Intergovernmental Oceanographic Commission
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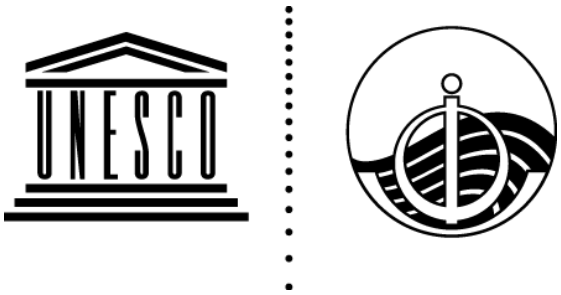

EXERCISE PACIFIC WAVE 15

A Pacific-wide Tsunami Warning and Enhanced Products Exercise

2-6 February 2015

Volume 1 Exercise Manual

UNESCO

Intergovernmental Oceanographic Commission
Technical Series

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1. BACKGROUND

Over history from 2000 BC to AD 2014, seventy-one percent of the world's confirmed tsunamis have occurred in the Pacific Ocean and its marginal seas. Of these, 76% or 245 tsunamis were deadly, with 38% in Japan, 15% in South America, 12% Indonesia (Pacific coast), 11% South Pacific Islands, 7% North and Central America, 6% Alaska, 6% Asia, 3% Russia, and 1% Hawaii. Most of these deadly tsunamis were caused by earthquakes (78%) or earthquake-generated landslides (10%). Seven of the top 10 most deadly tsunamis were in the Pacific.

In the 50 years since the start of the International Tsunami Warning 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 lost due to tsunamis in the far field prior to 1965.

Over the past seven years (2009–2015), the Pacific witnessed five 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 with people having only 10 to 30 minutes 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. And 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 damaged 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; PTWS Medium-Term Strategy 2014-2021, IOC 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 (ICG/PTWS).

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 ITIC, PTWC, and JMA. Altogether there have been four IOC-coordinated international exercises, Exercise Pacific Wave 2006, 2008, 2011, and 2013. 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 System and measure the readiness of countries to respond as national tsunami warning centers and emergency response agencies, and the public, to distant and local tsunamis. Exercise Pacific

Wave 2011, 2013, and now 2015 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 become official on 1 October 2014.

2. EXERCISE PURPOSE

The aim of Exercise Pacific Wave 2015 (PacWave15) is to test the new PTWC Enhanced Products.

The exercise provides an opportunity for Pacific countries to test the new products, and review their tsunami response procedures. 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 15 are to:

Objective 1. Test communications from the PTWS Tsunami Service Providers to Countries.

Objective 2. Test whether the PTWS PTWC Tsunami Service Provider products are interpreted by countries accurately and in a timely manner.

Objective 3. Test national and regional cooperation.

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

4. NEW ENHANCED PRODUCTS

The PTWC Enhanced Products are threat-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. These improvements should greatly reduce the number of areas warned unnecessarily and also provide some advance notice of potential local tsunamis. Details on the PTWC New Enhanced Products for the PTWS are provided in IOC Technical Series 105, User's Guide to the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System (Revised Edition, August 2014, in English and Spanish); the User's Guide can be downloaded from the PacWave15 web site (http://www.pacwave.info)

There are important differences between PTWC's former and its new enhanced products. Existing products use terminology that describes a level of alert for each country. Specifically, a country is currently designated by PTWC as being in a Tsunami Watch or a Tsunami Warning depending upon the tsunami threat presented by the event, as well as the time remaining until tsunami impact. Over the last several years, however, use of the Warning and Watch terms have caused confusion when the PTWC-designated levels of alert conflict 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 products will now change to avoid using the Warning and Watch terms, and instead provide forecast levels of impact along coasts.

At its Twenty-second Session, the ICG/PTWS (2007) started the process of improving the PTWS international alert products, starting first with the products of the PTWC. At its Twenty-fourth Session, the ICG/PTWS (May 2011) approved PTWC's Enhanced Tsunami Products proposal and asked them to proceed with their development. Exercise Pacific Wave 2011 (November) introduced those products and the ICG/PTWS Steering Committee (SC) met in May 2012 to review

the feedback and approve the final implementation timeline. Exercise Pacific Wave 2013 (April) was conducted to validate the products.

At the Twenty-fifth Session of the ICG/PTWS (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 them 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 issuance of its new enhanced products.

5. EXERCISE SCENARIO

Exercise Pacific Wave 2015 will be held within the period of 2-6 February 2015. PacWave15 is recommended to be a Tabletop Exercise and will be a live exercise, with the PTWC and NWPTAC issuing Dummy Text messages representing live TSP products between 3 to 5 February 2015. Actual messages corresponding the the Dummy Text message will be available beforehand on the PacWave15 web site. Participant countries may choose to run their exercise at other times to avoid conflict with other important national events.

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

- Nansei-Shoto Trench, Ryukyu Islands
- Tonga Trench
- Colombia-Ecuador Trench
- Northern Japan Trench
- Manila Trench
- Peru-Chile Trench

The exercise will require Member State evaluation of PTWC New 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).

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.

6. TYPE OF EXERCISE

It is recommended that Exercise Pacific Wave 2015 be carried out in at least 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 Center 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.

7. 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 available at the PacWave15 website.

8. ASSUMPTIONS

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

9. 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 PacWave15, it is recommended that the National Tsunami Warning Center and the National Disaster Management Office, participate.

Each country's lead agency and its PacWave15 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 PacWave15 Exercise Evaluation Form based on in-country feedback.

10. EXERCISE DOCUMENTATION

Exercise Pacific Wave 2015 planning, conduct, and evaluation should take into account the following documents:

- IOC Circular Letter No 2548: PTWS Pacific-wide Tsunami Exercise 'PacWave15', 2-6 February 2015, dated 4 November 2014
- Exercise Pacific Wave 15, A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 2–6 February 2015. Volume 1: Exercise Manual; IOC Technical Series No 117. UNESCO/IOC 2015 (English)

- Users Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System. IOC Technical Series No 105, Revised edition. UNESCO/IOC, 2014 (English; Spanish)
- Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS), (IOC/2011/TS/87rev), revised in August 2011.
- How to Plan, Conduct, and Evaluate IOC Tsunami Wave Exercises, IOC Manuals and Guides No 58, 2013.

All information related to Exercise Pacific Wave 2015 is available at the exercise website: http://www.pacwave.info

11. EXERCISE PRODUCTS

PacWave 15 will commence with a "dummy" kickoff exercise message. Participant countries should select a relevant scenario and its most convenient date and time to conduct the Tabletop Exercise within the 2-6 February 2015 time period. Participant countries may amend the exercise messages to suit their own timetable.

All international products will be provided online at the Exercise Pacific Wave 2015 website (http://www.pacwave.info) in advance to help countries plan and prepare. It is recommended to download from the PacWave15 website, the international products and messages for the appropriate scenario prior to the day of the exercise.

Each scenario will have a suite of PTWC enhanced product messages and forecasts. The Nansei-Shoto, Japan, and Manila Trench scenarios will also have JMA NWPTAC Tsunami Advisories. Please 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 time default date and time of the messages (e.g. 3 February 2015 @ 1500 hours) can be adjusted by participant countries to coincide with their selected Tabletop Exercise local date and time. Subsequent message traffic issuance date and times should then also be adjusted accordingly.

All documentation and correspondence relating to this exercise is to be clearly identified as **Exercise Pacific Wave 2015** 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.

12. EXERCISE DELIVERY/FORMAT

Only the suite of PTWC New Enhanced Products are being reviewed in PacWave 15. Northwest Pacific Tsunami Advisory Center (NWPTAC) – Japan Meteorological Agency (JMA) messages will be issued for the Nansei-Shoto, Japan, and Manila Trench scenarios for information and national decision-making purposes only, and all messages are listed in the Master Scenario Events List (Annex II).

Distribution of the series of international messages for each scenario within each country, available beforehand on the exercise website, will be the responsibility of each country.

Each Exercise Pacific Wave 2015 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 participant agency having their own set of envelopes.

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

12.1 MASTER SCHEDULE OF EVENTS LIST (MSEL) – EXERCISE SCRIPT

The Master Schedule of Events List (MSEL) is a detailed sequence of events used by the 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.

13. 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 15 post-exercise evaluation form.

All participating countries are asked to provide feedback through the PacWave15 Evaluation Form (Annex III) by 21 February 2015. Forms should be submitted online by visiting https://www.surveymonkey.com/s/pacwave15_eval. This feedback will greatly assist in the evaluation of Exercise Pacific Wave 2015.

13.1 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 PacWave15 is expected to conduct its own debriefs after the exercise. This may take the form of a hot debrief (or hotwash) on the day of the exercise, with each participating agency conducting its own cold (formal) debrief within the week(s) following the exercise.

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

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

A useful guide to debriefing is 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/memwebsite.nsf/Files/Information_Series/$file/DeBriefing Info Book.pdf

13.2 EXERCISE VALIDATION

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

13.3 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 3 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 Summary Report, the Exercise Task Team requests **one** international evaluation from each participating country.

13.4 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.

13.5 OBSERVERS

Exercise Pacific Wave 2015 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 invited to view the exercise is the responsibility of each participating country.

13.6 EVALUATION TOOLS

The goal of 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 2015 Summary Report.

The evaluation tool aims to inform and facilitate individual participant country evaluations as well as the Exercise Pacific Wave 2015 Summary Report.

All participanting countries are asked to complete the official PacWave15 Exercise Evaluation Form **(Annex III) by 21 February 2015**. Forms should be submitted online by visiting https://www.surveymonkey.com/s/pacwave15_eval.

13.7 EXERCISE PACIFIC WAVE 2015 SUMMARY REPORT

The Exercise Task Team will compile the Exercise Pacific Wave 2015 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

14. 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 Statement will not disrupt the exercise.

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

15. 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.

16. MEDIA ARRANGEMENTS

The UNESCO Bureau of Public Information will issue an international Media Advisory before the the Exercise Pacific Wave 15 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 PacWave15 website (http://www.pacwave.info).

ANNEX I. EXERCISE PACIFIC WAVE 2015 – SCENARIOS

Location	Latitude	Longitude	Depth	Magnitude	Past Exercise
Nansei-Shoto Trench	28.0 North	129.0 East	20km	9.0	PacWave11
Tonga Trench	23.6 South	175.5 West	20km	9.0	PacWave11
Colombia- Ecuador Trench	1.0 North	81.5 West	20km	9.0	PacWave11
Northern Japan Trench	38.1 North	142.9 East	20km	9.0	PacWave13
Manila Trench	17.0 North	119.0 East	20km	9.0	PacWave13
Peru-Chile Trench	11.4 South	78.7 West	20km	9.0	-

ANNEX II. INTERNATIONAL MASTER SCHEDULE OF EVENTS LIST (MSEL)

Scenario →		Peru-Chile		Colombia-Ecuador		Tonga		Japan				Nansei-Shoto				Manila			
Center →		PTWC		PTWC		PTWC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC	
Date (UTC)	Time (UTC)	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP
2/3	1500	Quake		Quake															
2/3	1507	1	TI	1	TI														
2/3	1530	2	TFI	2	TFI														
2/3	1600	3	TFP	3	TFP														
2/3	1700	4	TS	4	TS														
2/3	1800	5	TS	5	TS														
2/3	1900	6	TS	6	TS														
2/3	2000	7	TS	7	TS														
2/3	2100	8	TS	8	TS	Quake													
2/3	2107					1	TI												
2/3	2130					2	TFI												
2/3	2200	9	TS		TS	3	TFP												
2/3	2300	10	TS		TS	4	TS												
2/4	0000	11	TS		TS	5	TS												
2/4	0100	12	TS		TS	6	TS	Quake				Quake				Quake			
2/4	0107							1	TI			1	TI			1	TI		
2/4	0117									1	TAB			1	TAB			1	TAB
2/4	0130							2	TFI			2	TFI			2	TFI		
2/4	0145									2	TAB			2	TAB			2	TAB
2/4	0200	13	TS		TS	7	TS	3	TFP			3	TFP			3	TFP		
2/4	0230											4	TFH			4	TFH		
2/4	0240									3	TAB			3	TAB			3	TAB
2/4	0300	14	TS	14	TS	8	TS	4	TS			5	TS			5	TS		
2/4	0340									4	TAB			4	TAB			4	TAB
2/4	0400	15	TS	15	TS	9	TS	5	TS			6	TS			6	TS		
2/4	0440									5	TAB			5	TAB			5	TAB
2/4	0500	16	TS	16	TS	10	TS	6	TS			7	TS			7	TS		
2/4	0540									6	TAB			6	TAB			6	TAB
2/4	0600	17	TS	17	TS	11	TS	7	TS			8	TS			8	TS		
2/4	0640									7	TAB			7	TAB			7	TAB
2/4	0700	18	TS	18	TS	12	TS	8	TS			9	TS			9	TS		
2/4	0740									8	TAB			8	TAB			8	TAB
2/4	0800	19	TS	19	TS	13	TS	9	TS			10	TS			10	TS		
2/4	0840									9	TAB			9	TAB				
2/4	0900	20	TS	20	TS	14	TS	10	TS			11	TS			11	TS		
2/4	0940									10	TAB			10	TAB				
2/4	1000	21	TS	21	TS	15	TS	11	TS			12	TS			12	TS		
2/4	1100	22	TS	22	TS	16	TS	12	TS			13	TS			13	TS		
2/4	1200	23	TS	23	TS	17	TS	13	TS			14	TS			14	TS		
2/4	1300	24	TS	24	TS	18	TS	14	TS			15	TS			15	TS		
2/4	1400	25	TS	25	TS	19	TS	15	TS			16	TS			16	TS		
2/4	1500	26	TL	26	TL	20	TS	16	TS			17	TS			17	TS		
2/4	1600					21	TS	17	TS			18	TS			18	TS		
2/4	1700					22	TS	18	TS			19	TS			19	TS		
2/4	1800					23	TS	19	TS			20	TS			20	TS		
2/4	1900					24	TS	20	TS			21	TS			21	TS		
2/4	2000					25	TS	21	TS			22	TS			22	TS		
2/4	2100					26	TL	22	TS			23	TS			23	TS		
2/4	2200							23	TS			24	TS			24	TS		
2/4	2300							24	TS			25	TS			25	TS		
2/5	0000							25	TS			26	TS			26	TS		
2/5	0100							26	TL			27	TL			27	TL		

Message Types:
- **TI =** PTWC Initial Threat Message
- **TFI =** PTWC Threat Message with an Initial Forecast for the Region near the Earthquake
- **TFP =** PTWC Threat Message with a Pacific-wide Forecast
- **TFH =** PTWC Threat Message with a Forecast for Shallow Marginal Seas (High-Resolution Forecast Model Run)
- **TS =** PTWC Threat Message Supplement
- **TL =** PTWC Last Threat Message for this Event
- **TAB =** NWPTAC Tsunami Advisory Bulletin

ANNEX III. POST-EXERCISE EVALUATION

Exercise evaluation forms are to be completed by each participating agency and forwarded to the country Exercise Pacific Wave 2015 National Contact, or the country Tsunami National Contact. **The PacWave15 National Contact will compile the country Evaluation Form and complete and submit this online no later than 21 February 2015**.

Note: Only **one** on-line evaluation form is to be completed **per country**.

The PacWave15 Evaluation Form can be found at
https://www.surveymonkey.com/s/pacwave15_eval.

Alternatively, the country evaluation forms can be submitted by email or fax to the Exercise PacWave 15 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).

Exercise Pacific Wave 2015 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), or Not Applicable (N/A) by ticking the relevant box. • Comments should be used to explain/expand your Yes, No, or Not Applicable answers. • Tick the C (Comment) box to indicate if you are providing comments. • Write your comments on the page following the evaluation questions. Note the question number in the left column and write your comments alongside. **Example:** ☑ Y ☐ N ☑ C ☐ NA **Ref No.Comment**
4	Each participating Agency/Country	Send completed agency evaluation form to country PacWave15 National Contact so he/she can compile to complete the final Country PacWave15 Evaluation Form (online).
5	PacWave15 National Contact	PacWave15 National Contact should complete and submit the PacWave15 Evaluation Form by **21 February 2015** (https://www.surveymonkey.com/s/pacwave15_eval.). If there are problems or questions, please contact the PacWave15 Task Team co-Chairs (Laura Kong, laura.kong@noaa.gov; Jo Guard, jo.guard@dpmc.govt.nz)

Exercise Pacific Wave 2015 Evaluation Form Contact Details			
Agency:		**Country:**	
Contact Name:		**Contact Position:**	
Contact Phone:		**Contact Mobile:**	
Contact E-Mail:			

Country Exercise Scenario	
Scenario Used:	**Tick Scenario used during PacWave15:** ○ Nansei-Shoto Trench ○ Tonga Trench ○ Colombia-Ecuador Trench ○ Northern Japan Trench ○ Manila Trench ○ Peru-Chile Trench

OBJECTIVE 1

To test communication methods from the PTWS Tsunami Service Providers to participating countries.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
1.1	Did your country Tsunami Warning Focal Point receive the initial PTWS information/threat message (text product)?	*Y*	*N*	*C*	*NA*
1.2	If yes, when did you receive the message?	Please state the time in UTC			
1.3	How did you receive the message? Please tick all methods that apply: ○ GTS ○ AFTN ○ EMWIN ○ Fax ○ Email ○ CISN (Real-Time Earthquake Display) Other (Please specify):	Please list how you received the message			
1.4	Did your country Tsunami Warning Focal Point receive the initial PTWS threat message by email (graphical products)?	*Y*	*N*	*C*	*NA*
1.5	If yes, when did you receive the message by email?	Please state the time in UTC			

OBJECTIVE 2

To test whether PTWS PTWC Tsunami Service Provider products are interpreted by countries accurately and in a timely manner.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
2.1	Information provided in the relevant international warning centre messages was understood by and useful to the National Tsunami Warning Centre (NTWC)/National Disaster Management Office (NDMO).	*Y*	*N*	*C*	*NA*
2.2	Threat information through time in PTWC products was understood and useful. Please comment as necessary on product staging.				
	• 1st Product - General threat for nearest coasts,	*Y*	*N*	*C*	*NA*
	• 2nd Product - Numerical forecast for nearest coasts,	*Y*	*N*	*C*	*NA*
	• 3rd Product - Numerical forecast for the Pacific	*Y*	*N*	*C*	*NA*
	• 4th Product - Numerical forecast at a higher resolution for very shallow seas (if needed)	*Y*	*N*	*C*	*NA*
	• Later Products – Monitoring of tsunami via sea level observation readings	*Y*	*N*	*C*	*NA*
2.3	Components of the PTWC product suite were understood and useful. Please comment as necessary on product clarity, or confusion.				
	• Text Product	*Y*	*N*	*C*	*NA*
	• Coastal Tsunami Amplitude Forecast Polygons Map	*Y*	*N*	*C*	*NA*
	• Table of Forecast Statistics for Polygons	*Y*	*N*	*C*	*NA*
	• Deep-Ocean Tsunami Amplitude Forecast (Energy) Map	*Y*	*N*	*C*	*NA*
	• Coastal Tsunami Amplitude Forecast Map	*Y*	*N*	*C*	*NA*
	• Regional Coastal Tsunami Amplitude Forecast Maps	*Y*	*N*	*C*	*NA*
	• Coastal Tsunami Amplitude KMZ file	*Y*	*N*	*C*	*NA*
2.4	Please rank the PTWC products in order of their usefulness from 1 to 7, where 1 is the most useful product and 7 is the least useful product? ___ Text Product ___ Coastal Tsunami Amplitude Forecast Polygons Map ___ Table of Forecast Statistics for Polygons ___ Deep-Ocean Tsunami Amplitude Forecast				

OBJECTIVE 2

To test whether PTWS PTWC Tsunami Service Provider products are interpreted by countries accurately and in a timely manner.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
	(Energy) Map ___ Coastal Tsunami Amplitude Forecast Map ___ Regional Coastal Tsunami Amplit				
2.5	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				
	• NGD/WDC-MGG tsunami historical database (web)				
	• TsuDig historical database GIS tool (NGD/ITIC offline)				
	• National pre-computed tsunami scenarios				
	• National tsunami forecasts				
	• International tsunami forecasts. Note source of forecasts (PTWC, NWPTAC, WC/ATWC) in comments.				
	• Communication with outside sources (such as ITIC, media, other). Please specify in the comments section.				
2.6	The information provided assisted with decision making, e.g., warning levels, earthquake parameters, estimated arrival times, forecast wave heights, etc.				
2.7	The information issued by your country national Tsunami Warning Focal Point was according to standard operating procedures.				
2.8	Is the resolution quality of the graphical products acceptable? Currently, graphical products are sent to TWFPs as minimum-sized files, where each email contains 2 MB or less of attached files. As a result, the graphics are of poor quality when zoomed in.				
2.9	To improve the resolution quality of the graphical products, greater internet bandwidth is needed. Is your TWFP / NTWC able to efficiently receive emails and quickly download file attachments that are up to 5 MB?				

