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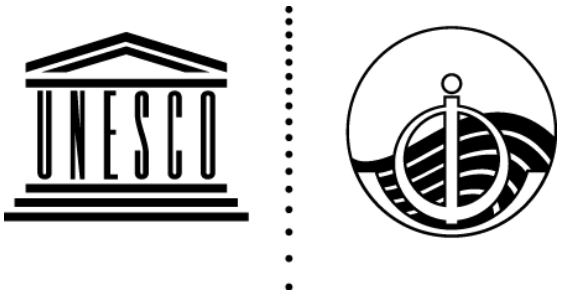

EXERCISE PACIFIC WAVE 2017

A Pacific-wide Tsunami Warning and Enhanced Products Exercise

15–17 February 2017

Volume 1 Exercise Manual

UNESCO

Intergovernmental Oceanographic Commission
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131

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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 that 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 revision; *PTWS Medium-Term Strategy 2014-2021* (IOC/2013/TS/108); *PTWS Implementation Plan 2013*, vers 4). In 2005, ITSU was re-established as the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System with a new acronym 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 Tsunami Service Provider (TSP) for the Pacific. 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 in April 2006 expanded 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. As of October 2015, the NWPTAC had issued the advisories for 190 events in total since it started the service in March 2005.

A Pacific-wide tsunami exercise is an effective tool for evaluating the readiness of PTWS countries and to identify 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 Teams with strong contributions from the International Tsunami Information Center (ITIC), PTWC, and Japan Meteorological Agency (JMA). Altogether there have been six IOC-coordinated international exercises, “Exercises Pacific Wave” 2006, 2008, 2011, 2013, 2015 and 2016.

The exercises, using a multitude of Pacific scenarios and accompanied by tsunami message products from the Pacific Tsunami Warning Center, Japan Northwest Pacific Tsunami Advisory Center, and the US National Tsunami Warning Center (formerly West Coast and Alaska Tsunami Warning Center), have been used to evaluate the effectiveness of the Tsunami Warning and Mitigation System and measure the readiness of countries to respond, as national tsunami warning centres and emergency response agencies and the public, to distant and local tsunamis. “Exercises Pacific Wave” 2011, 2013, and 2015 were additionally used to introduce and obtain feedback from tests, and validate the PTWC new enhanced forecast products which became official on 1st October 2014. “Exercise Pacific Wave” 2016 and 2017 are being used to evaluate experimental NWPTAC Enhanced Products and identify necessary modifications before the Enhanced Products are formally adopted in 2018.

At its 26th session, the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS-XXVI, Honolulu, United States of America, 22–24 April 2015) approved the conduct of “Exercise Pacific Wave” 2017 (PacWave17) during the first Quarter of 2017. At the Steering Committee (SC) of the ICG/PTWS (Honolulu, 29 June–2 July 2016), it was decided that PacWave17 would take place on 15-17 February 2017.

The Steering Committee also considered the progress of South China Sea Tsunami Advisory Center (SCSTAC) Tsunami Advisory Products, and agreed to take the opportunity to include testing of the SCSTAC products with PacWave17. Exercise details were discussed and agreed by the Task Team on the Establishment of the SCSTAC (TT-SCSTAC) at its 2nd Meeting on 24–25 October 2016 in Beijing. The testing and evaluation of the SCSTAC products will be done in parallel with PacWave17, and is overseen by the TT-SCSTAC with support from ITIC.

2. EXERCISE PURPOSE

"Exercise Pacific Wave" 2017 (PacWave17) intends to support the development of improved tsunami products and procedures, including the Enhanced Products of the Pacific Tsunami Warning Center (PTWC) and the Northwest Pacific Tsunami Advisory Center (NWPTAC) of the Japan Meteorological Agency (JMA).

The aim of PacWave17 is to test the NWPTAC and the PTWC enhanced Products.

PacWave17 provides a valuable opportunity for Pacific countries to test the new products, review their tsunami response procedures and test internal and external communication systems. 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 overall objectives for Exercise Pacific Wave 2017 are to:

1. Test communications from the PTWS PTWC and NWPTAC Tsunami Service Providers to Member States;
2. Test whether the PTWS PTWC and NWPTAC Tsunami Service Provider products are interpreted by Member States accurately and in a timely manner;
3. Test national and regional communication;
4. Test national and regional cooperation.

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

4. NEW ENHANCED PRODUCTS

The PTWC Enhanced Products are threat information products based on tsunami wave forecasts, rather than on earthquake magnitude and time or distance to impact. Several levels of tsunami threat have been established, and forecast threat levels are assigned to polygons representing segments of extended coastlines or to island groups. Details on the PTWC New Enhanced Products for the PTWS are provided in IOC Technical Series 105 (IOC/2013/TS/105 Rev.3), User's Guide to the Pacific Tsunami Warning Center Enhanced Products for the PTWS (2014); the User's Guide can also be downloaded from the PacWave17 web site (http://www.pacwave.info)

The PTWC Enhanced Products were first introduced in "Exercise Pacific Wave" 2011 (PacWave11) and feedback received through the post-exercise evaluation. "Exercise Pacific Wave" 2013 continued the development of the PTWC final products by introducing improved versions that addressed the feedback and comments received from PacWave11 and other meetings in 2011–2013.

At the Twenty-fifth Session of the ICG/PTWS (September 2013), Member States were asked to review and discuss the new products, and approve them, and agreed on an official changeover date in 2014. The new Enhanced Products went live to Member States of the ICG/PTWS on 1 October 2014. Exercise Pacific Wave 2015 again tested the PTWC Enhanced Products.

At the 26th Session of the ICG/PTWS (April 2015), Member States approved the development of new enhanced products by the Japan Northwest Pacific Tsunami Advisory Center. The NWPTAC new enhanced products consist of an initial text message prepared from a pre-established tsunami

simulation database and following text messages accompanied by graphical products based on real-time simulation techniques. The graphical products will be disseminated exclusively to national authorities of the recipient countries. There will be no change to the format of the text messages from the current format.

Full changeover to the new enhanced products is planned for 2018, after approximately one year's parallel issuance of existing and enhanced products. The new products are being introduced and feedback obtained through “Exercises Pacific Wave” 2016 and 2017.

Details of the proposed enhancement of NWPTAC products are as follows:

a. Text products

- Forecast method
  - Tsunami forecast database (the first message –and the second message, in the case of an update of hypocentral parameters–, without graphics)
  - Real-time simulation (subsequent messages, with graphical products)
- Contents (basically no change from the current format)
  - Hypocentral parameters (origin time, location, magnitude)
  - Tsunamigenic potential
  - Coastal blocks
  - Forecast amplitude and arrival time
  - Observed amplitude and arrival time
- Dissemination of products
  - GTS, FAX and E-mail

b. Graphical Products (Maps)

- Forecast method
  - Real-time simulation
- Contents
  - Deep-Ocean tsunami amplitude forecast map
  - Tsunami travel time map
  - Coastal tsunami amplitude forecast map
- Dissemination of products
  - E-mail

5. EXERCISE DATES

PacWave17 will be held within the period of 15-17 February 2017. Participating countries may choose to run their exercise at any time between 15-17 February 2017, allowing flexibility to avoid conflict with other important national events. PacWave17 is recommended to be a tabletop Exercise and will not be a live exercise. All products will be available beforehand on the PacWave17 website (http://www.pacwave.info).

5.1 PROVISIONAL TIMELINE AND MILESTONES

4 November 2016	Nomination of a National Contact for PacWave17
1 December 2016	Exercise Manual available on www.pacwave.info (including scenarios)
16 January 2017	NWPTAC Users Manual for PacWave17 available on www.pacwave.info (until this date, please refer to 'Manual on Experimental NWPTAC Enhanced Products for PacWave16'
31 January 2017	Exercise messages posted
15–17 February 2017	PacWave 17
18 February–10 March 2017	Countries to complete and submit evaluation survey online
28–31 March 2017	Draft PacWave17 Preliminary Results discussed at the ICG/PTWS-XXVII session
21 April 2017	Draft PacWave17 Preliminary Report available to Member States
30 June 2017	Final PacWave17 Summary Report uploaded to www.pacwave.info

6. EXERCISE SCENARIO

Each country will be responsible for designing its own national, provincial and/or local level exercise(s) in line with the international Exercise Pacific Wave exercise framework.

Six scenarios are available to allow all participating countries to select and exercise a distant/regional/local source tsunami event. Countries are recommended to choose one scenario to exercise. The exercise scenarios include major tsunamis generated by great earthquakes in the following areas (see Annex I for scenario details):

- Manila Trench
- New Britain-San Cristobal Trench
- New Hebrides Trench
- Tonga Trench
- Peru-Chile Trench
- Colombia-Ecuador Trench

The exercise will require Member State evaluation of both PTWC and experimental NWPTAC enhanced products, issuing of appropriate country specific alerts by National Tsunami Warning Centres, decision-making, including steps taken just prior to public notification. Member States may conduct the exercise through to the community level if they wish (however, this is not a requirement of the exercise).

If applicable, each country will be responsible for designing its own national, provincial and/or local level exercise(s) in line with the international Exercise Pacific Wave exercise framework.

7. TYPE OF EXERCISE

It is recommended that Exercise Pacific Wave 17 be carried out in a tabletop format (also referred to as a 'discussion exercise', or 'DISCEX').

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 only key stakeholders, such as the National Tsunami Warning Centre and the National Disaster Management Office, discussing their response to a tsunami threat in a particular area, where the only injects are tsunami messages from the international tsunami warning centres such as the PTWC in Hawaii, which describe the nature of the threat.

8. FURTHER GUIDANCE – HOW TO PLAN, CONDUCT AND EVALUATE TSUNAMI EXERCISES GUIDELINE

The IOC Manual and Guides 58, *How to Plan, Conduct and Evaluate IOC Tsunami Wave Exercises* (IOC/2011/MG/58, 2013, English, Spanish) has been developed to aid countries in planning, conducting, and evaluating a tsunami exercise at a national and/or provincial level. The guide is also available at the PacWave17 website (http://www.pacwave.info).

9. ASSUMPTIONS

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

10. EXERCISE PARTICIPATION

All Pacific countries are encouraged to participate in the exercise. However, it is up to each country to decide what level of governmental participation they will undertake. At a minimum, to meet the objectives of PacWave17, it is recommended that the National Tsunami Warning Centre and the National Disaster Management Office, participate.

Each country's lead agency and its PacWave17 National Contact 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.
- **During the exercise:**
  - Responding as necessary to fulfil their all-of-government and National, provincial and/or local arrangement obligations.
- **After the exercise:**
  - Encouraging the conduct of debriefs and evaluations by in-country agencies.
  - Completing the PacWave17 Exercise Evaluation Form based on in-country feedback.

11. EXERCISE DOCUMENTATION

Exercise Pacific Wave 2017 planning, conduct, and evaluation should take into account the following documents:

- IOC Circular Letter No 2636: Pacific Tsunami Warning and Mitigation System (PTWS) Exercise Pacific Wave 2017 (PacWave17), 15-17 February 2017, issued 16 August 2016
- *Exercise Pacific Wave 2017, A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 15-17 February 2017. Volume 1: Exercise Manual*, IOC Technical Series No 131. UNESCO/IOC 2016 (English) (*this document)*
- *User's Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System*. IOC Technical Series No 105. UNESCO/IOC rev. 2014 (English, Spanish)
- *Users Guide for the Northwest Pacific Tsunami Advisory Center Enhanced Products for the Pacific Tsunami Warning System*. (English, draft January 2017)
- *Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS)*, (IOC Technical Series N° 87, revised in August 2011 (English)
- *How to Plan, Conduct, and Evaluate IOC Tsunami Wave Exercises*, IOC Manuals and Guides No 58, 2013 (English, Spanish)

All information related to Exercise Pacific Wave 2017 is available at the exercise website: http://www.pacwave.info

12. EXERCISE PRODUCTS

PacWave17 will commence with a "dummy" kickoff exercise message from each Tsunami Service Provider at the earthquake time for each scenario in order to test communications from Tsunami Service Providers to countries. Participating countries should select a relevant scenario and its most convenient date and time to conduct the Tabletop Exercise within the 15-17 February 2017 time period. Participating countries may amend the exercise messages to suit their own timetable.

All PTWC and NWPTAC products will be provided online at the PacWave17 website in advance to help countries plan and prepare. It is recommended to download from the PacWave17 website, the PTWC and NWPTAC products and messages for the appropriate scenario prior to the day of the exercise.

The earthquake origin time default date and time of the messages can be adjusted by participating countries to coincide with their selected Tabletop Exercise local date and time. Subsequent message issuance date and times, and earthquake and tsunami arrival times should then also be adjusted accordingly.

All documentation and correspondence relating to this exercise is to be clearly identified as **PacWave17** and **For Exercise Purposes Only**.

Each country is also welcome to modify estimated arrival times or estimated wave amplitudes to suit their preference; for example, to have the arrival of tsunami sooner and with a larger amplitude.

13. EXERCISE DELIVERY/FORMAT

All messages for the different scenarios (Annex I) are listed in the Master Schedule of Events List (MSEL, Annex II).

Distribution of the series of Tsunami Service Provider messages for each scenario within each country (available beforehand on the exercise website) will be the responsibility of each country.

Each PacWave17 National Contact and their Exercise Planning Team should decide whether the exercise scenario messages are made known to the other national, provincial and local agencies prior to the exercise.

During the exercise, the Exercise Control Team may choose to feed the bulletins into the exercise at times of their own choosing, or alternatively put them in envelopes with the time they must be opened written on each, with each key participating agency having their own set of envelopes.

Country Exercise Planning Teams may want to add their own national and/or local injects.

14. MASTER SCHEDULE OF EVENTS LIST (MSEL) – EXERCISE SCRIPT

The Master Schedule of Events List (MSEL) is a detailed sequence of events used by Exercise Control Team to ensure that the exercise runs smoothly.

The International Master Schedule of Events List (MSEL) giving the timeline for issuance of international products, and the product types are given in Annex II.

Each country's Exercise Control Team will be responsible for executing Master Schedule of Events List.

15. 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. The exercise should also test an agency's Standard Operating Procedures (SOPs).

A review and hot and cold debrief 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" 2017 post-exercise evaluation form.

All participating countries are asked to provide feedback through the PacWave17 Evaluation Form (Annex III) by 10 March 2017. It is requested that each country compile evaluations from its jurisdictions and/or agencies, and submit only one PacWave17 evaluation. Forms should be submitted online by visiting https://www.surveymonkey.com/s/pacwave17_eval. This feedback will greatly assist in the evaluation of "Exercise Pacific Wave" 17 and the finalisation of the NWPTAC Enhanced Products.

15.1 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 organisational 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 PacWave17 is expected to conduct its own debrief 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 one used by New Zealand Ministry of Civil Defence & Emergency Management (ISBN 0-478-25467-9). It can be found at:

http://www.civildefence.govt.nz/assets/Uploads/publications/is-06-05-organisational-debriefing.pdf

15.2 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 agencies involved 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

15.3 EVALUATION CRITERIA

There will be two types of evaluation criteria. The first type will be international criteria based on the overall exercise objectives (see Section 2 above). These are provided in Annex III. The second type will be criteria to be determined by each individual country to measure its own objectives.

In compiling the "Exercise Pacific Wave" 2017 Summary Report, the Exercise Task Team will only require the international evaluation from each participating country.

15.4 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.

15.5 OBSERVERS

"Exercise Pacific Wave" 2017 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.

15.6 EVALUATION TOOLS

The goal of the exercise evaluation is to validate strengths and identify opportunities for improvement within the participating organisations. 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 organisations. At the international level, this would involved 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” 2017 Summary Report.

The evaluation tool aims to inform and facilitate individual participant country evaluations as well as the “Exercise Pacific Wave” 2017 Summary Report.

All participanting countries are asked to complete the official PacWave17 Exercise Evaluation Form (Annex III) **by 10 March 2017**. Forms should be submitted online by visiting https://www.surveymonkey.com/s/pacwave17_eval.

15.7 EXERCISE PACIFIC WAVE 2017 SUMMARY REPORT

The Exercise Task Team will compile the “Exercise Pacific Wave” 2017 Summary Report based on the official 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
- Recommendations on Plans of Action for Improvement

16. REAL EVENTS DURING EXERCISE PLAY

In the case of a real event occurring during the exercise, PTWC and JMA/NWPTAC 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 Bulletin will not disrupt the exercise.

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

17. 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.

18. 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" 17 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 IV contains a sample press release that can be customised by Member States. The sample press release is provided in English. Samples in other languages can be found at the PacWave17 website (http://www.pacwave.info).

ANNEX I

SCENARIOS

Location	Depth	Magnitude	Latitude	Longitude	Past Exercise
Manila Trench (South China Sea)	35 km	9.0	15.44 N	119.36 E	-
New Britain-San Cristobal Trench	20 km	9.0	7.3 S	156.0 E	PacWave16
New Hebrides Trench	20 km	9.0	14.3 S	166.2 E	PacWave11
Tonga Trench	20 km	9.0	23.6 S	175.5 W	PacWave11, 15
Peru-Chile Trench	20 km	9.0	32.3 S	71.9 W	-
Colombia-Ecuador Trench	20 km	9.0	1.0 N	81.5 W	PacWave15

ANNEX II

INTERNATIONAL MASTER SCHEDULE OF EVENTS LIST

Scenario →	Manila Trench				New Britain-San Cristobal Trench				New Hebrides Trench				Tonga Trench		Peru-Chile Trench		Colombia -Ecuador Trench	
Center →	PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		PTWC		PTWC	
Date & Time (UTC)	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP
15 Feb 1400															Quake		Quake	
1407															1	TI	1	TI
1435															2	TFR	2	TFR
1500															3	TFP	3	TFP
1600															4	TS	4	TS
1700															5	TS	5	TS
1800															6	TS	6	TS
1900															7	TS	7	TS
2000															8	TS	8	TS
2100									Quake				Quake		9	TS	9	TS
2107									1	TI			1	TI				
2120											**1**	**TI**						
2135									2	TFR			2	TFR				
2140											**2**	**TFR**						
2200									3	TFP			3	TFP	10	TS	10	TS
2300									4	TS			4	TS	11	TS	11	TS
2310											**3**	**TS**						
16 Feb 0000									5	TS			5	TS	12	TS	12	TS
0010											**4**	**TS**						
0100	Quake				Quake				6	TS			6	TS	13	TS	13	TS
0107	1	TI			1	TI												
0120			**1**	**TI**			**1**	**TI**										
0135	2	TFR			2	TFR												
0140			**2**	**TFR**			**2**	**TFR**			**5**	**TS**						
0200	3	TFP			3	TFP			7	TS			7	TS	14	TS	14	TS
0230	4	TFH																
0300	5	TS			4	TS			8	TS			8	TS	15	TS	15	TS
0310			**3**	**TS**			**3**	**TS**			**6**	**TS**						
0400	5	TS			5	TS			9	TS			9	TS	16	TS	16	TS
0440			**4**	**TS**			**4**	**TS**			**7**	**TS**						
0500	6	TS			6	TS			10	TS			10	TS	17	TS	17	TS
0600	7	TS			7	TS			11	TS			11	TS	18	TS	18	TS
0610			**5**	**TS**			**5**	**TS**			**8**	**TS**						
0700	8	TS			8	TS			12	TS			12	TS	19	TS	19	TS
0740			**6**	**TS**			**6**	**TS**			**9**	**TS**						
0800	9	TS			9	TS			13	TS			13	TS	20	TS	20	TS
0900	10	TS			10	TS			14	TS			14	TS	21	TS	21	TS
0910			**7**	**TS**			**7**	**TS**			**10**	**TS**						
1000	11	TS			11	TS			15	TS			15	TS	22	TS	22	TS
1040			**8**	**TS**			**8**	**TS**			**11**	**TS**						
1100	12	TS			12	TS			16	TS			16	TS	23	TS	23	TS
1200	13	TS			13	TS			17	TS			17	TS	24	TS	24	TS
1210			**9**	**TS**			**9**	**TS**			**12**	**TS**						
1300	14	TS			14	TS			18	TS			18	TS	25	TS	25	TS
1340			**10**	**TS**			**10**	**TS**			**13**	**TS**						
1400	15	TS			15	TS			19	TS			19	TS	26	TL	26	TL
1500	16	TS			16	TS			20	TS			20	TS				
1510			**11**	**TS**			**11**	**TS**										
1600	17	TS			17	TS			21	TS			21	TS				
1640			**12**	**TS**			**12**	**TS**										
1700	18	TL			18	TS			22	TL			22	TL				
1800					19	TS												
1900					20	TS												
2000					21	TS												
2100					22	TS												
2200					23	TS												
2300					24	TS												
17 Feb 0000					25	TS												
0100					26	TL												

Message Types: TI = PTWC/NWPTAC Initial Text Message
TFR = PTWC/NWPTAC text Message with a Forecast for the Regional near the Earthquake
TFP = PTWC Products with a Pacific-wide Forecast
TFH = PTWC Products with a Forecast for Shallow Marginal Seas (High-Resolution Forecast Model Run)
TS = PTWC/NWPTAC Text Message with Tsunami Observations
TL = PTWC Last Message for this Event

Note 1) Dummy messages will be issued at the time of the earthquake for each scenario.
Note 2) Participating countries may shift the schedule to adapt it to their own timetable.

ANNEX III

POST-EXERCISE EVALUATION

Exercise evaluation forms are to be completed by each participating agency and forwarded to the country "Exercise Pacific Wave" 2017 National Contact, or the country Tsunami National Contact. **The PacWave17 National Contact will compile the country Evaluation Form and complete and submit this online no later than 10 March 2017**.

Note: Only **one** on-line evaluation form is to be completed per country. The PacWave17 National Contact, TNC, or TWFP should compile sub-jurisdiction evaluations into one country evaluation to submit.

The PacWave17 Evaluation Form can be found at
https://www.surveymonkey.com/s/pacwave17_eval

Alternatively, the country evaluation forms can be submitted by email or fax to the Exercise PacWave 17 Task Team Chairs:

- Laura Kong (email: l.kong@noaa.gov, 1-808-725-6055), or
- Jo Guard (email: jo.guard@dpmc.govt.nz, fax: +64 4 817 8554), or
- Tomoaki Ozaki (email: hokusei@eqvol2.kishou.go.jp).

