

EXERCISE CARIBE WAVE/LANTEX 13
A Caribbean Tsunami Warning Exercise
20 march 2013

Volume 2

Final Report

**EXERCISE CARIBE WAVE/LANTEX 13
A Caribbean Tsunami Warning Exercise
20 march 2013**

Volume 2

Final Report

IOC Technical Series, 101, Volume 2
Paris, July 2020
English/Spanish

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariats of UNESCO and IOC concerning the legal status of any country or territory, or its authorities, or concerning the delimitation of the frontiers of any country or territory.

For bibliographic purposes, this document should be cited as follows:

UNESCO/IOC. 2020. *Exercise Caribe Wave/Lantex 13. A Caribbean Tsunami Warning Exercise, 20 March 2013. Volume 2: Final Report.* Paris, UNESCO.

Published in 2020
by United Nations Educational, Scientific
and Cultural Organization
7, Place de Fontenoy, 75352 Paris 07 SP

© UNESCO 2020

(IOC/2012/TS/101 Vol.2)

TABLE OF CONTENTS

page

Summary	1
1. BACKGROUND	3
1.1 EARTHQUAKE IMPACT SCENARIO	5
2. EXERCISE CONCEPT	6
2.1 PURPOSE.....	6
2.2 OBJECTIVES.....	6
2.3 TYPES OF EXERCISE.....	6
3. EXERCISE OUTLINE.....	8
3.1 GENERAL	8
3.2 MASTER SCHEDULE (EXERCISE SCRIPT)	11
3.3 ACTIONS IN CASE OF A REAL EVENT	13
3.4 PROCEDURE FOR FALSE ALARM.....	13
3.5 RESOURCES.....	13
3.6 MEDIA ARRANGEMENTS	14
4. POST-EXERCISE EVALUATION.....	15
5. REFERENCES.....	15

ANNEXES

- I. CARIBE WAVE/LANTEX 13 SURVEY RESULTS
- II. LIST OF ACRONYMS

Summary

On 20 March 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 (NTHMP). Thirty (30) Member States and 15 of the territories¹ 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.

Four hundred and eighty-one (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 (WCATWC), and/or the Puerto Rico Seismic Network (PRSN). 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 5th Commonwealth wide tsunami exercise.

Registered participants included 46 UNESCO CARIBE-EWS Tsunami Warning Focal Points (TWFPs) 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 metres.

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:

- 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.

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).

- 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 (CTWP) and included the UNESCO/IOC, CARIBE-EWS officers, Pacific Tsunami Warning Center (PTWC), West Coast and Alaska Tsunami Warning Center (WCATWC), the International Tsunami Information Center (ITIC), regional emergency management organizations and Tsunami National Contacts and Tsunami Warning Focal Points.

The Participant Handbook ([IOC/2012/TS/101 VOL.1](#)), 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://caribewave.info>) 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 (35) Tsunami National Contacts (TNC) 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:

- Ninety-seven percent (97%) of the respondents were satisfied with the planning, conduct, format and style of the exercise
- Ninety-four percent (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 Centres (TWC) .
- Eighty-three percent (83%) of the countries that responded also received the email messages that were issued to those who registered from the warning centres with the products.
- Seventeen percent (17%) of the countries that received the emails noted that they received them with delay, slight delay.
- Ninety-two percent (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
- Hundred percent (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
- Ninety-three percent (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.
- Fifty-nine percent (59%) (up from 50% in 2011) indicated that their country had an emergency response plan for tsunamis.
- Eight (8) Member States or their territories indicated that they had tsunami inundation maps available for evacuated areas.
- Twenty percent (20%) of the TWFP/NDMO indicated that they had tsunami mass coastal evacuation plan.

- Forty-seven percent (47%) indicated that the news media participated and covered the exercise.
- Sixteen (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.
- Eighty percent (80%) indicated that CARIBE WAVE should be conducted annually.

The countries and territories indicated through 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 20 March 2013 to assist tsunami preparedness efforts throughout the Caribbean and Adjacent regions. Thirty (30) Member States and 15 of the territories² 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.

² 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).

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 (CEMA), the Coordination Center for the Prevention of Natural Disasters in Central America (CEPREDENAC), the National Oceanic and Atmospheric Administration (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.

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 United States Geological Survey (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/>). 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/>). 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 Annex III of the Participant Handbook

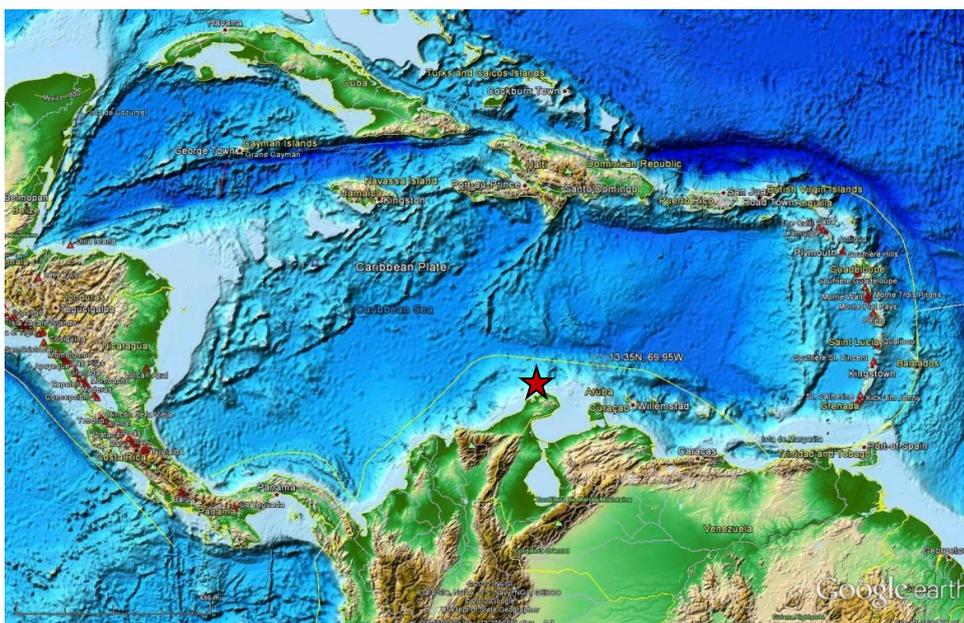


Figure 3. Caribe Wave 13/Lantex 13 earthquake epicentre location

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 ICG/CARIBE-EWS Tsunami Warning Focal Points (TWFPs) 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 programme. 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

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.

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.



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 hypocentre parameters:

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

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. [Annex II 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 and 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 cancelled. 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, 5 and 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.

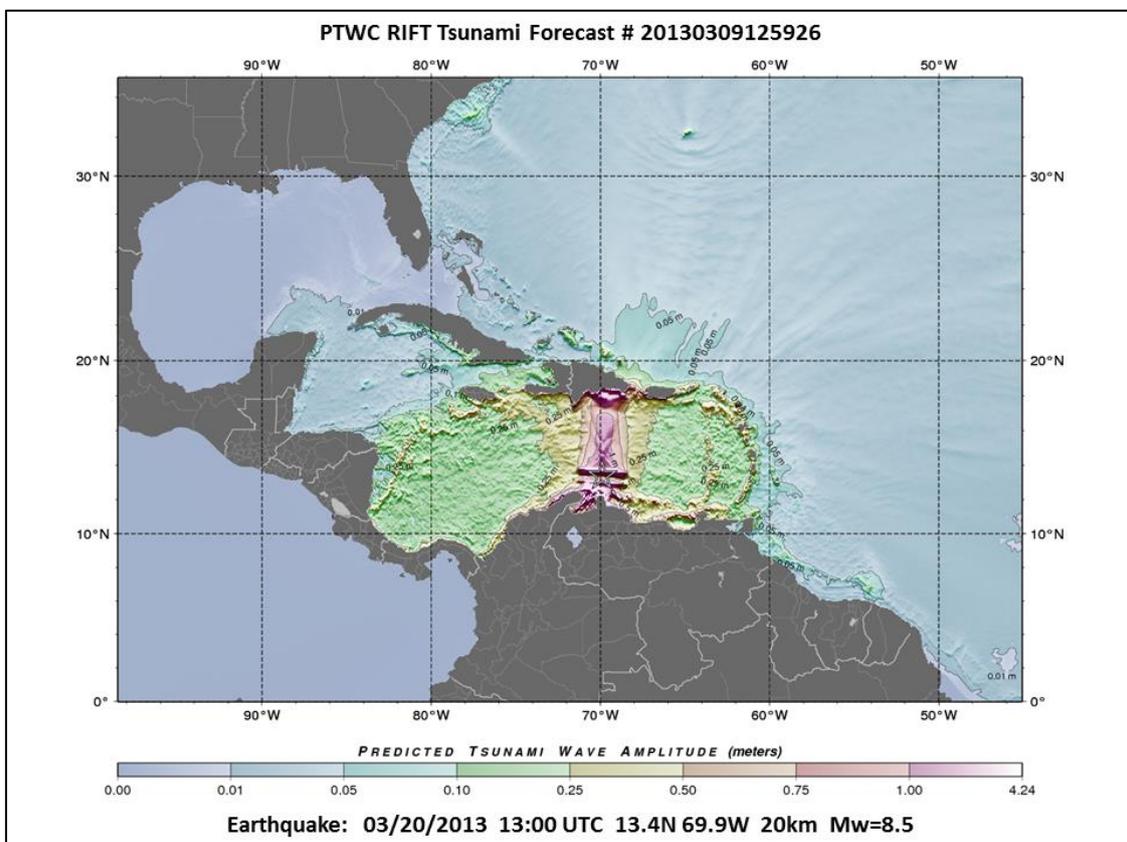


Figure 7. Propagation and energy map of simulated CARIBE WAVE 2013 tsunami.

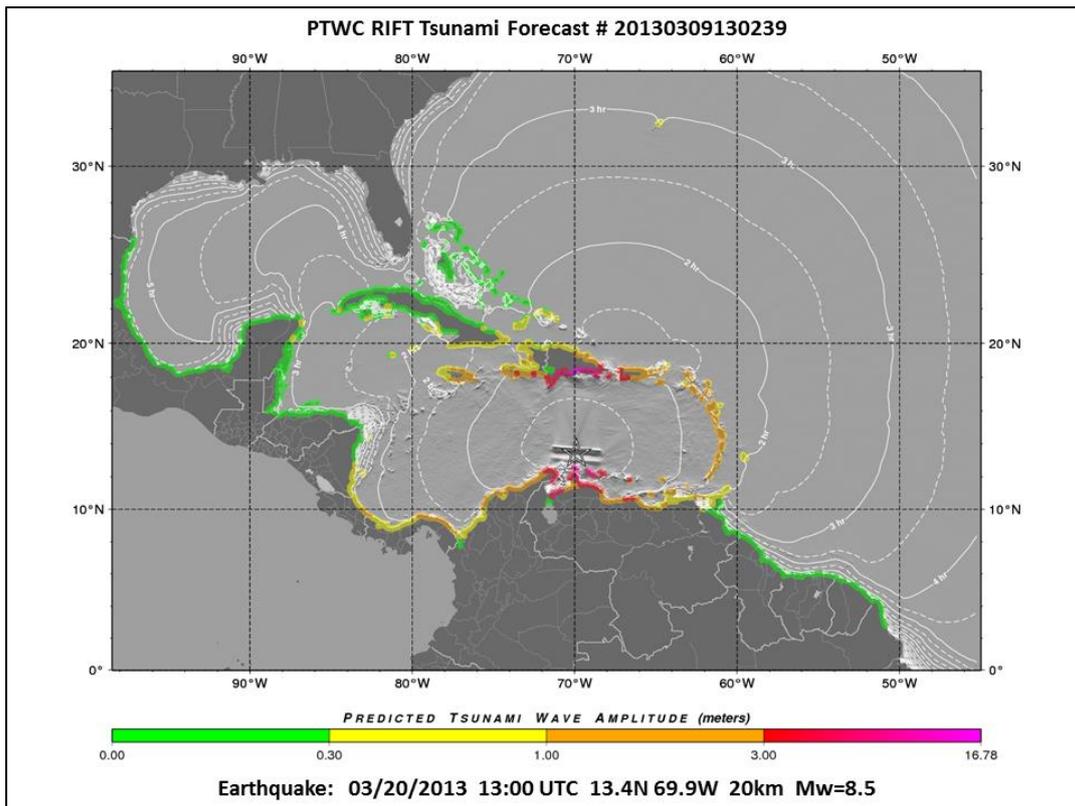


Figure 8. Predicted coastal amplitudes of tsunami at 1 m water depth for CARIBE WAVE 2013 scenario.

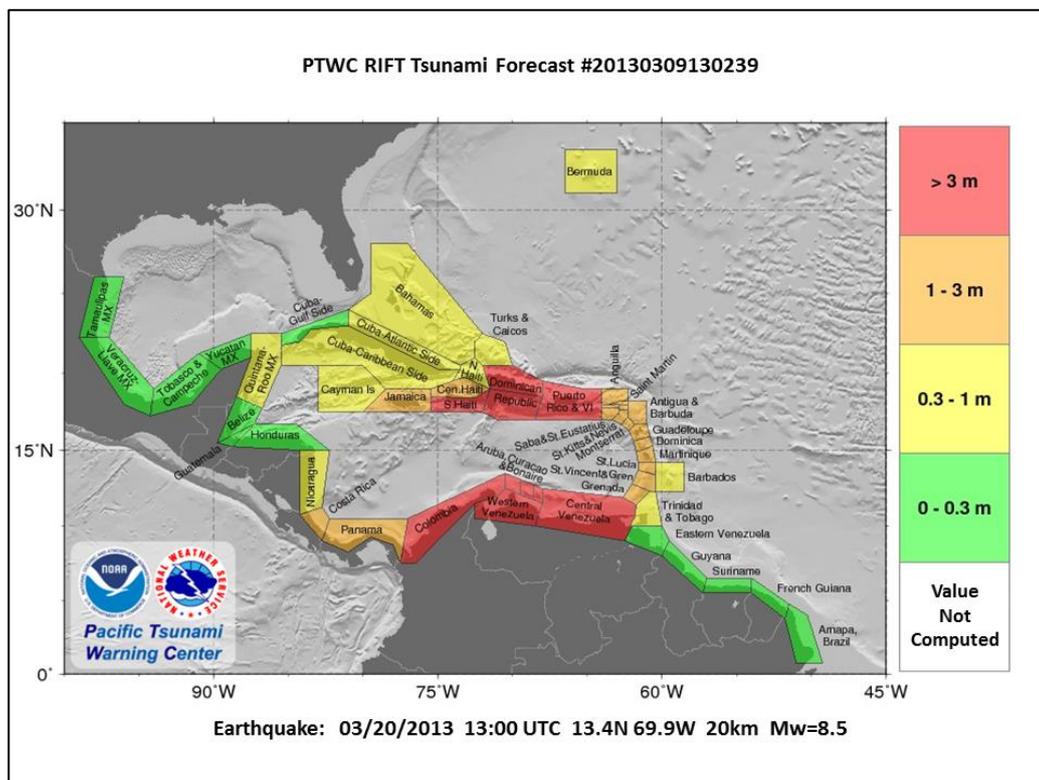


Figure 9. Map with summary of tsunami wave amplitudes by polygons for the CARIBE WAVE 2013 scenario.

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 20 March 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 Centres.

Date (UTC)	Time (UTC)	WCATWC Message				PTWC Message				
		#	Type	Dummy	Email	#	Type	Dummy	Email	
03/20/2013	1300		----- Earthquake Occurs -----							
03/20/2013	1302	01	Warn	Yes	Yes	01	Watch	Yes	Yes	
	1330					02	Watch	No	Yes	
03/20/2013	1337	02	Warn	No	Yes					
03/20/2013	1402	03	Warn	No	Yes					
	1420					03	Watch	No	Yes	
03/20/2013	1432	04	Warn	No	Yes					
03/20/2013	1502	05	Warn	No	Yes					
	1515					04	Watch	No	Yes	
03/20/2013	1604	06	Warn	No	Yes					
	1610					05	Watch	No	Yes	
03/20/2013	1704	07	Warn	No	Yes					
	1710					06	Watch	No	Yes	
03/20/2013	1803	08	Warn	No	Yes					
	1810					07	Watch	No	Yes	
03/20/2013	1902	09	Can	No	Yes					
	1910					08	Can	No	Yes	

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

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

Centre	WMO ID	AWIPS ID	NWWS	AFTN	GTS	EMWIN	Fax	Email
WCATWC	WEXX30 PAAQ	TSUATE	Yes	Yes	Yes	Yes	Yes	Yes
PTWC	WECA41 PHEB	TSUCAX	Yes	Yes	Yes	Yes	Yes	Yes

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

NWWS	NOAA Weather Wire Service
GTS	Global Telecommunications System
EMWIN	Emergency Manager's Weather Information Network

The TWFP reported using a variety of methods to receive the dummy message, with FAX and Email being the most common (Figure 6).

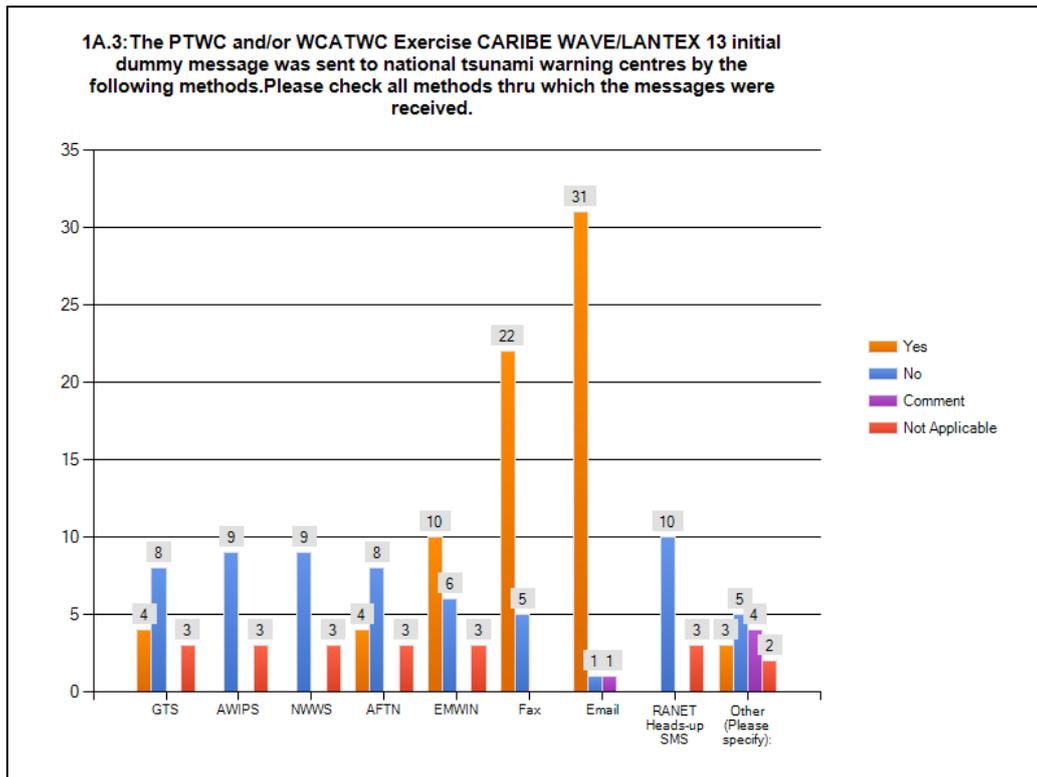


Figure 10. Methods that CARIBE-EWS TWFP used to receive the dummy message sent by the US TWC.

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 ICG/CARIBE-EWS 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.

Person	Telephone #	Email
Christa von Hillebrandt-Andrade, CARIBE EWS Chair and CTWP Manager and CARIBE WAVE 13 Task Team Chair for ICG CARIBE EWS	787-249-8307	christa.vonh@noaa.gov
Victor Cano, CARIBE EWS Vice Chair	58-212-2575153	vcano@funvisis.gob.ve
Philippe Sarron, CARIBE-EWS Vice Chair		philippe.sarron@martinique.pref.gouv.fr

Person	Telephone #	Email
Dawn French, CARIBE-EWS Vice Chair		director@nemo.gov.lc
Emilio Talavera, Chair CARIBE-EWS WG1	505-22492761	emilio.talavera@gf.ineter.gob.ni
Narcisse Zahibo, Chair CARIBE EWS WG2		narcisse.zahibo@univ-ag.fr
Elizabeth Klute, Chair CARIBE-EWS WG3		elizabeth.klute@gmail.com
Kerry Hinds, Chair CARIBE-EWS WG4	504-2290606 x401	kerry.hinds@gmail.com
Bernardo Aliaga, Technical Secretary CARIBE-EWS CTIC Director	33-1-45683980	b.aliaga@unesco.org
Laura Kong, ITIC Director		laura.kong@noaa.gov
Jeremy Collymore, Executive Director CDEMA	246-425-0386	Jeremy.Collymore@cdema.org
Wilfried Strauch, CEPREDENAC	502-2362-1981-83	wilfried.strauch@yahoo.com
Melinda Bailey, NWS Southern Region	817-978-1100x107	melinda.bailey@noaa.gov
Wilfredo Ramos, PREMA Rep.	787-724-0124	wramos@prema.pr.gov
Paul Whitmore WCATWC Director	907-745-4212	paul.whitmore@noaa.gov
James Waddell WCATWC Rep.	907-745-4212	james.waddell@noaa.gov
Charles McCreery PTWC Director	808-689-8207	charles.mccreery@noaa.gov
Gerard Fryer PTWC Rep.	808-689-8207	gerard.fryer@noaa.gov
Victor Huerfano PRSN Interim Director	787-833-8433	victor@prsn.uprm.edu

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. **Forty-seven percent (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 (endi.com, accessed 14 March 2013)

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 (36) 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 [Annex I](#). 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

- Benz, H.M. et al. 2011. *Seismicity of the Earth 1900–2010 Caribbean plate and vicinity*. U.S. Geological Survey Open-File Report 2010–1083-A, scale 1:8,000,000.
- Ministry of Civil Defense and Emergency Management. 2009. *CDEM Exercises Director's Guideline for Civil Defence Emergency Management Groups* (DGL101/09).
- ten Brink, U. et al. 2008. *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, 300pp.
- UNESCO/IOC. 2010. *Exercise Caribe Wave 11. A Caribbean Tsunami Warning Exercise, 23 March 2011. Participant Handbook, Media Reports and Supplement*. Paris, UNESCO, IOC Technical Series No. 93. (English, French and Spanish) ([IOC/2010/TS/93 Rev.](#))
- UNESCO/IOC. 2011. *Exercise Caribe Wave/Lantex 11. A Caribbean Tsunami Warning Exercise, 23 March 2011. Volume 2: Exercise Report*. Paris, UNESCO, IOC Technical Series No. 101. ([IOC/2011/TS/93Vol.2](#))
- UNESCO/IOC. 2011. *Exercise Caribe Wave/Lantex 11. A Caribbean Tsunami Warning Exercise, 23 March 2011. Volume 2 (Supplement): Media Reports*. Paris, UNESCO, IOC Technical Series No. 101, ([IOC/2011/TS/93Vol.2](#)).
- UNESCO/IOC. 2012. *Exercise Caribe Wave/Lantex 13. A Caribbean Tsunami Warning Exercise, 20 March 2013. Volume 1: Participant Handbook*. Paris, UNESCO, IOC Technical Series No. 101. ([IOC/2012/TS/101Vol.1](#))
- UNESCO/IOC. 2013. *How to plan, conduct and evaluate UNESCO/IOC tsunami wave exercises*. Paris, UNESCO, IOC Manuals and Guides No. 58 rev. (English, Spanish). ([IOC/2012/MG/58 Rev.](#)) (Important reference).

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).

ANNEX I

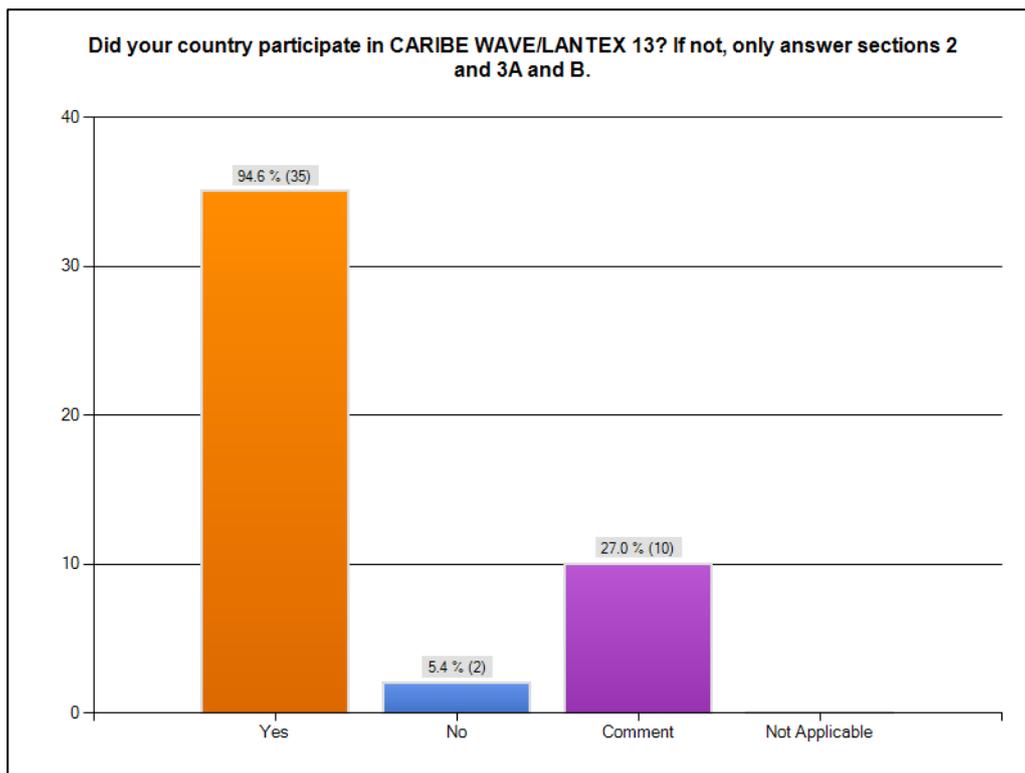
CARIBE WAVE/LANTEX 13 — SURVEY RESULTS

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, Guadeloupe, Saint Martin, Guyane, Saint Barthélemy) (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 of America (Puerto Rico and US Virgin Islands)
27. Venezuela (Bolivarian Republic of)

Country Contact Information Section



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.

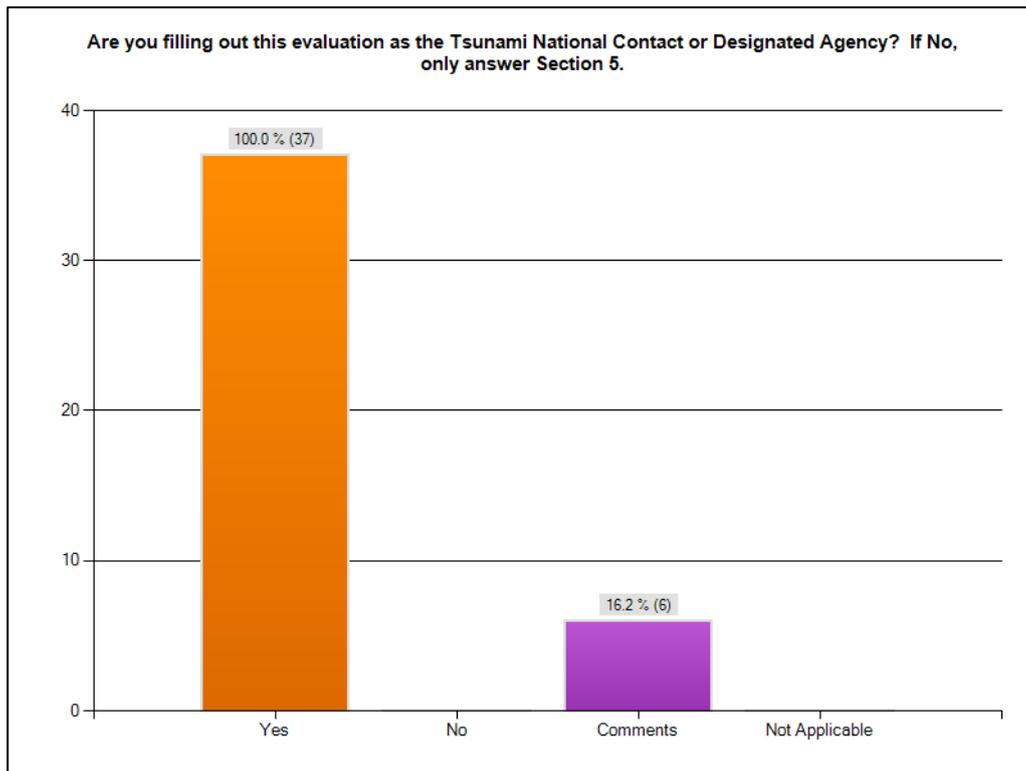
Nicaragua: En Nicaragua participamos tres instituciones gubernamentales: INETER, Secretaría Ejecutiva del Sistema Nacional de Atención y Prevención del Desastre (SE - SINAPRED) y Defensa Civil. Participaron alrededor de 30 personas en el marco del ejercicio.

Puerto Rico: This is our fifth participation in Lantex (2009, 2010, 2011, 2012 and 2013).

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.

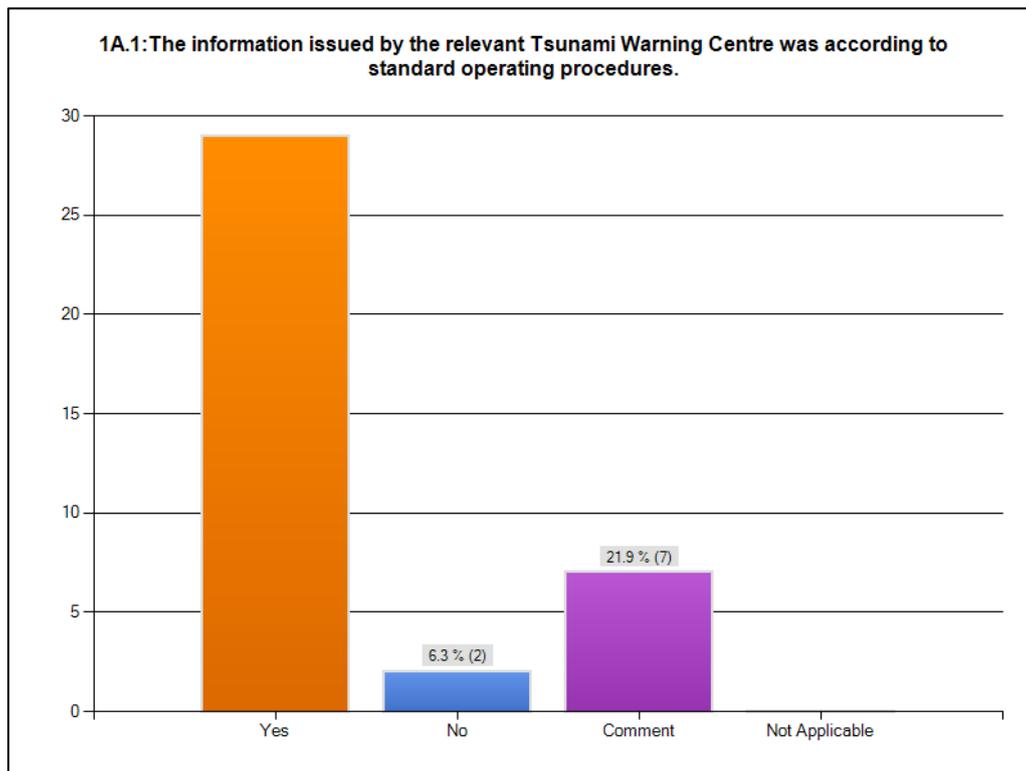
Saint Lucia: This evaluation is being filled out on behalf of the Tsunami National Contact Point, the National Emergency Management Organization.