Y *N* *C* *NA*

OBJECTIVE 3

To test national and regional cooperation.

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
3.1	The NTWC/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.				
3.2	The NTWC/NDMO knows its specific response role in the event of a tsunami.				
3.3	The NTWC/NDMO has, prior to the exercise, engaged in tsunami response planning.				
3.4	The NTWC/NDMO has undertaken activity to increase its capacity and capability to support a national tsunami response (for example, training, exercise, etc.) – Note activities in Comment section.				
3.5	The NTWC/NDMO has an appropriate management structure identified and documented to support tsunami response.				
3.6	The NTWC/NDMO has a tsunami mass coastal evacuation plan.				
3.7	Arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response were in place **before** the exercise.				
3.8	A country tsunami emergency response plan (standard operating procedures) for regional/local tsunamis exists.				
3.9	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				
3.10	Regional/local tsunami exercises are routinely conducted in-country. Note last exercise in Comments section.				
3.11	Tsunami-related curriculum programmes are in place for all levels of education. Note which levels in Comments section.				
3.12	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 PacWave15

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 for all of the statements below)		
Overall, the exercise planning, conduct, format and style were satisfactory. Comment:		
Exercise planning went well. Comment:		
The PacWave15 exercise website pages were useful. Comment:		
This evaluation form was easy to use. Comment:		
PacWave15 Exercise Manual provided an appropriate level of detail. Comment:		
IOC Manual & Guides 58: How to Plan, Conduct, and Evaluate IOC Tsunami Wave Exercises was useful. Comment:		

Please provide a general statement on your Exercise Pacific Wave 15 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**.

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**.

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)

FIFTH PACIFIC-WIDE TSUNAMI DRILL SET FOR FEBRUARY 2015

(Insert country name) will join over 30 other countries around the Pacific Rim as a participant in a mock tsunami scenario during 2-6 February 2015. The purpose of this Pacific-wide exercise is to exercise country tsunami decision-making procedures using the new enhanced forecast products of the U.S. Pacific Tsunami Warning Center (PTWC). The enhanced products include 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, the February 2013 Solomon Islands and the 2014 Chile tsunamis have increased our need to be more prepared for such events," said (insert name of appropriate official). "This important exercise will validate PTWC's enhanced products for future official use by countries of the Pacific Tsunami Warning and Mitigation System.

The exercise, titled Exercise Pacific Wave 2015 (PacWave15), will simulate Pacific countries being put into a Tsunami Warning situation requiring government decision-making. It is the fifth such exercise with the first having been carried out in May 2006, the second in October 2008, the third in November 2011 and the fourth in May 2013. Participating countries will select from six different Pacific scenarios and conduct a Tabletop Exercise within the first week of February. Destructive Pacific-wide tsunamis will be simulated through tsunami information messages from PTWC and Japan's Northwest Pacific Tsunami Advisory Centre and 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 15 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&lang=en

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://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://wcatwc.arh.noaa.gov/

[Insert country URLs]

ANNEX V. LIST OF ACRONYMS

DISCEX	Discussion Exercise' or Tabletop 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 Centre (Japan)
PTWC	Pacific Tsunami Warning Center (USA)
SOP	Standard Operating Procedures
TT	Task Team
TNC	Tsunami National Contact
TWFP	Tsunami Warning Focal Point
UNESCO	United Nations Educational, Scientific & Cultural Organization
USNTWC	US National Tsunami Warning Center (formerly West Coast/Alaska 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

(continued)

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
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 (8^{th} training-through-research cruise, June-August 1998). 1999	E only
55	Bruun Memorial Lectures, 1999: Ocean Predictability. 2000	E only
56	Multidisciplinary Study of Geological Processes on the North East Atlantic and Western Mediterranean Margins (9^{th} training-through-research cruise, June-July 1999). 2000	E only
57	Ad hoc Benthic Indicator Group - Results of Initial Planning Meeting, Paris, France, 6-9 December 1999. 2000	E only
58	Bruun Memorial Lectures, 2001: Operational Oceanography – a perspective from the private sector. 2001	E only
59	Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters. 2001	E only
60	Interdisciplinary Approaches to Geoscience on the North East Atlantic Margin and Mid-Atlantic Ridge (10^{th} training-through-research cruise, July-August 2000). 2001	E only
61	Forecasting Ocean Science? Pros and Cons, Potsdam Lecture, 1999. 2002	E only
62	Geological Processes in the Mediterranean and Black Seas and North East Atlantic (11^{th} training-through-research cruise, July- September 2001). 2002	E only

63	Improved Global Bathymetry – Final Report of SCOR Working Group 107. 2002	E only
64	R. Revelle Memorial Lecture, 2006: Global Sea Levels, Past, Present and Future. 2007	E only
65	Bruun Memorial Lectures, 2003: Gas Hydrates – a potential source of energy from the oceans. 2003	E only
66	Bruun Memorial Lectures, 2003: Energy from the Sea: the potential and realities of Ocean Thermal Energy Conversion (OTEC). 2003	E only
67	Interdisciplinary Geoscience Research on the North East Atlantic Margin, Mediterranean Sea and Mid-Atlantic Ridge (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

(continued)

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 *(under preparation)*	
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)	*Under preparation*
95.	International Post-Tsunami Survey for the 25 October 2010 Mentawai, Indonesia Tsunami	*Under preparation*
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	*Under preparation*
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. Vol. 1 Exercise Manual. 2012 Vol. 2 Evaluation Report. 2014	E only
103.	Exercise NEAMWAVE 12. A Tsunami Warning and Communication Exercise for the North-eastern Atlantic, the Mediterranean, and Connected Seas Region, 27–28 November 2012. Vol. 1: Exercise Manual. 2012 Vol. 2: Evaluation Report. 2013	E only
104.	Seísmo y tsunami del 27 de agosto de 2012 en la costa del Pacífico frente a El Salvador, y seísmo del 5 de septiembre de 2012 en la costa del Pacífico frente a Costa Rica. Evaluación subsiguiente sobre el funcionamiento del Sistema de Alerta contra los Tsunamis y Atenuación de sus Efectos en el Pacífico. 2012	Español solamente (resumen en inglés y francés)
105.	Users Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System, August 2014. Revised Edition. 2014	E, S
106.	Exercise Pacific Wave 13. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1–14 May 2013. Vol. 1 Exercise Manual. 2013 Vol. 2 Summary Report. 2013	E only
107.	Tsunami Public Awareness and Educations Strategy for the Caribbean and Adjacent Regions. 2013	E only
108.	Pacific Tsunami Warning and Mitigation System (PTWS) Medium-Term Strategy, 2014−2021. 2013	E only
109.	Exercise Caribe Wave/Lantex 14. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 26 March 2014. Vol. 1 Participant Handbook. 2014	E/S
110.	Directory of atmospheric, hydrographic and biological datasets for the Canary Current Large Marine Ecosystem. 2014	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*	*In preparation*
113.	*Exercise Indian Ocean Wave 2014: An Indian Ocean-wide Tsunami Warning and Communication Exercise.*	*In preparation*
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. I Manual	E only
115.	*Transboundary Waters Assessment Programme (TWAP) Assessment of Governance Arrangements for the Ocean*	*In preparation*
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	E only

(continued)

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

Intergovernmental Oceanographic Commission
Technical Series

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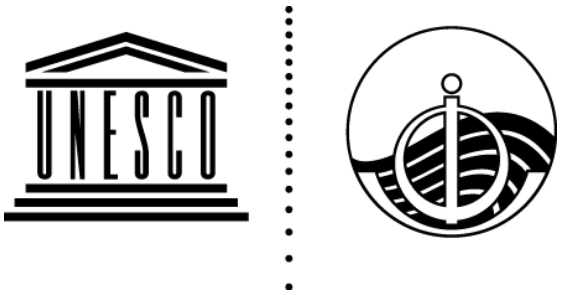

EXERCISE PACIFIC WAVE 15

A Pacific-wide Tsunami Warning and Enhanced Products Exercise

2-6 February 2015

Volume 2 Summary Report

UNESCO

Intergovernmental Oceanographic Commission
Technical Series

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EXERCISE PACIFIC WAVE 15

A Pacific-wide Tsunami Warning and Enhanced Products Exercise

2-6 February 2015

Volume 2 Summary Report

UNESCO 2015

IOC Technical Series, 117 (Volume 2)
Honolulu and Paris, April 2015
English only

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(English only)

Report prepared by: The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS)
ICG/PTWS Task Team on PACWAVE 15
International Tsunami Information Center
New Zealand Ministry of Civil Defence and Emergency Management

Published in 2015
by United Nations Educational, Scientific
and Cultural Organization
7, Place de Fontenoy, 75352 Paris 07 SP

(IOC/2015/TS/117 Vol.2)

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Most of the world's earthquakes and tsunamis occur in the Pacific Ocean and its marginal seas, and over 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 and 9 of them have occurred in the Pacific, Local and regional tsunamis occur most frequently, and in the Pacific over history, have been the cause of 99% of tsunami casualties as they will impact shorelines in minutes.

Exercise Pacific Wave 15 (PacWave15) is the fifth Pacific-wide drill of what is envisioned to be a regular schedule of Pacific exercises. PacWave15 evaluated the new enhanced tsunami products of the Pacific Tsunami Warning Center (PTWC), which started on October 1, 2014.

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

A total of 41 countries (including 6 sub-national entities) participated in the exercise. A strong majority of responding countries expressed a positive view of the planning and conduct of PacWave15. Exercise objectives were exercised, evaluated and reported, thus enabling PTWS recommendations and lessons learned to be formulated. PacWave15 provided valuable feedback from countries on the newly introduced PTWC enhanced products. PacWave15 reinforced the integration of PTWC enhanced products in their country decision-making processes, and in their Standard Operating Procedures (SOPs).

Countries overwhelmingly found the new procedures and forecast products timely, clear and useful. Countries generally understood the PTWC enhanced products and viewed them as adding important advice to guide them in providing more accurate national warnings. The text product was viewed as the most useful enhanced product.

Although all countries have now implemented the enhanced products into their national processes and procedures, there is still a need for continued training and exercising. Indications of improvements to the new products were seen as development in country technological abilities.

The findings from PacWave15 are as follows:

- An overwhelming majority of respondents ranked the text message as the most useful product, followed by the forecast polygon map. Moderately useful products were the coastal amplitude forecast map, energy forecast map, and forecast polygon table. The coastal KMZ file was ranked the least useful product.

- 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) understand the content of the enhanced products.

- The majority of respondents indicated the information in the enhanced products, in particular the earthquake parameters, estimated arrival times and forecast wave amplitudes, assisted with their decision-making.

- The majority of respondents indicated that the current resolution quality of the graphical products in acceptable, but acknowledged that the resolution of these products is poor when zoomed in. The majority of respondent also indicated that they would have the internet bandwidth to receive higher resolution images, but some would have to request the provision of greater internet bandwidth for this.

- 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 national tsunami experts to help assess the tsunami threat messages received. Most of the respondents had arrangements in place to assemble these experts before the exercise.

- 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.

- Overall, respondents indicated that stakeholder agencies now have a better understanding of their goals, responsibilities and roles in tsunami emergencies.

Based on a review of the PacWave15 responses, the following recommendations are made:

- Tsunami Warning Focal Point (TWFP) contact information needs to be 100% accurate, 100% of the time. Reference action is made to IOC Circular Letter 2563 “Updating information on National Tsunami Warning Centres (NTWC) and Tsunami Warning Focal Points (TWFP) for the PTWS region according to new definitions”.

- Countries need sufficient time to fully prepare for the PacWave exercises. The IOC should announce future PacWave activities at least six months prior to the exercise, and distribute the exercise manual at least three months prior. Tsunami Service Providers should make available tsunami products at least one month prior to the exercise.

- Thirty-five percent of responding countries do not have tsunami evacuation maps, hampering a community to plan for response. Preparedness efforts should be supported at highest priority. All at-risk communities should have evacuation maps.

- Thirty-five percent of the responding countries do not conduct routine tsunami exercises, relying upon IOC PacWave Exercises that occur every two years. Effective response readiness requires more frequent exercises. Countries are encouraged to conduct annual tsunami exercises, starting with small, controllable coastal school drills.

- Past PacWave exercises have been conducted in controlled, moderately-paced timelines as Table Top exercises. Many countries are ready to exercise realistic responses. Future exercises should be conducted in real time, initially during daytime working hours with full staffing during normal duty hours, and later, simulating the presence of minimal staff during night-time or weekend hours.

1. INTRODUCTION

1.1 INTERNATIONAL TSUNAMI EXERCISES

Historically, from 2000 B.C. to A.D. 2014, 71% percent of the worlds' confirmed tsunamis have occurred in the Pacific Ocean and its marginal seas. Of the 245 deadly tsunamis, 76% were in the Pacific, with 38% in Japan, 15% in South America, 12% in Indonesia (Pacific Coast), 11% in South Pacific Islands, 7% in North and Central America, 6% in Alaska, 6% in Asia, 3% in Russia, and 1% in Hawaii. Most of these deadly tsunamis were caused by earthquakes (78%) or earthquake-generated landslides (10%). Seven of the top 10 most deadly tsunamis occured in the Pacific.

In the 50 years since the start of the International Tsunami Warning 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 lost due to tsunamis in the far field prior to 1965.

Over the past seven years (2009–2015), the Pacific witnessed five 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 with people having only 10 to 30 minutes 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. And 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; PTWS Medium-Term Strategy 2014-2021—IOC Technical Series, 108; *PTWS Implementation Plan 2013*, vers. 3). In 2005, ITSU was re-established as 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 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), Pacific Tsunami Warning Center (PTWC), and Japan Meteorological Agency (JMA). Altogether there have been four IOC-coordinated international exercises,

Exercise Pacific Wave 2006, 2008, 2011 and 2013. 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 system and measure the readiness of countries to respond as national tsunami warning centres and emergency response agencies, to distant and local tsunamis. Pacific Wave Exercises 2011, 2013 and now 2015 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.

1.2 PACIFIC TSUNAMI WARNING CENTER NEW ENHANCED PRODUCTS

The PTWC Enhanced Products provide threat levels based on tsunami wave forecasts, rather than on 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 new enhanced products should greatly reduce the number of areas warned unnecessarily and also provide some advance notice of potential local tsunamis. Details on the PTWC New Enhanced Products for the PTWS are provided in IOC Technical Series 105, *User's Guide to the Pacific Tsunami Warning Center Enhanced Products for the PTWS* (Revised Edition, August 2014, in English and Spanish).

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, now provide forecast levels of impact along coasts.

At its 22nd Session, the ICG/PTWS (2007) started the process of improving the PTWS international alert products, starting first with the products of the PTWC. At its 24th Session, the ICG/PTWS (May 2011) approved PTWC's Enhanced Tsunami Products proposal and asked to proceed with their development. Exercise Pacific Wave 2011 (November) introduced those products and the ICG/PTWS Steering Committee (SC) met in May 2012 to review the feedback and approve the final implementation timeline. Exercise Pacific Wave 2013 (April) was conducted to further validate the products.

At the 25th Session of the ICG/PTWS (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 them 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. EXERCISE PACIFIC WAVE 15

A total of 41 countries (6 including subnational entities) independently participated in Exercise Pacific Wave 2015 (PacWave15). 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	• Nicaragua
• Chile	• Niue
• China (including Hong Kong)	• Palau
• Colombia	• Panama
• Cook Islands	• Papua New Guinea
• Costa Rica	• Peru
• Ecuador	• Philippines
• El Salvador	• Republic of Korea
• Federated States of Micronesia – Chuuk, Pohnpei, Kosrae, Yap	• Republic of Marshall Islands
• Fiji	• Russian Federation
• France – French Polynesia	• Samoa
• France – New Caledonia	• Singapore
• Guatemala	• Solomon Islands
• Honduras	• Thailand
• Indonesia	• Tonga
• Japan – JMA NWPTAC	• Timor Leste
• Kiribati	• Tokelau
• Malaysia	• Tuvalu
• Mexico	• United States of America– PTWC
• Nauru	• Vanuatu
• New Zealand	• Vietnam

Two countries provided PacWave15 National Contacts, but did not participate.

This PacWave15 Exercise Summary Report is based on the post-exercise evaluation data as compiled by the PacWave15 Task Team.

3. CONCEPT OF THE EXERCISE

3.1 PURPOSE

The purpose (aim) of Exercise PacWave15 was to test the new PTWC Enhanced Products.

The exercise provided an opportunity for Pacific countries to test the new products and review their tsunami response procedures. 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 was encouraged to participate.

3.2 OBJECTIVES

The overall objectives for Exercise PacWave15 were to:

- Objective 1. Test communications from the PTWS Tsunami Service Providers to Countries.
- Objective 2. Test whether the PTWS PTWC Tsunami Service Provider products are interpreted by countries accurately and in a timely manner.
- Objective 3. Test national and regional cooperation.

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

3.3 EXERCISE CONCEPT

PacWave15 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 2-6 February 2015 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 PacWave15 website (http://www.pacwave.info) in advance to help countries plan and prepare.

Each scenario contained a suite of PTWC enhanced product messages and forecasts. The Nansei-Shoto, Japan and Manila Trench scenarios also had JMA NWPTAC Tsunami Advisories. 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. 3 February 2015 @ 1500 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 15** 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.

3.4 EXERCISE DELIVERY/FORMAT

Only the suite of PTWC New Enhanced Products was reviewed in PacWave15. Northwest Pacific Tsunami Advisory Center (NWPTAC) – Japan Meteorological Agency (JMA) messages were issued for the Nansei-Shoto, Japan, and Manila Trench scenarios for information and national decision-making purposes only and were listed in the Master Schedule of Events List (Annex I) of the Exercise Manual (IOC/2015/TS/117 Vol.1).

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

Each Exercise PacWave15 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.

3.5 EXERCISE SCENARIO AND DATE

Exercise Pacific Wave 15 was held within the period of 2-6 February 2015. Participant countries could choose to run their exercise any time between 2-6 February 2015, allowing flexibility to avoid conflict with other important national events.

PacWave15 was recommended to be a table top exercise and was a live exercise with the PTWC and the NWPTAC issuing dummy test messages representing live products between 3 and 5 February 2015. Actual messages corresponding to the dummy test messages were available beforehand on the PacWave15 website.

3.6 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:

- Nansei-Shoto Trench, Ryuku Islands
- Tonga Trench
- Colombia-Ecuador Trench
- Northern Japan Trench
- Manila Trench
- Peru-Chile Trench

The exercise required Member States to: (i) evaluate the incoming PTWC New Enhanced Products; (ii) issue appropriate country specific alerts by National Tsunami Warning Centres; and (iii) 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.

3.7 EXERCISE TYPE

Participating countries were encouraged to carry out a table-top exercise for Exercise PacWave15 (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 Service Providers such as the PTWC in Hawaii, which describe the nature of the threat.

3.8 EXERCISE DOCUMENTATION

It was recommended to participating agencies that they take into account the following Exercise PacWave15 documents when planning, conducting, and evaluating the exercise:

- IOC Circular Letter No 2548: PTWS Pacific-wide Tsunami Exercise 'PacWave15', 2-6 February 2015, dated 4 November 2014
- *Exercise Pacific Wave 15, A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 2-6 February 2015. Volume 1: Exercise Manual*. IOC Technical Series No 117. UNESCO/IOC 2015 (English)
- *User's Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System*. IOC Technical Series No 105, Revised edition. UNESCO/IOC 2014 (English, Spanish)
- *How to Plan, Conduct, and Evaluate IOC Tsunami Wave Exercises*, IOC Manuals and Guides No 58, 2013.

All information related to Exercise PacWave15 is available at the exercise website: http://www.pacwave.info.

4. EVALUATION

4.1 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.