Exercise Pacific Wave 2017 Instructions on how to complete this 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 **end** of each section. However, do NOT change the reference numbers to the questions.
2	Each participating Agency/Country	Print this form and mark your evaluation answers on it.
3	Each participating Agency/Country	• Answer each statement with either Y (Yes), N (No). • Comments should be used to explain/expand upon your Yes or No answer • Write your comments on the page following the evaluation questions. Note the question number in the left column and write your comments alongside.
4	Each participating Agency/Country	Send completed agency evaluation form to country PacWave17 National Contact so he/she can compile to complete Country PacWave17 Evaluation Form (this URL).
5	PacWave17 National Contact	PacWave17 National Contact should complete and submit the PacWave17 Evaluation Form by **10 March 2017.** (https://www.surveymonkey.com/s/pacwave17_eval). If there are problems or questions, please contact the PacWave17 Task Team co-Chairs (Laura Kong, laura.kong@noaa.gov; Jo Guard, jo.guard@dpmc.govt.nz or Tomoaki Ozaki, hokusei@eqvol2.kishou.go.jp)

Exercise Pacific Wave 2017 Evaluation Form Contact Details			
Agency:		**Country:**	
Contact Name:		**Contact Position:**	
Contact Phone:		**Contact Mobile:**	
Contact E-Mail:			

Country Exercise Scenario	
Scenario Used:	**Tick Scenario(s) used during PacWave17:** ○ Manila Trench ○ New Britain-San Cristobal Trench ○ New Hebrides Trench ○ Tonga Trench ○ Peru-Chile Trench ○ Colombia-Ecuador Trench

OBJECTIVE 1

Test communications from the PTWC, and NWPTAC Tsunami Service Providers to Member StatesCountries.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
1.1	Did your country Tsunami Warning Focal Point receive the PTWS and/or NWPTAC information/threat message?	*Y*	*N*	*C*	*NA*
1.2	If yes, when did you receive the message(s)?	Please state the time:			
1.3	How did you receive the message(s)? ○ GTS ○ AFTN ○ EMWIN ○ Fax ○ Email ○ CISN (Real-Time Earthquake Display) ○ RANET Heads-up SMS ○ Other (Please specify):	Please list how you received the message			

OBJECTIVE 2

Test whether the PTWS PTWC/NWPTAC Tsunami Service Provider products are interpreted by Member States accurately and in a timely manner.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
2.1	Information provided by the relevant TSP products was understood by the National Tsunami Warning Centre (NTWC)/National Disaster Management Office (NDMO).				
2.2	How did your country assess the tsunami threat during the exercise? Please tick as many as apply: • National tsunami experts • National tsunami coordination committee • National tsunami historical database • NCEI/WDS tsunami historical database (web) • TsuDig historical database GIS tool (NCEI/ITIC offline) • National pre-computed tsunami scenarios • National tsunami forecasts • International tsunami forecasts. Note source of forecasts (PTWC, NWPTAC, US NTWC) in comments. • Communication with outside sources (such as ITIC, media, other). Please specify in the comments section.				
2.3	The information provided assisted with decision making, e.g., warning levels, earthquake parameters, estimated arrival times, forecast wave heights, etc.				
2.4	The information issued by our country national Tsunami Warning Focal Point was according to standard operating procedures.				

OBJECTIVE 3

*To test national and regional **communication.***

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
3.1	The warning was disseminated to: • Emergency services • Other national government agencies • Science agencies/universities involved in assessment • Local government: provincial/regional level • Local government: city/district level. • Public				
3.2	What time was the initial PTWC and/or NWPTAC PacWave17 scenario exercise start message sent to the agency or agencies listed in Q3.1? Please note the time using 24 hour clock and UTC, e.g., 14:35 UTC.	*Note answer on the following comment page*			
3.3	How did you send the initial PTWC and/or NWPTAC Exercise PacWave17 scenario exercise start message to the agency or agencies listed in Q3.1? • Fax • Email • SMS • Other (Please specify)				
3.4	Did the national disaster management organisation (or equivalent) maintain communication with the National Tsunami Warning Centre throughout the event?				
3.5	If you answered yes to Q3D.1, what was the nature of the communication **between the national disaster management organisation** (or equivalent) with the **national tsunami warning centre** throughout the event?	*Note answer on the following comment page*			
3.6	Did the national disaster management organisation (or equivalent) maintain communication with **local/regional disaster management organisations** (or equivalent)?				
3.7	If you answered yes to Q3.6, what was the nature of the communication **between the national disaster management organisation** (or equivalent) **with local/regional** disaster management organisations (or equivalent)?	*Note answer on the following comment page*			

OBJECTIVE 4

*To test national and regional **cooperation.***

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
4.1	The NTWC/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.	*Y*	*N*	*C*	*NA*
4.2	The NTWC/NDMO knows its specific response role in the event of a tsunami.				
4.3	The NTWC/NDMO has, prior to the exercise, engaged in tsunami response planning.				
4.4	The NTWC/NDMO has undertaken activities to increase its capacity and capability to support a national tsunami response (for example, training, exercise, etc.) – Note activities in Comment section.				
4.5	The NTWC/NDMO has an appropriate management structure identified and documented to support tsunami response.				
4.6	The NTWC/NDMO has a tsunami mass coastal evacuation plan.				
4.7	Arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response were in place **before** the exercise.				
4.8	A country tsunami emergency response plan (standard operating procedures) for regional/local tsunamis exists.				
4.9	The warning was disseminated to: • Emergency services • Other national government agencies • Science agencies/universities involved in assessment • Local government: provincial/regional level • Local government: city/district level. • Public				
4.10	Regional/local tsunami exercises are routinely conducted in-country. Note last exercise in Comments section.				
4.11	Tsunami-related curriculum programmes are in place for all levels of education. Note which levels in Comments section.				
4.12	Communities have tsunami evacuation maps, routes, evacuation signs and assembly points for evacuation areas? Please note any gaps and future plans to fill gaps.				

GENERAL EXERCISE OBSERVATIONS
Provide feedback on the planning and conduct of PacWave17

Evaluation Statements / Questions. Indicate Yes or No	**Yes**	**No**
Overall assessment		
Country stakeholder agencies have a better understanding of the goals, responsibilities and roles in tsunami emergencies.		
Gaps in capability and capacity have been identified.		
Exercise planning (please make comments on the following page to all of the statements below)		
Overall, the exercise planning, conduct, format and style were satisfactory.		
Exercise planning went well.		
The PacWave17 exercise website pages were useful.		
This evaluation form was easy to use.		
PacWave17 Exercise Manual provided an appropriate level of detail.		
IOC Manual & Guides 58: How to Plan, Conduct, and Evaluate IOC Tsunami Wave Exercises was useful.		

Please provide a general statement on your Exercise Pacific Wave 17 experience.

Exercise Planning

Please provide a general statement about **what went well**.
Insert comments

Please provide a general statement about **what did not go well**.
Insert comments

Please provide a general statement about **what could be improved**.
Insert comments

Exercise Conduct

Please provide a general statement about **what went well**.
Insert comments

Please provide a general statement about **what did not go well**.
Insert comments

Please provide a general statement about **what could be improved**.
Insert comments

Exercise Debrief or Evaluation

Please provide a general statement about **what went well**.
Insert comments

Please provide a general statement about **what did not go well**.
Insert comments

Please provide a general statement about **what could be improved**.
Insert comments

ANNEX IV

SAMPLE PRESS RELEASE

TEMPLATE FOR NEWS RELEASE

USE AGENCY MASTHEAD

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

FOR IMMEDIATE RELEASE
(insert date)

SEVENTH PACIFIC TSUNAMI DRILL SET FOR FEBRUARY 2017

(Insert country name) will join over 40 other countries around the Pacific Rim as a participant in a mock tsunami scenario during 15-17 February 2017. The purpose of this Pacific-wide exercise is to exercise country tsunami decision-making procedures and communication systems and processes. It will also provide an opportunity for those countries that receive products from the Northwest Pacific Tsunami Advisory Center (NWPTAC) in Japan to assess new experimental enhanced forecast products, including tsunami wave forecasts that enable each country to better assess its own tsunami threat.

"The recent events of the 2009 Samoa Islands, 2010 Chile, 2011 Japan, and the February 2013 Solomon Islands tsunamis have increased our need to be more prepared for such events," said (insert name of appropriate official). "This important exercise will validate the enhanced products for future official use by countries of the Pacific Tsunami Warning and Mitigation System.

The exercise, titled Exercise Pacific Wave 2017 (PacWave17), will simulate Pacific countries being put into a Tsunami Warning situation requiring government decision-making. It is the seventh such exercise with the first having been carried out in May 2006, and subsequent exercises held in October 2008, November 2011, May 2013, February 2015 and February 2016.

Participating countries will select from six different Pacific scenarios and conduct a Tabletop Exercise within the second week of February. Destructive Pacific-wide tsunamis will be simulated through tsunami information messages from the Pacific Tsunami Warning Center in Hawaii and Japan's NWPTAC, and then reviewed by focal points designated by each country that are responsible for their country's tsunami response.

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 2017 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

Pacific Tsunami Warning and Mitigation System:
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, http://ptwc.weather.gov

Northwest Pacific Tsunami Advisory Centre:
http://www.jma.go.jp/en/distant_tsunami/WEPA40/index.html

US National Tsunami Warning Center: http://www.tsunami.gov

[Insert country URLs]

ANNEX V

LIST OF ACRONYMS

DISCEX	Discussion Exercise' or Table top Exercise
ICG/PTWS	Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (formerly ITSU)
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
ITIC	International Tsunami Information Center (UNESCO/IOC–NOAA)
JMA	Japan Meteorological Agency
MSEL	Master Schedule of Events List
NDMO	National Disaster Management Office
NOAA	National Oceanic & Atmospheric Administration (USA)
NTWC	National Tsunami Warning Centre
NWPTA	Northwest Pacific Tsunami Advisory
NWPTAC	Northwest Pacific Tsunami Advisory Center (Japan)
PTWC	Pacific Tsunami Warning Center (USA)
SCSTAC	South China Sea Tsunami Advisory Center (China)
SOP	Standard Operating Procedures
TT	Task Team
TNC	Tsunami National Contact
TWFP	Tsunami Warning Focal Point
UNESCO	United Nations Educational, Scientific & Cultural Organization
US NTWC	US National Tsunami Warning Center (USA)
WG	Working Group

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	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.	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	E/S
110.	Directory of atmospheric, hydrographic and biological datasets for the Canary Current Large Marine Ecosystem, 2nd edition: revised and expanded. 2016	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.	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	E only
116.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Third Enlarged Communication Test Exercise (CTE3), 1st October 2013. Vol. 1 Exercise Manual Vol. 2 Evaluation Report	E only
117.	Exercise Pacific Wave 15. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 2–6 February 2015 Vol. 1: Exercise Manual; Vol. 2: Summary Report	E only
118.	Exercise Caribe Wave/Lantex 15. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 25 March 2015 (SW Caribbean Scenario) Vol. 1: Participant Handbook	E only
119.	Transboundary Waters Assessment Programme (TWAP) Assessment of Governance Arrangements for the Ocean Vol 1: Transboundary Large Marine Ecosystems Vol 2: Areas Beyond National Jurisdiction	E only
120.	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	*In preparation*
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
123	Preparing for the next tsunami in the North-Eastern Atlantic, the Mediterranean and Connected Seas – Ten years of the Tsunami Warning System (NEAMTWS)	*In preparation*
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	E only

(continued)

126	Exercise Pacific Wave 16. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1-5 February 2016. Volume 1: Exercise Manual.	E only
127	How to reduce coastal hazard risk in your community – A step by step approach	E only
128.	Exercise Indian Ocean Wave 2016: An Indian Ocean-wide Tsunami Warning and Communications Exercise, 7–8 September 2016 Vol 1: Participant Handbook Vol. 2: Evaluation report	E only
129.	*In preparation*	
130	*In preparation*	
131	Exercise Pacific Wave 2017. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 15-17 February 2017. Volume 1: Exercise Manual	E only

Intergovernmental Oceanographic Commission
Technical Series

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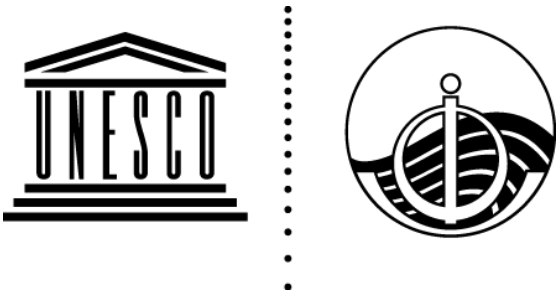

EXERCISE PACIFIC WAVE 17

A Pacific-wide Tsunami Warning and Enhanced Products Exercise

15–17 February 2017

Volume 2 Exercise Report

UNESCO

Intergovernmental Oceanographic Commission
Technical Series
131

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1. EXECUTIVE SUMMARY

Most of the world's earthquakes and tsunamis occur in the Pacific Ocean and its marginal seas, and throughout history, 76% of the world's fatal tsunamis have occurred there. On average, the Pacific is struck by a locally damaging tsunami every one to two years, and by a major Pacific-wide tsunami a few times each century. Since 2005, there have been 14 deadly tsunamis, 9 of them have occurred in the Pacific. Local and regional tsunamis occur most frequently, and in the Pacific, they have been the cause of 99% of tsunami casualties as they impact shorelines in minutes.

Exercise Pacific Wave 17 (PacWave17) is the seventh Pacific-wide drill in a regular schedule of Pacific exercises. PacWave17 provided the opportunity to evaluate the improved tsunami products and procedures, including the Enhanced Products of the Pacific Tsunami Warning Center (PTWC) and the Northwest Pacific Tsunami Advisory Center (NWPTAC) of the Japan Meteorological Agency (JMA).

The new enhanced products provide guidance on the levels of threat along coastal segments using real-time tsunami wave forecasts, and aim to greatly reduce the number of areas that have previously been unnecessarily warned.

Thirty-four countries (including 6 sub-national entitles) participated in the Exercise. A summary of the findings from the completed evaluation forms is provided in Annex III. The majority of responding countries expressed a positive view of the planning and conduct of PacWave17. The objectives were exercised, evaluated, thus enabling PTWS recommendations and the identified lessons to be formulated. PacWave17 reinforced the integration of PTWC enhanced products in their country decision-making processes, and in their Standard Operating Procedures (SOPs).

Countries overwhelmingly found PacWave17 to be a useful way to test their current tsunami SOPs. Countries generally understood the PTWC enhanced products and viewed them as adding important advice to guide them in providing more accurate national warnings.

Although all countries have a good understanding of the PTWC enhanced products and its relation into their national processes and procedures, there is still a need for continued training and exercising. Indications of improvements to PacWave17 were received as countries look to test their tsunami response plans more thoroughly in the future.

The findings from PacWave17 are as follows:

- The majority of participants received the initial exercise kick-off notification messages from PTWC in a timely manner and without any issues.

- The timing of the exercise being early in the year proved difficult for some countries who indicated that they would have had a larger audience if the exercise was not in February.

- The majority of respondents agreed that the format and content of PTWC enhanced products were clear and easy to understand. Some suggestions for improvements were made.

- The majority of respondents indicated the National Tsunami Warning Centres (NTWCs) and National Disaster Management Offices (NDMOs) understood the content of the enhanced products.

- The majority of respondents indicated that they disseminated the warning to the emergency services and then to other national agencies. The comments indicated that, in the case of a real event, they would disseminate the warning to all of the avenues mentioned, however, for the purposes of the exercise this was done notionally.

- All respondents indicated that the NTWC/NDMO knows its specific response role in the event of a tsunami, and the majority of respondents agreed that the NTWC/NDMO has an activation and response process in place in case of tsunami warning.

- The majority of respondents used international tsunami forecasts to help assess the tsunami threat to their countries. National tsunami experts followed this closely. Most of the respondents indicated that they used the PTWC and NWPTAC forecast products to assess their countries' tsunami threat.

- Half of respondents indicated that tsunami-related curriculum programmes are in place of all levels of education. The comments revealed that many respondents did have some programmes in place, though not for all educational levels and not specific to tsunami.

- The majority of the respondents indicated that they have a tsunami mass coastal evacuation plan. The comments revealed that either some countries were in the process of creating evaluation plans or it was not the responsibility of their agency.

- A number of comments noted that it was difficult to obtain external agency participation into the exercise and felt a need to raise international awareness.

- Overall, respondents indicated that PacWave17 gave their NTWC/NDMO an opportunity to continue to exercise their tsunami standard operating procedures.

Based on a review of the PacWave17 responses, the following recommendations were made:

(i) **Mass Coastal Evacuation Planning**

Issue: 29% of countries do not have tsunami mass coastal evacuation plans.

Recommendation: IOC/ITIC to provide guidance and support to Member States to develop tsunami mass coastal evacuation plans.

(ii) **Community tsunami routes, signage and assembly points**

Issue: 20% of countries do not have community tsunami routes, evacuation signs and assembly points for evacuation areas.

Recommendation: Members States ensure their at-risk coastal communities have tsunami routes, evacuation signs and assembly points for evacuation areas.

(iii) **Conduct of future exercises**

Issue: Not all countries routinely conduct regional/local tsunami exercises. Past PacWave Exercises have generally been conducted in controlled, moderately-paced timelines, typically using Table Top coordination. Many countries are now ready to move towards a more realistic exercise response timetable.

Recommendation: Future PacWave Exercises should be conducted in real time, initially during daytime working hours with full staffing during normal duty hours. Later, countries should consider conducting real time exercises simulating the presence of minimal staff during night-time or weekend hours.

(iv) Exercise Timing and Participation

Issue: Short notice to prepare for the exercise (availability of documentation in advance of the exercise). February is a difficult month for many countries due to heightened risk of wildfire, cyclone or summer holidays, which affects planning and participation.

Recommendation:

- IOC to announce future PacWave activities at least 180 days prior.
- Exercise manual to be published 90 days prior as indicated in the Terms of Reference of the Task Team on PacWave Exercises.
- Tsunami Service Providers to provide products at least 1 month prior.
- Exercise PacWave18 to be conducted in November to coincide with Tsunami Awareness Day (5 November) also providing a public education opportunity.

(v) Education

Issue: 47% of respondents do not have tsunami related curriculum programmes in place for all levels of education.

Recommendation: Members States are strongly encouraged to introduce tsunami related curriculum programmes in place for all levels of education.

2. INTRODUCTION

2.1 INTERNATIONAL TSUNAMI EXERCISES

Historically, from 1610 B.C. to A.D. 2016, seventy percent of the worlds' confirmed tsunamis have occurred in the Pacific Ocean and its marginal seas. Of these, 22% of the sources were in Japan, 15% in the South Pacific Islands, 7% each in North and Central America, and in South America, 5% each in Russian Federation, in Asia, and in Indonesia (Pacific), 4% in Alaska, and <1% in Hawaii. Most of them were caused by earthquakes (81%) or earthquake-generated landslides (6%). Fifteen of the top 20 most deadly tsunamis have occurred in the Pacific, with 10 in Japan (1498, 1605, 1611, 1703. 1707, 1771, 1792, 1896, 1933, 2011), followed by 2 in Peru (1687, 1746), 1 in Chile (1868), 1 in Russian Federation (1952), and the 1 in Philippines (1976).

In the 50 years since the start of the International Tsunami Warning and Mitigation System in the Pacific, there have been 37 deadly tsunamis, or approximately one deadly tsunami occurs every 1.5 years. Of these, only two caused deaths in the far field (2011 Tohoku, Japan, and 2012 Haida Gwaii, Canada). Since the PTWS was established, only 21 deaths resulted from Pacific Ocean tsunamis in the far field, compared to many thousands of lost due to tsunamis in the far field prior to 1965.

Over the past eight years (2009–2016), the Pacific witnessed six destructive and deadly tsunamis that each placed PTWS (Pacific Tsunami Warning and Mitigation System) countries

in various levels of warning for regional or distant tsunamis. Locally, a number of countries were impacted nearly immediately within only 10 to 30 minutes following an earthquake before the first large waves hit.

On 29 September 2009, Samoa, American Samoa, and Tonga were hit by a deadly tsunami that was the largest since the 1998 Sissano, Papua New Guinea, event. Altogether, 192 lives were lost locally. This was followed, five months later, by the 27 February 2010 Chile tsunami where 124 lives were lost. One year later, the Pacific and the world watched the 11 March 2011 Japan tsunami devastate the Honshu coastlines within 30 minutes claiming 17,000 lives. On 6 February 2013, a local tsunami was generated by a powerful 8.0 magnitude earthquake that struck near the town of Lata, on Santa Cruz in Temotu, the Eastern-most province in the Solomon Islands. Nine people were killed and hundreds of homes in five villages were damaged or destroyed. Finally, on 1 April 2014, a magnitude 8.2 earthquake off the coast of Northern Chile generated a tsunami that was observed all over the Pacific region and caused damage locally.

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 magnitude 9.5 earthquake off the coast of Chile that generated a tsunami killing 2000 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 warnings, and advocate for comprehensive national programmes in hazard assessment, warning guidance, and preparedness (ITSU Master Plan, 2004 (IOC/INF.1124rev.), PTWS Medium-term Strategy 2014-2021 (IOC/2013/TS/108), PTWS Implementation Plan 2013, version 4). In 2005, ITSU was renamed the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS).

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 Teams with strong contributions from the International Tsunami Information Center (ITIC), the Pacific Tsunami Warning Center (PTWC), and Japan Meteorological Agency (JMA).

Altogether, there have been seven IOC-coordinated international exercises: 2006, 2008, 2011, 2013, 2015, 2016 and 2017. The exercises, using a multitude of Pacific scenarios and accompanied by tsunami message products from the Pacific Tsunami Warning Center, Northwest Pacific Tsunami Advisory Center, and the US National Tsunami Warning Center (formerly West Coast and Alaska Tsunami Warning Center), have been used to evaluate the effectiveness of the System and measure the readiness of countries and public to respond as national tsunami warning centres and emergency response agencies, to distant and local tsunamis. Exercise Pacific Wave 11, 13, and 15 have been additionally used to introduce and obtain feedback, test, and validate the PTWC new enhanced forecast products. After a trial period of 1.5 years, the products became official on 1 October 2014.

Exercise Pacific Wave 16 was used to introduce and obtain feedback on the NWPTAC new enhanced forecast products.

2.2 PACIFIC TSUNAMI WARNING CENTRE: NEW ENHANCED PRODUCTS

The PTWC enhanced products provide tsunami threat information to the Pacific countries based on tsunami wave forecasts, rather than based upon earthquake magnitude thresholds and time or distance to impact. Several levels of tsunami threat have been established, and forecast threat levels are assigned to polygons representing segments of extended

coastlines or to island groups. The improvements are intended to greatly reduce the number of areas warned unnecessarily and provide some advanced notice of potential local tsunamis. Details on the PTWC new enhanced products for the PTWS are provided in IOC Technical Series 105 entitled *User's guide for the Pacific Tsunami Warning Center: enhanced products for the Pacific Tsunami Warning System (revised edition, August 2014, in English and Spanish, IOC/2013/TS/105 REV.3)*. The User's Guide can be downloaded from the PacWave17 web site (http://*www*.pacwave.info).

