



# **EXERCISE PACIFIC WAVE 2020**

## **A Pacific-wide Tsunami Service Provider Communications Exercise**

**5 November 2020**

**Volume 1**

**Exercise Manual**

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The exercise manual *Ejercicio Tsunami-CA 20. Ejercicio de alerta de tsunami para América Central: un terremoto lento y tsunami frente al golfo de Fonseca, 11 de noviembre de 2020 (Vol. 1)* (IOC Technical Series, 156) completes this publication.

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## TABLE OF CONTENTS

	page
<b>1. BACKGROUND.....</b>	<b>1</b>
<b>2. EXERCISE PURPOSE .....</b>	<b>2</b>
<b>3. EXERCISE OBJECTIVE.....</b>	<b>2</b>
<b>4. CENTRAL AMERICA TSUNAMI ADVISORY CENTRE (CATAC).....</b>	<b>3</b>
4.1 BACKGROUND .....	3
4.2 PRODUCTS.....	4
<b>5. TSUNAMI COASTAL ASSESSMENT TOOL (TsuCAT) .....</b>	<b>4</b>
<b>6. EXERCISE DATES.....</b>	<b>5</b>
6.1 PROVISIONAL TIMELINE AND MILESTONES.....	6
<b>7. TSUNAMI SERVICE PROVIDER COMMUNICATIONS TEST .....</b>	<b>6</b>
<b>8. CATAC REGIONAL EXERCISE.....</b>	<b>6</b>
<b>9. REGIONAL AND NATIONAL EXERCISES.....</b>	<b>7</b>
<b>10. TYPE OF EXERCISE.....</b>	<b>7</b>
<b>11. FURTHER GUIDANCE .....</b>	<b>8</b>
11.1 PLANS AND PROCEDURES FOR TSUNAMI WARNING AND EMERGENCY MANAGEMENT GUIDELINE .....	8
11.2 HOW TO PLAN, CONDUCT AND EVALUATE TSUNAMI EXERCISES GUIDELINE.....	8
11.3 PREPARING FOR COMMUNITY TSUNAMI EVACUATIONS: FROM INUNDATION TO EVACUATION MAPS, RESPONSE PLANS, AND EXERCISES .....	9
11.4 INTERNATIONAL DAY FOR DISASTER REDUCTION AND WORLD TSUNAMI AWARENESS DAY .....	9
<b>12. ASSUMPTIONS.....</b>	<b>9</b>
<b>13. EXERCISE PARTICIPATION .....</b>	<b>9</b>
<b>14. EXERCISE DOCUMENTATION .....</b>	<b>10</b>
<b>15. EXERCISE PRODUCTS .....</b>	<b>11</b>
<b>16. EXERCISE DELIVERY/FORMAT .....</b>	<b>11</b>
<b>17. POST-EXERCISE EVALUATION .....</b>	<b>11</b>
17.1 DEBRIEFING.....	12
17.2 EXERCISE VALIDATION.....	12

17.3	EVALUATION CRITERIA.....	12
17.4	EVALUATORS.....	13
17.5	EVALUATION TOOLS .....	13
17.6	EXERCISE PACIFIC WAVE 2020 SUMMARY REPORT .....	13
18.	<b>OBSERVERS .....</b>	<b>13</b>
19.	<b>REAL EVENTS DURING EXERCISE PLAY .....</b>	<b>14</b>
20.	<b>RESOURCING.....</b>	<b>14</b>
21.	<b>MEDIA ARRANGEMENTS .....</b>	<b>14</b>

## **ANNEXES**

- I.** TSUNAMI SERVICE PROVIDER COMMUNICATIONS TEST MESSAGES
- II.** POST-EXERCISE EVALUATION FORM
- III.** SAMPLE PRESS RELEASE
- IV.** LIST OF ACRONYMS

## 1. BACKGROUND

The Intergovernmental Oceanographic Commission (IOC) of UNESCO established the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) in 1965 in response to the 1960 earthquake off the coast of Chile, which generated a tsunami killing 2,000 people locally, and hundreds in the far field in Hawaii, Japan, and the Philippines. The main focus of the Group is to facilitate the issuance of timely international alerts, and advocate for comprehensive national programmes in hazard assessment, warning guidance, and preparedness (*ITSU Master Plan*, 2004 [IOC/INF-1124 Rev.]; *Medium-term Strategy: Pacific Tsunami Warning and Mitigation System* (PTWS MTS), 2014–2021 [IOC/2013/TS/108]; *PTWS Implementation Plan 2013*, (evolving document, version 4). In 2005, ITSU was re-established as the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS).

The US Pacific Tsunami Warning Center (PTWC), established in 1965 with the start of the Tsunami Warning System in the Pacific, serves as the lead Tsunami Service Provider (TSP) for the Pacific. Because of the Pacific's large size, several regional Tsunami Service Providers have been, or are being, established in order to improve the timeliness and threat assessment accuracy of especially regional events.

In response to Member State requests for additional regional information, Japan began operation of its Northwest Pacific Tsunami Advisory Center (NWPTAC) in March 2005, and from April 2006 – November 2019 provided services on an interim basis to the South China Sea. The NWPTAC, which serves as the TSP for the Northwest Pacific, provides timely alerts for earthquakes occurring in the Northwest Pacific extending North to South from Russia to the Solomon Islands, and West to East from Thailand to Micronesia. Between 2018 and 12 October 2020, the NWPTAC issued advisories for 38 events.

In 2013, Member States approved the proposal for the South China Sea Tsunami Warning and Mitigation System, and the establishment of the South China Sea Tsunami Advisory Center (SCSTAC) hosted by China. The SCSTAC services countries bordering the South China Sea, Sulu Sea, and Celebes Sea. The SCSTAC began issuing trial products in January 2019 and commenced full operation on 5 November 2019.

A Pacific-wide tsunami exercise is an effective tool for evaluating the readiness of PTWS countries and identifying changes that can improve its effectiveness. The international tsunami exercises were first conceived and conducted in 2006 by the ICG/PTWS under the leadership of the PTWS Exercises Task Team with strong contributions from the International Tsunami Information Center (ITIC), PTWC, and Japan Meteorological Agency (JMA). Altogether there have been eight IOC-coordinated international tsunami exercises: Exercise Pacific Wave in 2006 (IOC/INF-1244), 2008 (IOC/2008/TS/82), 2011, (IOC/2011/TS/97 Vol.1 and 2); 2013 (IOC/2013/TS/106 Vol.1 and 2), 2015 (IOC/2015/TS/117 Vol.1 and 2), 2016 (IOC/2015/TS/126 Vol.1 and 2), 2017 (IOC/2016/TS/131 Vol.1 and 2), and 2018 (IOC/2018/TS/139 Vol.1 Rev.2 and Vol. 2).

The exercises, using a multitude of Pacific scenarios and accompanied by tsunami message products from the Pacific Tsunami Warning Center, Japan Meteorological Agency's Northwest Pacific Tsunami Advisory Center, the US National Tsunami Warning Center (formerly West Coast and Alaska Tsunami Warning Center), and the South China Sea Tsunami Advisory Centre (SCSTAC), have been used to evaluate the effectiveness of the system and measure the readiness of countries to respond, as national tsunami warning centres (NTWCs) and emergency response agencies and the public, to distant and local tsunamis. Exercise Pacific Wave 2011, 2013, and 2015 were additionally used to introduce and obtain feedback, test, and validate the PTWC new enhanced forecast products, which became official on 1 October 2014 (CL-2535). Exercise Pacific Wave 2016 and 2017 were used to evaluate experimental

NWPTAC Enhanced Products and identify necessary modifications before the Enhanced Products are formally adopted. Exercise Pacific Wave 2017 was also used to support the development of the SCSTAC products. Exercise Pacific Wave 2018 was used to validate the NWPTAC enhanced products, which were officially adopted from 28 February 2019 (CL-2753) and test the new SCSTAC products, which were subsequently adopted from 5 November 2019 (CL-2777).

The ICG/PTWS, at its 28th session (Barcelo Montelimar, Nicaragua, 2019), approved the conduct of Exercise Pacific Wave 2020 (PacWave20) during the last quarter of 2020 to support International Disaster Risk Reduction Day (13 October) and World Tsunami Awareness Day (5 November).

The PTWS Steering Committee held an online meeting in June 2020. It noted and reiterated the difficulty of conducting Exercise Pacific Wave 2020 as was originally planned in 2019 given the COVID-19 global situation, and recommended that PacWave20 only test two of the four objectives, namely, communications from the PTWS Tsunami Service Providers to Tsunami Warning Focal Points (TWFP) and National Tsunami Warning Centres (NTWC), and development of tsunami procedures and products by the Central America Tsunami Advisory Centre (CATAC). Other activities are encouraged but would be at the discretion of each country.