4.2 OBSERVERS

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

4.3 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 Pacific Wave 2015 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 PacWave15 Summary Report.

All participating countries were asked to complete the official Exercise PacWave15 Evaluation Form (Annex II) by 21 February 2015. Forms were submitted online by visiting https://www.surveymonkey.com/s/pacwave15_eval.

5. POST-EXERCISE EVALUATION FINDINGS

A total of 41 countries, including six 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. PTWC and JMA NWPTAC message dissemination summaries can be found in the International Master List of Events table found in Annex I.

The strong majority of responding countries expressed a positive view of the planning and conduct of PacWave15. Exercise objectives were exercised, evaluated and reported, thus enabling PTWS recommendations and lessons learned to be formulated. PacWave15 provided valuable feedback from countries on the newly introduced PTWC enhanced products. PacWave15 reinforced the integration of PTWC enhanced products in their country decision-making processes, and in their Standard Operating Procedures (SOPs).

Countries overwhelmingly found the new procedures and forecast products timely, clear and useful. Countries generally understood the PTWC enhanced products and viewed them as adding important advice to guide them in providing more accurate national warnings. The text product was viewed as the most useful enhanced product.

Although all countries have now implemented the enhanced products into their national processes and procedures, there is still a need for continued training and exercising. Indications of improvements to the new products were seen as development in country technological abilities.

The findings from PacWave15 are as follows:

- The majority of participants received the messages from PTWC in a timely manner and without any issues.

- An overwhelming majority of respondents ranked the text message as the most useful product, followed by the forecast polygon map. Moderately useful products were the coastal amplitude forecast map, energy forecast map, and forecast polygon table. The coastal KMZ file was ranked the least useful product.

- 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 Centers (NTWCs) and National Disaster Management Offices (NDMOs) understand the content of the enhanced products.

- The majority of respondents indicated the information in the enhanced products, in particular the earthquake parameters, estimated arrival times and forecast wave amplitudes, assisted with their decision-making.

- The majority of respondents indicated that the current resolution quality of the graphical products in acceptable, but acknowledged that the resolution of these products is poor when zoomed in. The majority of respondent also indicated that they would have the

internet bandwidth to receive higher resolution images, but some would have to request the provision of greater internet bandwidth for this.

- 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 national tsunami experts to help assess the tsunami threat messages received. Most of the respondents had arrangements in place to assemble these experts before the exercise.

- 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.

- Overall, respondents indicated that stakeholder agencies now have a better understanding of their goals, responsibilities and roles in tsunami emergencies.

6. RECOMMENDATIONS

Based on a review of the PacWave15 responses, the following recommendations are made:

(i) Tsunami Warning Focal Point contact data

Issue: TWFP contact information needs to be 100% accurate, 100% of the time.

Recommendation: Countries need to routinely review and confirm their 24x7 Tsunami Warning Focal Point contact data to the IOC, who will forward them to the Tsunami Service Providers for immediate update. Reference action is made to IOC Circular Letter 2563 "Updating information on National Tsunami Warning Centres (NTWC) and Tsunami Warning Focal Points (TWFP) for the PTWS region according to new definitions" for countries to officially update or re-confirm contact information on their National Tsunami Warning Centres and Tsunami Warning Focal Points (TWFP) by 16 February 2015.

(ii) Exercise Planning

Issue: Provide countries with sufficient time to fully prepare for the PacWave exercise.

Recommendation: IOC should officially announce future PacWave activities at least six months prior to the exercise, and distribute the exercise manual at least three months prior. Tsunami Service Providers should make available tsunami products at least one month prior to the exercise.

(iii) Community Preparedness

Issue: 35% of the responding countries do not have tsunami evacuation maps, evacuation signs, routes, assembly areas, etc. This hampers a community to plan for tsunami emergency response.

Recommendation: IOC and Member States should support preparedness efforts as highest priority. All communities at risk should have tsunami evacuation maps. An example training effort is the PTWS-endorsed new international course being piloted by ITIC in Central America that is focusing on evacuation plans, maps, and procedures.

(iv) **Routine Exercising**

Issue: Similarly, 35% of the responding countries do not conduct annual, routine tsunami exercises. They rely upon IOC PacWave Exercises that occur only every two years. Effective tsunami response readiness requires more frequent, routine exercises.

Recommendation: Countries are encouraged to conduct annual tsunami exercises, starting with small, controllable coastal school drills. PacWave Exercise manuals, scenarios, and message products can be utilized as injects and as guidance to plan and integrate tsunami with other natural hazard exercises.

(v) **Conduct of Future Exercises**

Issue: 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.

ANNEX I

INTERNATIONAL MASTER SCHEDULE OF EVENTS LISTS

Scenario →		Peru-Chile		Colombia-Ecuador		Tonga		Japan				Nansei-Shoto Ryukyu Islands				Manila			
Center →		PTWC		PTWC		PTWC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC	
Date (UTC)	Time (UTC)	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP
2/3	1500	Quake		Quake															
2/3	1507	1	TI	1	TI														
2/3	1530	2	TFI	2	TFI														
2/3	1600	3	TFP	3	TFP														
2/3	1700	4	TS	4	TS														
2/3	1800	5	TS	5	TS														
2/3	1900	6	TS	6	TS														
2/3	2000	7	TS	7	TS														
2/3	2100	8	TS	8	TS	Quake													
2/3	2107					1	TI												
2/3	2130					2	TFI												
2/3	2200	9	TS	9	TS	3	TFP												
2/3	2300	10	TS	10	TS	4	TS												
2/4	0000	11	TS	11	TS	5	TS												
2/4	0100	12	TS	12	TS	6	TS	Quake				Quake				Quake			
2/4	0107							1	TI			1	TI			1	TI		
2/4	0117									1	TAB			1	TAB			1	TAB
2/4	0130							2	TFI			2	TFI			2	TFI		
2/4	0145									2	TAB			2	TAB			2	TAB
2/4	0200	13	TS	13	TS	7	TS	3	TFP			3	TFP			3	TFP		
2/4	0230											4	TFH			4	TFH		
2/4	0240									3	TAB			3	TAB			3	TAB
2/4	0300	14	TS	14	TS	8	TS	4	TS			5	TS			5	TS		
2/4	0340									4	TAB			4	TAB			4	TAB
2/4	0400	15	TS	15	TS	9	TS	5	TS			6	TS			6	TS		
2/4	0440									5	TAB			5	TAB			5	TAB
2/4	0500	16	TS	16	TS	10	TS	6	TS			7	TS			7	TS		
2/4	0540									6	TAB			6	TAB			6	TAB
2/4	0600	17	TS	17	TS	11	TS	7	TS			8	TS			8	TS		
2/4	0640									7	TAB			7	TAB			7	TAB
2/4	0700	18	TS	18	TS	12	TS	8	TS			9	TS			9	TS		
2/4	0740									8	TAB			8	TAB			8	TAB
2/4	0800	19	TS	19	TS	13	TS	9	TS			10	TS			10	TS		
2/4	0840									9	TAB			9	TAB				
2/4	0900	20	TS	20	TS	14	TS	10	TS			11	TS			11	TS		
2/4	0940									10	TAB			10	TAB				
2/4	1000	21	TS	21	TS	15	TS	11	TS			12	TS			12	TS		
2/4	1100	22	TS	22	TS	16	TS	12	TS			13	TS			13	TS		
2/4	1200	23	TS	23	TS	17	TS	13	TS			14	TS			14	TS		
2/4	1300	24	TS	24	TS	18	TS	14	TS			15	TS			15	TS		
2/4	1400	25	TS	25	TS	19	TS	15	TS			16	TS			16	TS		
2/4	1500	26	TL	26	TL	20	TS	16	TS			17	TS			17	TS		
2/4	1600					21	TS	17	TS			18	TS			18	TS		
2/4	1700					22	TS	18	TS			19	TS			19	TS		
2/4	1800					23	TS	19	TS			20	TS			20	TS		
2/4	1900					24	TS	20	TS			21	TS			21	TS		
2/4	2000					25	TS	21	TS			22	TS			22	TS		
2/4	2100					26	TL	22	TS			23	TS			23	TS		
2/4	2200							23	TS			24	TS			24	TS		
2/4	2300							24	TS			25	TS			25	TS		
2/5	0000							25	TS			26	TS			26	TS		
2/5	0100							26	TL			27	TL			27	TL		

Message Types: **TI = PTWC Initial Threat Message**
TFI = PTWC Threat Message with an Initial Forecast for the Region near the Earthquake
TFP = PTWC Threat Message with a Pacific-wide Forecast
TFH = PTWC Threat Message with a Forecast for Shallow Marginal Seas (High-Resolution Forecast Model Run)
TS = PTWC Threat Message Supplement
TL = PTWC Last Threat Message for this Event
TAB = NWPTAC Tsunami Advisory Bulletin

ANNEX II

EXERCISE PACIFIC WAVE 2015 EVALUATION FORM

INSTRUCTIONS

Exercise Pacific Wave 15 Instructions for completing the PacWave15 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), or Not Applicable (N/A) by ticking the relevant box. • Comments should be used to explain/expand your Yes, No, or Not Applicable answers. • Tick the C (Comment) box to indicate if you are providing comments. • 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 Pacific Wave15 National Contact so he/she can compile to complete the final Country Pacific Wave15 Evaluation Form (online).
5	PacWave15 National Contact	PacWave15 National Contact should complete and submit the PacWave15 Evaluation Form by **21 February 2015** (https://www.surveymonkey.com/s/pacwave15_eval). If there are problems or questions, please contact the Pacific Wave15 Task Team co-Chairs (Laura Kong, laura.kong@noaa.gov; Jo Guard, jo.guard@dpmc.govt.nz)

EXERCISE PACIFIC WAVE 2015 EVALUATION FORM

CONTACT DETAILS

1. **Country**
2. **Agency:**
3. **Contact Name:**
4. **Contact Position**
5. **Contact Phone:**
6. **Contact Mobile:**
7. **Contact E-mail:**

COUNTRY EXERCISE SCENARIO

8. Select Scenario Used:

___ Nansei-Shoto Trench

___ Tonga Trench

___ Colombia-Ecuador Trench

___ Northern Japan Trench

___ Manila Trench

___ Peru-Chile Trench

OBJECTIVE 1

To test communication methods from the PTWS Tsunami Service Providers to participating countries.

9. Did your country Tsunami Warning Focal Point receive the Msg #1: PTWC DUMMY information/threat message (text product)? This message referred to recipient to the actual Text Product, which was posted for pre- or during-exercise download on the PacWave15 website. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed. If your answer if Yes, please comment when you received the message? (UTC time). If your answer is No, please comment.

___ Y ___ N ___ N/A

Comments (including UTC receipt time):

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

___ GTS

___ AFTN

___ EMWIN

___ Fax

___ Email

___ CISN (Real-Time Earthquake Display)

___ Other (please specify)

11. Did your country Tsunami Warning Focal Point receive the Msg#1: JMA NWPTAC DUMMY information/threat message (text product)? This message referred the recipient to the actual Text Product, which was posted for pre- or during-exercise download on the PacWave15 web site. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed. If your answer of Yes, please comment when you received the message? (UTC time). If your answer is No, please comment.

___ Y ___ N ___ N/A

Comments (including UTC receipt time):

12. How did you receive the JMA NWPTAC text message? Please tick all methods that apply:

___ GTS

___ AFTN

___ Fax

___ Email

___ Other (please specify)

13. Did your country Tsunami Warning Focal Point receive the Msg#2: PTWC DUMMY threat message by email (enhanced graphical products - regional)? This message referred the recipient to the actual Enhanced Products, which was posted for pre- or during-exercise download on the PacWave15 web site. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed. If your answer of Yes, please comment when you received the message? (UTC time). If your answer is No, please comment.

___ Y ___ N ___ N/A

Comments (including UTC receipt time):

14. Did your country Tsunami Warning Focal Point receive the Msg#3: PTWC DUMMY threat message by email (enhanced graphical products – Pacific-wide)? This message referred the recipient to the actual Enhanced Products, which was posted for pre- or during-exercise download on the PacWave15 web site. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed. If your answer of Yes, please comment when you received the message? (UTC time). If your answer is No, please comment.

___ Y ___ N ___ N/A

Comments (including UTC receipt time):

15. For Nansei-Shoto and Manila Trench scenarios only. Other scenarios should reply N/A. Did your country Tsunami Warning Focal Point receive the Msg#4: PTWC DUMMY threat message by email (enhanced graphical products – Shallow Marginal Seas, High-Resolution Forecast)? This message referred the recipient to the actual Enhanced Products, which was posted for pre- or during-exercise download on the PacWave15 web site. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

If your answer of Yes, please comment when you received the message? (UTC time). If your answer is No, please comment.

___ Y ___ N ___ N/A

Comments (including UTC receipt time):

16. You may add additional individual agency evaluation statements regarding OBJECTIVE 1 in the section below.

Comments:

OBJECTIVE 2

To test whether PTWS PTWC Tsunami Service Provider products are interpreted by countries accurately and in a timely manner.

17. Information provided in the PTWC products (text and enhanced) was understood by and useful to the National Tsunami Warnign Centre (NTWC)/National Disaster Managemetn Office (NDMO). Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

18. Product Staging: Threat information through time in PTWC products was timely, understood, and useful. Please comment as necessary, e.g., was the information in the PTWC products timely, or too late? Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

Msg#1: Text – General threat for nearest coasts ___ Y ___ N ___ N/A

Msg#2: Region – Numerical forecast for nearest coasts ___ Y ___ N ___ N/A

Msg#3 Pacific – Numerical forecast for the Pacific ___ Y ___ N ___ N/A

Msg#4 (if applicable) Shallow Marginal Seas –
Numerical forecast as higher resolution for very shallow seas ___ Y ___ N ___ N/A

Later products: Text – Monitoring of tsunami via sea level
observation readings ___ Y ___ N ___ N/A

Comments (optional):

19. Product Understanding: Components of the PTWC product suite were understood and useful. Please comment, as necessary, on product clarity., e.g., was the information on the PTWC products useful or not useful; was the information clear and easy to understand, or confusing, or too difficult? Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

Text Products (initial, later) ___ Y ___ N ___ N/A

Coastal Tsunami Amplitude Forecast Polygons Map ___ Y ___ N ___ N/A

Table of Forecast Statistics for Polygons ___ Y ___ N ___ N/A

Deep-Ocean Tsunami Amplitude Forecast (Energy) Map ___ Y ___ N ___ N/A

Coastal Tsunami Amplitude Forecast Map ___ Y ___ N ___ N/A
Regional Coastal Tsunami Amplitude Forecast Maps ___ Y ___ N ___ N/A

Coastal Tsunami Amplitude KMZ File ___ Y ___ N ___ N/A

Comments (optional):

20. Please RANK the PTWC products in norder of their usefulness from 1 to 7, where 1 is the most useful product and 7 is the least useful product?

___ Text product

___ Coastal Tsunami Amplitude Forecast

___ Polygons Map

___ Table of Forecast Statistics for Polygons

___ Deep-Ocean Tsunami Amplitude Forecast (Energy) Map

___ Coastal Tsunami Amplitude Map

___ Regional Coastal Tsunami Amplitude Map

Comments (optional):

21. How did your country assess the tsunami threat during the exercise? Please tick as many as apply.

National tsunami experts ___ Y ___ N ___ N/A

National tsunami coordination committee ___ Y ___ N ___ N/A

National tsunami historical database ___ Y ___ N ___ N/A

NGDC/WDS-MGG tsunami historical database (web) ___ Y ___ N ___ N/A

TsuDig historical database GIS tool (NGD/ITIC offline) ___ Y ___ N ___ N/A

National pre-computed tsunami scenarios ___ Y ___ N ___ N/A

National tsunami forecasts ___ Y ___ N ___ N/A

International tsunami forecasts. Specify forecast source (PTWC, NWPTAC) in comments. ___ Y ___ N ___ N/A

Communication with outside sources (such as ITIC,

media, other). Specify in comments. ___ Y ___ N ___ N/A

Comments (optional):

22. The information provided assisted with decision making, e.g., warning levels, earthquake parameters estimated arrival times, forecast wave amplitudes, etc. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

23. The information issued by your country National Tsunami Warning Centre (NTWC) was according to standard operating procedures. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

24. Is the resolution quality of the graphical products acceptable? Currently, graphical products are sent to TWFPs as minimum-sized files, where each email contains 2 MB or less of attached files. As a result, the graphics are of poor quality when zoomed in. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

25. To improve the resolution quality of the graphical products, greater internet bandwidth is needed. Is your TWFP/NTWC able to efficiently receive emails and quickly download file attachments that are up to 5 MB? Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

26. You may add additional individual agency evaluation statements regarding OBJECTIVE 3 in the section below.

Comments:

OBJECTIVE 3

To test national and regional cooperation.

27. The NTWC/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

28. The NTWC/NDMO knows it specific response role in the event of a tsunami. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

29. The NTWC/NDMO has, prior to the exercise, engaged in tsunami response planning. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

30. The NTWC/NDMO regularly undertakes activities to increase its capacity and capability to support a national tsunami response (for example, training, exercise, etc.) – Note activities in Comment section. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

31. The NTWC/NDMO has an appropriate management structure identified and documented to support tsunami response. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

32. The NTWC/NDMO has a mass tsunami coastal evacuation plan. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

33. Arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response were in place before the exercise. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

34. A country tsunami emergency response plan (standard operating procedures) for regional/local tsunamis exists. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

35. The warning was disseminated to: Please tick as many as apply.

Emergency services	___ Y	___ N	___ N/A
Other national government agencies	___ Y	___ N	___ N/A
Science agencies/universities involved in assessment	___ Y	___ N	___ N/A
Local government: provincial/regional level	___ Y	___ N	___ N/A
Local government: city/district level	___ Y	___ N	___ N/A
Public	___ Y	___ N	___ N/A

Comments (optional):

36. Regional/local tsunami exercises are routinely conducted in-country. Specify last exercise in Comments section. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

37. Tsunami-related curriculum programmes are in place for all levels of education. Specifiy which levels in Comments section. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

38. Communities have tsunami evacuation maps, routes, evacuation signs and assembly points for evacuation areas? Please specify any gaps and future plans to fill gaps. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

___ Y ___ N ___ N/A

Comments (optional):

39. You may add additional individual agency evaluation statements regarding OBJECTIVE 3 in the section below.

Comments:

GENERAL EXERCISE OBSERVATIONS

Provide feedback on the planning and conduct of PacWave15

40. Overall assessment. Please provide comments as needed.

___ Y ___ N Country stakeholder agencies have a better understanding of the goals, responsibilities and roles in tsunami emergencies.

___ Y ___ N Gaps in capability and capacity have been identified.

Comments and/or suggested preparations (optional):

41. Exercise planning. Please provide comments as needed.

___ Y ___ N Overall, the exercise planning, conduct, format and style were satisfactory.
___ Y ___ N Exercise planning went well.
___ Y ___ N The PacWave15 exercise website pages were useful.
___ Y ___ N This evaluation form and online format was easy to use.
___ Y ___ N PacWave15 Exercise Manual provided an appropriate level of detail.
___ Y ___ N IOC Manual & Guides 58: How to Plan, Conduct, and Evaluate IOC Tsunami Wave Exercises was useful.

Comments:

If you would like please provide general statements on your Exercise PacWave 15. experience.

42. Exercise Planning

Please provide a general statement about **what went well**.
Please provide a general statement about **what did not go well**.
Please provide a general statement about **what could be improved**.

43. Exercise Conduct

Please provide a general statement about **what went well**.
Please provide a general statement about **what did not go well**.
Please provide a general statement about **what could be improved**.

44. Exercise Debrief or Evaluation

Please provide a general statement about **what went well**.
Please provide a general statement about **what did not go well**.
Please provide a general statement about **what could be improved**.

ANNEX III

POST-EXERCISE EVALUATION COMPILATION

This Annex contains a compilation of the responses provided by countries to the Exercise Pac Wave15 post-exercise evaluation form. Altogether, 41 countries submitted evaluation forms between February and March 2015.

Surveys were completed online through the Survey Monkey online survey and questionnaire tool, or submitted by transmission of the completed survey file to the PacWave15 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. Several 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.co/s/pacwave15_eval. The survey was divided into three sections according to the PacWave15 objectives, and evaluation statements and questions focused on different components of the warning and response process.