There are important differences between PTWC's former and its new enhanced products. The old products used terminology that described a level of alert for each country. Specifically, a country was designated by PTWC as being in a 'Tsunami Watch' or a 'Tsunami Warning' depending on the tsunami threat presented by the event, as well as the time remaining until tsunami impact. Over the last few years, the use of the Warning and Watch terms have caused confusion when the PTWC-designated levels of alert conflicted with a country's independently derived levels of alert. As each country is sovereign and thus responsible for the safety of its own population, the PTWC new enhanced products have changed to avoid using the Warning and Watch terms, and instead provide forecast levels of impact along coasts.

In 2007, the Intergovernmental Co-ordination Group for the Pacific Warning and Mitigation System at its Twenty-second Session (ICG/PTWS-XXII) started the process of improving the PTWS international alert products, starting first with the products of the PTWC. In 2011, the ICG/PTWS at its Twenty-fourth Session (ICG/PTWS-XXIV) approved PTWC's Enhanced Tsunami Products proposal and asked PTWC to proceed with their development. Exercise Pacific Wave 11 (IOC/2011/TS/97Vol.1 and Vol.2), held the 9 and 10 November 2011, introduced those products. In May 2012, the ICG/PTWS Steering Committee (SC) met to review the feedback and approve the final implementation timeline. Exercise Pacific Wave 13 (IOC/2013/TS/106 Vol.1 + Vol.2) was conducted from 1 to 14 May 2013 to validate the products.

At the Twenty-fifth Session of the ICG/PTWS (ICG/PTWS-XXV), held from 9 to 11 September 2013, Member States approved the final products and agreed on the target changeover date of 1 October 2014 proposed by the PTWS SC. Member States further decided that the public text product will continue, and that additional forecast guidance products be only sent to country Tsunami Warning Focal Points to assist their NTWCs in assessing their national threat. In July 2014, the PTWS SC met to perform the final readiness review and, satisfied, approved the full operation start date. At 0000Z on 1 October 2014, the PTWC retired its existing products and started issuing its new enhanced products.

2.3 NORTHWEST PACIFIC TSUNAMI WARNING CENTER: NEW ENHANCED PRODUCTS

The NWPTAC new enhanced products consist of an initial text message prepared from a pre-established tsunami simulation database and followed by test messages and accompanied by graphical products based on real-time simulation techniques. The graphical products are disseminated exclusively for national tsunami warning authorities of the recipient countries. There is no change to the format of the text messages from the current format.

At the 26th session the ICG/PTWS held in Honolulu, United States of America, from 22 to 24 April 2015 (ICG/PTWS-XXVI), it was agreed that the Northwest Pacific Tsunami Advisory Center (NWPTAC) should proceed with its development of enhanced products for the North West Pacific, targeting 2018 for its complete transition.

3. EXERCISE PACIFIC WAVE 17

3.1 OVERVIEW

Exercise Pacific Wave 17 (PacWave17) intends to support the development of improved tsunami products and procedures, including the Enhanced Products of the Pacific Tsunami Warning Center (PTWC) and the Northwest Pacific Tsunami Advisory Center (NWPTAC) of the Japan Meteorological Agency (JMA).

PacWave17 provides a valuable opportunity for Pacific countries to test the new products, review their tsunami response procedures and test internal and external communication systems. 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.

PacWave17 includes multiple scenarios to enable all Member States to select a distant or regional event that will cause the greatest impact to their country. Each exercise scenario start during the daytime with a dummy message issued by the PTWC, and as needed, by the NWPTAC and the South China Sea Tsunami Advisory Centre (SCSTAC).

3.2 COUNTRY PARTICIPATION

Thirty-four countries (including 6 subnational entities) participated in PacWave17. A summary compiling the exercise evaluation responses is provided at Annex III. Pacific countries and sub-national jurisdictions that participated and submitted post-exercise evaluation forms were:

- Australia
- Brunei Darussalam
- Chile
- China – SOA, Hong Kong
- Colombia
- Cook Islands
- Costa Rica
- Ecuador
- El Salvador
- Federated States of Micronesia – Chuuk, Pohnpei, Kosrae, Yap
- Fiji
- France – New Caledonia, French Polynesia
- Guatemala
- Indonesia
- Malaysia
- Mexico
- Nauru
- New Zealand
- Nicaragua
- Niue
- Palau
- Panama
- Papua New Guinea
- Peru
- Philippines
- Republic of Korea
- Russian Federation
- Samoa
- Singapore
- Solomon Islands
- Thailand
- Tonga
- Vanuatu
- Vietnam

One country provided PacWave17 National Contacts, but did not participate.

This Exercise PacWave17 Exercise Report is based on the post-exercise evaluation data as compiled by the PacWave17 Task Team.

4. CONCEPT OF THE EXERCISE

4.1 PURPOSE

The intent of PacWave17 was to support the development of improved tsunami products and procedures, including the Enhanced Products of the Pacific Tsunami Warning Center (PTWC) and the Northwest Pacific Tsunami Advisory Center (NWPTAC) of the Japan Meteorological Agency (JMA).

The overall aim of PacWave17 was to test the NWPTAC and the PTWC enhanced Products.

4.2 OBJECTIVES

The overall objectives for Exercise PacWave17 were to:

1. Test communications from the PTWS PTWC and NWPTAC Tsunami Service Providers to Member States;
2. Test whether the PTWS PTWC and NWPTAC Tsunami Service Provider products are interpreted by Member States accurately and in a timely manner;
3. Test national and regional communication;
4. Test national and regional cooperation.

Each country was given the opportunity to expand and/or customise its own objectives for the exercise.

4.3 EXERCISE CONCEPT

PacWave17 commenced with a ‘dummy’ kick-off exercise message. Participating countries selected a relevant scenario and its most convenient date and time to conduct the table-top exercise within the 15–17 February 2017 time period. Participating countries were able to amend the exercise messages to suit their own timetable.

All international products were provided online at the Exercise PacWave17 website (http:www.pacwave.info) in advance to help countries plan and prepare.

Each scenario contained a suite of PTWC and JMA NWPTAC enhanced product messages. Countries were advised to note that each centre carries out its forecasting independently, so the forecasts may differ. Likewise, the sea level observations may also differ in the messages of the two international centres since they are based on the centre-independent simulations and/or historical observations.

The earthquake origin default date and time of the messages (e.g. 15 February 2017 @ 0107 hours) was able to be adjusted by participating countries to coincide with their selected table top exercise local date and time. Subsequent message traffic issuance date and times were then also adjusted accordingly.

All documentation and correspondence relating to this exercise was to be clearly identified as Exercise Pacific Wave 17 and For Exercise Purposes Only.

Each country was also welcome to modify estimated arrival times or estimated wave amplitudes to suit their preference for example, to have the arrival of tsunami sooner and with a larger amplitude.

4.4 EXERCISE DELIVERY/FORMAT

Distribution of the series of international messages for each scenario, available on the exercise website, was the responsibility of each country.

Each Exercise PacWave17 National Contact and their Exercise Planning Team could decide whether the exercise scenario messages were made known to the other national, provincial and local agencies prior to the exercise.

During the exercise, the Exercise Control Team could choose to feed the bulletins into the exercise at times of their own choosing, or alternatively put them in envelopes with the time they must be opened written on each, with each key participant agency having their own set of envelopes.

Country Exercise Planning Teams could decide if they wanted to add their own national and/or local injects.

4.5 EXERCISE SCENARIO AND DATE

Exercise Pacific Wave 17 was held within the period of 15–17 February 2017. Participant countries could choose to run their exercise any time between 15 and17 February 2017, allowing flexibility to avoid conflict with other important national events.

PacWave17 was generally recommended to be a table-top exercise, however, the initial notification was a live exercise with the PTWC and the NWPTAC issuing dummy test messages representing live products. Actual messages corresponding to the dummy test messages were available beforehand on the PacWave17 website.

4.6 SCENARIOS

Six scenarios were available that allowed all Pacific countries to select and exercise a distant/regional/local source tsunami event. Countries were asked to choose only one scenario to exercise. The exercise scenarios included major tsunamis generated by great earthquakes in the following areas:

- Manila Trench
- New Britain-San Cristobal Trench
- New Hebrides Trench
- Tonga Trench
- Peru-Chile Trench
- Colombia-Ecuador Trench

The Exercise required Member States to evaluate the incoming PTWC and NWPTAC new enhanced products, issue appropriate country specific alerts by National Tsunami Warning Centres, conduct decision-making, including the steps they would take just prior to public

notification. Member States were able to conduct the exercise through to the community level if they wished (however, this was not a requirement of the exercise).

Each country was responsible for designing its own national, provincial and/or local level exercise(s) in line with the international Exercise Pacific Wave exercise framework.

4.7 EXERCISE TYPE

Participating countries were encouraged to carry out a table-top exercise for Exercise PacWave17 (also referred to as a 'discussion exercise', or 'DISCEX').

In a table-top 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 table-top exercise may involve only key stakeholders, such as the National Tsunami Warning Centre and the National Disaster Management Office, discussing their response to a tsunami threat in a particular area, where the only injects are tsunami messages from the international tsunami warning centres such as the PTWC in Hawaii, which describe the nature of the threat.

4.8 EXERCISE DOCUMENTATION

It was recommended to participating agencies that they take into account the following Exercise PacWave17 documents when planning, conducting, and evaluating the exercise:

- IOC Circular Letter No 2636: Pacific Tsunami Warning and Mitigation System (PTWS) Exercise Pacific Wave 2017 (PacWave17), 15-17 February 2017, issued 16 August 2016

- *Exercise Pacific Wave 17, A Pacific-wide Tsunami* Warning *and enhanced products exercise, 15-17 February 2017. Volume 1: Exercise Manual*. IOC Technical Series No 131. UNESCO/IOC 2016 (English)

- *User's* Guide *for the Pacific Tsunami Warning Center: enhanced products for the Pacific Tsunami Warning System*. IOC Technical Series No 105. UNESCO/IOC rev. 2014 (English, Spanish)

- *Users Guide* for *the Northwest Pacific Tsunami Advisory Center Enhanced Products for the Pacific Tsunami Warning System*. (English, draft January 2017)

- *Operational users guide for the Pacific Tsunami Warning and Mitigation System (PTWS)* (IOC Technical Series No 87), revised in August 2011 (English)

- *How to plan,* conduct*, and evaluate UNESCO/IOC tsunami wave exercises*, IOC Manuals and Guides No 58, 2013 (English, Spanish)

All information related to Exercise Pacific Wave 2017 is available at the exercise website: http://www.pacwave.info

5. EVALUATION

5.1 EVALUATORS

Participating countries were required to appoint their own exercise evaluators to observe and evaluate selected objectives during their exercise. It was recommended that evaluators 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.

5.2 OBSERVERS

The invitation of internal or external agency personnel invited to view the exercise was the responsibility of each participating country.

5.3 EVALUATION TOOLS

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

Evaluation of Exercise PacWave17 focused 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. The evaluation tool aimed to inform and facilitate individual participant country evaluations as well as the Exercise PacWave17, Exercise Report.

All participating countries were asked to complete the official Exercise PacWave17 Evaluation Form (Annex II) by 10 March 2017. Forms were submitted online by visiting https://www.surveymonkey.com/r/pacwave17_eval.

6. POST-EXERCISE EVALUATION FINDINGS

Thirty-four countries, including 6 sub-national entities and agencies participated in the exercise, and submitted evaluation forms. A summary of the findings from the completed evaluation forms is provided in Annex III.

The strong majority of responding countries expressed a positive view of the planning and conduct of PacWave17. Exercise objectives were exercised, evaluated and reported, thus enabling PTWS recommendations and lessons learned to be formulated. PacWave17 reinforced the integration of PTWC enhanced products in their country decision-making processes, and in their Standard Operating Procedures (SOPs).

Countries overwhelmingly found PacWave17 to be a useful way to test their current tsunami SOPs. Countries generally understood the PTWC enhanced products and viewed them as adding important advice to guide them in providing more accurate national warnings.

Although all countries have a good understanding of the PTWC enhanced products and its relation into their national processes and procedures, there is still a need for continued training and exercising. Indications of improvements to PacWave17 were received as countries look to test their tsunami response plans more thoroughly in the future.

The findings from PacWave17 are as follows:

- The majority of participants received the initial exercise kick-off notification messages from PTWC in a timely manner and without any issues.

- The timing of the exercise being early in the year proved difficult for some countries who indicated that they would have had a larger audience if the exercise was not in February.

- The majority of respondents agreed that the format and content of PTWC enhanced products were clear and easy to understand. Some suggestions for improvements were made.

- The majority of respondents indicated the National Tsunami Warning Centres (NTWCs) and National Disaster Management Offices (NDMOs) understood the content of the enhanced products.

- The majority of respondents indicated that they disseminated the warning to emergency services and then to other national agencies. The comments indicated that in the case of a real event they would disseminate the warning to all of the avenues mentioned, however, for the purposes of the exercise, this was done notionally.

- All respondents indicated that the NTWC/NDMO knows its specific response role in the event of a tsunami and the majority of respondents agreed that the NTWC/NDMO has an activation and response process in place for when tsunami warnings are received.

- The majority of respondents used international tsunami forecasts to help assess the tsunami threat to their countries. National tsunami experts followed this closely. Most of the respondents indicated that they used the PTWC and NWPTAC messaging to assess their countries' tsunami threat.

- Half of respondents indicated that tsunami-related curriculum programmes are in place of all levels of education. The comments revealed that many respondents did have some programmes in place, though not for all educational levels and not specific to tsunami.

- A majority of the respondents indicated that they have a tsunami mass coastal evacuation plan. The comments revealed that either some countries were in the process of creating evaluation plans or it was not their agency's responsibility.

- Overall, respondents indicated that the PacWave17 was satisfactory and gave their NTWC/NDMO an opportunity to continue to exercise their tsunami standard operating procedures.

Based on a review of the PacWave17 responses, the following recommendations are made:

(i) **Mass Coastal Evacuation Planning**

Issue: 29% of countries do not have tsunami mass coastal evacuation plans.

Recommendation: IOC/ITIC to provide guidance and support to Member States to develop tsunami mass coastal evacuation plans.

(ii) Community tsunami routes, signage and assembly points

Issue: 20% of countries do not have community tsunami routes, evacuation signs and assembly points for evacuation areas.

Recommendation: Members States ensure their at-risk coastal communities have tsunami routes, evacuation signs and assembly points for evacuation areas.

(iii) Conduct of future exercises

Issue: Not all countries routinely conduct regional/local tsunami exercises. Past PacWave exercises have generally been conducted in controlled, moderately paced timelines, typically using table-Top coordination. Many countries are now ready to move towards a more realistic exercise response timetable.

Recommendation: Future PacWave Exercises should be conducted in real time, initially during daytime working hours with full staffing during normal duty hours. Later, countries should consider conducting real time exercises simulating the presence of minimal staff during nighttime or weekend hours.

(iv) Exercise Timing and Participation

Issue: Short notice to prepare for the exercise (availability of documentation in advance of the exercise). February is a difficult month for many countries due to heightened risk of wildfire, cyclone or summer holidays, which affects planning and participation.

Recommendation:

- IOC to announce future PacWave activities at least 180 days prior.
- Exercise manual to be published 90 days prior as indicated in the Terms of Reference of the Task Team on PacWave Exercises.
- Tsunami Service Providers to provide products at least 1 month prior.
- Exercise PacWave18 to be conducted in November to coincide with Tsunami Awareness Day (5 November) also providing a public education opportunity.

(v) Education

Issue: 47% of respondents do not have tsunami related curriculum programmes in place for all levels of education.

Recommendation: Members States are strongly encouraged to introduce tsunami related curriculum programmes in place for all levels of education.

PTWC and JMA NWPTAC message dissemination summaries can be found in the International Master List of Events table in Annex I.

ANNEX I

INTERNATIONAL MASTER SCHEDULE OF EVENTS LIST

Scenario →	Manila Trench				New Britain-San Cristobal Trench				New Hebrides Trench				Tonga Trench		Peru-Chile Trench		Colombia-Ecuador Trench	
Center →	PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		PTWC		PTWC	
Date & Time (UTC)	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP
15 Feb 1400															Quake		Quake	
1407															1	TI	1	TI
1435															2	TFR	2	TFR
1500															3	TFP	3	TFP
1600															4	TS	4	TS
1700															5	TS	5	TS
1800															6	TS	6	TS
1900															7	TS	7	TS
2000															8	TS	8	TS
2100									Quake				Quake		9	TS	9	TS
2107									1	TI			1	TI				
2120											**1**	**TI**						
2135									2	TFR			2	TFR				
2140											**2**	**TFR**						
2200									3	TFP			3	TFP	10	TS	10	TS
2300									4	TS			4	TS	11	TS	11	TS
2310											**3**	**TS**						
16 Feb 0000									5	TS			5	TS	12	TS	12	TS
0010											**4**	**TS**						
0100	Quake				Quake				6	TS			6	TS	13	TS	13	TS
0107	1	TI			1	TI												
0120			**1**	**TI**			**1**	**TI**										
0135	2	TFR			2	TFR												
0140			**2**	**TFR**			**2**	**TFR**			**5**	**TS**						
0200	3	TFP			3	TFP			7	TS			7	TS	14	TS	14	TS
0230	4	TFH																
0300	5	TS			4	TS			8	TS			8	TS	15	TS	15	TS
0310			**3**	**TS**			**3**	**TS**			**6**	**TS**						
0400	5	TS			5	TS			9	TS			9	TS	16	TS	16	TS
0440			**4**	**TS**			**4**	**TS**			**7**	**TS**						
0500	6	TS			6	TS			10	TS			10	TS	17	TS	17	TS
0600	7	TS			7	TS			11	TS			11	TS	18	TS	18	TS
0610			**5**	**TS**			**5**	**TS**			**8**	**TS**						
0700	8	TS			8	TS			12	TS			12	TS	19	TS	19	TS
0740			**6**	**TS**			**6**	**TS**			**9**	**TS**						
0800	9	TS			9	TS			13	TS			13	TS	20	TS	20	TS
0900	10	TS			10	TS			14	TS			14	TS	21	TS	21	TS
0910			**7**	**TS**			**7**	**TS**			**10**	**TS**						
1000	11	TS			11	TS			15	TS			15	TS	22	TS	22	TS
1040			**8**	**TS**			**8**	**TS**			**11**	**TS**						
1100	12	TS			12	TS			16	TS			16	TS	23	TS	23	TS
1200	13	TS			13	TS			17	TS			17	TS	24	TS	24	TS
1210			**9**	**TS**			**9**	**TS**			**12**	**TS**						
1300	14	TS			14	TS			18	TS			18	TS	25	TS	25	TS
1340			**10**	**TS**			**10**	**TS**			**13**	**TS**						
1400	15	TS			15	TS			19	TS			19	TS	26	TL	26	TL
1500	16	TS			16	TS			20	TS			20	TS				
1510			**11**	**TS**			**11**	**TS**										
1600	17	TS			17	TS			21	TS			21	TS				
1640			**12**	**TS**			**12**	**TS**										
1700	18	TL			18	TS			22	TL			22	TL				
1800					19	TS												
1900					20	TS												
2000					21	TS												
2100					22	TS												
2200					23	TS												
2300					24	TS												
17 Feb 0000					25	TS												
0100					26	TL												

Message Types: TI = PTWC/NWPTAC Initial Text Message
TFR = PTWC/NWPTAC text Message with a Forecast for the Regional near the Earthquake
TFP = PTWC Products with a Pacific-wide Forecast
TFH = PTWC Products with a Forecast for Shallow Marginal Seas (High-Resolution Forecast Model Run)
TS = PTWC/NWPTAC Text Message with Tsunami Observations
TL = PTWC Last Message for this Event

Note 1: Dummy messages will be issued at the time of the earthquake for each scenario.
Note 2: Participating countries may shift the schedule to adapt it to their own timetable.

ANNEX II

EXERCISE PACIFIC WAVE 2017 EVALUATION FORM:
POST-EXERCISE EVALUATION

Exercise evaluation forms are to be completed by each participating agency and forwarded to the country "Exercise Pacific Wave" 2017 National Contact, or the country Tsunami National Contact. **The PacWave17 National Contact will compile the country Evaluation Form and complete and submit this online no later than 10 March 2017**.

Note: Only **one** on-line evaluation form is to be completed per country. The PacWave17 National Contact, TNC, or TWFP should compile sub-jurisdiction evaluations into one country evaluation to submit.

The PacWave17 Evaluation Form can be found at
https://www.surveymonkey.com/s/pacwave17_eval

Alternatively, the country evaluation forms can be submitted by email or fax to the Exercise PacWave 17 Task Team Chairs:

- Laura Kong (email: l.kong@noaa.gov, 1-808-725-6055), or
- Jo Guard (email: jo.guard@dpmc.govt.nz, fax: +64 4 817 8554), or
- Tomoaki Ozaki (email: hokusei@eqvol2.kishou.go.jp).

