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EXERCISE CARIBE WAVE 22

A Caribbean and Adjacent Regions Tsunami Warning Exercise

10 March 2022

(Western Muertos Trough and Northern Panama)

Volume 2 Summary Report

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NOTE: The United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Intergovernmental Oceanographic Commission (IOC) pattern the contents of this handbook after the CARIBE WAVE 2011, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020 and 2021 Exercises. Each of these exercises has a handbook and a report published in the IOC Technical Series. These CARIBE WAVE exercises followed the Pacific Wave exercises which commenced in 2008 with manual published by the Intergovernmental Oceanographic Commission (Exercise Pacific Wave 08: A Pacific-wide Tsunami Warning and Communication Exercise, 28–30 October 2008, IOC Technical Series, 82, Paris, UNESCO 2008). The UNESCO How to Plan, Conduct and Evaluate Tsunami Wave Exercises, IOC Manuals and Guides, 58 rev., Paris, UNESCO 2013 (English and Spanish) is another important reference.

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Report prepared by: Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS)

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Summary

The CARIBE WAVE exercise is conducted within the framework of the UNESCO/IOC Intergovernmental Coordination Group for Tsunamis and other Coastal Hazards for the Caribbean and Adjacent Regions (CARIBE-EWS). The 2022 annual tsunami exercise took place on March 10 to test Tsunami Warning Systems and promote tsunami preparedness in the Caribbean and adjacent regions. The exercise was coordinated by the CARIBE WAVE task team, the NOAA International Tsunami Information Center Caribbean Office, and supported by the Caribbean Tsunami Information Center and Pacific Tsunami Warning Center. It was left up for Member States and Territories to choose between the Western Muertos Through and Northern Panama scenarios and to decide the level of participation and activity to be held in their country.

CARIBE WAVE exercises focus on communications and evaluating procedures and programmes within Member States and Territories. The Pacific Tsunami Warning Center (PTWC), the Regional Tsunami Service Provider, issued a “Dummy” message through the different warning systems at 1400 UTC to test communications with Tsunami Warning Focal Points (TWFP) and National Tsunami Warning Centers (NTWC). Different methods of communications were used to test and disseminate the message: The World Meteorological Organization (WMO), Advanced Weather Interactive Processing System (AWIPS), Aeronautical Information Replacement System (AIRS), NOAA Weather Wire, GEONETCast Americas, Fax, Email, and Social Media. According to feedback as well as social media and web posts, the dummy message was successfully received. The Central America Tsunami Advisory Center (CATAC) also disseminated simulated products for the Northern Panama scenario to its stakeholders.

When PTWC issued its simulated “end of threat” messages for the exercise, over 406,000 people from across the entire Caribbean basin had registered on the Tsunami Zone website (tsunamizone.org). The majority of the participants were from K-12 Schools. Local governments, universities and preparedness organizations also had a high level of participation. According to the 48 Member States and Territories feedback, 413,285 people were directly engaged in the exercise. Social media platforms, which has become the primary source for communicating tsunami awareness, reached over 402 K people worldwide during the exercise.

Sea level data availability is important to forecast and confirm a real tsunami event. If a tsunami had occurred during the day of the exercise, data of 34 of the 64 sea-level stations in the region would have been available for event analysis. Only two of the Deep Ocean Assessment and Reporting on Tsunamis (DARTs) were operational during the exercise. CARIBE WAVE has been improving and validating tsunami preparedness since 2011, which is why tsunami exercises are crucial to maintain readiness in case of a real tsunami event.

1. BACKGROUND

The UNESCO/IOC Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions at its Eighth session (ICG/CARIBE-EWS-VIII, Port of Spain, Trinidad and Tobago, 29 April–1 May 2013), decided to conduct exercises named CARIBE WAVE on an annual basis leaving each Member State to define its level of participation. At an 15th session (online, 27–29 April), the ICG/CARIBE-EWS recommended that Exercise CARIBE WAVE 22 take place on 10 March 2022, with two hypothetical tsunami scenarios. The first scenario simulates a tsunami generated by a magnitude 8.0 earthquake located on the Western Muertos Trough and the second scenario is generated by an 8.3 magnitude earthquake located along North Panama Deformed Belt (NPDB).

Historical tsunami records from sources such as the National Oceanic and Atmospheric Administration's (NOAA) Centers for Environmental Information (NCEI) show that from 1530 to 2020 tsunamis from earthquake, landslide, and volcanic sources have affected the region. According to NCEI, in the past 500 years, at least 83 tsunamis have been observed and approximately 4,500 people have lost their lives from tsunamis in the Caribbean and adjacent regions. Since the most recent devastating tsunami of 1946, 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 (von Hillebrandt-Andrade, 2013).

Recognizing the need for an early warning system, especially after the lessons learned from the 2004 Indian Ocean tsunami, the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS) was established in 2005 as a subsidiary body of the UNESCO/IOC with the purpose of providing assistance to all Member States of the region to establish their own early tsunami warning system. The main objective of the CARIBE-EWS is to identify and mitigate the hazards posed by local, regional and distant tsunamis. The ultimate goal is to create a fully integrated end-to-end warning system comprising four key components: monitoring and detection systems, hazard assessment, tsunami related services (dissemination), and community preparedness, readiness and resilience.

The CARIBE WAVE 22 exercise provided simulated threat tsunami messages from the PTWC triggered by two hypothetical earthquakes: (1) 8.0 Mw with an epicenter at 17.5ºN, 69.5ºW located at the Western Muertos Trough (Figure 1) and (2) 8.3 Mw with an epicenter at 9.3ºN, 80.3ºW located in Northern Panama (Figure 2).

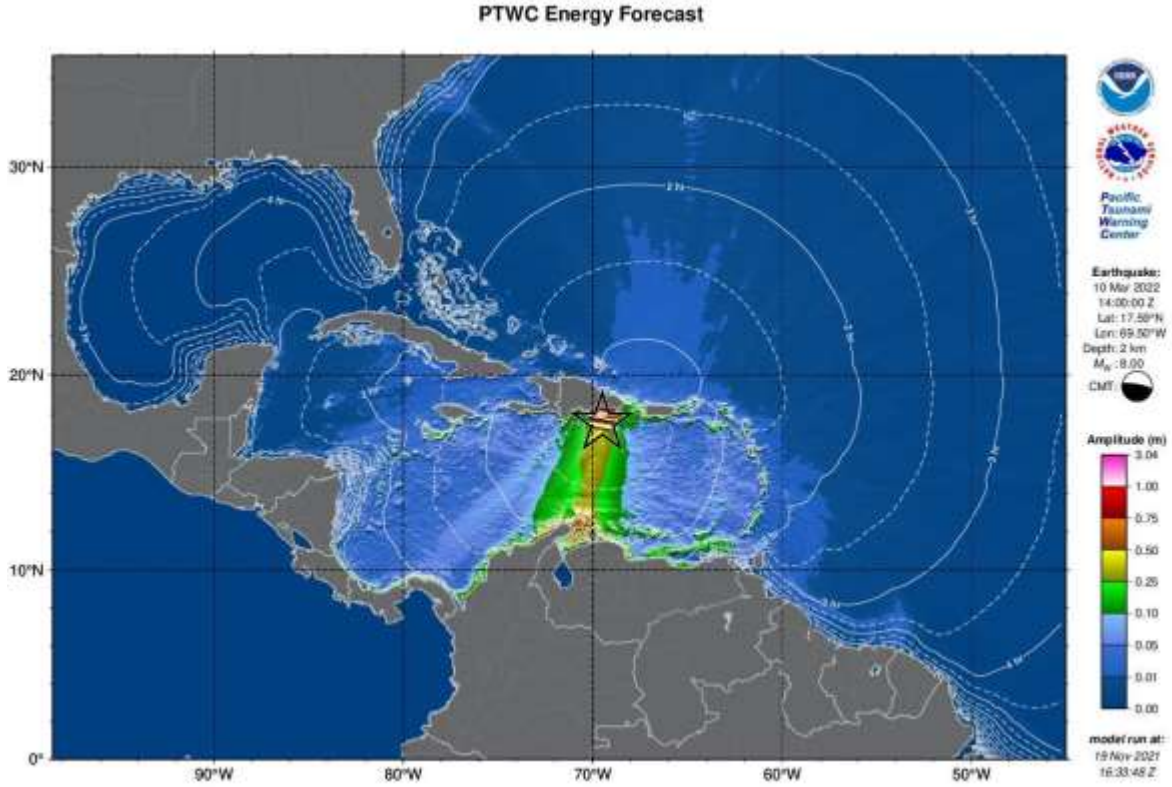

Figure 1. PTWC maximum deep-ocean amplitude map generated using RIFT for Western Muertos Trough scenario.

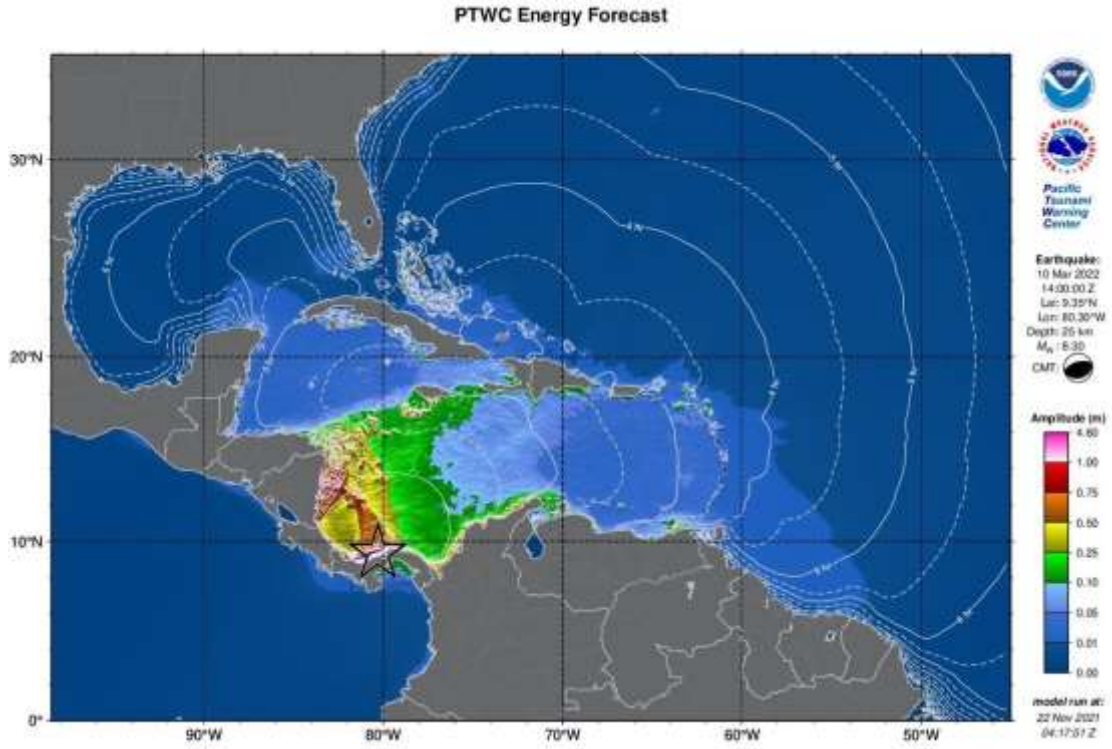

Figure 2**.** PTWC maximum deep-ocean amplitude map generated using RIFT for Northern Panama scenario.

