareness about tsunami's *Schools getting trained in fire drills, but no other emergencies *No knowledge of incapacitated persons whereabouts by committee/Police *Police missing key response gear - PA system for cars - local radio communications - Road block signs -road barricades - Hi vis vests - First Aid Kits" *No hi vis vests to identify disaster committee *Ability to operate a remote emergency centre with gear and resources *No evacuation routes marked on the ground with stencils or with street signs or combination. Safety areas to be identified and marked with
signage. *No hazard maps installed *Tsunami warning not received immediately by key officials *Families don't have disaster plans

**France:** The three French territories (Martinique, Guadeloupe, Saint-Martin) played simultaneously exercise with the same objectives. The main objective of Caribe Wave 13 was to validate the concept down with a warning TWFP (which receives the alert uplink) and NDMO (which analyzes and disseminates alert). Transmission of the alert is made with a platform of mass mailing with 90% success. (Authorities for decisions, and services for equities) Alert the media: Alert the media is through an SMS alert from the NDMO. Upon receipt of the message, the media broadcast a message to the people of preformatted communication. Main lesson learnt: - Develop an action plan for the SOP - Highlighting the need to build a public awareness strategic plan.

**Guatemala:** Se tuvo problemas al inicio con el Internet en nuestras instalaciones, pero rápidamente se hicieron los arreglos y se pudo proseguir, por lo demás todo bien, se recibieron los mensajes de acuerdo a lo planificado, creemos que el ejercicio en general estuvo muy bien. La recepción de datos fue en el centro de emergencia fueron claros y precisos, se llamaba para confirmar su recepción. Como una recomendación sería necesario emitir los boletines en varios idiomas.

**Nicaragua:** El ejercicio es una oportunidad para sensibilizar a la población, tomadores de decisiones a nivel local. Mejorar los planes de respuesta y Capacitación de la población. Establecer prioridades y tener mejores conocimientos de cómo afrontar el fenómeno. Esta evaluación fue avalada por el Secretario Ejecutivo del Sistema Nacional para la Prevención, Mitigación y Atención de Desastres (SE - SINAPRED), Dr. Guillermo González.

**Panama:** In general communications went well and were timely at the national level. The main obstacle is that the populations of the most probable hardest hit areas have not been prepared and do not know how to behave in case of a major tsunami.

**Puerto Rico:** As in previous years, in Puerto Rico we had a wide participation. We are in the process of collecting all the After Action Reports. Right now I can only comment on the subject of communications: All products were received and disseminated in a clear, timely and accurate manner. This includes the WCATWC dummy message and the nine products issued by the Puerto Rico Seismic Network. The dissemination of the nine products from the Puerto Rico Emergency Management Agency (TWFP) to the 44 coastal local emergency management offices in Puerto Rico was performed within the first two minutes of the receipt of the product from the TWC. All other information about what went well, what did not go well and what could be improved, in aspects of exercise planning, as well as exercise conduct, will be evaluated and will be reported later.

**Saint Kitts and Nevis:** The Orientation Exercise that was conducted for Saint Kitts Nevis went well. The exercise provided the participants with relevant information for sensitization on tsunamis and served to enhance relationship between them and the National emergency management organization. It also served to highlight the complexity and various issues critical to tsunami readiness at the national level. This exercise provided the ideal platform for identification of gaps in the national plan regarding the mass public alerting mechanism and the development of SOPs and plans for tsunamis However, there were a number of stakeholders absent.
**Saint Lucia:** the exercise in Saint Lucia went well. We evacuated eight schools, with approximately 1350 children taking part in the exercise. The inter-agency cooperation and coordination was at the highest level. Another highlight was the cooperation of the Police, who did a great job in protecting the students as they evacuated from their schools. Traffic management and crowd control measures were implemented with rapidity by the Police. The Ministry of Education has been working with the schools to ensure that all schools have a disaster plan and this exercise gave the schools an opportunity to test the evacuation component of the plan. The National Planning committee was put in place very early, which ensured that all issues were ventilated and dealt with. Several actionable points emerged at the After Action Review with the express aim of strengthening the tsunami response capability and capacity of the response agencies in the country. The webinars, although useful could have contributed more in terms of assisting countries with specific issues that they might have been encountering. Also, the IOC should consider providing the countries with some financial support to put on these drills. The cost of putting on a full scale tsunami exercise may preclude some countries from putting on more elaborate drills to fully test our response agencies. Consideration should be given to run the drill every year, providing there is some financial support offered to countries that might not be in a fiscal position to run the exercise every year.

**Saint Vincent and the Grenadines:** Understanding the standard procedures from when the initial message and watch is received to the dissemination of information for public went well. There was however some confusion as to whether an 'alert' shall be given first instead of a warning, despite going over the script.

**Sint Maarten:** On Sint Maarten the exercise was carried out in the form of a communications test. All stakeholders received the messages and were asked to respond virtually. Not all agencies complied though. Some agencies did not receive the messages in a timely fashion or did not read their messages until after the drill.

**Turks and Caicos:** The Turks and Caicos Islands took part in a table top exercise at the Department of Disaster Management and Emergencies, Providenciales, on 20th March, 2013 at 8:30 am. This exercise involved agencies with disaster management responsibilities, thus eliciting constructive discussions on plans, policies and procedures moving forward. Out of this discussion, disaster management and its partnering agencies will be able to review lines of communication, review tsunami response procedures, and promote tsunami preparedness throughout the entire Turks and Caicos Islands communities. A quasi-functional testing of communications was also carried out by 911 Police who tested the Telecommunications Capability to the primary media partners in the Turks and Caicos Islands. Issues to be examined: Building Communication Redundancies Continuity of Government Public Awareness and Dissemination Products such as Social Media Further integration of Tsunami Hazard Information into the Educational Curriculum Audit of Warning and Dissemination Products already in existence Linkages with the Academic/Scientific Community Impacts on Tourism and Financial Sector.

**US Virgin Islands:** It enabled the Emergency Service Coordinators (ESC) to interact/discuss and understand they their agency plan must be updated.

**Venezuela:** The exercise Caribe Wave 13 fulfilled his mission and aims, the tsunami drill allowed to evaluate and to check our strengths and our weaknesses. For example: We tested communications and raises several questions there: What happens if: the light fails and cellular
telephone--- how we manage the communication? Etc. In general the exercise planning was very well because is possible to think what happen if... but in the exercise conduct is necessary money and to meet the goals and this is sometimes not easy to get if you have no support from the authorities.