Exercise Pacific Wave 2017 **Instructions on how to complete this 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 **end** of each section. However, do NOT change the reference numbers to the questions.
2	Each participating Agency/Country	Print this form and mark your evaluation answers on it.
3	Each participating Agency/Country	• Answer each statement with either Y (Yes), N (No). • Comments should be used to explain/expand upon your Yes or No answer Write your comments on the page following the evaluation questions. Note the question number in the left column and write your comments alongside.
4	Each participating Agency/Country	Send completed agency evaluation form to country PacWave17 National Contact so he/she can compile to complete Country PacWave17 Evaluation Form (this URL).
5	PacWave17 National Contact	PacWave17 National Contact should complete and submit the PacWave17 Evaluation Form by **10 March 2017.** (https://www.surveymonkey.com/s/pacwave17_eval). If there are problems or questions, please contact the PacWave17 Task Team co-Chairs: Laura Kong, laura.kong@noaa.gov, Jo Guard, jo.guard@dpmc.govt.nz or Tomoaki Ozaki, hokusei@eqvol2.kishou.go.jp

Exercise Pacific Wave 2017 Evaluation Form Contact Details			
Agency:		**Country:**	
Contact Name:		**Contact Position:**	
Contact Phone:		**Contact Mobile:**	
Contact E-Mail:			

Country Exercise Scenario	
Scenario Used:	**Tick Scenario(s) used during PacWave17:** ○ Manila Trench ○ New Britain-San Cristobal Trench ○ New Hebrides Trench ○ Tonga Trench ○ Peru-Chile Trench ○ Colombia-Ecuador Trench

OBJECTIVE 1

Test communications from the PTWC, and NWPTAC Tsunami Service Providers to Member StatesCountries.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
1.1	Did your country Tsunami Warning Focal Point receive the PTWS and/or NWPTAC information/threat message?				
1.2	If yes, when did you receive the message(s)?	Please state the time:			
1.3	How did you receive the message(s)? ○ GTS ○ AFTN ○ EMWIN ○ Fax ○ Email ○ CISN (Real-Time Earthquake Display) ○ RANET Heads-up SMS	Please list how you received the message			

OBJECTIVE 1

Test communications from the PTWC, and NWPTAC Tsunami Service Providers to Member StatesCountries.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
	○ Other (Please specify):				

OBJECTIVE 2

Test whether the PTWS PTWC/NWPTAC Tsunami Service Provider products are interpreted by Member States accurately and in a timely manner.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
2.1	Information provided by the relevant TSP products was understood by the National Tsunami Warning Centre (NTWC)/National Disaster Management Office (NDMO).	*Y*	*N*	*C*	*NA*
2.2	How did your country assess the tsunami threat during the exercise? Please tick as many as apply: • National tsunami experts • National tsunami coordination committee • National tsunami historical database • NCEI/WDS tsunami historical database (web) • TsuDig historical database GIS tool (NCEI/ITIC offline) • National pre-computed tsunami scenarios • National tsunami forecasts • International tsunami forecasts. Note source of forecasts (PTWC, NWPTAC, US NTWC) in comments. • Communication with outside sources (such as ITIC, media, other). Please specify in the comments section.	*Y*	*N*	*C*	*NA*
2.3	The information provided assisted with decision making, e.g., warning levels, earthquake parameters, estimated arrival times, forecast wave heights, etc.	*Y*	*N*	*C*	*NA*

OBJECTIVE 2

Test whether the PTWS PTWC/NWPTAC Tsunami Service Provider products are interpreted by Member States accurately and in a timely manner.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
2.4	The information issued by our country national Tsunami Warning Focal Point was according to standard operating procedures.	*Y*	*N*	*C*	*NA*

OBJECTIVE 3

*To test national and regional **communication.***

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
3.1	The warning was disseminated to: • Emergency services • Other national government agencies • Science agencies/universities involved in assessment • Local government: provincial/regional level • Local government: city/district level. • Public				
3.2	What time the initial PTWC and/or NWPTAC PacWave17 scenario exercise start message was sent to the agency or agencies listed in Q3.1? Please note the time using 24-hour clock and UTC, e.g., 14:35 UTC.	*Note answer on the following comment page*			
3.3	How did you send the initial PTWC and/or NWPTAC Exercise PacWave17 scenario exercise start message to the agency or agencies listed in Q3.1? • Fax • Email • SMS • Other (Please specify)				
3.4	Did the national disaster management organization (or equivalent) maintain communication with the National Tsunami Warning Centre throughout the event?				
3.5	If you answered yes to Q3D.1, what was the nature of the communication **between the national disaster management organization** (or equivalent) with the **national tsunami warning centre** throughout the event?	*Note answer on the following comment page*			
3.6	Did the national disaster management organisation (or equivalent) maintain communication with **local/regional disaster management organisations** (or equivalent)?				
3.7	If you answered yes to Q3.6, what was the nature of the communication **between the**	*Note answer on the following comment page*			

Y *N* *C* *NA*

OBJECTIVE 3

*To test national and regional **communication.***

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
	national disaster management organization (or equivalent) **with local/regional** disaster management organisations (or equivalent)?				

OBJECTIVE 4

*To test national and regional **cooperation.***

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
4.1	The NTWC/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.				
4.2	The NTWC/NDMO knows its specific response role in the event of a tsunami.				
4.3	The NTWC/NDMO has, prior to the exercise, engaged in tsunami response planning.				
4.4	The NTWC/NDMO has undertaken activities to increase its capacity and capability to support a national tsunami response (for example, training, exercise, etc.) – Note activities in Comment section.				
4.5	The NTWC/NDMO has an appropriate management structure identified and documented to support tsunami response.				
4.6	The NTWC/NDMO has a tsunami mass coastal evacuation plan.				
4.7	Arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response were in place **before** the exercise.				
4.8	A country tsunami emergency response plan (standard operating procedures) for regional/local tsunamis exists.				
4.9	The warning was disseminated to: • Emergency services • Other national government agencies • Science agencies/universities involved in assessment • Local government: provincial/regional level • Local government: city/district level.				

Y *N* *C* *NA*

OBJECTIVE 4 *To test national and regional **cooperation.***

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
	• Public				
4.10	Regional/local tsunami exercises are routinely conducted in-country. Note last exercise in Comments section.				
4.11	Tsunami-related curriculum programmes are in place for all levels of education. Note which levels in Comments section.				
4.12	Do communities have tsunami evacuation maps, routes, evacuation signs and assembly points for evacuation areas? Please note any gaps and future plans to fill gaps.				

GENERAL EXERCISE OBSERVATIONS
Provide feedback on the planning and conduct of PacWave17

Evaluation Statements / Questions. Indicate Yes or No	Yes	No
Overall assessment		
Country stakeholder agencies have a better understanding of the goals, responsibilities and roles in tsunami emergencies.		
Gaps in capability and capacity have been identified.		
Exercise planning (please make comments on the following page to all of the statements below)		
Overall, the exercise planning, conduct, format and style were satisfactory.		
Exercise planning went well.		
The PacWave17 exercise website pages were useful.		
This evaluation form was easy to use.		
PacWave17 Exercise Manual provided an appropriate level of detail.		
IOC Manual & Guides 58: How to Plan, Conduct, and Evaluate IOC Tsunami Wave Exercises was useful.		

Please provide a general statement on your Exercise Pacific Wave 17 experience.

Exercise Planning

Please provide a general statement about **what went well**.
Insert comments

Please provide a general statement about **what did not go well**.

Insert comments

Please provide a general statement about **what could be improved**.
Insert comments

Exercise Conduct

Please provide a general statement about **what went well**.
Insert comments

Please provide a general statement about **what did not go well**.
Insert comments

Please provide a general statement about **what could be improved**.
Insert comments

Exercise Debrief or Evaluation

Please provide a general statement about **what went well**.
Insert comments

Please provide a general statement about **what did not go well**.
Insert comments

Please provide a general statement about **what could be improved**.
Insert comments

ANNEX III

POST-EXERCISE EVALUATION COMPILATION

This Annex contains a compilation of the responses provided by countries to the Exercise PacWave17 post-exercise evaluation form. Altogether, 34 countries submitted forms between February and March 2017.

Surveys were completed through the Survey Monkey online survey and questionnaire tool, or submitted by transmission of the completed survey file to the PacWave17 Co-Chairs. Surveys submitted to the Co-Chairs were then manually inputted into the online tool in order to create a summary comprised of all responses. Some countries submitted multiple evaluations to reflect the participation and experience of these agencies. Where submissions were from different agencies within the same country, these were combined into a single survey to facilitate compilation. The survey was available in English only at https://www.surveymonkey.com/r/pacwave17_eval.

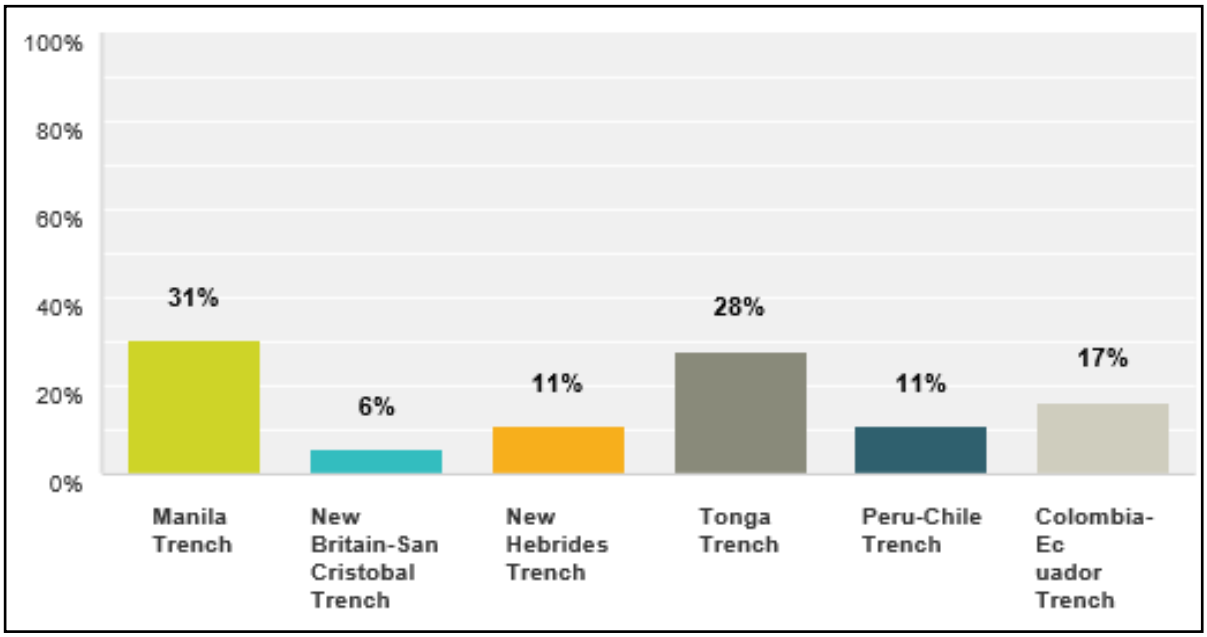
The survey was divided into four sections according to the PacWave17 objectives, and evaluation statements and questions focused on different components of the warning and response process. For each question, a short statement is provided that summarises the responses, and this is followed by comments provided by the countries.

1. Country and Agency: Participation List

	Country	Agency
1	Australia	Australian Bureau of Meteorology
2	Brunei Darussalam	Brunei Darussalam Meteorological Department
3	Chile	Hydrographic and Oceanographic Service of the Chilean Navy
4	China (including Hong Kong)	National Marine Environmental Forecasting Center
5	Colombia	Corporación OSSO /Comisión Colombiana del Océano
6	Cook Islands	Meteorological Service
7	Costa Rica	Comisión Nacional De Prevención De Riesgos Y Atención De Emergencias, Sistema Nacional de Monitoreo de Tsunamis (SINAMOT)
8	Ecuador	Instituto Oceanográfico de la Armada
9	El Salvador	Ministry of Environment and Natural Resources
10	Fiji	Seismology Section, MRP
11	France (Including New Caledonia and French Polynesia)	MRCC Noumea, CEA/DASE/LDG Tahiti - CPPT
12	Federated States of Micronesia (FSM)	WSO Pohnpei, WSO Chuuk, WSO Yap and Kosrae State DCO
13	Guatemala	Instituto Nacional de Sismología, Vulcanología, Meteorología e Hidrología

	Country	Agency
14	Indonesia	Agency for Meteorology Climatology and Geophysics (BMKG)
15	Malaysia	Malaysian Meteorological Department
16	Mexico	National Tsunami Warning Centre (Mexico)
17	Nauru	Nauru Tsunami Focal Point
18	New Zealand	Ministry of Civil Defence & Emergency Management
19	Nicaragua	INETER
20	Niue	Niue Meteorological Service (NDMO)
21	Peru	Directorate of Hydrography and Navigation (DHN)
22	Panama	Autoridad Marítima de Panama
23	Papua New Guinea	Port Moresby Geophysical Observatory (PMGO)
24	Philippines	Philippine Institute of Volcanology and Seismology
25	Republic of Palau	National Weather Service
26	Republic of Korea	Korea Meteorological Administration
27	Russian Federation	Sakhalin Tsunami Warning Center, Federal Service of Russia for hydrometeorology and environmental monitoring
28	Samoa	Ministry of Natural Resources & Environment
29	Singapore	Meteorological Service Singapore
30	Solomon Islands	National Disaster Management Office
31	Thailand	National Disaster Warning Center
32	Tonga	Tonga Meteorological Service
33	Vanuatu	Vanuatu Meteorological Service
34	Vietnam	Vietnam Earthquake Information and Tsunami Warning Center, Institute of Geophysics, Vietnam Academy of Science and Technology

2. **<u>Country Exercise Scenario:</u>** Select scenario used during PacWave17:



A majority of countries (31%) used the Manila Trench tsunami source scenario, while 28% selected the Manila Trench source and 17% selected the Colombia-Ecuador Trench source. The majority has shifted since the last Pacific Wave Exercise in 2015 where nearly half of the countries used the Tonga Trench scenario.

Comments

- The scenario as per PTWC threat message was in essence a regional earthquake/tsunami scenario for Samoa (i.e.>1 hour ETA for the first wave based on the scenario parameters. However the Samoa Coordinating Instructions was generally tailored towards a local event scenario i.e. <1 hour ETA. (Samoa)
- A strong earthquake has an impact on Malaysia. (Malaysia)
- This seismic scenario (Colombia-Ecuador Trench), besides being close to the country, has a historical antecedent. (Costa Rica)
- Due location it was interesting for Mexican agencies management. (Mexico)
- This scenario is known by historical data that had impacts on the coast of Panama. (Panama)
- Message all received by email and RSFTA. (New Caledonia)

<u>More than two scenarios used</u>

- Tonga Trench and Peru-Chile Trench (Republic of Korea)

Objective 1

Test communications from the PTWC, and NWPTAC Tsunami Service Providers to Member State Countries.

3. Did your country Tsunami Warning Focal Point receive the PTWS and/or NWPTAC information/threat message?

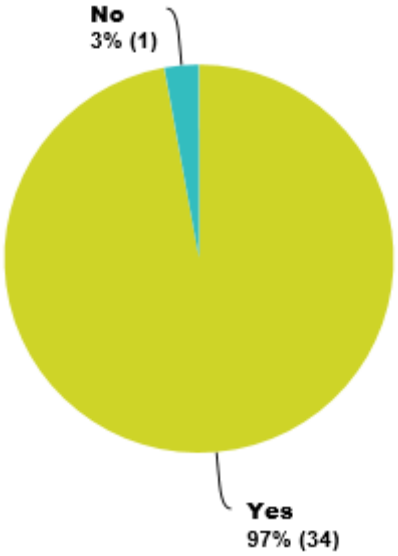


Figure 1**:** Receipt of initial PTWS information/threat message (text product).

The majority of respondents to this question indicated that the initial exercise kick-off message was received (97%). One respondent indicated that the message was not received, and others used the online messages for their exercise. For those that received the message, it was received in a timely manner.

4. If yes, when did you receive the message(s)? Please provide date and time using 24 hours clock and UTC.

Received time

Scenario	Sent Time	Received Time
New Britain-San Cristobal Trench	2/16 01:07	01:00 by Email (Federated States of Micronesia)
		01:00 by GTS, Fax & Email (Russian Federation)
Tonga Trench	2/15 21:07	21:00 by Email (Colombia)
		21:00 by Fax & Email (French Polynesia)
		21:01 by GTS & Email (Australia)
		21:01 by AFTN & Email (New Zealand)
		21:01 by Email & Fax (Solomon Islands)
		21:08 by Email (Niue Island)
		21:00 Email (Samoa)
		19:00 (2/17) GTS, AFTN, EMWIN & Email (Cook Islands)

Scenario	Sent Time	Received Time
		00:30 (3/20) by GTS (Republic of Korea)
		N/A by Email (Fiji)
		Simulated (Tonga)
Colombia-Ecuador Trench	2/15 14:07	14:01 by Email & CISN (Nicaragua)
		14:02 by Fax & Email (El Salvador)
		14:00 by Email (Costa Rica)
		14:12 by Email (Mexico)
		14:01 by Email (Panama)
		14:02 by Fax & Email (Guatemala)
		14:01 by Fax & Email (Ecuador)
New Hebrides Trench	2/15 21:07	21:00 by AFTN & Email (New Caledonia)
		21:00 by Email (Nauru)
		08:10 by Email (Vanuatu)
Manila Trench	2/16 01:07	01:00 by GTS, Fax & Email (Thailand)
		01:01 by Email (Papua New Guinea)
		09:01 by GTS, Fax & Email (Malaysia)
		02:44 by Fax & Email (Indonesia)
		01:01 by Fax, Email & CISN (Vietnam)
		01:00 by Fax & Email (China)
		01:00 by Fax & Email (Philippines)
		09:00 by GTS, Fax & Email (Brunei Darussalam)
		01:00 by GTS, Fax & Email (Singapore)
		01:00 by Fax & Email (Republic of Palau)
Peru-Chile Trench	2/15 14:07	14:14 by Email (Chile)
		14:01 by Fax & Email (Ecuador)
		09:00 by AFTN Fax & Email (Peru)

Not received

- At the moment, Fiji's TNC & TWFP contacts are outdated and process is underway to formalise and update these positions through Foreign Affairs. Mr Rajendra Prasad (IOC Representative of Fiji) act on behalf of PTWS (Fiji).

5. How did you receive the PTWC text message? Please tick all methods that apply.

The majority of countries indicated that they received the initial text product by email (91%). Fax was the next most common form of receipt (42%). Other methods of receipt include GTS, AFTN and EMWIN.

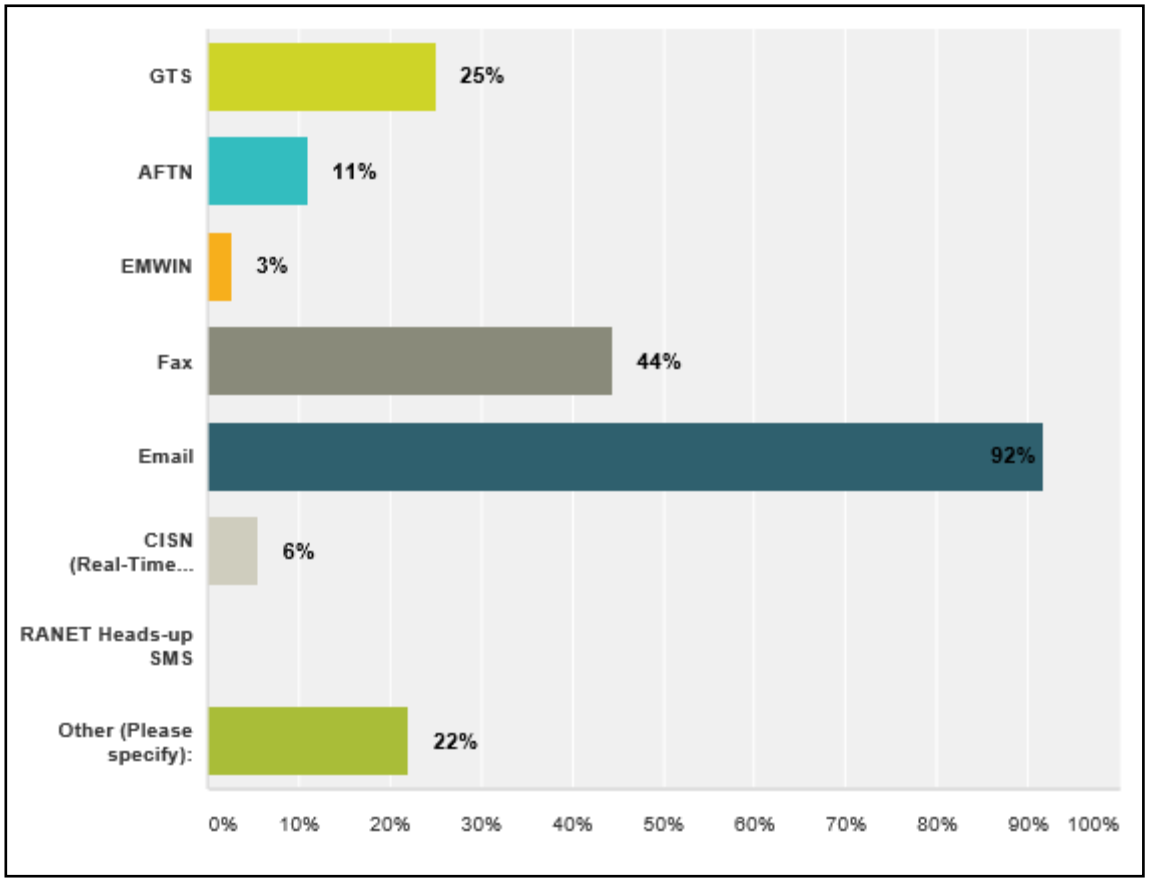


Figure 2**:** Methods of receiving the PTWC text message (more than one option could be chosen).

Comments

- We only received the dummy message of the start of exercise. (Nicaragua)

Not Received

- There was no live message coming in on the date of the exercise so we used the pre-emailed messages for Pohnpei station. Chuuk and Yap Station received all messages live. (FSM)

- Nothing was received via EMWIN, CISN or SMS; the Tsunami Warning Focal Point was on duty travel however, the nominated alternative did not even receive any email or SMS. (Samoa)

Objective 2

Test whether the PTWS PTWC/NWPTAC Tsunami Service Provider products are interpreted by Member States accurately and in a timely manner.

6. Information provided by the relevant TSP products was understood by the National Tsunami Warning Centre (NTWC)/National Disaster Management Office (NDMO).

Almost all responses to this question (94%) agreed that the PTWC products are useful and understood.

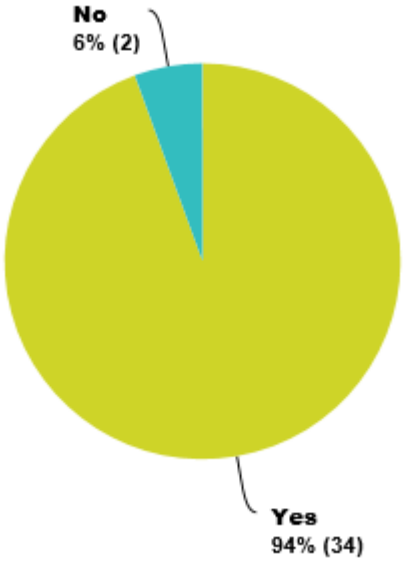


Figure 3**.** Information provided in the PTWC products (text and enhanced) was understood by and useful to the National Tsunami Warning Centre (NTWC)/National Disaster Management Office (NDMO).