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.

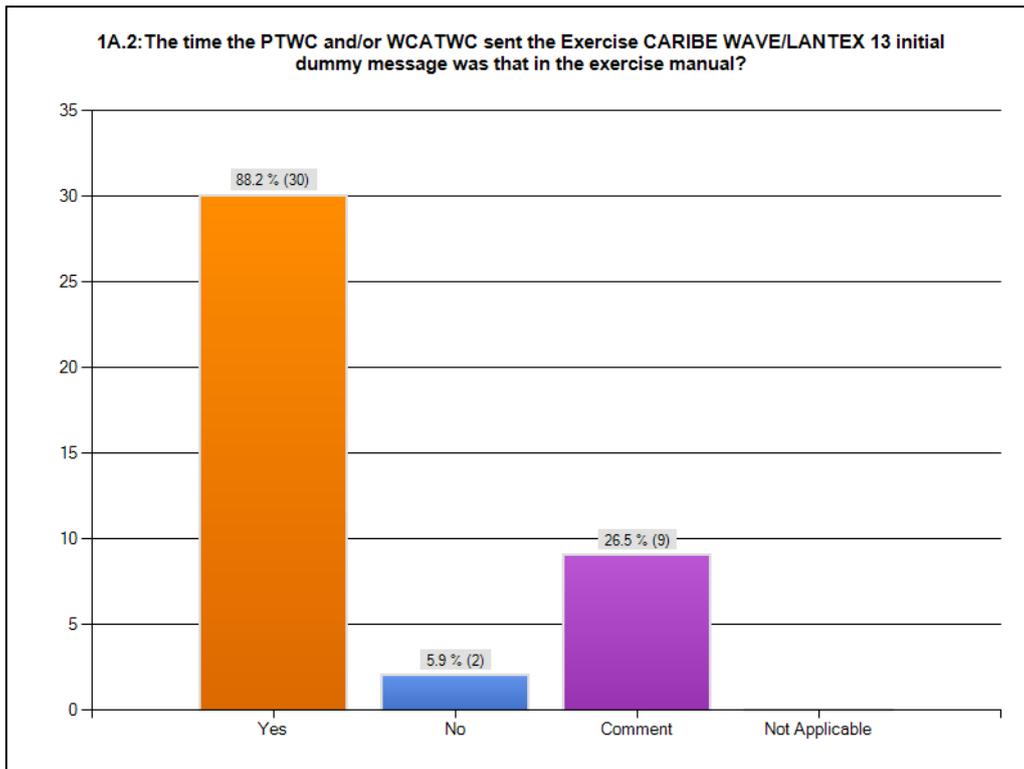
Curacao: Through the different communication channels the message was received as test and not the dummy message itself. This caused some confusion.

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.

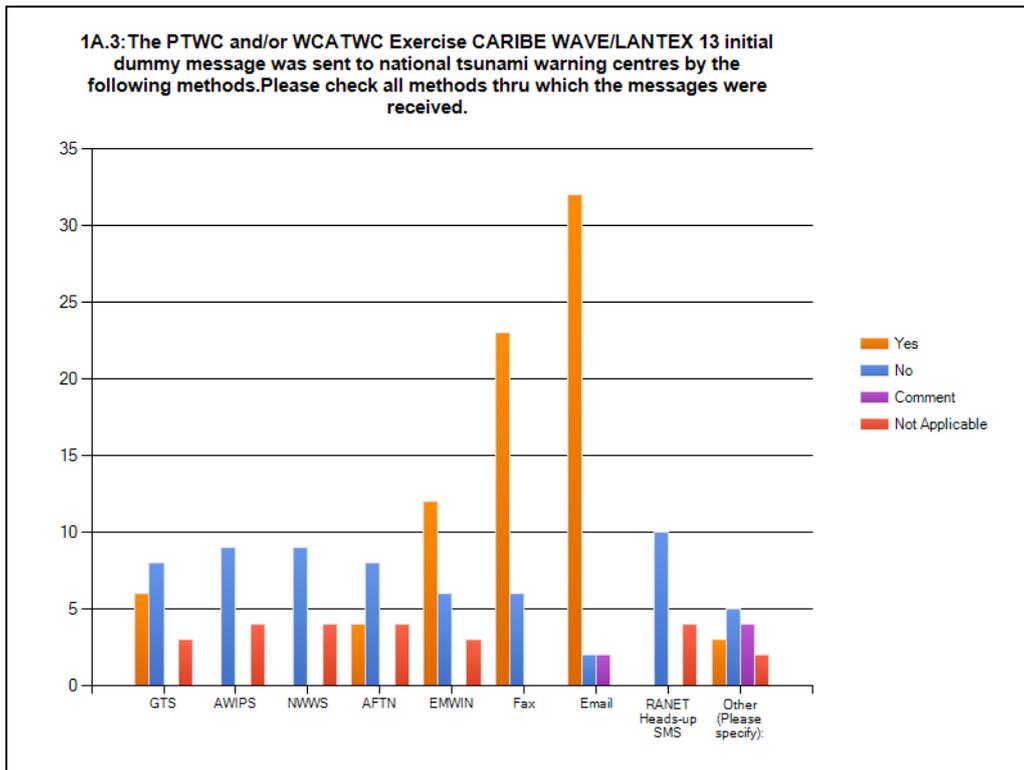
Dominica: We did not receive the message until 12 minutes after messages were sent as data over mobile network is slow and we were not in the office with the fax machine. No SMS was received prompting us to find faster internet connection to look at the full information in the messages.

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:

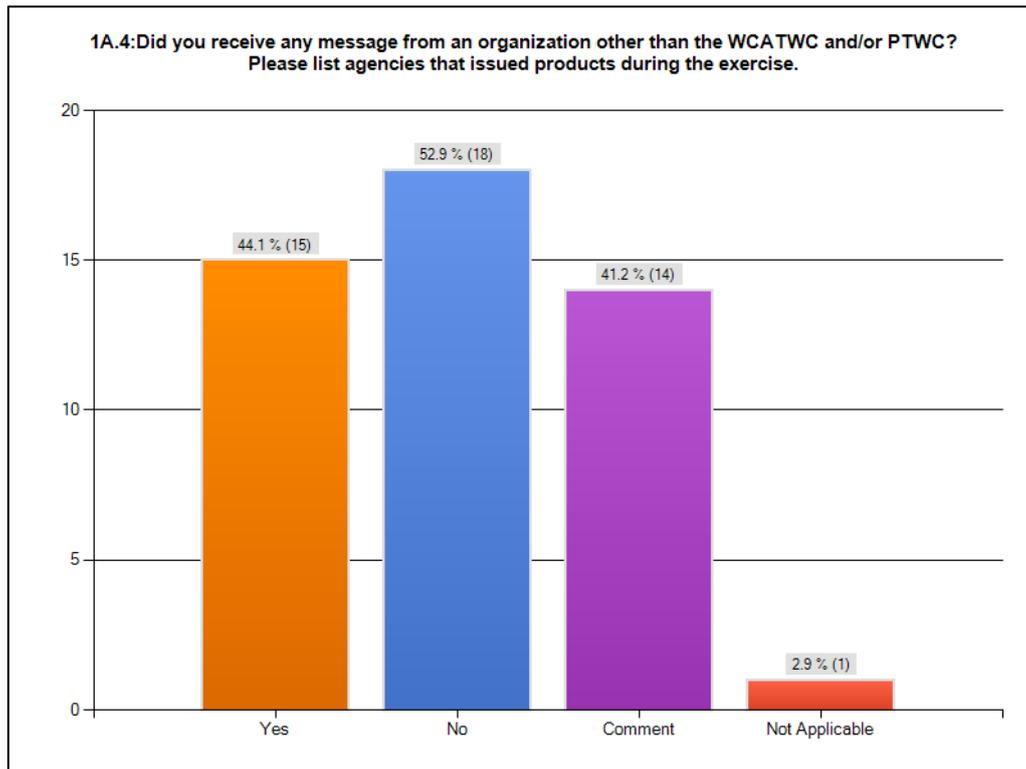
Bermuda: Message also received on our AIS-R (Aeronautical Information System Replacement).

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 + Inmarsat-C.

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).

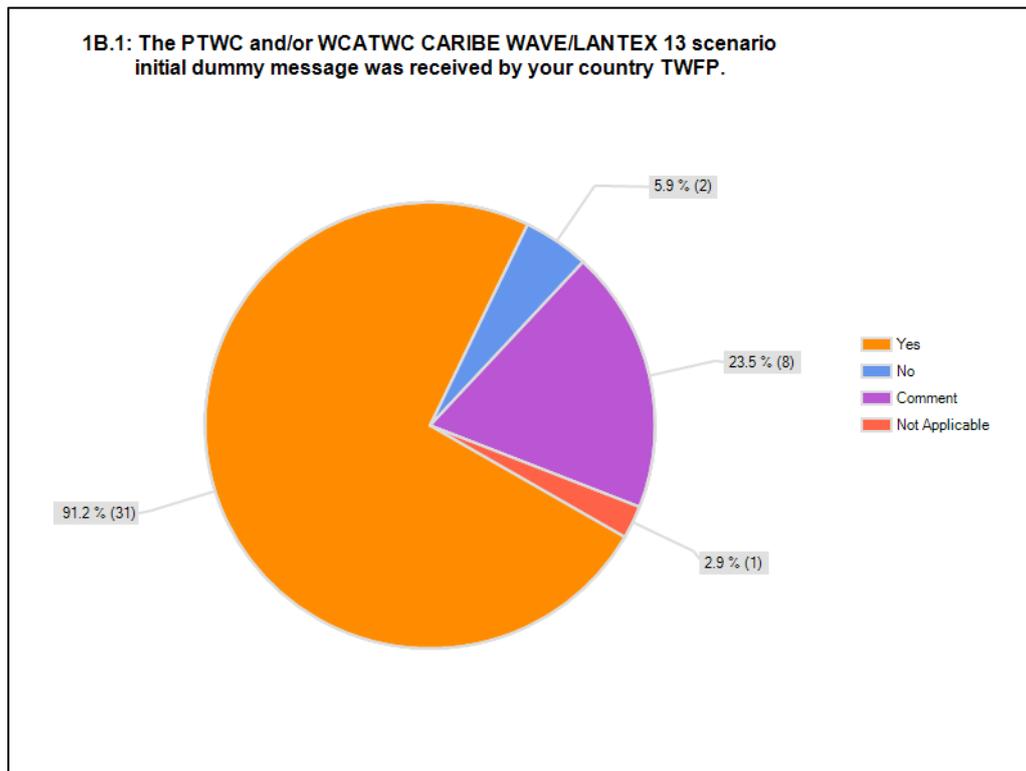
St. Kitts and Nevis: Messages were received from Antigua and Barbuda MET services.

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.

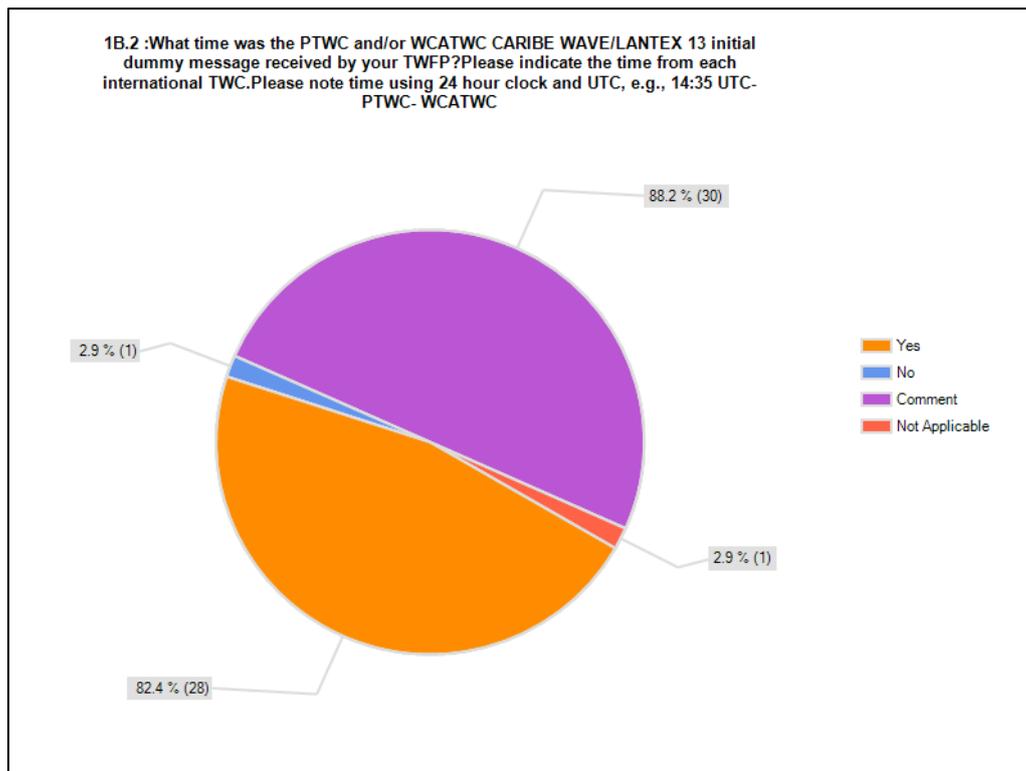
Dominican Republic: PTWC.

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: 13:04UTC.

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 CANCELATION - 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 CANCELATION.

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: 13:04UTC. 1301 UTC

Saint Vincent and the Grenadines: Messages received by both PTWC and WCATWC at 1303UTC.

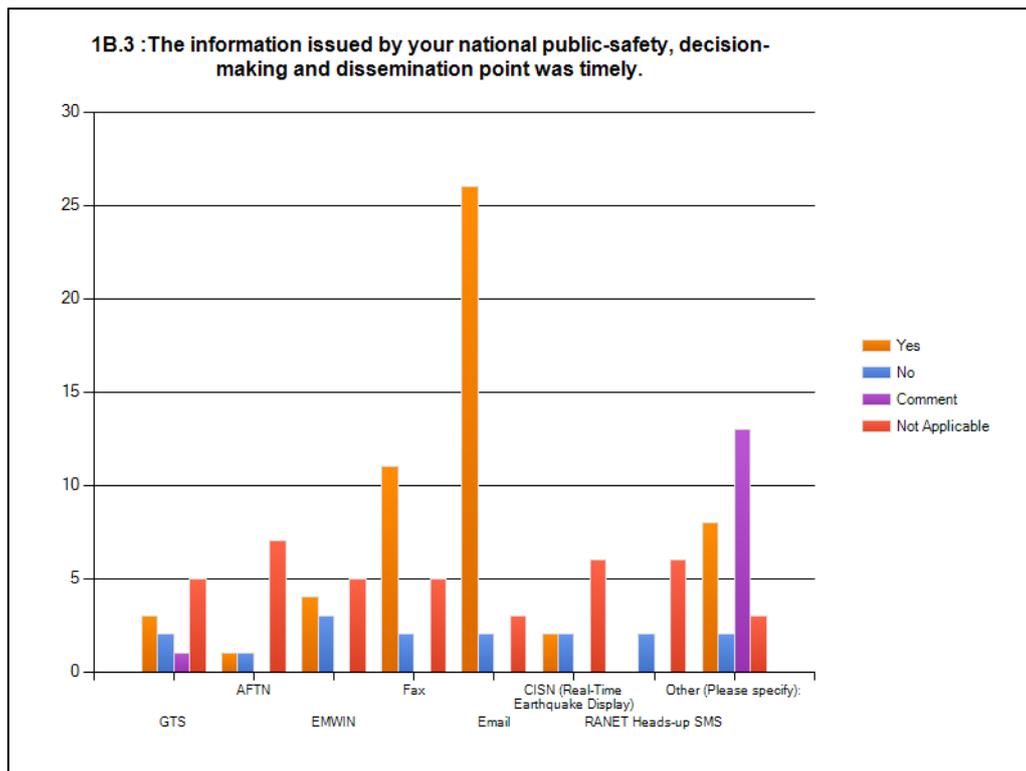
Sint Maarten: 09:05 AST = 13:05 UTC.

Trinidad and Tobago: 1300 hrs UTC.

Turks and Caicos: The message was received at 2:02 UTC time.

US Virgin Islands: 10:10 UTC.

Venezuela: 13:04 UTC fax PTWC Message 1 13:04 UTC PTWC Message 2 13:30 UTC PTWC Message 3 14:20 UTC PTWC Message 4 15:15 UTC PTWC Message 5 16:10 UTC PTWC Message 6 17:10 UTC PTWC Message 7 18:10 UTC PTWC Message 8 19:10 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 relación especialistas en oceanografía y sismología 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 + **Inmarsat-C**.

Nicaragua: Hubo comunicación fluida vía radio con defensa civil y Sinapred desde el INETER.

Panama: radio and telephone.

Puerto Rico: Radio Frequency Computer Aided-Dispatch.

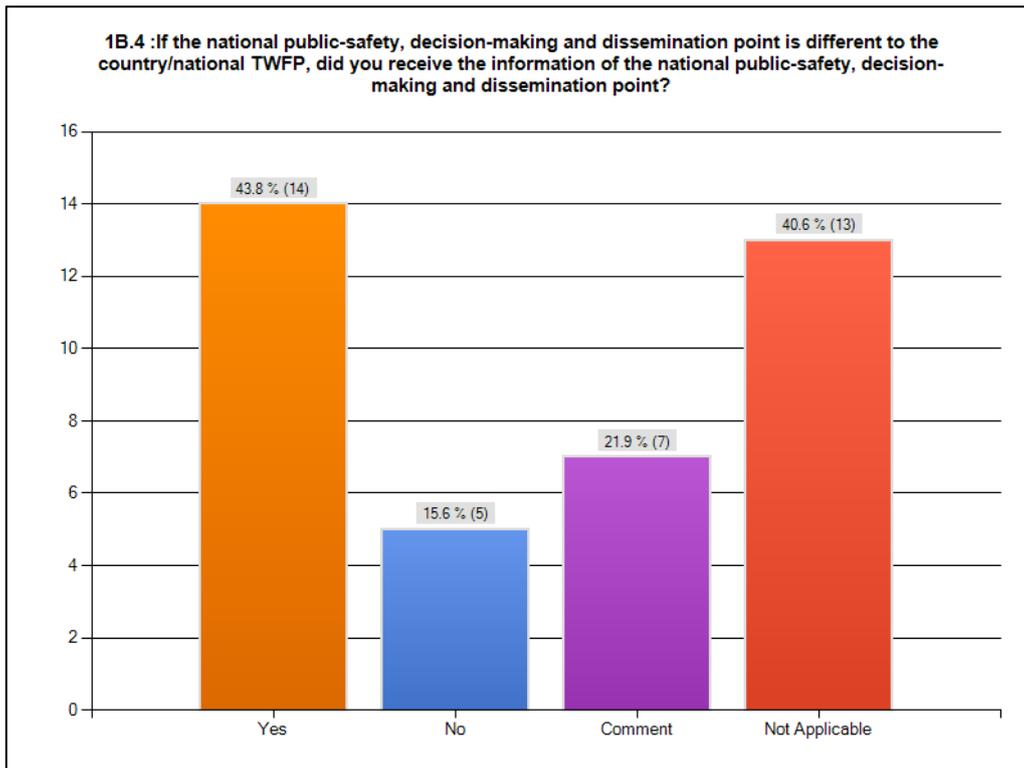
Saint Kitts Nevis: Saint Kitts Nevis held an orientation exercise so this question was not applicable.

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:

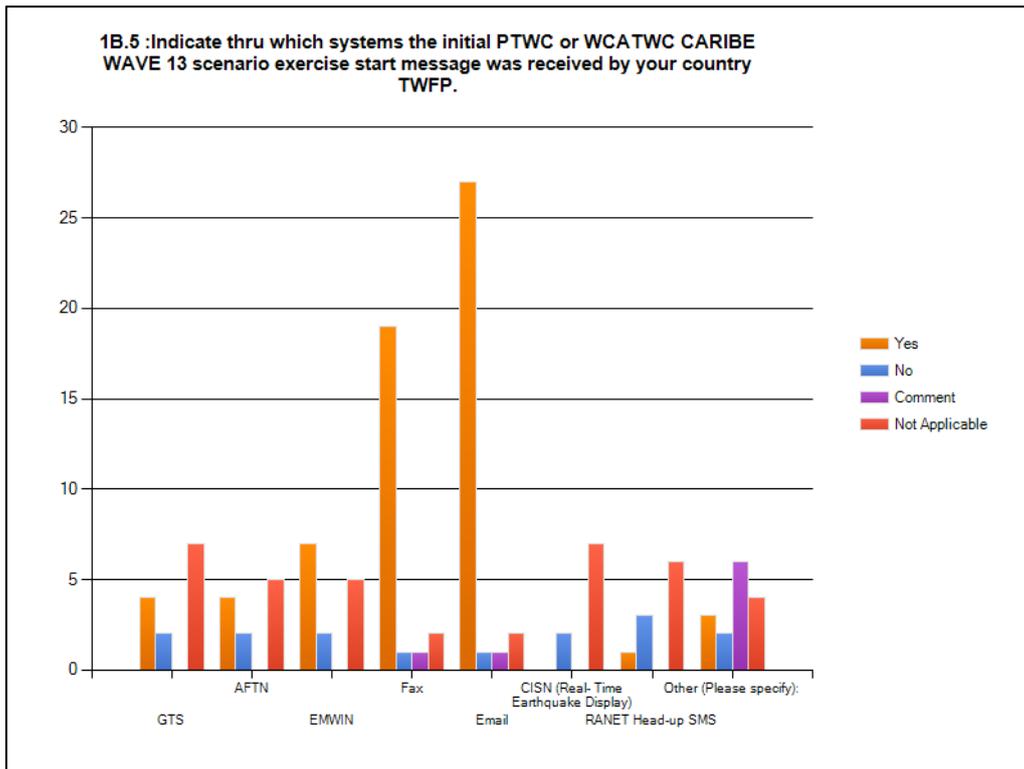
Costa Rica: ambas figuras convergen en el seno del COMITE ASESOR TECNICO MARINO COSTERO, el cual fue convocado de forma permanente durante el ejercicio.

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.



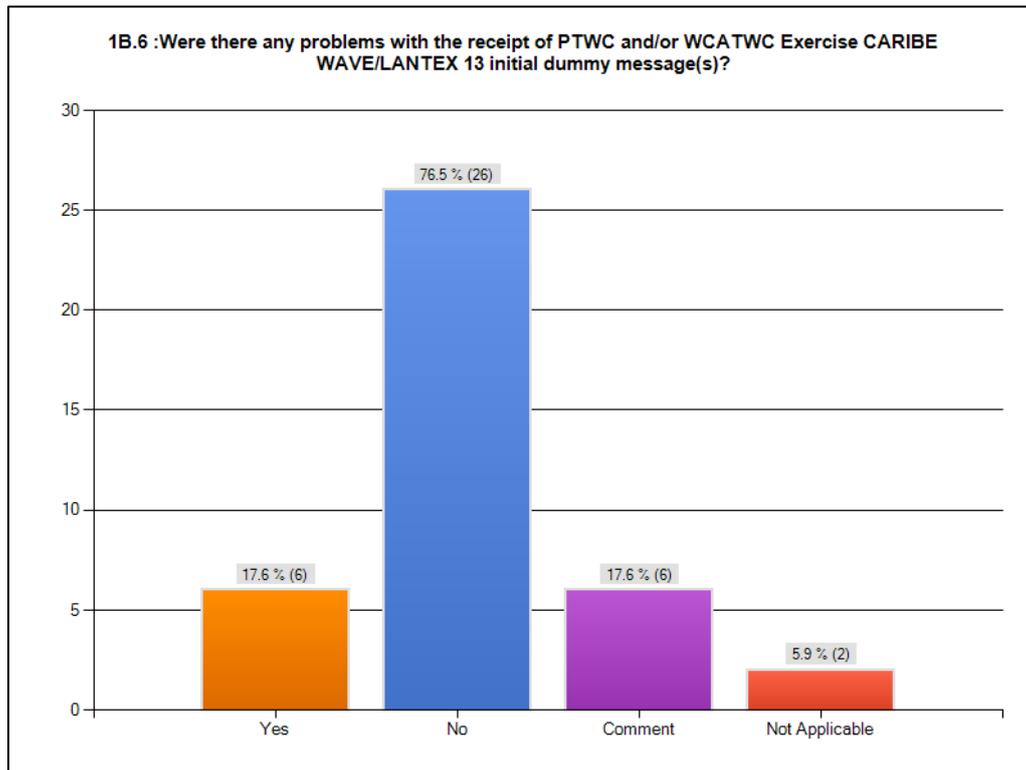
The other systems received from the participant Tsunami National Contacts (TNC) were:

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.

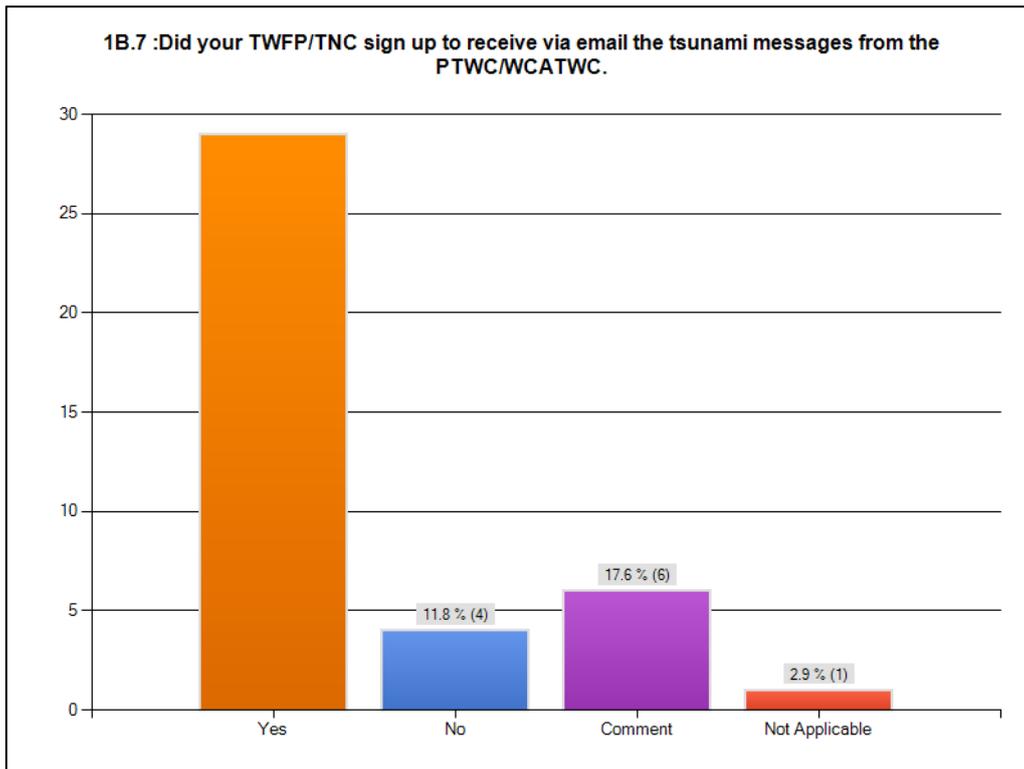
Costa Rica: el sistema de email en esta ocasión sufrió un atraso debido a problemas tecnológicos de los organismos de protección civil, sin embargo la información fluyó a través de otras vías alternas, como por ejemplo el punto focal

Dominica: No SMS, poor data connection for email onto mobile phone. Message only received due to call to office to check fax.

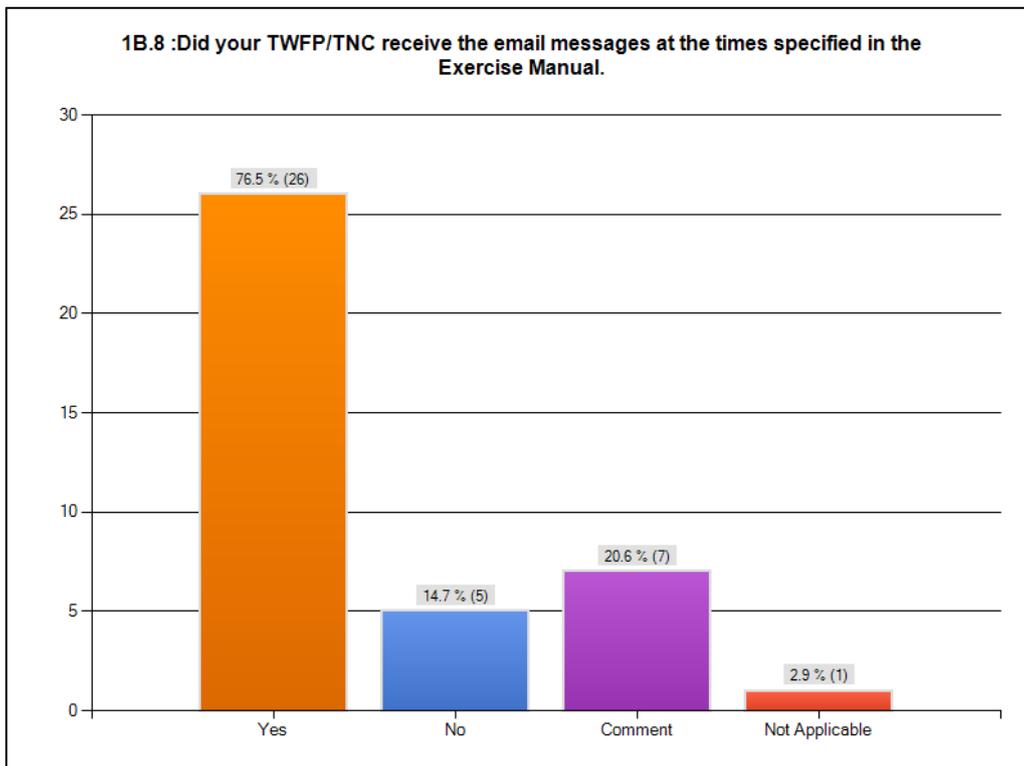
Dominican Republic: With the fax machine Forecast Center

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.