2. EXERCISE CONCEPT

2.1 PURPOSE

The purpose of the exercise was to improve Tsunami Warning System effectiveness in the Caribbean and adjacent regions. The exercise provided an opportunity for emergency management organizations throughout the region 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 in case of an emergency. This is particularly true for the Caribbean and adjacent regions, where tsunamis are infrequent but can be of very high impact. Every emergency management organization (EMO) was encouraged to participate.

2.2 OBJECTIVES AND GOALS

Each organization developed its objectives for the exercise depending on its level of involvement in the scenario. There were two principal overarching objectives for the exercise.

1. Exercise and evaluate communications between Regional Tsunami Service Provider and Members States/Territories.

a. Validate the issuance of tsunami products from the PTWC.

b. Validate receipts of tsunami products by CARIBE-EWS Tsunami Warning Focal Points (TWFPs) and/or National Tsunami Warning Centers (NTWCs).

2. Evaluate the tsunami procedures and programmes within Members States/Territories.

a. Validate readiness to respond to a tsunami.

b. Validate the operational readiness of the TWFPs/NTWCs and/or the National Disaster Management Office (NDMO).

c. Improve operational readiness. Before the exercise, ensure appropriate tools and response plan(s) have been developed, including public education materials.

d. Validate that the dissemination of warnings and information/advice by TWFPs and NTWCs, to relevant in-country agencies and the public is accurate and timely.

e. Evaluate the status of the implementation of the pilot CARIBE-EWS Tsunami Ready recognition programme.

ICG/CARIBE-EWS has established metrics to evaluate the goals of the exercise (Table 1). 100% of Member States and Territories submitted the Post-Exercise Survey, with 88% being satisfied with the exercise.

Goals	2016 Results	2017 Results	2018 Results	2019 Results	2020 Results	2021 Metrics	2021 Results	2022 Metrics	2022 Results
TWFP receive the dummy message	84%	95%	100%	89%	97%	100%	97%	100%	91%
Participation of Member States of ICG/CARIBE-EWS with designated focal warning point	100%	100%	97%	100%	92%	100%	98%	100%	100%
Community involvement (including agencies beyond TWFP)	73%	82%	77%	66%	38%	95%	56%	95%	43%
Number of participants*	332,812	679,985	643,403	793,353	4,622	+10%	333,518	+10%	413,281
Countries who participate submit exercise questionnaire	100%	100%	91%	82%	92%	100%	95%	100%	100%
Members State and territories are satisfied with exercise				82%	76%	100%	96%	100%	88%

Table 1. Goals and Metrics. *As reported by Member States and Territories.

2.3 TYPE OF EXERCISES

The CARIBE WAVE 22 was planned for Caribbean countries to carry exercises at various scales of magnitudes and sophistication. It was up for Member States and territories to decide the type of exercise that would be carried out. The CARIBE WAVE Task Team recommended countries to plan and execute the exercise accordingly by taking into consideration the CARIBE-EWS COVID-19 guidelines. Communication tests were carried out to validate the issuance and receipt of the messages distributed by the Pacific Tsunami Warning Center (PTWC), the Regional Tsunami Service Provider, and evaluations of the tsunami procedures and programmes within Member States and Territories. The Central America Tsunami Advisory Center (CATAC) also distributed messages during the exercise. Several of the National and local Offices of Emergency Management (OEM) were able 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 Member States, the number of participants in the exercise was 413,281 people throughout the Caribbean and adjacent regions. The participants in the eleventh annual regional tsunami exercise hailed from forty-eight Member States and territories. It represented a participation rate of 100% of all the Member States of the UNESCO Intergovernmental Coordination Group for Tsunamis and other Coastal Hazards for the Caribbean and Adjacent Regions (CARIBE-EWS). This level of participation represents the high enthusiasm from the CARIBE-EWS Members States to participate despite the trying situation of the COVID-19 pandemic.

Exercises were conducted at various scales of magnitude and sophistication. Exercises simulated the development, training, testing, and evaluation of Disaster Plans and Standard Operating Procedures (SOPs). The reported exercises included a variety of activities including testing communication systems, performing tabletop exercises, conducting seminars and drills (Figure 3).

Additionally, the Task Team organized a post-exercise “hot wash” webinar to permit Member States and Territories to discuss and provide feedback on the exercise in an open forum.

Figure 3. Participation of the exercise, CARIBE WAVE 22: PTWC (a), and Mexico (b).

3. EXERCISE OUTLINE

3.1 GENERAL

The tsunami messages that were issued for this exercise by the PTWC were based on two hypothetical earthquakes (Figure 4) with the following hypocenter parameters:

Western Muertos Trough Earthquake Scenario:

Origin Time	14:00:00 UTC March 10, 2022
Latitude	17.58ºN
Longitude	69.50ºW
Magnitude	8.0 – M_w
Depth	2.5 km

Northern Panama Earthquake Scenario:

Origin Time	14:00:00 UTC March 10, 2022
Latitude	9.35ºN
Longitude	80.30ºW
Magnitude	8.3 – M_w
Depth	25 km

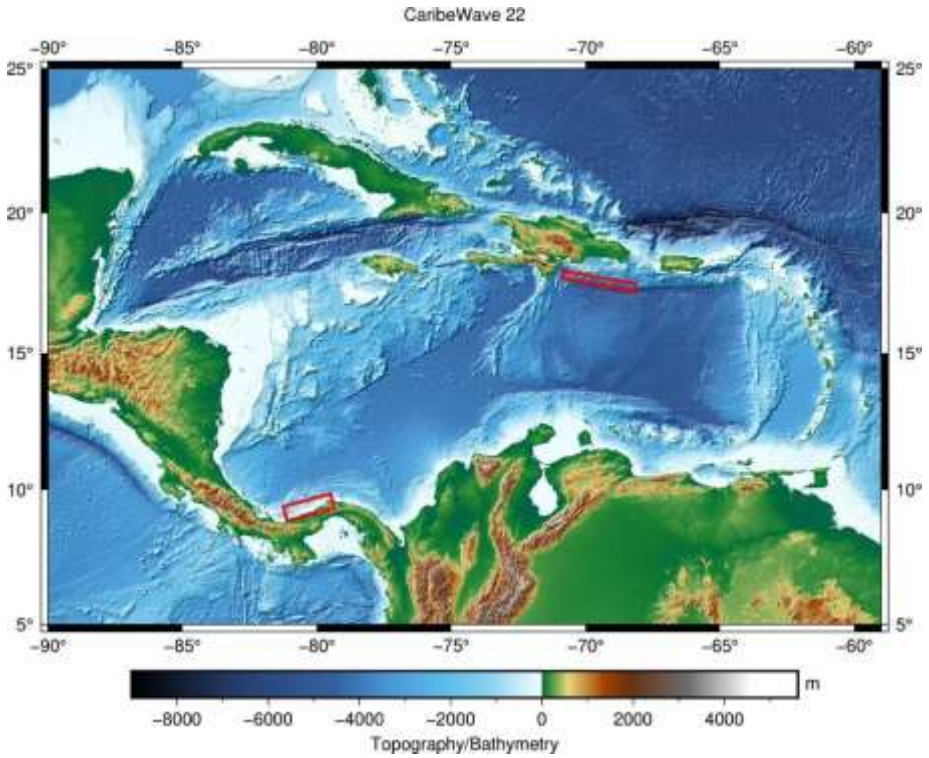

Figure 4. Map of the CARIBE WAVE 22 scenarios. Red boxes indicate the map view of the ruptured fault segments. This figure was generated using PyGMT (Uieda et al., 2021) and GEBCO 2021 background model (GEBCO, 2021).

Messages Issued by the PTWC

The PTWC issued (16) international simulated messages for CARIBE WAVE 22. The first tsunami threat message for the Western Muertos Trough and Northern Panama scenarios was based on the earthquake magnitude and location, and the tsunami travel times. While as of the third messages were based on simulated tsunami wave forecast, rather than seismic information. Tsunami threat forecast indicated the levels of threat that have been forecast and to which the countries or places they apply. The levels are tsunami heights of 0.3-1 meters, 1-3 meters, and greater than 3 meters above the normal tide levels are determined. The threats were updated usually within an hour.

Member States were required to select one scenario by February 25 for the 2022 exercise. Those who did not select a scenario, the organizers decided for which scenario the PTWC would send the products. All simulated products (text and graphical) were disseminated through email to the corresponding TWFPs and NTWCs and were made available in the Exercise Handbook. Any further dissemination was the responsibility of the corresponding national and local authorities.

The PTWC also issued live over all standard broadcast channels (WMO/AWIPS IDs WECA41 PHEB/TSUCAX) the initial dummy message to start the exercise at 1400 UTC on 10 March 2022.

Messages Issued by CATAC (Annex 2)

CATAC issued five (5) simulated messages in Spanish for CARIBE WAVE 22, with a similar format as the PTWC products. The first tsunami threat message was based on the earthquake magnitude and location. The third message included the simulated tsunami wave forecast and graphical products with predicted amplitudes at sea gauges and coastal zones. The messages were only disseminated for the Northern Panama scenario to Central American countries. All simulated products (text and graphical) were disseminated by email and telegram.

The initial dummy message was also issued through email to start the exercise at 1400 UTC on 10 March 2022. According to the Member States and Territories feedback, the message was

successfully received by five countries in Central America. The content of the Dummy message as well as the tsunami simulated messages is given in Annex I.

3.2 MASTER SCHEDULE (EXERCISE SCRIPT)

CARIBE-EWS Tsunami Service Provider (PTWC) issued the initial dummy message for the two scenarios on March 10, 2022 at 1400 UTC. This message was used to test communications with TWFPs and NTWCs, and to start the exercise. The transmission methods used to send the dummy message were GTS - WIS (WMO Information System), EMWIN, AISR, NWWS, GNC-A, Email, Fax, and AWIPS (Advanced Weather Interactive Processing System), using header IDs WECA41 PHEB/TSUCAX. All simulated products (text and graphical) were disseminated only thru email to TWFPs and NTWCs. Eight (8) threat messages were issued for the Western Muertos Trough scenario, and eight (8) for the Northern Panama scenario. The graphical enhanced products were included in the third threat message for both Western Muertos Trough and Northern Panama scenario. As in past years, the most common methods to receive the Dummy messages were Email and Fax. WMO Information System (GTS) was also a method where several countries received the message (Figure 5).