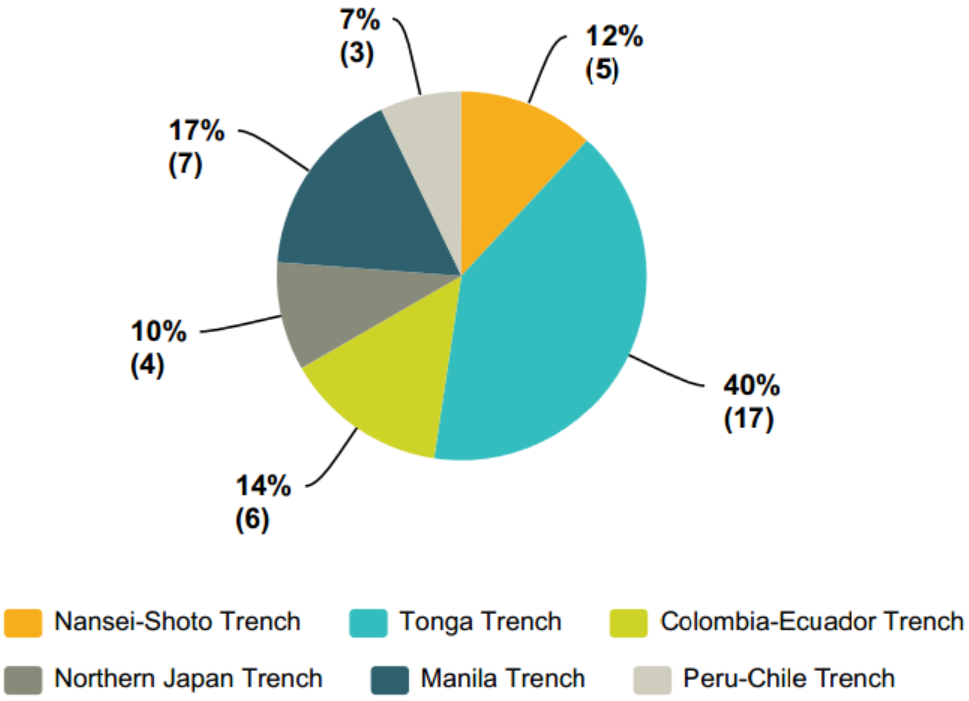
For each question, a short statement is provided that summarises the responses, and this is followed by comments provided by the countries. Translations of Spanish comments into English were done by ITIC.

1. Country and Agency

	Country	**Agency**
1	Australia	Australian Bureau of Meteorology
2	Chile	Hydrographic and Oceanographic Service of the Chilean Navy
3	China (including Hong Kong)	Tsunami Warning Center of State Oceanic Administration and Hong Kong Observatory
4	Colombia	Corporacion OSSO /Comisión Colombiana del Oceano
5	Cook Islands	Meteorological Service
6	Costa Rica	SINAMOT (Sistema Nacional de Monitoreo de Tsunamis de Costa Rica)
7	Ecuador	INOCAR
8	El Salvador	Ministry of Environment and Natural Resources
9	Fiji	Mineral Resources Department
10	France (New Caledonia)	IRD
11	French Polynesia	CEA/DASE/LDG
12	Federated States of Micronesia (FSM)	WSO Pohnpei, WSO Chuuk, WSO Yap and Kosrae State DCO
13	Guatemala	INSIVUMEH
14	Honduras	COPECO
15	Indonesia	Agency for Meteorology Climatology and Geophysics (BMKG)
16	Japan	Japan Meteorological Agency (NWPTAC)
17	Kiribati	Kiribati Meteorological Services
18	Malaysia	Malaysian Meteorological Department
19	Mexico	Centro De Alerta De Tsunamis

	Country	Agency
20	Nauru	National Disaster Risk Management
21	New Zealand	Ministry of Civil Defence & Emergency Management
22	Nicaragua	INETER
23	Niue	Niue Meteorological Service
24	Panama	Autoridad Maritima de Panama
25	Papua New Guinea	Port Moresby Geophysical Observatory (PMGO)
26	Peru	Directorate of Hydrography and Navigation (DHN)
27	Philippines	Philippine Institute of Volcanology and Seismology
28	Republic of Korea	Korea Meteorological Administration
29	Republic of Marshall Islands	Weather Service Office Majuro
30	Republic of Palau	National Weather Service/NEMO
31	Russian Federation	Sakhalin Tsunami Warning Center, Federal Service of Russia for hydrometeorology and environmental monitoring
32	Samoa	Ministry of Natural Resources & Environment
33	Singapore	Meteorological Service Singapore
34	Solomon Islands	Solomon Islands Government
35	Thailand	National Disaster Warning Center
36	Timor-Leste	National Disastre Management Directorate (NDMD)
37	Tokelau	Department of Transport and Support Services
38	Tonga	Tonga Meteorological Service
39	Tuvalu	Tuvalu Meteorological Service
40	United States	NOAA/National Weather Service
41	Vanuatu	Vanuatu Meteorology & Geo-Hazards Department
42	Vietnam	Earthquake Information and Tsunami Warning Center, Institute of Geophysics

8. Country Exercise Scenario: Select scenario used during PacWave15:



Nearly half of countries (40%) used the Tonga Trench tsunami source scenario, while 17% selected the Manila Trench source and 14% selected the Colombia-Ecuador Trench source.

Comments

- New Hebrides (Vanuatu) Trench could have also been a selected scenario. (Vanuatu)
- The Earthquake/Exercise start time changed from the original 2100UTC 3 Feb to 0000UTC 4 Feb to suit Australian participation better. (Australia)
- JMA did not conduct country exercise, but issued NWPTAs as a responsible TSP. (Japan)
- No se dio la participación de los países vecinos Perú y Colombia (ECUADOR)
  Not given the participation of neighboring countries of Peru and Colombia. (Ecuador)
- We selected the scenario to be a Regional Tsunami based on the fact that we have already conducted a few long distances tsunami exercises and experienced two real events (Chile 2010 and Japan 2011). Regarding Local Tsunamis, we have experienced the 2007 Gizo Tsunami and 2013 Santa Cruz Tsunami. Not in our recent history have we experienced a Regional Tsunami. As such, the Tonga Scenario would best place us in experiencing a most likely event in responding to Regional Tsunamis. (Solomon Islands)

More than two scenarios used

- Nansei-Shoto Trench and Manila Trench (China (including Hong Kong))

- Chuuk - Philippines Trench; Yap - Nansei Trench; Pohnpei and Kosrae – Northern Japan Trench (FSM)
- Tonga and Northern Japan (Tonga)

Objective 1: *To test communication methods from the PTWS Tsunami Service Providers to participating countries.*

9. **Did your country Tsunami Warning Focal Point receive the Msg #1: PTWC DUMMY information/threat message (text product)? This message referred the recipient to the actual Text Product, which was posted for pre- or during-exercise download on the PacWave15 web site. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed. If your answer is Yes, please comment when you received the message (UTC time). If your answer is No, please comment.**

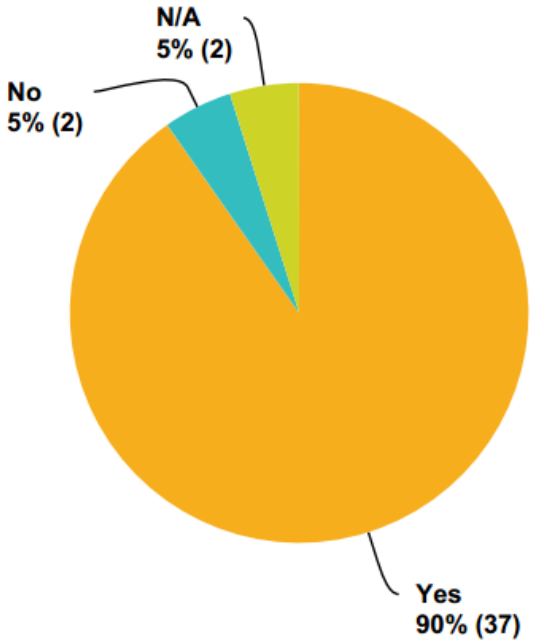


Figure 1: Receipt of initial PTWS information/threat message (text product).

The majority of respondents to this question indicated that the initial message was received (90%). Two respondents indicated that the message wasn't received, and others used the online messages for their exercise. For those that received the message, it was received in a timely manner.

Received time

Scenario	Sent Time	Received Time
Nansei-Shoto Trench	2/4 01:07	00:30 by GTS (Republic of Korea)
		01:00 by Email (Republic of Korea, China (including Hong Kong))
		01:00 (Hong Kong)
		01:02 by Fax (Republic of Korea, China(including Hong Kong))
		01:03 (Indonesia)
		01:06 (United States)
		01:17 (Republic of Palau)
Tonga Trench	2/3 21:07	21:00 (French Polynesia, New Zealand, Tuvalu, Vanuatu)
		21:00 by GTS (Australia)
		21:00 by EMWIN & Email (Tonga)
		21:01 (Niue, Solomon Islands)
		21:01 by Email (Australia)
		21:03 (Kiribati)
		21:07 by Fax (Tonga)
		21:09 by Fax & EMWIN (Republic of Marshall Islands)
		18:00 (Samoa)
		website (Mexico)
		indicated time (France (New Caledonia))
		not received (Nauru)
Colombia-Ecuador Trench	2/3 15:07	15:00 (Costa Rica, El Salvador, Nicaragua, Panama)
Northern Japan Trench	2/4 01:07	01:00 (Russian Federation, FSM, Japan)
		01:00 by Email and EMWIN (Tonga)
		01:05 by Fax (Tonga)
		15:00 (Colombia)
Manila Trench	2/4 01:07	01:00 (Philippines, Singapore, Thailand)
		01:10 (Malaysia)
		15:00 (Cook Islands)
		15:03 by Fax (Vietnam)
Peru-Chile Trench	2/3 15:07	15:09 (Peru)
		website (Chile)

Not received

- Unfortunately my official email account was down due to office transfer. (Nauru)

10. 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 (88%). Fax was the next most common form of receipt (63%). Other methods of receipt include GTS, AFTN and EMWIN.

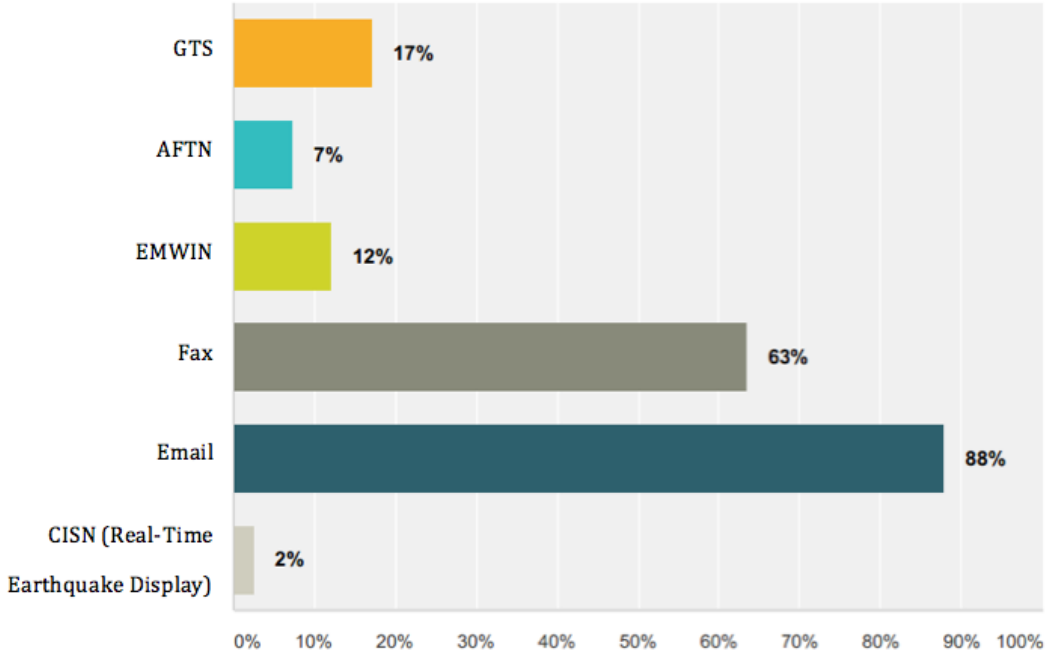


Figure 2: Methods of receiving the PTWC text message (more than one option could be chosen).

Comments

- PTWC confirmed that the messages were transmitted to the GTS and AFTN, and by fax and email. (United States)
- Fax and email for China and email only for Hong Kong. (China (including Hong Kong)
- First live message came in through the fax and later messages was referred to pre-downloaded scenario messages. (FSM)
- Email received as schedule - 03/02/15 2100UTC - Test msg from PTWC received late on EMWIN.... 04/03/15 around midday. (Tuvalu)
- PacWave15 web site. (Samoa)
- It was received only by one method. (CHILE)
- Our TNC received through text and email to me. (Fiji)
- AFTN for MRCC Fax for DSCGR Email for both DSCGR and MRCC SMS to DSCGR watch person (+687700247). (France - New Caledonia)
- Fax --> bulletin 1 Email --> bulletin1, 2,3,4. (Indonesia)

- Fax received at 0104UTC. (Singapore)

Not Received

- Unfortunately I did not receive the dummy exercise? Guessing of no availability of my registered official email address or some problems that I might encounter - break of communication. (Nauru)

- Our fax was broken. (Panama)

11. Did your country Tsunami Warning Focal Point receive the Msg #1: JMA NWPTAC DUMMY information/threat message (text product)? This message referred the recipient to the actual Text product, which was posted for pre- or during-exercise download on the PacWave 15 web site. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed. If your answer is Yes, please comment when your received the message? (UTC time). If your answer is No, please comment.

44% of respondents received the initial message, while 37% were not using a scenario that used messages from JMA (so Not Applicable). Of those that indicated they received this message, it was received in a timely manner.

Scenario	Sent Time	Received Time
Nansei-Shoto Trench	2/4 01:17	00:30 by GTS (Republic of Korea)
		00:59 by Email (China (including Hong Kong))
		01:00 by Email (Republic of Korea)
		01:02 by Fax (Republic of Korea)
		01:02 (Republic of Palau - NEMO)
		01:08 (Republic of Palau - National Weather Service)
		01:18 (Indonesia)
Northern Japan Trench	2/4 01:17	01:00 (Russian Federation)
Manila Trench	2/4 01:17	00:59 (Thailand)
		01:00 (Singapore)
		01:00 by Email (Vietnam)
		01:01 (Philippines)
		01:02 by Fax (Vietnam)
Tonga Trench	-	18:00 (Samoa)
		21:03 (Kiribati)
Colombia-Ecuador Trench	-	02:00 (Nicaragua)
		10:00 (Panama)

Figure 3: Receipt of initial JMA NWPTAC information/threat message.

Not Received

- Cannot sight the e-mail on this particular message. (Cook Islands)
- JMA did not have messages for Tonga Trench scenario. (Australia)
- JMA products are not being transmitted to the WSO. (Republic of Marshall Islands)

12. How did you receive the JMA NWPTAC text message? Please tick all methods that apply.

The most common form for receipt of these messages was by email (83%), followed by fax (41%) and GTS (22%).

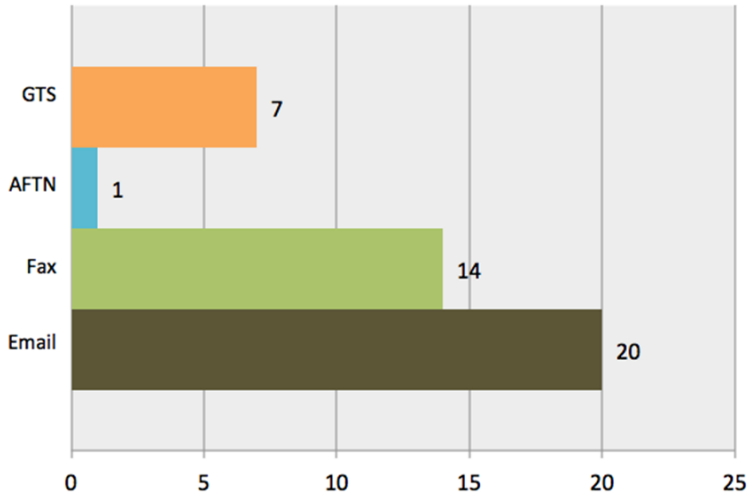


Figure 4: Methods of receiving the JMA NWPTAC text message (more than one option could be chosen).

Comments

- Por lo general se reciben de ptwc donotreply nws-ntwc.
  In general, received messages from PTWC and Do Not Reply NWS-NTWC. (Honduras)
- GTS and email for China. (China (including Hong Kong))
- PacWave15 Web site. (Samoa)
- The JMA NTWPTAC text message was received via Fax at SBST 12:02, 4 Feb 15. (Solomon Islands)
- Text through our TNC and emailed to me. (Fiji)
- JMA website. (Republic of Marshall Islands)
- GTS --> bulletin 1 Fax --> bulletin 1 Email --> bulletin1, 2,3,4. (Indonesia)
- Fax received at 0216UTC. (Singapore)

Not Received

- Cook Islands, Niue, Timor-Leste, Nauru, FSM, Australia, Tuvalu, Colombia, Tonga, Peru, Chile, France - New Caledonia, New Zealand, Mexico, El Salvador, Malaysia, Costa Rica.

13. Did your country Tsunami Warning Focal Point receive Msg #2: PTWC DUMMY threat message by email (enhanced graphical products – regional)? This message referred the recipient to the actual Enhanced Products, which were posted for pre- or during-exercise download on the PacWave15 web site. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed. If your answer is Yes, please comment when you received the message by email? (UTC time). If your answer is No, please comment.

The majority of respondents (73%) indicated that this message was received, however 24% indicated they did not receive this message. From the comments, it appears there was some confusion among participants about what messages were to be sent during the exercise, with some unaware that the products themselves would not be sent, and that only two messages would be sent with the others to be accessed from the PacWave15 web site.

Scenario	Sent Time	Received Time
Nansei-Shoto Trench	2/4 01:30	01:30 (China (including Hong Kong))
		01:32 (Indonesia)
Tonga Trench	2/3 21:30	21:30 (Australia, New Zealand, Niue, Tonga)
		21:30 by Email (Tuvalu)
		21:35 (Kiribati)
		18:00 (Samoa)
		indicated time (France (New Caledonia))
		a day late by EMWIN (Tuvalu)
Colombia-Ecuador Trench	2/3 15:30	15:30 (Costa Rica, El Salvador, Nicaragua, Panama)
Northern Japan Trench	2/4 01:30	01:30 (Russian Federation, Tonga)
		15:30 (Colombia)
Manila Trench	2/4 01:30	01:30 (Cook Islands, Thailand, Timor-Leste)
		01:35 (Malaysia)
		15:30 (Singapore)
Peru-Chile Trench	2/3 15:30	15:30 (Chile)

Figure 5: Receipt of PTWC message #2 (enhanced graphical products – regional).

Comments

- Si llegan los msn por email del ptcw pero no estan llegando los productos mejorados pronostico de llegada de ola en imagen tipo tide tool. *Yes, received by MSN email from PTWC but the new products were not received.* (Honduras)

- Pre-downloaded messages. (FSM)

- No message received after msg#1. However, documents on enhanced graphical products have been downloaded previously by National Contact. (Vietnam)

- E-mailed the enhanced graphical products (regional) to watchstander email address instead. (Philippines)

- Our country just worked with Enhanced Products which were posted by ITIC web site days before to Pacwave15, we didn't receive by email your graphical products. Also we worked with the compendium/guide elaborated during regional training in Guayaquil, Ecuador (2-4 June 2014). (Peru)

- According to our TNC he received only the Message 1. (Fiji)

- Msg #2 was downloaded prior to the commencement of the exercise. (Republic of Marshall Islands)

- For the actual exercise, we ONLY received Msg#1. This caused confusion for us since we were not aware that that was the only message we would receive by fax for the exercise. We were not informed that we would be running the exercise ourselves without getting the rest of the messages from PTWC. It would have been good if we were instructed that for the exercise, only one message would be generated and that we would take over the rest on our own. (Republic of Palau)

- Se inicio el ejercicio con material disponible. *Exercise began with materials provided.* (Guatemala)

- The products were used previously posted online. (Mexico)

14. Did your country Tsunami Warning Focal Point receive Msg #3: PTWC DUMMY threat message by email (enhanced graphical products – Pacific-wide)? This message referred the recipient to the actual Enhanced Products, which were posted for pre- or during-exercise download on the PacWave15 web site. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed. If your answer is Yes, please comment when you received the message by email? (UTC time). If your answer is No, please comment.