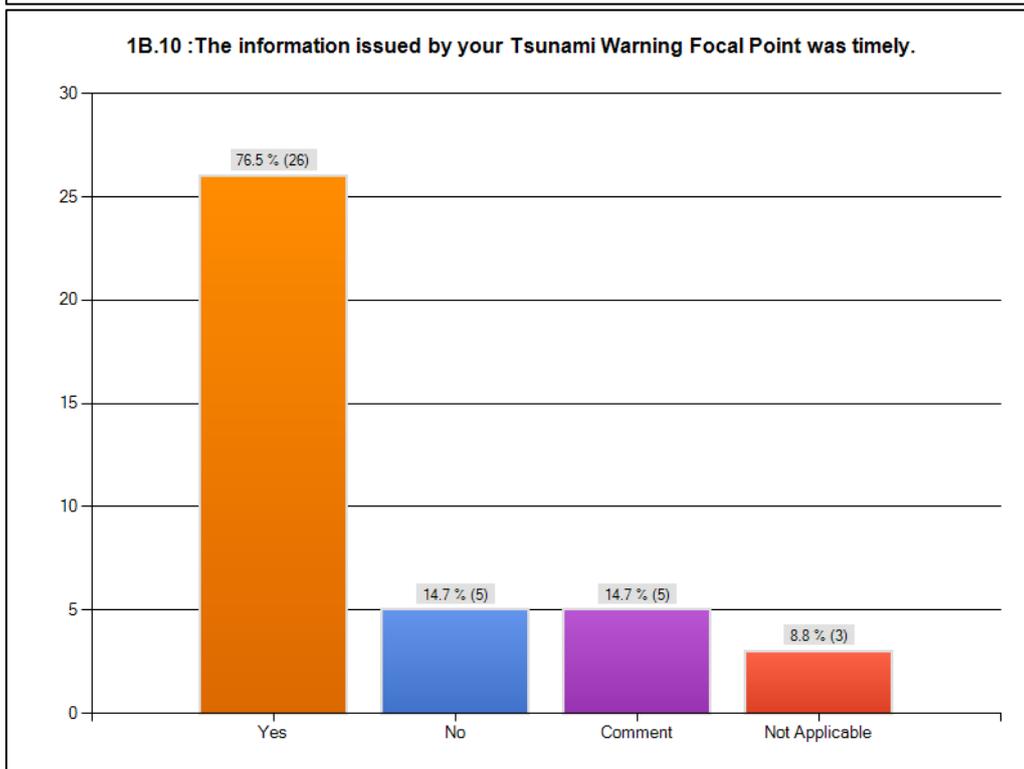
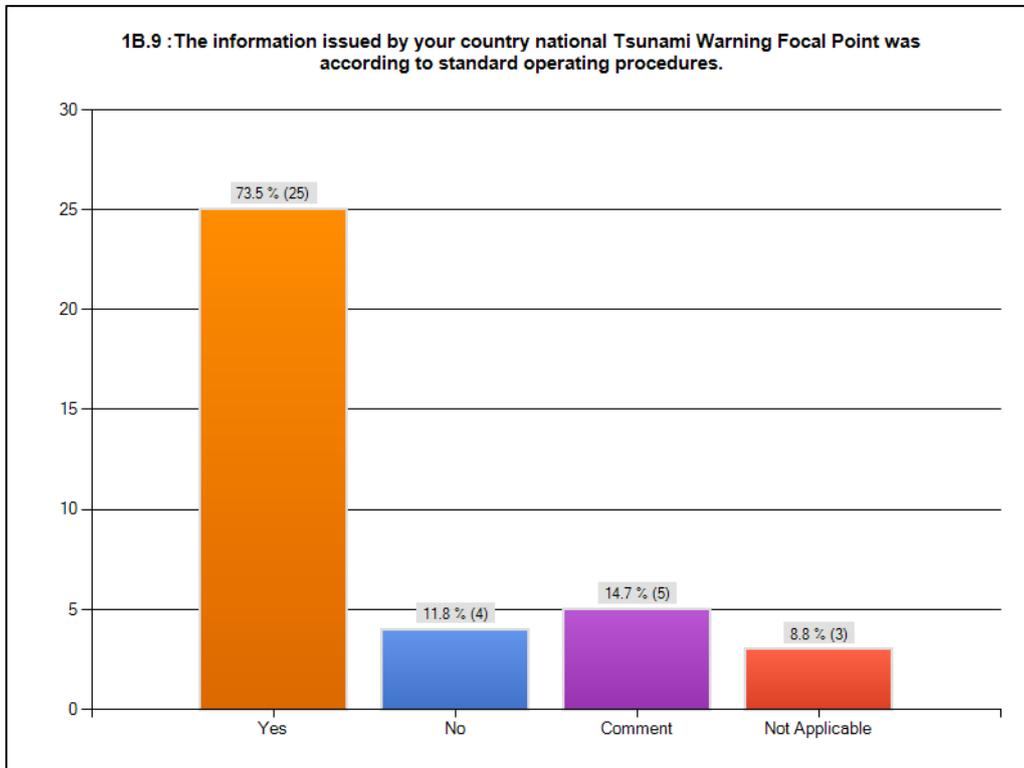
The comments received from the participant Tsunami National Contacts (TNC) were:

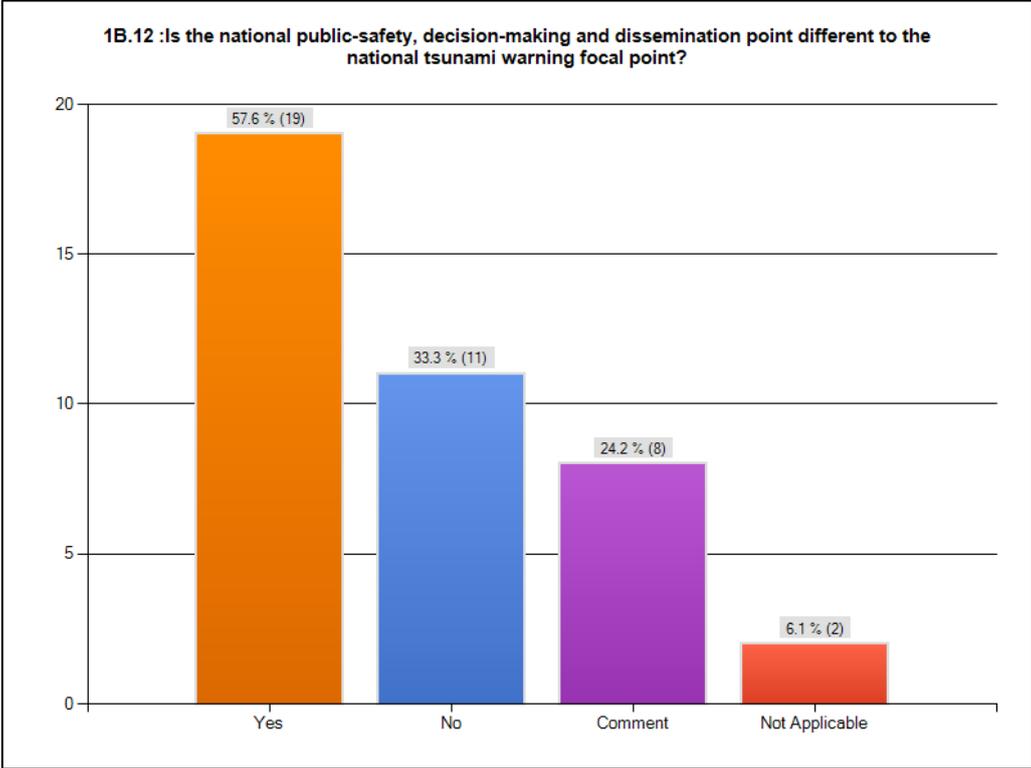
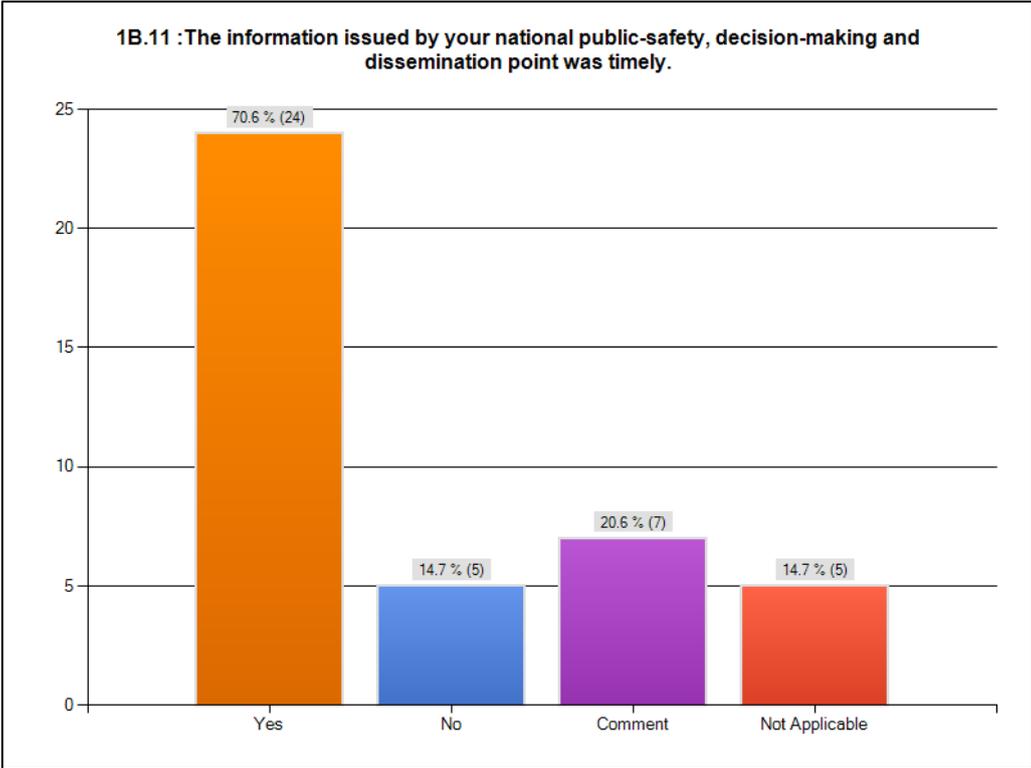
Anguilla: slightly delayed.

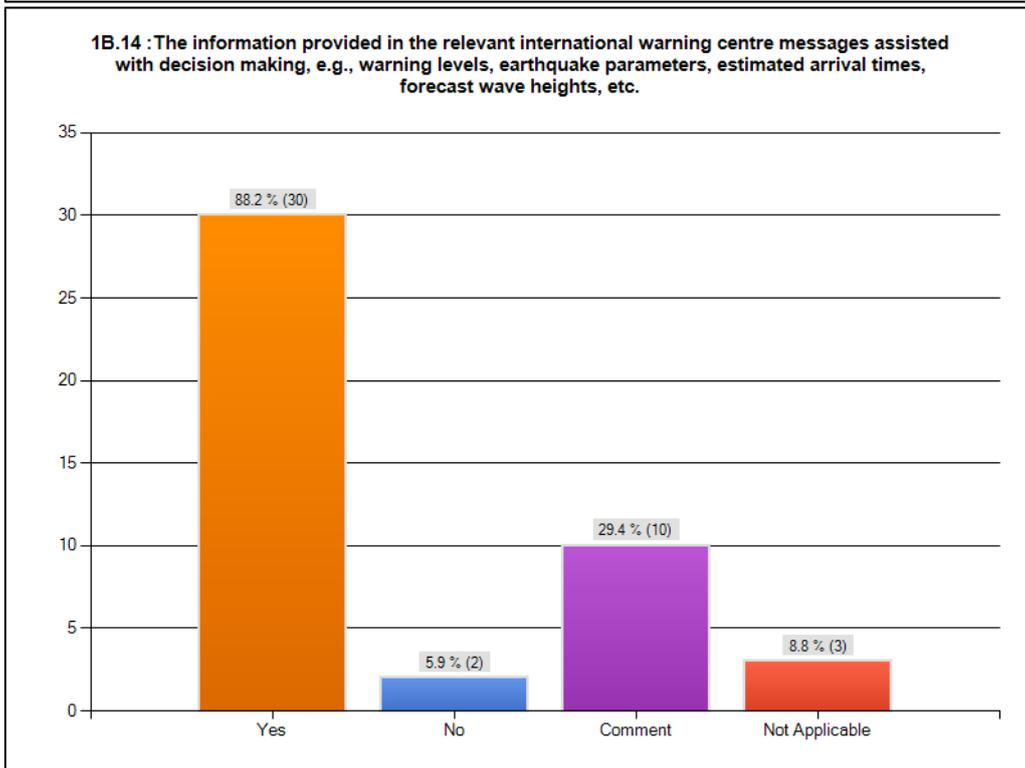
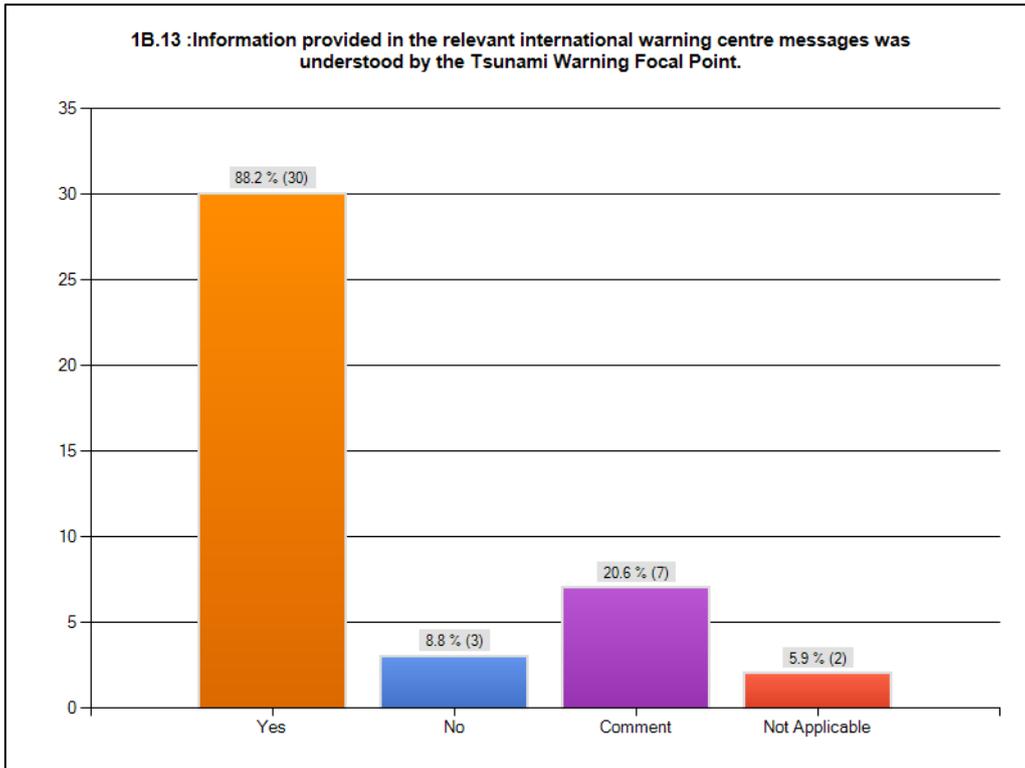
Cayman Islands: 2 minute delay

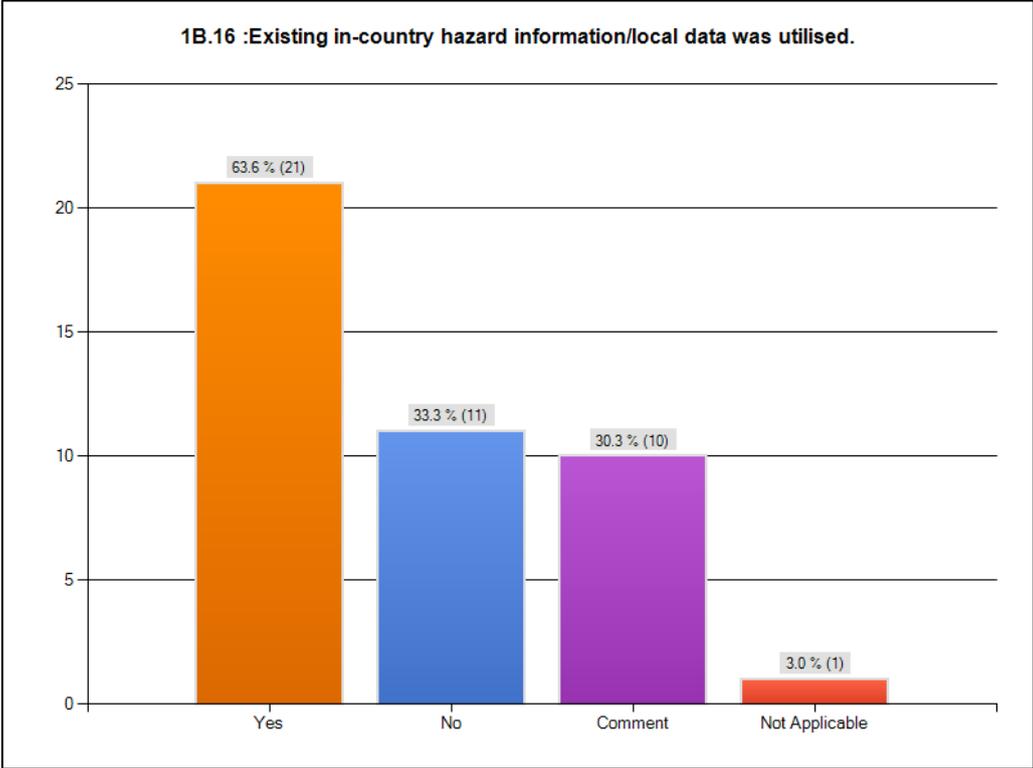
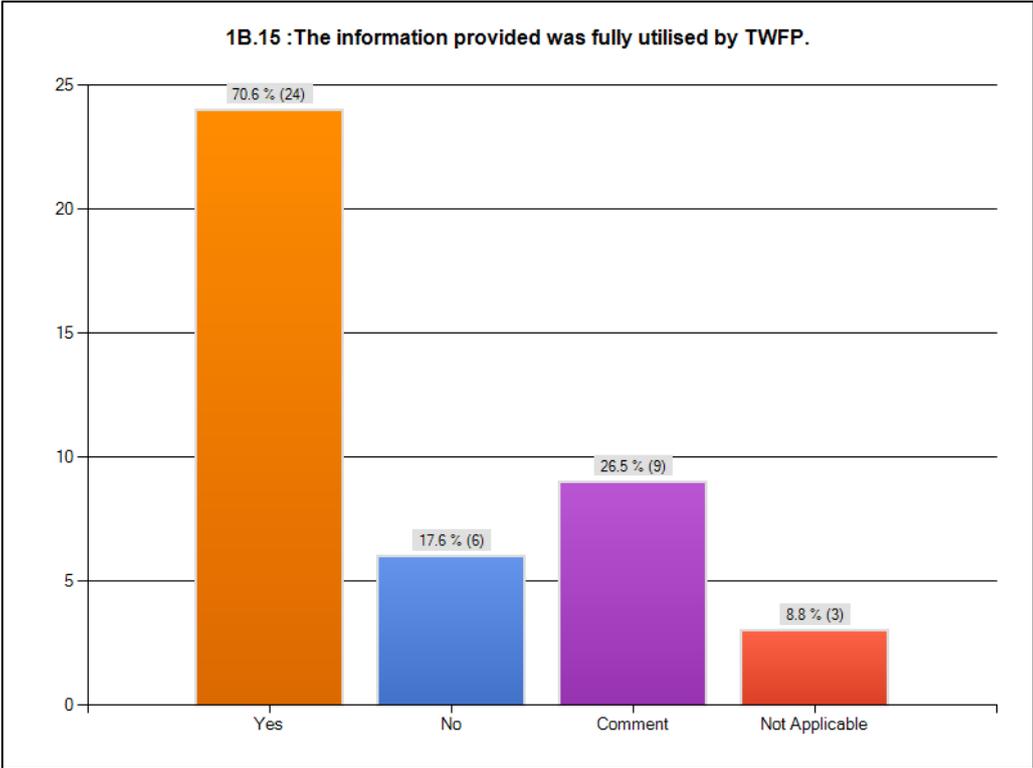
Dominica: slow mobile data connection meant that the time of message was correct however the connection meant the message was late.

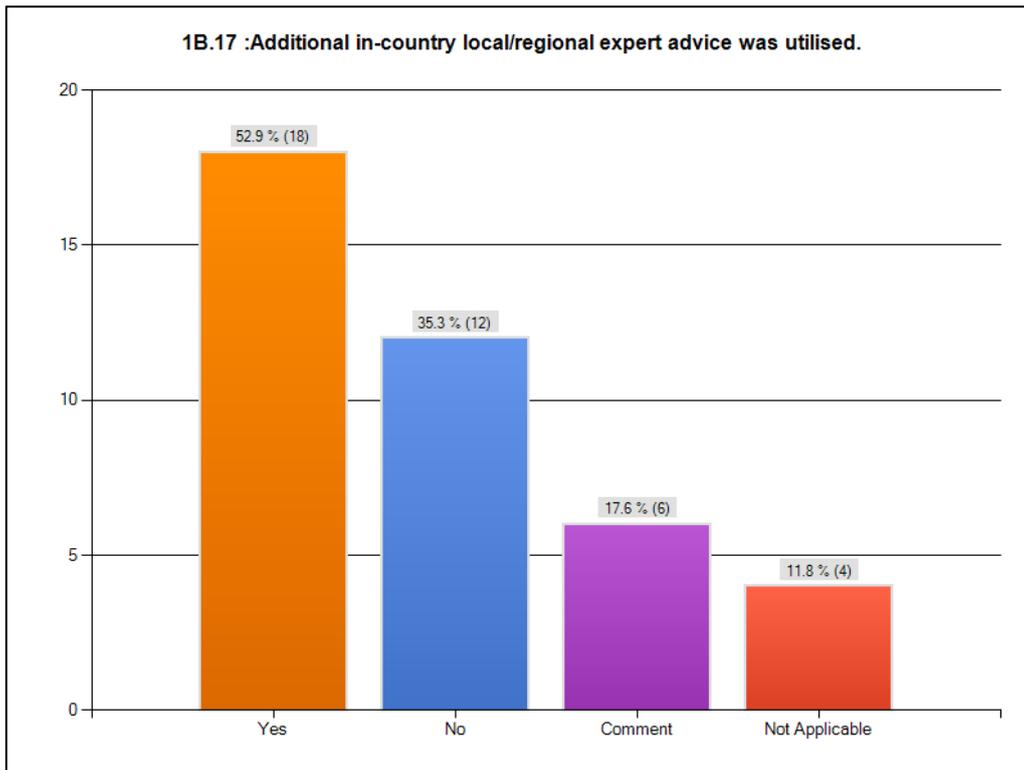
US Virgin Islands: TWFP did not see Exercise Manual.





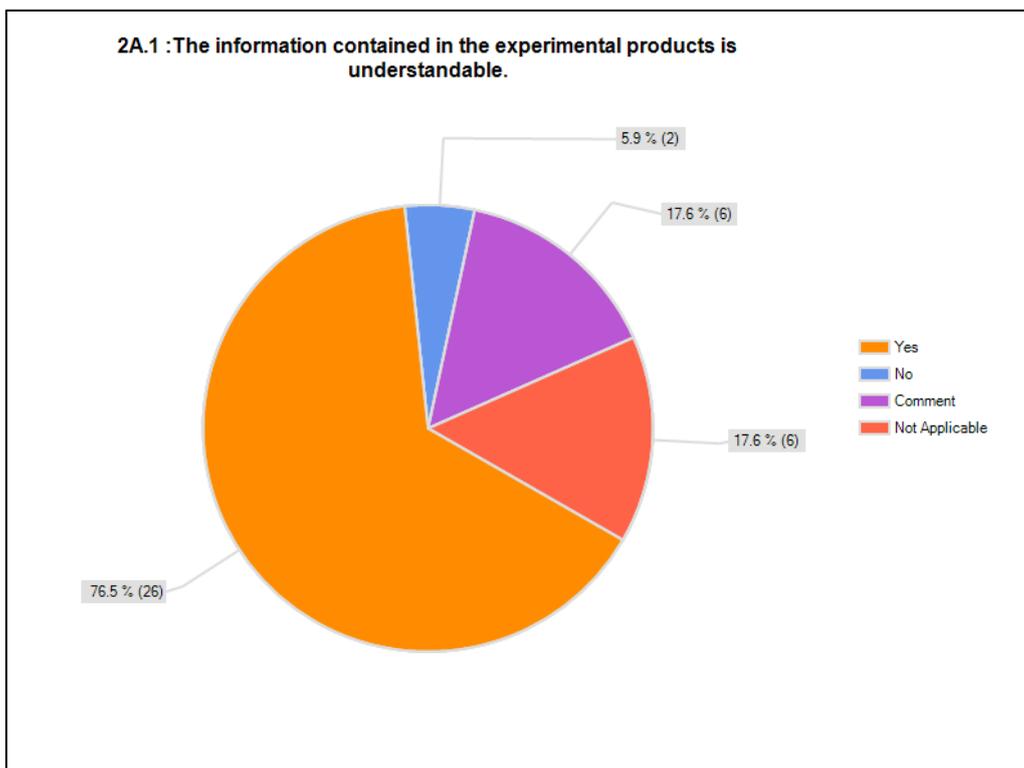






Objective 2: To begin a process of exposure to an initial test version of PTWC experimental products.

Sub-Objective 2A: Review and evaluate PTWC experimental products that will be posted one month before the exercise at <http://www.caribewave.info> with existing PTWC products for the exercise scenario.



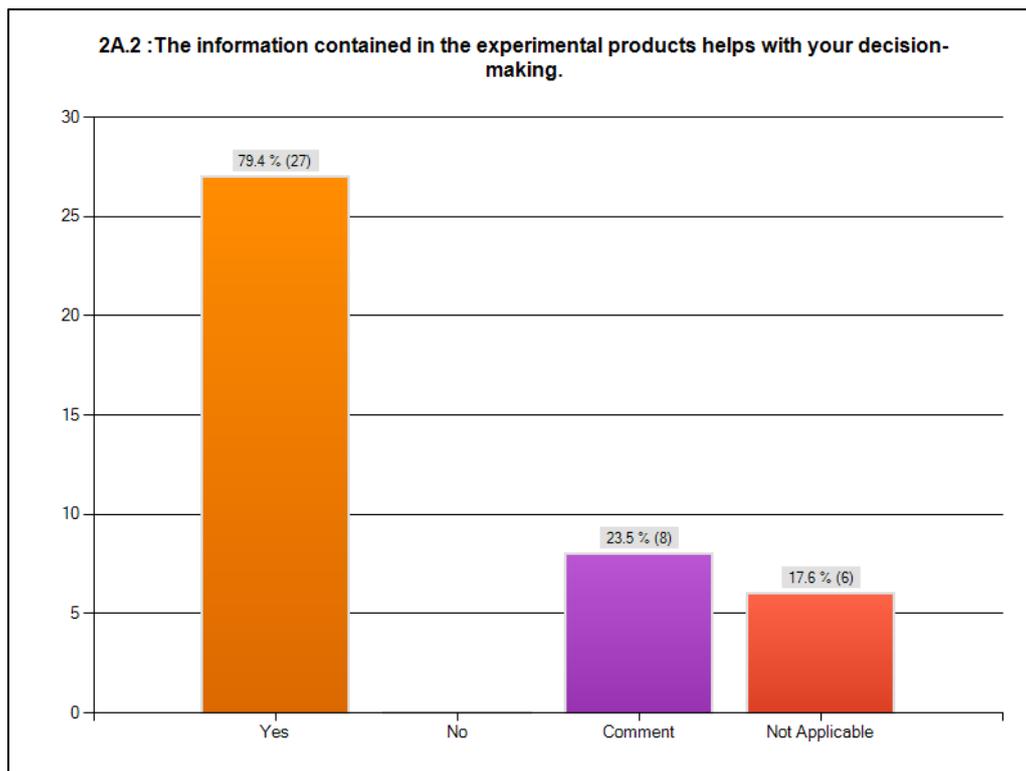
The country who answered no to the above question was: Dominica and Sint Maarten.

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.