## **2. EXERCISE PURPOSE**

Exercise Pacific Wave 2020 (PacWave20) intends to support the development of improved PTWS tsunami products and procedures, including the products of the Central America Tsunami Advisory Centre (CATAC) of the Instituto Nicaragüense de Estudios Territoriales (INETER).

Accordingly, the aim of PacWave20 is to test PTWS tsunami service provider arrangements, country preparedness arrangements and operational procedures to respond and recover from a destructive tsunami.

PacWave20 provides a valuable opportunity for Pacific countries to engage regionally in coordination and cooperation, test the new products (where relevant), review their tsunami response procedures, test internal and external communication systems, and engage with communities through public education activities. Regular exercises are important for maintaining staff readiness in case of a real event. This is especially true for tsunamis, which are infrequent, but when they occur, require a rapid response. Every Pacific country is encouraged to participate.

## **3. EXERCISE OBJECTIVE**

The original objectives for Exercise Pacific Wave 2020 were fourfold:

- (a) Test communications from the PTWS Tsunami Service Providers to Tsunami Warning Focal Points and National Tsunami Warning Centres of Member States.
- (b) Test national communication and cooperation, and readiness within the country.
- (c) Test regional communication and cooperation between Member States.
- (d) Support the development of tsunami procedures and products by the Central America Tsunami Advisory Center (CATAC) (Only applicable to relevant countries).

Each country may expand and/or customise its own objectives for the exercise.

As noted above, only objectives (a) and (d) are to be tested during PacWave20.

Each individual country may organize at its discretion additional PacWave20 activities in line with the four original objectives, and specifically to fulfill objectives (b) and (c). They could include:

- To conduct regional exercises organized and conducted through the relevant PTWS Regional Working Groups where applicable, with support from the PTWS Tsunami Service Providers (TSPs) and the International Tsunami Information Centre (ITIC), involving all PTWS countries.
- To include country exercises such as:
  - Conducting in real time during the daytime working hours with full staffing, or simulating minimal staff during night time or weekend hours.
  - Testing a country's capability to carry out their warning and response responsibilities for the situation where one or more PTWS TSPs is not able to provide guidance in a timely manner.
  - Conducting the exercise down to the community level, including where possible including an extensive public awareness campaign.
  - Conducting the exercise to reflect on the [Sendai Framework for Disaster Risk Reduction \(SFDRR\) 2015–2030](#) seven global targets and four priorities for action, World Tsunami Awareness Day and/or the UN Decade of Ocean Science for Sustainable Development.

#### **4. CENTRAL AMERICA TSUNAMI ADVISORY CENTRE (CATAC)**

##### **4.1 BACKGROUND**

In 2008, the Intergovernmental Oceanographic Commission (IOC) of UNESCO adopted Resolution EC-XLI.6, encouraging Member States around regional seas, as appropriate, to actively promote the development, establishment and sustained operation of National and Subregional Tsunami Warning and Mitigation Systems.

The Intergovernmental Coordination Group for the Pacific Tsunami Warning System at its 19th session (IOC/ITSU-XIX, Wellington, New Zealand, 29 September – 2 October 2003), established the Regional Working Group on the Central American Pacific Coast Tsunami Warning and Mitigation System (WG-CA).

At its 25th session ([ICG/PTWS-XXV](#), Vladivostok, Russian Federation, 9 – 11 September 2013), the ICG/PTWS noted that El Salvador or Nicaragua (or both cooperating countries) could establish an Interim Tsunami Warning Centre to disseminate warnings to all Central American countries and established a Technical Committee for the Development of a Regional Tsunami Warning and Mitigation System ([ICG/PTWS-XXV.1](#)).

At its 26th session ([ICG/PTWS-XXVI](#), Honolulu, USA, 22 – 24 April 2015), the ICG/PTWS accepted the offer of Nicaragua to host and develop CATAC under the guidance of the ICG/PTWS-WG-CA within the framework of the ICG/PTWS, ICG/CARIBE-EWS and TOWS-WG ([ICG/PTWS-XXVI.2](#)). The ICG/PTWS created the Central American Subregional Working Group Task Team on the Establishment of a Central American Tsunami Advisory Centre (TT-CATAC) for “Assisting the Central American Working Group in the establishment of CATAC until it has the capacity to provide operational services.”



In 2015, the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS) at its 10th session also accepted the offer of Nicaragua to host and develop CATAC as a Subregional Tsunami Service Provider (TSP) under the leadership of the PTWS Regional Working Group for Central America Pacific Coast and within the framework of ICG/PTWS, ICG/CARIBE-EWS and TOWS-WG ([Recommendation ICG/CARIBE-EWS-X.7](#))

Member States of the ICG/PTWS at its [28th session](#) (Barcelo Montelimar, Nicaragua 2–5 April 2019) decided to support the efforts and progress made by Nicaragua in the creation of the Central America Tsunami Advisory Centre (CATAC), as a tsunami service provider (TSP) within the framework of the ICG/PTWS. A *draft User's Guide for the Central American Tsunami Advisory Centre (CATAC)* was made available on 28 March 2019 in English and Spanish. To begin to develop the CATAC service, a regional tsunami exercise was organised on 19 August 2019 (Spanish, Ref. [IOC/2019/TS/148 Vol.1](#)).

Exercise Pacific Wave 2020 will be used to further develop the new CATAC products. This CATAC Regional Exercise will take place on 11 November 2020. The exercise manual, *Ejercicio Tsunami-CA 20. Ejercicio de alerta de tsunami para América Central: un terremoto lento y tsunami frente al golfo de Fonseca 11 de noviembre de 2020 (Vol.1)* (IOC Technical Series, 156) will be distributed to CATAC Member States by email and posted to the [PacWave20 website](#).

## 4.2 PRODUCTS

The provision of CATAC's tsunami advisory products is intended to enable target countries (Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama) to take appropriate action against local and regional threats, in collaboration with the service provided by PTWC for the entire Pacific.

The development of tsunami advisory products that take into account regional characteristics and the particular requirements of CATAC Member States is crucial for an effective regional tsunami warning and mitigation system.

The CATAC products will consist of text messages and additional graphic products with more information and levels of detail. These are to include maps showing deep ocean tsunami amplitude forecasts, tsunami travel time forecasts, and expected maximum wavelengths in coastal areas. CATAC's tsunami advisory products will incorporate the most advanced forecasting capabilities, such as a tsunami scenario database, as well as real-time numerical modelling based on a rapid Centroid Moment Tensor (CMT) solution for the earthquake.

A draft *Users' Guide for the Central American Tsunami Advisory Centre (CATAC)* is available at the PacWave20 website. PacWave20 will be used to support the development of the CATAC products. Future PacWave exercises will be used to validate the new CATAC products.

## 5. TSUNAMI COASTAL ASSESSMENT TOOL (TsuCAT)

To help countries with their national tsunami exercises, the International Tsunami Information Centre (ITIC) and the Pacific Marine Environmental Laboratory (PMEL) of the National Oceanic and Atmospheric Administration (NOAA) are making available [TsuCAT \(Tsunami Coastal Assessment Tool\)](#). TsuCAT enables countries to choose their own scenario and to generate the PTWC's enhanced text and graphical products that they can then use to conduct their exercises.

TsuCAT provides access to a Pacific, Caribbean, and Indian Ocean database of tsunami modelling results from NOAA's pre-computed catalog of sources, and for the Pacific and

Caribbean, the RIFT model, to assist a country in its tsunami hazard assessment, tsunami exercise and response planning, and warning decision-making. Simulations for historical tsunami sources from NOAA's National Centers for Environmental Information (NCEI) and the U.S. Geological Survey (USGS) earthquake archive, as well as IOC expert meeting worst-case regional seismic tsunami scenarios are included. TsuCAT is platform independent and 'stand-alone' in that it runs on the Windows, Apple, and Linux computing platforms, and does not require Internet connectivity. All libraries, databases, and documentation are installed in their entirety on the host machine. The only requirement is a Java v1.8 or higher free installation.

Additional information can be accessed from the PacWave20 web site ([www.pacwave.info](http://www.pacwave.info)) and the TsuCAT website ([http://itic.ioc-unesco.org/index.php?option=com\\_content&view=category&layout=blog&id=2239&Itemid=2763](http://itic.ioc-unesco.org/index.php?option=com_content&view=category&layout=blog&id=2239&Itemid=2763))

TsuCAT v1 was introduced at the 27th session of the ICG/PTWS (ICG/PTWS-XXVII, Tahiti, French Polynesia, 28–31 March 2017), and subsequent versions released at meetings and trainings to authoritative tsunami officials globally. Version 4.0 was distributed at the 28th session of the ICG/PTWS (ICG/PTWS-XXVIII, Barcelo Montelimar, Nicaragua 2–5 April 2019). Version 4.1 was distributed during ITIC Training Program classes in the Caribbean (Regional SOPs, Barbados, July 2019) and Pacific (Papua New Guinea, September 2019; Hawaii, September 2019; Tonga, October 2019; Colombia, November 2019; Indonesia, January 2020).