The majority of respondents (80%) indicated that this message was received. Again there was some confusion expressed in the comments about not receiving the actual Enhanced Products via this email during the exercise.

Scenario	Sent Time	Received Time
Nansei-Shoto Trench	2/4 02:00	02:00 (China (including Hong Kong))
		02:03 (Indonesia)
Tonga Trench	2/3 22:00	22:00 (French Polynesia, New Zealand, Niue, Solomon Islands, Tonga)
		22:00 by Email (Tuvalu)
		22:01 (Australia)
		22:03 (Kiribati)
		18:00 (Samoa)
		indicated time (France (New Caledonia))
		a day late by EMWIN (Tuvalu)

Scenario	Sent Time	Received Time
Colombia-Ecuador Trench	2/3 16:00	16:00 (Costa Rica, El Salvador, Nicaragua, Panama)
Northern Japan Trench	2/4 02:00	02:00 (Japan, Russian Federation, Tonga)
		16:00 (Colombia)
Manila Trench	2/4 02:00	00:00 (Singapore)
		02:00 (Cook Islands, Thailand, Timor-Leste)
		02:03 (Malaysia)
Peru-Chile Trench	2/3 16:00	16:00 (Chile)

Figure 6: Receipt of PTWC message #3 (enhanced graphical products – Pacific-wide).

Comments

- Se recibe el mensaje pero solo con tabla de tiempo de llegada de la ola a costa de pacific. *Message was received but only with the table with wave arrival times to the Pacific, no graphical products.* (Honduras)
- Pre-downloaded messages. (FSM)
- No message received after Msg#1. However, documents on enhanced graphical products have been downloaded previously by National Contact. (Vietnam)
- Msg #3 was downloaded prior to the commencement of the exercise. (Republic of Marshall Islands)
- We work with products previously posted online. (Mexico)
- E-mailed the enhanced graphical products (Pacific-wide) to watchstander email address instead. (Philippines)
- We only received the Msg #1: JMA NWPTAC DUMMY information/threat message (text product). (Republic of Korea)
- We don't have any idea why our country don't receive enhanced products. We ask to PTWC to do a new test with the new products. (Peru)
- For the actual exercise, we ONLY received Msg#1. This caused confusion for us since we were not aware that that was the only message we would receive by fax for the exercise. We were not informed that we would be running the exercise ourselves without getting the rest of the messages from PTWC. It would have been good if we were instructed that for the exercise, only one message would be generated and that we would take over the rest on our own. (Republic of Palau)

15. **For Nansei-Shoto and Manila Trench scenarios only. Other scenarios should reply N/A. Did your country Tsunami Warning Focal Point receive the Msg #4: PTWC DUMMY threat message by email (enhanced graphical products - Shallow Marginal Seas, High-Resolution Forecast)? This message referred the recipient to the actual Enhanced Products, which were posted for pre- or during-exercise**

download on the PacWave15 web site. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed. If your answer is Yes, please comment when you received the message by email? (UTC time)If your answer is No, please comment.

For 63% of respondents using other scenarios, this question was not applicable. 24% of respondents indicated this message was received.

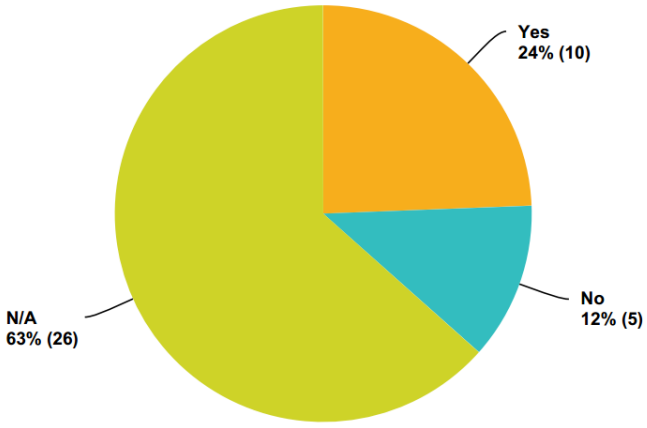


Figure 7: Receipt of PTWC message #4 (enhanced graphical products – shallow margin seas, high resolution forecast).

Received Time

- 02:03 UTC (Indonesia)
- 02:30UTC 4th Feb 2015 (Cook Islands)
- 02:30 UTC (China (including Hong Kong), Timor-Leste, Thailand, Nicaragua)

Comments

- Pre-downloaded messages. (FSM)
- No message received after msg#1. However, documents on enhanced graphical products have been downloaded previously by National Contact. (Vietnam)
- e-mailed the enhanced graphical products (shallow marginal seas, high resolution forecast) to watchstander email address instead. (Philippines)
- We only received the Msg #1: JMA NWPTAC DUMMY information/threat message (text product). (Republic of Korea)
- For the actual exercise, we ONLY received Msg#1. This caused confusion for us since we were not aware that that was the only message we would receive by fax for the exercise. We were not informed that we would be running the exercise ourselves without getting the rest of the messages from PTWC. It would have been good if we were instructed that for the exercise, only one message would be generated and that we would take over the rest on our own. (Republic of Palau)

- Only threat message received, not the graphical products. (Malaysia)

- Possible reason is that the messages sent through mail were received by my colleague who is no longer a focal point. (Singapore)

16. You may add additional individual agency evaluation statements regarding OBJECTIVE 1 in the section below.

The following comments were received from countries in this section:

- NWPTAC 00:59 (Thailand)

- There was around a 1 min delay between PTWC sending emails and JATWC receiving them. The GTS message was received immediately. (Australia)

- The Solomon Islands have added three of its own additional objectives as stated below: Objective 4: Test communications from SIMS/NEOC as the NTWC Tsunami Service Provider to agencies and organizations with tsunami dissemination roles and responsibilities. [Communications and cooperation]. Objective 5: Test whether the NTWC Products are interpreted accurately and disseminated across the country. [Information reach]. Objective 6: Test the NTWS Activation Procedures and the National Disaster Management Arrangements Activation Procedures. [Tsunami Sub-Plan SOPs and DM Arrangements Clusters SOPs]. (Solomon Islands)

- No threat email message was sent from PTWS, only a fax that mentioned the initiation of PacWave 15 exercise. No scenario with data. Only messages with info were downloaded to PacWave 15 site. (Republic of Palau)

- There were no messages received via GTS and Fax (as PacWaves before). (Malaysia)

17. 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). Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

Almost all responses to this question (90%) agreed that the PTWC products are useful and understood.

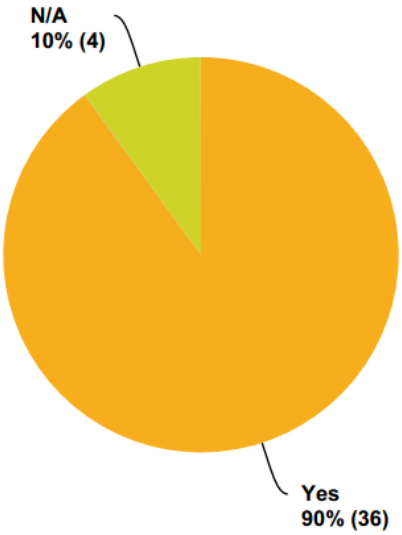


Figure 8: Information provided in the PTWC products (text and enhanced) was understood by and useful to the National Tsunami Warning Centre (NTWC)/National Disaster Management Office (NDMO).

Comments

- En el caso de la copeco se recibe se entiende la tabla de tiempo de llegada (los demas productos no estan llegando. *In case of COPECO, the table with wave arrival times was received, no graphical products received.* (Honduras)
- My office did not receive the text messages. (Nauru)
- While JATWC received the test PTWC products in real time, the actual review of their usefulness occurred outside the exercise. The review focused on whether useful to be incorporated in future tsunami warning process as additional independent scientific sources. (Australia)
- New products are not shared with NDMO. Only for the use of NTWC. (Colombia)
- The majority of the staff of the NTWC/NDMO understand except for a few. It was also complicated when we opened one of the kmz file to find none of the 5 coastal points located along the coastlines - either located inland or in the seas. (Tonga)
- The Enhanced Products are managing as additional tool (for local tsunami) just for our National Tsunami Warning Centre (CNAT-PERU) because when we received the information from PTWC we evaluate the parameters according to our thresholds (SOP Peru) using our software called PRE-TSUNAMI made in Peru by staff at DHN. The results of evaluation (warning and/or alarm bulletins) are issued to NDMO (called INDECI). INDECI is in charge of disseminate the information to regional and local government. (Peru)
- Before the exercise PacWave15, the NTWC/NDMO was training with the new enhanced products of PTWC. (Nicaragua)
- The Products are easily interpreted and was understood by officials involved in the Exercise. (Solomon Islands)

- Current arrangement permit the text products only be made available to the NDMO. On the other hand the NTWC (WSO) have access to both the Text and Enhanced products. (Republic of Marshall Islands)

- The products provided by PTWC were extremely useful. (Panama)

- Both participating agencies (the Ministry of Civil Defence & Emergency Management (MCDEM) and GNS Science) understood the information provided in the warning centre messages and found it useful for decision making. A suggestion for the Tsunami Observations table is to put the country label in a separate column so identification is easier. An alternative suggestion for this table to make the identification of each country's data easier is to group each country's points within the table. In the tables provided of sea level observations and wave heights recorded – it is not clear whether this is the height of the first arriving waves, or the maximum wave height recorded at a location. (New Zealand)

18. **Product Staging: Threat information through time in PTWC products was timely, understood and useful. Please comment, as necessary, e.g. was the information in the PTWC products timely, or too late? Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.**

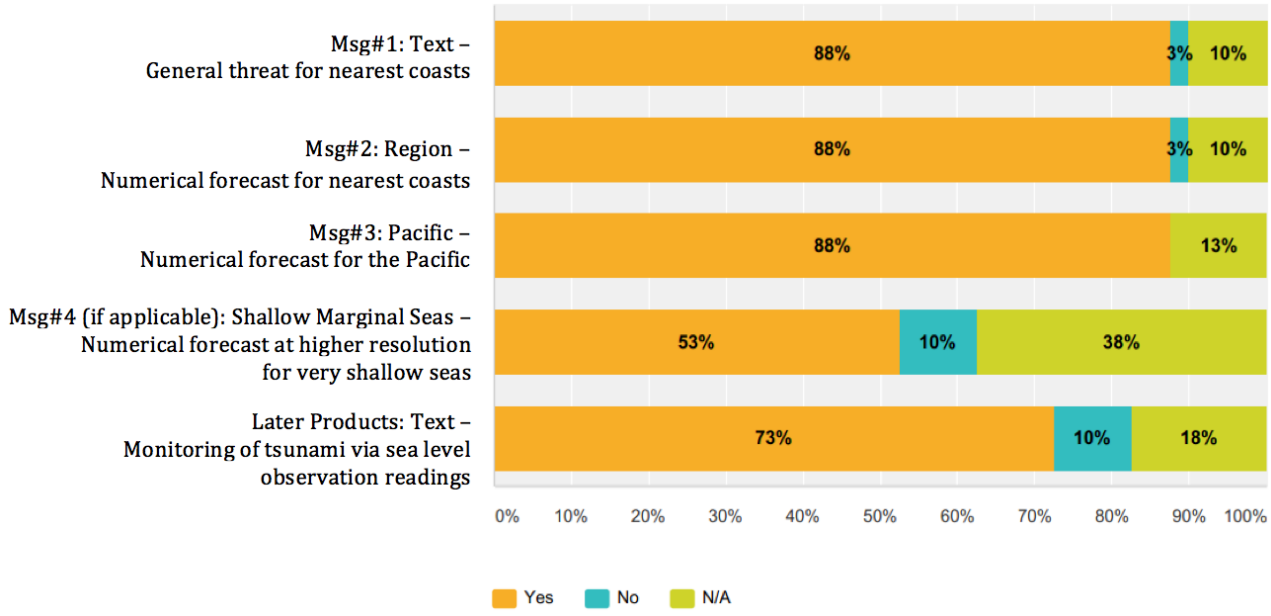


Figure 9: Threat information through time in PTWC products was timely, understood and useful.

Comments

The following information highlights responses from countries:

- Se observa los mareografos a traves de la COI (en el caso de honduras los 10 mareografos no aparecen en la coi ni tide tool ?sera que todavia no estan ingresadas las ip? *Observed the tide gauges on IOC. In the case of Honduras, our 10 tide gauges do not appear on IOC or Tide Tool. Is this because we have not been integrated on IP?* (Honduras)

- Need some in-house simulation on this particular topic. (Cook Islands)

- The FSM rely heavily on the text messages rather than numeric simulations due to the fact that Green's law does not apply for our islands. Wave height might be lower in our islands but we use the same wave heights to be on the safe side. (FSM)

- Tsunami arrived during low tide. Local sea level tide proven useful. (Samoa)

- It was useful because prediction for Chile was shown in the 2nd bulletin, 30 min after the quake. (Chile)

- The Exercise has provided our staff with the opportunity to technically familiarize themselves with the new enhanced products. (Solomon Islands)

- All the three first messages were very useful. (Panama)

- As Australia is more than three hours away from the epicentre, the first two messages are not really useful for us due to no threat information about Australia. Of course they would become useful in a closer by event. (Australia)

- All products were timely, understood and useful to take decision about the tsunami threat. (Nicaragua)

- The Exercise has provided our staff with the opportunity to technically familiarise themselves with the new enhanced products. (Solomon Islands)

- The sequencing of the products provided was considered appropriate. For New Zealand, the initial text product is the most useful; as it alerts relevant agencies to the event and that there may be a threat. This is the trigger for further work and investigation in-country. The later products are useful in the sense that they confirm the approach/understanding of the NTWC/NDMO. (New Zealand)

- For Malaysia, the products may be a little late as the arrival time for the tsunami from Manila Trench is about 2 hours. (Malaysia)

Information Arrival

- Note from Co Chair: Niue did not provide a response for msg#4 so I have put No. (NIUE)

- Hong Kong NA for Message 2 and 4. (China (including Hong Kong))

- My office did not received message. (Nauru)

- Only Msg#1 was received. (Vietnam)

- Msg received well on time via email, but receives very late via EMWIN system. (Tuvalu)

- For Malaysia, the products may be a little late as the arrival time for the tsunami from Manila Trench is about 2 hours. (Malaysia)

19. Product Understanding: Components of the PTWC product suite were understood and useful. Threat information through time in PTWC products was timely, understood and useful. Please comment, as necessary, on product clarity, e.g. was the information in the PTWC products useful or not useful; was the information clear and easy to understand, or confusion, or too difficult? Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

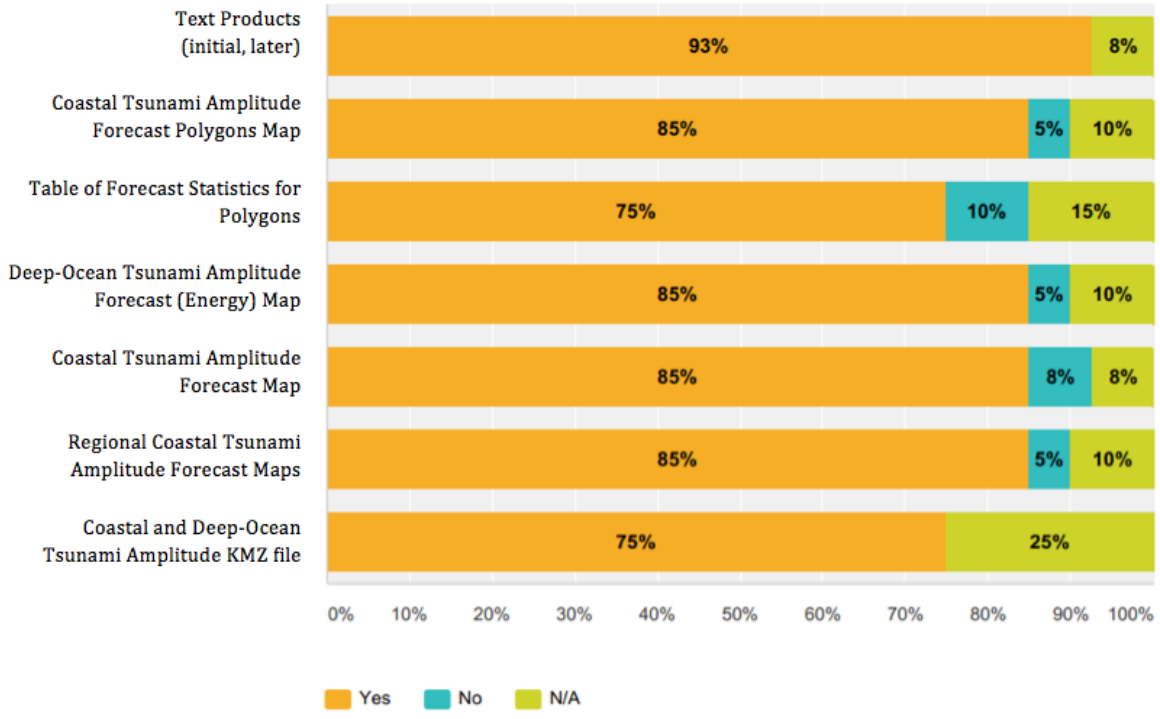


Figure 10: Components of the PTWC product suite were understood and useful. Threat information through time in PTWC products was timely, understood and useful.

Comments

- My office did not receive message. (Nauru)
- We did not use the KMZ file. (Kiribati)
- N/A indicates product (Table of Forecast Statistics for Polygons & Deep-Ocean Tsunami Amplitude Forecast (Energy) Map) was not used. KMZ file was used the most. (France (New Caledonia))
- Very useful with our own local expert judgment. (Samoa)
- The products are ok. (Solomon Islands)
- Yes all this products were clearly understood. (Panama)
- All products were understood and useful, but observed some lack of coincidences between numerical representation (text product) and color bars (graphical products). (Nicaragua)

Text Products

- The FSM rely heavily on the text messages rather than numeric simulations due to the fact that Green's law does not apply for our islands. Wave height might be lower in our islands but we use the same wave heights to be on the safe side. (FSM)

- The initial text product is only useful as quick heads-up to countries within 3 hours of impact. The lack of detailed wave forecasts makes it qualitative only. In the ETAs Section, locations between 3 and 6 hour isochrones were also listed, inconsistent with countries listed under the Tsunami Threat Forecast Section. To minimize the confusion and ensure consistency, we suggest limiting the ETA listing to those within 3 hours of arrival in message #1. Message#2 is more useful with the wave forecast information for nearby regions. However the ETA listing is still inconsistent with the countries under threat. Suggest limiting the ETA list to locations of countries under threat only. The subsequent messages cover the entire Pacific so the above-mentioned inconsistency disappeared automatically. To cater for the live news broadcasts etc., where practically possible, suggest producing the products at least 10min before the hour (e.g., 0050UTC instead of 0100UTC). We found it very useful to have what's new/updated explained right at the top of the content. Under the Next Update and Additional Information, only USA agencies were listed despite the agreement at the 25th ICG/PTWS meeting to list of all Pacific countries that have the live and readily updated national tsunami warning pages. The JATWC link for Australian tsunami warnings should be listed there as well. (Australia)

- The text product is the most useful as it is the message that triggers all the internal processes for assessing and disseminating the threat to New Zealand. It was agreed that the new text products are a significant improvement over the old ones. Especially useful is the section up front that indicates what information has been changed or updated in each message. (New Zealand)

Graphical Products

- We commend the useful feature in the coastal tsunami amplitude forecast map to have the deep-ocean amplitude forecast field overlayed as background. Suggest accentuating the deep ocean amplitude background a bit more such as a light blue to blue color scheme instead of greyscale to avoid being mistaken as bathymetry background. The polygons aren't fine enough. The 25th ICG/PTWS agreed for each country to supply their coastal threat zones to PTWC so that they can be incorporated in the new Products. Australia has supplied its own zone dataset but yet to see them taking effect on the polygon maps. The KMZ files are useful to check local wave forecast details when displayed in the Google Earth. We are however perplexed by some coastal points were over land instead of in the water. (Australia)

- The Table of Statistics is not entirely understandable, because this product shows many columns (max, min, median, STD and Total Points) not useful in case of tsunami emergency (warning, alarm), it can create confusion. However this product shows important information for tsunami analysis in the following bulletins. (Peru)

- With regard to the graphical products, MCDEM does not really use or refer to the maps, as they are relying on more specific products developed by GNS Science. However, the map products are useful to give a broad indication of the Pacific-wide potential effects. GNS Science found the map products helpful for corroborating their own maps, to ensure they are both tracking with broadly similar predictions. The energy map was

useful as a comparison, but GNS Science would also quickly produce their own. In the KMZ map, strange colors were used. (New Zealand)

20. Please rank the PTWC products in order of their usefulness from 1 to 7, where 1 is the most useful product and 7 is the least useful product?