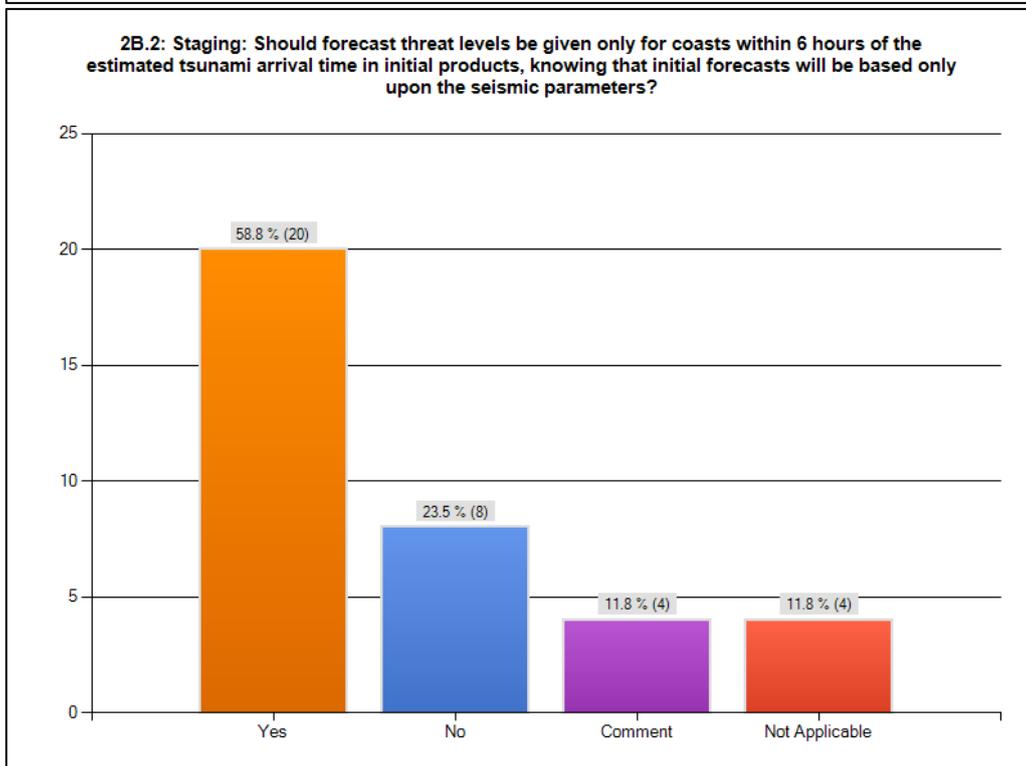
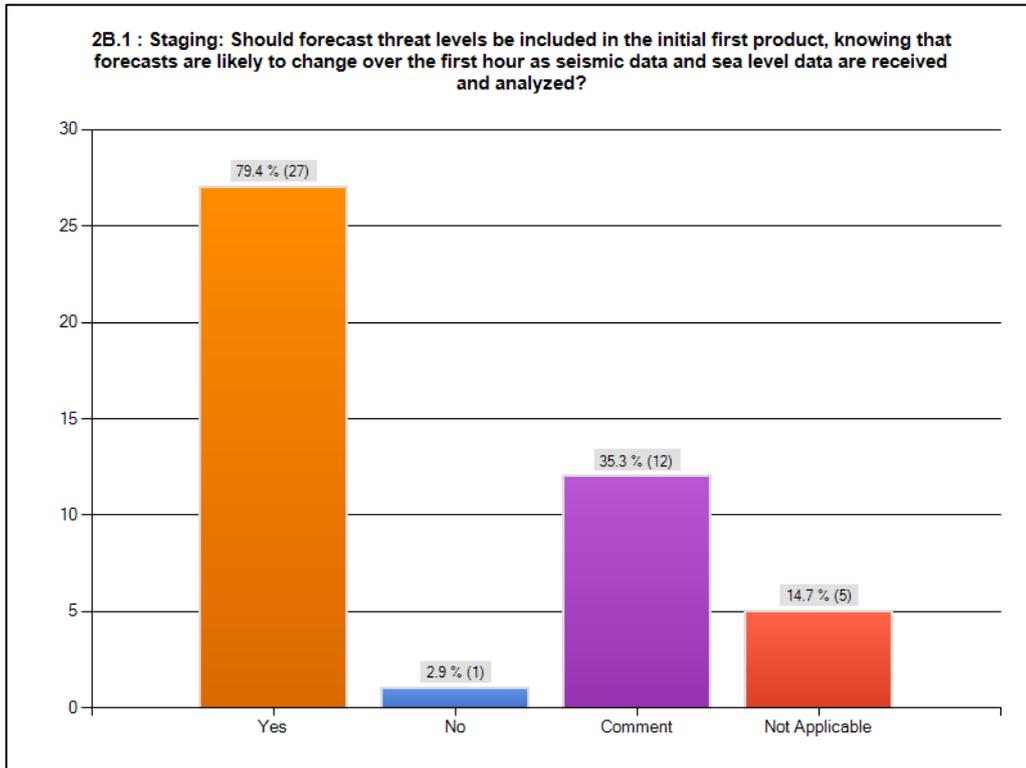
The comments received from the participant Tsunami National Contacts (TNC) were:

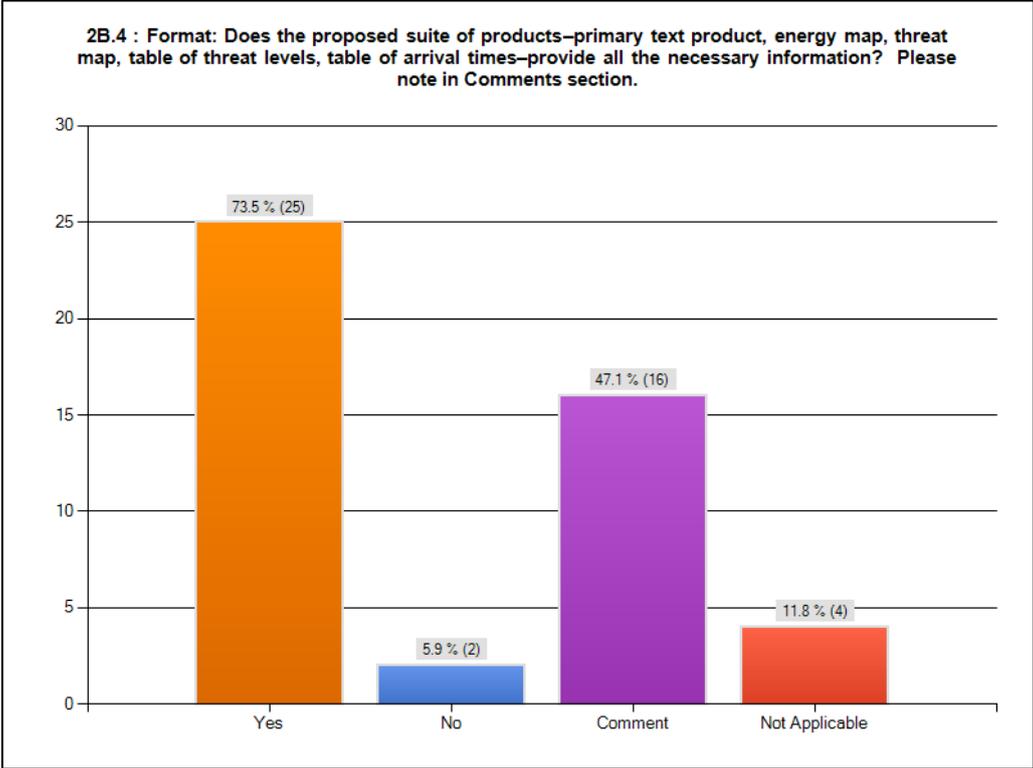
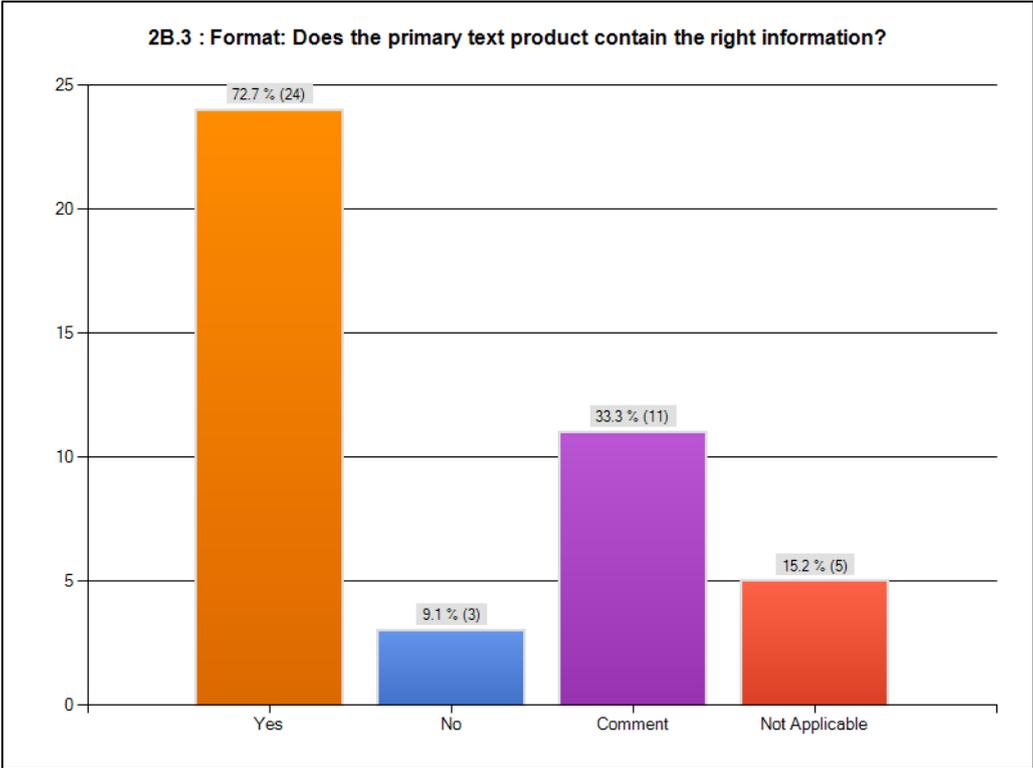
Guatemala: Fue de mucha ayuda aunque el ejercicio fue de mesa, se puede establecer o evaluar el tipo de peligro que pueda tener nuestras costas.

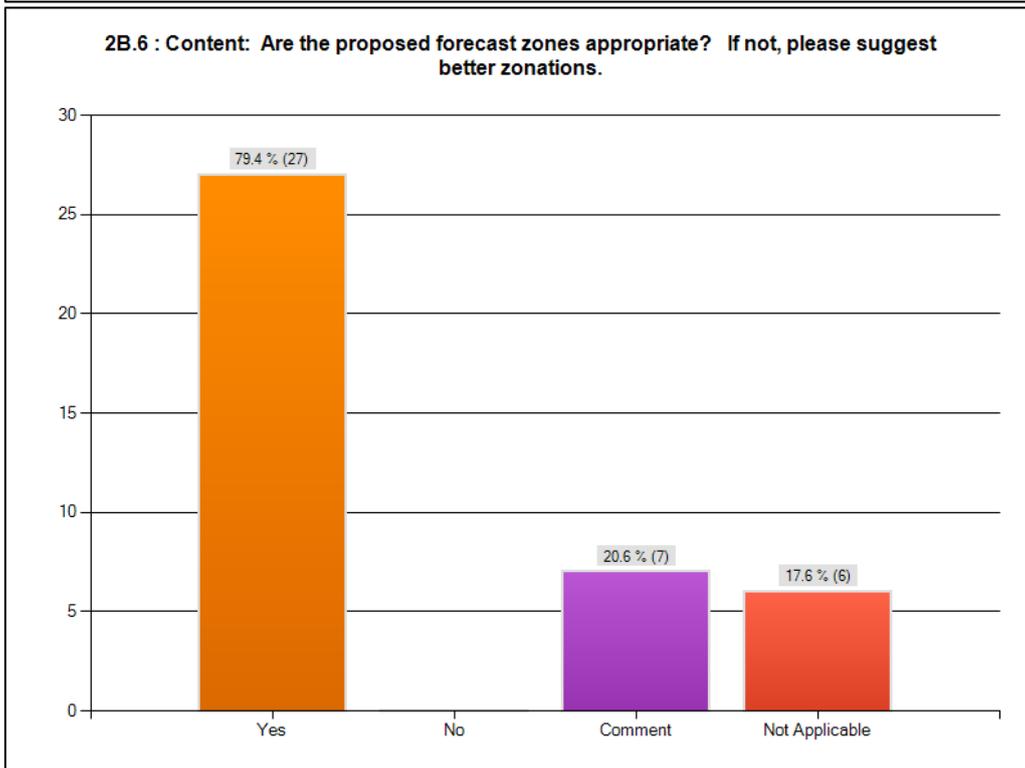
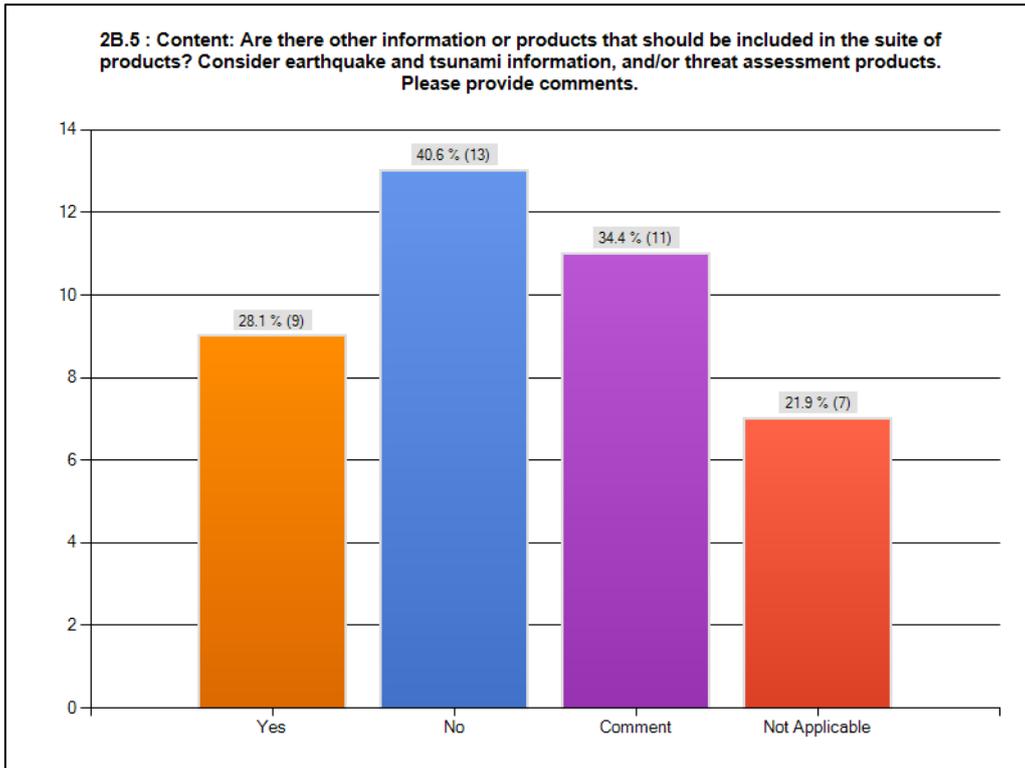
Sint Maarten: Once it was understood we tried to work with it.

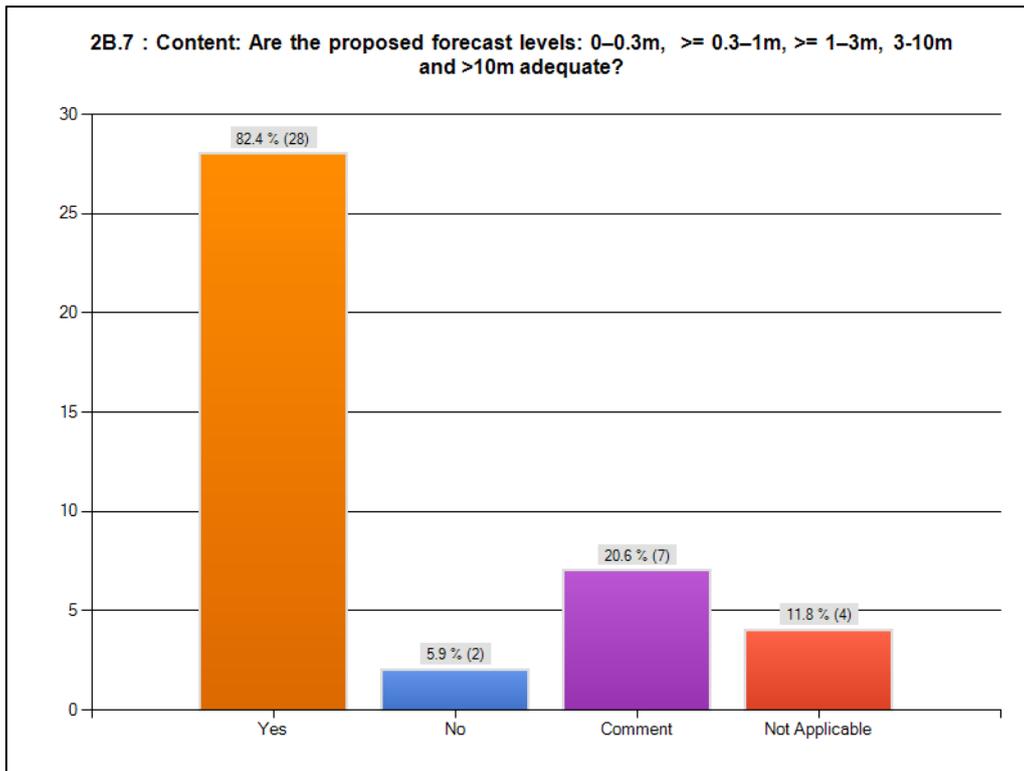
Turks and Caicos: The products for example allowed the country to make an informed decision. Based on the scenario the wave's heights throughout the territory would be minimal. It meant that evacuation of the territory's beaches would be necessary but would not necessitate a wide scale evacuation.

Sub-Objective 2B: Provide feedback on the staging, format and content of the experimental products.



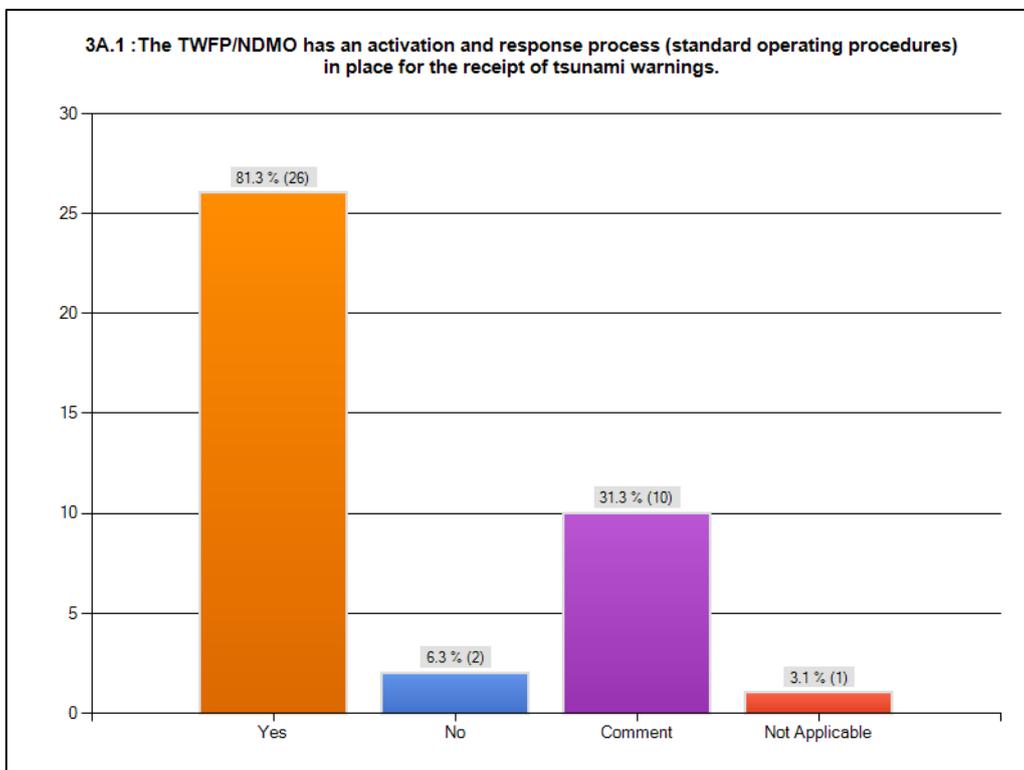






Objective 3: To validate the readiness of Member States to respond to a local/regional source tsunami.

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).



The country who answered no to the above question was: Dominica and Saint Kitts and Nevis.

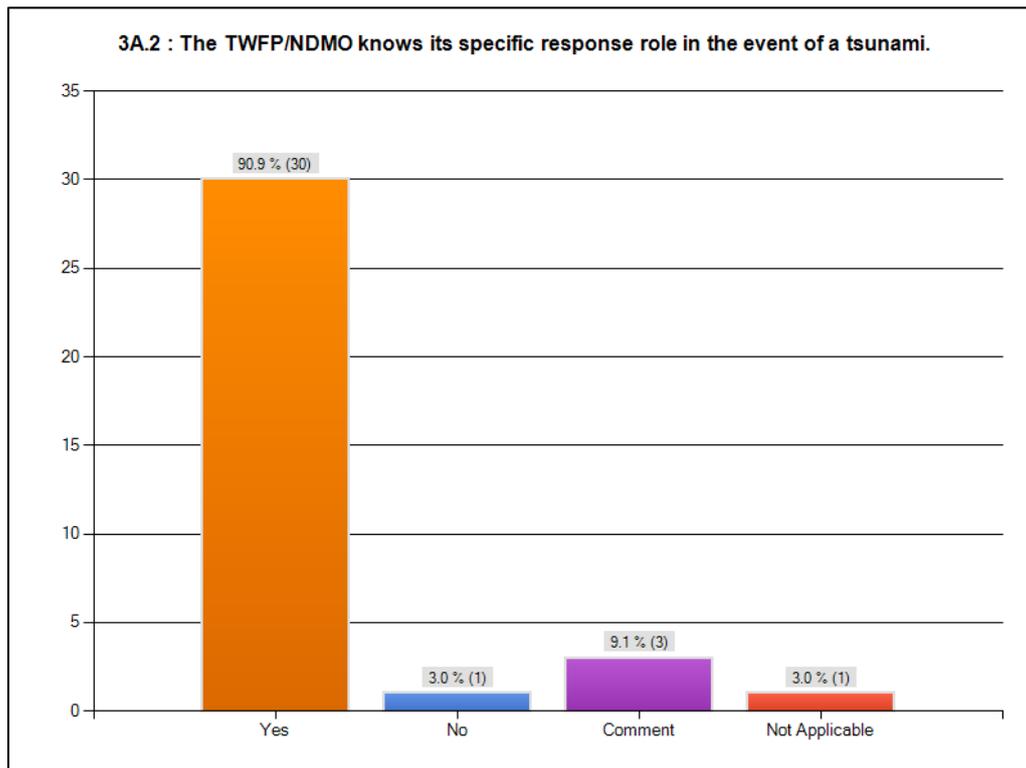
The comments received from the participant Tsunami National Contacts (TNC) were:

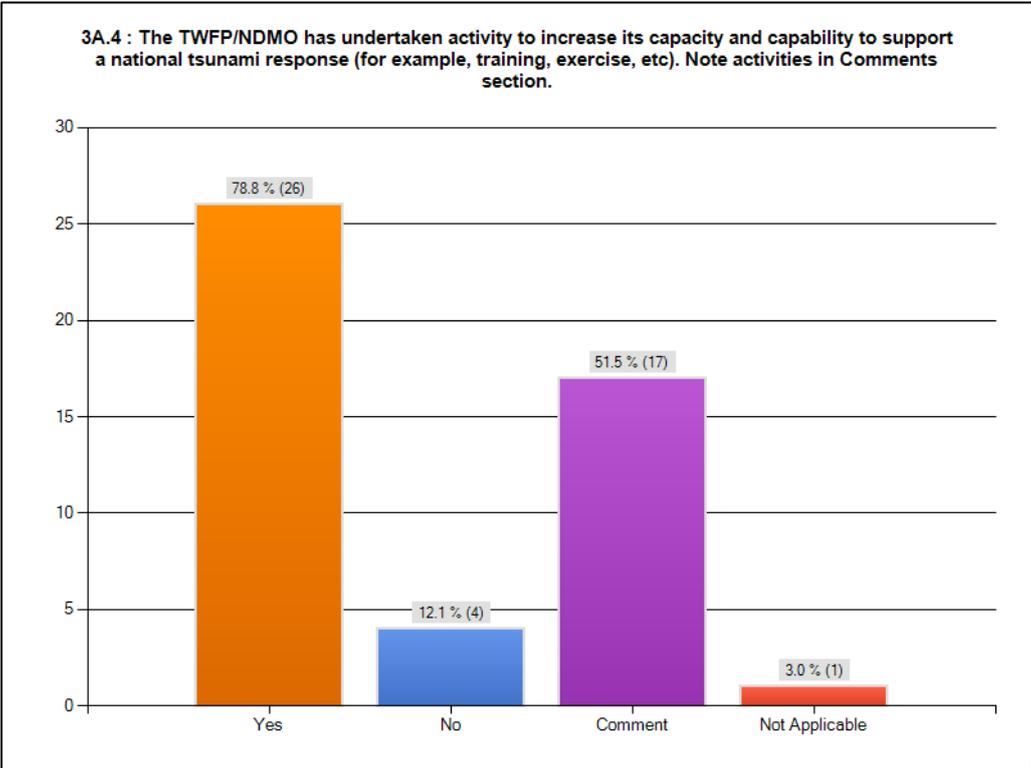
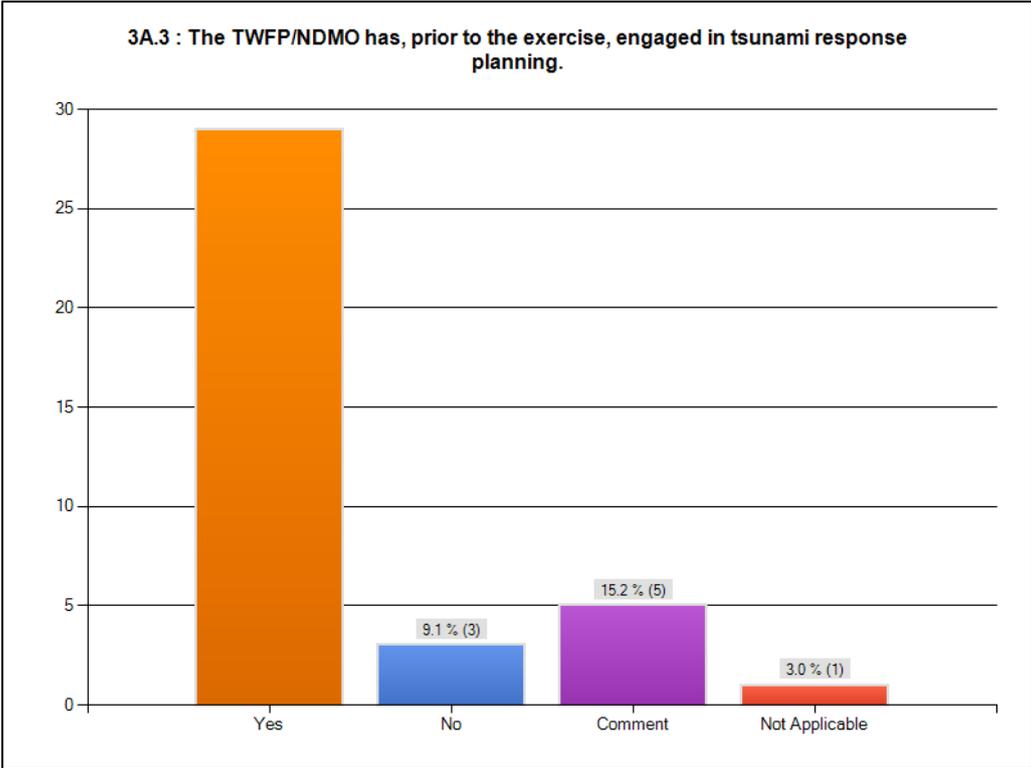
Dominica: Still in draft. Exercise tested the SOP.

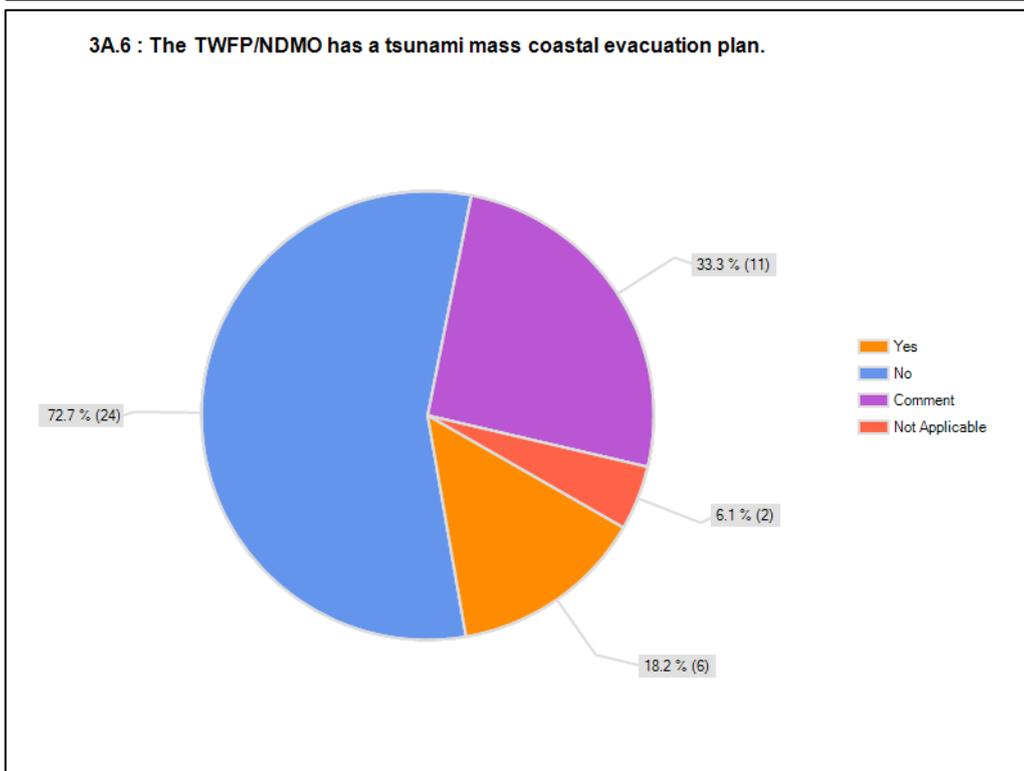
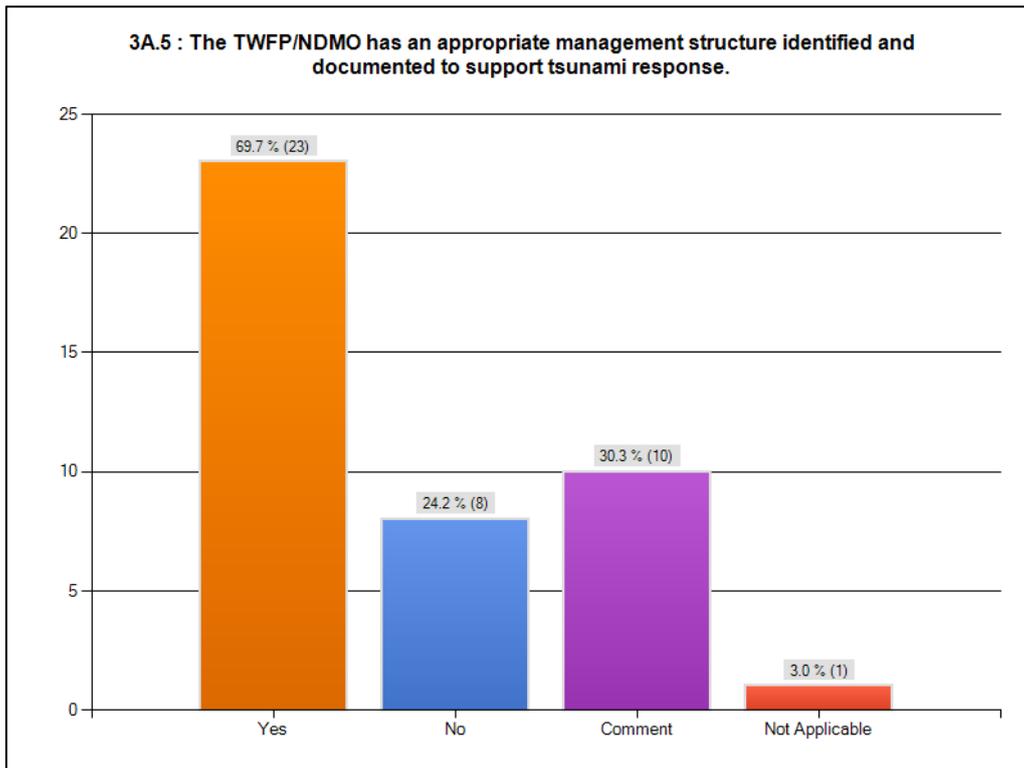
Nicaragua: Se está mejorando el Plan de respuesta.

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.







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.

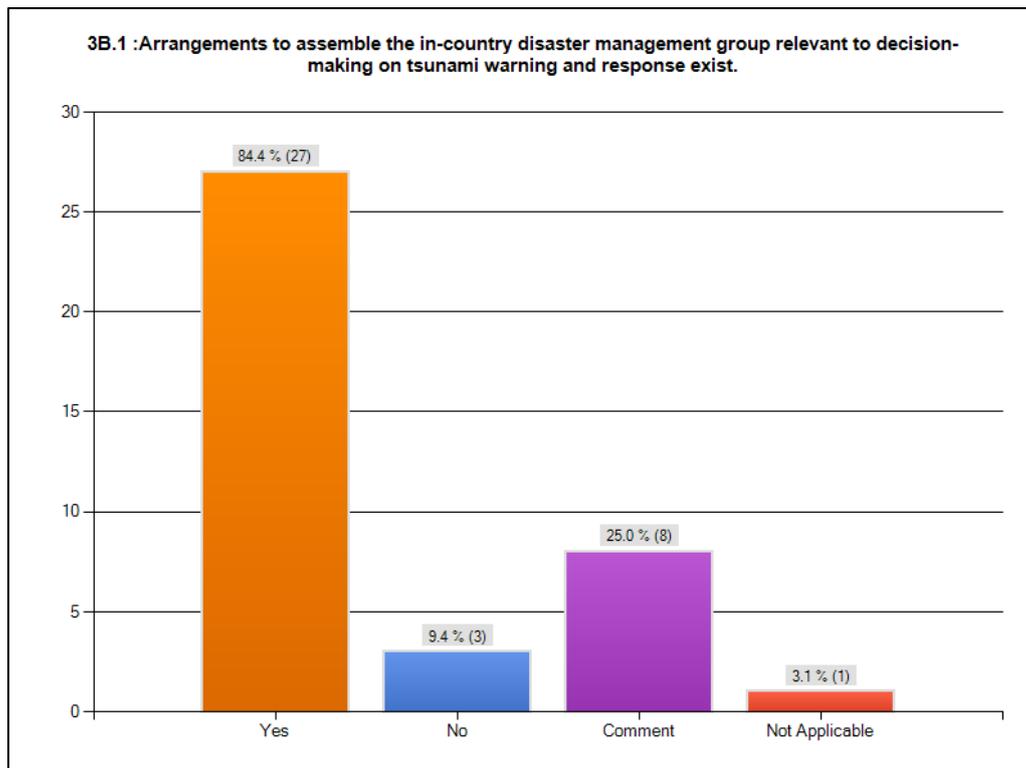
Trinidad and Tobago: In development.