Comments

- National tsunami warning templates were used to translate this message into local threat language and impact. The National Tsunami Warning Centre picked up inconsistencies. Details in the exercise PTWC threat message should be checked for consistency/accuracy relative to participating countries prior to exercise execution e.g. the time for bulletin issuance, earthquake origin time, and estimated times of wave arrival were out of sync with the Samoa Coordinating Instructions. (Samoa)

- Australia possesses its own independent tsunami detection and threat assessment capability and the Joint Australian Tsunami Warning Centre (JATWC) did not use the TSP products. (Australia)

- This is because the BDMD was not able to participate in the PacWave17 Exercise, due to unforeseen technical issue, which BDMD was not able to resolve in time. (Brunei)

- The operator translate to Spanish the most relevant information to send to Civil Protection Service of Panama (SINAPROC), Emergency Operations Centre (COE). (Panama)

7. How did your country assess the tsunami threat during the exercise?

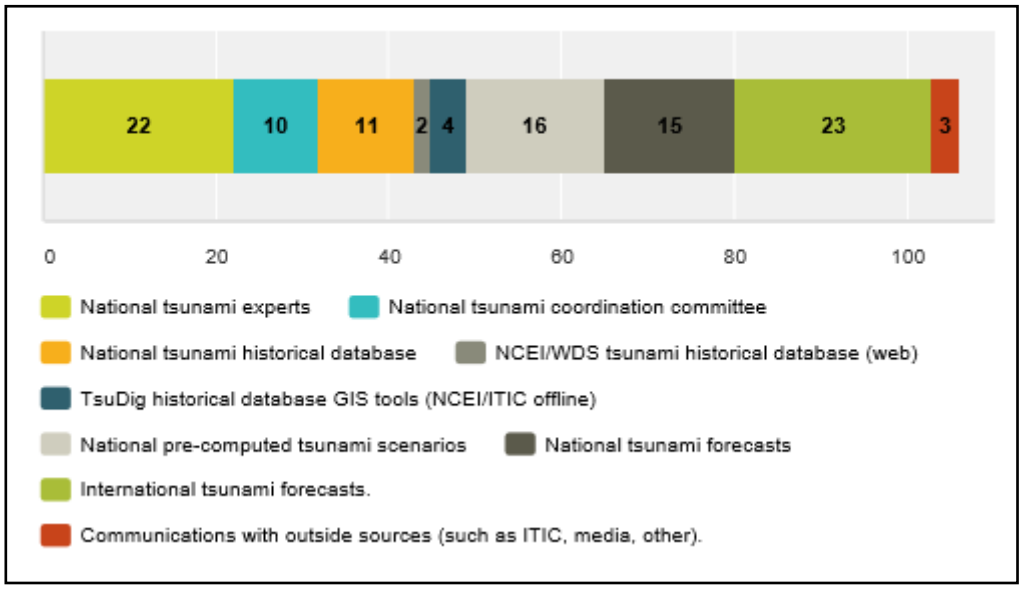


Figure 4. Assessment methods of tsunami threat messages

Comments

The following information highlights responses from countries:

- The determination of threat was based on the historical tsunami event that affected Samoa in 2009. (Samoa)
- We applied COMMIT Most Model. (Ecuador)
- In a real event, we would communicate with outside sources but in this exercise, we did not. (New Zealand)
- National tsunami historical database and National pre-computed tsunami scenarios only in local scenarios. (El Salvador)
- Assessment of tsunami threat was made after comparing the national and international forecasts such as PTWC, NWPTAC and SCSTAC. (Malaysia)

8. The information provided assisted with decision-making, e.g., warning levels, earthquake parameters, estimated arrival times, forecast wave heights, etc.

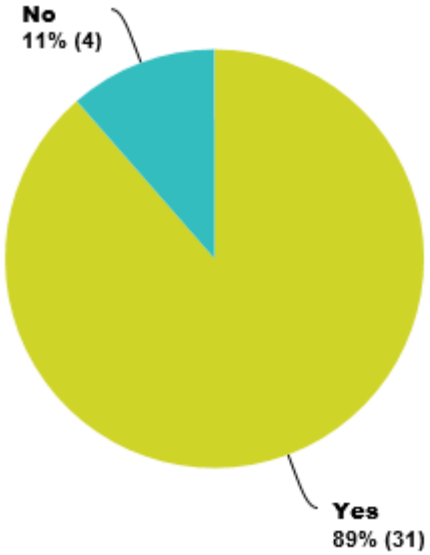
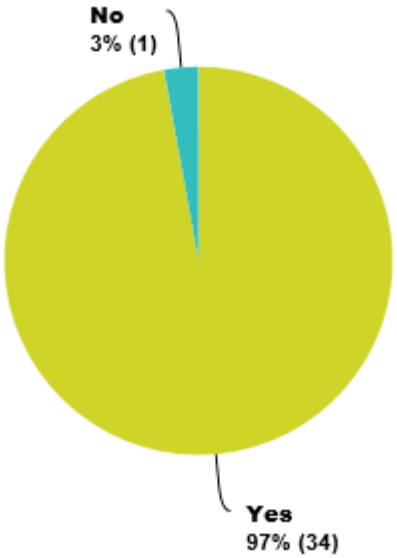


Figure 5**.** Components of the PTWC product suite were understood and useful.
Threat information through time in PTWC products was timely, understood and useful.

Comments

- Yes, however it was noted that an estimated wave height was not initially provided in the PTWC threat message. (Samoa)
- Australia made use of its own independent tsunami detection and threat assessment capability. (Australia)
- According to the Standard Operational Procedures (POE) of the SNAM for "Near Field" events, there is realized the evaluation of the tsunami threat to the Chilean coasts by means of the Integrated Forecasting and Tsunami Warning System (SIPAT), in consequence, the TSP products were used for comparing later information and for analysing possible new actions. (Chile)

9. The information issued by our country national Tsunami Warning Focal Point was <u>according</u> to standard operating procedures.



<u>Figure 6</u>. Information issued by our country was according to standard operating procedures.

Comments

- Emergency protocols were followed in accordance with the NTWC SOP for earthquake/tsunami. Based on the evaluation of the initial PTWC threat message, a tsunami watch was issued. However, in a real event, this will not be the practice, as according to the Samoa Threshold Table a warning must be issued. (Samoa)

- The JATWC (also as TWFP) has well developed standard operating procedures which were followed throughout the exercise.(Australia)

Objective 3

To test national and regional coordination

10. The <u>warning</u> was disseminated from your agency to?

A majority of responses to this question (73%) disseminated the tsunami warnings to emergency services. This is followed by Other National Government Agencies (52%) and Local Government/Provincial/ Regional Level (48%). A small amount of respondents disseminated their information to science agencies/universities.

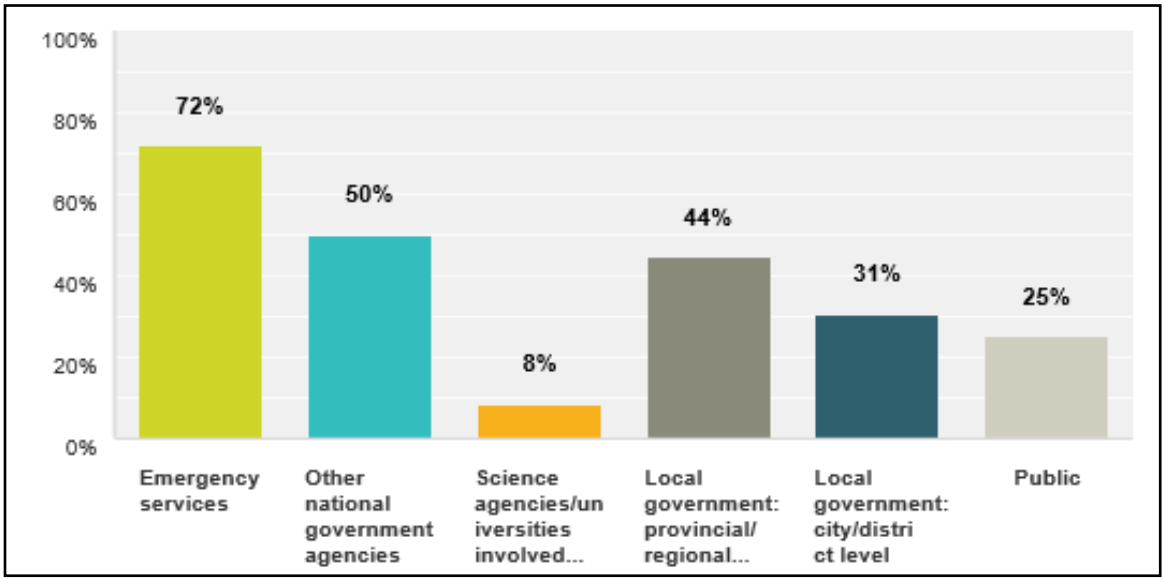


Figure 7. Where the warning was disseminated to
(NB: Over 100% as information was disseminated by Countries to more than one of the above avenues).

Comments

- Advisories were also disseminated simultaneously (Tsunami e-mail group). (Vanuatu)
- The warning was disseminated to Risk Management office Guayaquil SGR. (Ecuador)
- The warning was disseminated using a customized message, not the PTWC message. (Costa Rica)
- For the purposes of the exercise, only one village in the Southern Coast of Upolu Island was invited to participate. The message went to the designated recipients of the village warning and evacuation response teams. (Samoa)
- Tsunami warnings were distributed to the Department of Defence, New South Wales State Emergency Services (NSW SES), and Surf Life Saving Australia. (Australia)
- Note that this was done notionally in this exercise only. (New Zealand)
- The Tsunami Threat bulletin was spread to the ONEMI (National Office of Emergency of the Department of the Interior and Public Security), CSN (National Seismological Center) and to the Maritime Authority. (Chile)
- In the country, there is an organization for emergency care, based on three levels national, local government and community, some attempt to integrate the three in the exercise. (Costa Rica)
- The exercises was conducted internally (within the agency only). It was not disseminated outside PHIVOLCS. (Philippines)

- For this exercise, we focused mainly on testing the communications between Singapore NTWC, PTWC and NWPTAC, and to be familiar with the advisory products.(Singapore)

- To the Emergencies Operations Centre of SINAPROC. (Panama)

11. What time the initial PTWC and/or NWPTAC PacWave17 scenario exercise start message was sent to the agency or agencies listed in Q3.1? Please note the time using 24 hour clock and UTC, e.g., 14:35 UTC.

Scenario	Sent Time	Received Time
New Britain-San Cristobal Trench	2/16 01:07	01:00 (Federated States of Micronesia)
		01:03 PTWC; 01:01 NWPTAC (Russian Federation)
Tonga Trench	2/15 21:07	21:10 (Colombia)
		N/A (Australia)
		21:27 (New Zealand)
		21:01 (Solomon Islands)
		21:15 (Niue Island)
		See comments (Samoa)
		19:12 (Cook Islands)
		00:30 (3/20) by GTS (Republic of Korea)
		20:00 Simulated table-top (Tonga)
		2136 Fiji
Colombia-Ecuador Trench	2/15 14:07	14:05 (Nicaragua)
		14:02 (Email); 14:07 (Fax) (El Salvador)
		14:13 (Ecuador)
		14:19 (Costa Rica)
		08:15 (Mexico)
		14:17 (Panama)
		14:10 (Guatemala)
New Hebrides Trench	2/15 21:07	21:08 (New Caledonia)
		22:00 by Email (Nauru)
		08:15 (Vanuatu)
Manila Trench	2/16 01:07	N/A (Thailand)
		01:15 (Papua New Guinea)
		00:50 (Malaysia)
		01:10 (Indonesia)
		01:11 (Vietnam)
		01:35 (China)
		14:00 (2/15) (Philippines)
		N/A (Brunei Darussalam)
		N/A (Singapore)
		01:07 (Republic of Palau)

Scenario	Sent Time	Received Time
Peru-Chile Trench	2/15 14:07	14:09 (Chile) 00:00 (Peru)

Comments

- Samoa did not wait for the PTWC PCWAVE17 messages to be received because of the time it decided to carry out its exercise. However the same messages contained in the PACWAVE17 Coordinating Instructions were used and were injected initially at 7:45am Samoa local time on 15/2/2015 which was hand delivered by the Exercise evaluator at the NTWC. (Samoa)

- 1127 NZDT 15 February 2017 (2227 UTC 14 February 2017) – Note that we conducted our exercise at a time that suited us, and did not use the Dummy Kick-off messages to initiate our exercise. (New Zealand)

- Approximately times were: (from the national to the local level); 14.00 UTC...14.06 UTC....14.38 (Costa Rica)

12. What time the initial PTWC and/or NWPTAC PacWave17 scenario exercise start message was sent to the agency or agencies listed in Q3.1? Please note the time using 24 hour clock and UTC, e.g., 14:35 UTC.

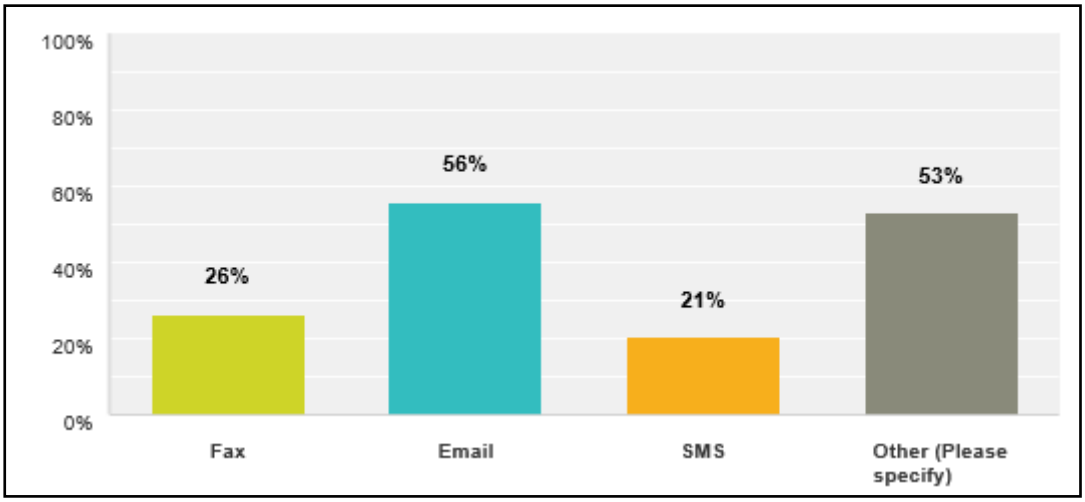


Figure 8.How exercise start messages were sent to the agencies listed in 3.1
(NB: Over 100% of the information was disseminated by countries
to more than one of the above avenues).

Other

- Initial exercise scenario messages were sent to NDMO via fax and landline in order to make sure phone lines were in good working order and to confirm that NDMO receives each messages. (Palau)

- Radio (Guatemala)

- Telephone, Radio Network (Costa Rica)

- N/A - Tabletop exercise (Tonga)

- Government Internal Network (China)
- Telephone calls were also made to the key members of Tsunami Warning committee to follow up on the emailed and faxed messages sent. (FSM)
- Tsunami warning was disseminated to all relevant stakeholders/Partners and rural communities for taking pro-active actions. (Solomon Islands)
- Digital VHF radio was also used to relay all the local bulletins that were issued throughout the exercise; email was only used to relay the message from the NTWC to the National Emergency Operation Centre. (Samoa)
- Radio and Facebook (Cook Islands)
- The bulletin N°1 spread by the SNAM was sent by e-mail, maritime network of communications DATAMAR2 and VHF. (Chile)
- Cellular phone (Panama)
- Call by phone (New Caledonia)

13. Did the national disaster management organization (or equivalent) maintain communication with the National Tsunami Warning Centre throughout the event?

A large majority of counties maintained communication with the National Tsunami Warning Centre throughout the event (78%), while a small proportion did not (24%).

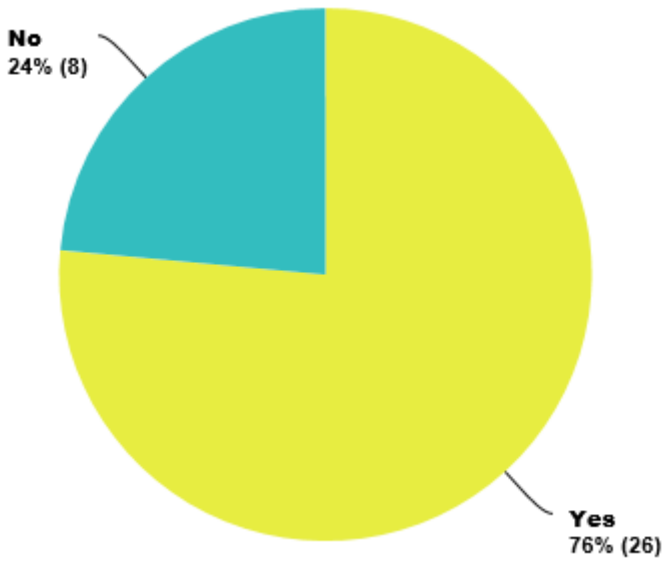


Figure 9. Majority of countries that maintained communication with the National Tsunami Warning Centre throughout the event.

Comments

- Phone contacts were maintain. (Nauru)
- Table-top exercise to check sops so everyone was sitting around the table. (Tonga)

- Via VHF radio and mobile telephones. (Samoa)

- The NDMO did not participate in this exercise. However, NSW SES maintained communication with the JATWC during PacWave17. The NDMO is not the primary emergency response agency in Australia. (Australia)

- In this exercise we are the same entity – MCDEM (New Zealand)

- We provide communication with BMKG's regional station in Manado and Ternate throughout the event by video conference "skype". (Indonesia)

- Initial exercise scenario messages were sent to nemo via fax and landline in order to make sure phone lines were in good working order and to confirm that nemo receives each messages. (Palau)

14. <u>If</u> you answered yes to Q3.1, what was the nature of the communication between the <u>national</u> disaster management organization (or equivalent) with the national tsunami warning centre throughout the event?

<u>Nature of communication</u>

- WSO KOROR maintains communication with nemo via landline to make sure phone lines are working and that nemo receives each messages. (Palau)

- Every day for the information about disasters. (Guatemala)

- NTWC sent messages to DMO giving updates. (Costa Rica)

- Email and phone. (Nauru)

- Cross check of SOPs. (Tonga)

- The warnings cover (1) prediction of arrival time and height of tsunami, (2) real time water levels at tide gauge stations of affected areas, (3) General advice. (China)

- YES. PTWC was on standby throughout the whole exercise.(FSM)

- Tsunami warning was disseminated to all relevant stakeholders/Partners and rural communities for taking pro-active actions. (Solomon Islands)

- To relay information on the tsunami threat that has been issued, and to clarify further details on at risk areas on the islands. (Samoa)

- Linking the SOP of the TWC and that of the Cook Islands is essential for good communications. This role was played by EMCI in ensuring that any personnel left out by the TWC is addressed by them. EMCI had other stakeholders not on the government server and had also the interest of the nation through the private sector, the commercial sector and those that a vulnerable at times like this. This dialogue between the 2 parties has been an on-going process in ensuring each other that they are on the same wavelength as far as the warning is concerned. (Cook Islands)

- In accordance with national protocols. (Colombia)

- Meeting and discussions to determine the appropriated cause of actions to executing tasks. (Niue Island)

- Discussions were held between MCDEM and GNS Science (both co-located in the National Crisis Management Centre). I.e. the Emergency Management organization working with the Science advisors to determine the level of threat to New Zealand and to determine what advice to give the responding agencies, the media and the public. (New Zealand)

- Radio and Phone. (Nicaragua)

- According to the regulations under normal conditions. (Russian Federation)

- Phone Communications (Papua New Guinea)

- Radio, FAX and messages (SMS). (El Salvador)

- The nature of the communication between the SHOA and ONEMI was to transmit the evaluation of the tsunami threat for Chile, detailed the possible tsunami's amplitudes ranges for the region and later to send the arrival time of the tsunami waves and monitoring of the sea level stations. Finally, the communication was to spread the cancellation of the simulated event during the exercise. (Chile)

- When to issue a tsunami warning and tsunami termination bulletin. (Malaysia)

- Just for information about the drill. (Mexico)

- Through phone, email and fax. (Fiji)

- Via cellular phone. The radio failed, and the fax was out of service.(Panama)

15. Did the national disaster management organization (or equivalent) maintain communication with local/regional disaster management organizations (or equivalent)?

A large majority of counties maintained communication with the local/regional disaster management organisations throughout the event (71%) while nearly a third of counties did not (29%).

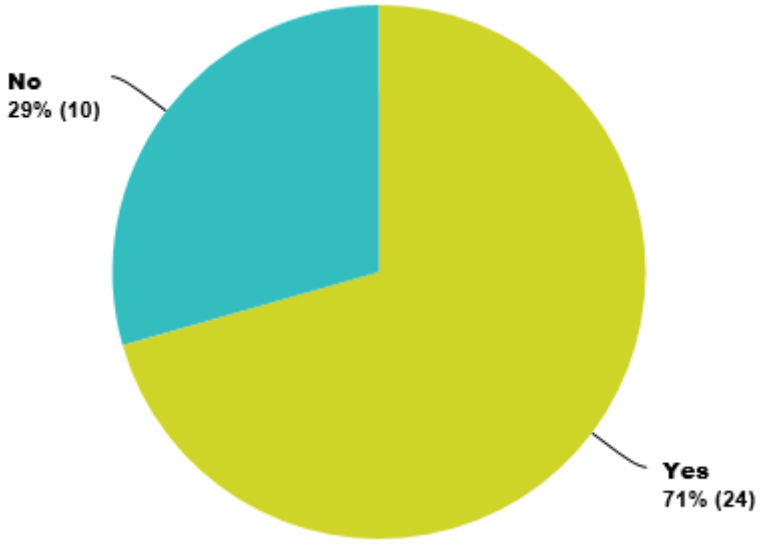


Figure 10. Majority of countries that maintained communication with the local/regional disaster management organisation.

Comments

- NDMO staff did not always call WSO KORRO to acknowledge receipt of all messages. WSO staff had to call to make sure they received the messages.(Palau)
- DMO regularly communicated information received from the NTWC to the village that participated as well as the response agencies and sectors to enable them to provide first response actions to the at risk/affected areas.(Samoa)
- With Disaster Managers of Government Agencies. (Cook Islands)
- The JATWC communicated with NSW SES by telephone. (Australia)
- This was done notionally in this exercise. (New Zealand)
- As part of the event attendance process itself. (Costa Rica)

16. If you answered yes to Q3.6, what was the nature of the communication between the national disaster management organization (or equivalent) with local/regional disaster management organizations (or equivalent)?

Nature of Communication

- To re-transmit the information received from NTWC. Also monitoring, coordinating, and discussing possible impact. (Costa Rica)
- Email and phone. (Nauru)
- Table-top consultations. (Tonga)

- Technical advice, particularly on the interpretation of tsunami forecasts and situation reports. (China)

- Tsunami warning was disseminated to all relevant stakeholders/partners and rural communities for taking pro-active actions. (Solomon Islands)

- Information to the villages were on evacuation of at risk areas in the villages and also to for villages to relay back information on emergency needs as well as casualties. DMO also maintained communication with response agencies and sectors to provide first aid and medical assistance, and food relief, as well as assistance for foreigners who were in the affected area, etc. (Samoa)

- To ensure there is someone in each agency that is familiar with the warning process as well as their respective SOP. (Cook Islands)

- In accordance with national protocols. (Colombia)

- Checked PTWC bulletins as they were received. Carried out (notional) response and evacuation activities. Advised land evacuation for specific areas of New Zealand's coastline. Getting (notional) information on initial impact assessments. (New Zealand)

- The national DMO have communication with local/regional DMO via radio. (Nicaragua)

- According to the regulations under normal conditions. (Russia)

- Phone comms, email. (Papua New Guinea)

- Radio, messages (SMS) and telephone. (El Salvador)

- The nature of the communication between central ONEMI and ONEMI's field unit Coquimbo was to transmit the evaluation of the tsunami threat, as well as all the information issued by the SNAM and to carry out the local coordination's of the actions needed for the simulated event. (Chile)

- Issuance of tsunami warning and tsunami termination. (Malaysia)

- SMS, Fax, Email and 'skype'. (Indonesia)

- Telephone, Fax, Email. (Vietnam)

- Telephone and Fax. (Philippines)

- Just for information. (Mexico)

- Through phone, email and fax. (Fiji)

- Via radio. (Panama)

17. The NTWC/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.

All countries noted that there is an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.