The responses received ranked the text product (93%) as the most useful product, followed by the forecast polygon map (43%). Moderately useful products were the forecast polygon table, energy forecast map, and the coastal and regional forecast maps. The coastal KMZ file was ranked the least useful product.

Answer Options	Most useful 1	2	3	4	5	6	Least useful 7
Text Product	37	1	1	0	0	0	0
Coastal Tsunami Amplitude Forecast Polygons Map	1	18	4	7	3	4	2
Table of Forecast Statistics for Polygons	0	2	9	7	6	7	8
Deep-Ocean Tsunami Amplitude Forecast (Energy) Map	1	2	9	10	5	7	5
Coastal Tsunami Amplitude Forecast Map	2	7	9	8	11	1	1
Regional Coastal Tsunami Amplitude Map	0	5	6	3	9	12	4
Coastal and Deep-Ocean Tsunami Amplitude KMZ file	1	8	2	2	3	6	17

Figure 11: Ranking of the usefulness of the PTWC products.

Comments

- Most useful to least useful may not be the best way to evaluate the products. Each has a unique purpose that may or may not be useful, depending upon the situation. (United States)
- No comment coz my office did not received message. (Nauru)
- I cannot select 1 for more than 1 or 2 and 3 where most are most useful. (Fiji)

Text Product

- The text product is essential in getting information across to different sectors and at times need to slightly change them so as to be understood by those sectors. Not all the text products are used but those used are fairly understood by all. (Cook Islands)
- The text products are most useful with details of earthquake, countries under threat, the ETAs of locations and observations. They are sufficient for public to turn attention to own country authorities for further advice on what to do. (Australia)

Coastal Tsunami Amplitude Forecast Polygons Map

- The polygon maps are not fine enough for details. (Australia)
- Polygons' limits are required. Also if is possible, we would like to add some others for Juan Fernandez Archipelago, San Felix Island and the Antarctic. (Chile)

Table of Forecast Statistics for Polygons

- The table of forecast statistics under each polygon is useful for post-evacuation purpose, not useful when immediate decisions are required in the "heat of the battle". (Australia)

Deep-Ocean Tsunami Amplitude Forecast (Energy) Map

- Deep-ocean maps are only useful for illustration purpose. (Australia)

- We suggest change the color scale (maybe from blue to red) because it is possible get confused with the other products, trying avoid green, yellow, orange and red. (Chile)

Coastal Tsunami Amplitude Forecast Map

- Pohnpei, Kosrae and Chuuk might not consider coastal tsunami amp. forecast most useful, but Yap island might hold this at a higher importance than the rest of the islands. (FSM)

- For NTWCs requiring more threat details from PTWC, the coastal amplitude forecasts maps are important with enough details to supplement the text products. (Australia)

Coastal and Deep-Ocean Tsunami Amplitude KMZ file

- The KMZ files are useful for details but care to take not to read too much into individual values. (Australia)

- The color scale must be the same of the other products (green, yellow, orange, red). (Chile)

21. How did your country assess the tsunami threat during the exercise? Please tick as many as apply.

The responses to this question indicate that there are a number of key methods of assessing tsunami threat, with the most popular being international tsunami forecasts (76%), national tsunami experts (73%) and national tsunami forecasts (71%). Least used were the NGDC/WDC-MGG tsunami historical database (24%) and TsuDig historical database GIS tool (20%).

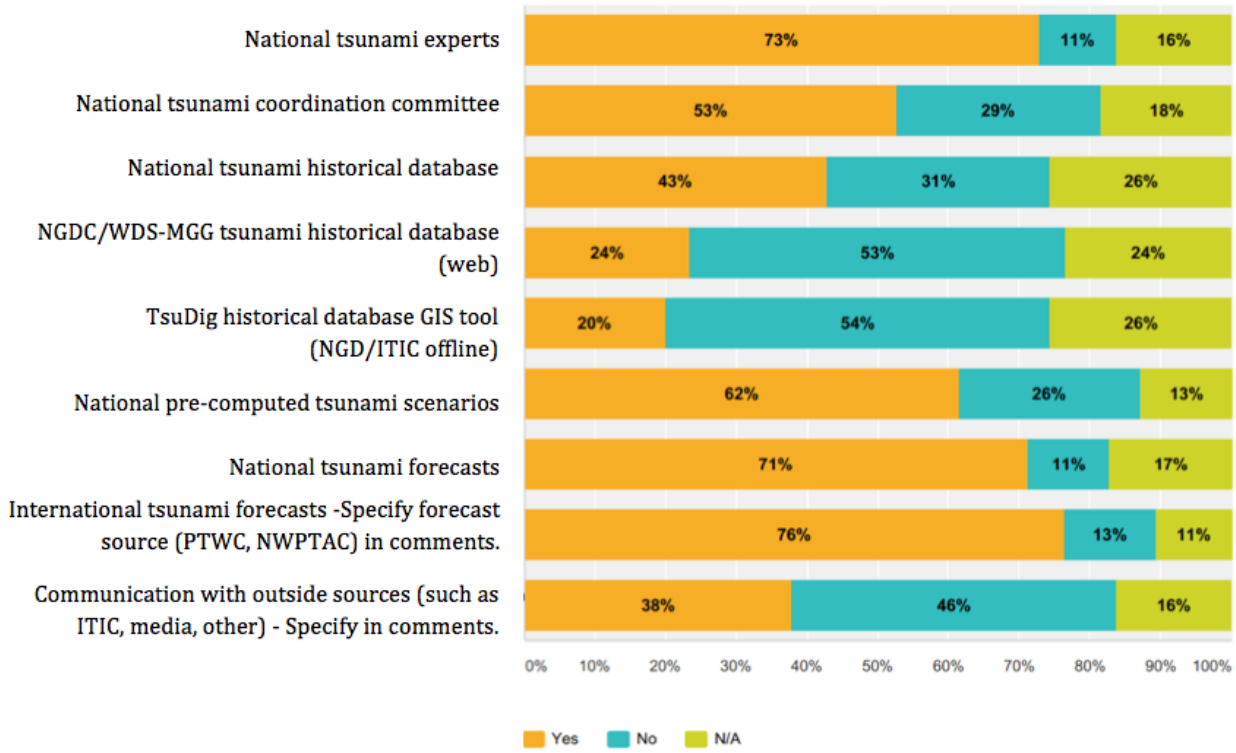


Figure 12: How countries assessed the tsunami threat during the Exercise.

National tsunami experts

- Ph.D. Wilfried Strauch. (NICARAGUA)
- National Tsunami Experts (in the Solomon Islands National Tsunami Warning Arrangements we have a team which we called the Hazard Advisors). The team consists of SIMS, GeoHazards Division and NDMO. (Solomon Islands)
- Noted from our exercise was that during a tsunami warning response, the tsunami modellers in the Tsunami Expert Panel group are providing at least 80% of the long-term technical effort. So although the initial phase (first 30 min-1 hour) is strongly relying on the earthquake duty officer, the long-term response is fed by the tsunami modellers; not only by the detailed tsunami modelling they carry out but also from their experience and in the careful wording of messages they provide to MCDEM. (New Zealand)

Historical database

- Simple lookup table relating EQ parameters to risk/no risk for New Caledonia coasts (separated into East/West coast and Loyalty Islands). (France (New Caledonia))

National pre-computed tsunami scenarios

- About National pre-computed tsunami we have our software Pre-Tsunami with a catalogue of source-units around Peruvian coast in order to obtain quickly the arrival time and height wave of local and regional tsunami (arrival time). (Peru)

- Was used the ITDB program to simulate the tsunami propagation through the Pacific Ocean from Ecuador to Guatemala and also were represented historical tsunamis near Central America and South America Coasts. (Nicaragua)

- The National Pre-computed tsunami scenarios (for the Solomon Islands we use our own threat assessment model called MOST or Method of Splitting Tsunamis). (Solomon Islands)

National tsunami forecasts

- Australia has a 24/7 Joint Australia Tsunami Warning Centre (JATWC) with seismologists from Geoscience Australia conducting seismic analysis before providing the earthquake solution to the Bureau of Meteorology who has experienced forecasters to assess tsunami threat to Australia with the pre-computed tsunami scenarios before issuing tsunami warnings. As part of the forecasting and warning refinement, JATWC constantly monitors information from the observation networks as well as any trustworthy anecdotal evidence (media footages and SITREPs from emergency authorities) to confirm tsunami threat. (Australia)

International tsunami forecasts

- Esperar los productos de PTWC aparado de los paises vecinos en caso de la emicion de una alerta. *Waited for PTWC products and neighboring countries issuance of an alert.* (Honduras)

- PTWC (China (including Hong Kong), Peru, Panama, Nicaragua, France (New Caledonia), New Zealand, Costa Rica)

- Since most of our islands does not have or have minimal historic tsunami data, we rely mostly on PTWC for tsunami forecasting. (FSM)

- PTWC. We did not have an external communications, because it was a Tabletop exercise. (El Salvador)

- Websites of PTWC, JMA, CISN, GEOFON, RIMES, etc. (Vietnam)

- PTWC and NWPTAC. (MALAYSIA)

- Discussed PTWC forecasts with NDMO and Police. (Kiribati)

- Regarding the International Tsunami Forecasts, our Forecast Source in activating our TEWS is PTWC. (Solomon Islands)

- NEMO, Geology Office and the Met office staff were assessing the tsunami threat through coordination using the PTWC forecast products, reference to the pre-model for the worst case scenario for Tonga. Outsiders such as members from Police, Army, Firemen, media were also involved in the exercise but as observers only. (Tonga)

- Were used PTWC forecasts for assess the tsunami threat. SNAM is the only institution who assess the tsunami threat in Chile, information which is convey for many ways to ONEMI. (Chile)

Communication with outside sources

- A formatted Press Release is prepared and only facts are added during the events. (Cook Islands)
- Was used RITLAC, which is a social network to NTWC in Central America and Mexico. (Nicaragua)
- As outside sources were received information from ONEMI and the National Seismological Center, Institutions which were part of the exercise. (Chile)
- Media were also present during the exercise. (Fiji)
- We exchanged Whatsapp with colleagues from Colombia and Central America. (Costa Rica)

Other comments

- No comment coz my office did not received message. (Nauru)

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

95% of respondents agreed with this statement.

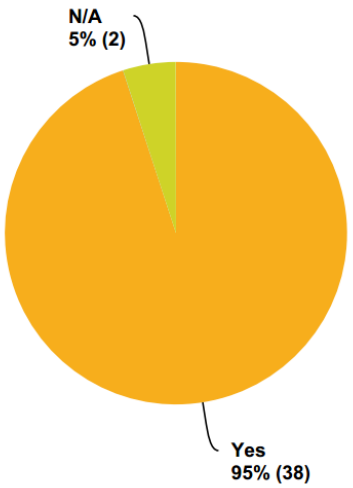


Figure 13: The information provided assisted with decision making, e.g. warning levels, earthquake parameters, estimated arrival times, forecast wave heights, etc.

The following information highlights responses from countries:

- Parametros de terremoto yes. *earthquake parameters, yes.* (Honduras)
- Australia is currently undergoing its own performance evaluation of the RIFT model and new PTWC products. If positive outcome, Australia will make use of the products as additional scientific source to assist with making warning decisions. (Australia)
- Yes they were all useful for the decision makings for that particular time the event happened. However decision making exercises expanded to accommodate questions

such as what would we do if the tsunami arrived at the time of high tide, and how about if there were 2 or 3 cruise ships docked at the wharf, how about if the tsunami arrived during the peak hours and etc. (Tonga)

- All provided information was important, it helped to take decisions to the makers at national and institutional levels, following the level of hazards indicated on the new SOP´s; and to follows or accomplishing the national protocols of SINAPRED, according to the current event. (Nicaragua)

- As comparison with our national forecasts for decision making. (Malaysia)

- No comments coz my office did not received message. (Nauru)

23. The information issued by your country national Tsunami Warning Focal Point was according to standard operating procedures. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

The majority of respondents (85%) agreed with the statement. There were a small number (5) who responded 'not applicable' to this question.

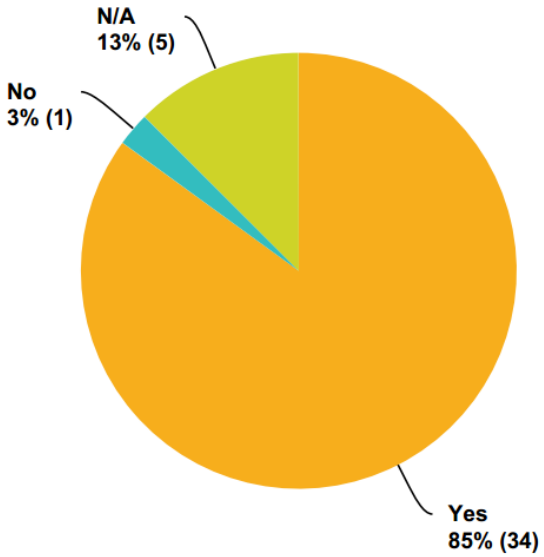


Figure 14: The information issued by your country national Tsunami Warning Focal Point was according to standard operating procedures.

The following information highlights responses from countries:

- The original text are normally amended to identify the Cook Islands Met Service as the National Tsunami Warning Center while the other changes are the dates to be localized. This becomes quicker in the dissemination to stakeholders. (Cook Islands)

- It was clear some of the staff issued template not according to our standard operating procedures. (Tonga)

- We issued the Tsunami Warning to regional weather observatories. (Republic of Korea)

- The NTWC (INETER) issued timely information at all levels (national, departmental, municipal and local), following the SOP established by the SINAPRED. (Nicaragua)

- Solomon Islands will review its Sub-Tsunami Plan and SOP for Tsunamis commencing this year to align it with the PTWC New Enhanced Product and also looking at options in upgrading our MOST to compatible with the New Enhanced Products. (Solomon Islands)

- It was according to our standard protocols. (El Salvador)

- No comments coz my office did not received message. (Nauru)

24. Is the resolution quality of the graphical products acceptable? Currently, graphical products are sent to TWFPs as minimum-sized files, where each email contains 2MB or less of attached files. As a result, the graphics are of poor quality when zoomed in. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

75% (30) of the respondents to this questions indicated that the resolution quality of the graphical products is acceptable.

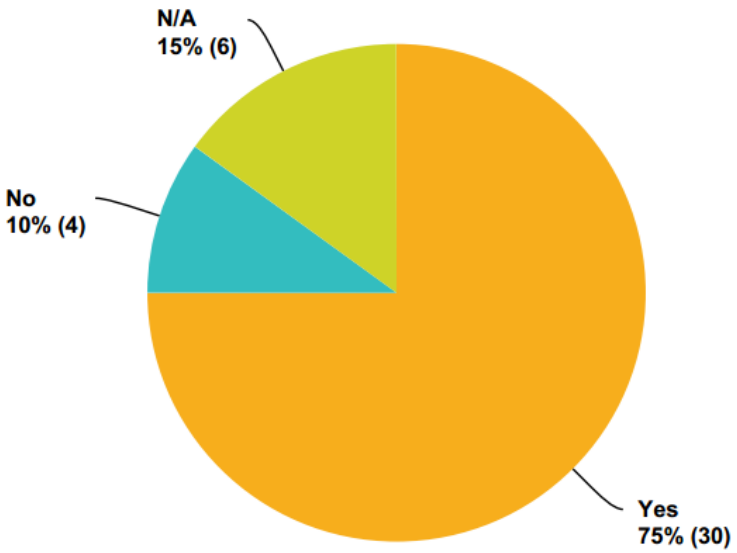


Figure 15: Is the resolution quality of the graphical products acceptable?

The following information highlights responses from countries:

- Higher resolution is suggested. (China (including Hong Kong))

- In fact the resolution of graphics have poor quality but is acceptable but the full colors demands more time to print the graphics. (Peru)

- Applying zoom, the images are distort. (Nicaragua)

- Better resolution is needed. (Republic of Marshall Islands)

- Adequate as information. However if to directly incorporate the products in future decision making, Australia would like to seek additional digital products with appropriate format (such as GIS shape files) to allow easy ingestion into Australia's own decision supporting tool. (Australia)

- For regional and distal scenarios are acceptable. (El Salvador)

- No comments coz my office did not received message. (Nauru)

- TWFP Indonesia did not receive graphical products during the exercise. (Indonesia)

- We use the coastal and deep-ocean Tsunami Amplitude KMZ file. (Colombia)

- Resolution issues are solved out using the KMZ file, in the case Internet is available. (Chile)

- We only used the one sent before the exercise. (Fiji)

25. To improve the resolution quality of the graphical products, greater internet bandwidth is needed. Is your TWFP/NTWC able to efficiently receive emails and quickly download file attachments that are up to 5 MB? Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

75% of respondents indicate they would be able to download attachments up to 5MB efficiently. 7 respondents (18%) however, indicate that they wouldn't be able to do this.

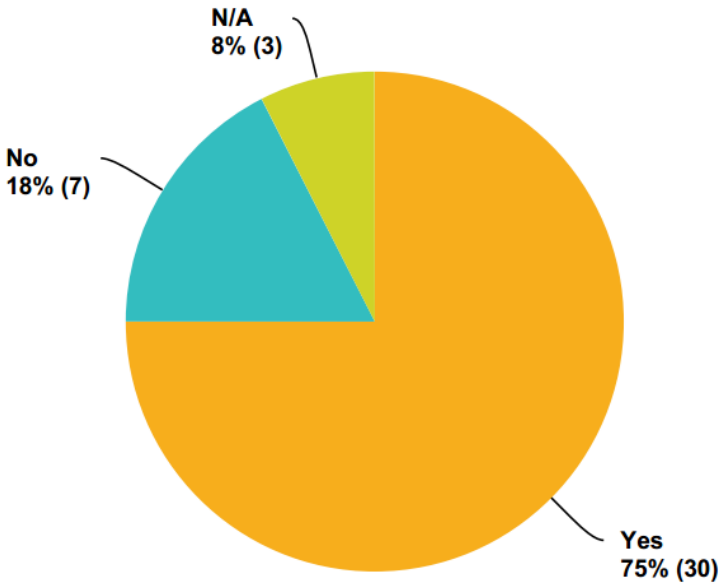


Figure 16: Is your TWFP/NTWC able to efficiently receive emails and quickly download file attachments that are up to 5 MB?

The following information highlights responses from countries:

- It can be adjusted to cater for this demand. (Cook Islands)

- No problems with the current internet setup. (Samoa)

- Solomon Islands Telekom has supported the NTWC in having a greater Internet bandwidth. (Solomon Islands)

- Maybe in the future we will be able to increase internet bandwidth (official email). (Indonesia)

- Can be arranged. (Malaysia)

- In case of graphic products demands more capacity in Megas and bandwidth, we can ask requirements like this to Peruvian Minister. (Peru)

- Yes but only if Wi-Fi connection is employed. We don't have 24/7 staff and therefore sometimes need to download those files from mobile networks. (Costa Rica)

- We can upload but some time very slowly. (Timor-Leste)

- Yes, but it may takes up to a minute or so to download these graphic products. (Tuvalu)

- The maximum attached files are 2mb in our work email at the TWFP/NTWC. (Tonga)

- No comments coz my office did not received message. (Nauru)

26. You may add additional individual agency evaluation statements regarding OBJECTIVE 2 in the section below.

The following information highlights responses from countries:

- Provinces receiving the messages were not able to send reply promptly due to various issues (power, some links down etc.). (Papua New Guinea)

- Antarctic polygons are needed, not only for Chile. They would be also useful for countries such as New Zealand and Australia. (Chile)

- Refer to the objectives specific to SI which was set-out in Qtn #16. (Solomon Islands)

- The products provided by PTWC were extremely useful and help us to take right decisions. (Panama)

- The exercise was very organized. (Mexico)

- We use TTT to assess the travel time for different points along the coastal line. (El Salvador)

- The model outputs (estimated time of arrival) in the PTWC tsunami messages do not include Malaysia. Whereas, JMA model output list Northwest coasts of Kalimantan (should also include North coast since the arrival time may be earlier for the area if tsunami originated from Manila Trench. (Malaysia)

27. The NTWC/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

Almost all responses to this question (93%) agreed that activation and response procedures are in place.