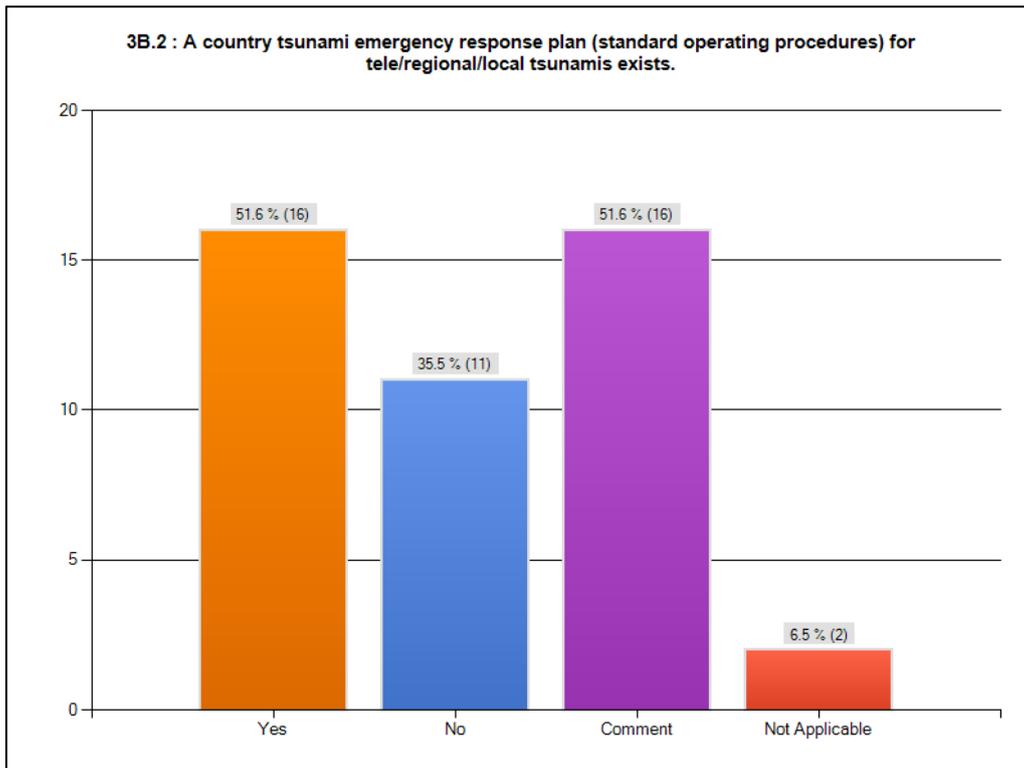
Costa Rica: si tienen planes de contingencia generales, que se han utilizado en casos reales sobre todo inundaciones y sismos.

Haiti: The National Risk and Disaster Management System tsunami has mass coastal evacuation plan for two cities in the North Department : Cap-Haitien and Port-de-Paix

Mexico: No. Nowadays twfp 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.





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.

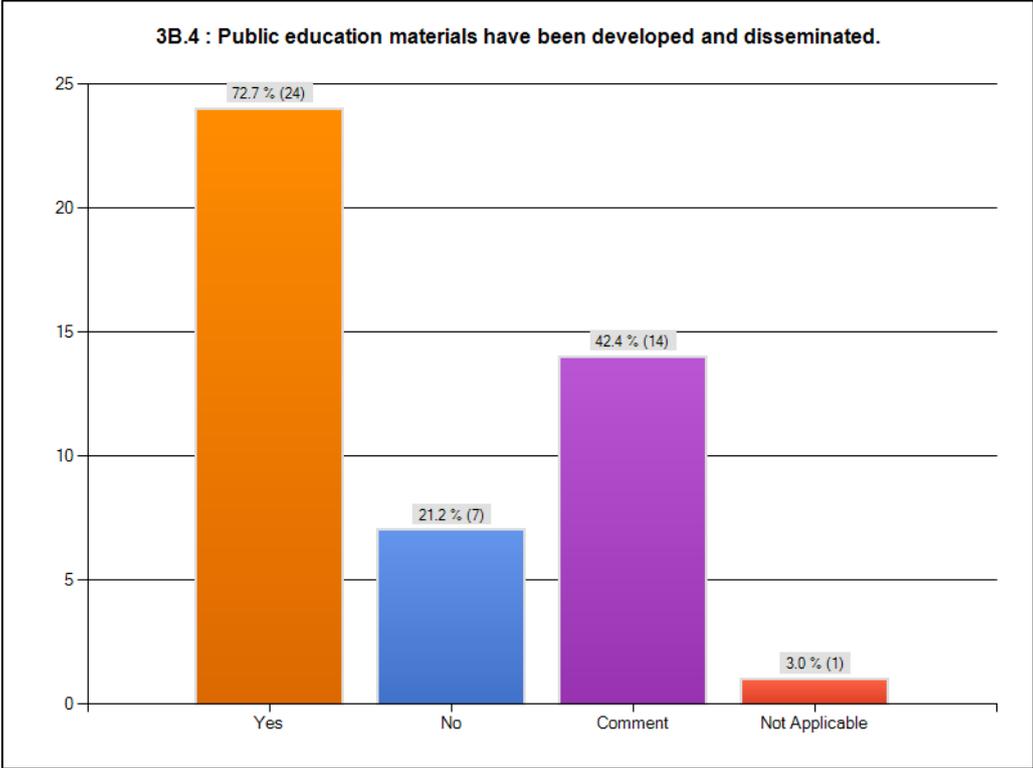
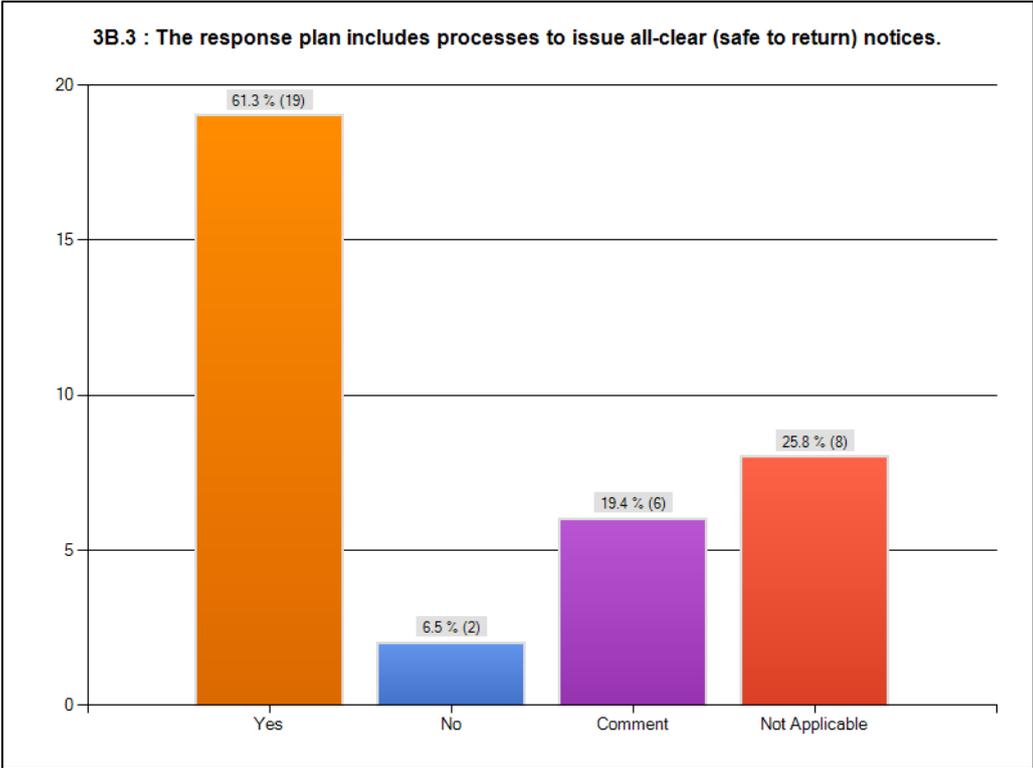
Haiti: To be validated.

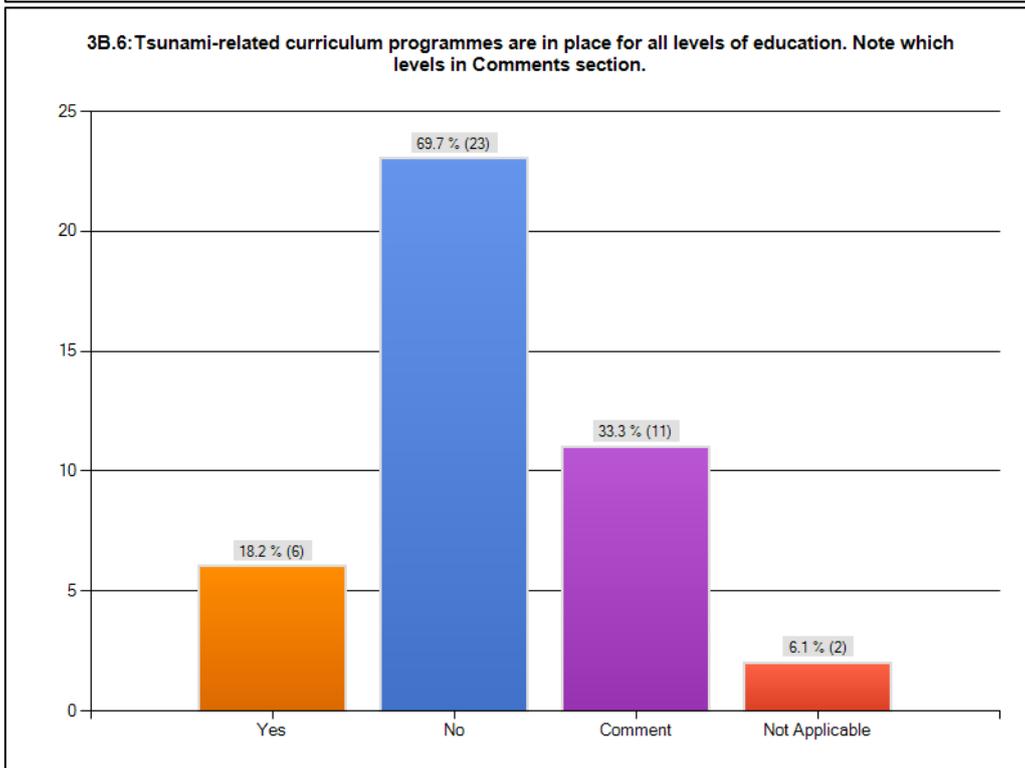
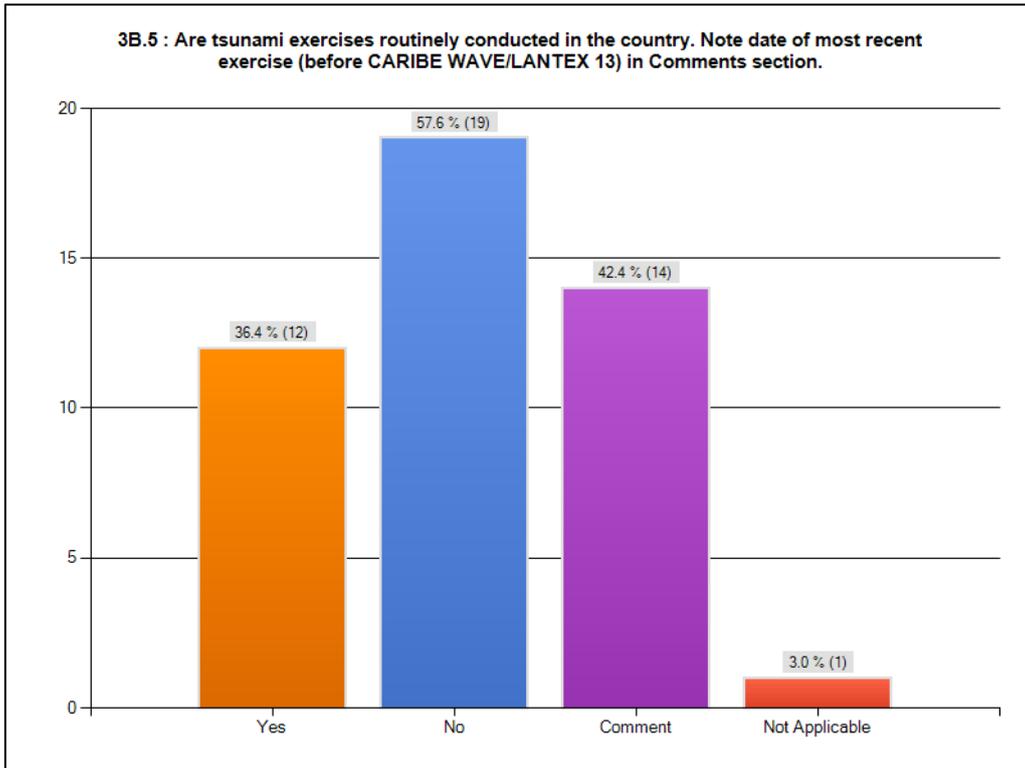
Puerto Rico: The emergency response plan for each coastal community sets the action to take for each event type: tele / regional / local tsunami.

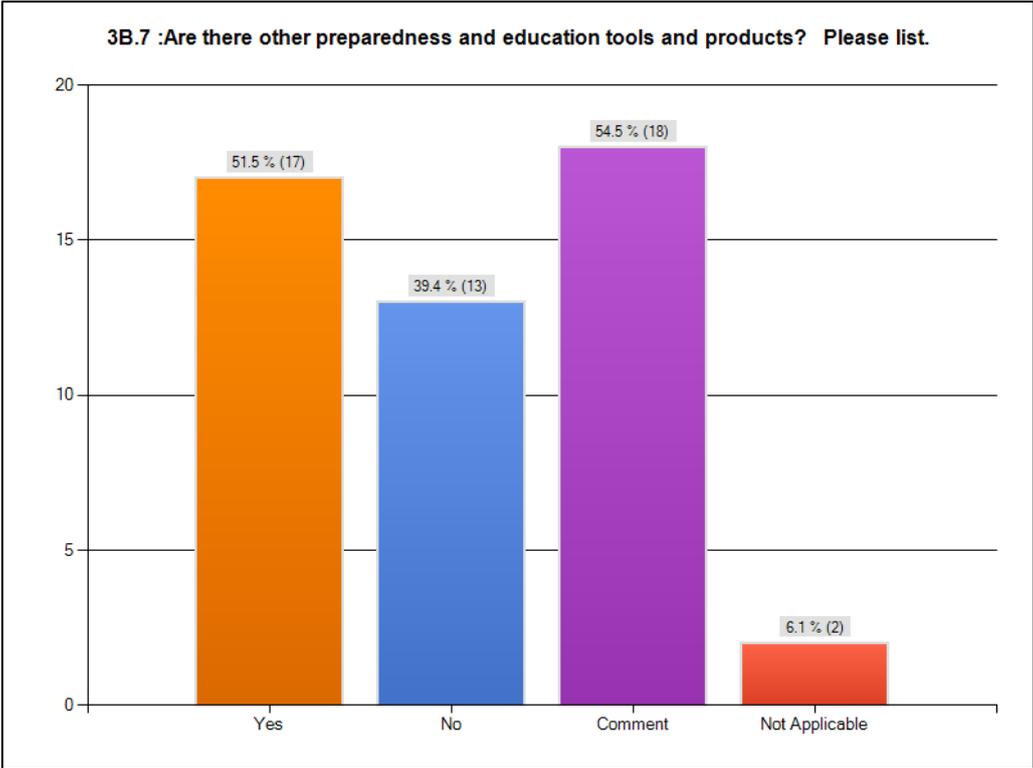
St. Vincent and the Grenadines: Use national response mechanism.

Trinidad and Tobago: In draft form.

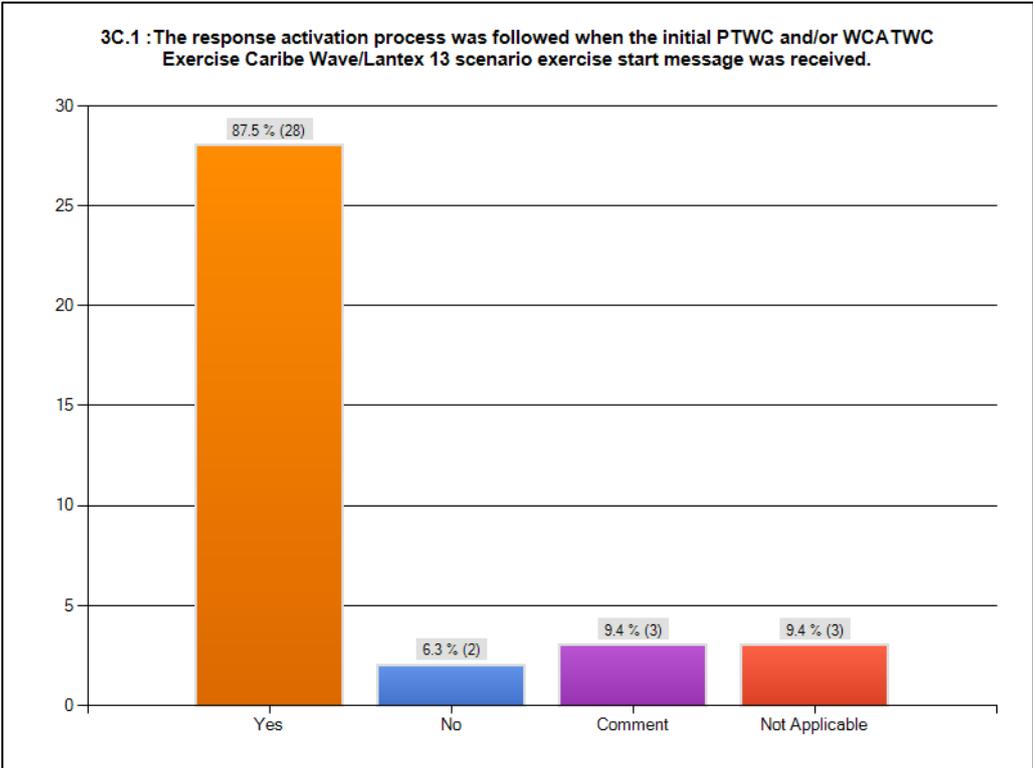
Venezuela: No yet, we are planning his production at this moment.

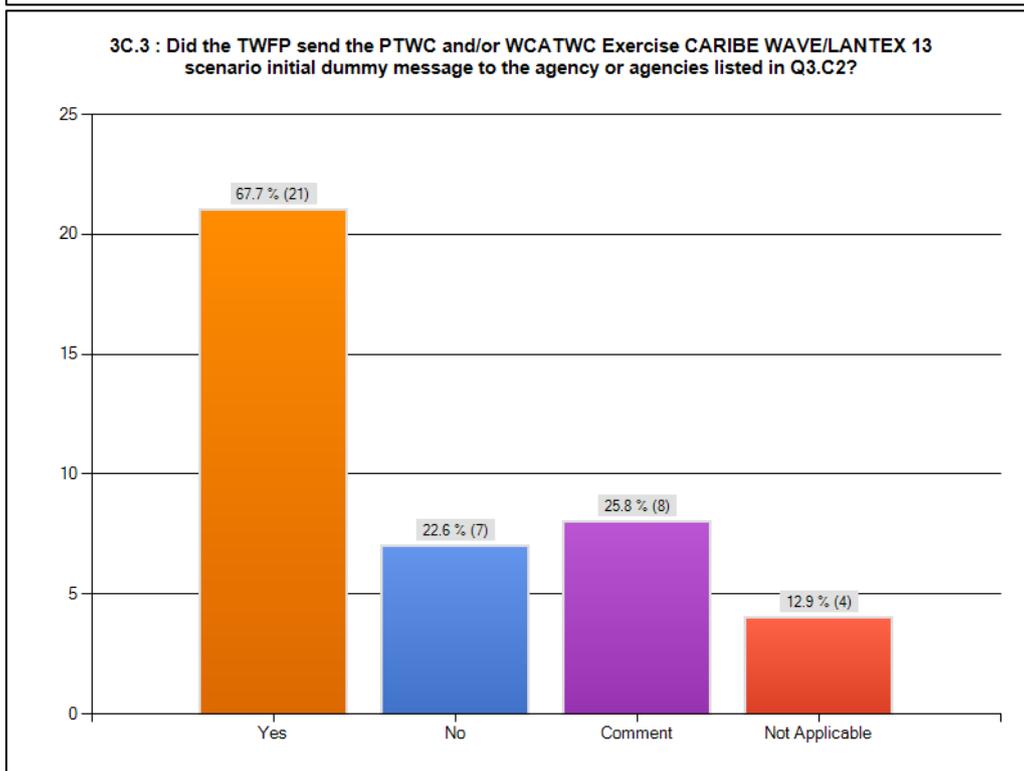
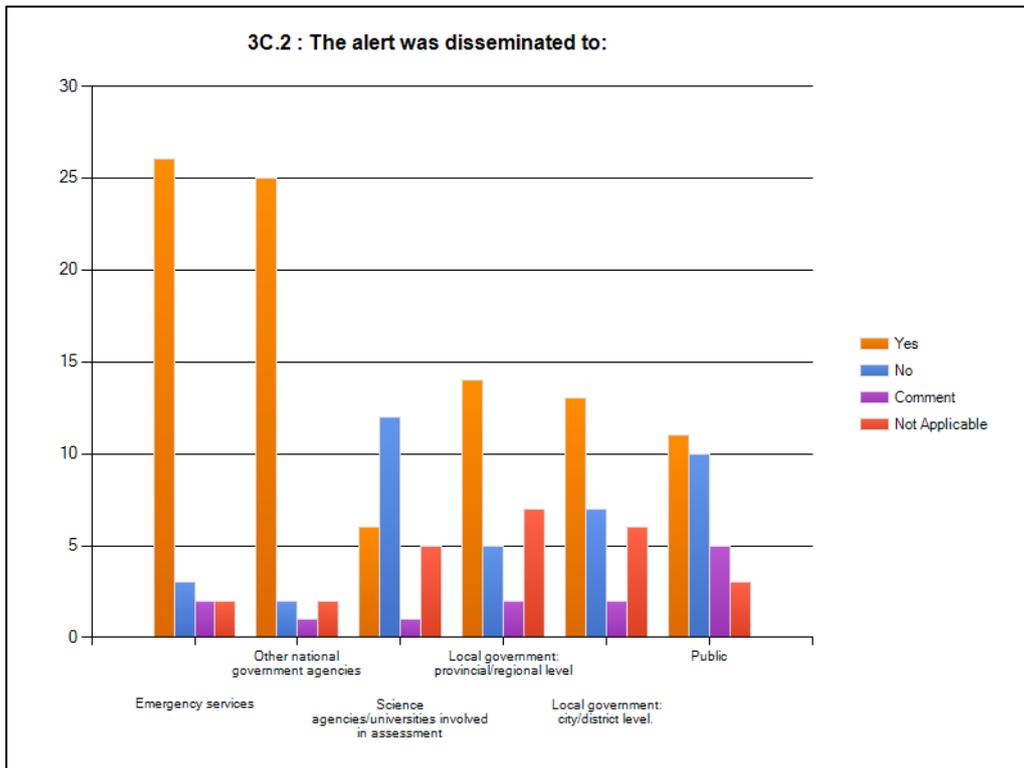


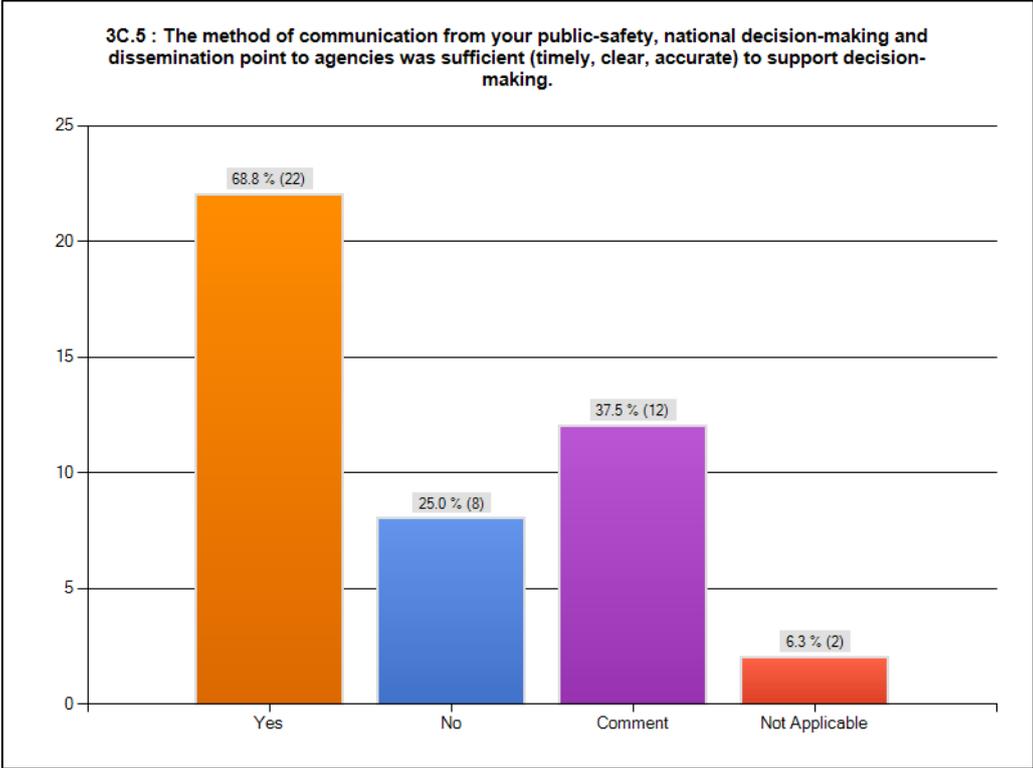
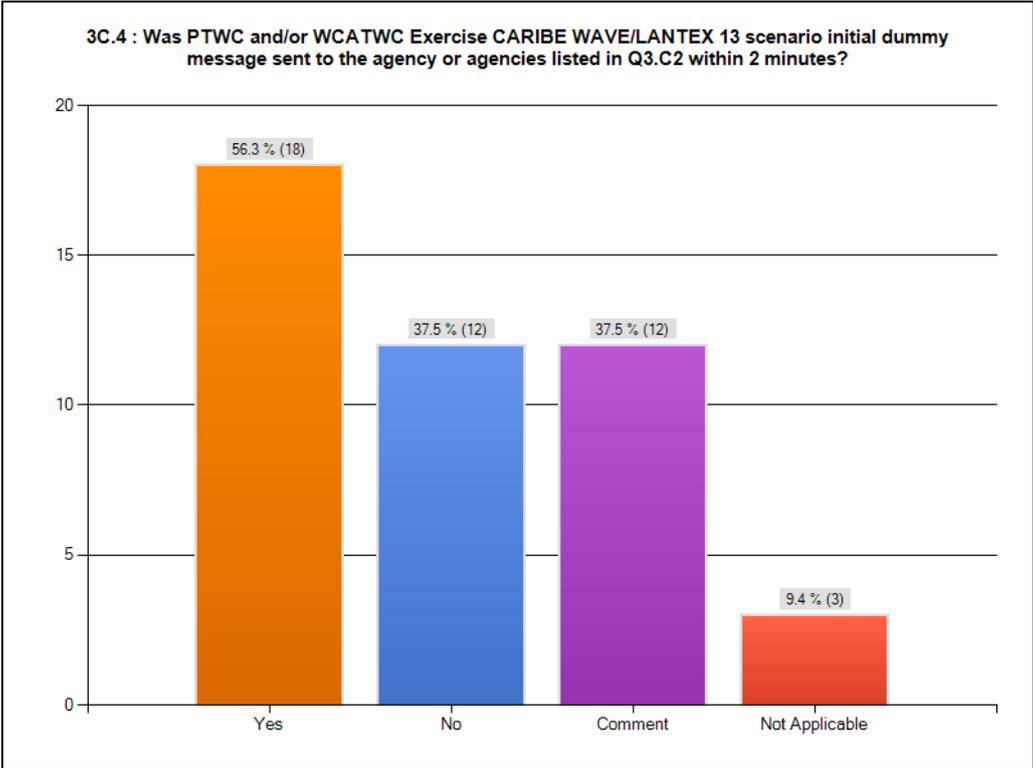


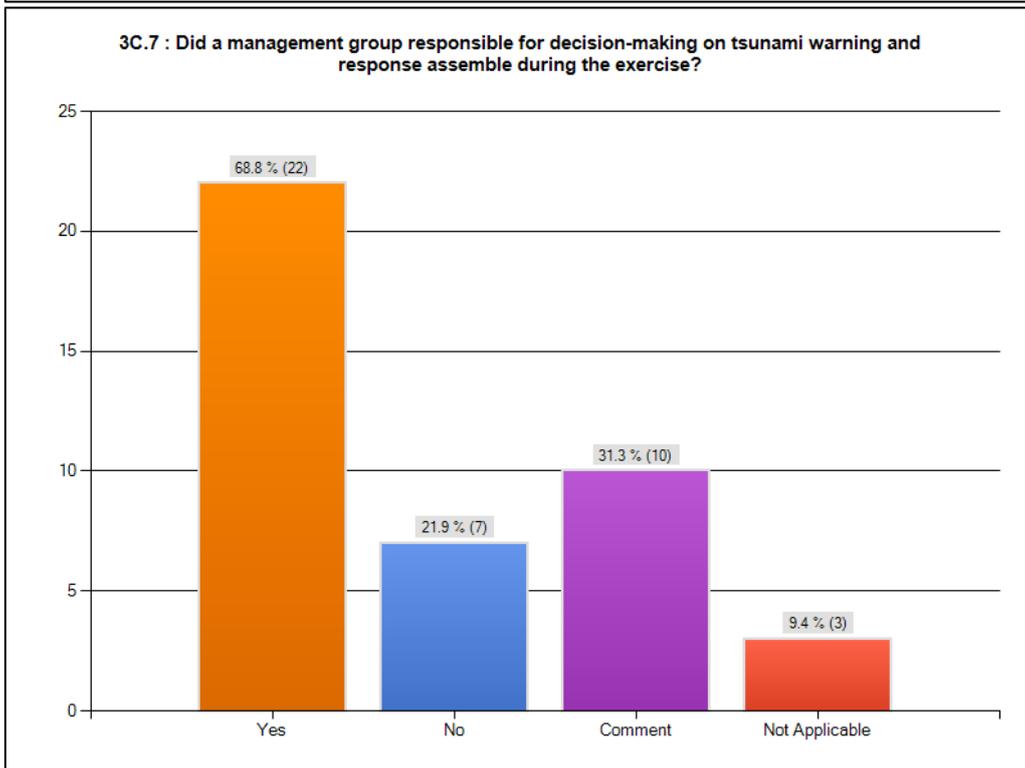
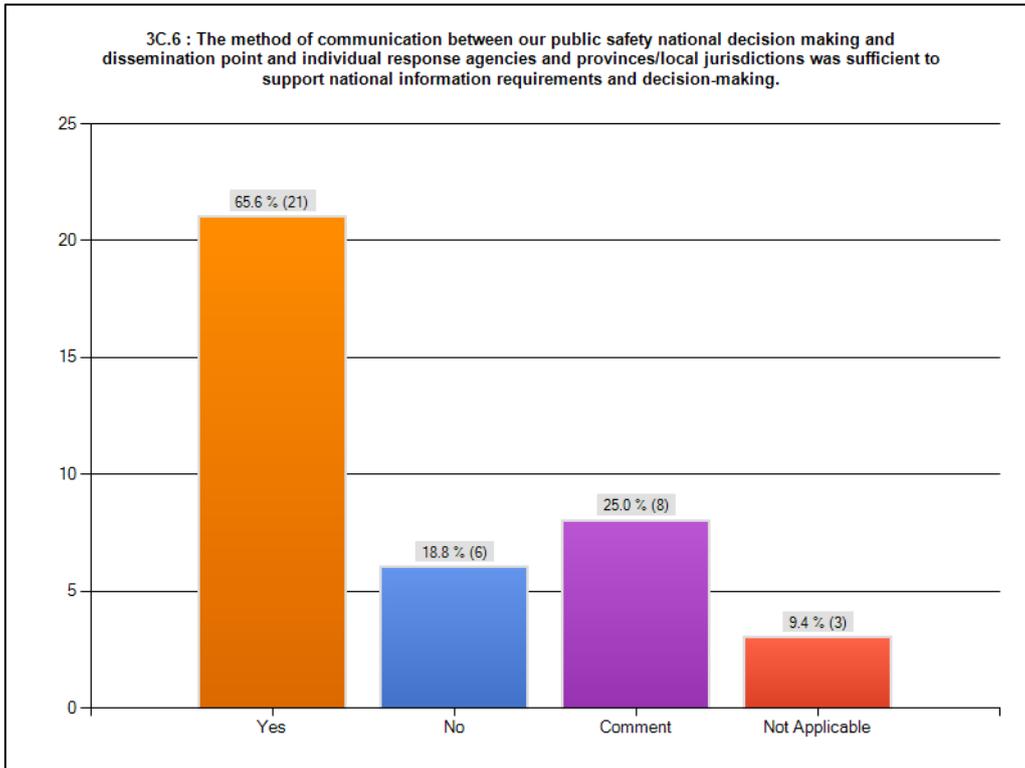


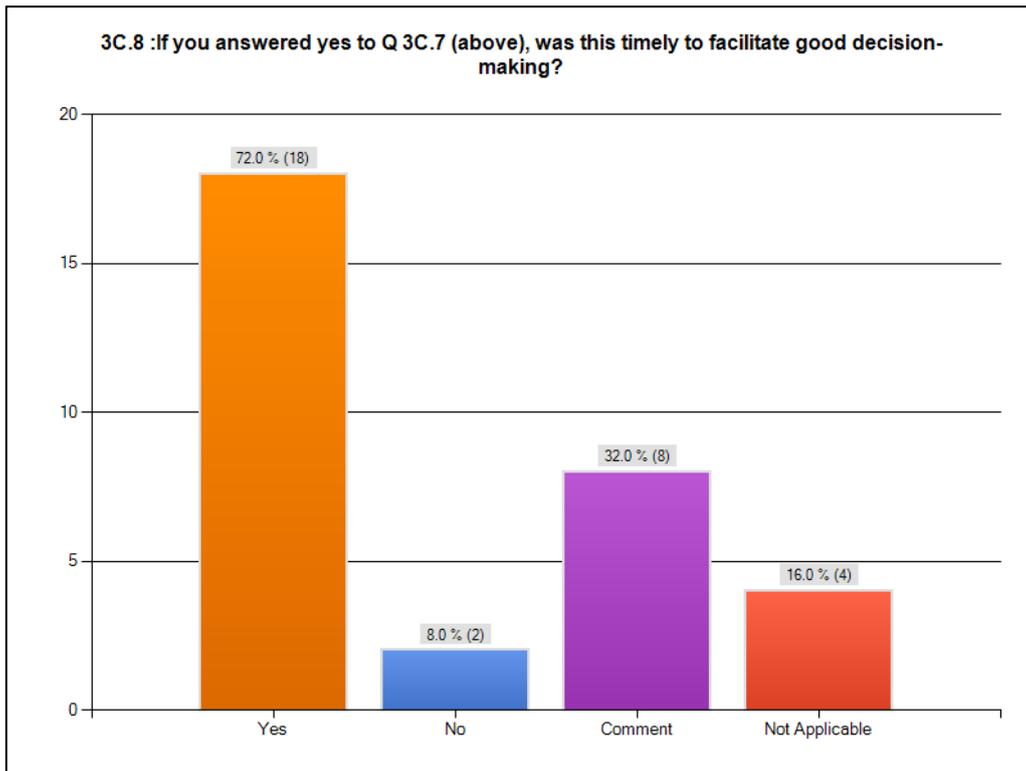
Sub-Objective 3C: Validate dissemination of warnings and information/advice by Tsunami Warning Focal Point to relevant in-country agencies and the public is accurate and timely.