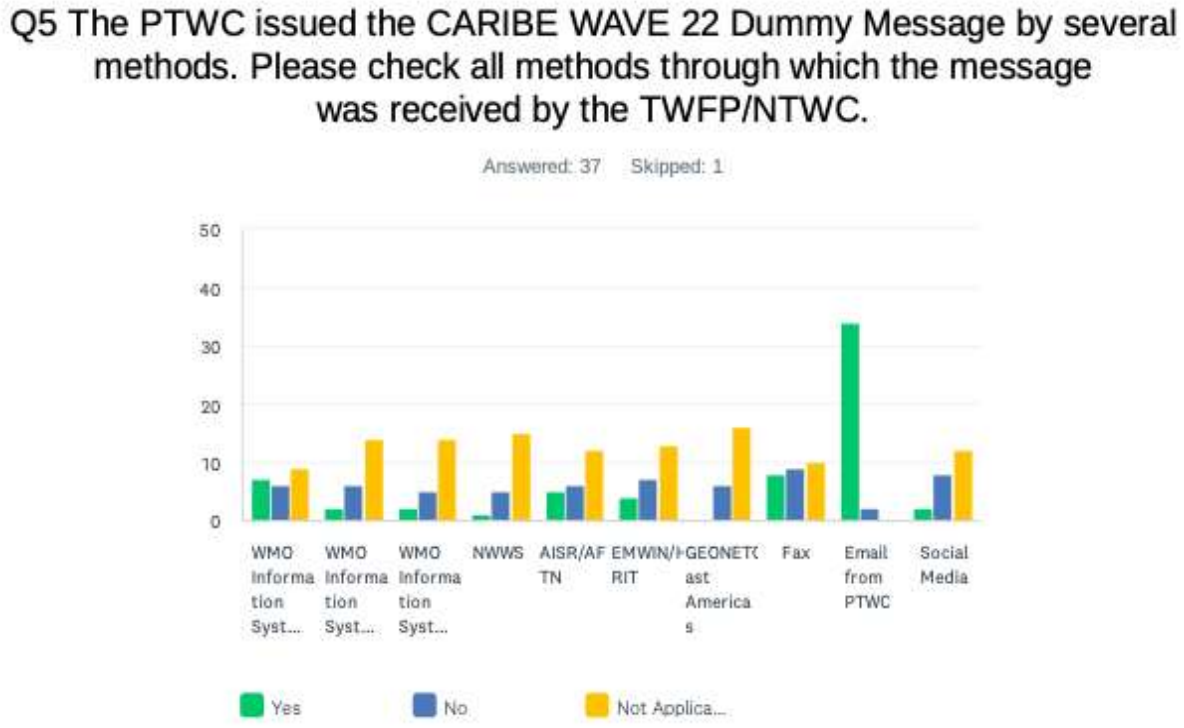

Figure 5. Methods that the CARIBE-EWS TWFPs/NTWCs used to receive the Dummy message by the PTWC.

3.3 ACTIONS IN THE CASE OF A REAL EVENT AND FALSE ALARMS

No significant real events and false alarms were reported by the Member States and Territories during the exercise. No actions were thus required.

3.4 REGISTRATION PROCEDURE

As for past exercises, the CARIBE-EWS teamed up with TsunamiZone.org for online registration (Figure 6). The link used for the registration was http://www.tsunamizone.org/register/. Under the “Register Here” Tab, participants were able to sign up and choose among the three major categories:

1. Myself and/or my family,
2. My school, district, college/university, or childcare center, and
3. My organization, department, or agency (including TNCs. TWFPs and NTWCs). EMOs were encouraged to promote this registration system.

Most people registered directly on the TsunamiZone.org which is an open registration system available during the whole year. As of 29 April 2022, 409,667 people had registered (Table 2). Nevertheless, according to Member States who answered the post-exercise survey the estimated number of people actually participating were approximately 413,285 (Table 3).

Figure 6. Registration by categories and Country for the CARIBE WAVE 22 Regional Tsunami Exercise.

Category	Number of Participants
Individuals/Families	1,424
Childcare and Pre-Schools	3,915
K-12 Schools and Districts	253,827
Colleges and Universities	32,581
Local Government	38,968
State Government	21,686
Federal/National Government[1*]	16,962
Businesses	1,780

[1*] This includes TWFPs and TNCs

Category	Number of Participants
Hotels and Other Lodgings	663
Healthcare	12,022
Senior Facilities/Communities	395
Disability/AFN Organizations	198
Non-Profit Organizations	2,856
Neighborhood Groups	1,065
Preparedness Organizations	18,008
Faith-based Organizations	210
Museums, Libraries, Parks, etc.	109
Volunteer/Service Clubs	45
Youth Organizations	225
Agriculture/Livestock	182
Volunteer Radio Groups	699
Science/Engineering Organizations	609
Media Organizations	37
Other	1,201
Total	**409,667**

Table 2. List of registrants and participants by Categories on TsunamiZone.org in the Caribbean (as of 04/29/2022)

Country	Participants according to Member States	Participants according to Tsunami Zone
Antigua and Barbuda	5,454	0
Aruba	11,960	11,960
Bahamas	1	3
Barbados	70	102
Belize	1	0
Brazil	10	9
Colombia	49	39
Costa Rica	45	62

Country		Participants according to Member States	Participants according to Tsunami Zone
Cuba		350	0
Curacao		50	3
Dominica		100	5
Dominican Republic		400	374
France (Martinique, Guadeloupe, Guyane, St. Barthelemy, St. Martin)		196,400	196,393
Grenada		2,000	6,464
Guatemala		50	0
Guyana		6	0
Haiti		958*	958
Honduras		1	0
Jamaica		253*	253
Mexico		6,000	357
Netherlands (Bonaire, Saba, Sint Eustatius)		26	37
Nicaragua		300	320
Panama		7	838
Saint Kitts and Nevis		5,000	5,000
Saint Lucia		884*	884
Sint Maarten		5	2
Saint Vincent and the Grenadines		45	101
Suriname		1	0
Trinidad and Tobago		50	265
United Kingdom	**Anguilla**	1,250*	1,250
	Bermuda	100	328
	British Virgin Islands	4,755	4,802
	Cayman Islands	1,000	3,250
	Montserrat	0*	0
	Turks and Caicos	200	27
United States	**Puerto Rico**	117,696	117,773
	US Virgin Island	12,351	12,351

Country	Participants according to Member States	Participants according to Tsunami Zone
Venezuela	45,457	45,457
TOTAL	**413,285**	**409,667**

Table 3. List of participants by Country/Territory (as of 04/29/2022)
*Number taken from TsunamiZone.org for cases where countries did not report number of participants in survey.

3.5 STATUS OF SEA LEVEL STATIONS DURING EXERCISE

An analysis of sea level stations status was carried out by the International Tsunami Information Center Caribbean Office (ITIC-CAR) as part of the CARIBE WAVE 22 Regional Tsunami Exercise. This allowed ITIC-CAR to analyze the availability of sea level data. The PTWC provided simulated forecasted maximum wave heights for 64 CARIBE-EWS stations in the simulated bulletins. Only about 53% of these sea level stations were online on the IOC Sea Level facility during the exercise period (Fig. 7 and 8). Similarly, the Tide Tool system used by many Tsunami Warning Centers had around 50% of stations operational, this is a slight increase over the 46% data availability in 2021 and much less than the 76% data availability in CARIBE WAVE 2020 (Figure 10 and 11). Only 2 of the 8 reported DART stations were streaming data in the Caribbean/Gulf and Atlantic thru the National Buoy Center during the day of the exercise (Figure 12).

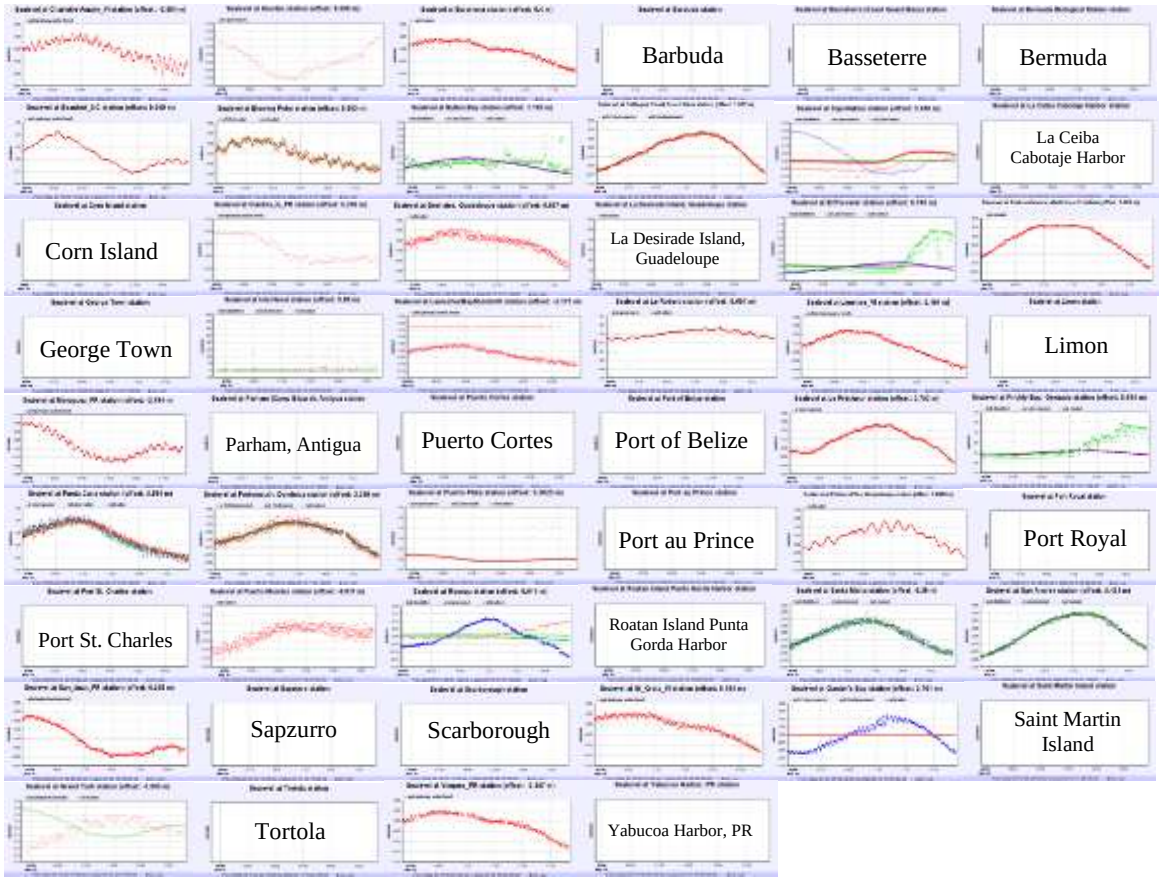

Figure 7. Forecast of maximum wave heights for the Western Muertos Trough scenario from 52 CARIBE-EWS coastal sea level stations during the CARIBE WAVE exercise. Stations for which the name of the station is provided, and not the wave form, are stations that had no data on the IOC Sea Level Monitoring Facility.