The current version 4.2 makes improvements in the displays and exercise messages. To request v4.2, please contact ITIC directly (ITIC Director, [laura.kong@noaa.gov](mailto:laura.kong@noaa.gov)).

## 6. EXERCISE DATES

To meet objective (a) of Exercise Pacific Wave 2020, one **Live Tsunami Service Provider Communications Test will take place at 0000 UTC on 5 November 2020**. Dummy Exercise messages ( [Annex I](#) ) will be issued by the PTWS Tsunami Service Providers (TSP) to Member State Tsunami Warning Focal Points (TWFPs) and National Tsunami Warning Centres (NTWCs).

The Tsunami Service Providers for the Pacific Tsunami Warning and Mitigation System are:

- Pacific Tsunami Warning Center (PTWC, since 1965) hosted by USA NOAA;
- Northwest Pacific Tsunami Advisory Center (NWPTAC, since 2006) hosted by the Japan Meteorological Agency (JMA);
- South China Sea Tsunami Advisory Center (SCSTAC, since 2019) hosted by China's State Oceanic Administration (SOA).

In addition to the three approved TSPs, the Central America Tsunami Advisory Centre (CATAC) hosted by Nicaragua's INETER is currently under development.

The PacWave20 CATAC Regional Exercise will take place on 11 November 2020. Exercise details can be found in the document Exercise manual for the *Ejercicio Tsunami-CA 20*.

Any additional country or regional exercises mentioned above in complement to PacWave20 should take place during the period 1 September to 30 November 2020 if they are to be reported upon in the Post-Exercise Evaluation Form that will need to be completed and returned by 21<sup>st</sup> December 2020.

All information can be found on the PacWave20 website (<http://www.pacwave.info>). Participating countries may choose to run their optional exercises at any time between 1 September and 30 November 2020, allowing flexibility to avoid conflict with other important national events.

To answer questions related to the conduct of PacWave20, **ITIC and IOC will host PacWave20 informational webinars on 28 October 2020 at 1900 UTC and 29 October 2020 at 0300 UTC**. Connection details will be sent to all PTWS TNCs and TWFPs via email.

## 6.1 PROVISIONAL TIMELINE AND MILESTONES

Timeline	Milestone
23 October 2020	Exercise manual, including the CATAC regional exercise. available on <a href="http://www.pacwave.info">www.pacwave.info</a>
28 October 2020, 1900 UTC 29 October 2020, 0300 UTC	PacWave20 Informational Webinars
1 September – 30 November 2020	PacWave20 related additional country/regional activities.
0000 UTC 5 November 2020	Live TSP Communications Test
11 November 2020	CATAC Regional Exercise (only applicable to relevant countries)
21 December 2020	Countries to complete and submit PacWave20 Post-Exercise Evaluation Form online
ICG/PTWS-XXIX, 2021	Draft PacWave20 Preliminary Report discussed at the ICG meeting
30 June 2021	Draft PacWave20 Preliminary Report available to Member States
31 August 2021	Final PacWave20 Summary Report uploaded to <a href="http://www.pacwave.info">www.pacwave.info</a>

Table 1. Provisional Timeline and milestones

## 7. TSUNAMI SERVICE PROVIDER COMMUNICATIONS TEST

To test communications from the Tsunami Service Providers to each Member State, a live message will be issued for PacWave20. The live test will occur at 0000 UTC on 5 November 2020. Member States should note when and how they receive the live communications test message and report back through the Post-Exercise Evaluation Form.

## 8. CATAC REGIONAL EXERCISE

To meet objective (d) of Exercise Pacific Wave 2020, a CATAC Regional Exercise will be conducted on 11 November 2020 to provide an opportunity to further develop the CATAC products. The exercise manual *Ejercicio Tsunami-CA 20. Ejercicio de alerta de tsunami para América Central: un terremoto lento y tsunami frente al golfo de Fonseca, 11 de noviembre de 2020 (Vol.1)* (IOC Technical Series, 156) provides information on the exercise.

## **9. REGIONAL AND NATIONAL EXERCISES**

Each region and/or country will be responsible for designing its own regional, national, provincial and/or local level exercise(s) in line with the international Exercise Pacific Wave exercise framework. The TsuCAT tool may be used to generate the PTWC text and enhanced products. Optionally, you may choose to exercise a previous PacWave scenario; TSP message products for these scenarios are available on the ITIC International Pacific Exercises pages. If your exercise will also use products from the NWPTAC and/or SCSTAC, please directly contact these centres to obtain their products.

Due to the COVID-19 pandemic, countries may choose not to conduct national or regional exercises.

## **10. TYPE OF EXERCISE**

For national exercises, it is recommended that, if possible, Exercise Pacific Wave 2020 be carried out as a functional exercise with community engagement, or at a minimum, be carried out in a Tabletop format (also referred to as a 'discussion exercise', or 'DISCEX').

Exercise Pacific Wave 2020 could be carried out in a drill format within communities or as a functional exercise. In a drill exercise, staff physically handle equipment or perform a specific procedure. The exercise usually has a time frame element and is used to test the procedures. An example of a drill exercise may involve activating an emergency operations centre or using alternative communications (such as radios).

A functional exercise may also be referred to as an 'operational' or a 'tactical' exercise. It takes place in an operational environment and requires participants to actually perform the functions of their roles. Participants interact within a simulated environment through an exercise control group who provide prewritten injects and respond to questions and tasks developing out of the exercise. Functional exercises normally involve multi-agency participation (real or simulated) and this type of exercise is used to practice multiple emergency functions, e.g. direction and control, resource management and communications. An example of a functional exercise is a multiple agency response to a tsunami threat, where evaluation of a coastal area is required. Messages and injects are provided by exercise control and are handled by participants in the way described in appropriate plans and procedures. Outcomes are generated that would be expected in a real situation.

Finally, functional exercises that include the practice evacuation of communities, or sectors of a community such as a school or other important facilities, are encouraged where possible. A school evacuation would test the procedures for receiving the warning and subsequent evacuation order, and the evacuation of school staff and school children to a designated tsunami safe area.

In a Tabletop exercise, participants are presented with a situation or problem that they are required to discuss and for which they have to formulate the appropriate response or solution. Normally, the exercise requires no simulation other than the scenario and/or prewritten exercise injects. An exercise controller or moderator introduces a simulated scenario to participants and, as the exercise advances (in time), exercise problems and activities (injects) are further introduced. This type of exercise is used to practice problem solving and coordination of services with or without time pressures. There is no deployment or actual use of equipment or resources.

An example of a Tabletop Exercise may involve the key stakeholders, such as the National Tsunami Warning Centre and the National Disaster Management Office (NDMO) in one country, and/or National Tsunami Warning Centres from neighbouring countries, discussing

their response to a tsunami threat in a particular area, where the only injects are the tsunami products from the relevant Tsunami Service Providers.

## **11. FURTHER GUIDANCE**

### **11.1 PLANS AND PROCEDURES FOR TSUNAMI WARNING AND EMERGENCY MANAGEMENT GUIDELINE**

The IOC Manual and Guides entitled *Plans and procedures for tsunami warning and emergency management* (IOC/2017/MG/76 Rev, available on PacWave20 website) has been developed to provide guidance for countries in strengthening tsunami warning and emergency response through the development of Plans and Standard Operating Procedures for their warning and emergency management authorities. National authorities should have aligned and robust tsunami warning and response plans and procedures to ensure timely, actionable warnings and effective response by coastal communities.

The guideline is a product of collaboration between the four Intergovernmental Coordination Groups (ICGs) through the Working Group on Tsunamis and Other Hazards related to Sea-Level Warning and Mitigation Systems (TOWS-WG), and is a reference point for global consistency with regard to planning for and responding to tsunamis.

The content is based largely on training materials developed by the ICG/PTWS, the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWMS) and their respective Tsunami Information Centres, in particular the UNESCO/IOC-NOAA International Tsunami Information Centre (ITIC), based in Hawaii, USA, and was developed through training workshops conducted in countries of the Indian Ocean, Southeast Asia and South China Sea region during 2008 to 2010, as part of the project entitled “*Strengthening Tsunami Warning and Emergency Responses: Training Workshops on the Development of Standard Operating Procedures for Indian Ocean and Southeast Asian Countries*”. It includes contributions from international experts in the fields of tsunami science, early warning and mitigation, disaster management and community awareness.

### **11.2 HOW TO PLAN, CONDUCT AND EVALUATE TSUNAMI EXERCISES GUIDELINE**

The IOC Manual and Guides *How to plan, conduct and evaluate UNESCO/IOC tsunami wave exercises* (IOC/2011/MG/58 Rev, English/Spanish, available on PacWave20 website) has been developed to aid countries in planning, conducting, and evaluating a tsunami exercise at a national and/or provincial level.