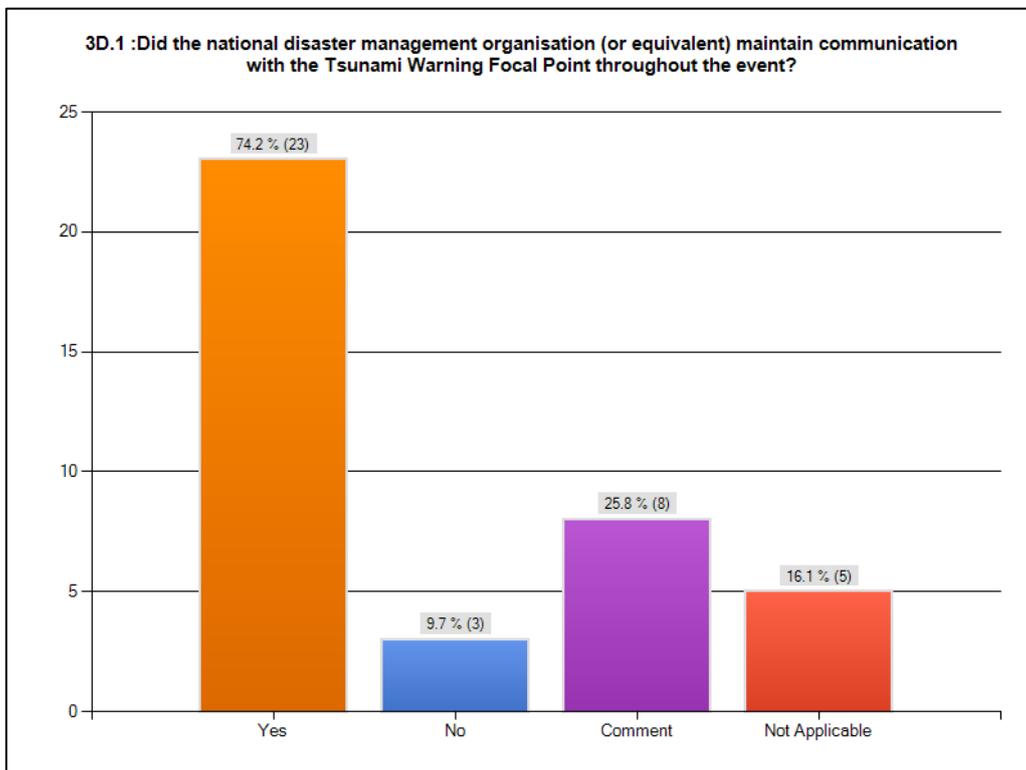


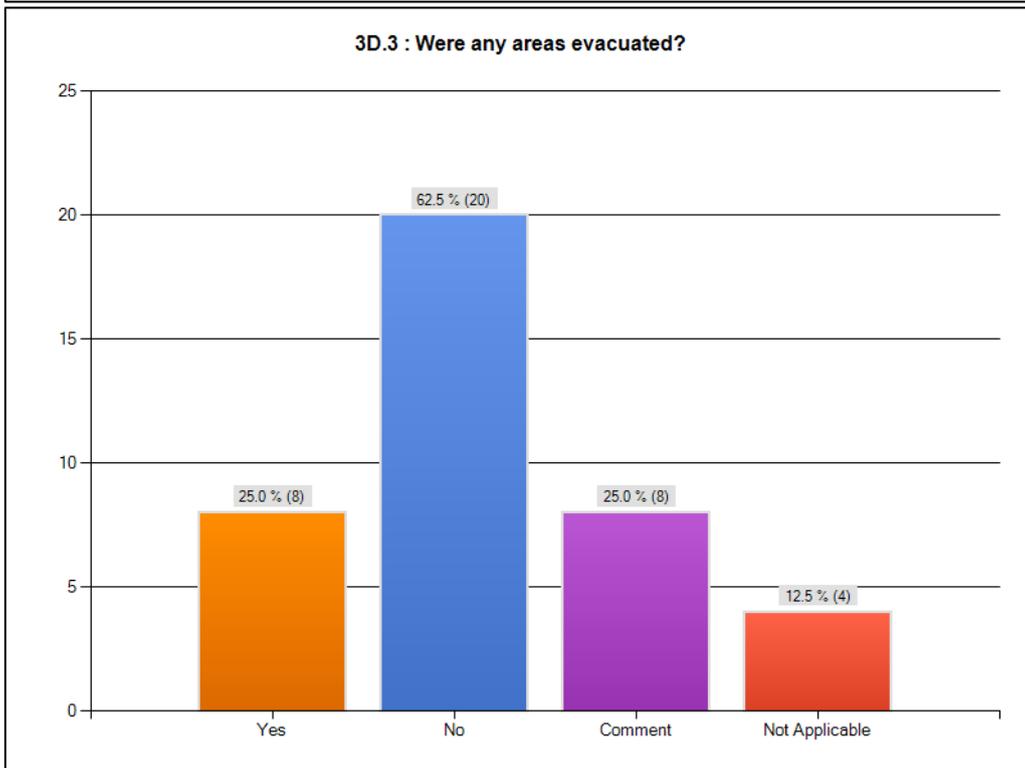
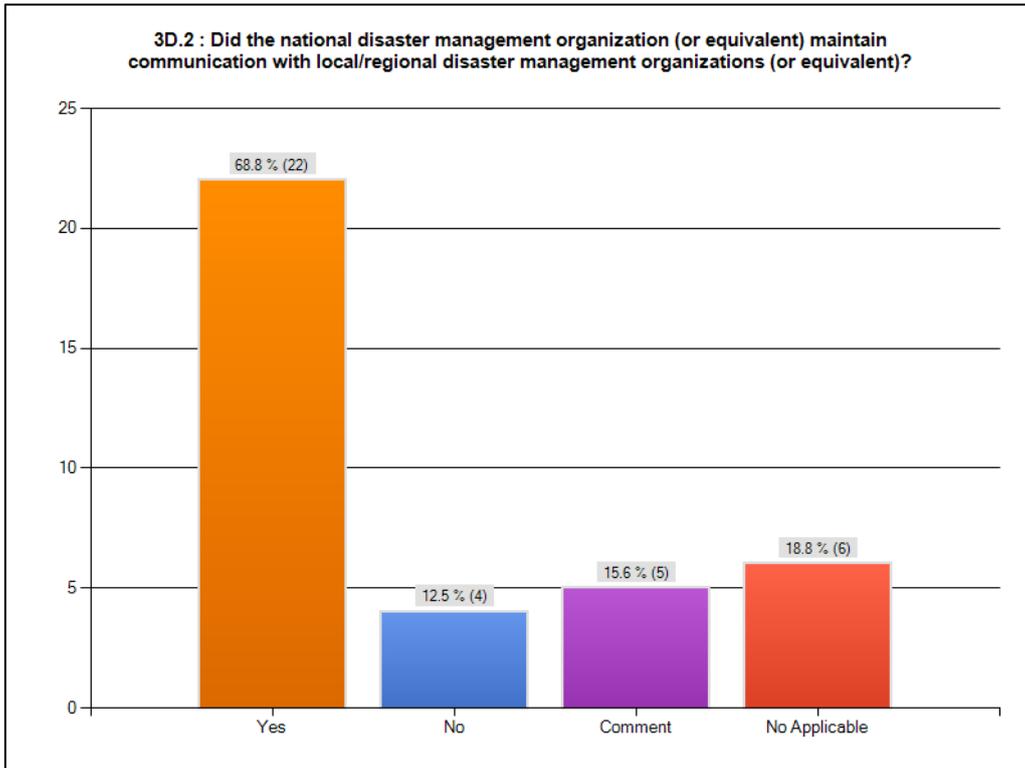


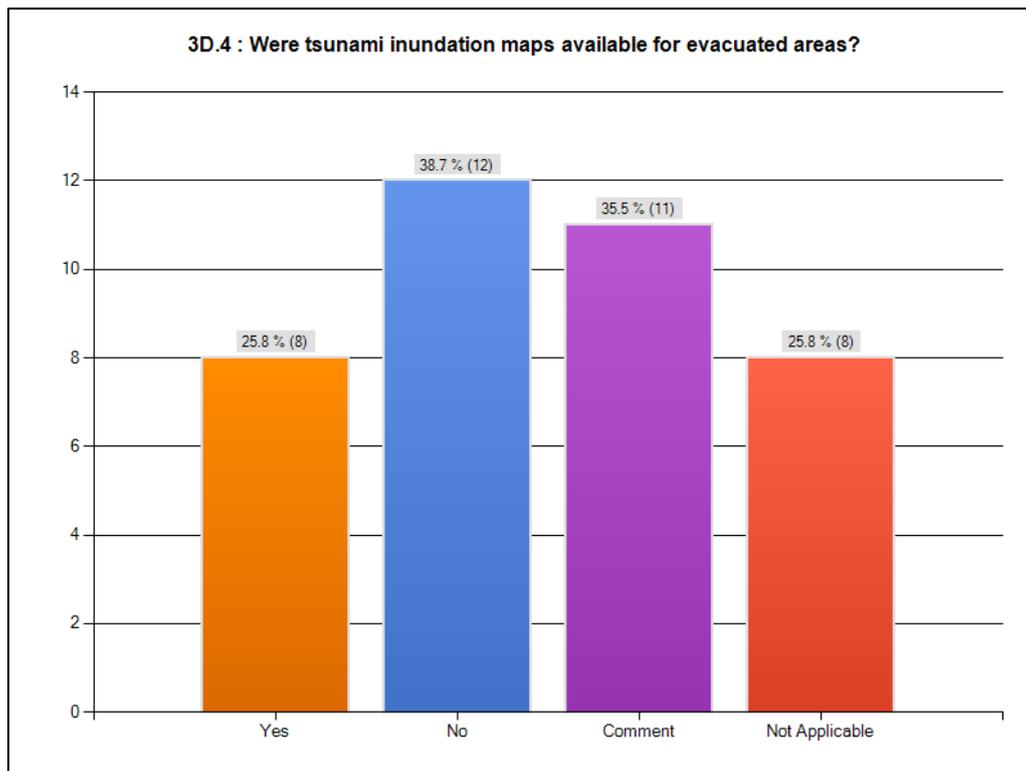




Sub-Objective 3D: Validate the organizational decision-making process about public warnings and evacuations.







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

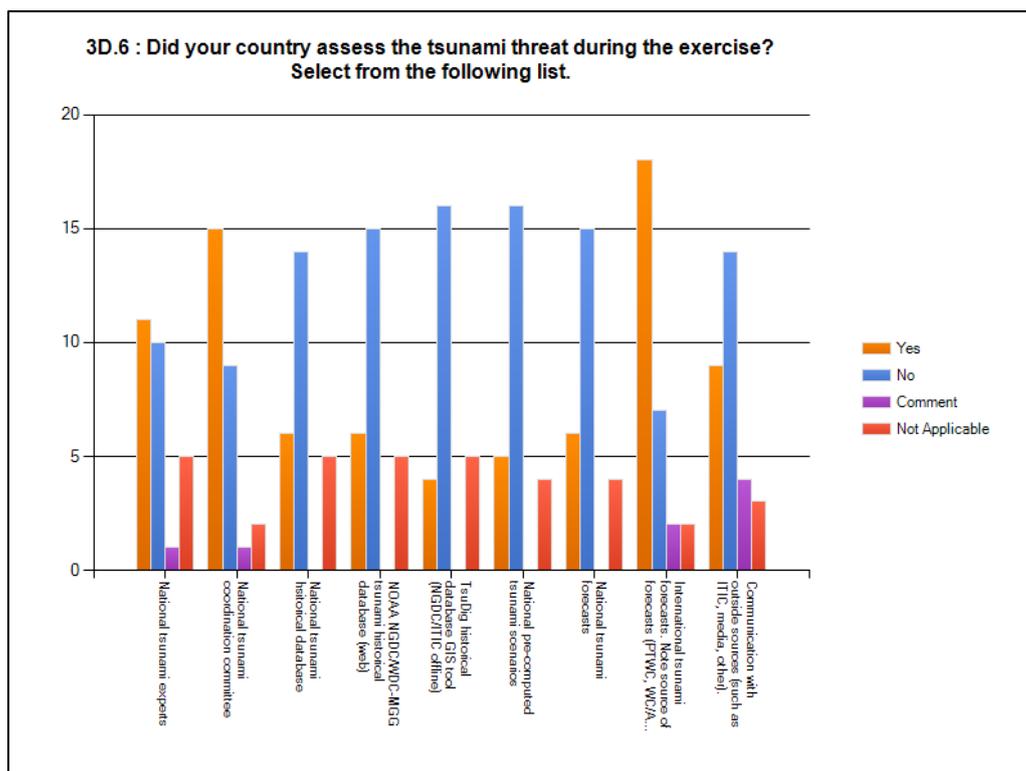
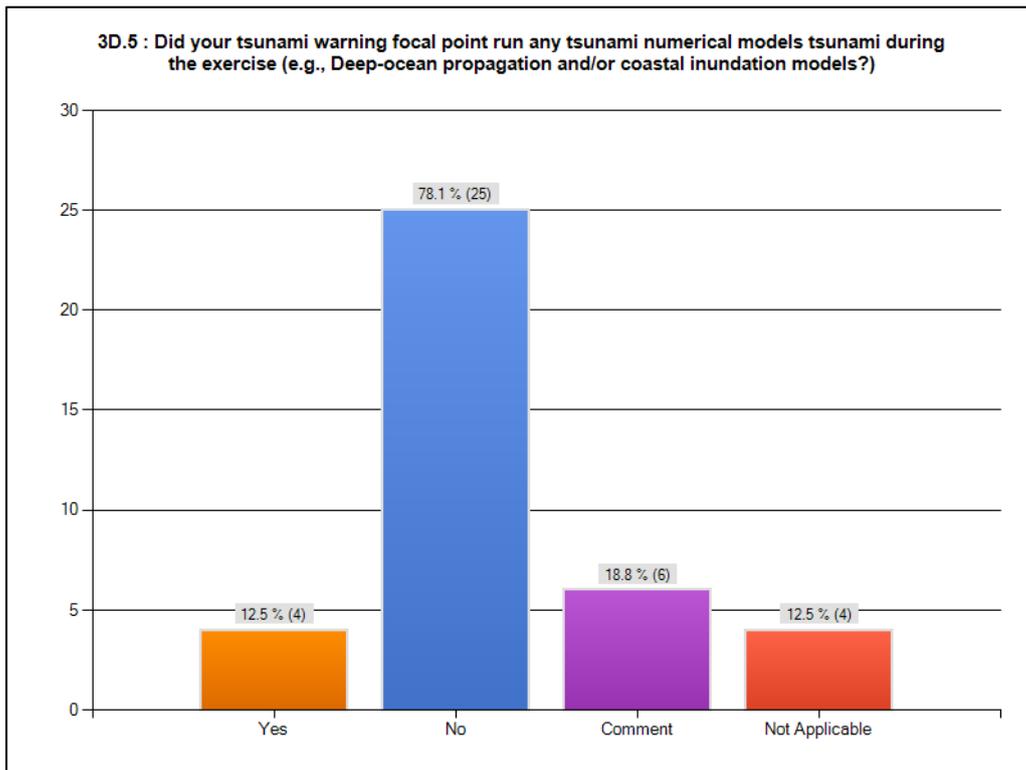
Puerto Rico: We have inundation maps for all 44 coastal communities.

Saint Lucia: yes, the maps were produced and the information taken into consideration in siting the assembly points for the evacuated students.

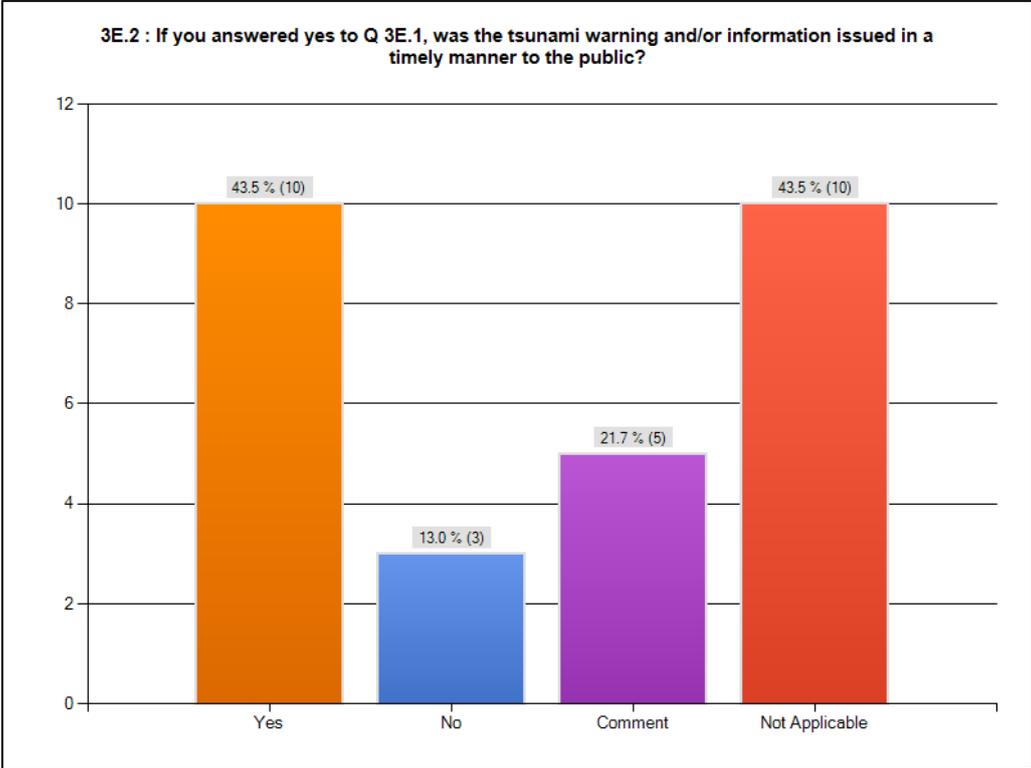
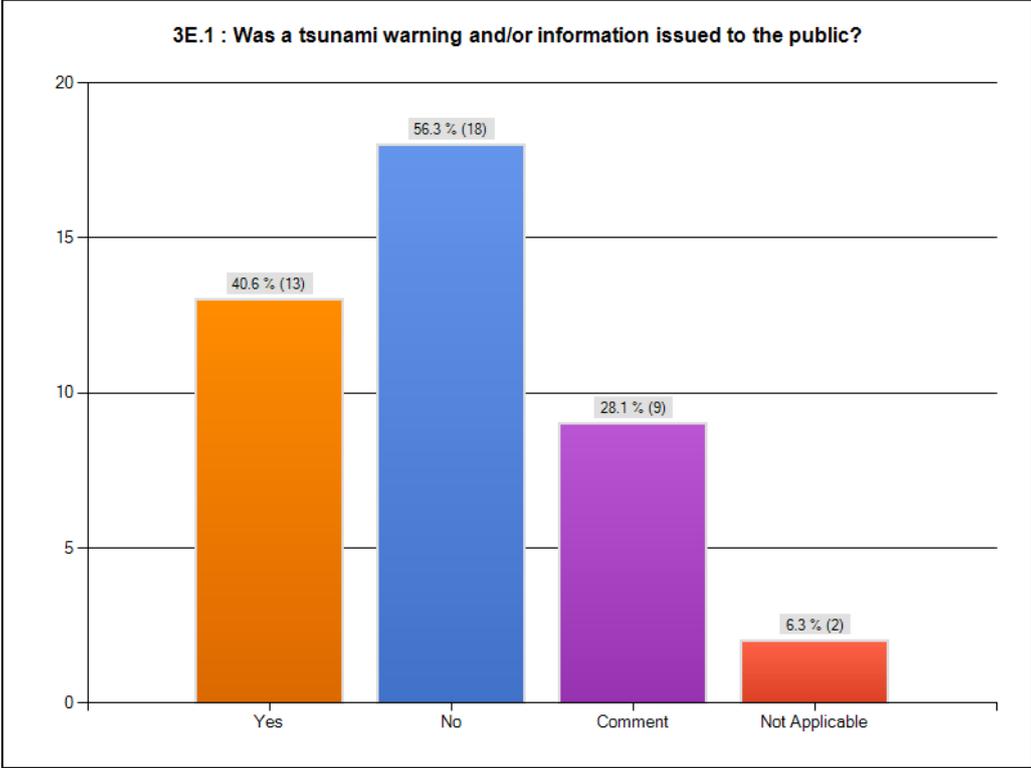
St. Kitts and Nevis: These are yet to be developed.

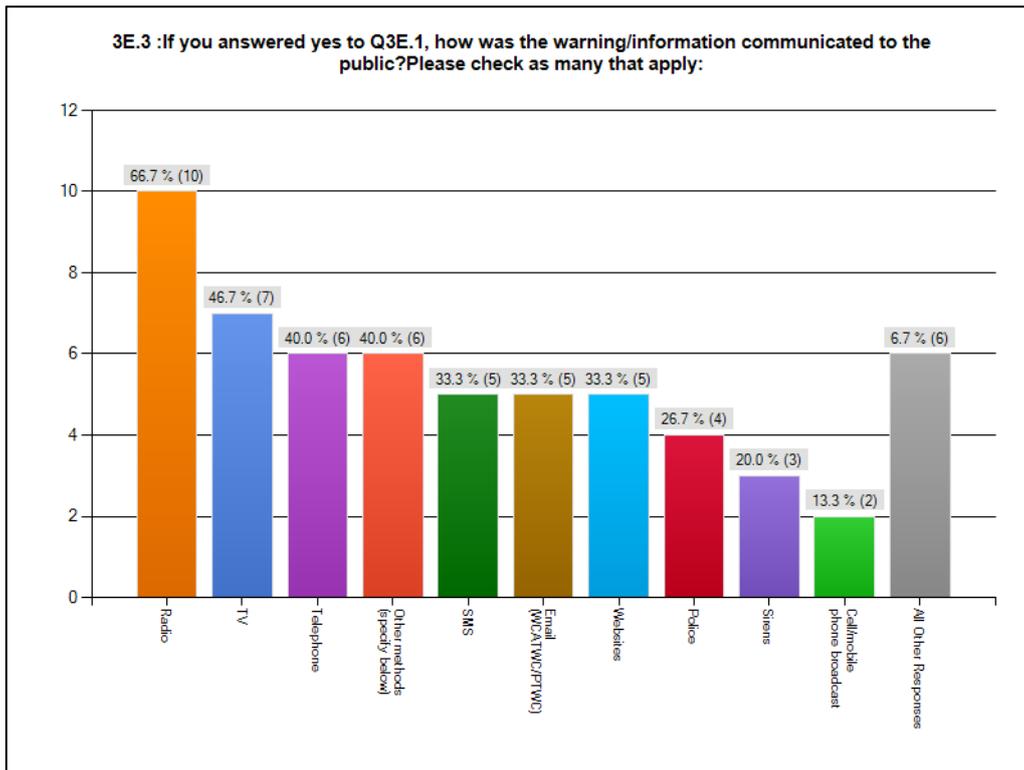
Turks and Caicos: Maps were available but used as part of the table top exercise.

Venezuela: were available only for the institutions that participated in the exercise.

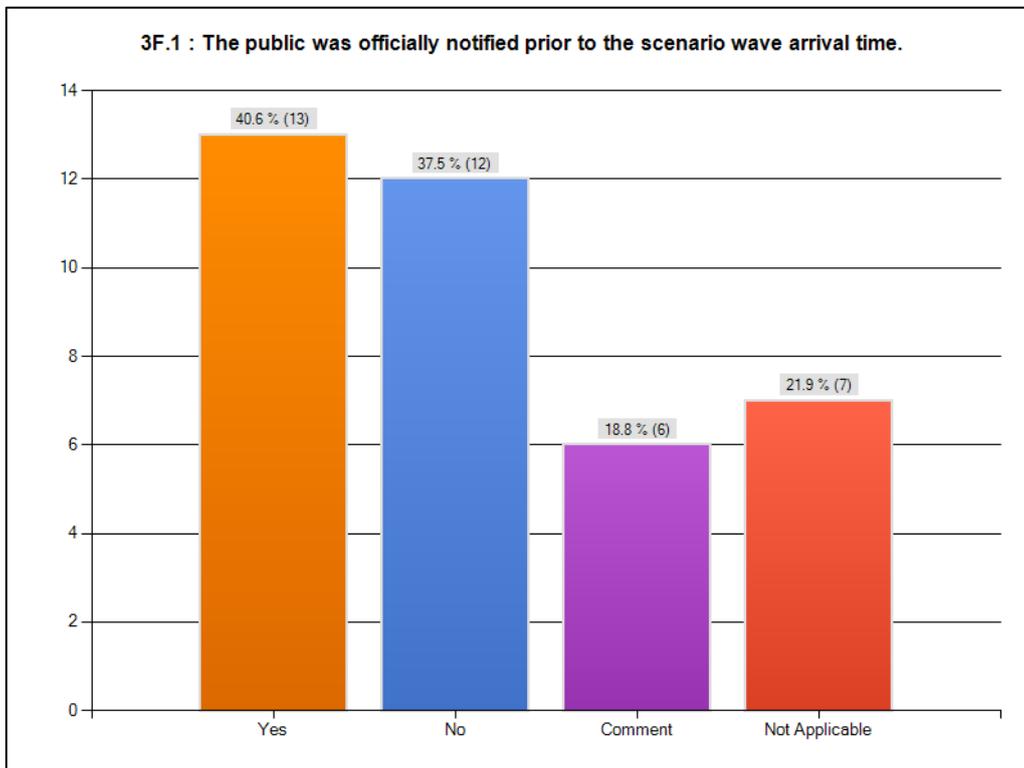


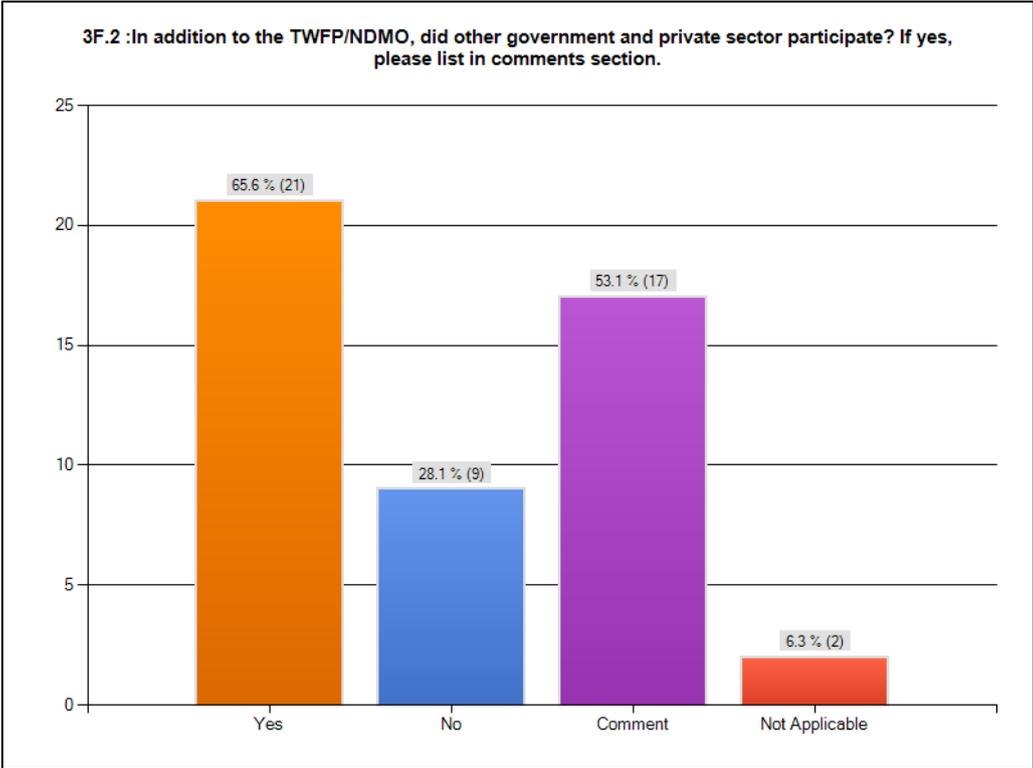
Sub-Objective 3E: Validate the methods used to notify and instruct the public are accurate and timely.