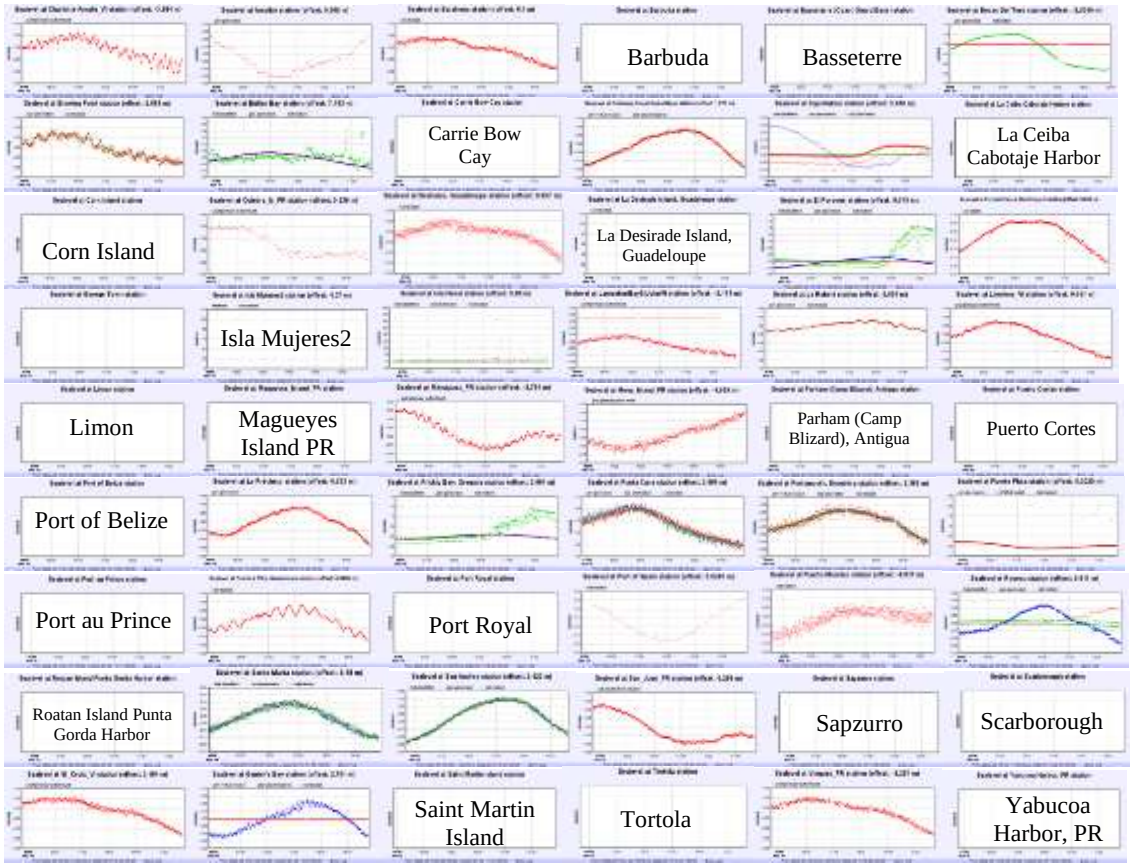

Figure 8. Forecast of maximum wave heights for the Northern Panama scenario from 54 CARIBE-EWS coastal sea level stations during the CARIBE WAVE exercise. Stations for which the name of the station is provided, and not the wave form, are stations that had no data on the IOC Sea Level Monitoring Facility.

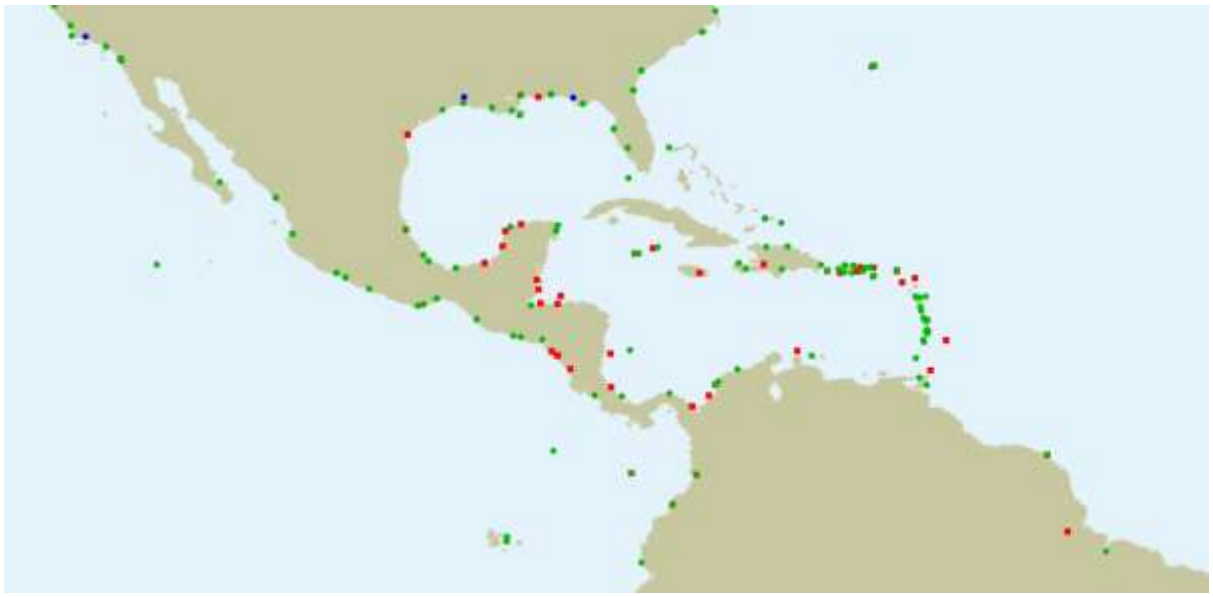

Figure 9. Screenshot showing IOC Sea Level facilities operating during the CARIBE WAVE 22 exercise. In green are stations for which data were available, red dots are for station for which there were no data.

3.6 RESOURCES

Although Emergency Management Organizations (EMOs) had advance notice of the exercise and some elected to set up a special dedicated shift to allow normal core business to continue uninterrupted, it was suggested that realistic resource levels be deployed in order to reflect some of the issues that are likely to be faced in a real event. Considering the pandemic, agencies were requested to adjust the exercise to their best convenience.

This year Elizabeth Vanacore was the Exercise Chair; while Alberto Lopez was the scientific experts that helped in the determination of the Western Muertos Trough scenario; Natalia Zamora was the scientific expert for the Northern Panama scenario which was based upon the outcome of a recent experts meeting in the region. ITIC-CAR coordinated the exercise for CARIBE-EWS.

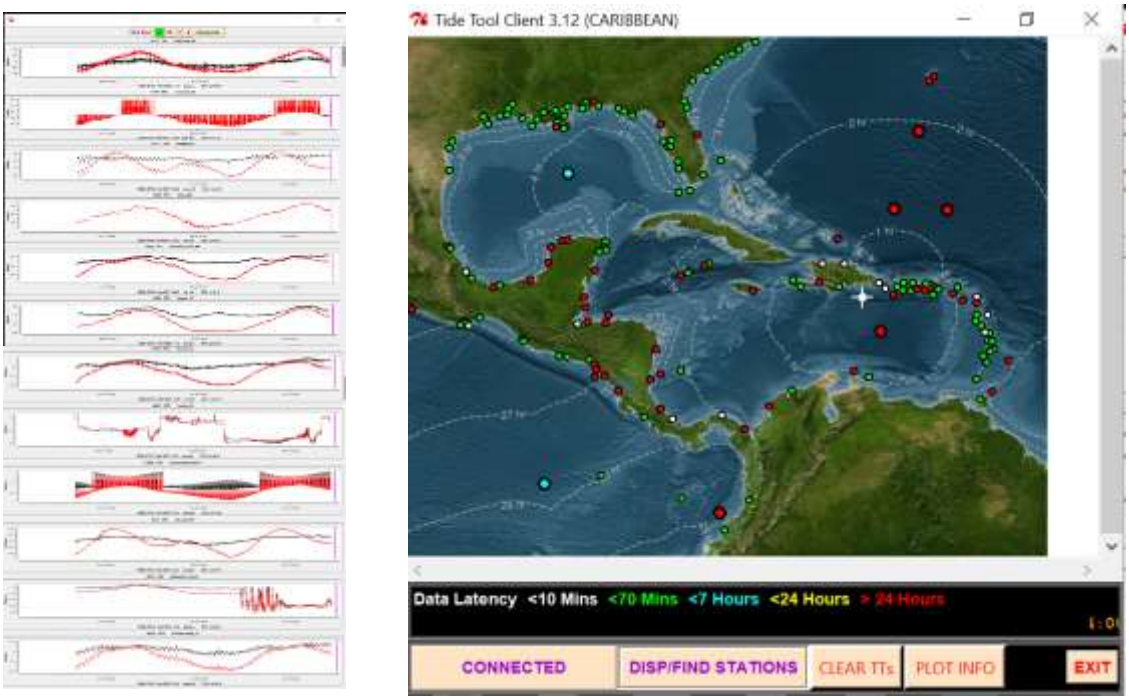

Figure 10. Screenshot from Tide Tool for the CARIBE WAVE 22 Western Muertos Trough scenarios. Tide Tool includes both coastal gauges and DARTs. In White and Green are operational stations, in red are stations with no data over the past 24 hours (non-operational). The Isochrons represent the travel time from the source of the simulated tsunami from. The Strip Chart to the left includes the marigrams from the closest 12 stations. The magenta stripe marks the estimated time of arrival.

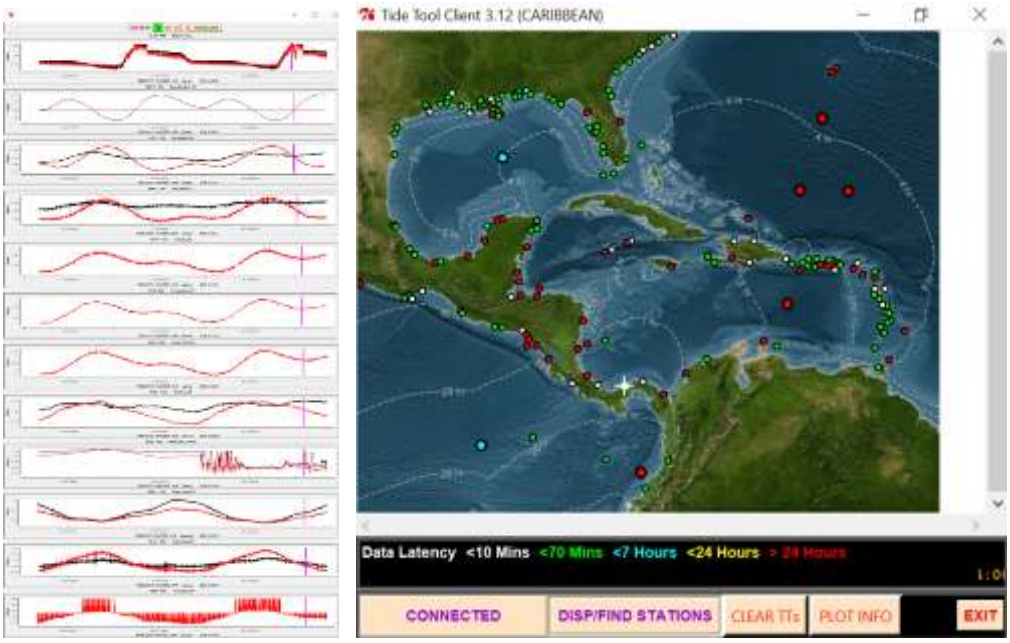

Figure 11. Screenshot from Tide Tool for the CARIBE WAVE 22 Northern Panama Scenario. Tide Tool includes both coastal gauges and DARTs. In White and Green are operational stations, in red are stations with no data over the past 24 hours (non-operational). The Isochrons represent the travel time from the source of the simulated tsunami from. The Strip Chart to the left includes the marigrams from the closest 12 stations. The magenta stripe marks the estimated time of arrival.