This guideline contains information on how to plan, conduct and evaluate tsunami wave exercises. It has been designed for use by IOC Member States who will participate in these exercises and has been divided into four easy stages to provide a range of practical advice and templates for in-country exercise developers to analyse the need for an exercise at the country, provincial or local level, design the exercise, conduct the exercise, and evaluate the exercise. A number of case studies have also been included to provide examples of various in-country tsunami exercises. The case study examples are not necessarily based on tsunami wave exercise scenarios, but they provide an insight into the planning and execution of national level tsunami exercises.

### 11.3 PREPARING FOR COMMUNITY TSUNAMI EVACUATIONS: FROM INUNDATION TO EVACUATION MAPS, RESPONSE PLANS, AND EXERCISES

The IOC Manual and Guides *Preparing for Community Tsunami Evacuations: from inundation to evacuation maps, response plans and exercises* (IOC/2020/MG/82, English/Spanish) has been developed to aid countries in preparing communities for the next tsunami. It consists of a guide presenting a high-level summary of each programme module and the rationale behind them, and two Supplements that contain additional detailed information, templates, reference to specialized documents, tutorials and best practice examples ([http://itic.ioc-unesco.org/index.php?option=com\\_content&view=category&layout=blog&id=2166&Itemid=2640](http://itic.ioc-unesco.org/index.php?option=com_content&view=category&layout=blog&id=2166&Itemid=2640)).

This guide focuses on actions that communities can take to build resilience to the next tsunami. It effects actions with the end goal of saving lives and reducing tsunami impact by focusing on coordinated Stakeholder Response Planning and Preparedness, accompanied by continuous awareness on the end-to-end warning system to sustain advocacy. The actions and products of this guide —tsunami hazard assessments, inundation and evacuation maps, response plans and procedures, awareness, and exercises— assist communities in making themselves more prepared. The guide, formatted to support the training of people who are responsible for these deliverables, can be used as part of the process to become UNESCO/IOC Tsunami Ready, or simply to enhance preparedness.

### 11.4 INTERNATIONAL DAY FOR DISASTER REDUCTION AND WORLD TSUNAMI AWARENESS DAY

It will be useful to link your exercise and especially any community activities with either the International Day for Disaster Reduction on 13 October 2020, or the World Tsunami Awareness Day on 5 November 2020. Note that a live communication test from the Tsunami Service Providers to Member States will be conducted at 0000 UTC on 5 November 2020.

## 12. ASSUMPTIONS

Each country will be responsible for determining what assumptions should be considered as part of its national, provincial, and/or local tsunami exercise (if conducted).

## 13. EXERCISE PARTICIPATION

All Pacific countries are strongly encouraged to participate in the exercise. At a minimum, to meet the objectives of PacWave20, it is recommended that the Tsunami Warning Focal Point or National Tsunami Warning Centre participate.

Each country's lead agency will be responsible for:

- **During the initial phase of exercise planning:**
  - Determining their country's level of participation.
  - Planning their exercise through the country's Exercise Planning Team, including any regional or joint exercises.
- **During the exercise:**
  - Participating in the live communication test between the Tsunami Service Providers and Member States at 0000 UTC on 5 November 2020.
  - Participating in the CATAC Regional Exercise on 11 November 2020 (only



- applicable to relevant countries).
- Responding as necessary to fulfil their all-of-government and national, provincial and/or local arrangement obligations.
- Responding as necessary to fulfil regional commitments.
- **After the exercise:**
  - Encouraging the conduct of debriefs and evaluations by in-country agencies, and/or country-country evaluation.
  - Completing the PacWave20 Exercise Evaluation Form based on in-country feedback.

#### 14. EXERCISE DOCUMENTATION

All information related to Exercise Pacific Wave 2020 is available at the exercise website: <http://www.pacwave.info>

Exercise Pacific Wave 2020 planning, conduct, and evaluation should take into account the following documents:

- IOC Circular Letter 2812: Pacific Tsunami Warning and Mitigation System (PTWS) Exercise Pacific Wave 2020 (PacWave20), 5 & 11 November 2020, issued 21 October 2020 (CL-2812).
- Exercise Pacific Wave 2020. *A Pacific-wide Tsunami Service Provider Communications Exercise, 5 November 2020. Volume 1: Exercise Manual*. Paris, UNESCO, IOC Technical Series No 155 (English only) (this document).
- *User's guide for the Pacific Tsunami Warning Center: enhanced products for the Pacific Tsunami Warning System*. Paris, UNESCO, IOC Technical Series No 105, Revised edition, 2014 (English; Spanish) (IOC/2013/TS/105 REV.3).
- *Users' Guide for the Northwest Pacific Tsunami Advisory Center (NWPTAC): enhanced Products for the Pacific Tsunami Warning System*. Paris, UNESCO, IOC Technical Series No 142, 2019. (English) (IOC/2019/TS/142).
- *User's Guide for the South China Sea Tsunami Advisory Center (SCSTAC) products for the South China Sea Tsunami Warning and Mitigation System*. Paris, UNESCO, IOC Technical Series No 149, 2019. (English) (IOC/2019/TS/149).
- *Draft User's Guide for the Central American Tsunami Advisory Centre (CATAC)*, version 28 March 2019 (English, Spanish).
- *Operational users guide for the Pacific Tsunami Warning and Mitigation System (PTWS)*. Paris, UNESCO, IOC Technical Series No 87 rev., 2011. (English) (IOC/2011/TS/87rev).

Resources on the development of tsunami Standard Operating Procedures for warning and emergency response including tsunami evacuation, and the planning, conduct, and evaluation of exercises include the following:

- *Plans and procedures for tsunami warning and emergency management*. Paris, UNESCO, IOC Manuals and Guides No. 76, 2017, 72 pp., English. (IOC/2017/MG/76 REV).

- *How to plan, conduct and evaluate UNESCO/IOC tsunami wave exercises*. Paris, UNESCO, IOC Manuals and Guides No.58, 2013 (English, Spanish) ([IOC/2012/MG/58 REV](#)).
- *Preparing for Community Tsunami Evacuations: from inundation to evacuation maps, response plans and exercises*. Paris, UNESCO, IOC Manuals and Guides No. 82, 2020 (English, Spanish) ([IOC/2020/MG/82](#)).

## 15. EXERCISE PRODUCTS

One **Live Tsunami Service Provider (TSP) Communications Test** from the Tsunami Service Providers to Member State Tsunami Warning Focal Points (TWFPs) and National Tsunami Warning Centres (NTWCs) **will take place at 0000 UTC on 5 November 2020**. The TSP Dummy Exercise messages that will be issued are provided in [Annex I](#).

Participating Member States should note the date, time, and method of receipt of the live communication test and report the finding in their Post-Exercise Evaluation Form.

For the CATAC regional exercise, please refer to the *Ejercicio Tsunami-CA-20* exercise manual for product details.

All documentation and correspondence relating to this exercise is to be clearly identified as **PacWave20** and **for exercise purposes only**.

## 16. EXERCISE DELIVERY/FORMAT

For the Live Communications Test at 0000 UTC on 5 November, the PTWS TSP will issue an Exercise Dummy Message to each of the PTWS TWFPs and NTWCs through their usual methods of message communication.

For the CATAC regional exercise, please refer to the *Ejercicio Tsunami-CA-20* exercise manual for delivery / format details.

## 17. POST-EXERCISE EVALUATION

All exercises should have a learning focus. Learning is maximised when there is a continuous process of review to draw out the lessons identified. Review is the process of evaluating and validating the exercise.

A review should evaluate the effectiveness of arrangements in place and identify if there are any corrective actions and gaps to fill. The hot and cold debriefs are then used to complete the Exercise Pacific Wave 2020 Post-Exercise Evaluation Form.

Due to the COVID-19 pandemic, countries may choose not to conduct national or regional exercises, and therefore objectives (b) and (c) may not be addressed.

**All participating countries are asked to provide feedback through the PacWave20 Evaluation Form ([Annex II](#)) by 21 December 2020**. It is requested that each country compile evaluations from its jurisdictions and/or agencies, and submit only **ONE (1) PacWave20 evaluation per country**.

The online PacWave20 Post-Exercise Evaluation Form will be made available at [https://www.surveymonkey.com/r/pacwave20\\_eval](https://www.surveymonkey.com/r/pacwave20_eval) from the 1 November 2020.



This feedback will greatly assist in the evaluation of Exercise Pacific Wave 2020 and the testing of the CATAC Products.

## 17.1 DEBRIEFING

A post-exercise debrief is a critical review of the entire exercise. It identifies those areas that were handled well, those areas where issues were experienced, and recommendations for improvement.