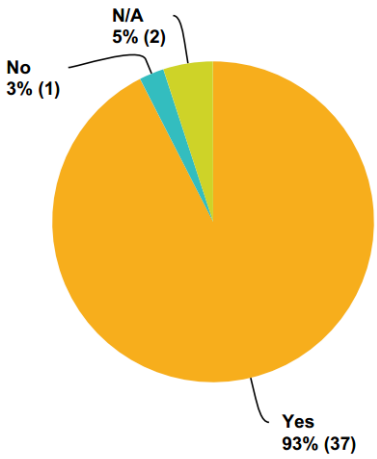


Figure 17: The NTWC/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.

The following information highlights responses from countries:

- All the four states and national government have proposed plans which is yet to be finalized, but have a temporary plan that is put in effect until finalization. (FSM)
- Only communication between NTWC and the Dyke management, flood and storm control Department, Ministry of Agriculture and Rural Development was made. (Vietnam)
- During Pacific Wave 15 exercise, we tested the update standard operating procedures. (Colombia)
- The NDMO has activated and follow the NEOC SOP for Tsunami during the Exercise. (Solomon Islands)
- No comments coz my office did not received message. (Nauru)

28. The NTWC/NDMO knows its specific response role in the event of a tsunami. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

All respondents (100%) agreed that the NTWC/NDMO knows its response role in the event of a tsunami.

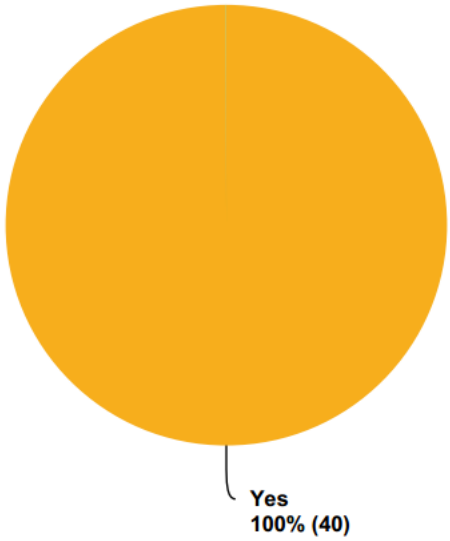


Figure 18: The NTWC/NDMO knows its specific response role in the event of a tsunami.

The following information highlights responses from countries:

- Yes my office would know its roles in times of tsunami. (Nauru)
- In Vietnam, two organisations usually play the role of tsunami response are: the Dyke management, flood and storm control Department, MARD and the National Committee for Search and Rescue. (Vietnam)
- Yes, but a need to have more in-country awareness/trainings for all Govt/NGOs institutions.....as SOPs are still fresh to accommodate all on new PTWC arrangements in 2014. (Tuvalu)
- NDMO has hosted the NEOC which has the function of the National Tsunami Warning Centre. (Solomon Islands)

29. The NTWC/NDMO has, prior to the exercise, engaged in tsunami response planning. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

The majority of respondents (95%) agreed that the NTWC/NDMO has engaged in prior tsunami response planning.

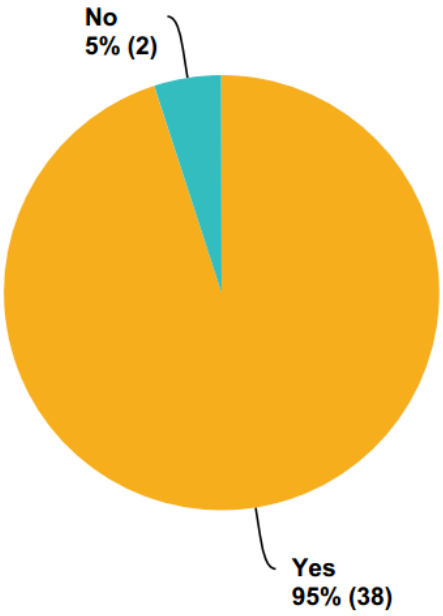


Figure 19: The NTWC/NDMO has, prior to the exercise, engaged in tsunami response planning.

The following information highlights responses from countries:

- Yes my office would have engaged of the plan. (Nauru)
- Yes, one month before to decide the objectives. (Colombia)
- Both (NTWC and NDMO) have internal protocols (in-SOP) but NDMO (INDECI in Peru) is in charge of tsunami response planning for local and regional governments. (Peru)
- Solomon Islands has set-up its Tsunami Exercise Planning Team lead by the NDMO. The team organise and plans for PacWave as well as our own National Tsunami Exercise called Exercise Aelan Weiv (Island Wave). (Solomon Islands)
- The NTWC/NDMO has engaged in broader all-hazards response planning prior to the exercise, as well as some tsunami-specific planning for the warning aspect of response only. (New Zealand)

30. The NTWC/NDMO regularly undertakes activities to increase its capacity and capability to support a national tsunami response (for example, training, exercise, etc.) – Note activities in Comment section. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

85% of respondents (34) agreed that regular capacity and capability building exercises are undertaken to support a tsunami response. However, 6 respondents indicated that these activities are not taking place in their countries.

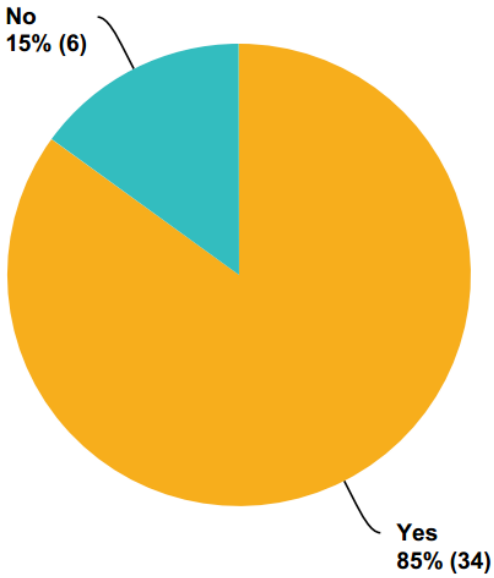


Figure 20: The NTWC/NDMO regularly undertakes activities to increase its capacity and capability to support a national tsunami response

Activities

- Simulacros de evacuacion en escuela frente a las costas. *Evacuation simulations in schools on coast.* (Honduras)
- Yes - national evacuation exercise - emergency services deployed. (Nauru)
- Australian Tsunami Warning System that involved JATWC, NDMO and RDMOs etc. regularly conducts tsunami exercises. The latest one prior to PacWAVE15 was the IOWAVE14 held in Sep 2014. Forecasters at JATWC went through the formal competency-based training and assessment program in 2014 to be reaccredited to take on the tsunami warning operation tasks. (Australia)
- Activities include periodic trainings, drills on tsunami response. (Vietnam)
- Training for national and local institutions and exercises. (Colombia)
- Training and drills to earthquakes are going to help every month this year in all schools. (Nicaragua)
- We make daily internal drill exercises. Also at least every 3 months we participate in exercises with ONEMI (NDMO) and National Seismological Center, which in some cases has evacuation of population. (Chile)
- Drills carried out by schools, awareness by the seismology team. (Fiji)
- Last exercise was April 2013. (France - New Caledonia)
- National exercises. (Mexico)
- Regularly we carry out trainings and external-internal exercises. (El Salvador)

- NTWC/NDMO conducts tsunami drills annually. (Malaysia)

- SINAMOT perform internal exercises regularly to practice our SOPs. We give talks to the public or organizations on demand. (Costa Rica)

- Some tsunami training and exercising has been carried out in New Zealand, but the last full, major exercise was a long time ago (Exercise Tangaroa in 2010). (New Zealand)

Problems

- Need funding and experts in these specialized field to run these trainings etc. mainly in-country training/workshops etc. (Tuvalu)

- No tenemos ningun Sistema de alerta temprana de tsunami. *We have no tsunami early warning system.* (Guatemala)

31. The NTWC/NDMO has an appropriate management structure identified and documented to support tsunami response. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

95% of respondents agreed that appropriate management structures had been identified and documented in their countries.

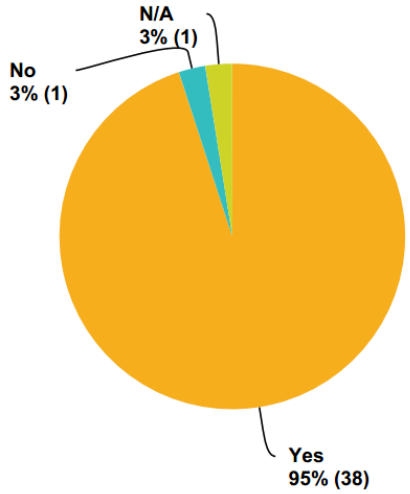


Figure 21: The NTWC/NDMO has an appropriate management structure identified and documented to support tsunami response.

Comments

- There is a structure within the National Disaster Council and Police Department. (Niue)

- Protocols and contingency plans to tsunami. (Nicaragua)

- The National Emergency Operations Centre (NEOC) is the Unit with the structure that has the function that supports tsunami response. (Solomon Islands)

- But is still a draft tsunami response plan. (Fiji)

- No, NDMO need to work on such structure to identify and documentation. (Tuvalu)

32. The NTWC/NDMO has a tsunami mass coastal evacuation plan. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

53% (21) of respondents indicated that their country has a tsunami mass coastal evacuation plan. However, 45% (18) of respondents don't have such a plan in place.

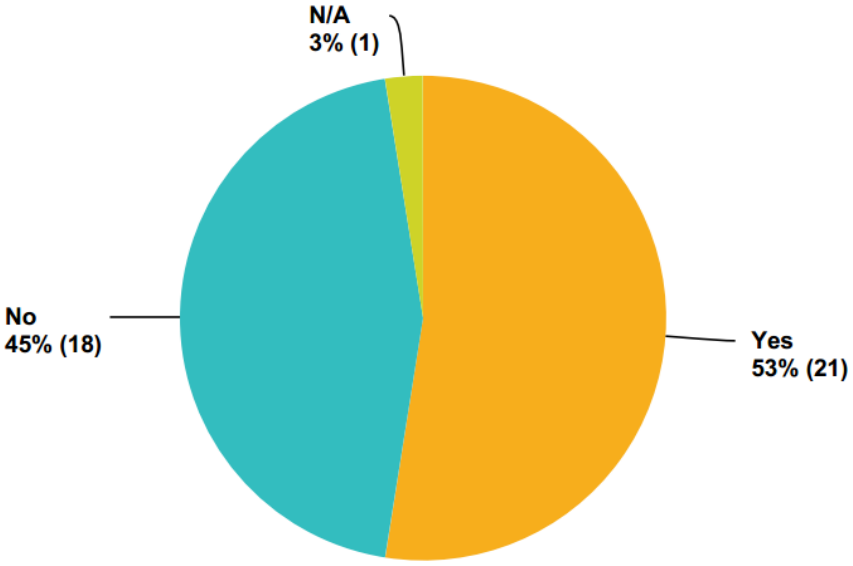


Figure 22: The NTWC/NDMO has a tsunami mass coastal evacuation plan.

A Tsunami Mass Coastal Evacuation Plan

- Sat Tsunami. (Honduras)
- The State/Territory emergency authorities rather than NDMO in Australia are responsible for coordinating and planning for the response to and recovery from a disaster such as tsunami within their borders. The response plan includes tsunami mass coastal evacuation plan. For large disaster covering multiple State/Territories, the Attorney General's Department (AGD) through the Australian Government Crisis Coordination Centre (AGCCC) – the Australian version of NDMO, coordinates the federal government non-financial assistance under COMPDISPLAN, upon receiving requests for assistance from the affected States/Territories. COMPDISPLAN is for all-hazard. JATWC as NTWC for Australia does NOT have a role in the evacuation plan. (Australia)
- Only within coastal provincial framework, not national-wide. (Vietnam)
- We have the National Standard operating procedures, National Disaster System. Evacuation Plan exists only for some cities in the Pacific Coast. (Colombia)
- We are only a technical center to assess the tsunami, is the Civil Protection Office to inform the population. (Chile)

In Preparation

- Still in review, a plan for evacuation is in place as an SOP. (Niue)
- We are currently early planning stages (Timor-Leste)

- But we have the Tsunami Support Plan (draft). (Nauru)

- NDMO still working on evacuation plan and hazard maps. (Tuvalu)

- Current evacuation plan only states evacuation up to 12 m altitude, which is both unclear and unrealistic. New evacuation plans are being designed. (France - New Caledonia)

- The NTWC/NDMO does not have a tsunami mass coastal evacuation plan, as responsibility for evacuation planning is devolved to regional CDEM Groups. Some of these have undertaken mass evacuation planning. (New Zealand)

- But, there is an evacuation plan for other threats. Its structure can be used in case of tsunami, although the required time of response is different. We are working in the development of tsunami-specific evacuation plans for the most vulnerable coastal communities. (Costa Rica)

Not yet

- The NDMO required the support from ITIC to assist in developing the mass coastal evacuation plan. In the Solomon Islands, no such thing as a mass evacuation plan, however, individual organizations, i.e., Schools, Hotels, Banks, Telekom, Hospital do have their tsunami evacuation plans helped developed by the NDMO. (Solomon Islands)

- The NTWC doesn´t know whether the NDMO has a mass coastal evacuation plan, specific for tsunamis. However, they could have an internal procedures related with this matter. (El Salvador)

33. Arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response were in place before the exercise. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

80% (32) of respondents indicated that assembly arrangements were in place for their country's disaster management group. 15% (6) of respondents indicated that these arrangements are not in place.

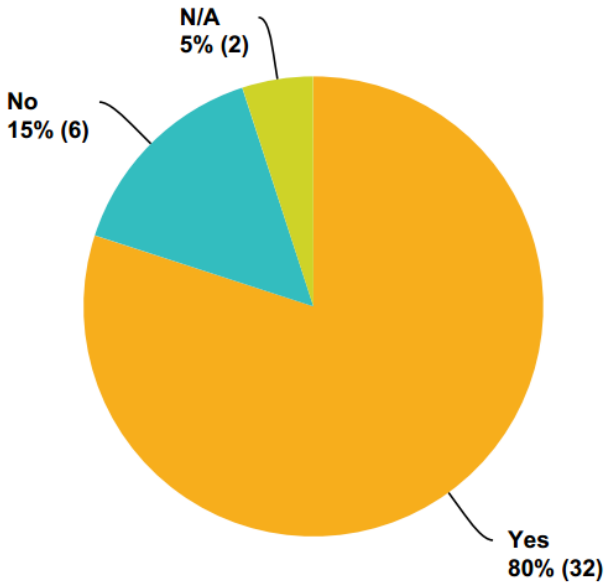


Figure 23: Arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response were in place before the exercise.

Comments

- Should there be any tsunami, it is treated as per normal of any disaster. (Niue)
- Although not tested, there is arrangement to coordinate national response when a large-scale tsunami. This is through the quick assembly of Australian Government Crisis Committee (AGCC) which consists of senior officials from all government agencies including defense. (Australia)
- The group exists in Colombia. It is the "Sistema Nacional para la Detección y Alerta de Tsunamis". (Colombia)
- Before exercise, work sessions were conducted to prepare the plan dynamically to be used for all key actors in the realization. (Nicaragua)
- There was communications between NTWC and NDMO before the exercise. (El Salvador)
- No for China and Yes for Hong Kong. (China (including Hong Kong))
- Some communication mishaps. (Cook Islands)

34. A country tsunami emergency response plan (standard operating procedures) for regional/local tsunamis exists. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

85% (34) of respondents indicated that they have regional/local tsunami response plans in place.

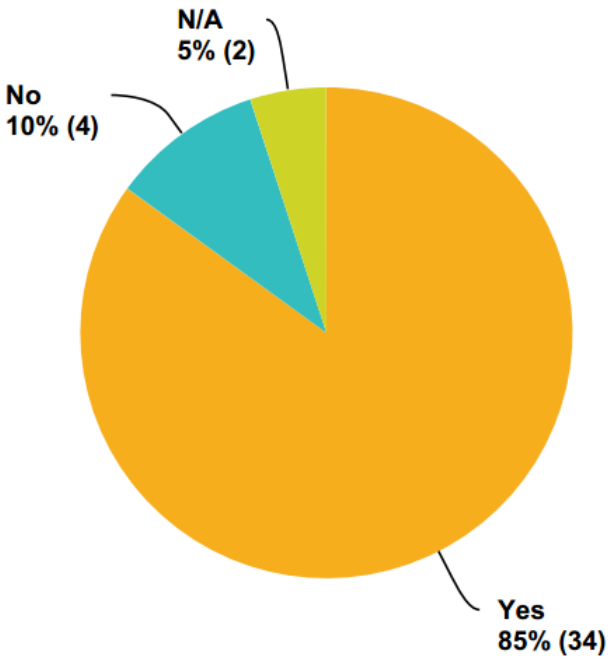


Figure 24: A country tsunami emergency response plan (standard operating procedures) for regional/local tsunamis exists.

Tsunami Emergency Response Plan

- Not sure about this question but we have the Australian Tsunami Warning System in place for regional/local tsunamis. (Australia)
- For local and regional tsunami we work with our national SOP (approved in June 2012) in addition with Regional Protocol between Colombia, Ecuador, Peru and Chile (elaborated in November 2012). (Peru)
- The national tsunami emergency response plan that New Zealand has covers the warning period of a tsunami response only. There is no specific tsunami response plan for arranging the impact of a tsunami. (New Zealand)
- An emergency response plan is in development for the various disaster agencies. (Malaysia)

In Preparation

- Currently in plan. (Timor-Leste)
- There is a plan but needed to be updated. (Tonga)

Not yet

- Do not have one. Nauru is still not a member of IOC? (Nauru)
- Not concerned by near field tsunami. (French Polynesia)
- But various organizations have their own. (Fiji)

35. Where was the warning disseminated to?

The majority of participants in the exercise disseminated the warning message to emergency services (73%) and other national government agencies (60%). Only 28% provided the warning message with public as part of the exercise. Other agencies the warning message was shared with were science agencies/universities involved in assessment (33%), local government – provincial/regional level (50%), and local government – city/district level (45%).

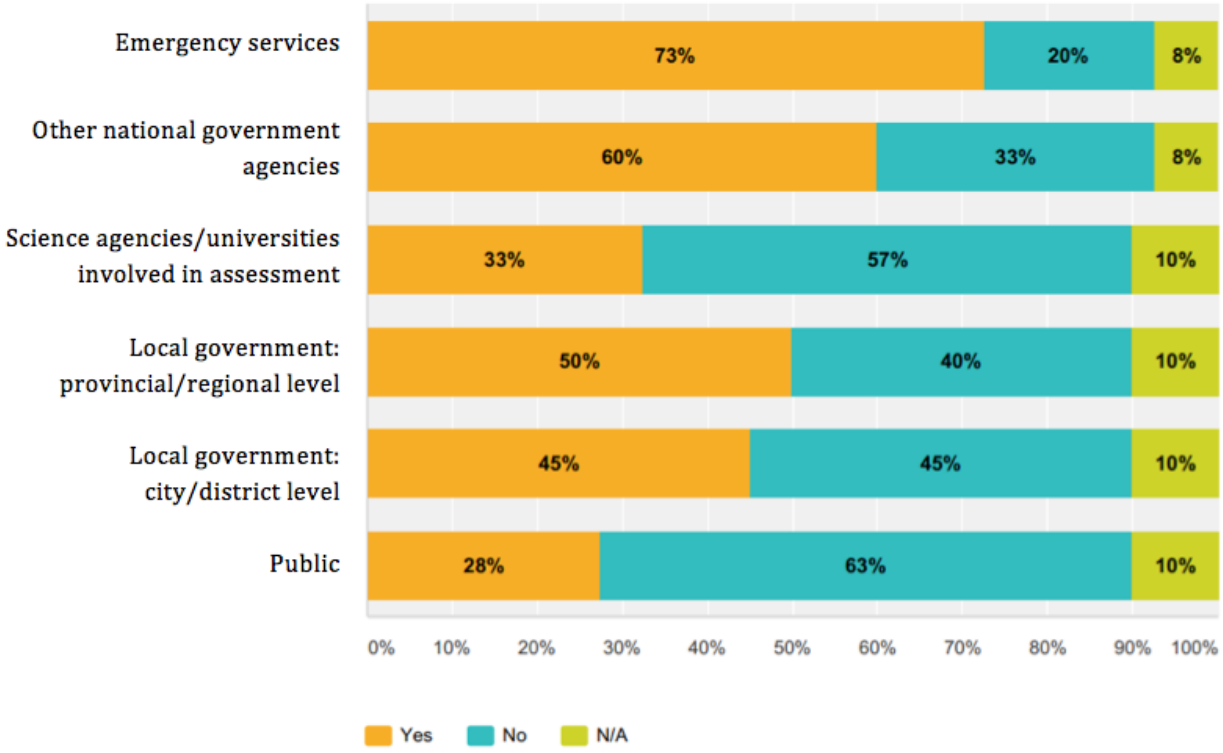


Figure 25: Where the warning was disseminated to.