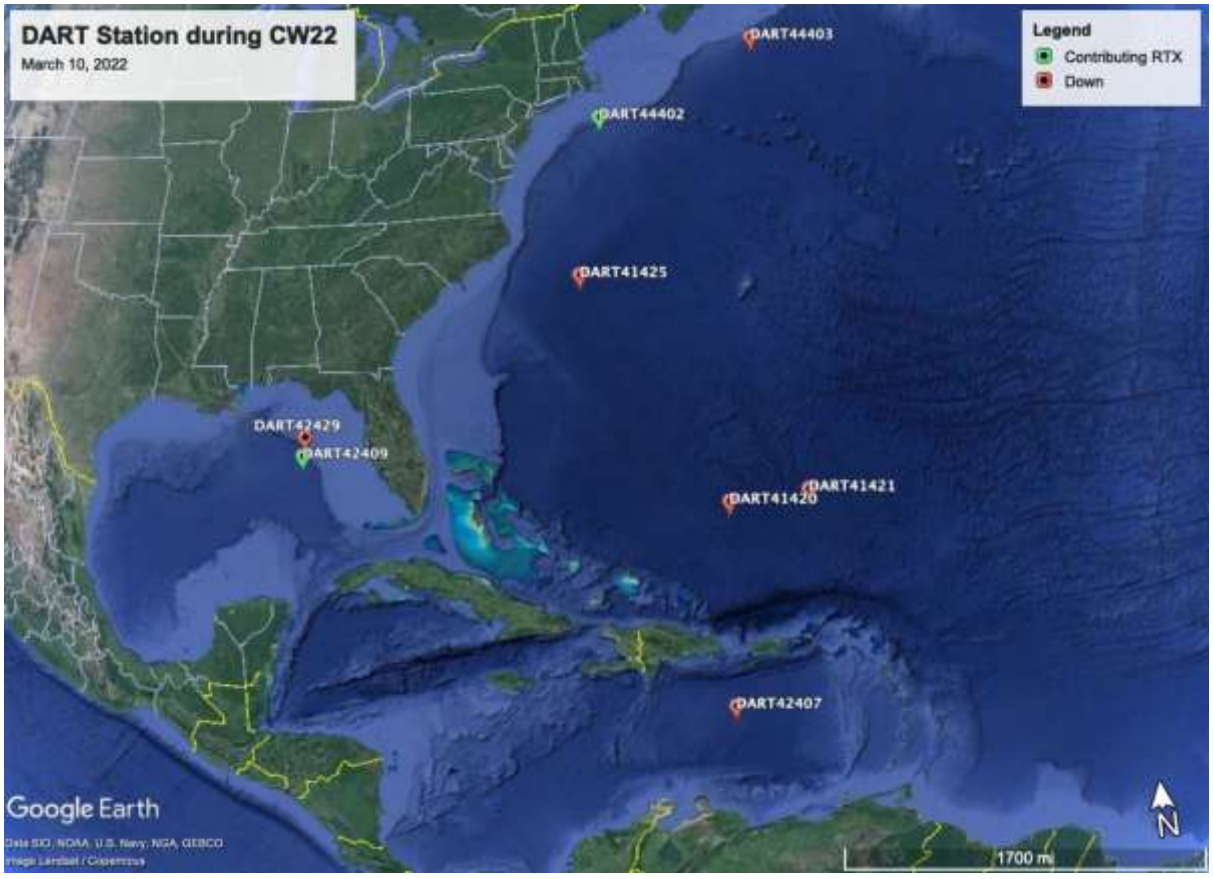

Figure 12. Map of operational and non-operational status of the DART's on March 10, 2022.

3.7 MEDIA ARRANGEMENTS

One advantage in conducting exercises is that it provides a venue to promote tsunami awareness. The exercise offers an opportunity to collaborate with the media and disseminate more broadly information on the warning system. The CARIBE-EWS Member States and Territories indicated that about 43% of the news media participated and covered the exercise. The hashtag tracker Brand24 was used to monitor #CaribeWave and #CaribeWave22 from February 14 to March 16. Its data resulted in over 300 mentions on social media outlets and posts reaching over 1.7 million people worldwide (Figure 13). Emergency management agencies from countries such as Antigua and Barbuda, Barbados, Grenada, St. Kitts and Nevis, and others informed citizens through online article publications and social media posts that their country would participate in the exercise on March 10. The International Tsunami Information Center Caribbean Office, as well as the Puerto Rico Seismic Network also published informative posts related to tsunami awareness in preparation for CARIBE WAVE.

During the exercise, text messages and tweets about the start of the exercise were displayed on the PTWC account (Figure 14).

Figure 13. Graphs showing the #CaribeWave and #CaribeWave22 trending between the 14th of February and 16th of March 2022.

Figure 14. Twitter post about the CARIBE WAVE 22 exercise from NWS PTWC's account.

Additionally, for CARIBE WAVE 22 a promotional video was produced in English, Spanish and French encouraging participants to act, prepare, and register for the exercise. The video was shared through social media and with the Member States and Territories through email.

EN - UNESCO/IOC Caribe Wave Exercise	https://vimeo.com/684809796
SP - Ejercicio Caribe Wave UNESCO/COI	https://vimeo.com/684839860
FR - UNESCO/COI Exercise Caribe Wave	https://vimeo.com/68484154

3.8 POST-EXERCISE EVALUATION

All participating countries were requested to provide feedback on the exercise through an online questionnaire. This feedback assists the ICG/CARIBE-EWS in the evaluation of CARIBE WAVE 22 and the development of subsequent exercises. It also helps response agencies document lessons learned and lead to improvements of the national systems. The survey contained 35 questions and was conducted by the IOC UNESCO using the Survey Monkey service. 38 surveys were completed representing the feedback from 100% of the Member States and Territories.[2*]

The survey was available from the start of the exercise on March 10 and extended through March 31. Overall, the results indicated that the Dummy (Start of Exercise) message was received by 34 Member States, representing 91% of the CARIBE-EWS Member States and Territories. There was a strong dependency on email for the reception of products from the PTWC. The message was received by most countries within the first 1-2 minutes, and few countries reported delays. Despite COVID-19, 59% of the Member States indicated that the TWFP/NTWC issued messages to relevant in country agencies. The exercise planning went well under extenuating circumstances, resulting in a 88% of satisfaction of Member States and territories, and a total participation of 413,285 people from the Caribbean. The questions as well as the answers and comments are contained in the Supplement.

This evaluation contains valuable information and gives to the ICG/CARIBE-EWS group insights to address the objectives of the exercise. The results for the status of the implementation of the pilot CARIBE-EWS Tsunami Ready recognition project indicated that 93% of the countries are interested in implementing the programme and 55% of these are already implementing it with 304 as total number of target communities to be recognized as Tsunami Ready (Table 4).

[2*] Countries answering the post-exercise survey: Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Brazil, Colombia, Costa Rica, Cuba, Curacao, Dominica, Dominican Republic, France (Martinique, Guadeloupe, Guyane, St. Barthelemy, St Martin), Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Netherlands (Bonaire, Saba and Saint Eustatius), Nicaragua, Panama, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Sint Maarten, Suriname, Trinidad and Tobago, United Kingdom (Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Montserrat, Turks and Caicos), United States (Puerto Rico and the US Virgin Islands) and Venezuela.

In addition, the survey provided the Member States an opportunity to provide additional feedback on the exercise (Table 5).

Country	Already Implementing	Interested in Implementing	TsunamiReady® or Tsunami Ready Communities (as reported by Member States)	TsunamiReady® or Tsunami Ready Communities (IOC Records For CARIBE EWS)	Target Number
Antigua and Barbuda	Yes	-	1	1	5
Aruba	No	Yes	0	0	8
Bahamas	Yes	-	2	0	22
Barbados	Yes	-	8	1	50
Belize	No	Yes	0	0	2
Brazil	No	Yes	-	0	-
Colombia	No	Yes	0	0	5
Costa Rica	Yes	-	5	0	4
Cuba	Yes	-	0	0	4
Curacao	No	Yes	-	0	5
Dominica	-	Yes	-	0	-
Dominican Republic	No	Yes	0	1	4
France	Yes	-	0	0	4
Grenada	Yes	-	2	2	7
Guatemala	No	Yes	0	0	2
Guyana	No	-	-	0	-
Haiti	Yes	-	1	1	20
Honduras	Yes	-	4	2	10
Jamaica	-	Yes	10	1	5
Mexico	Yes	-	0	0	21
NL- Bonaire, Saba, and Sint Eustatius	No	-	-	0	-

Country	Already Implementing	Interested in Implementing	TsunamiReady® or Tsunami Ready Communities (as reported by Member States)	TsunamiReady® or Tsunami Ready Communities (IOC Records For CARIBE EWS)	Target Number
Nicaragua	Yes	-	3	2	6
Panama	Yes	Yes	0	0	9
Saint Kitts and Nevis	Yes	-	-	1	-
Saint Lucia	No	Yes	-	0	-
Saint Vincent and the Grenadines	Yes	-	0	1	40
Sint Maarten	Yes	-	0	0	1
Suriname	No	Yes	0	0	2
Trinidad and Tobago	Yes	-	1	1	-
UK- Anguilla	Yes	-	-	1	-
UK- Bermuda	No	-	-	0	-
UK- British Virgin Islands	Yes	-	4	1	4
UK- Cayman Islands	No	Yes	0	0	-
UK- Montserrat	-	-	-	0	-
UK- Turks and Caicos	No	Yes	0	0	15
USA- Puerto Rico	Yes	-	46	46	46
USA- US Virgin Islands	Yes	-	-	3	3
Venezuela	No	Yes	0	0	0
TOTAL	20 YES	15 INTERESTED	87	65	304

Table 4. Status of Implementation of the Pilot CARIBE EWS Tsunami Ready Recognition Programme.