The aim of organizational debriefing is for staff to communicate their experiences of the exercise so that lessons can be identified. Arrangements (plans, procedures, training etc.) can then be modified to reflect lessons identified along with best practice, and therefore improve the agency's ability to respond in future exercises/real events.

Each agency that participates in PacWave20 is expected to conduct its own debriefs after the exercise. This may take the form of a hot debrief (or hotwash) on the day of the exercise, with each participating agency conducting its own cold (formal) debrief within the week(s) following the exercise.

A formal exercise debrief inclusive of all participants in the respective countries will be required to facilitate a collective and official evaluation. The method (in person meeting, survey, teleconference, or other means) used to collect the data required is to be decided upon by the individual participant countries.

The feedback received from this structured debrief is then used to complete standard evaluation forms which are to be based on the overall exercise objectives, plus any additional evaluation forms or tools developed by each country.

A useful guide to debriefing is the one used and published by New Zealand Ministry of Civil Defence & Emergency Management (ISBN 0-478-25467-9). It can be found at:  
<https://www.civildefence.govt.nz/assets/Uploads/publications/is-06-05-organisational-debriefing.pdf>

## 17.2 EXERCISE VALIDATION

The final stage of the exercise process is to determine whether or not the exercise has met its objectives. At the country level, a national exercise should compare the performance of the involved agencies during the exercise against the performance expected. After validation, countries and agencies may need to change or develop new plans, procedures, and training programmes. Exercise outcomes may be retested in future tsunami exercises, or new exercises written to meet newly identified needs.

Due to the COVID-19 pandemic, countries may choose not to conduct national or regional exercises.

## 17.3 EVALUATION CRITERIA

There will be three types of evaluation criteria. The first type will be international criteria (Section 3, objectives a, d). The key PacWave20 objectives are provided in Annex II. The second type will be criteria to be determined by each individual country to measure its own objectives (Section 3, objectives b, c). Because of the global COVID-19 pandemic, these objectives are discretionary.

In compiling the Exercise Pacific Wave 2020 Summary Report, the Exercise Task Team will require ONE (overall) evaluation form per participating country.

## 17.4 EVALUATORS

Countries may appoint Exercise Evaluators to observe and evaluate selected objectives during their exercise. Evaluators should be subject matter experts in the field they are evaluating, such as in warning centre operations, emergency response, or in specific agency areas of responsibility.

Appointing and assigning evaluators is the responsibility of each participating country.

## 17.5 EVALUATION TOOLS

The goal of exercise evaluation is to validate strengths and identify opportunities for improvement within the participating organizations. This is to be accomplished by collating supporting data; analysing the data to compare effectiveness against requirements; and determining what changes need to be made by participating organizations. At the international level, this would involve the ICG/PTWS as the Intergovernmental Coordinating Group supporting effective tsunami warning and decision making.

Evaluation of an exercise should focus on the adequacy of plans, policies, procedures, assessment capabilities, communication, resources and inter-agency/inter-jurisdictional relationships that support effective tsunami warning and decision-making at all levels of government. Participants that choose to include additional objectives, for example by exercising public warning and/or response plans, can expand the evaluation form accordingly. The evaluation of such additional objectives will be for the use of the particular participating agency only, and is not required for the PTWS Exercise Pacific Wave 2020 Summary Report.

The evaluation tool aims to inform and facilitate individual participant country evaluations as well as the Exercise Pacific Wave 2020 Summary Report.

All participating countries are asked to complete the official PacWave20 Post-Exercise Evaluation Form (**Annex II**) **by 21 December 2020**. Forms should be submitted online by visiting [https://www.surveymonkey.com/s/PacWave20\\_eval](https://www.surveymonkey.com/s/PacWave20_eval)

## 17.6 EXERCISE PACIFIC WAVE 2020 SUMMARY REPORT

The Exercise Task Team will compile the Exercise Pacific Wave 2020 Summary Report based on the official Post-Exercise Evaluation Forms received. The report will include the following:

- Exercise description,
- Post-Exercise Evaluation Summary and Findings,
- Identification of Best Practices or Strengths,
- Identification of Areas for Improvement, and
- Recommendations on Plans of Action for Improvement.

## 18. OBSERVERS

Exercise Pacific Wave 2020 may generate interest within the wider sector or local community. Visitors from other agencies (whether local or international) may be invited to observe various exercise activities. Media may also be invited to observe as a way of helping to increase tsunami awareness. Some media may also participate or be simulated, if they are part of the official warning and evacuation dissemination chain.

The invitation of internal or external agency personnel to observe the exercise is the responsibility of each participating country.

## **19. REAL EVENTS DURING EXERCISE PLAY**

In the case of a real event occurring during the exercise, PTWC, NWPTAC, SCSTAC and CATAC will issue their normal message products for the event. Such messages will be given full priority and a decision will be made by each international centre whether to continue or cease their participation in the exercise. Smaller earthquakes that only trigger a Tsunami Information Statement will not disrupt the exercise.

Nationally, each country may suspend or terminate the exercise for their own reasons.

## **20. RESOURCING**

Although participating countries will have advance notice of the exercise and may elect to stand up a special dedicated shift to allow normal core business to continue uninterrupted, it is requested that realistic resource levels be deployed in order to reflect some of the issues that are likely to be faced in a real event.

## **21. MEDIA ARRANGEMENTS**

The UNESCO Division of Public Information / Sector for External Relations and Public Information will issue an international Media Advisory one week before the development of the Exercise Pacific Wave 2020 providing details of the exercise. ICG/PTWS Member States should consider issuing at least one press release to their respective country's media. Member States' press releases will give adequate alert to their country's population and give their local media time to conduct interviews and documentaries with participating exercise organisations in advance of the exercise.

**Annex III** contains a sample press release that can be customised by Member States. The sample press release is provided in English.

## ANNEX I

### TSUNAMI SERVICE PROVIDER COMMUNICATIONS TEST MESSAGES

The following messages will be used by each approved Tsunami Service Providers (PTWC, **NWPTAC**, **SCSTAC**) and the one developing Tsunami Service Provider (**CATAC**) for the Live Communications Test at 0000UTC on 5 November 2020.

#### PACIFIC TSUNAMI WARNING CENTER (PTWC)

ZCZC  
WEPA40 PHEB 050000  
TSUPAC

TEST... DUMMY MESSAGE FOR PACWAVE20 EXERCISE...TEST  
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI  
0000 UTC WED NOV 05 2020

...THIS MESSAGE IS FOR TEST PURPOSES ONLY...  
...TEST PACWAVE20 TSUNAMI EXERCISE TEST...

THIS IS A TEST. THIS MESSAGE IS BEING ISSUED AS A PART OF THE  
PACWAVE20 TSUNAMI EXERCISE. ITS PURPOSE IS TO TEST  
COMMUNICATIONS BETWEEN THE PACIFIC TSUNAMI WARNING CENTER  
AND THE TSUNAMI WARNING FOCAL POINTS AND NATIONAL TSUNAMI  
WARNING CENTERS OF THE COUNTRIES AND TERRITORIES THAT MAKE  
UP THE UNESCO-IOC PACIFIC TSUNAMI WARNING AND MITIGATION  
SYSTEM. THE MESSAGE IS BEING SENT OVER

- THE WMO GLOBAL TELECOMMUNICATIONS SYSTEM
- THE AERONAUTICAL FIXED TELECOMMUNICATIONS NETWORK
- THE EMERGENCY MANAGERS WEATHER INFORMATION NETWORK
- EMAIL
- TELEFAX
- AND OTHER SYSTEMS

THIS IS A TEST. PLEASE NOTE THE TIME AND MEANS OF  
ARRIVAL OF THIS MESSAGE FOR REPORTING IN THE POST-EXERCISE  
EVALUATION.

**NORTHWEST PACIFIC TSUNAMI ADVISORY CENTER (NWPTAC)**

NWPTA COMMUNICATIONS TEST FOR EXERCISE PACIFIC WAVE 20  
ISSUED BY NWPTAC(JMA)  
ISSUED AT 0000Z 05 NOV 2020  
PART 01 OF 01 PARTS

THIS IS A TEST MESSAGE FOR EXERCISE PACIFIC WAVE 20.  
THIS MESSAGE IS FOR TEST PURPOSES ONLY.

THIS TEST MESSAGE HAS BEEN SENT TO EACH RECIPIENT ORGANIZATION  
IN ORDER TO TEST RECEIPT OF NWPTAC MESSAGES AS PART OF EXERCISE  
PACIFIC WAVE (PACWAVE)20.