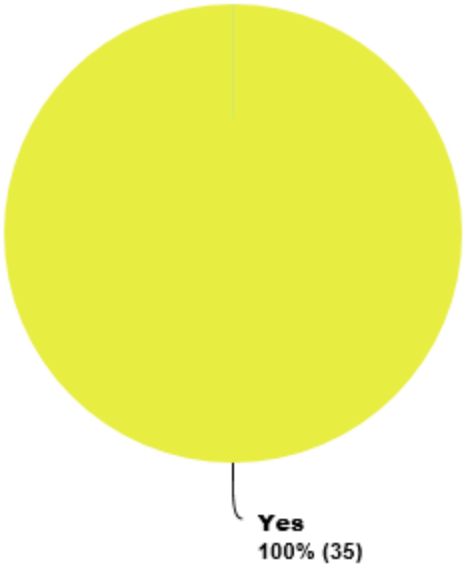


Figure 11. The NTWC/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.

Comments

- Tsunami Support Plan (Nauru)
- These were finalized about 2 months ago and this exercise was timely to test the SOP. (Cook Islands)
- The NTWC of PANAMA was activated. (Panama)

18. The NTWC/NDMO knows its specific response role in the event of a tsunami.

All countries noted that the NTWC/NDMO know its specific response role in the event of a tsunami.

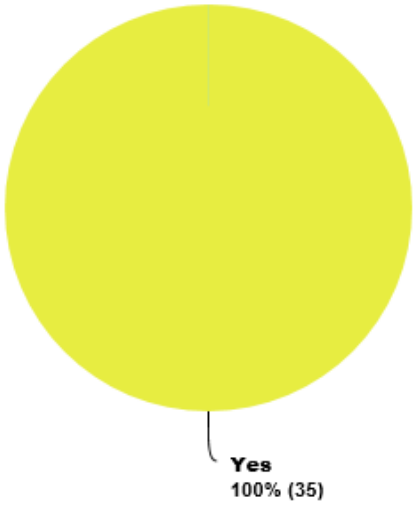


Figure 12. The NTWC/NDMO knows its specific response role in the event of a tsunami.

Comments

- NTWC is the authoritative agency for tsunami warning dissemination while the NDMO facilitates the distribution of such a warning. (Cook Islands)

19. The NTWC/NDMO has, prior to the exercise, engaged in tsunami response planning.

All countries indicated that they had engaged in tsunami response planning prior to the exercise.

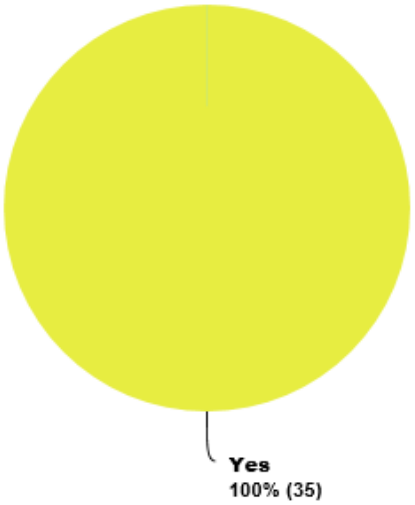


Figure 13. The NTWC/NDMO has, prior to the exercise, engaged in tsunami response planning.

Comments

- With relevant agencies. (Nauru)
- Both the NTWC and NDMO have engaged tsunami response planning in the past, during previous PCWAVEs, real events, TWS reviews, national and village level simulation exercises. Briefings were also conducted prior to the exercise. (Samoa)
- The local committee met on Feb 9th to brief NTWC and NDMO on the Pacwave2017 Exercise. (Cook Islands)
- Tsunami response planning is the responsibility of regional authorities in Australia. To ensure national consistency, the plans are shared and coordinated by the Australian Tsunami Advisory Group (ATAG) which brings together the JATWC, NDMO and regional emergency services representatives. (Australia)

20. The NTWC/NDMO has undertaken activities to increase its capacity and capability to support a national tsunami response (for example, training, exercise, etc.) – Note activities in Comment section.

A majority of countries has undertaken activities to increase its capacity and capability to support a national tsunami response (91%). While a small amount have not (9%).

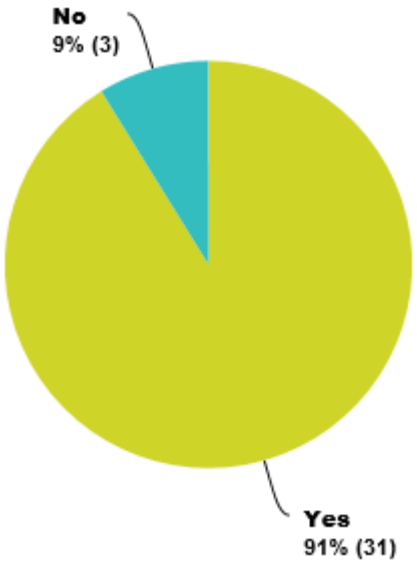


Figure 14. The NTWC/NDMO has undertaken activities to increase its capacity and capability to support a national tsunami response (for example, training, exercise, etc.) – Note activities in Comment section.

Undertaken activities:

- Conducting evacuation drills for education. (Nauru)
- Tsunami awareness radio and tv programs. (Tonga)
- We participated in previous national and village level drills and exercises including previous PCWAVEs, village/location based tsunami risk mapping, training such SOP and exercise writing, AIIMs, review of national TWS, development of TWS and siren

SOPs, village-based contingency planning through the community disaster and climate risk management program, etc. (Samoa)

- A talkback show was done on the national radio, a meeting with stakeholders were called to brief all on what is needed if they have SOPs in place. Assistance was rendered to those in need. (Cook Islands)

- Training to local authorities and National exercise. (Colombia)

- Staff competency training (renewable every three years). Tsunami Decision Support Tool software development project. (Australia)

- New Zealand undertook a nation-wide tsunami exercise in August and September 2016 focusing on a regional source scenario. We have also had four recent real events: (i) East Cape Earthquake and Tsunami (2 September), (ii) Kaikoura Earthquake and Tsunami (14 November), (iii) Solomon Islands Tsunami (9 December 2016) and (iv) PNG Tsunami (17 December 2016). All events and exercises have provided a great learning opportunity and have allowed assessments of holistic tsunami risk management nationally and locally. There are notable advances in understanding tsunami risk, assessing reduction and mitigation measures and learning how to respond to such from tsunami. A number of updates to New Zealand guidelines, and operating procedures have occurred since as a result. (New Zealand)

- Meetings, capacitation, training, drills. (Nicaragua)

- Regional (local) tsunami exercises with NDMO, trainings with NDMO and tsunami experts and staff. (Russia)

- Meeting for clarify the exercise. (Thailand)

- NTWC/NDMO collaborated in conducting tsunami drills and tsunami workshops and campaigns. (Malaysia)

- NTWC conducted Table Top eXercise (TTX) in local DMO (BPBD), local government, media to established and/or examine their SOP on response of tsunami. (Indonesia)

- Information, dissemination, sensitization, identification of vulnerable areas. (Costa Rica)

- National Tsunami Warning Center conducted a tsunami exercise last year at a city in Hainan province. (China)

- Training Warning system Drills. (Mexico)

- Inter-agency briefings and table-top exercises on tsunami response and coordination were conducted in 2016. (Singapore)

- We have participated in training and meetings with SINAPROC to coordinate the activities in case of tsunami threat. (Panama)

21. The NTWC/NDMO has an appropriate management structure identified and documented to support tsunami response.

The majority of respondents (91%) stated that their countries NTWC/NDMO has an appropriate management structure identified and documented to support a tsunami response. Those who stated that they did not also noted that they are in the midst of upgrading their capabilities.

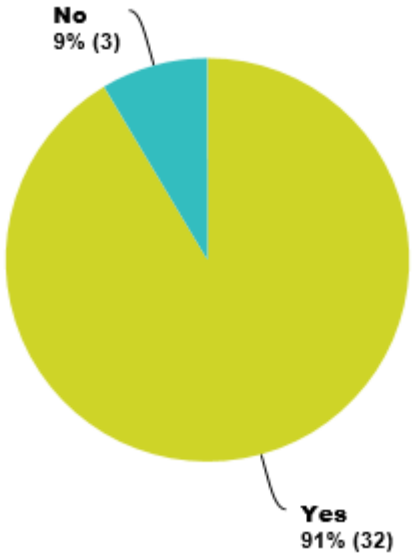


Figure 15. The proportion of NTWC/NDMO who has an appropriate management structure identified and documented to support tsunami response.

Comments

- Although we still need to develop functional SOPs for the NEOC and also NTWC which is one of the key areas that was identified following this exercise. (Samoa)
- A comprehensive document structure is in place at the JATWC. The JATWC is also working towards quality management ISO 9001 certification. (Australia)
- It has a structure that is constantly under construction and adaptation to events of any nature, the lack of frequency of tsunamis generates a lack of awareness regarding their potential danger. (Costa Rica)
- No - Actually, we are improving our centre. (Panama)

22. The NTWC/NDMO has a tsunami mass coastal evacuation plan.

The majority of respondents (71%) stated that their countries NTWC/NDMO has an appropriate management structure identified and documented to support a tsunami response. Nearly one third of countries stated they did not (29%). Of the countries that stated they did not have a tsunami mass coastal evacuation plan, it was explained that it was either in development or it is not their agency's responsibility.

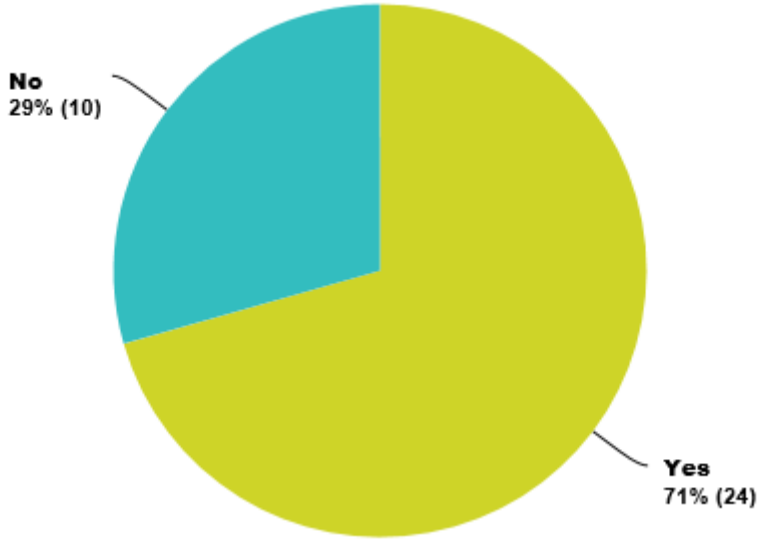


Figure 16. The proportion of NTWC/NDMO that have mass coastal evacuation plans.

Comments

- NEMO has a tsunami support plan in place which covers evacuation routes and maps identifying evacuation shelters but a detailed evacuation plan has not been formalized as of yet. This plan is pending. (Palau)
- We are into, in Sipacate-Escuintla. (Guatemala)
- Need expert to help Nauru build CEP. (Nauru)
- Partly. (Tonga)
- The Solomon Islands have a tsunami sub-plan, but in an event when tsunami is approaching, the NDMO and its stakeholders will disseminate warnings and recommend mas evacuation for the most vulnerable areas like the coastal communities. (Solomon Islands)
- As part of the national tsunami hazard plan. (Samoa)
- Only for some coastal towns. (Colombia)
- The NDMO is the not the responsible agency for coastal evacuation. Coastal evacuation plans are the responsibility of regional authorities in Australia. Each state/territory emergency service organization has its own mass coastal evacuation plan for tsunami. (Australia)

- No. The National Disaster Management Office (Dirección General de Protección Civil, DGPC) has a tsunami contingency plan, approved nationally. In addition, there´s a coastal evacuation plan at local level for every local village involving the participation of community commissions. (El Salvador)

- In some areas only. (Philippines)

- As the national tsunami warning agency, we have several county level evacuation maps for specific counties along China coastline. (China)

- Not yet, we are working on it. Just on some places. (Mexico)

- For Fiji, existing evacuation plan is only for most of the major urban areas of the country. Work is in progress to include all coastal areas evacuation plan for the country. (Fiji)

- We are working on it. (Panama)

23. Arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response were in place before the exercise.

The majority of respondents (91%) stated that their countries have arrangements to assemble the in-country disaster management group relevant to decision making on tsunami warning and response were in place before the exercise. A small proportion did not (9%), however, in these cases it was stated that these groups exist but were not included in their individual exercises.

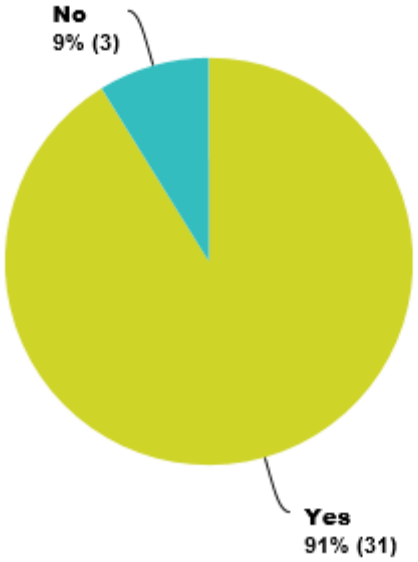


Figure 17: The proportion of countries that have arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response were in place before the exercise.

Comments

- Emergency agencies only. (Nauru)

- Nemc. (Tonga)

- The disaster management group includes the JATWC and representatives from state/territory emergency service organizations. (Australia)

- MCDEM, GNS Science and GeoNet (a monitoring programme housed within GNS Science) regularly collaborate before and during tsunami events. Collaboration occurs through the national tsunami risk management programme, run by MCDEM and includes, but is not limited to yearly duty team catch-ups where personnel from both agencies meet to discuss advances in work programmes and share ideas and experiences about: advancing risk reduction, readiness, and response; improving risk assessment, science understanding and its application into policy; early warning systems, public education, evacuation planning, built environment impacts and broader impact assessments, vertical evacuation planning and preparedness. Part of the national tsunami risk management programme is the National Tsunami Working Group support all items and deliverables associated with the work programme. The Group comprises local council hazard and emergency managers, GNS Science, NIWA, MCDEM and as required other central government agencies. The group supports any required high-level decision making. During a response, the Tsunami Experts Panel reports to GeoNet to provide detailed advice on tsunami threat assessments to support evacuation decisions. (New Zealand)

- We make the arrangements in the Institute of Geoscience at University of Panama. (Panama)

24. A country tsunami emergency response plan (standard operating procedures) for regional/local tsunamis exists.

The majority of respondents (86%) stated that their countries have tsunami emergency response plans for regional/local exists. A small proportion did not (14%) however it was noted that either they are in development or sit outside of their organization and exercise arrangements.

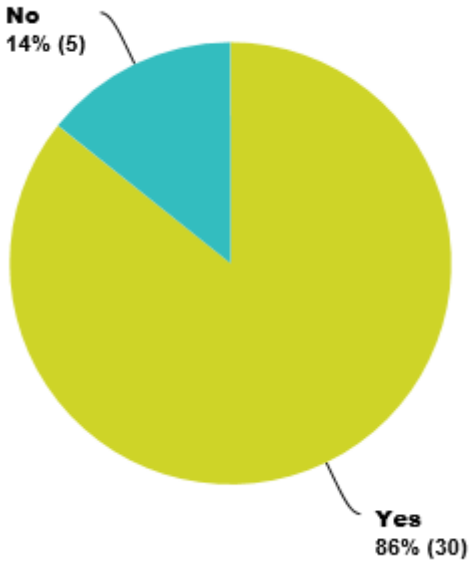


Figure 18: The proportion of countries that have tsunami emergency response plans for regional/local tsunami exists.

Comments

- Tsunami support plan. (Nauru)
- Met service has tsunami emergency response plans but country level needs upgrading. (Tonga)
- Australia's main threat from tsunamis is from regional/distant earthquake sources and this is the focus of the Australian Tsunami Warning System. (Australia)
- New Zealand has a National Tsunami Warning and Advisory Plan and local councils via the regional CDEM have tsunami response plans, which are supported and reviewed by MCDEM. This provides context on tsunami hazard and risk in New Zealand, from all sources and lists responsible agencies and their roles and responsibilities. However, this is not a national standard operating procedure. The National Tsunami Warning and Advisory Plan has other supporting standards and guidance to help local authorities. (New Zealand)
- There is a recently adopted national tsunami contingency plan. It covers 8 departments, 29 municipalities in the coastal area on 123 km of beach. (El Salvador)
- They are in the process of development. (Costa Rica)
- Not yet, we are working on it. (Mexico)
- The draft Tsunami Response Plan still exist and still amended at this stage, once finalised will be then tabulated for parliament sitting. (Fiji)
- A country tsunami emergency response plan (standard operating procedures) for regional/local tsunamis exists, but actually is not approved. (Panama)

25. The warning <u>was</u> disseminated to:

The majority of tsunami warnings were disseminated to Emergency services (69%). This was followed by other national government agencies and local government: provincial/regional level (53%, 50% respectively). A small proportion of tsunami warnings was sent to science agencies/universities (14%).

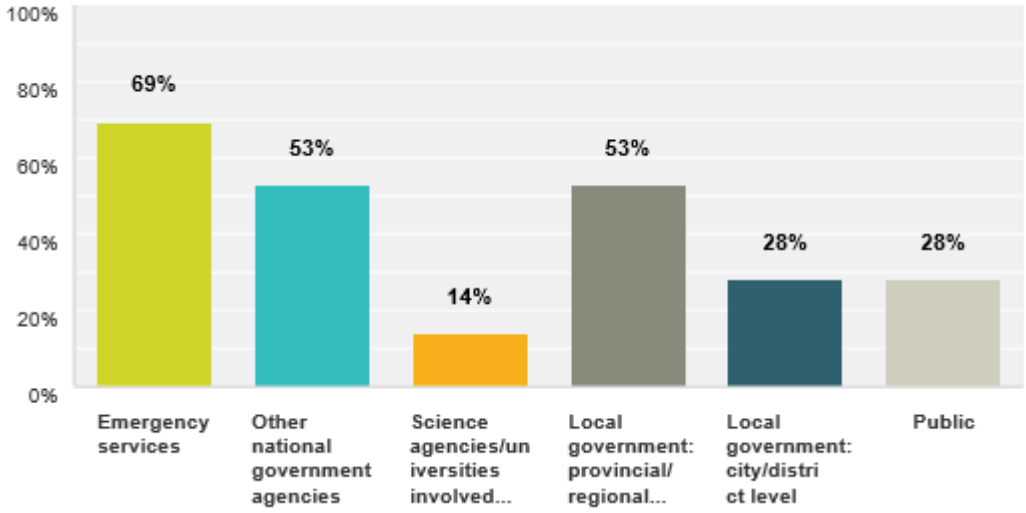


Figure 19. The percentage of where tsunami warnings were disseminated to.

Comments

- Warning was disseminated only to nemo although with continued collaboration with WSO KOROR, both agencies are now planning a large-scale tsunami table-top exercise for 2018 to include other national government agencies (i.e., ministry of health, bureau of public safety, state governments, etc.). (Palau)
- Emergency services only. (Nauru)
- Tsunami warning was disseminated to all relevant stakeholders/Partners and rural communities for taking pro-active actions. (Solomon Islands)
- Note that the local tsunami threat messages was only disseminated to exercise participants including the village that was invited to participate. (Samoa)
- This exercise had a limited dissemination list. In a real event, all of the above would receive the warnings. (Australia)
- The Tsunami Threat was disseminated to ONEMI, CSN and Maritime Authority. (Chile)
- The warning was not disseminated outside the agency. (Philippines)
- For this exercise, we focused mainly on testing the communications between Singapore NTWC, PTWC and NWPTAC, and to be familiar with the advisory products. (Singapore)

26. Regional/local tsunami exercises are routinely conducted in-country. Note last exercise in comments section below.

The majority of countries indicated that they routinely conduct in country exercises (74%).The proportion of countries that did not (28%) are looking at conducting regular country tsunami exercises.

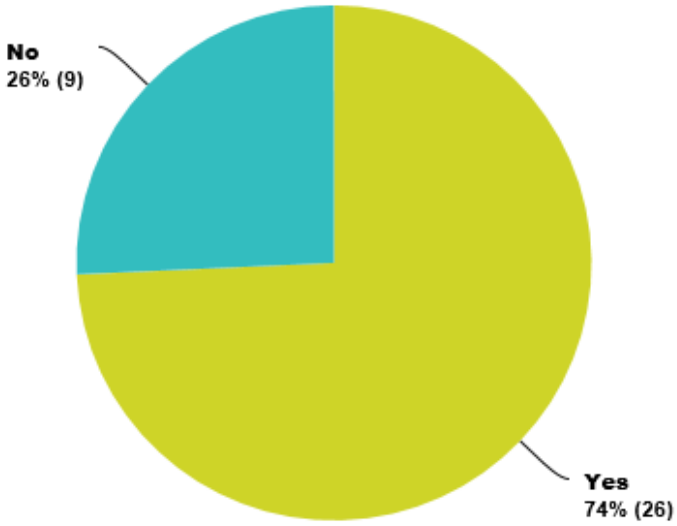


Figure 20. Percentage of countries that routinely conduct tsunami exercises in their country.