Country	Exercise Caribe Wave 22 General Statements
Aruba	Very useful and forms part of yearly full-scale programme.
Antigua and Barbuda	Over 5400 persons who took part in the exercise country-wide. • More than 35 primary and secondary schools participated • Of the disaggregated data collected from 50% of participating bodies representing some 45% of total participants showed a participation ratio of o Females 45% to Males 55% Generally it was noted that there was a good overall awareness of the activity by teachers and students alike, with a high level of interest and enthusiasm expressed by students and many volunteers. • It was noted that preschools did utilize ropes to guide small children and a significant number of schools that had to cross active streets used teachers and security personnel to help manage the traffic where students had to cross, Many Schools ranging from several dozen to several hundred students in St Johns area, St Peters and St Marys areas recorded times of 5 mins or less for evacuation. • There were persons from communities joining student as they moved towards evacuation areas when final counts were made in assembly areas. The National time spread from the time from the initial message was received at the NTWC to receipt of disseminated message (of Early Warning via the Common Alerting Protocol (CAP) app) by participants country wide was 11 minutes.
Barbados	There were three (3) separate and distinct aspects to the Caribe Wave 2022 Exercise: (1) The virtual Table-Top Exercise, which prompted participants to respond to the Tsunami threat to Barbados in accordance with the Exercise CARIBE WAVE 2022 Scenario. (2) A Communications Exercise executed by the Department of Emergency Management (DEM) and Barbados Citizen Band Radio Association (BCBRA) technical teams. The communications aspect of the exercise facilitated the response and transmission of messages in accordance with the parameters of the exercise and lent support to the third facet of the exercise. (3) Two (2) small, scaled evacuation exercises which targeted the tourism community and the disabled community in conjunction with their month of activities. From all accounts all three activities went well and there were no major disruptions besides the failure of the CAP system which prompted the use of primarily Astro and VHF radio. The disabled community was very appreciative with being involved in the exercise as it was the 1st time being involved in the physical aspect of the exercise. This promoted knowledge of the evacuation routes and the maintenance and development of family plans to promote self-evacuation of the disabled and their caretakers. With respect to the Island Inn Hotel evacuation exercise this was well received as even more hotel guests than anticipated participated in the exercise without incident. The tabletop exercise scenarios allowed for agencies to explore their actions when faced with peculiar but yet realistic circumstances and they were able to express their actions in conjunction with their Sops. In conclusion the exercise provided an experience on which to build on by enhancing the involvement of the disabled community in future physical exercises, development and hotel's EOPs and finetuning the communications of agencies of the National Emergency Management System.
Belize	Similar to the above, no action was taken but the exercise served to test the ability of the TWFP to receive the messages in a timely manner. There is the need for the use of another medium whether it be SMS or using a platform such as WhatsApp.
Brazil	The webinars are essential to get me involved and understand how the exercise works. For the first time it was possible to interact with the Brazilian Navy that

Country	Exercise Caribe Wave 22 General Statements
	also participated on the webinars. It was possible to verify that there was an error on the email server configuration and not all in the PTWC emailing list received the warnings. Also, the exercise is important as a mind change process, working on the "No Tsunami Risk" culture in Brazil.
Colombia	The Caribe Wave 22 exercise went well, the bulletins were received within the times established in the manual and the established script was complied with at the national level. The National Emergency Management Office (UNGRD) will ensure that future exercises include the participation of territorial entities.
Cuba	Use the Caribbean Wave exercise as an example for all the countries of the world since it allows strengthening the response capacity in the event of a sudden event like this. Also, to train all member states to protect the population and its economic assets.
Curacao	We have been participating for years in the Caribe Wave Exercise. At the beginning of this year, we were still in the middle of a pandemic, and this also had an impact on the number of people who could participate in the exercise this year. We hope that next year we can plan a bigger exercise regarding Caribe Wave 2023.
Dominica	The exercise was useful in promoting public awareness on Tsunami hazard and safety. The virtual presentation was well supported, and participants expressed their appreciation for the information provided. Participants also indicated interest in further engagement to increase awareness on tsunami safety as well as other hazards.
Dominican Republic	The Western Muertos represents a threat due to its proximity to the Dominican Republic. On this occasion, a simulation exercise was carried out between the National Seismology Center, the Emergency Operations Center and the National Meteorology Office, which is the Focal Point for tsunamis.
France	In addition to territorial fragmentation, one of the difficulties encountered in FWI is the high turnover of managers (e.g., DMO) in the public institutions. It is difficult to implement actions over time, including CW exercises. Individual who registered did not receive any message of the exercise.
Grenada	The annual exercise was an excellent opportunity for the country to test its Tsunami protocol. It also gave us an opportunity to measure the public's knowledge to adequately respond in times of need to the hazard. It has also given the Agency an opportunity to initiate the conversation of safety among the business community not just for Tsunami's but also hazards in general.
Guatemala	Although our country was not in the threat zone, we received all the PTWC messages. That is very useful to test our capabilities to respond in case of tsunami threat.
Haiti	That is a good exercise. It lets the focus group in Jeremie experiment the tsunami messages from Codomar that is the National Tsunami Warning Center (NTWC). It lets also the focus group in Jeremie to start an experience of tsunami Early Warning System with CARIBE WAVE 2022 and understand better the Standard Operating Procedures (SOPs).

Country	Exercise Caribe Wave 22 General Statements
Honduras	It is important to have greater preparation, more exercises; however, they must be procedures that are socialized with greater anticipation and with greater commitment on the part of the pauses in participation. For this, face-to-face workshops must be held to define participation strategies.
Mexico	In a general way, we can cite that both in the reception and distribution of the different messages there were no major problems. However, there are small communities where there is no telephone and/or internet coverage, in these cases the notices were given through megaphones and in person. The general comments of the participants are in the areas of training, which are already considered. The percentage of participation was satisfactory.
Nicaragua	It provides us with better knowledge of the different activities that we must develop with the community, preparation and training of community personnel. As NTFP and NTC it allows us to improve the exchange of knowledge with the different response institutions and as CATAC it strengthens us to improve our Standard Operational Plans.
NL-Bonaire, Saba, and Sint Eustatius	Already discussed via email: - We find that the modeling for computing the Forecasted Wave Heights takes a long time. - We received the Graphical Forecast Products via email 10 minutes later than the 2nd warning message. - We are interested in accessing the products, including more data formats, via an API or something similar. Other remarks: - Some internal stakeholders found the dummy message confusing because it states that it is the only message that they will receive. We will consider not forwarding it to them in next exercises. - As in other years, we had problems with reaching some of the officials of the local government in a timely manner.
Panama	The exercises are very important to perform, to coordinate and compare actions in a real event and not to forget the procedures. The CARIBE WAVE 22 Tsunami Exercise always provide important procedures (in this case, communication procedures), which have to follow in case of a real scenario (local, regional and distant).
Saint Kitts and Nevis	CARIBE WAVE exercise has strengthened the relationship between the various emergency agencies within the Caribbean region and the partner agencies around the world. CARIBE WAVE 22 Tsunami Exercise has shown that many people hesitate to respond to exercises but will respond when immediate danger is present. The education process is very good and will continue to ensure that another evacuation exercise will receive excellent response from residents in the targeted areas.
Saint Vincent and the Grenadines	The exercise was extremely timely and useful. The following are some of the main takeaways from the exercise. 1. There is a need for some small-scale exercise to improve NEOC response and management (can be in the form of table-top exercises). 2. Refresher training exercise needed to prepare threats messages that will be disseminated to the public 3. Frequent simulations are necessary to increase familiarity with local and organizational SOPs.

Country	Exercise Caribe Wave 22 General Statements
Sint Maarten	Due to our current workload, we were not able to actively participate. We hope to join again in 2023.
Suriname	Due to an emergency situation in Suriname, we could not participate in the CARIBE WAVE 22 Tsunami Exercise.
Trinidad and Tobago	The exercise gave us the opportunity to test the SOPs outlined in Trinidad and Tobago Tsunami Warning Information Dissemination Protocol and Standard Operating Procedures (SOPs). In addition, it involved working through the process from receipt of the initial threat message to discontinuation. It has certainly provided the context for identifying the areas in our tsunami response that require development and/or strengthening.
UK- Bermuda	Bandwidth for this has been limited in Bermuda, but we're starting to see more interest tsunami preparedness (and in DRR in general). DRRM did a good job in coordinating agency attendance and asking some pointed questions that get people thinking about action plans. Still much work to do about tsunami awareness, but recent volcanic and seismic activity (Tonga, St. Vincent & the Grenadines, Canary Islands) have helped to focus attention on the risk.
UK- Cayman Islands	Can we have a meeting to discuss risk analysis? Thank you for all your hard work on the exercise and it is useful.
USA- Puerto Rico	During the CARIBE WAVE 2022 Exercise, the Puerto Rico Seismic Network (PRSN) tested multiple communication methods with emergency management agencies in our area of responsibility (Puerto Rico and Virgin Islands Region). The agencies within the (seismic) area of responsibility of the Puerto Rico Seismic Network are: Puerto Rico Emergency Management Bureau (PREMB, Puerto Rico), National Weather Service San Juan Forecast Office (NWS-SJ, Puerto Rico), Department of Disaster Management (DDM, British Virgin Islands), Virgin Islands Territorial Emergency Management Agency (VITEMA, US Virgin Islands), Oficina Nacional de Meteorología (ONAMET, Dominican Republic) y el Instituto Sismológico Universitario (ISU, Dominican Republic). Among the PRSN communication methods tested are the Broadcast System (System to Disseminate Information on Earthquakes and Tsunamis), dedicated telephones (ring downs and private telephone line), the PREMB radio frequency, RSS (PRSN), text message (Tsunami Warning Focal Points [TWFP] and some primary agencies), e-mail lists (emergency management list), automatic phone calls (TWFP), fax (TWFP), PRSN official web page and social media (Facebook and Twitter). Communication tests were conducted by ham radio with radio amateur volunteers between the PRSN (Mayagüez) and the rest of the region. PRSN updated the official web page for the CARIBE WAVE 2022 Communication Exercise (http://caribewave.uprm.edu/) for Puerto Rico and the Virgin Islands. This web page contains all the materials and guidelines developed by the PRSN for this year's exercise, the EAS activation announcement for Puerto Rico and the promotion to complete the Official Registry of the Exercise (at tsunamizone.org), a description of the Western Muertos Trough Scenario, information in How to participate, among other materials. Starting on February 10, 2022, pre-exercise communication tests were conducted to promote Caribe Wave Exercise in the Puerto Rico and Virgin Islands Region among emergency managers and the public. These tests were issued on February 10, February 28, March 3, and March 9, by all communication lines available in PRSN (dedicated telephones, emails, fax, text message, RSS, and social media). PRSN issued 14 messages during the exercise. The 46 TsunamiReady communities participate in a different level including communication test, sirens activation and full-scale evacuation exercise. For this exercise, (only for Puerto Rico) the EAS system was activated in coordination with the Puerto Rico Emergency Management

Country	Exercise Caribe Wave 22 General Statements
	Bureau, National Weather Service (San Juan), Puerto Rico Broadcast Association, and Puerto Rico EAS Committee, through the following communication means: radio, T.V., cable TV, and NOAA weather radio. The real alert code of tsunamis (TWS) was issued during the exercise at 10:07 AM on March 10, 2022, by the National Weather Service (San Juan Forecast Office) to announce the Tsunami Warning for Puerto Rico, according to the Western Muertos Trough Scenario choose for Puerto Rico and the Virgin Islands. At the PRSN we monitored the activation of EMWIN, the NOAA radios, as well as the Puerto Rico EAS and WEA (as scheduled for the exercise). At PRSN we received the PTWC Dummy Message at 10:00 AM (14:00 GMT) through the EMWIN System and email. Puerto Rico Broadcaster Association will prepare a final report about the activation of the EAS System for Puerto Rico. Puerto Rico Emergency Management Bureau emits the WEA for Puerto Rico at 10:07 AM (14:07 GMT) to announce the Tsunami Warning for Puerto Rico, according to the Western Muertos Trough Scenario choose for Puerto Rico. The PRSN conducted Amateur Radio communication exercise with local volunteers.
USA-US Virgin Islands	Exercise was great, we need to just engage more agencies to exercise their plans and understand the importance of participating, as well as placing more educational staple signage in the community so that it can be seen in highly populated areas.
Venezuela	The CARIBE WAVE exercises have shown us the capacity that regional and local communities and authorities have to manage the tsunami emergency, I have seen local reports that estimate material damage and the number of people affected, injured, deceased, etc., they have created good databases with the inventories of hospital facilities and equipment necessary for handling the emergency, coordination has improved notably, despite the uncertainty when there is a change of authority, the response personnel continue to lead the exercise and with more and more enthusiasm and responsibility. All response personnel are observed assuming their role in accordance with the provisions of the laws, we hope to improve our economy to promote and evaluate the coastal areas that could be candidates for the Tsunami Ready programme. I congratulate the programmers of the Caribbean Wave and the supports of the COI/Caribbean.