YOUR ACTION IS REQUIRED  
PLEASE TAKE NOTE OF THE TIME YOU RECEIVE THIS MESSAGE AND THE METHOD(S)  
BY WHICH YOU RECEIVE THIS MESSAGE AND REPORT BACK THROUGH THE EXERCISE  
PACWAVE POST-EXERCISE ONLINE EVALUATION SURVEY BY 21 DECEMBER 2020.  
=

**SOUTH CHINA SEA TSUNAMI ADVISORY CENTER (SCSTAC)**

WESS31 BABJ 050600

\*\*TEST\*\* PACWAVE20 TSUNAMI EXERCISE \*\*TEST\*\*

ISSUED BY SOUTH CHINA SEA TSUNAMI ADVISORY CENTER (SCSTAC)

ISSUED AT 0600Z 05 NOV 2020

THIS IS A COMMUNICATION TEST BULLETIN FOR PACWAVE20 TSUNAMI EXERCISE.

THIS IS A TEST TO VERIFY COMMUNICATION LINKS AND DETERMINE  
TRANSMISSION TIMES INVOLVED IN THE DISSEMINATION OF OPERATIONAL  
TSUNAMI ADVICE PRODUCTS FROM THE SOUTH CHINA SEA TSUNAMI ADVISORY  
CENTER TO DESIGNATED 24-HOUR TSUNAMI WARNING FOCAL POINTS OF THE SOUTH  
CHINA SEA TSUNAMI WARNING SYSTEM.

THIS TEST MESSAGE IS SENT BY GTS, FAX AND EMAIL.

RECIPIENTS ARE REQUESTED TO PLEASE RESPOND BACK TO ICG PTWS TASK TEAM  
ON PACWAVE20. GUIDANCE FOR THE EXERCISE CAN BE FOUND IN

THE PACWAVE20 EXERCISE MANUAL LOCATED AT

[WWW.PACWAVE.INFO](http://WWW.PACWAVE.INFO)

PLEASE RESPOND BEFORE THE DUE DATE SPECIFIED IN THE EXERCISE MANUAL.

THANK YOU FOR YOUR PARTICIPATION IN THIS COMMUNICATION TEST

NNNN

**CENTRAL AMERICA TSUNAMI ADVISORY CENTER (CATAC)**

PRUEBA DE COMUNICACIONES CATAC PARA EL EJERCICIO PACIFIC WAVE 20  
EMITIDO POR CATAC (INETER)  
EMITIDO A LAS 0000Z 05 NOV 2020

ESTE ES UN MENSAJE DE PRUEBA PARA EL EJERCICIO PACIFIC WAVE 20.  
ESTE MENSAJE ES PARA PRUEBAS ÚNICAMENTE.

ESTE MENSAJE DE PRUEBA SE HA ENVIADO A CADA ORGANIZACIÓN BENEFICIARIO  
PARA PROBAR LA RECEPCIÓN DE MENSAJES CATAC COMO PARTE DEL EJERCICIO  
PACIFIC WAVE (PACWAVE) 20.

SE REQUIERE SU ACCIÓN.  
TENGA EN CUENTA LA HORA EN QUE RECIBE ESTE MENSAJE Y EL (LOS) MÉTODO (S)  
POR EL CUAL USTED RECIBE ESTE MENSAJE E INFORME A TRAVÉS DE LA  
ENCUESTA DE EVALUACIÓN EN LÍNEA POST-EJERCICIO DE PACWAVE20 A PARTIR  
DEL 21 DE DICIEMBRE DE 2020.

## ANNEX II

### POST-EXERCISE EVALUATION FORM

Post-Exercise Evaluation Forms are to be completed by each participating agency and forwarded to the country Exercise Pacific Wave 2020 National Contact, or the country Tsunami National Contact (TNC). **The PacWave20 National Contact will compile the country Post-Exercise Evaluation Form and complete and submit this online no later than 21 December 2020.**

Note: **Only ONE (1) on-line evaluation form is to be completed per country.** The PacWave20 National Contact, TNC, or Tsunami Warning Focal Point (TWFP) should compile sub-jurisdiction evaluations into one country evaluation to submit.

The PacWave20 Post-Exercise Evaluation Form can be found at:  
[https://www.surveymonkey.com/s/pacwave20\\_eval](https://www.surveymonkey.com/s/pacwave20_eval)

Alternatively, the country evaluation forms can be submitted by email to the Exercise Pacific Wave 2020 Task Team Chairs:

- Laura Kong (email: [laura.kong@noaa.gov](mailto:laura.kong@noaa.gov), or
- Emilio Talavera (email: [emilio.talavera@gf.ineter.gob.ni](mailto:emilio.talavera@gf.ineter.gob.ni))



EXERCISE PACIFIC WAVE 2020 Instructions on how to Complete this Post-Exercise Evaluation Form		
STEP	WHO COMPLETES THIS STEP?	DESCRIPTION
1	Each participating Agency/Country	Decide if your agency/country will include additional evaluation questions for each objective. Country/agency evaluation questions can be added at the <b>end</b> of each section. However, do NOT change the reference numbers to the questions.
2	Each participating Agency/Country	<p>Print this form and mark your evaluation answers on it.</p> <p>Answer questions only for the Objectives (activities) that your country participated in.</p> <p>Due to the COVID-19 pandemic, countries may not have conducted national or regional exercises, and therefore Objectives b) and c) would not have been addressed.</p> <p>Objective 1 (a) is the only requirement for PacWave20.</p> <p>Objective 4 (d) is required for those countries participating in the CATAC regional exercise.</p>
3	Each participating Agency/Country	<ul style="list-style-type: none"> <li>• Answer each statement with either Y (Yes), N (No).</li> <li>• Comments should be used to explain/expand upon your Yes or No answer</li> <li>• Write your comments on the page following the evaluation questions. Note the question number in the left column and write your comments alongside.</li> </ul>
4	Each participating Agency/Country	Send completed agency evaluation form to country PacWave20 National Contact so he/she can compile to complete Country PacWave20 Post-Exercise Evaluation Form (this URL).
5	PacWave20 National Contact	<p>PacWave20 National Contact should complete and submit the PacWave20 Post-Exercise Evaluation Form by <b>21 December 2020</b>. (<a href="https://www.surveymonkey.com/s/PacWave20_eval">https://www.surveymonkey.com/s/PacWave20_eval</a>). If there are problems or questions, please contact the PacWave20 Task Team co-Chairs:</p> <p>Laura Kong, <a href="mailto:laura.kong@noaa.gov">laura.kong@noaa.gov</a>; or</p> <p>Emilio Talavera, <a href="mailto:emilio.talavera@gf.ineter.gob.ni">emilio.talavera@gf.ineter.gob.ni</a></p>

Exercise Pacific Wave 2020 Post-Exercise Evaluation Form			
Contact Details			
Agency:		Country:	
Contact Name:		Contact Position:	
Contact Phone:		Contact Mobile:	
Contact E-Mail:			

**OBJECTIVE 1 (Objective a)**

*Test communications from the approved and developing Tsunami Service Providers (PTWC, NWPTAC, SCSTAC, CATAC) to Member States/Countries.*

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable	
1.1	Did your country Tsunami Warning Focal Point receive the PTWS, NWPTAC, SCSTAC, and/or CATAC Exercise Dummy message?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA
1.2	If yes, please state which Tsunami Service Provider you received the Exercise Dummy message from: <ul style="list-style-type: none"> <li>PTWC</li> <li>NWPTAC</li> <li>SCSTAC</li> <li>CATAC</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA
1.3	If you received an Exercise Dummy message, when did you receive the message(s)? <ul style="list-style-type: none"> <li>PTWC</li> <li>NWPTAC</li> <li>SCSTAC</li> <li>CATAC</li> </ul>	Please state the time in UTC:				
1.4	How did you receive the message(s)? <ul style="list-style-type: none"> <li>GTS</li> <li>AFTN</li> </ul>	Please tick methods				

		Yes	No	Comment	Not applicable
Ref No	Evaluation Statements/Questions				
	<ul style="list-style-type: none"> <li>• EMWIN</li> <li>• Fax</li> <li>• Email</li> <li>• Other (Please specify):</li> </ul>				

•

Ref No	Objective 1 (Objective a) Comments <i>(Insert extra rows as required)</i>

**OBJECTIVE 2 (Objective b)**

To test ***national*** communication and cooperation, and readiness within the country.