Comments

- Tsunami evacuation exercises are routinely done with schools, last one in October 2015. Last tsunami exercise between NTWC and NDMO was the PacWave16. (France – French Polynesia)
- NEMO conducts local tsunami exercises with the ministry of education as well as coordinating exercises with state level communities. Last exercise was PacWave16. (Palau)
- Yearly drill exercise. (Nauru)
- Need to do more drills in a regular basis. (Tonga)
- Yes. Pohnpei State just had their overall emergency response exercise that includes tsunami warnings. However, we are still in the process of planning to coordinate with the DOE to incorporate a statewide tsunami drill, starting with the grade school levels. (FSM)
- Village's exercises in 2016 and PacWave15. (Samoa)
- In August in a village on one of the outer islands, the exercise used a manual siren to warn the people and they moved to the highest point of the island. (Cook Islands)
- National Local Exercise in October 2016. (Colombia)

- The last exercise in which Australia participated before PacWave17 was IOWave16. A national "Ausnami" exercise is scheduled for later this year. (Australia)

- The New Zealand National Civil Defence Emergency Management Exercise Programme has included a nation-wide tsunami exercise in 2010 and 2016. However, New Zealand has a number of other hazards that must also be factored into the programme. Therefore large-scale exercise activities are spread across a ten-year exercise schedule, covering a wide range of hazards. A small number of communities do practice tsunami response and evacuation, but it is not widespread or routine and is not a requirement. This has included review of evacuation plans and carrying out planned evacuations. We have experienced a number of real events to test our systems and procedures that go some way to preparing agencies, however, we acknowledge that at all levels of government, tsunami exercises are not held regularly. (New Zealand)

- In Nicaragua we have four local tsunami exercise every year, and also we participate in two international exercises Pacific and Caribbean. (Nicaragua)

- On 1 December 2016, the last exercise of the year was realized in the coastal of the Araucania region, and contemplated the participation of nearly 8000 persons. In this exercise took part ONEMI, SHOA, CSN, Maritime Authority, local Authorities, Schools, Day-care Centers and the community. (Chile)

- Tsunami drill conducted in Putatan, Sabah, on 5 November 2016. (Malaysia)

- Indian Wave Exercise (IOWave16) on 7 and 8 September 2016. (Indonesia)

- Not so frequently. Usually organized in terms of multi-disasters response drills. (Vietnam)

- Last year in May National Tsunami Warning Center has started to issue tsunami bulletins using our own earthquake detection system, and thus we held a series of tsunami exercises and training workshop to improve forecasting capability. (China)

- The last drill was on 19 September 2016. (Mexico)

- Discussion to further conduct national exercises to include public as well were some of the highlights during the debriefing session. (Fiji)

- Singapore NTWC participated in the following exercises: IOWave16, 13th IOTWMS Communication Test, and PacWave16. (Singapore)

- Just only regional exercise, organized by the PTWC and Caribe Wave. (Panama)

27. Tsunami-related curriculum programmes are in place for all levels of education. Note which levels in comments section below.

The number of countries that have tsunami-related curriculum programmes for all levels of education: only a slight majority said yes at 53%. There was a mix of feedback from the countries that indicated that they did not have curriculum programmes (see comments below).

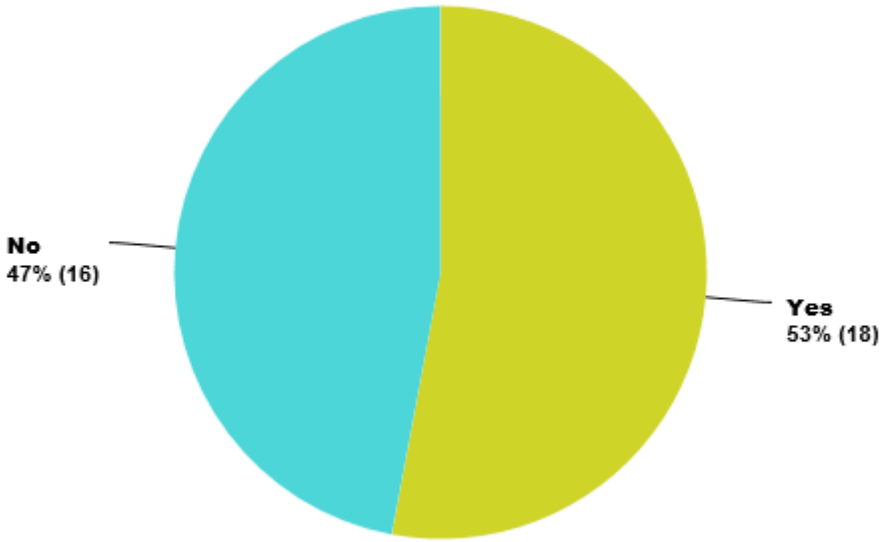


Figure 21**.** The percentage of countries that have tsunami-related curriculum programmes in place for all levels of education.

Comments

- Tsunami drills are conducted by the Ministry of Education in collaboration with NEMO to exercise schools evacuation plans. (Palau)
- Need to initiate curriculum programme with education department. (Nauru)
- Tsunami related curriculum programme for early childhood (kindergarten, primary and secondary levels). (Samoa)
- Educational materials, such as the online tool *Tsunami: The Ultimate Guide,* have been promoted to education departments for curriculum consideration. (Australia)
- Tsunami education is not currently included in the New Zealand Curriculum at any level. *New Zealand's What's the Plan, Stan?* is an education resource for years 1 to 8 that includes tsunami content. This resource is available for all New Zealand primary schools. New Zealand's East Coast LAB is currently developing a Tsunami Safer Schools Preparedness Guide for schools and early childhood education centres on the East and South coasts of the North Island that are located within a tsunami evacuation zone. (New Zealand)
- All the schools and students in the coastal zones, participate in the exercises. (Nicaragua)
- Lectures and excursions are conducted regularly. Booklets and posters are distributed to schools. (Russia)

- Primary and Secondary School. (Thailand)
- Secondary and Tertiary (Papua New Guinea)
- The Ministry of Education includes in the program the theme of threats and natural hazards (eg Safe School plan). The DGPC plans to create the civil protection national school, allowing a better preparation of the technicians who are part of different commissions. Each education institution independently incorporates the theme of tsunamis at different levels of education. (El Salvador)
- In Chile, the Department of Education is in charge of establishing the contents of the curricular programs. Currently, the subject matters associated with tsunamis have been included specifically in learning activities of some grades of primary school and in the first grade of the high school. Additional, for higher education the Catholic University of Valparaiso provide a graduate program in tsunamis: Diplomado en Tsunamis para la Costa de Chile: Bases científicas, amenaza y vulnerabilidad". (Chile)
- Earthquakes and tsunami related studies are available at primary and tertiary levels in schools. (Malaysia)
- On all levels, from kindergarten to university. (Indonesia)
- Although they are mentioned very superficially, giving more emphasis to other recurring events. (Costa Rica)
- Only disseminated within some organizations related to natural disaster warning/response. (Vietnam)
- Elementary Level. (Philippines)
- Not yet, we are working on it. (Mexico)
- Tsunami-related education programmes are in place for all levels of education. (Singapore)
- We have only risk managements in the education programmes. (Panama).

28. Communities have tsunami evacuation maps, routes, evacuation signs and assembly points for evacuation areas? Please note any gaps and future plans to fill gaps.

The number of countries communities that have tsunami evacuation maps, routes, signs and assembly points are a majority with 80%. A small proportion (20%) did not have them. Of those countries that indicated that they did not, programmes are under development to create facets of tsunami preparedness tools.

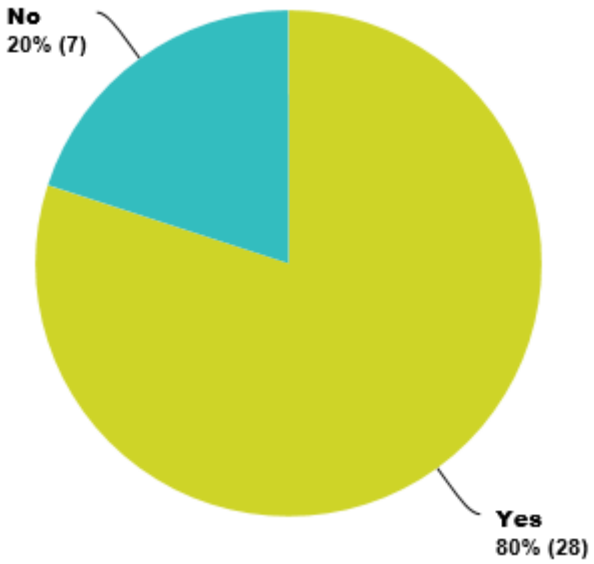


Figure 22: Percentage of countries that have tsunami evacuation maps, routes, evacuation signs and assembly points for evacuation areas.

Comments

- NEMO just recently completed community based disaster risk reduction (CBDRR) projects, which are funded through EU grant for BSRP. Through this project, NEMO completed evacuation maps, routes and signs, and identified shelters throughout the communities. (Palau)
- Need experts to help Nauru develop maps. (Nauru)
- Not all of them, but have started, tsunami mapping in villages is part of the community disaster and climate risk management program which is on going to cover the whole country. (Samoa)
- Although maps and routes are given, assembly points need to be addressed, as these are just high grounds with no structure on it to indicate as an evacuation area. (Cook Islands)
- Only for some coastal communities. (Colombia)
- Each State Emergency Services organization has varying amounts of maps, signage etc. available for community preparedness. Efforts are being made to cover gaps. (Australia)
- Communities have tsunami evacuation maps, routes, evacuation signs. (Russia)

- Gap: The maintenance of evacuation sign. The future plan: Development of evacuation maps and routes by set the annual reproduce. (Thailand)

- Variable levels of preparation. (Papua New Guinea)

- Communal commissions have a basic emergency plan. A vulnerability analysis is done and the best evacuation routes are defined. DGPC has a plan for the dissemination of the national contingency plan against tsunamis in the next six months and trainings to verify the operation of the plan. (El Salvador)

- The communities have signs that indicate the tsunami evacuation route. In addition, SHOA has published in the website *Tsunami hazard maps (CITSU),* which can be downloaded in a free way for all the persons and institutions and with these maps it is possible to know the maximum inundations levels estimated for an extreme tsunami event of near field source. Nevertheless, not all coastal places are covered, therefore, a five-year plan exists to increase the number of tsunami hazard maps for the coast of Chile. (Chile)

- There have been efforts to build awareness on tsunami threats in the communities concerned and communities involved in identifying the safe routes and evacuation points. (Malaysia)

- There are still a lack of self-awareness of some coastal communities to maintain tsunami evacuation facilities; therefore, we continue to raise people awareness through the earthquake and tsunami drill. (Indonesia)

- They should be improved, updated and extended to other regions of the country. (Costa Rica)

- In some coastal areas only. We planned to continue the Community-based Early Warning System to other coastal areas in the Philippines. (Philippines)

- There are several county level evacuation maps for specific areas along China coastline. (China)

- Not yet, we are working on it. Mexico has adopted a new law. It is for restaurants, hotels, etc.; they have to put signs evacuation routes on their areas. (Mexico)

- Mostly for hotels, resorts whereas for local communities, tsunami outreach awareness is conducted on annual basis and evacuation routes and maps are at their discretion to conduct. (Fiji)

- Maps are being prepared in some communities as we conduct the tsunami drills. (Panama)

29. Overall assessment

Overall exercise Pacific Wave 17 increased the majority of the countries stakeholder agencies understanding of tsunami emergencies (92%). The exercise further gave countries an opportunity to identify gaps in capability and capacity (81%).

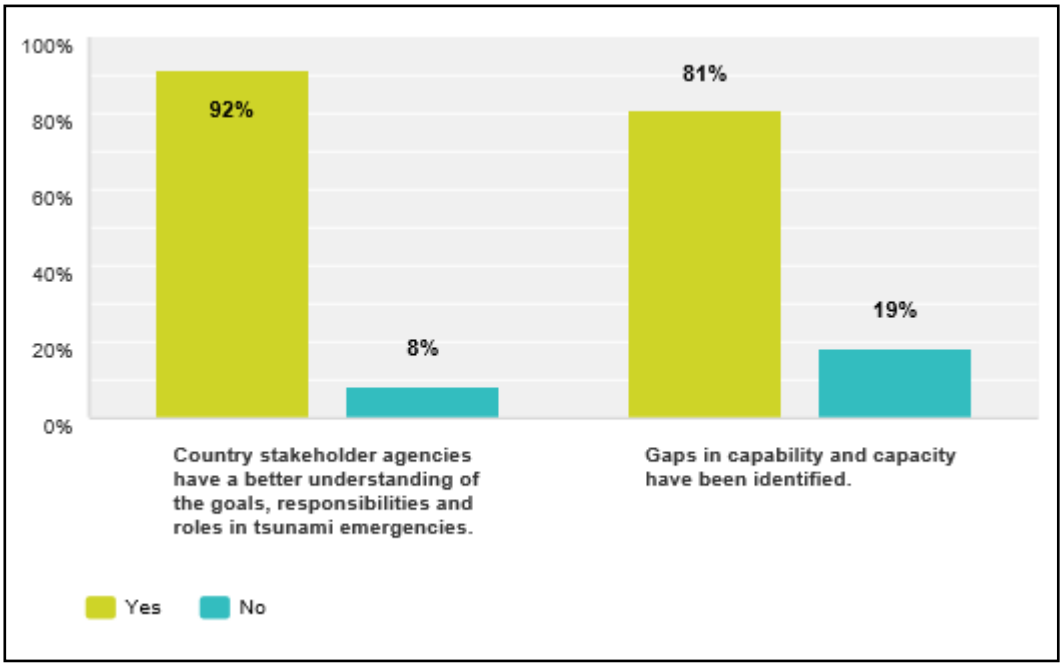


Figure 23: Overall assessment from countries for PacWave17.

Comments

- Tonga trench is one of the worst scenario for French Polynesia. The shortest tsunami time travel is about 2h30 so NTWC and NDMO must fix the warning level in less than one hour. (France - French Polynesia)
- I think country stakeholder agencies have a 30% understanding of the goals, responsibilities and roles in tsunami emergencies. (Ecuador)
- Further awareness on tsunami hazard, tsunami zones that have been mapped and knowing what they mean. Functional SOPs for NEOC and NTWC. There is a need to have an exercise after normal working hours to test response by NEOC/DMO etc. and NTWC as the exercise was conducted during normal working hours when everyone was at work. (Samoa)
- Some agencies does not have and SOP. Some do not have a communications plan to receive/listen/feel the warning when first given. (Cook Islands)
- Agencies involved were fully understanding on the roles and responsibilities. (Niue Island)
- PacWave17 was a limited-participation exercise for Australia. The Australian Tsunami Warning System will be more rigorously tested later in the year. (Australia)
- PMGO capacity issue - staff shortage/ (Papua New Guinea)
- Awareness and importance of less frequent events such as tsunamis. (Costa Rica)

- Awareness on tsunami threat in country has to be enhanced. (Vietnam)
- We are improving our procedures for these events. (Panama)

30. Exercise Planning

This section gave respondents the opportunity to provide overall comment on the planning of the exercise and their preparation for it. Overall, respondents were pleased with the planning of the exercise and the materials provided.

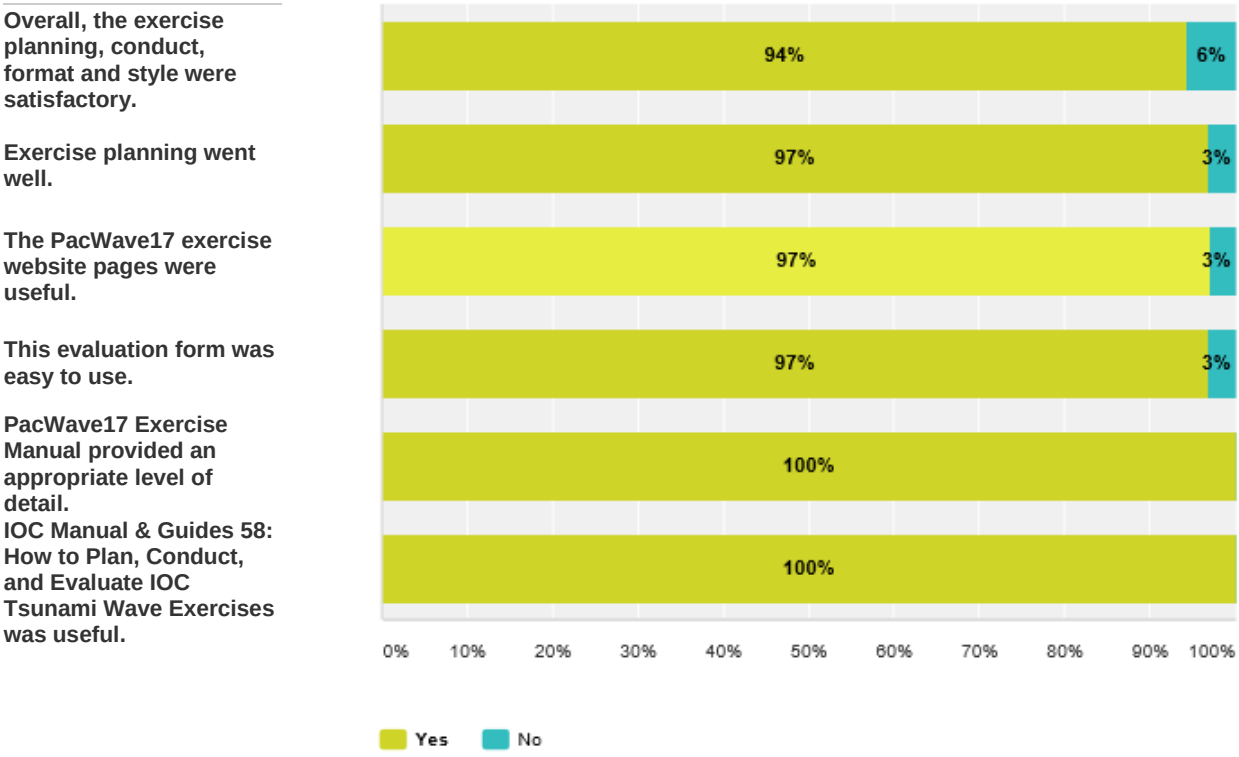


Figure 24: Overall assessment from countries for PacWave17.

Comments

Overall, the exercise planning, conduct, format and style were satisfactory

- Only from PTWC. (Ecuador)
- Not enough info. Just one message Nauru received. (Nauru)
- Yes - excellent as per comments and feedback from national level participants. (Samoa)
- NTWC and NDMO tested our sirens the day before the exercise. Any improvement were made for the exercise. (Cook Islands)
- It were satisfactory. (Colombia)
- The feedback from the participating agencies was positive. (Australia)
- Everything was according to plan. (Nicaragua)

- Power failure at NDMO during the exercise caused some communication problems. (Papua New Guinea)

Exercise planning went well

- Just emergency agencies. (Nauru)
- Yes, but we need to change the venue for our table-top exercise as recommended by the national level participants. (Samoa)
- Media release was given in time for all to know of the exercise. (Cook Islands)
- Yes, MET/POLICE/NDMO discussed and agreed that a table-top exercise to be used. (Niue Island)
- Planning with NDMO went fine. (Papua New Guinea)
- Some processes in the communication should be improved, n addition to sensitizing to the national authorities with respect to the importance of the exercises. (Costa Rica)
- Yes for the countries that have coasts in the Caribbean and Pacific we think so the dates of the exercises will be planning with more separation. (Panama)

The PacWave 17 exercise website pages were useful

- PTWC message. (Nauru)
- Yes, we downloaded the information on the PTWC threat messages from this website. (Samoa)
- Readily accessible to products is essential in convincing the authorities of the warnings. (Cook Islands)
- Very useful but too many information to download, read and printing. (Niue Island)
- Australia predominantly made use of its own independent threat assessment capability. (Australia)
- The site tends to be a wall of text and navigating to find the appropriate documentation is difficult. (New Zealand)
- Very useful, because all documentation was in the website. (Nicaragua)
- The website pages were very useful. PNG NDMO is now familiar and comfortable with the tsunami information products. (Papua New Guinea)

The evaluation form was easy to use

- Very clear and it is based on the objectives of the exercise. (Samoa)
- The questions referring to the NDMO may not be applicable to countries such as Australia; which have state/territory emergency management organizations as the key response agencies. Some questions are not specifically exercise related. It may

be better to ask these questions in a separate survey on community preparedness. (Australia)

- In the early sections of the hard copy form, it asks you to put a comment – however, there is no comment section. (New Zealand)
- Very easy (Nicaragua)
- A little bit slow. (China)

PacWave17 Exercise Manual provided an appropriate level of detail

- It is desirable, to have the PacWave17 Exercise Manual with more time. (Colombia)
- The manual was very appropriated. (Nicaragua)

IOC Manual & Guides 58: How to plan, conduct, and evaluate UNESCO/IOC tsunami wave exercises was useful

- Very useful. (Ecuador)
- It is a useful document but hard to locate on the website (refer to earlier comment about a wall of text and difficulty navigating the PacWave documents on the site. (New Zealand)

EXERCISE PLANNING

Please provide a general statement of what went well

- Tonga Trench is the nearest tsunami source for French Polynesia. It was an exercise planned to test a rapid scenario. Therefore, the risk evaluation time for civil authorities is very short less than 30 minutes. (French Polynesia - France)
- PTWC planning. (Ecuador)
- Coordination between WSO KOROR Aand NEMO. (Palau)
- The information in time. (Guatemala)
- Discussion between emergency agencies. (Nauru)
- Easy to plan tabletop exercise with first responders. (Tonga)
- The local scheduled communication test was well conducted and master scenarios well prepared. (China)
- Planning was good. The materials provided on how to plan and conduct the PacWave exercise was very helpful. (FSM)
- Overall planning of the Exercise was very well. Tsunami Exercise Planning team have been established. (Solomon Islands)
- The exercise instructions were clear and provided what was required, the briefings helped all participants to understand the exercise and its objectives and the special

injects really helped the agencies to think about the potential impacts and how they would response to them; it generally helped building awareness and understanding of tsunami hazard and impact, improve coordination with local and regional partners in providing response; it helped in identifying the weakness in response to a tsunami threat within the NTWC, NEOC, response agencies and sectors etc. (Samoa)

- Stakeholders made a commitment to the exercise by attending the first planning meeting and the stakeholders meetings. (Cook Islands)
- Opportunity to strengthen and train local entities. (Colombia)
- Meeting was held between MET/POLICE/NDMO to discussing the exercise went well. (Niue Island)
- An exercise manual for Australian participants was prepared prior to the exercise. All participating agencies were appropriately briefed. (Australia)
- We have been involved in a number of PacWave exercises so know what to expect. Collaboration between agencies in order to put the exercise together was excellent. (New Zealand)
- All was according to the planification of exercise. (Nicaragua)
- Choice of the scenarios for each country. Sakhalin TWC received all training materials before Exercise Pacific Wave 17. It was enough time to plan and prepare at the local level. All information related to Exercise Pacific Wave 17 was available at the exercise website. Sakhalin TWC had possibility to consult with ITIC about Exercise Pacific Wave 17 before the drill. (Russia)
- The Exercise planning could complete overall plan and objective. (Thailand)
- Good co-operation between PMGO and NDMO. (Papua New Guinea)
- The necessary documentation was available for planning the exercise with sufficient time for planning. Several test exercises, prior to the official exercise. The necessary technical staff. (El Salvador)
- The planning and organization of the exercise were realized in a perfect way between SHOA, National Office of Emergencies of the Department of the Interior (ONEMI) and the National Seismological Center (CSN). (Chile)
- The flow of dissemination of information. (Malaysia)
- Well prepared in scenario, rundown (timeline) and task exercise management ("who doing what"). (Indonesia)
- The selection of communities, and the seismic scenario defined. (Costa Rica)
- Readiness to conduct PAC WAVE exercise in the country. (Vietnam)
- Tsunami exercise was planned two weeks in advance. (China)
- General meeting was conducted before the PacWave Exercise. This includes review of SOP's, templates and previews PacWave exercises. (Philippines)

- The information was enough. (Mexico)
- Coordination and communication with NDMD went well. (Fiji)
- The tsunami bulletins and graphical products were made available for viewing and downloading sufficiently early before the exercise. This is certainly helped in the preparation work and arrangement. (Singapore)
- The coordination was correct between Institute of Geosciences (IGC) and SINAPROC-COE. (Panama)
- All message are on the web. (New Caledonia)

Please provide a general statement about what did not go well.