Table 5. General statements on CARIBE WAVE 22 Tsunami Exercise experience from countries that participated.

4. REFERENCES

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ANNEX I. CATAC Dummy (Start of Exercise) Message

¡Este es sólo un mensaje de prueba enviado por CATAC en apoyyo al Ejercicio CaribeWave 22!
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Centro de Asesoramiento de Tsunami para América Centra (CATAC)

XXXXXXX ESTE ES UN EJERCICIO XXXXXXXXXX ESTE ES UN EJERCICIO XXXXXXXXXX

Aviso: Este es un mensaje de inicio del ejercicio Caribe Wave 2022 para los países de América Central, como apoyo a la Comisión Oceanográfica Intergubernamental (COI), de la UNESCO y al ICG/CARIBE-EWS

Emisión: 2020-03-10 14:00 Hora (UTC)
2020-03-10 08:00 Hora de Centroamérica
2020-03-10 09:00 Hora de Panamá

Este mensaje se está utilizando para iniciar el ejercicio de tsunami Caribe Wave 2022, con origen en las costas del norte de Panamá.

El manual está disponible en el sitio web http://catac.ineter.gob.ni/
El propósito del ejercicio es proporcionar asesoría a la gestión de emergencias.
Es un escenario para poner a prueba los planes de respuesta ante tsunamis en los países de América Central

XXXXXXX ESTE ES UN EJERCICIO XXXXXXXXXX ESTE ES UN EJERCICIO XXXXXXXXXX

ANNEX II. CATAC Exercise Messages

The following messages created for the CARIBE WAVE 22 tsunami exercise were issued by the Central American Tsunami Advisory Center for a magnitude 8.3 earthquake and subsequent tsunami originating in Northern Panama. Only Central American countries and regions by agreement with the center received the messages.

CATAC Message #1

¡Este es sólo un mensaje de prueba enviado por CATAC en apoyyo al Ejercicio CaribeWave 22!
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Centro de Asesoramiento de Tsunami para América Central - CATAC

XXXXXXX ESTE ES SOLO UN EJERCICIO
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXX

AVISO : Este mensaje se publica únicamente a título informativo como apoyo a los países de América Central. Las autoridades nacionales son responsables de determinar el nivel de alerta y efectuar las medidas
adecuadas para su país.

Boletín sobre tsunami N° 01

Publicado: 2022-03-10 14:03 Hora UTC
2022-03-10 08:03 Hora de Centroamérica
2022-03-10 09:03 Hora de Panamá

Un terremoto ha ocurrido con los siguientes estos parámetros preliminares:

Magnitud : 7.5
Fecha : 10/03/2022
Hora : 08:00 Hora Centroamérica, 09:00 Hora Panamá, 14:00 Hora UTC
Latitud : 09.40 Norte
Longitud : 80.30 Oeste
Profundidad : 25 Km
Ubicación : Norte de Panamá

Evaluación:
Considerando magnitud, profundidad del hipocentro, y ubicación del terremoto existe posibilidad de un tsunami destructivo para las zonas cercanas al epicentro, es decir Norte de Panamá y Costa Rica.

Acciones recomendadas:
Se urge tomar acciones inmediatas para la protección de la población en las costas del Caribe de América Central
Se proveerá mayor información en los próximos minutos.
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XXXXXXX ESTE SOLO ES UN EJERCICIO
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CATAC Message #2

¡Este es sólo un mensaje de prueba enviado por CATAC en apoyyo al Ejercicio CaribeWave 22!
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Centro de Asesoramiento de Tsunami para América Central - CATAC

XXXXXXX ESTE ES SOLO UN EJERCICIO XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

AVISO : Este mensaje se publica únicamente a título informativo como apoyo a los países de América Central. Las autoridades nacionales son responsables de determinar el nivel de alerta y efectuar las medidas
adecuadas para su país.

Boletín sobre tsunami N° 02

Publicado: 2022-03-10 14:09 Hora UTC
2022-03-10 08:09 Hora de Centroamérica
2022-03-10 09:09 Hora de Panamá

Una advertencia de tsunami destructivo está en efecto para las zonas costeras del Mar Caribe de los países de América Central.

Un terremoto ha ocurrido con los siguientes estos parámetros:

Magnitud : 8.3
Fecha : 10/03/2022
Hora : 08:00 Hora Centroamérica, 09:00 Hora Panamá, 14:00 Hora UTC
Latitud : 09.40 Norte
Longitud : 80.30 Oeste
Profundidad : 25 Km
Ubicación : Norte de Panamá

Evaluación:

Por magnitud, profundidad y ubicación del terremoto existe la posibilidad de que se haya producido un tsunami destructivo
que afectaría con gran intensidad a las costas más cercanas, hasta unos cien kilómetros del epicentro del terremoto.
A mayores distancias también puede causar estragos en dependencia de las condiciones locales.
Las autoridades deben tomar acciones correspondientes a sus planes de respuestas.
Resultados de la simulación de tsunami:

Estimados de Tiempos de Arribo (ETA) en hora local y Altura Máxima (AM) de olas del tsunami, en diferentes puntos de pronóstico:

Sitio País ETA AM(m)

Colon Panamá 2022/03/10 09:00 8.84 Turtle Island Panamá 2022/03/10 09:00 2.17
Veraguas-Carbe Panamá 2022/03/10 09:07 7.71
San Blas Panamá 2022/03/10 09:14 2.27
Bocas del Toro Panamá 2022/03/10 09:26 4.10
Limón Costa Rica 2022/03/10 08:27 4.58
Corn Island Nicaragua 2022/03/10 08:59 2.68
San Juan de Nicaragua Nicaragua 2022/03/10 09:03 2.86
Little Corn Island Nicaragua 2022/03/10 09:10 2.51
Cayos Miskitos Nicaragua 2022/03/10 11:16 1.89
Cayos de Honduras Honduras 2022/03/10 12:08 1.60

Resultado gráfico:

Revise en el archivo adjunto a este mensaje, las zonas de pronóstico codificados con colores según el peligro,
para las zonas costeras del Mar Caribe de América Central y la propagación de energía.

Actualizaciones:

Se proveerá más información en los próximos minutos.

Los países podrán recibir adicionalmente, mensajes del Centro de Alerta de Tsunami para el Pacífico (PTWC). En caso de diferencias entre los resultados de CATAC y del PTWC, recomendamos preferir de manera conservativa,
las estimaciones que corresponden a un mayor peligro.

Información adicional:

Información detallada del sismo y tsunami se encuentra en el sitio
web http://catac.ineter.gob.ni/

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XXXXXXX ESTE ES SOLO UN EJERCICIO XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

CATAC Message #3

¡Este es sólo un mensaje de prueba enviado por CATAC en apoyyo al Ejercicio CaribeWave 22!
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Centro de Asesoramiento de Tsunami para América Central - CATAC

XXXXXXX ESTE ES SOLO UN EJERCICIO
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

AVISO : Este mensaje se publica únicamente a título informativo como apoyo a los países de América Central. Las autoridades nacionales son responsables de determinar el nivel de alerta y efectuar las medidas
adecuadas para su país.

Boletín sobre tsunami N° 03

Publicado: 2022-03-10 14:30 Hora UTC
2022-03-10 08:30 Hora de Centroamérica
2022-03-10 09:30 Hora de Panamá

Una advertencia de tsunami está en efecto para las zonas costeras de los países de América Central

Un terremoto ha ocurrido con los siguientes estos parámetros:

Magnitud : 8.3
Fecha : 10/03/2022
Hora : 08:00 Hora Centroamérica, 09:00 Hora Panamá, 14:00 Hora UTC
Latitud : 09.40 Norte
Longitud : 80.30 Oeste
Profundidad : 25 Km
Ubicación : Norte de Panamá

Evaluación:

Se ha producido un tsunami que afecta con mayor intensidad a las costas más cercanas al epicentro.
Existe afectación severa para las zonas costeras de Panamá, Costa Rica, Nicaragua..

Las autoridades deben tomar acciones correspondientes a sus planes de respuestas.
Resultados de la simulación de tsunami:

Estimados de Tiempos de Arribo (ETA), en hora local y Altura Máxima (AM) de olas del tsunami, en diferentes puntos de pronóstico:

Hora Centroamérica
ZONAS PAÍS ETA AM(m)
Colon Panamá 2022/03/10 09:00 8.84
Turtle Island Panamá 2022/03/10 09:00 2.17

Veraguas-Carbe Panamá 2022/03/10 09:07 7.71
San Blas Panamá 2022/03/10 09:14 2.27
Bocas dek Toro Panamá 2022/03/10 09:26 4.10
Limón Costa Rica 2022/03/10 08:27 4.58
Corn Island Nicaragua 2022/03/10 08:59 2.68
San Juan de Nicaragua Nicaragua 2022/03/10 09:03 2.86
Little Corn Island Nicaragua 2022/03/10 09:10 2.51
Cayos Miskitos Nicaragua 2022/03/10 11:16 1.89
Cayos de Honduras Honduras 2022/03/10 12:08 1.60

Resultado gráfico:

Revise en el archivo adjunto a este mensaje, las zonas de pronóstico codificados con colores según el peligro,
ara las zonas costeras del Océano Pacífico de América Central.

Mediciones en estaciones del nivel del mar:

Código Coordenadas País Hora Amax
VZ.LIMON 9.98N 83.02O Costa Rica 10/3/2022 08:14:10 3.96
VZ.BDTO 9.35N 82.25O Panamá 10/3/2022 09:00:00 2.34
VZ.COIS 12.32N 83.06O Nicaragua 10/3/2022 08:17:55 1.94
VZ.ELPO 9.55N 78.94O Panamá 10/3/2022 09:00:00 1.86
VZ.TELA 15.78N 87.45O Honduras 10/3/2022 11:31:43 0.37
VZ.CEIB 15.79N 86.76O Honduras 10/3/2022 11:13:40 0.33
VZ.RTAS 16.34N 86.54O Honduras 10/3/2022 10:33:40 0.21

Actualizaciones:

Se proveerá más información en los próximos minutos.

Mensajes del PTWC:
Los países podrán recibir adicionalmente, mensajes del Centro de Alerta de Tsunami para el Pacífico (PTWC). En caso de diferencias entre los resultados de CATAC y del PTWC, recomendamos preferir de manera conservativa,
las estimaciones que corresponden a un mayor peligro.