➔ **Objective 2a**

To test ***national*** communication and cooperation within the country

		Yes	No	Comment	Not applicable				
Ref No	Evaluation Statements/Questions								
2.1	<p>The warning was disseminated to:</p> <ul style="list-style-type: none"> <li>• Emergency services</li> <li>• Other national government agencies</li> <li>• Science agencies/universities involved in assessment</li> <li>• Local government: provincial/regional level</li> <li>• Local government: city/district level.</li> <li>• Public</li> </ul> <p>Please list number of destinations in Comments</p>		Y		N		C		NA
2.2	<p>What time was warning sent to the agency or agencies or Public listed in Q2.1? Please note the date and time using 24-hour clock and UTC, e.g., 5 Nov, 14:35 UTC.</p>	Insert time in UTC							
2.3	<p>How did you send the warning to emergency, national, science, and local government agencies in Q2.1? Tick all that apply.</p> <ul style="list-style-type: none"> <li>• Landline Telephone</li> <li>• Satellite Telephone</li> <li>• Cell or Mobile Phone</li> <li>• Fax</li> <li>• Email</li> <li>• SMS</li> <li>• Radio (UHF, VHF, Amateur)</li> <li>• Chatty Beetle</li> <li>• TV</li> <li>• Website</li> <li>• Twitter</li> </ul>		Y		N		C		NA

**OBJECTIVE 2 (Objective b)**

To test ***national*** communication and cooperation, and readiness within the country.

➔ **Objective 2a**

To test ***national*** communication and cooperation within the country

		Yes	No	Comment	Not applicable
Ref No	Evaluation Statements/Questions				
	<ul style="list-style-type: none"><li>Facebook</li><li>RSS</li><li>Other (Please specify)</li></ul>				
2.4	<p>How did you send the warning to the Public? Tick all that apply.</p> <ul style="list-style-type: none"><li>Landline Telephone</li><li>Satellite Telephone</li><li>Cell or Mobile Phone</li><li>Fax</li><li>Email</li><li>SMS</li><li>Radio (UHF, VHF, Amateur)</li><li>Chatty Beetle</li><li>TV</li><li>Website</li><li>Twitter</li><li>Facebook</li><li>RSS</li><li>Sirens</li><li>Public Announcement Systems (voice speakers)</li><li>Emergency cell / mobile phone broadcast</li><li>Police</li><li>Door-to-door announcements</li><li>Electronic billboards</li><li>Other (Please specify)</li></ul>	Y	N	C	NA

**OBJECTIVE 2 (Objective b)**

To test **national** communication and cooperation, and readiness within the country.

➔ **Objective 2a**

To test **national** communication and cooperation within the country

		Yes	No	Comment	Not applicable
Ref No	Evaluation Statements/Questions				
2.5	Based on feedback from agencies, were the communication methods timely and appropriate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA
2.6	Based on feedback from agencies, were the message(s) disseminated from the NTWC/NDMO accurate and clear?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA
2.7	Did the national disaster management organisation (or equivalent) maintain communication with the National Tsunami Warning Centre throughout the event?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA
2.8	If you answered yes to Q2.4, what was the nature of the communication <b>between the national disaster management organisation</b> (or equivalent) with the <b>national tsunami warning centre</b> throughout the event?	Note answer in the comment box			

Ref No	Objective 2a Comments ( <i>insert extra rows as required</i> )

➔ **Objective 2b**

To test **national** readiness within the country.

		Yes	No	Comment	Not applicable
Ref No	Evaluation Statements/Questions				
2.9	The NTWC/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA
2.10	The NTWC/NDMO knows its specific response role in the event of a tsunami.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA

→ **Objective 2b**

To test ***national readiness*** within the country.

		Yes No Comment Not applicable					
Ref No	Evaluation Statements/Questions						
2.11	The NTWC/NDMO has, prior to the exercise, engaged in tsunami response planning.		Y		N		C NA
2.12	The NTWC/NDMO has undertaken activities to increase its capacity and capability to support a national tsunami response (for example, training, exercise, etc.) – List activities in Comments.		Y		N		C NA
2.13	The NTWC/NDMO has an appropriate management structure identified and documented to support tsunami response.		Y		N		C NA
2.14	The NTWC/NDMO has a national tsunami mass coastal evacuation plan.		Y		N		C NA
2.15	Arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response were in place before the exercise.		Y		N		C NA
2.16	A country tsunami emergency response plan (standard operating procedures) for tsunamis exists. Tick all that apply <ul style="list-style-type: none"> <li>Local (less than 1 hour arrival time)</li> <li>Regional (1-3 hours arrival time)</li> <li>Distant (greater than 3 hours)</li> </ul>		Y		N		C NA
2.17	The response plan includes processes to issue Safe-to-Return (All-Clear) notices		Y		N		C NA
2.18	Tsunami exercises are routinely conducted in-country. Please list last exercise, and type of exercise scenario (local, regional, distant) in Comments.		Y		N		C NA
2.19	Tsunami-related public education and awareness materials have been developed and disseminated		Y		N		C NA
2.20	Tsunami-related curriculum programmes are in place for all levels (pre, primary, secondary, post-secondary) of education. If No, please list which levels have programmes in Comments.		Y		N		C NA
2.21	All tsunami-vulnerable communities have tsunami evacuation maps, signage, and		Y		N		C NA

→ **Objective 2b**

To test ***national readiness*** within the country.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable	
	assembly points for evacuation? If No, please list number of communities with maps and signage, gaps, and future plans to fill gaps in Comments.					
2.22	What type of exercise did you conduct? <ul style="list-style-type: none"> <li>• Orientation</li> <li>• Drill</li> <li>• Tabletop</li> <li>• Functional</li> <li>• Full Scale</li> <li>• Other (Please specify)</li> </ul>		Y	N	C	NA
2.23	Did you conduct community evacuation? If Yes, what type? <ul style="list-style-type: none"> <li>• Schools</li> <li>• Businesses</li> <li>• Community</li> <li>• Other (Please specify)</li> </ul>		Y	N	C	NA
2.24	If you answered yes to Q2.23, approximately how many people were evacuated in total?	Insert total				

Ref No	Objective 2b Comments <i>(insert extra rows as required)</i>



### OBJECTIVE 3 (Objective c)

To test **regional** communication and cooperation.

		Yes	No	Comment	Not applicable				
Ref No	Evaluation Statements/Questions								
3.1	Did your country engage in communication and cooperation with other countries in the region for PacWave20? If yes, please list countries in Comments		Y		N		C		NA
3.2	What types of cooperation were conducted? <ul style="list-style-type: none"><li>Data sharing (seismic, sea level, etc.)</li><li>Event information sharing</li><li>Alert coordination (levels, dissemination)</li><li>Joint PacWave20 exercise</li><li>Other (Please specify)</li></ul>		Y		N		C		NA
3.3	Did the National Tsunami Warning Centre communicate with other countries during the event? If Yes, please list countries		Y		N		C		NA
3.4	Did the National Disaster Management Agency communicate with other countries during the event? If Yes, please list countries		Y		N		C		NA
3.5	Was national information shared with other countries during the event? If Yes, please list		Y		N		C		NA
3.6	What type of national information did you share? Tick all that apply. <ul style="list-style-type: none"><li>Seismic phase arrival times</li><li>Earthquake hypocentre and/or magnitude</li><li>Tsunami Alert Level (such as Warning, Cancellation, etc.)</li><li>Tsunami Forecast</li><li>Tsunami Observations</li><li>Tsunami Evacuation</li><li>Tsunami Impact</li><li>Other (Please specify)</li></ul>								
3.7	How did you communicate the information? <ul style="list-style-type: none"><li>Radio (UHF, VHF, Amateur)</li></ul>								

**OBJECTIVE 3 (Objective c)**

To test **regional** communication and cooperation.

		Yes	No	Comment	Not applicable
Ref No	Evaluation Statements/Questions				
	<ul style="list-style-type: none"> <li>• Landline Telephone</li> <li>• Satellite Telephone</li> <li>• Cell or Mobile Phone</li> <li>• Fax</li> <li>• Email</li> <li>• SMS</li> <li>• Chatty Beetle</li> <li>• Other (Please specify)</li> </ul>				

Ref No	Objective 3 Comments <i>(insert extra rows as required)</i>

**OBJECTIVE 4 (Objective d). (Available in Spanish in online version)**

*Evaluate the format and content of the Central America Tsunami Advisory Centre (CATAC) Products (if applicable for your country).*

		Yes	No	Comment	Not applicable	
Ref No	Evaluation Statements/Questions					
4.1	Information provided in the Central America Tsunami Advisory Centre (CATAC) messages was understood by and useful to the National Tsunami Warning Centre (NTWC)/National Disaster Management Office (NDMO)		Y	N	C	NA
4.2	Threat information in CATAC products was understood and useful. Please comment as necessary. <ul style="list-style-type: none"><li>Text products</li><li>Graphical products</li></ul>		Y	N	C	NA
4.3	Components of the CATAC product suite were understood and useful. Please comment as necessary on product clarity or confusion.		Y	N	C	NA
4.4	The information provided assisted with decision making, e.g. warning levels, earthquake parameters, estimated arrival times, forecast wave heights, etc.		Y	N	C	NA

Ref No	Objective 4 Comments <i>(insert extra rows as required)</i>

## GENERAL EXERCISE OBSERVATIONS

Provide feedback on the planning and conduct of PacWave20

Please also provide information on your country's exercise.