- We have to change the date of the exercise; we played the exercise on the 22th of February 19:00 UTC because of inundation hazards triggered for Society Islands and Tuamotu islands. (French Polynesia)
- National planning. (Ecuador)
- Everything was well. (Guatemala)
- Only one message Nauru received. (Nauru)
- Some agencies still do not know functions during diff warning phases. (Tonga)
- Participation of the members of the Planning Team was one of the constraint however, we still have strength to move further with our Planning even we have few people sometimes. (Solomon Islands)
- Pre-exercise briefing for response agencies and sectors were not well attended mainly due delays in passing the invitations/general briefings to the representatives of participating agencies and sectors although the invitations were sent out well before the briefings and the exercise. Some of the key response agencies (e.g. Police, National Health Services, Ministry of Health and Agriculture) and sectors such as Education, Health, Tourism and Agriculture did not have any participant present at the main venue of the exercise at the national level (table-top), although Police participated at the village level functional exercise. (Samoa)
- Talk back on radio mentioned the exercise but did not elaborate on the signs and precautions needed to be taken. (Cook Islands)
- Short notice given to work on the exercise to include all other agencies. Due to short staff in other departments no one was available to concentration in the exercise in order for better execution. (Niue Island)
- Due to the short notice and because the exercise occurred during Australia's severe weather season, the NDMO and some state emergency response agencies could not participate. An Australian exercise is being planned for later in the year to allow wider participation. (Australia)
- February remains a difficult time for New Zealand to conduct any exercise activity. We have a public holiday in early February and people are just returning from their

summer holidays in mid-late January, so developing the exercise is tight in terms of time, and therefore puts undue pressure on exercise planners. This evaluation form does not have comments at the end of the sections at the beginning of the document so it was difficult to find space to answer the questions more fully. (New Zealand)

- The Exercise planning could not complete overall plan and objective. (Thailand)
- Lack of information for southern half of PNG. (Papua New Guinea)
- There was few Regional coordination for the development of the exercise. It is necessary to work hand in globe with the regional countries to get a fluid cooperation. (Chile)
- The participation of all the actors involved, greater involvement at the level of community organization, mass communication and communication and others. (Costa Rica)
- Linkage between tsunami warning centre and response organizations in country should be improved. (Vietnam)
- Information dissemination to other personnel who did not attend the meeting. (Philippines)
- Fax was out of services the communication via radio did not work. (Panama)

<u>Please provide a general statement about what could be improved.</u>

- We needed the focal mechanism estimated by PTWC to prepare this exercise to compare the tsunami forecast heights given by NTWC and PTWC. (French Polynesia)
- Translate the information. (Ecuador)
- To have all emergency personnel involved in the planning stage & other meetings pertaining to this exercise in the future. (Palau)
- Only the communications ways, e-mail, fax, radio. (Guatemala)
- send polygon etc. (Nauru)
- SOPs to be reviewed. (Tonga)
- Identified members to spare their time for the planning. (Solomon Islands)
- Invitations need to go out early and also follow up by the exercise planning team. Regular briefings by the exercise planning team. (Samoa)
- Having a buy-in to those key agencies that did not participate in any meetings and were caught out during the exercise. (Cook Islands)
- Communications between the national and local level and availability of information on the local tsunami threat. (Colombia)

- Better planning and more staff available for the exercise. (Niue Island)
- Earlier notification and availability of the Exercise Manual may have enabled more Australian agencies to participate. Australia would prefer the exercise to be held outside of its severe weather season. The objectives should be emphasizing deeper and wider participation rather than desktop only exercises. (Australia)
- The timing of the exercise could be moved to later in the year. The PacWave website with the list of documents could be reformatted to make it easier to find documents. (New Zealand)
- The Exercise planning overall plan and objective should fill in the gap. (Thailand)
- Need complete info for all of PNG. (Papua New Guinea)
- Include General Directorate of Civil Protection (DGPC) during exercise planning. (El Salvador)
- To know with more anticipation the information related to the exercise (documents, Manual, Products) in order to plan more activities and to get a major profit of the exercise. (Chile)
- Pre-sensitization to local and national authorities. (Costa Rica)
- Coordination between warning and response organisations in the country. (Vietnam)
- Information wide dissemination to all personnel involve. (Philippines)
- Local internet services (government users) too slow and need to be improved. (Fiji)
- It would be more convenient if a website could be set up for member to update their focal points and national contacts whenever there is any changes. (Singapore)
- The communication between IGC and SINAPROC-COE. The budget for the Tsunami National Warning Center. Approval the national protocols (Panama)

EXERCISE CONDUCT

Please provide a general statement of what went well

- The Tonga trench scenario was useful to test a rapid response of civil authorities. (French Polynesia)
- PTWC conduct. (Ecuador)
- Coordination and cooperation between WSO KOROR and NEMO. (Palau)
- Everything. (Guatemala)
- Discussion phase. (Nauru)
- Conduct in local language and conditions. (Tonga)

- The coordination and communication between the Tsunami warning committee went well and everyone responded and participated throughout the whole exercise. (FSM)
- General running of the exercise is very good. (Solomon Islands)
- Exercise well controlled by the control team. (Samoa)
- Warnings went out to all government personnel, via e-mail, radio and facebook. (Cook Islands)
- Participation of local/regional/national institutions. (Colombia)
- Timings of relaying the information from the MET to the EOC was on time to determine the cause of actions including the dissemination of information to other level. (Niue Island)
- The exercise was well controlled and did not inadvertently alarm the public or other organizations. Tsunami procedures were functionally tested at the JATWC and desktop exercised at NSW SES. (Australia)
- Having MCDEM and GNS Science onsite (but operating in two separate rooms to simulate the reality of the two agencies separated by distance in any real event until a National Crisis Management Centre activation) worked well. Having the two agencies staff meet to discuss the scenario and associated actions was very useful to facilitate networking. The exercise presented an opportunity for the two agencies to align their standard operating procedures and clarify roles and responsibilities. The involvement of public information staff worked well. (New Zealand)
- The reception of the dummy message. The transmission of the information to the DMO. (Nicaragua)
- Testing new experimental products. (Russia)
- The Exercise conduct could complete overall plan and objective. (Thailand)
- Good communications between PMGO and NDMO. (Papua New Guinea)
- Good collaboration and communication between seismology and landslide technicians. Scheduled times for each activity were respected. A detailed assessment of the activities was carried out. Actions were carried out on the basis of the tsunami protocol and each participant was aware of their responsibilities. (El Salvador)
- The personnel involved in the exercise had a rapid action during its execution. The communication was fluid between SHOA, CSN and ONEMI. (Chile)
- The whole dissemination process. (Malaysia)
- Overall, the exercise was going well as planning. All the communication tools were implemented during exercise such as sms, fax, email, skype. (Indonesia)
- Order, community interest, and local authorities. (Costa Rica)
- Communication and dissemination of exercise information. (Vietnam)

- At the time of activity, all the tsunami warning information was sent on time, and each watch stander was required to conduct an earthquake scenario with issuing a warning by himself after the formal exercise. (China)

- Receiving of tsunami information from international agencies, issuance of tsunami information in accordance to the SOP. (Philippines)

- Receive bulletins on time. (Mexico)

- Communication between agencies and NDMO went well. (Fiji)

- Information on advisory products were clear and easy to interpret. (Based on pre-downloaded advisory products from PacWave17 website). (Singapore)

- The national messages were produced in acceptable times. (Panama)

- Message about tsunami threat. (New Caledonia)

Please provide a general statement of what did not go well.

- It was very difficult to coordinate activities with our risk management agencies. (Ecuador)

- NEMO experienced power outage during the initial start of the exercise. (Palau)

- Expecting more messages to receive so that we can be more prepared and to understand more of the messages. (Nauru)

- Breakdowns in communications during exercise. (Tonga)

- Will need a more spacious room for the exercise due to large number of organization participated, both the private and public sectors. (Solomon Islands)

- Some participants did not know how to use radio communication that was used to communicate with the NEOC, response agencies and sectors; venue for the tabletop exercise was too open, could not hear information relayed on radio and by exercise control team. Participants noted that there no representatives from the private sector participating in the exercise. (Samoa)

- People relied on e-mail only without having a back-up to the warnings. A radio would have given the indication of the warning. There was the national radio and two FM radio stations who broadcasted the warnings. (Cook Islands)

- Limited staff and other agencies were not participated in the exercise. (Niue Island)

- There were some minor delays in communications between the NTWC and NSW SES. However, this was an exercise management issue and would not occur during a real event. (Australia)

- PTWC products are still difficult to read, especially trying to find the NZ wave times within the alerts; as it is listed as wave times not by location. It seems that the forecast points differ from event to event and there appears to be no protocol for changes or version control. (New Zealand)

- The Exercise conduct could not complete overall plan and objective. (Thailand)

- Omission of half of PNG due to lack of information. Power failure at NDMO during exercise. (Papua New Guinea)

- It was detected that the application for notification of natural events has some technical problems and in the courier groups there were no key people of the DGPC. Staffs from other areas of the natural hazard monitoring center were not incorporated. There are some gaps in the interpretation of the focal mechanism of the event. It is necessary to send in a shorter time the information to the General Directorate of Civil Protection. The recommendations after the impact and how to report the affections in the bulletins are not defined. The General Directorate of Civil Protection is not familiar with the technical language that MARN handles in case of a tsunami threat. (El Salvador)

- There was few regional communication during the exercise, in spite of having a platform on line and available channels of communication. (Chile)

- The standard operating procedures of certain agencies. (Malaysia)

- Lack of follow-up, some level of improvisation, and lack of sensitivity to the issue in local and national government authorities. (Costa Rica)

- Reaction from the response organizations to the exercise. (Vietnam)

- Confusion in the initial test message, which does not include earthquake parameters to be used in the exercise. (Philippines)

- Graphical products and bulletins were not received in our emails during the actual exercise itself. (Singapore)

- The radio communications was not well. The fax was out of services. The internet connection was very slow. (Panama)

<u>Please provide a general statement of what could be improved</u>

- The sending of NTWC second bulletin that contains the tsunami forecast heights should become a fully automatic bulletin. (French Polynesia)

- National coordination. (Ecuador)

- Commitment for a successful exercise by all emergency personnel. (Palau)

- More discussion country level and PTWS to send more message. (Nauru)

- Easier planning. (Tonga)

- Need to improve on timeliness on preparation for public messages. (FSM)

- We need large rooms for more people next time. Scenario is not really affecting the Solomon Islands. (Solomon Islands)

- Change the venue to closed venue. Ensure that participants from the private sector are invited to participate and also have representatives from participating villages to be present at the venue of table top exercise. (Samoa)

- Some rendezvous points up the hills for people to meet when evacuating. (Cook Islands)

- Better planning, and more staff and stakeholders and other agencies to be involved. Information should be available well in advanced. Too many information need simple and easy to understanding. (Niue Island)

- Feedback from the participants suggested overall satisfaction with the conduct of the exercise. However, Australia's warning dissemination system could be improved to better cater for tsunami exercises of varying scales and degrees of participation. (Australia)

- The bulletins need to be machine-readable. More Public Information specific injects would be useful next time. If PTWC could bold any changes from the previous bulletin's changes to more easily identify new material that would improve readability. The Tsunami Experts Panel could be included next time. (New Zealand)

- The Exercise conduct overall plan and objective should fill in the gap. (Thailand)

- Need complete info for all of PNG. Forecast points to include: Lae, Misima, Alotau, Port Moresby, others? (Papua New Guinea)

- Interpretation of PTWC products, the Deep-Ocean Tsunami Amplitude Forecast generates some confusion in seismology and landslide technicians. Improve the interpretation of focal mechanisms. Improve the application and the text message application. Use the camera images on the docks for documenting and monitoring the phenomenon. Document the event with Civil Protection (DGPC) observers, web cam and MARN staff on the coast. Civil Protection is working on the contingency plan for tsunami and earthquake, be conscious of the development of the same and have basic knowledge of this. Involve more institutions in future exercise. (El Salvador)

- It might have tested the communication with neighbouring countries since there was simulated a great magnitude event. Even it was necessary to have tested communication with Japan, to check the correct functioning of this one, nevertheless not having to be realized in the same schedule for the whole Pacific Ocean is difficult the communication with countries out of the region. (Chile)

- A well-informed and standardized SOP with the relevant agencies. (Malaysia)

- Community organization, investment of resources in prevention at the local level, installation of alert equipment, education to communities, labeling, and others. (Costa Rica)

- The coordination between warning and response organizations in country. (Vietnam)

- Text messages should contain clear and complete details.(Philippines)

- Receive more bulletins frequently. (Mexico)

- Government users network capability was not good (poor/slow). (Fiji)

- We need more equipment for communications, computers, radios, fax machine, others. (Panama)

EXERCISE DEBRIEF AND EVAULATION

Please provide a general statement of what went well

- The debrief between the NTWC and Civil authorities was done just after the exercise on the 22th and 23th of February. (French Polynesia)
- PTWC evaluation. (Ecuador)
- WSO KOROR and NEMO coordination and understanding reached. (Palau)
- All the ways online. (Guatemala)
- Discussion and expectation from the threat message was understood. (Nauru)
- Good awareness. (Tonga)
- Debriefing went well. All key players on the Tsunami committee responded well and comments were acknowledged. (FSM)
- Evaluation was good, Gaps were identified. (Solomon Islands)
- Exercise was well evaluation by the evaluators. Evaluators have a good understanding of Samoa's emergency response procedures as well as tsunami threat SOPs, participants provided frank and very useful feedback; agencies and sector representatives that did not participate during the exercise participated in the formal evaluation. (Samoa)
- All agencies and representatives from other sectors attended the debrief. (Cook Islands)
- It allowed advancing in the implementation of the National Procedures. (Colombia)
- Agencies involved were able to experience the time of waiting and preparation for responses to what information received. (Niue)
- A hot debrief occurred immediately after the exercise was completed and this was found to be very helpful. Written feedback was sought and received. (Australia)
- New Zealand used the opportunity to run the PacWave scenario through its new warning system software, which is currently under development. This worked well as it was a credible scenario that could be tested end to end and allowed for discussion at various points of the process to confirm the build is on the right track. It also provided an opportunity to introduce the new software and its benefits to the people who will be using it in a safe environment where they could ask questions and provide feedback. The networking opportunity and sharing of information across the duty teams went very well and was useful. (New Zealand)
- All went very well. (Nicaragua)

- Exercise was carried out satisfactorily at all levels. There was no significant remarks and lacks during the Exercise Pacific Wave 17. Submissions from PTWC and NWPTAC, allow us to make quick and preliminary assessment of the tsunami threat, which is very important and relevant for local authorities. (Russia)

- The Exercise Debrief or Evaluation could complete overall plan and objective. (Thailand)

- Good understanding of exercise at PMGO, NDMO. (Papua New Guinea)

- Geological monitoring technicians and other personnel from the geology area were involved to carry out the evaluation of the exercise. (El Salvador)

- Good organization and planning of the exercise. Excellent communication with the national entities during the exercise. (Chile)

- The flow of the exercise went well. (Malaysia)

- The evaluation succeed as expected. After the exercise all player sit together to get discuss about upgrading SOP, upgrading system of back up in Bali. (Indonesia)

- Maintain the current issue in local and national authorities. (Costa Rica)

- Promptly reply from national tsunami warning centre. (Vietnam)

- All PacWave activities was properly time-lined. The conduct of PacWave started and end successfully. (Philippines)

- The bulletins were disseminated well and on time. (Mexico)

- Reactive on time (timely response). (Fiji)

- Exercise kick-off messages were timely received. (Singapore)

- The messages was realized in acceptable times. (Panama)

<u>Please provide a general statement of what did not go well</u>

- National evaluation, it was very difficult to obtain this evaluation from our risk management agencies. (Ecuador)

- Need more message so more discussion and decision can be made. (Nauru)

- Communications not robust enough. (Tonga)

- Almost all Private companies that attended did not have standard operating procedures. (Solomon Islands)

- Some agencies did not receive the warnings via e-mails. (Cook Islands)

- Information received was pretty much the same and time consuming. (Niue)

- A national debrief was organized within 2 weeks of the exercise but not all agencies were represented. (Australia)

- We used compressed time and this made it difficult to make decisions in the time available. (New Zealand)

- The Exercise Debrief or Evaluation could not complete overall plan and objective. (Thailand)

- Some provincial contacts closed down prior to official end of exercise due to misunderstandings brought on by power failure at NDMO. (Papua New Guinea)

- Greater strength in the need to raise awareness regarding the national vulnerability to this type of events. (Costa Rica)

- Not so many organisations and people know about the exercise. (Vietnam)

- Communication bit slow. (Fiji)

- The radio communications was not well. The fax was out of services. The internet connection was very slow. (Panama)

Please provide a general statement of what could be improved

- In the PTWC messages, estimated times of arrival are ranged from earlier arrival to latest whereas the tsunami observations are in a reverse order also the date of the observation is missing. (Vanuatu)

- Promote the participation of our agencies in all activities related to the Pacific wave. (Ecuador)

- WSO KOROR and NEMO planning a large-scale tabletop tsunami exercise for 2018 to include ministry of health, bureau of public safety, and other government agencies. (Palau)

- Improve inter agency communications. (Tonga)

- NDMO will work closely with organizations in the development of the tsunami SOPs and Response plans for particular organization. (Solomon Islands)

- Have an agency representative meet with their counterparts from other agencies and have them meet regularly to be familiar with the communication process. (Cook Islands)

- Some specific aspects in the National Procedures as messages formats. (Colombia)

- We could be more prepared to inject in our own activities what might have happened locally if we had a better planning or time to plan the activity. (Niue)

- Customized-post exercise survey forms could have been sent to participating agencies. (Australia)

- Review the decision to use compressed time in tsunami events. Provide more activities, tasks, injects to the public information participants. Include the Tsunami Experts Panel in future PacWave exercises. (New Zealand)

- The Exercise Debrief or Evaluation overall plan and objective should fill in the gap. (Thailand)

- Include other government agencies in the evaluation of the exercise. (El Salvador)

- For National level: To include the active participation of the local and regional community, through ONEMI for practice the evacuation plans for the most affected zones. It would be interesting to exercise these plans with some schools and institutions, planning this activity previously. (Chile)

- More exercises being conducted in the future. (Malaysia)

- We need to improve with involve many stakeholder in eastern part in Indonesia. In this exercise, we just involve Manado and Ternate then next we can involve more such as Jayapura. On the other hand, we will built dummy system for exercise. (Indonesia)

- Increased frequency of exercises, direct support in the implementation of training activities, communication, and identification of dangerous sites. (Costa Rica)

- The communication, coordination and collaboration between tsunami warning and response organisations in the country. (Vietnam)

- Updates of SOP, templates and increase the competency of manpower. (Mexico)

- Internet services to be improved. More exercises. (Fiji)

- A password-protected website is desirable for member countries to view the advisory products. (Singapore)

- We need more equipment for communications, computers, radios, fax machine, others. (Panama)

ANNEX IV

REPORT PREPARATION AND FINAL REPORT

The planning, conduct, and evaluation of Exercise PacWave17 was coordinated by the PTWS Exercise PacWave17 Task team (TT).

The Exercise PacWave17 Exercise Report and Annex III were compiled by Ms Jo Guard and Mr Callum Chapman (Ministry of Civil Defence & Emergency Management, New Zealand), Dr Laura Kong (International Tsunami information Center) and Mr Tomoaki Ozaki (Japan Meteorological Agency). Translation of Annex III evaluation comments from Spanish to English was provided by ITIC.

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- Mr Carlos Zuniga, Chile, SHOA,
- Mr Tetsuyuki Ueyama, Japan, Japan Meteorological Agency,
- Mr Chip McCreery – USA, Director, PTWC,
- Mr Rajendra Prasad – Fiji, UNESCO/IOC SPC-SOPAC Division,
- Mr Anthony Blake – Fiji, UNESCO/IOC SPC-SOPAC Division,
- Mr Hy Mok – Hong Kong,
- Ms Silvia Chacon – Costa Rica,
- Mr David Coetzee, New Zealand, Ministry of Civil Defence & Emergency Management.

ANNEX V

LIST OF ACRONYMS

DISCEX	Discussion Exercise' or Table top Exercise
ICG/ITSU	International Coordination Group for the Tsunami Warning System in the Pacific
ICG/PTWS	Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (formerly ITSU)
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
ITIC	International Tsunami Information Center (UNESCO/IOC–NOAA)
JMA	Japan Meteorological Agency
MSEL	Master Schedule of Events List
NDMO	National Disaster Management Office
NOAA	National Oceanic & Atmospheric Administration (USA)
NTWC	National Tsunami Warning Centre
NWPTA	Northwest Pacific Tsunami Advisory
NWPTAC	Northwest Pacific Tsunami Advisory Center (Japan)
PTWC	Pacific Tsunami Warning Center (USA)
SCSTAC	South China Sea Tsunami Advisory Center (China)
SCSTAC	South China Sea Tsunami Advisory Centre
SOP	Standard Operating Procedures
TT	Task Team
TNC	Tsunami National Contact
TWFP	Tsunami Warning Focal Point
UNESCO	United Nations Educational, Scientific & Cultural Organization
US NTWC	US National Tsunami Warning Center (USA)
WG	Working Groupp

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	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.	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	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.	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	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
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*—	*(IOC/INF-1340)*
124	Indicadores Marino Costeros del Pacífico Sudeste / Coastal and Marine Indicators of the Southeast Pacific (SPINCAM)	E/S

(continued)

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	E only
126	Exercise Pacific Wave 16. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1-5 February 2016. Volume 1: Exercise Manual. Volume 2: Summary Report	E only
127	How to reduce coastal hazard risk in your community – A step by step approach	E only
128.	Exercise Indian Ocean Wave 2016: An Indian Ocean-wide Tsunami Warning and Communications Exercise, 7–8 September 2016 Vol 1: Participant Manual Vol. 2: Exercise Report	E only
129	What are Marine Ecological Time Series telling us about the Ocean – A status report	E only
130	Tsunami Watch Operations – Global Service Definition Document	E only
131	Exercise Pacific Wave 2017. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 15-17 February 2017. Volume 1: Exercise Manual Volume 2: Exercise Report	E only
132.	2nd March 2016 Southwest of Sumatra Earthquake and Tsunami Event Post-Event Assessment of the Performance of the Indian Ocean Tsunami Warning and Mitigation System; 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	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	E only