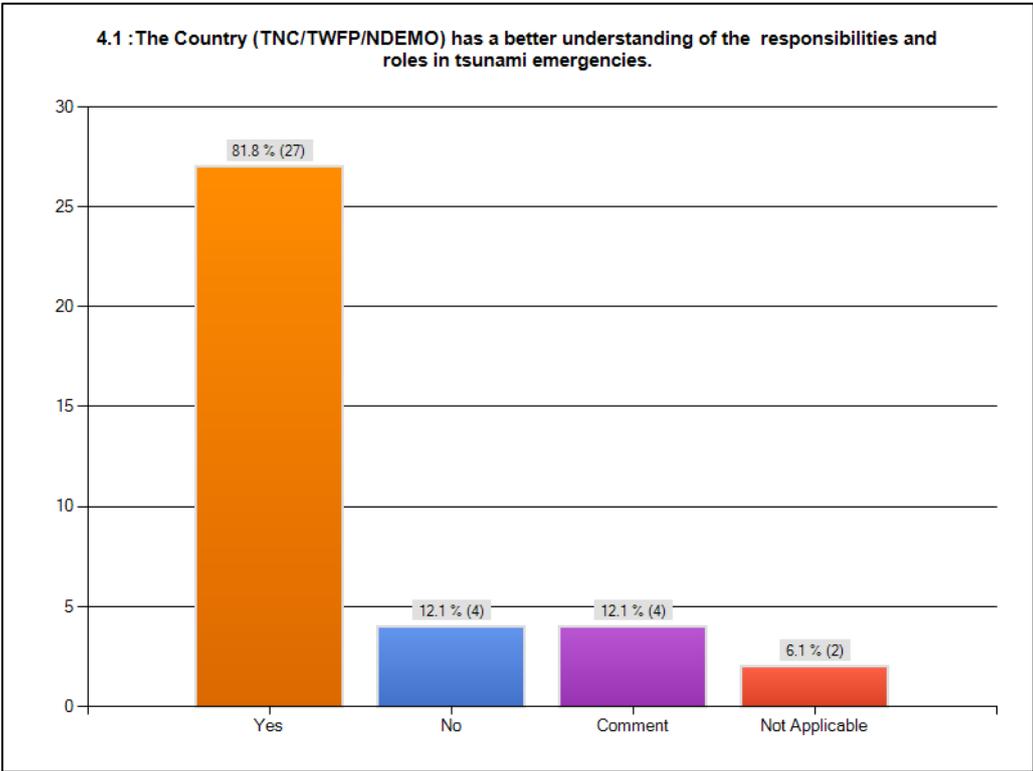


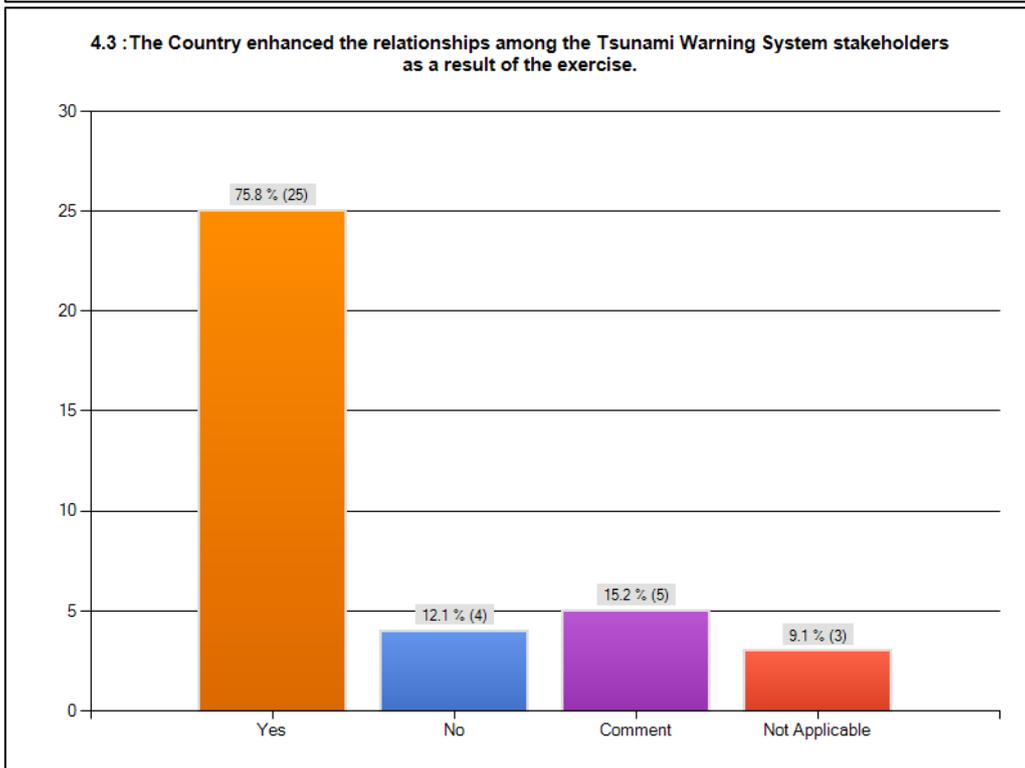
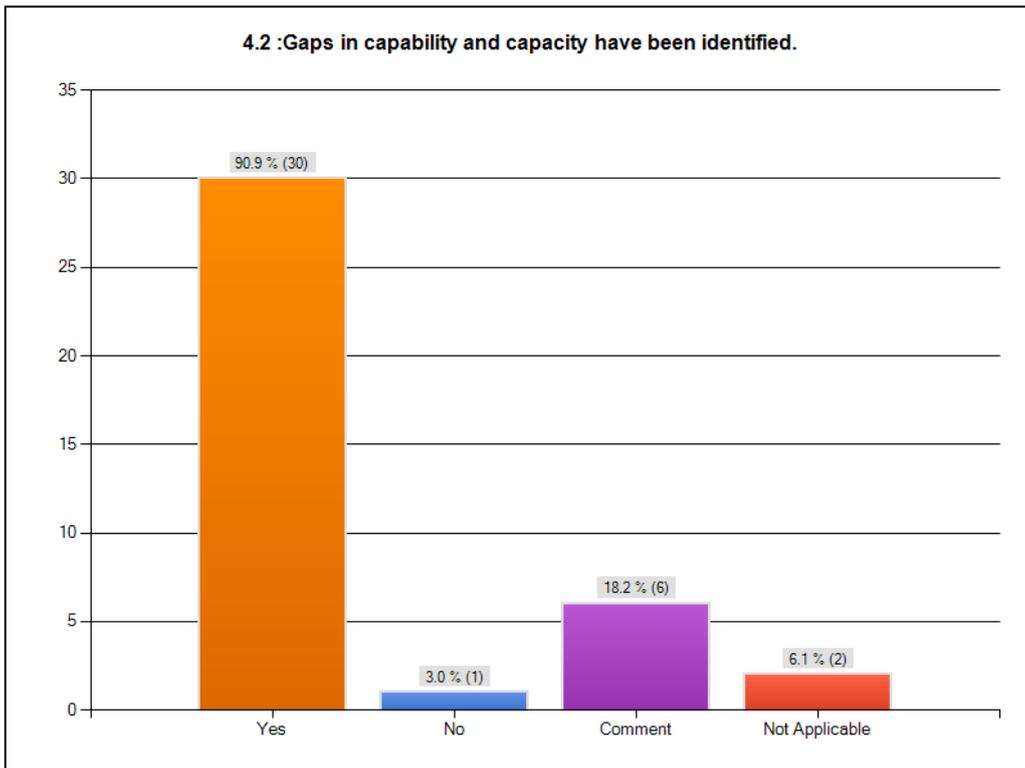
Sub-Objective 3F: Validate the elapsed time until the public would be notified and instructed/advised.

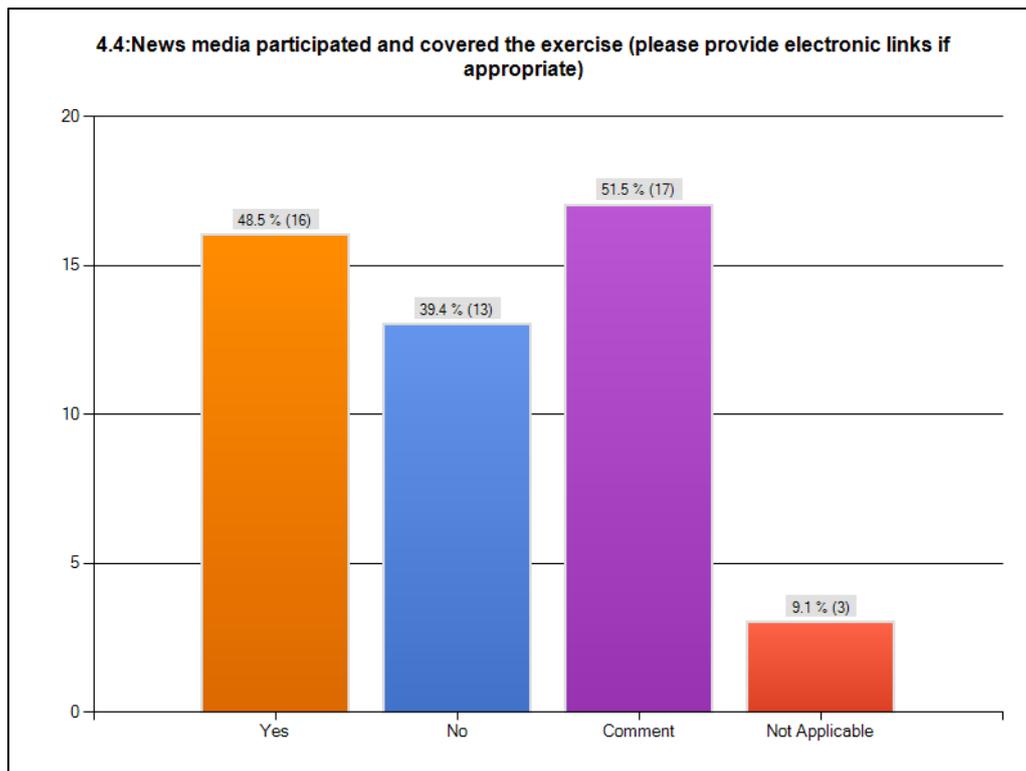




General Observations







The media coverage reported by the Tsunami National Contacts (TNC) were:

Aruba: <http://www.24ora.com/local-mainmenu-5/61251-meteo-aruba-lo-forma-parti-di-e-ehercicio-caribe-wave-lantex-2013-diaranzon-awor> <http://masnoticia.com/aruba-lo-forma-parti-di-e-ehercicio-di-tsunami-warning/>.

Barbados:

http://www.gisbarbados.gov.bb/index.php?categoryid=15&p2_articleid=10282
http://www.gisbarbados.gov.bb/index.php?categoryid=15&p2_articleid=10303
<http://www.barbadostoday.bb/2013/03/21/tsunami-readiness-put-to-test/>
<http://www.barbadostoday.bb/2013/03/19/tsunami-ready/>
<http://www.barbadostoday.bb/2013/03/07/eyes-on-the-sea/>
<http://www.barbadostoday.bb/2013/01/30/ready-to-ride-the-wave/>
<http://www.barbadostoday.bb/2013/03/12/watching-the-wave/>
<http://www.barbadostoday.bb/2013/03/11/northern-winter-swells-for-remainder-of-week/>
<http://www.barbadosadvocate.com/newsitem.asp?more=3Dlocal&NewsID=28959>
<http://www.barbadosadvocate.com/newsitem.asp?more=3Dlocal&NewsID=28958>

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

Cayman Islands: <http://compasscayman.com/caycompass/2013/03/20/Tsunami-exercise-under-way/>.

Colombia:

http://www.elinformador.com.co/index.php?option=com_content&view=article&id=50412:costa-caribe-se-prepara-frente-a-riesgos-por-tsunami-y-huracanes&catid=83:en-la-region&Itemid=460

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:

<http://www.lenouvelliste.com/article4.php?newsid=114777>

<http://www.hpnhaiti.com/site/index.php/societe/9009-haiti-tsunami-haiti-participe-ce-mercredi-a-un-exercice-dalerte-au-tsunami> <http://www.maximini.com/fr/news/haiti/societe-manifestation/participation-haitienne-a-la-simulation-d-alerte-au-tsunami-dans-la-mer-des-caraibes-21442.html> <http://www.haitilibre.com/en/news-8145-haiti-social-haiti-participates-to-the-exercise-caribe-wave-lantex-13.html>

Puerto Rico: <http://puertorico.univision.com/ultima-hora/puerto-rico/article/2013-03-20/realizan-simulacro-caribe-wave-lantex> <http://www.noticel.com/noticia/139103/exitoso-simulacro-de-tsunami-lantex-2013.html> <http://www.woletv.net/demo/2013/03/25/simulacro-tsunami-lantex-2013-cumplio-con-exito/> http://www.wapa.tv/noticias/locales/exitoso-el-simulacro-lantex-2013_20130320172030.html http://www.wapa.tv/noticias/locales/pronto-el-simulacro-de-terremoto-y-tsunami-lantex_20130312113441.html

St. Kitts and Nevis:

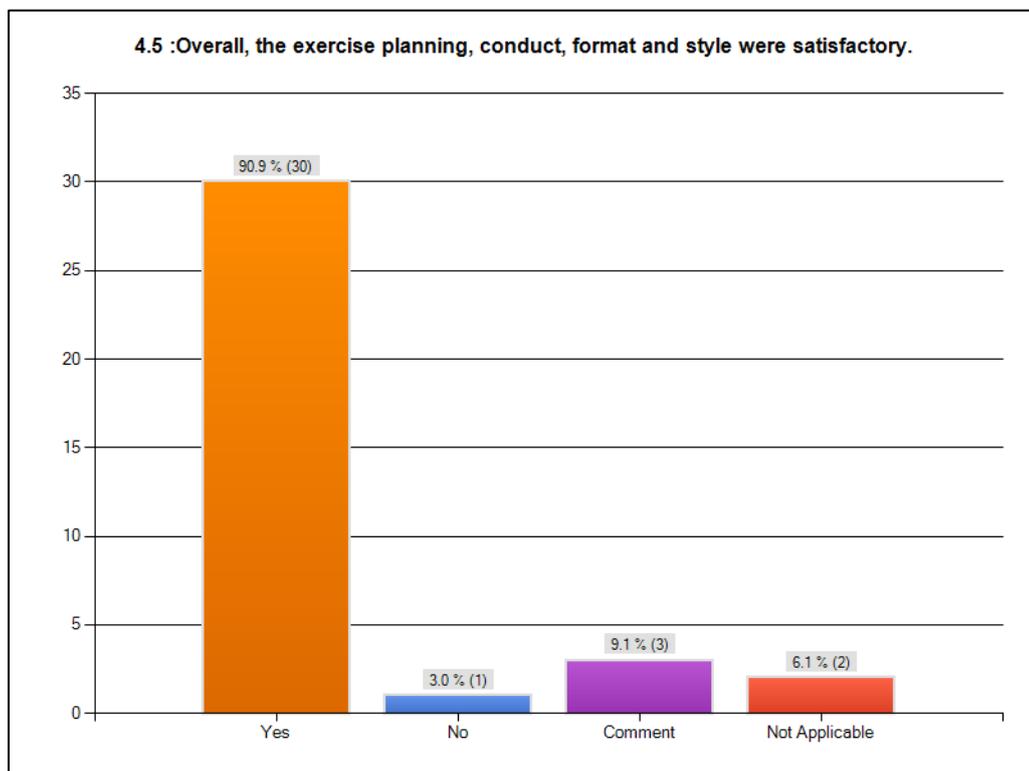
[http://www.miyvue.com/index.php?option=com_content&view=article&id=12406:nema-preparing-for-tsunami&catid=1:national&Itemid=55,](http://www.miyvue.com/index.php?option=com_content&view=article&id=12406:nema-preparing-for-tsunami&catid=1:national&Itemid=55)

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/funvisis-coordin%C3%B3-exitosamente-ejercicio-de-respuesta-comunicacional-ante-tsunami> <http://www.vtv.gob.ve/articulos/2013/03/20/funvisis-coordino-exitosamente-ejercicio-de-respuesta-comunicacional-ante-tsunami-3197.html>



The country who answered no to the above question was: Guyana

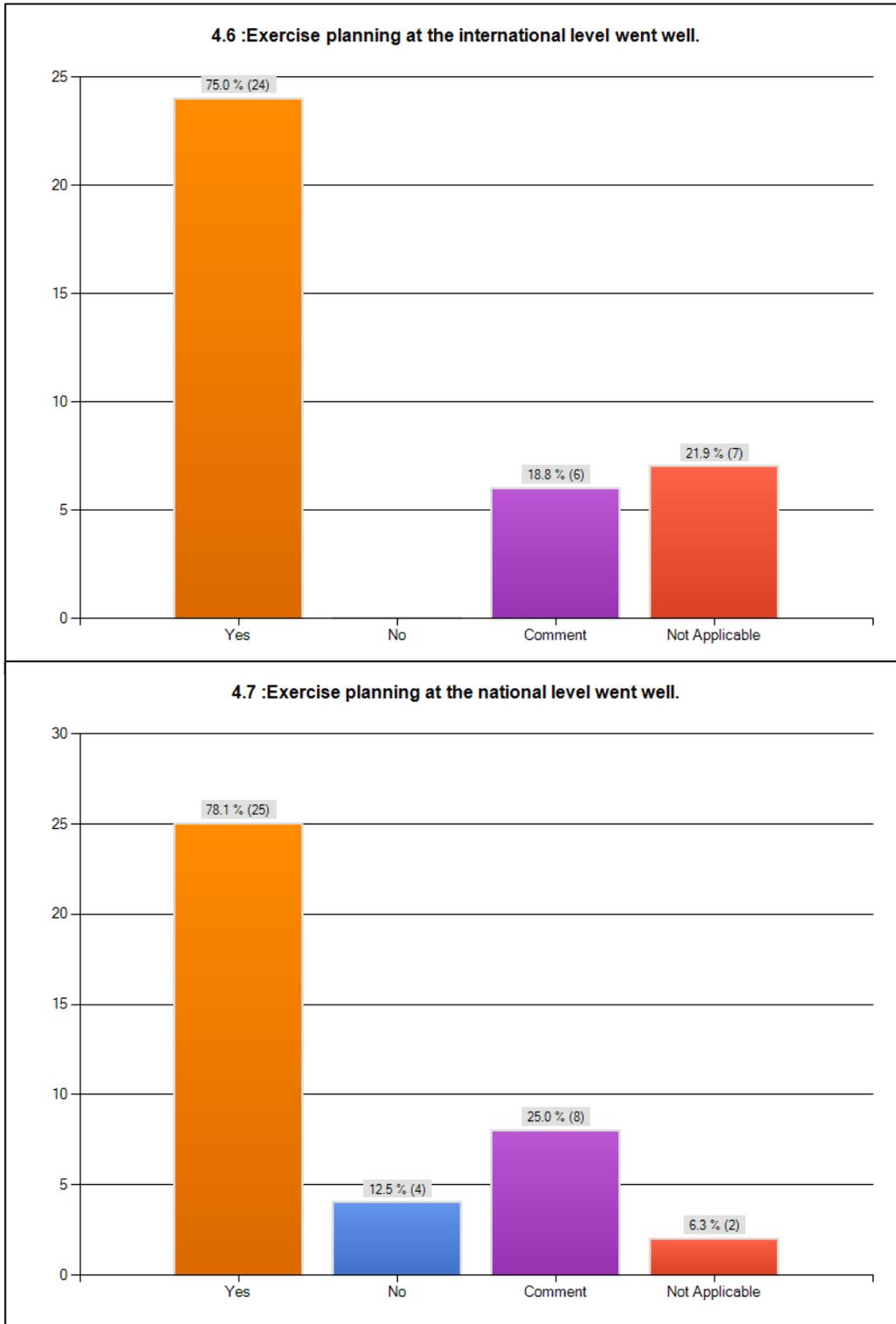
The country who answered not applicable to the above question was: Panama

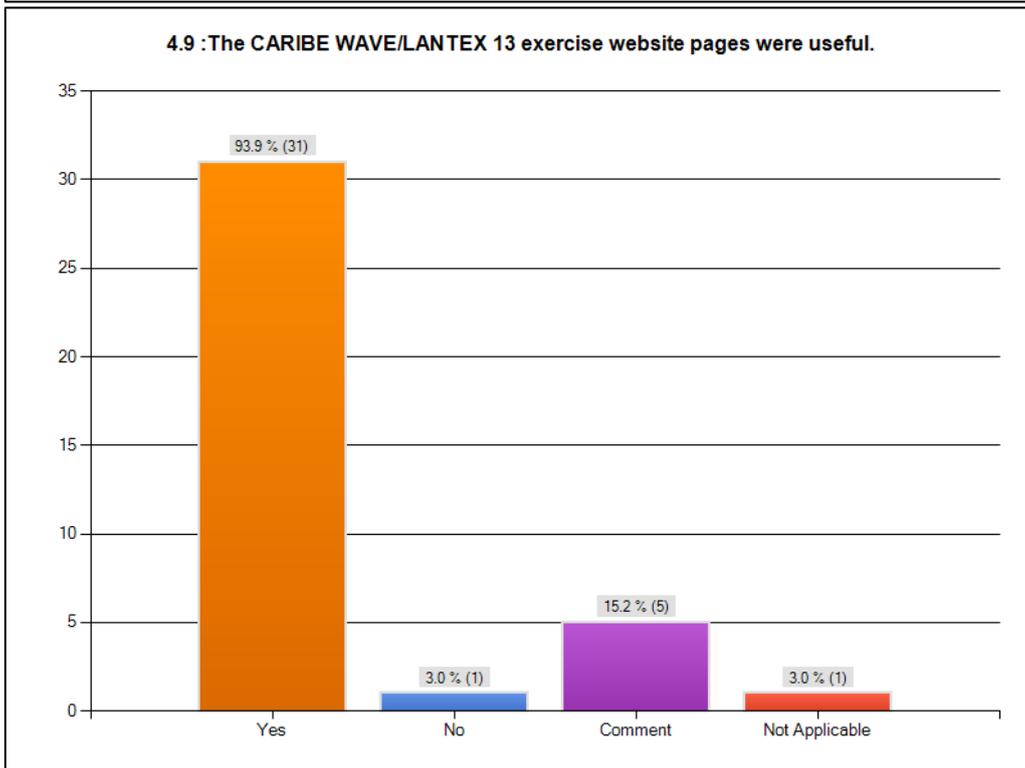
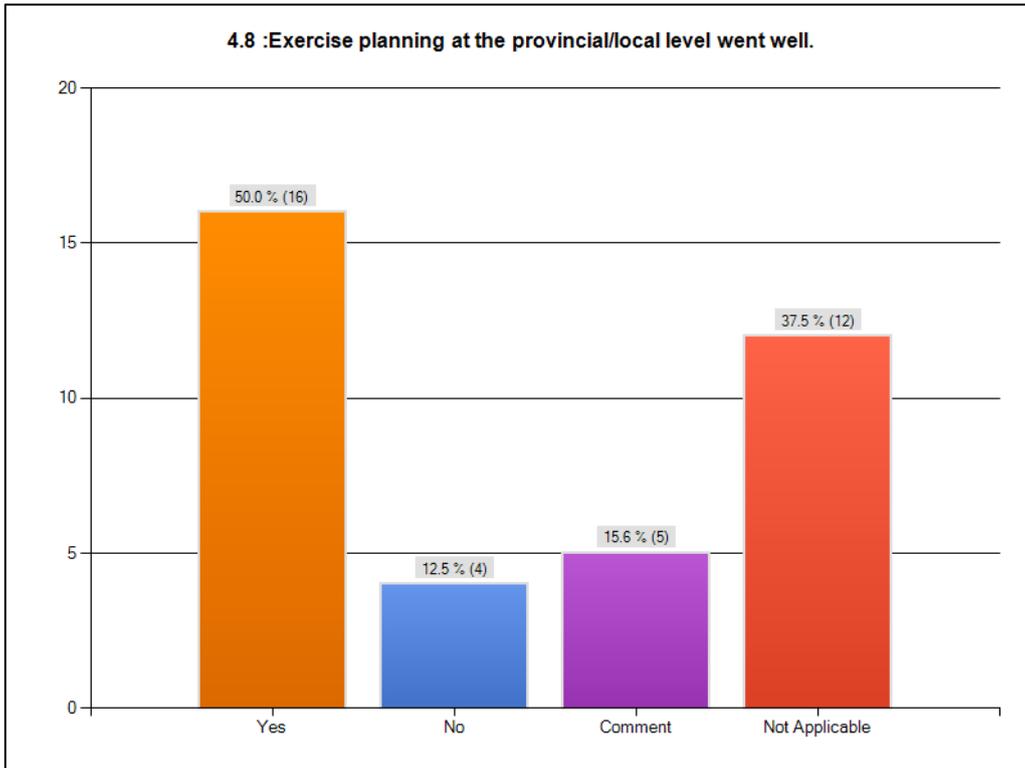
The comments received from the participant Tsunami National Contacts (TNC) were:

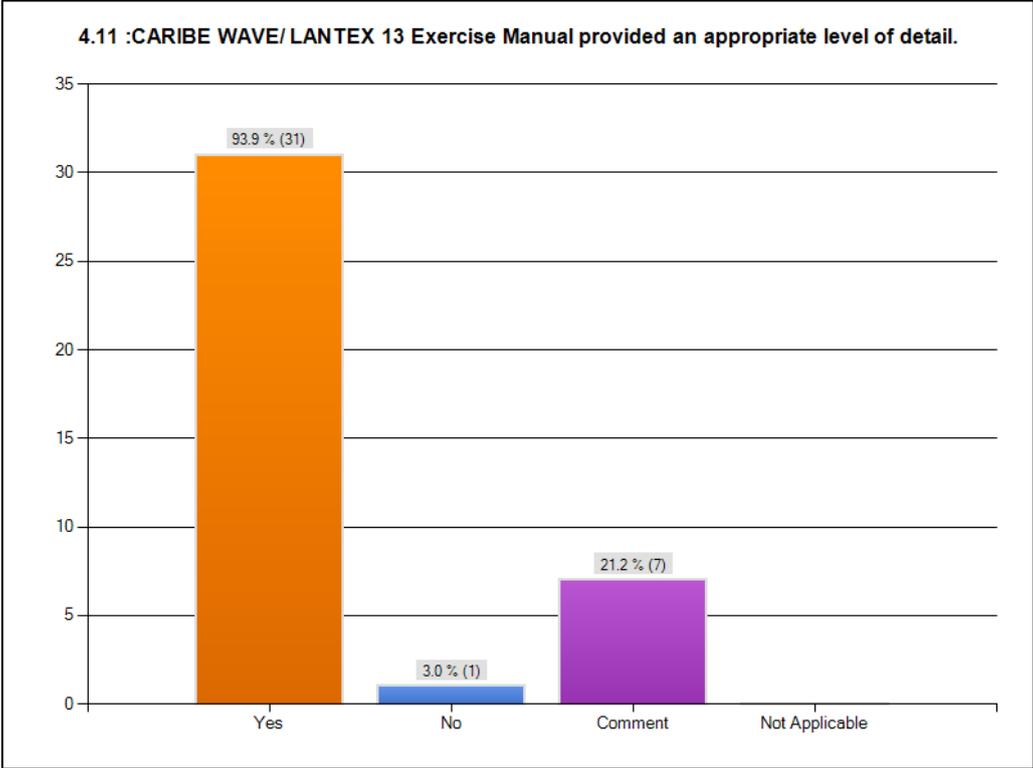
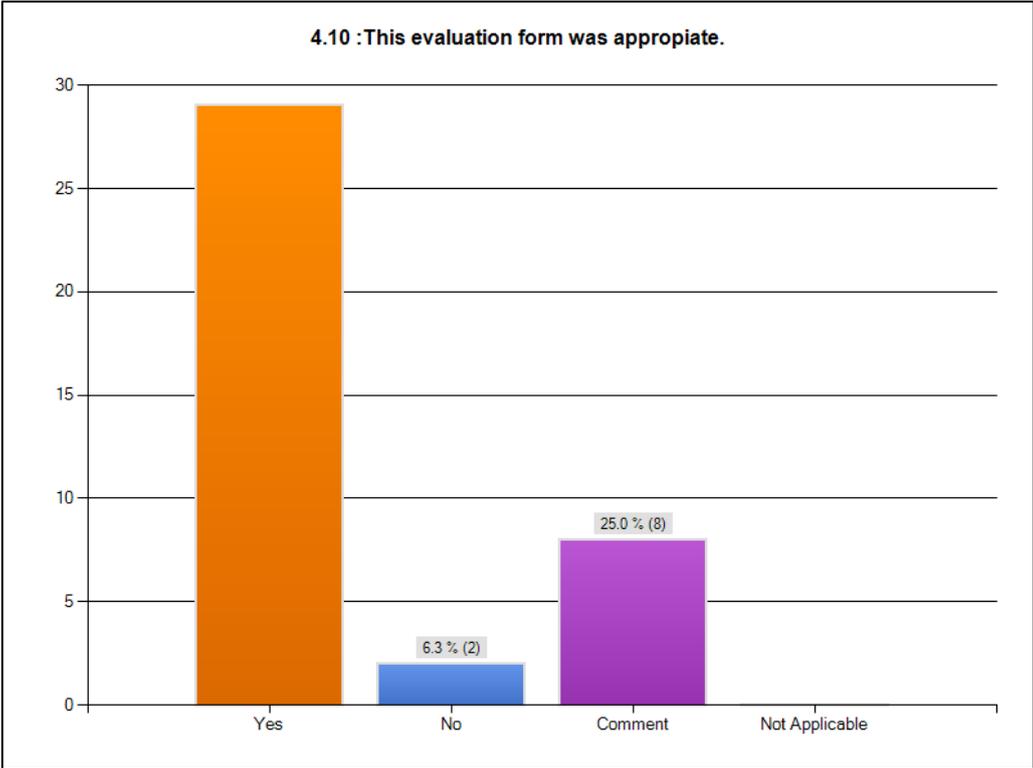
Guatemala: The information was excellent.