- Include electronic links to Media Coverage in Comments section.
- Send summaries, photos and videos directly to the PTWS Technical Secretary (Bernardo Aliaga, [b.aliaga@unesco.org](mailto:b.aliaga@unesco.org)) and PacWave20 Chairs (Laura Kong, [laura.kong@noaa.gov](mailto:laura.kong@noaa.gov), Emilio Talavera, [emilio.talavera@gf.ineter.gob.ni](mailto:emilio.talavera@gf.ineter.gob.ni))

Evaluation Statements / Questions. Indicate Yes or No	Yes	No
<b>Overall assessment</b>		
Country stakeholder agencies have a better understanding of the goals, responsibilities and roles in tsunami emergencies.		
Gaps in capability and capacity have been identified.		
Community have a better understanding of their tsunami risk and are better prepared for tsunami events.		
News media participated and covered the exercise (Please provide electronic links if applicable in Comments).		
How many people do you estimate participated in the exercise within your country/territory? Include both government and non-government agencies and public, if applicable	Estimated number	
<b>Exercise planning (please make comments on the following page to all of the statements below)</b>		
Overall, the exercise planning, conduct, format and style were satisfactory.		
Exercise planning at the international level went well.		
Exercise planning at the national level went well.		
Exercise planning at the provincial/local level went well.		
The PacWave20 exercise website pages were useful.		
This evaluation form was easy to use.		
PacWave20 Exercise Manual provided an appropriate level of detail.		
IOC Manual & Guides 76: Plans and Procedures for Tsunami Warning and Emergency Management was useful.		
IOC Manual & Guides 58: How to Plan, Conduct, and Evaluate IOC Tsunami Wave Exercises was useful.		
IOC Manual & Guides 82: Preparing for Community Tsunami Evacuations: from inundation to evacuation maps, response plans and exercises.		

Please provide a general statement on your Exercise Pacific Wave 2020 experience.

Exercise Planning

Please provide a general statement about <b>what went well</b> .
<i>Insert comments</i>

Please provide a general statement about <b>what did not go well</b> .
<i>Insert comments</i>

Please provide a general statement about <b>what could be improved</b> .
<i>Insert comments</i>

Exercise Conduct

Please provide a general statement about <b>what went well</b> .
<i>Insert comments</i>

Please provide a general statement about <b>what did not go well</b> .
<i>Insert comments</i>

Please provide a general statement about <b>what could be improved</b> .
<i>Insert comments</i>

Exercise Debrief or Evaluation

Please provide a general statement about <b>what went well</b> .
<i>Insert comments</i>

Please provide a general statement about <b>what did not go well</b> .
<i>Insert comments</i>

Please provide a general statement about <b>what could be improved</b> .
<i>Insert comments</i>

ANNEX III

**SAMPLE PRESS RELEASE**

TEMPLATE FOR NEWS RELEASE

USE AGENCY MASTHEAD

Contact: (insert name)  
(insert phone number)  
(insert email address)

**FOR IMMEDIATE RELEASE**  
(insert date)

**NINTH PACIFIC TSUNAMI EXERCISE SET FOR 5 NOVEMBER 2020**

(Insert country name) will join 46 countries around the Pacific Rim as a participant in a live tsunami exercise on 5 November 2020, World Tsunami Awareness Day. The purpose of this Pacific-wide exercise is to test communications from the UNESCO Intergovernmental Oceanographic Commission's Tsunami Service Providers (TSP) in the Pacific to every country's official tsunami warning authority. Exercise messages will be sent from the Pacific Tsunami Warning Center (PTWC) in Hawaii, USA, the Northwest Pacific Tsunami Advisory Center (NWPTAC) in Japan, the South China Sea Tsunami Advisory Center (SCSTAC) in China, and the developing Central America Tsunami Advisory Center (CATAC) in Nicaragua.

Tsunamis are no-notice, fast onset natural hazards that can cause catastrophic impacts. It is impossible to know when or where the next tsunami will hit, but we know that early warnings will save lives. For distant tsunamis, the Tsunami Service Providers provide timely alerts to country National Tsunami Warning Centres who evaluate their own tsunami threat and issue tsunami warnings to their coastal communities. And for local tsunamis, continuous education is essential so that everyone self-evacuates upon recognizing nature's natural tsunami warnings. If people do not evacuate in time, thousands of lives will be lost and massive losses incurred that will have long lasting humanitarian, social and economic impacts.

*"insert quote" said (insert name of appropriate official).*

The exercise, titled Exercise Pacific Wave 2020 (PacWave20), will ensure that the communications system to officially alert countries of the Pacific Tsunami Warning and Mitigation System is working. It is the ninth such exercise with the first having been carried out in 2006, and subsequent exercises held in 2008, 2011, 2013, 2015, 2016, 2017, and 2018.

*Insert paragraph tailored for specific country. Could identify participating agencies and specific plans. Could describe current early warning program, past evacuation drills (if any), ongoing mitigation and public education programs, etc. Could describe tsunami threat, history of tsunami hazards, if any.*

The exercise is sponsored by UNESCO's Intergovernmental Oceanographic Commission through its Intergovernmental Coordination Group of the Pacific Tsunami Warning and Mitigation System (ICG/PTWS).###

On the Web:

Exercise Pacific Wave 2020 information site: <http://www.pacwave.info>

Media Resources:

[http://itic.ioc-unesco.org/index.php?option=com\\_content&view=category&layout=blog&id=1150&Itemid=1150](http://itic.ioc-unesco.org/index.php?option=com_content&view=category&layout=blog&id=1150&Itemid=1150)

Pacific Tsunami Warning and Mitigation System:

[http://www.ioc-tsunami.org/index.php?option=com\\_content&view=article&id=11&Itemid=12&lang=en](http://www.ioc-tsunami.org/index.php?option=com_content&view=article&id=11&Itemid=12&lang=en)

Pacific Tsunami Warning Center: <http://www.tsunami.gov>

Northwest Pacific Tsunami Advisory Center:

<http://www.data.jma.go.jp/svd/eqev/data/nwptac/index.html>

South China Sea Tsunami Advisory Center: <http://www.scstac.org>

Central America Tsunami Advisory Center: <http://catac.ineter.gob.ni/>

[Insert country URLs]

## ANNEX IV

### LIST OF ACRONYMS

<b>CATAC</b>	Central America Tsunami Advisory Centre
<b>CL</b>	Circular Letter
<b>CMT</b>	Centroid Moment Tensor
<b>DISCEX</b>	Discussion Exercise or Tabletop Exercise
<b>ICG</b>	Intergovernmental Coordination Groups
<b>ICG/CARIBE-EWS</b>	Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions
<b>ICG/IOTWMS</b>	Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System
<b>ICG/ITSU</b>	International Coordination Group for the Tsunami Warning System in the Pacific (now renamed ICG/PTWS)
<b>ICG/PTWS</b>	The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System
<b>INETER</b>	Instituto Nicaragüense de Estudios Territoriales
<b>IOC</b>	Intergovernmental Oceanographic Commission of UNESCO
<b>ITIC</b>	International Tsunami Information Center
<b>JMA</b>	Japan Meteorological Agency
<b>MTS</b>	Medium-term Strategy
<b>NCEI</b>	National Center for Environmental Information
<b>NDMO</b>	National Disaster Management Office
<b>NOAA</b>	US National Oceanic and Atmospheric Administration
<b>NTWC</b>	National Tsunami Warning Centre
<b>NWPTAC</b>	Northwest Pacific Tsunami Advisory Center
<b>PacWave20</b>	Exercise Pacific Wave 2020
<b>PMEL</b>	Pacific Marine Environmental Laboratory
<b>PTWC</b>	Pacific Tsunami Warning Center
<b>PTWS</b>	Pacific Tsunami Warning and Mitigation System



<b>SCSTAC</b>	South China Sea Tsunami Advisory Center
<b>SFDRR</b>	Sendai Framework for Disaster Risk Reduction
<b>SOA</b>	China State Oceanic Administration
<b>SOP</b>	Standard Operating Procedure
<b>TOWS-WG</b>	Working Group on Tsunamis and Other Hazards related to Sea-Level Warning and Mitigation Systems
<b>TSP</b>	Tsunami Service Providers
<b>TsuCAT</b>	Tsunami Coastal Assessment Tool
<b>TT</b>	Task Team
<b>TT-CATAC</b>	Task Team on the Establishment of a Central American Tsunami Advisory Centre
<b>TWFP</b>	Tsunami Warning Focal Point
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>USGS</b>	U.S. Geological Survey
<b>WG-CA</b>	Working Group on the Central American Pacific Coast Tsunami Warning and Mitigation System

# 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 Interecalibration 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 <sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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 <sup>nd</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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 / 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.	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 <sup>rd</sup> 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 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; <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

(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 — <i>Cancelled</i>	(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
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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
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