Información adicional:

Información detallada del sismo y tsunami se encuentra en el sitio
web http://catac.ineter.gob.ni/

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CATAC Message #4

¡Este es sólo un mensaje de prueba enviado por CATAC en apoyyo al Ejercicio CaribeWave 22!
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Centro de Asesoramiento de Tsunami para América Central - CATAC

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AVISO : Este mensaje se publica únicamente a título informativo como apoyo a los países de América Central. Las autoridades nacionales son responsables de determinar el nivel de alerta y efectuar las medidas
adecuadas para su país.

Boletín sobre tsunami N° 04

Publicado: 2022-03-10 15:00 Hora UTC
2022-03-10 09:00 Hora de Centroamérica
2022-03-10 10:00 Hora de Panamá

Se ha detectado un tsunami que está afectando a las zonas costeras de los países de América Central

Magnitud : 8.3
Fecha : 10/03/2022
Hora : 08:00 Hora Centroamérica, 09:00 Hora Panamá, 14:00 Hora UTC
Latitud : 09.40 Norte
Longitud : 80.30 Oeste
Profundidad : 25 Km
Ubicación : Norte de Panamá

Evaluación:

De acuerdo a informaciones recibidas y datos obtenidos, se confirma la generación de olas de tsunami,
que están afectando las zonas costeras del Mar Caribe de América Central.

Se hace hincapié a alturas de olas con amplitudes significativas que pueden ocurrir horas después del terremoto, inclusive en Guatemala.

Resultados de la simulación de tsunami:

Mediciones en estaciones del nivel del mar:

Código Coordenadas País Hora Amax
VZ.LIMON 9.98N 83.02O Costa Rica 10/3/2022 08:14:10 3.96
VZ.BDTO 9.35N 82.25O Panamá 10/3/2022 09:00:00 2.34
VZ.COIS 12.32N 83.06O Nicaragua 10/3/2022 08:17:55 1.94

VZ.ELPO 9 .55N 78.94O Panamá 10/3/2022 09:00:00 1.86
VZ.TELA 15.78N 87.45O Honduras 10/3/2022 11:31:43 0.37
VZ.CEIB 15.79N 86.76O Honduras 10/3/2022 11:13:40 0.33
VZ.RTAS 16.34N 86.54O Honduras 10/3/2022 10:33:40 0.21

Actualizaciones:
Se proveerá más información en los próximos minutos

Mensajes del PTWC:

Los países podrán recibir adicionalmente, mensajes del Centro de Alerta de Tsunami para el Pacífico (PTWC). En caso de diferencias entre los resultados de CATAC y del PTWC, recomendamos preferir de manera conservativa,
las estimaciones que corresponden a un mayor peligro.

Información adicional:

Información detallada del sismo y tsunami se encuentra en el sitio
web http://catac.ineter.gob.ni/

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CATAC Message #5

¡Este es sólo un mensaje de prueba enviado por CATAC en apoyyo al Ejercicio CaribeWave 22!
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Centro de Asesoramiento de Tsunami para América Central - CATAC

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AVISO : Este mensaje se publica únicamente a título informativo como apoyo a los países de América Central. Las autoridades nacionales son responsables de determinar el nivel de alerta y efectuar las medidas
adecuadas para su país.

Boletín sobre tsunami N° 05

Publicado: 2022-03-10 16:00 Hora UTC
2022-03-10 10:00 Hora de Centroamérica
2022-03-10 11:00 Hora de Panamá

Un potente tsunami está afectando las costas del Pacifico de todos los países de América Central.

Se hace hincapié a alturas de olas con amplitudes significativas que pueden ocurrir horas después del terremoto, inclusive en Panamá. Se sugiere a las autoridades tomar las medidas pertinentes tomando en cuenta la magnitud del evento,
por lo que se pordrían generar olas con amplitudes signifiativas en el trancurso de las próximas horas.

Resultados de la simulación de tsunami:

Mediciones en estaciones del nivel del mar, en hora local y altura máxima en metros:

Código Coordenadas País Hora Amax
VZ.LIMON 9.98N 83.02O Costa Rica 10/3/2022 08:14:10 3.96
VZ.BDTO 9.35N 82.25O Panamá 10/3/2022 09:00:00 2.34
VZ.COIS 12.32N 83.06O Nicaragua 10/3/2022 08:17:55 1.94
VZ.ELPO 9.55N 78.94O Panamá 10/3/2022 09:00:00 1.86
VZ.TELA 15.78N 87.45O Honduras 10/3/2022 11:31:43 0.37
VZ.CEIB 15.79N 86.76O Honduras 10/3/2022 11:13:40 0.33
VZ.RTAS 16.34N 86.54O Honduras 10/3/2022 10:33:40 0.21

Evaluación:
Según nuestras simulaciones, amplitudes considerablemente mayores pueden ocurrir en las próximas horas.
las autoraidades nacionales de los diferentes países debern tomar las decisiones adecuadas, de acuerdo a sus planes de respuesta.

Mensajes del PTWC:

Los países podrán recibir adicionalmente, mensajes del Centro de Alerta de Tsunami para el Pacífico (PTWC). En caso de diferencias entre los resultados de CATAC y del PTWC, recomendamos preferir de manera conservativa,
las estimaciones que corresponden a un mayor peligro.

Información detallada del sismo y tsunami se encuentra en el sitio
web www.catac.ineter.gob.ni

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XXXXXXX Este el el último mensaje, en el marco del ejercicio CaribeWave 22, enitido por CATAC XXXXXXXXX

ANNEX III. List of Acronyms

AWIPS	Advanced Weather Interactive Processing System
CATAC	Central American Tsunami Advisory Centre
EAS	Emergency Alert System
EMO	Emergency Management Organization
EMWIN	Emergency Management Weather Information Network
GTS	Global Telecommunication System
ICG/CARIBE-EWS	IOC Intergovernmental Coordination Group for the Tsunamis and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions
INETER	Instituto Nicaragüense de Estudios Territoriales
IOC	Intergovernmental Oceanographic Commission of UNESCO
ITIC-CAR	International Tsunami Information Center Caribbean Office
NCEI	National Centers for Environmental Information
NDMO	National Disaster Management Offices
NPDB	North Panama Deformed Belt
NOAA	US National Oceanic and Atmospheric Administration
NTWC	National Tsunami Warning Centre
NWS	National Weather Service
PRSN	Puerto Rico Seismic Network
PTWC	Pacific Tsunami Warning Center
RIFT	Rapid Inundation and Forecasting of Tsunamis
TWFP	Tsunami Warning Focal Points
UNESCO	United National Educational, Scientific, and Cultural Organization
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 Interealibration 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 Bathymerographs 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 *Pacem in Maribus* 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 1'exploitation des pêcheries maritimes au Cameroun et leur gestion intégrée dans la sous-région du Golfe de Guinée *(cancelled)*	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 (8th 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 (9th 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 (10th 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 (11th 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 (12th training-through-research cruise, June-August 2002). 2003	E only
68	Interdisciplinary Studies of North Atlantic and Labrador Sea Margin Architecture and Sedimentary Processes (13th 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 (14th 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 (2nd Revision). 2009	E only
72	Deep-water Cold Seeps, Sedimentary Environments and Ecosystems of the Black and Tyrrhenian Seas and the Gulf of Cadiz (15th 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 *(electronic only)*	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 (16th 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.	*Cancelled*	
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	*Electronic publication*

(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	*Under preparation*
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 / Exercise 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. Volume 1: Participant Handbook. 2012 Volume 2: Final Report	E only
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. Vol. 1: Exercise Manual. 2012 Vol. 2: Evaluation Report. 2013	E only
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, 3rd 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 *(revised in 2016)*	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 Vol. 2: Summary Report	E only
119.	Transboundary Waters Assessment Programme (TWAP) Assessment of Governance Arrangements for the Ocean Vol 1: Transboundary Large Marine Ecosystems; Supplement: 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	*In preparation*
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

(continued)

123	Preparing for the next tsunami in the North-Eastern Atlantic, the Mediterranean and Connected Seas – Ten years of the Tsunami Warning System (NEAMTWS). 2017 —*Cancelled*	*(see 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	Experiencias locales de manejo costero integrado: casos piloto SPINCAM en el Pacífico Sudeste. (ICAM Dossier nº9)	S 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; Supplement: 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 Warning Exercise, 14 March 2019. Volume 1: Participant handbook. Volume 2: Summary Report	E only
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	*The Global Ocean Observing System 2030 Strategy* (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 no 10)	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
154	La contribución de las actividades marítimas a la economía de los países del Pacífico Sur	S only
155	Exercise Pacific Wave 2020: A Pacific-wide Tsunami Service Provider Communications Exercise,5 November 2020 Volume 1: Exercise Manual	E only
156	Ejercicio Tsunami-CA 20 – Ejercicio de respuesta en caso de tsunami para América Central: un terremoto lento y tsunami frente al golfo de Fonseca, 11 de noviembre de 2020. Vol.1: Manual para participantes	S only
157	Exercise Caribe Wave 21. Tsunami Warning Exercise, 11 March 2021 (Jamaica and Northern Lesser Antilles). Volume 1: Participant Handbook. Volume 2: Summary Report	E only
160	Current conditions and compatibility of maritime uses in the Western Mediterranean: technical report	E, F
161	Current conditions and compatibility of maritime uses in the Gulf of Guayaquil: technical report	E, S
162	Future conditions and scenarios for marine spatial planning and sustainable blue economy opportunities in the Western Mediterranean: technical report	E, F
163	Future conditions and scenarios for marine spatial planning and sustainable blue economy opportunities in the Gulf of Guayaquil: technical report	E, S
164	NEAMWave 21 Tsunami Exercise. A Tsunami Warning and Communication Exercise for the North-eastern Atlantic, the Mediterranean, and Connected Seas Region. Exercise Manual (Vol.1): Exercise Instructions (Part 1) and Exercise Supplements (Part 2).	E only

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165	A Sustainable Blue Economy for Cabo Verde/Uma Economia Azul Sustentável para Cabo Verde (2021)	E/P(bilingual)
166	A Sustainable Blue Economy for Trinidad and Tobago (2021)	E only
167	Recommendations to promote knowledge exchange and transfer on MSP (Marine Spatial Planning)	E only
168	*Pacific Islands Marine Bioinvasions Alert Network (PacMAN) Monitoring Plan*	In preparation
169	MSPglobal Initiative (Marine Spatial Planning): Lessons learned	E only
170	CARIBE WAVE 22, A Caribbean and Adjacent Regions Tsunami Warning Exercise, 10 March 2022 (Western Muertos Trough & Northern Panama Scenarios) Volume 1: Participant Handbook Volume 2: Summary Report	E only
171	*Strategy of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS) 2021–2030*	In preparation
172	*Strategy of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS) 2022–2030*	In preparation
173	IOC State of the Ocean Report – Pilot edition 2022	E only
174	*Best Practices in Biofouling Management*	*Pending*
175	Exercise Pacific Wave 2022. A Pacific-wide Tsunami Warning and Communications Exercise, 1 September – 30 November 2022. Volume 1: Exercise Manual	E only