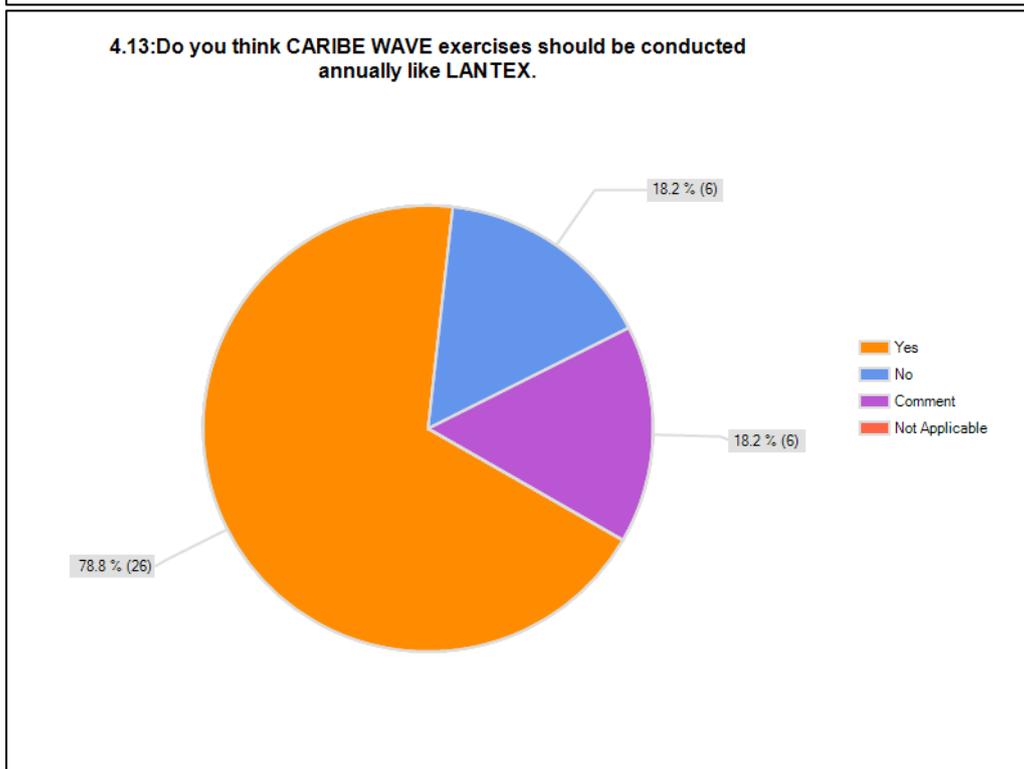
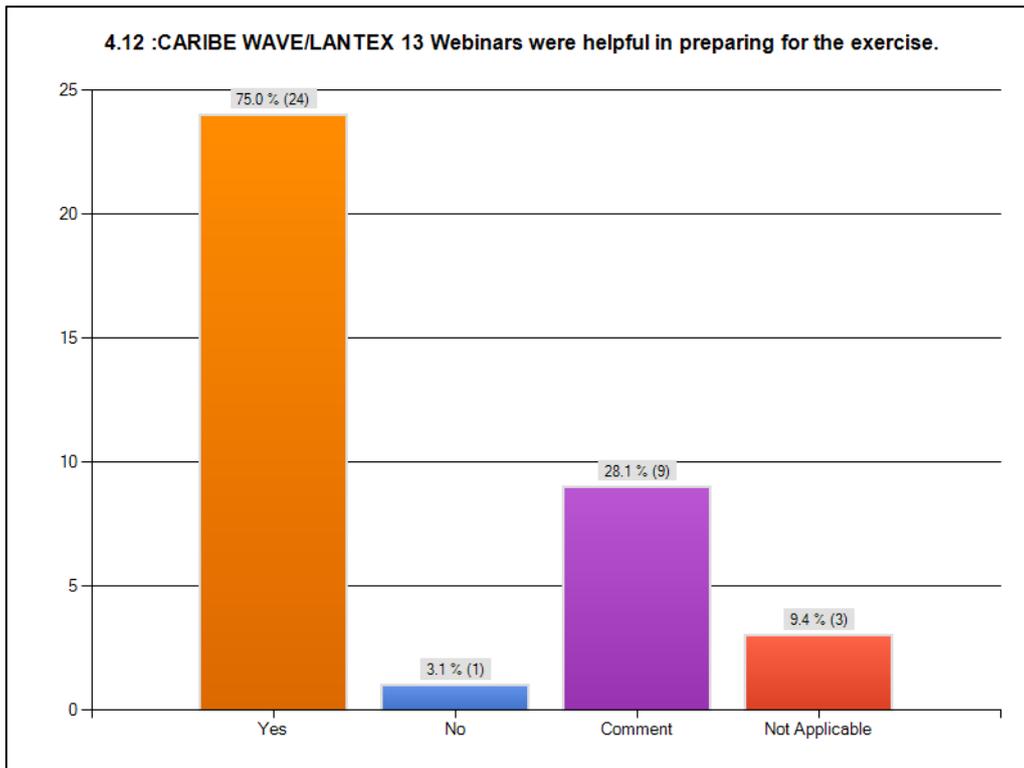
Mexico: Yes, we improved communications and detected errors. Also engage more institutions in the exercise.

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.









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:

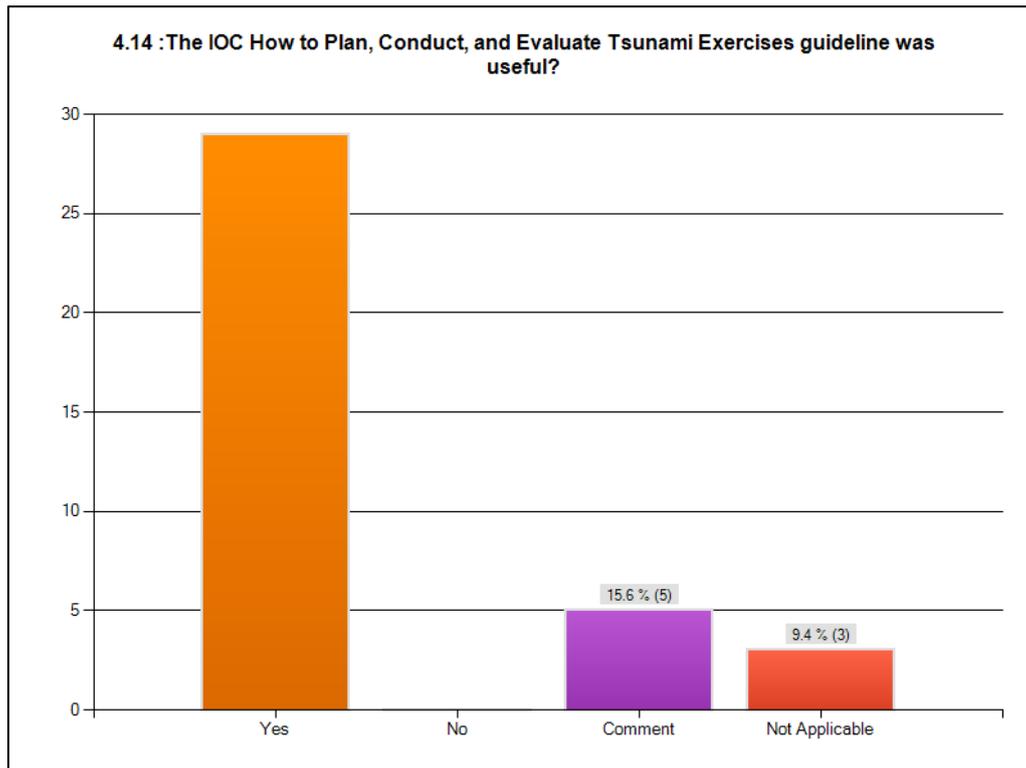
Curacao: At our current level of preparedness we see that exercising every two years gives us sufficient time to adapt procedures and work on the necessary. Plus from a budgetary perspective and taking into account the other types of hazards that need to be addressed we see think that every two years 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 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.

ANNEX II

LIST OF ACRONYMS

AWIPS	Advanced Weather Interactive Processing System
CDEMA	Caribbean Emergency Management Agency
CEPREDENAC	Coordination Center for the Prevention of Natural Disasters in Central America
CTWP	Caribbean Tsunami Warning Program
EAS	the Emergency Alert System
EMO	Emergency Management Organization
EMWIN	Emergency Manager's Weather Information Network
FUNVISIS	Fundación Venezolana de Investigaciones Sismológicas
GTS	Global Telecommunications System
ICG/CARIBE-EWS	Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions
INETER	Instituto Nicaraguense de Estudios Territoriales
IOC	Intergovernmental Oceanographic Commission
ITIC	International Tsunami Information Center
NDMO	National Disaster Management Office
NGDC	National Geophysical Data Center
NOAA	National Oceanic and Atmospheric Administration's
NOAA	National Oceanic and Atmospheric Administration
NTHMP	US National Tsunami Hazard Mitigation Program
NWWS	NOAA Weather Wire Service
PAGER	Prompt Assessment of Global Earthquakes for Response
PRSN	Puerto Rico Seismic Network
PTWC	Pacific Tsunami Warning Center
SOP	Standard Operational Procedure
TNC	Tsunami National Contacts
TWFPs	Tsunami Warning Focal Points

UNESCO	United Nations Educational, Scientific and Cultural Organization
WCATWC	West Coast and Alaska Tsunami Warning Center
WFO	Weather Forecast Offices
WMO	World Meteorological Organization

IOC Technical Series

No.	Title	Languages
1	Manual on International Oceanographic Data Exchange. 1965	(out of stock)
2	Intergovernmental Oceanographic Commission (Five years of work). 1966	(out of stock)
3	Radio Communication Requirements of Oceanography. 1967	(out of stock)
4	Manual on International Oceanographic Data Exchange - Second revised edition. 1967	(out of stock)
5	Legal Problems Associated with Ocean Data Acquisition Systems (ODAS). 1969	(out of stock)
6	Perspectives in Oceanography, 1968	(out of stock)
7	Comprehensive Outline of the Scope of the Long-term and Expanded Programme of Oceanic Exploration and Research. 1970	(out of stock)
8	IGOSS (Integrated Global Ocean Station System) - General Plan Implementation Programme for Phase I. 1971	(out of stock)
9	Manual on International Oceanographic Data Exchange - Third Revised Edition. 1973	(out of stock)
10	Bruun Memorial Lectures, 1971	E, F, S, R
11	Bruun Memorial Lectures, 1973	(out of stock)
12	Oceanographic Products and Methods of Analysis and Prediction. 1977	E only
13	International Decade of Ocean Exploration (IDOE), 1971-1980. 1974	(out of stock)
14	A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines. 1976	E, F, S, R
15	Bruun Memorial Lectures, 1975 - Co-operative Study of the Kuroshio and Adjacent Regions. 1976	(out of stock)
16	Integrated Ocean Global Station System (IGOSS) General Plan and Implementation Programme 1977-1982. 1977	E, F, S, R
17	Oceanographic Components of the Global Atmospheric Research Programme (GARP) . 1977	(out of stock)
18	Global Ocean Pollution: An Overview. 1977	(out of stock)
19	Bruun Memorial Lectures - The Importance and Application of Satellite and Remotely Sensed Data to Oceanography. 1977	(out of stock)
20	A Focus for Ocean Research: The Intergovernmental Oceanographic Commission - History, Functions, Achievements. 1979	(out of stock)
21	Bruun Memorial Lectures, 1979: Marine Environment and Ocean Resources. 1986	E, F, S, R
22	Scientific Report of the Intercalibration Exercise of the IOC-WMO-UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open Ocean Waters. 1982	(out of stock)
23	Operational Sea-Level Stations. 1983	E, F, S, R
24	Time-Series of Ocean Measurements. Vol.1. 1983	E, F, S, R
25	A Framework for the Implementation of the Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment. 1984	(out of stock)
26	The Determination of Polychlorinated Biphenyls in Open-ocean Waters. 1984	E only
27	Ocean Observing System Development Programme. 1984	E, F, S, R
28	Bruun Memorial Lectures, 1982: Ocean Science for the Year 2000. 1984	E, F, S, R
29	Catalogue of Tide Gauges in the Pacific. 1985	E only
30	Time-Series of Ocean Measurements. Vol. 2. 1984	E only
31	Time-Series of Ocean Measurements. Vol. 3. 1986	E only
32	Summary of Radiometric Ages from the Pacific. 1987	E only
33	Time-Series of Ocean Measurements. Vol. 4. 1988	E only
34	Bruun Memorial Lectures, 1987: Recent Advances in Selected Areas of Ocean Sciences in the Regions of the Caribbean, Indian Ocean and the Western Pacific. 1988	Composite E, F, S
35	Global Sea-Level Observing System (GLOSS) Implementation Plan. 1990	E only

(continued)

36	Bruun Memorial Lectures 1989: Impact of New Technology on Marine Scientific Research. 1991	Composite E, F, S
37	Tsunami Glossary - A Glossary of Terms and Acronyms Used in the Tsunami Literature. 1991	E only
38	The Oceans and Climate: A Guide to Present Needs. 1991	E only
39	Bruun Memorial Lectures, 1991: Modelling and Prediction in Marine Science. 1992	E only
40	Oceanic Interdecadal Climate Variability. 1992	E only
41	Marine Debris: Solid Waste Management Action for the Wider Caribbean. 1994	E only
42	Calculation of New Depth Equations for Expendable Bathymetographs Using a Temperature-Error-Free Method (Application to Sippican/TSK T-7, T-6 and T-4 XBTS. 1994	E only
43	IGOSS Plan and Implementation Programme 1996-2003. 1996	E, F, S, R
44	Design and Implementation of some Harmful Algal Monitoring Systems. 1996	E only
45	Use of Standards and Reference Materials in the Measurement of Chlorinated Hydrocarbon Residues. 1996	E only
46	Equatorial Segment of the Mid-Atlantic Ridge. 1996	E only
47	Peace in the Oceans: Ocean Governance and the Agenda for Peace; the Proceedings of <i>Pacem in Maribus</i> XXIII, Costa Rica, 1995. 1997	E only
48	Neotectonics and fluid flow through seafloor sediments in the Eastern Mediterranean and Black Seas - Parts I and II. 1997	E only
49	Global Temperature Salinity Profile Programme: Overview and Future. 1998	E only
50	Global Sea-Level Observing System (GLOSS) Implementation Plan-1997. 1997	E only
51	L'état actuel de l'exploitation des pêcheries maritimes au Cameroun et leur gestion intégrée dans la sous-région du Golfe de Guinée (<i>cancelled</i>)	F only
52	Cold water carbonate mounds and sediment transport on the Northeast Atlantic Margin. 1998	E only
53	The Baltic Floating University: Training Through Research in the Baltic, Barents and White Seas - 1997. 1998	E only
54	Geological Processes on the Northeast Atlantic Margin (8 th training-through-research cruise, June-August 1998). 1999	E only
55	Bruun Memorial Lectures, 1999: Ocean Predictability. 2000	E only
56	Multidisciplinary Study of Geological Processes on the North East Atlantic and Western Mediterranean Margins (9 th training-through-research cruise, June-July 1999). 2000	E only
57	Ad hoc Benthic Indicator Group - Results of Initial Planning Meeting, Paris, France, 6-9 December 1999. 2000	E only
58	Bruun Memorial Lectures, 2001: Operational Oceanography – a perspective from the private sector. 2001	E only
59	Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters. 2001	E only
60	Interdisciplinary Approaches to Geoscience on the North East Atlantic Margin and Mid-Atlantic Ridge (10 th training-through-research cruise, July-August 2000). 2001	E only
61	Forecasting Ocean Science? Pros and Cons, Potsdam Lecture, 1999. 2002	E only
62	Geological Processes in the Mediterranean and Black Seas and North East Atlantic (11 th training-through-research cruise, July- September 2001). 2002	E only
63	Improved Global Bathymetry – Final Report of SCOR Working Group 107. 2002	E only
64	R. Revelle Memorial Lecture, 2006: Global Sea Levels, Past, Present and Future. 2007	E only
65	Bruun Memorial Lectures, 2003: Gas Hydrates – a potential source of energy from the oceans. 2003	E only
66	Bruun Memorial Lectures, 2003: Energy from the Sea: the potential and realities of Ocean Thermal Energy Conversion (OTEC). 2003	E only

67	Interdisciplinary Geoscience Research on the North East Atlantic Margin, Mediterranean Sea and Mid-Atlantic Ridge (12 th training-through-research cruise, June-August 2002). 2003	E only
68	Interdisciplinary Studies of North Atlantic and Labrador Sea Margin Architecture and Sedimentary Processes (13 th training-through-research cruise, July-September 2003). 2004	E only
69	Biodiversity and Distribution of the Megafauna / Biodiversité et distribution de la mégafaune. 2006 Vol.1 The polymetallic nodule ecosystem of the Eastern Equatorial Pacific Ocean / Ecosystème de nodules polymétalliques de l'océan Pacifique Est équatorial Vol.2 Annotated photographic Atlas of the echinoderms of the Clarion-Clipperton fracture zone / Atlas photographique annoté des échinodermes de la zone de fractures de Clarion et de Clipperton Vol.3 Options for the management and conservation of the biodiversity — The nodule ecosystem in the Clarion Clipperton fracture zone: scientific, legal and institutional aspects	E F
70	Interdisciplinary geoscience studies of the Gulf of Cadiz and Western Mediterranean Basin (14 th training-through-research cruise, July-September 2004). 2006	E only
71	Indian Ocean Tsunami Warning and Mitigation System, IOTWS. Implementation Plan, 7–9 April 2009 (2 nd Revision). 2009	E only
72	Deep-water Cold Seeps, Sedimentary Environments and Ecosystems of the Black and Tyrrhenian Seas and the Gulf of Cadiz (15 th training-through-research cruise, June–August 2005). 2007	E only
73	Implementation Plan for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (NEAMTWS), 2007–2011. 2007 (<i>electronic only</i>)	E only
74	Bruun Memorial Lectures, 2005: The Ecology and Oceanography of Harmful Algal Blooms – Multidisciplinary approaches to research and management. 2007	E only
75	National Ocean Policy. The Basic Texts from: Australia, Brazil, Canada, China, Colombia, Japan, Norway, Portugal, Russian Federation, United States of America. (Also Law of Sea Dossier 1). 2008	E only
76	Deep-water Depositional Systems and Cold Seeps of the Western Mediterranean, Gulf of Cadiz and Norwegian Continental margins (16 th training-through-research cruise, May–July 2006). 2008	E only
77	Indian Ocean Tsunami Warning and Mitigation System (IOTWS) – 12 September 2007 Indian Ocean Tsunami Event. Post-Event Assessment of IOTWS Performance. 2008	E only
78	Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (CARIBE EWS) – Implementation Plan 2013–2017 (Version 2.0). 2013	E only
79	Filling Gaps in Large Marine Ecosystem Nitrogen Loadings Forecast for 64 LMEs – GEF/LME global project Promoting Ecosystem-based Approaches to Fisheries Conservation and Large Marine Ecosystems. 2008	E only
80	Models of the World's Large Marine Ecosystems. GEF/LME Global Project Promoting Ecosystem-based Approaches to Fisheries Conservation and Large Marine Ecosystems. 2008	E only
81	Indian Ocean Tsunami Warning and Mitigation System (IOTWS) – Implementation Plan for Regional Tsunami Watch Providers (RTWP). 2008	E only
82	Exercise Pacific Wave 08 – A Pacific-wide Tsunami Warning and Communication Exercise, 28–30 October 2008. 2008	E only
83.	<i>Cancelled</i>	
84.	Global Open Oceans and Deep Seabed (GOODS) Bio-geographic Classification. 2009	E only
85.	Tsunami Glossary	E, F, S
86	Pacific Tsunami Warning System (PTWS) Implementation Plan	<i>Electronic publication</i>

(continued)

87.	Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS) – Second Edition. 2011	E only
88.	Exercise Indian Ocean Wave 2009 (IOWave09) – An Indian Ocean-wide Tsunami Warning and Communication Exercise – 14 October 2009. 2009	E only
89.	Ship-based Repeat Hydrography: A Strategy for a Sustained Global Programme. 2009	E only
90.	12 January 2010 Haiti Earthquake and Tsunami Event Post-Event Assessment of CARIBE EWS Performance. 2010	E only
91.	Compendium of Definitions and Terminology on Hazards, Disasters, Vulnerability and Risks in a coastal context	<i>Under preparation</i>
92.	27 February 2010 Chile Earthquake and Tsunami Event – Post-Event Assessment of PTWS Performance (Pacific Tsunami Warning System). 2010	E only
93.	Exercise CARIBE WAVE 11 / LANTEX 11—A Caribbean Tsunami Warning Exercise, 23 March 2011	
	Vol. 1 Participant Handbook / Exercice CARIBE WAVE 11 —Exercice d’alerte au tsunami dans les Caraïbes, 23 mars 2011. Manuel du participant / Ejercicio Caribe Wave 11. Un ejercicio de alerta de tsunami en el Caribe, 23 de marzo de 2011. Manual del participante. 2010	E/F/S
	Vol. 2 Report. 2011	E only
	Vol. 3 Supplement: Media Reports. 2011	E/F/S
94.	Cold seeps, coral mounds and deep-water depositional systems of the Alboran Sea, Gulf of Cadiz and Norwegian continental margin (17th training-through-research cruise, June–July 2008)	E only
95.	International Post-Tsunami Survey for the 25 October 2010 Mentawai, Indonesia Tsunami	E only
96.	Pacific Tsunami Warning System (PTWS) 11 March 2011 Off Pacific coast of Tohoku, Japan, Earthquake and Tsunami Event. Post-Event Assessment of PTWS Performance	E only
97.	Exercise PACIFIC WAVE 11: A Pacific-wide Tsunami Warning and Communication Exercise, 9–10 November 2011	
	Vol. 1 Exercise Manual. 2011	E only
	Vol. 2 Report. 2013	E only
98.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and connected seas. First Enlarged Communication Test Exercise (ECTE1). Exercise Manual and Evaluation Report. 2011	E only
99.	Exercise INDIAN OCEAN WAVE 2011 – An Indian Ocean-wide Tsunami Warning and Communication Exercise, 12 October 2011	E only
	Vol. 1 Exercise Manual. 2011	
	Supplement: Bulletins from the Regional Tsunami Service Providers	
	Vol. 2 Exercise Report. 2013	
100.	Global Sea Level Observing System (GLOSS) Implementation Plan – 2012. 2012	E only
101.	Exercise Caribe Wave/Lantex 13. A Caribbean Tsunami Warning Exercise, 20 March 2013.	E only
	Volume 1: Participant Handbook. 2012	
	Volume 2: Final Report	
102.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas — Second Enlarged Communication Test Exercise (CTE2), 22 May 2012.	E only
	Vol. 1 Exercise Manual. 2012	
	Vol. 2 Evaluation Report. 2014	
103.	Exercise NEAMWAVE 12. A Tsunami Warning and Communication Exercise for the North-eastern Atlantic, the Mediterranean, and Connected Seas Region, 27–28 November 2012.	E only
	Vol. 1: Exercise Manual. 2012	
	Vol. 2: Evaluation Report. 2013	
104.	Seísmo y tsunami del 27 de agosto de 2012 en la costa del Pacífico frente a El Salvador, y seísmo del 5 de septiembre de 2012 en la costa del Pacífico frente a Costa Rica. Evaluación subsiguiente sobre el funcionamiento del Sistema de Alerta contra los Tsunamis y Atenuación de sus Efectos en el Pacífico. 2012	Español solamente (resumen en inglés y francés)

105.	Users Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System, August 2014. Revised Edition. 2014	E, S
106.	Exercise Pacific Wave 13. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1–14 May 2013. Vol. 1 Exercise Manual. 2013 Vol. 2 Summary Report. 2013	E only
107.	Tsunami Public Awareness and Educations Strategy for the Caribbean and Adjacent Regions. 2013	E only
108.	Pacific Tsunami Warning and Mitigation System (PTWS) Medium-Term Strategy, 2014–2021. 2013	E only
109.	Exercise Caribe Wave/Lantex 14. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 26 March 2014. Vol. 1 Participant Handbook. 2014 Vol. 2 Evaluation Report. 2015 (English only)	E/S
110.	Directory of atmospheric, hydrographic and biological datasets for the Canary Current Large Marine Ecosystem, 3 rd edition: revised and expanded. 2017	E only
111.	Integrated Regional Assessments in support of ICZM in the Mediterranean and Black Sea Basins. 2014	E only
112.	11 April 2012 West of North Sumatra Earthquake and Tsunami Event - Post-event Assessment of IOTWS Performance	E only
113.	Exercise Indian Ocean Wave 2014: An Indian Ocean-wide Tsunami Warning and Communication Exercise. Vol.1 Manual Vol. 2 Exercise Report. 2015	E only
114.	Exercise NEAMWAVE 14. A Tsunami Warning and Communication Exercise for the North-Eastern Atlantic, the Mediterranean, and Connected Seas Region, 28–30 October 2014 Vol. 1 Manual Vol. 2 Evaluation Report – Supplement: Evaluation by Message Providers and Civil Protection Authorities	E only
115.	Oceanographic and Biological Features in the Canary Current Large Marine Ecosystem. 2015 (<i>revised in 2016</i>)	E only
116.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Third Enlarged Communication Test Exercise (CTE3), 1st October 2013. Vol. 1 Exercise Manual Vol. 2 Evaluation Report	E only
117.	Exercise Pacific Wave 15. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 2–6 February 2015 Vol. 1: Exercise Manual; Vol. 2: Summary Report	E only
118.	Exercise Caribe Wave/Lantex 15. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 25 March 2015 (SW Caribbean Scenario) Vol. 1: Participant Handbook	E only
119.	Transboundary Waters Assessment Programme (TWAP) Assessment of Governance Arrangements for the Ocean Vol 1: Transboundary Large Marine Ecosystems; <u>Supplement</u> : Individual Governance Architecture Assessment for Fifty Transboundary Large Marine Ecosystems Vol 2: Areas Beyond National Jurisdiction	E only
120.	Transboundary Waters Assessment Programme (TWAP) – Status and Trends in Primary Productivity and Chlorophyll from 1996 to 2014 in Large Marine Ecosystems and the Western Pacific Warm Pool, Based on Data from Satellite Ocean Colour Sensors. 2017	E only
121.	Exercise Indian Ocean Wave 14, an Indian Ocean wide Tsunami Warning and Communications Exercise, 9–10 September 2014	<i>In preparation</i>
122.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Sixth Communication Test Exercise (CTE6), 29 July 2015. Vol. 1: Exercise Manual Vol. 2: Evaluation Report	E only
123	Preparing for the next tsunami in the North-Eastern Atlantic, the Mediterranean	(see

(continued)

	and Connected Seas – Ten years of the Tsunami Warning System (NEAMTWS). 2017 — <i>Cancelled</i>	IOC/INF-1340)
124	Indicadores Marino Costeros del Pacífico Sudeste / Coastal and Marine Indicators of the Southeast Pacific (SPINCAM)	E/S
125	Exercise CARIBE WAVE 2016: A Caribbean and Adjacent Regions Tsunami Warning Exercise, 17 March 2016 (Venezuela and Northern Hispaniola Scenarios) Volume 1: Participant Handbook Volume 2: Final Report	E only
126	Exercise Pacific Wave 16. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1-5 February 2016. Volume 1: Exercise Manual. Volume 2: Summary Report	E only
127	How to reduce coastal hazard risk in your community – A step by step approach	E only
128.	Exercise Indian Ocean Wave 2016: An Indian Ocean-wide Tsunami Warning and Communications Exercise, 7–8 September 2016 Vol 1: Participant Manual Vol. 2: Exercise Report	E only
129	What are Marine Ecological Time Series telling us about the Ocean – A status report	E only
130	Tsunami Watch Operations – Global Service Definition Document	E only
131	Exercise Pacific Wave 2017. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 15-17 February 2017. Volume 1: Exercise Manual Volume 2: Exercise Report	E only
132.	2nd March 2016 Southwest of Sumatra Earthquake and Tsunami Event Post-Event Assessment of the Performance of the Indian Ocean Tsunami Warning and Mitigation System; <u>Supplement</u> : Tsunami Service Provider Bulletins and Maps	E only
133.	Exercise CARIBE WAVE 17. A Caribbean and Adjacent Regions Tsunami Warning Exercise, 21 March 2017 (Costa Rica, Cuba and Northeastern Antilles Scenarios). Volume 1: Participant Handbook Volume 2: Final Report	E only
134.	Tsunami Exercise NEAMWave17 – A Tsunami Warning and Communication Exercise for the North-eastern Atlantic, the Mediterranean, and Connected Seas Region, 31 October – 3 November 2017 Volume 1: Exercise Instructions. 2017 Volume 2: Evaluation Report. 2018 Supplement: Evaluation by Message Providers and Civil Protection Authorities	E only
135.	User's Guide for the Pacific Tsunami Warning Center Enhanced Products for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (CARIBE-EWS), October 2017	E only
136.	Exercise CARIBE WAVE 18. Tsunami Warning Exercise, 15 March 2018 (Barbados, Colombia and Puerto Rico Scenarios). Volume 1: Participant Handbook. 2017 Volume 2: Final Report	E only
137.	The Ocean is losing its breath: declining oxygen in the world's ocean and coastal waters	(under preparation)
138.	Exercise Indian Ocean Wave 2018: An Indian Ocean-wide Tsunami Warning and Communication Exercise, 4–5 September 2018 Volume 1: Exercise Manual & Supplements Volume 2: Exercise Report. 2019	E only
139.	Exercise Pacific Wave 2018. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, September to November 2018. Volume 1: Exercise Manual. Volume 2: Summary Report	E only
140	Analysis of transboundary Water Ecosystems and Green and Blue Infrastructures: Intercontinental Biosphere Reserve of the Mediterranean: Andalusia (Spain) – Morocco	E F S
141	Exercise Caribe Wave 2019. A Caribbean and Adjacent Region Tsunami	E only

Warning Exercise, 14 March 2019. Volume 1: Participant handbook.
Volume 2: Summary Report

142	Users' Guide for the Northwest Pacific Tsunami Advisory Center (NWPTAC) – Enhanced Products for the Pacific Tsunami Warning System. 2019	E only
143	Capacity Assessment of Tsunami Preparedness in the Indian Ocean, Status Report, 2018 + Supplement: National Reports	E only
144	Indian Ocean Tsunami Warning and Mitigation System (IOTWMS): Medium Term Strategy, 2019–2024	E only
145	IOTWMS Users Guide for National Tsunami Warning Centres	(under preparation)
146	Definition of Services provided by the Tsunami Service Providers of the IOTWMS	E only
147	<i>The Global Ocean Observing System 2030 Strategy</i> (IOC Brochure 2019-5)	(See GOOS Report 239)
148	Ejercicio TSUNAMI-CA 19. Un simulacro de tsunami para Centroamérica, 19 de agosto de 2019. Volumen 1, Manual para participantes.	S only
149	User's Guide for the South China Sea Tsunami Advisory Center (SCSTAC) products for the South China Sea Tsunami Warning and Mitigation System	E only
150	Limitations and Challenges of Early Warning Systems: A Case Study from the 28 September 2018 Palu-Donggala Tsunami	E, Bahasa
151	Exercise CARIBE WAVE 20. Tsunami Warning Exercise, 19 March 2020 (Jamaica and Portugal). Volume 1: Participant Handbook Volume 2: Summary Report	E only
152	Technical Report on the status of coastal vulnerability in central African countries (ICAM Dossier N° 9)	E, F
153	Exercise Indian Ocean Wave 2020: An Indian Ocean-wide Tsunami Warning and Communication Exercise, 6–20 October 2020. Volume 1: Exercise Manual Supplement 1: TSP Bulletins for Scenario 1 South of Java Supplement 2: TSP Bulletins for Scenario 2 Andaman Islands Supplement 3: TSP Bulletins for Scenario 3 Off Coast of Pakistan Volume 2: Exercise Report	E only

(continued)