Comments

- All emergency services in the affected east coast states (Queensland, New South Wales, Victoria, and Tasmania) and Norfolk Island took part in the exercise and received the test warnings from JATWC. In addition, national agencies including AGCCC, Australian Maritime Safety Authority (AMSA), Defense, Surf Life Saving Australia (SLSA), Australian Broadcast Corporation (ABC) also took part in. Apart from them, no public or universities or local governments took part in or received the test warnings. (Australia)

- The exercise was only a table top discussion between NTWC, NDMO and Police. No warnings were disseminated. (Kiribati)

- During this exercise, warning messages was sent only to selected Provinces. (Papua New Guinea)

- Emergencies services participated in the exercises but as observers were fire, army and police. (Tonga)

- The warning bulletin is issued by NTWC (CNAT-Peru) and then disseminated to local and regional government by NDMO (INDECI-Peru). (Peru)
- We only considered the institutions members of the National Tsunami Warning System. (Chile)
- The Warnings was widely disseminated including on web through the Solomon Islands Broadcasting Services (AM and FM Radio Broadcaster) online service (live streaming). (Solomon Islands)
- New Zealand conducted a table-top discussion exercise, so that is why the warning was not disseminated. (New Zealand)
- It was a table top exercise. (El Salvador)
- Only the NDMO was involved with exercise. (Malaysia)

Other comments

- From my understanding that the warning was supposed to be sent to my official email but my official email was down. (Nauru)

36. Regional/local tsunami exercises are routinely conducted in-country. Specify last exercise in Comments section. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

The majority of countries conduct exercises routinely with 65% indicating that regular exercises are conducted. 35% of respondents do not conduct regular exercises.

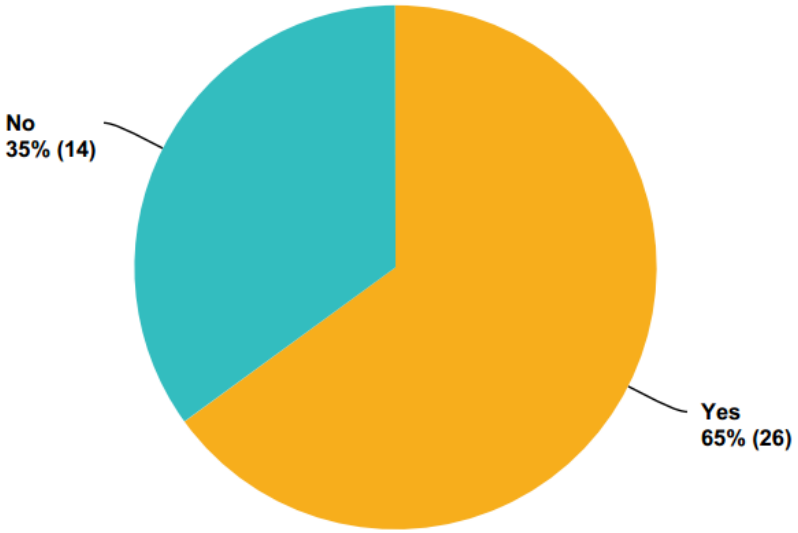


Figure 26: Regional/local tsunami exercises are routinely conducted in-country.

Last Regional/Local Tsunami Exercise

- Las regionales de la Copeco realizan esta por hacerce uno en el sat tisnami de santa fe en Colon. *COPECO regional offices, for instance conducted one in Santa Fe in Colon.* (Honduras)
- Following Pac exercise. (China (including Hong Kong))
- IOWave September 2014. (Timor-Leste)
- Once a year? (Nauru)
- JATWC national communications test in Dec 2014; IOWAVE14 in Sep 2014; Victoria Police tsunami exercise in June 2014; PacWAVE13 in 2013; Ausnami 2012. (Australia)
- Last regional drill on tsunami response was conducted in Quang Nam province in 2014. (Vietnam)
- Pacwave 2013, Pacwave 2015. (Kiribati)
- The last exercise was Local tsunami Exercises with Ecuador in February 2014. (Colombia)
- December 18, 2014. (Russian Federation)
- Last local tsunami exercise was September 2013, and last regional exercise was 3 July 2014 with a major earthquake occurred in Vanuatu. (Tonga)
- DMO siren test 2/3/15. (Samoa)
- The last local tsunami exercise was 13th February 2015 which involved evacuation people in Lima's city (Peru). The last regional tsunami exercise was 28th August 2014 between Ecuador, Colombia and Chile using virtual platform SRATPS as communication via. (Peru)
- Since 2014, SINAPRED conduct routinely tsunami exercise in the Pacific coast. And Nicaragua joint yearly under the coordination of IOC/UNESCO to the PacWave exercise. (Nicaragua)
- last exercise was conducted on 9 January 2015 with the Direction of Civil Defense and Army Headquarters with a Chile scenario. (French Polynesia)
- We participated in internal drill exercises along ONEMI and the National Seismological Center in May; simulation with school evacuation for regions organized for Civil Protection Office in August (2), September (1), November (1), December (1); a international exercise with SEP (South East Pacific) in August and a Navy one, covering the whole country. (Chile)
- Our National Tsunami Exercise is called Eksasaes Aelan Weiv, The last was in Oct 2013. No Exercise in 2015 due to the April Flash Floods Disaster which really affected the country. Provinces and Organizations do conduct their own tsunami exercises. (Solomon Islands)
- The last I could remember was some years back but only in Suva city. (Fiji)

- Last exercise was April 2013. (France - New Caledonia)

- As part of the National Civil Defence Emergency Management (CDEM) Exercise Programme, exercises are regularly planned and carried out at all levels – national, regional and local. The last tsunami-based regional exercise listed was in 2009, while the last national tsunami exercise was in 2010. The next national tsunami exercise is scheduled for 2016. (New Zealand)

- Last exercise in Aceh on December, 2014. (Indonesia)

- El ultimo fue en el 2014 a nivel regional. *Last was in 2014 at regional level.* (Guatemala)

- November 26, 2014. (Mexico)

- We carried out the last exercise in January 21st of 2015 (internal). (El Salvador)

- Conducts 2 local tsunami exercises annually. The last one was in November 2014. (Malaysia)

- So far only PacWave and CaribeWave. However it is very likely that we'll start conducting exercises with authorities more regularly. (Costa Rica)

Other Comments

- Tsunami is fairly a new induction in our national overall disaster plan so we have yet to conduct an exercise. Emphasis of tsunami to the public is in an outreach form to communities and schools through different disaster member agencies. (FSM)

- No in-country exercise conducted in Tuvalu thus far on as routine basis. (Tuvalu)

37. Tsunami-related curriculum programmes are in place for all levels of education. Note which levels in Comments section.

Participant responses to this question were split, with 53% (21) countries indicating that tsunami curriculum programmes are in place, and 40% disagreeing with this.

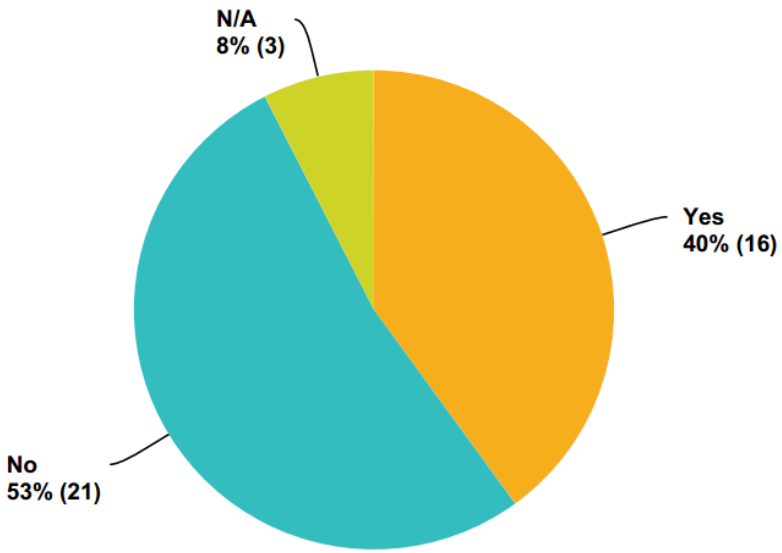


Figure 27: Tsunami-related curriculum programmes are in place for all levels of education.

Comments

- Not sure how systematic or widespread there is in the Australian education system to introduce tsunami education in the curriculum but certainly tsunami education has been seen in high-school geography subject of some schools. The recently developed Australian tailored online tsunami resource https://www.emknowledge.gov.au/#/ was designed to support school education. (Australia)

- Since last year (2014), tsunami preparation was include in the curriculum programme of education: 1 and 2 level. (Nicaragua)

- Educational spots and brochure. (French Polynesia)

- The Chilean Ministry of Education has included tsunami issues in curriculum programs since elementary school for Math, PE, Natural sciences, History and Geography. (Chile)

- The education unit has emphasized to all schools the importance of having school drills but still something needs to be included into their curriculum. (Fiji)

- Such programmes are provided by NGOs like the Red Cross. Talks are underway to include it directly into school curriculum. (France - New Caledonia)

- Tsunami-related information is included as part of the “What’s the Plan Stan” primary school education programme. (New Zealand)

- From Elementary to High School level. (Republic of Palau)

- It is taught as part of a topic in primary school and learned at exhibitions or visits to the National Tsunami Early Warning Centre. (Malaysia)

Only Limited Area/School

- Primary and Secondary Schools. (Cook Islands)
- only at elementary school in coast areas. (Timor-Leste)
- Generally yes, though it depends on individual schools. (Japan)
- Only some levels of education. (Tuvalu)
- There is high school curriculum but not sure of its effectiveness. Something needs to be done about this. (Papua New Guinea)
- Available for schools but is not yet part of the formal curriculum. (Solomon Islands)
- Yes for China No for Hong Kong. (China (including Hong Kong))

Other Comments

- I guess would need to draft one. (Nauru)
- No yet, but this year we are going to involve Education Minister in order to include tsunami curriculum programme. (Peru)

38. Communities have tsunami evacuation maps, routes, evacuation signs and assembly points for evacuation areas? Please specify any gaps and future plans to fill gaps. Indicate Yes or No or Not Applicable (N/A), and provide comments as needed.

60% of participants indicated that tsunami evacuation routes and maps are available.

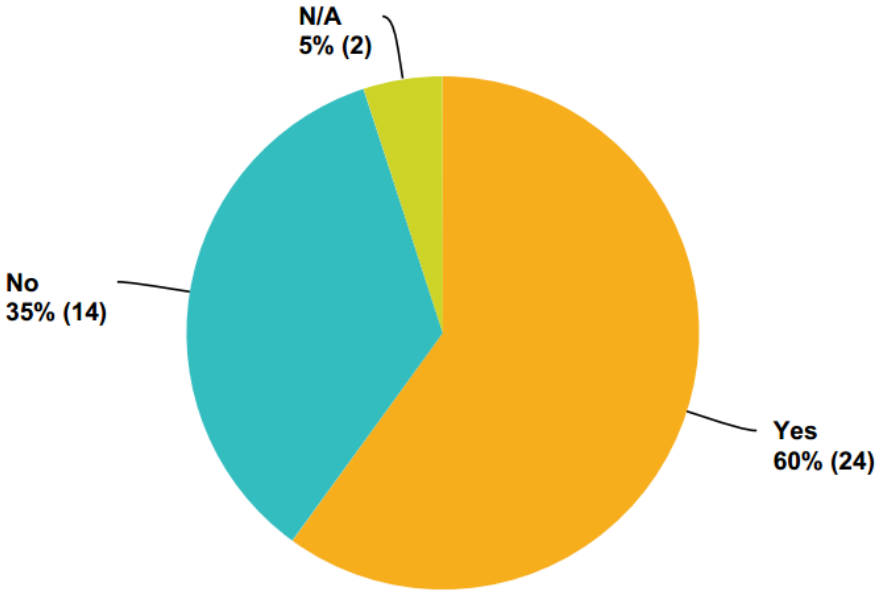


Figure 28: Communities have tsunami evacuation maps, routes, evacuation signs and assembly points for evacuation areas.

Comments

- Existen mapas de ambas costas identificados con sus respectivas alertas algunas comunidades si estan informadas las mas cercanas a las costas. *Maps exist on both coasts with alert systems to some communities close to coast.* (Honduras)
- Generally yes, though it depends on individual municipalities. (Japan)
- Yes for China No for Hong Kong. (China (including Hong Kong))
- There are in Tumaco (Nariño), Buenaventura (Valle del Cauca) and small cities in Choco. (Colombia)
- Only in the low lying areas in the main island. (Tonga)
- For important places maps are available, but for small communities are in process. (Nicaragua)
- Most of the communes have their own tsunami emergency plan, and altitude/distance of security; but there is no evacuation signs. (French Polynesia)
- Inundation maps are developed by SHOA and those are public in its website. ONEMI and local authorities are in charge of evacuation plans, signs, routes and assembly point. (Chile)
- Currently there are not Evacuation Map drawn but designated Evacuation area and structures have been identified and documented in disaster plans. (Republic of Marshall Islands)
- Coastal evacuation maps exist only for some areas. It is the responsibility of city councils. (France - New Caledonia)
- Some coastal communities have tsunami evacuation maps, routes, signs and assembly points but not all. (New Zealand)
- Some NGO´s have conducted efforts related. However, in most of the coastal areas don´t have an evacuation maps, routes, signs. (El Salvador)
- Currently, some studies have been conducted in villages where assembly points have been identified. (Malaysia)

Still Planning

- Still and planning stages. (Timor-Leste)
- Community plan not avail would need to draft one. (Nauru)
- Not available for all coastal provinces. (Vietnam)
- There is a still plan to do tsunami signage in the communities. (Solomon Islands)
- NEMO is currently in the process of getting this project done through funding from outside source. (Republic of Palau)

- We are planning to start to develop tsunami evacuation maps this year 2015. (Costa Rica)

Required Improvement

- Evacuation areas need to be improved as some of these are just clearings with no shelters or facilities on them. (Cook Islands)

- Not a widespread known activity along the Australian coastlines, probably due to the large areas to cover and the perceived very low probability of threat. Many States/Territories are considering developing evacuation maps for tsunami inundation with New South Wales already having draft maps ready for publication, once finalized/approved by the relevant authority. However there is clearly lack of guidance/best practice on how to proceed with drawing evacuation maps, and no national consistency in doing the mapping etc. To reduce the gap, the Bureau is organizing a Joint Storm Surge/Tsunami Evacuation Mapping Workshop in May this year to discuss this mapping issue and learn from each other on best practices. Overseas practitioners including NZ and Hawaii are welcome to attend and share knowledge and practice. (Australia)

- There is patchy coverage at community level. This is something that needs to be done. (Papua New Guinea)

- Our worry is to make tsunami inundation maps in areas where population is increasing along our coast and where we have seismic gaps such as in northern and south of Peru. Fortunately we have planning for this year and the following to make new inundation maps in order to cover these areas. (Peru)

- During our awareness programs we noted that some communities have some of those in place and still more needs to have it as well. (Fiji)

39. You may add additional individual agency evaluation statements regarding OBJECTIVE 3 in the section below.

No further comments were received.

OVERALL ASSESSMENT

This section gave respondents the opportunity to provide overall comment on the exercise and how it contributed to the development of tsunami response in each country.

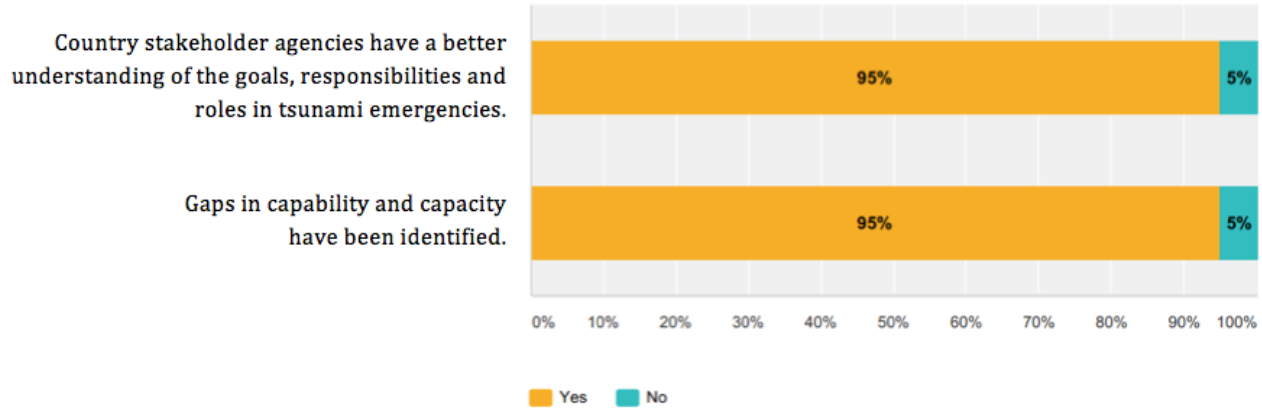


Figure 29: Overall assessment of the exercise.

Country stakeholder agencies have a better understanding of the goals, responsibilities and roles in tsunami emergencies.

- I would have guess yes if we were to receive the message. (Nauru)
- Not all stakeholders have a good understanding of these tsunami emergencies goals and responsibilities - in-country training might be a solution. (Tuvalu)
- It is necessary the practice and exchange of protocols through inter-institutional workshops. Establish a meeting calendar to plan and develop the necessary actions to the execution of yearly exercises. (Nicaragua)
- The main problem lies in the communications with the national emergency agency. We send the messages via email, telephone and radio, but they were not prepared for a tsunami emergency and showed lack of coordination. (Panama)
- The exercise was a good opportunity to discuss the respective roles of MCDEM and GNS Science in responding to a tsunami threat and this helped to clarify some of the responsibilities of each agency. A number of actions for both agencies were identified during the exercise where processes and procedures can be improved. (New Zealand)

Gaps in capability and capacity have been identified.

- The exercise has gone really well with JATWC issuing in real-time and all agencies receiving in real-time the test tsunami warnings. Due to the exercise being in the very busy severe weather season in Australia, apart from receiving the test warning messages and practicing the liaison with JATWC in real-time, most emergency services only performed the desktop discussion exercises. Despite the lack of the exercise scale, each participating agency felt that this exercise created opportunities to review their respective SOPs and find gaps. (Australia)

- At times communication difficulties were experienced due to power issues, telephone links. (Papua New Guinea)

- The importance of having common understanding of what to look for or what particular information to extract from the new the PTWC products. Gaps especially in the current standard operating procedures in all the respective stakeholders were identified. (Tonga)

- There are still gaps that need to be rectified as deliberated during the evaluation after the exercise. Communication link to some NGO's and stakeholders needs to be addressed as well. Message released needs to be clear and to be in laymans terms. (Fiji)

- We will continue with this kind of exercises in order to improve our response capacity. Small internal aspects were identified. We have to use a standard terminology in our reports. We have to work in technical matters with the NDMO in order to improve the national capabilities. (El Salvador)

Other Comments

- Every year NTWC and NDMO are improving with the management of risk and disaster for tsunami. (Peru)

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 pf the exercise, although the late posting of message details on the website caused some problems for participants.

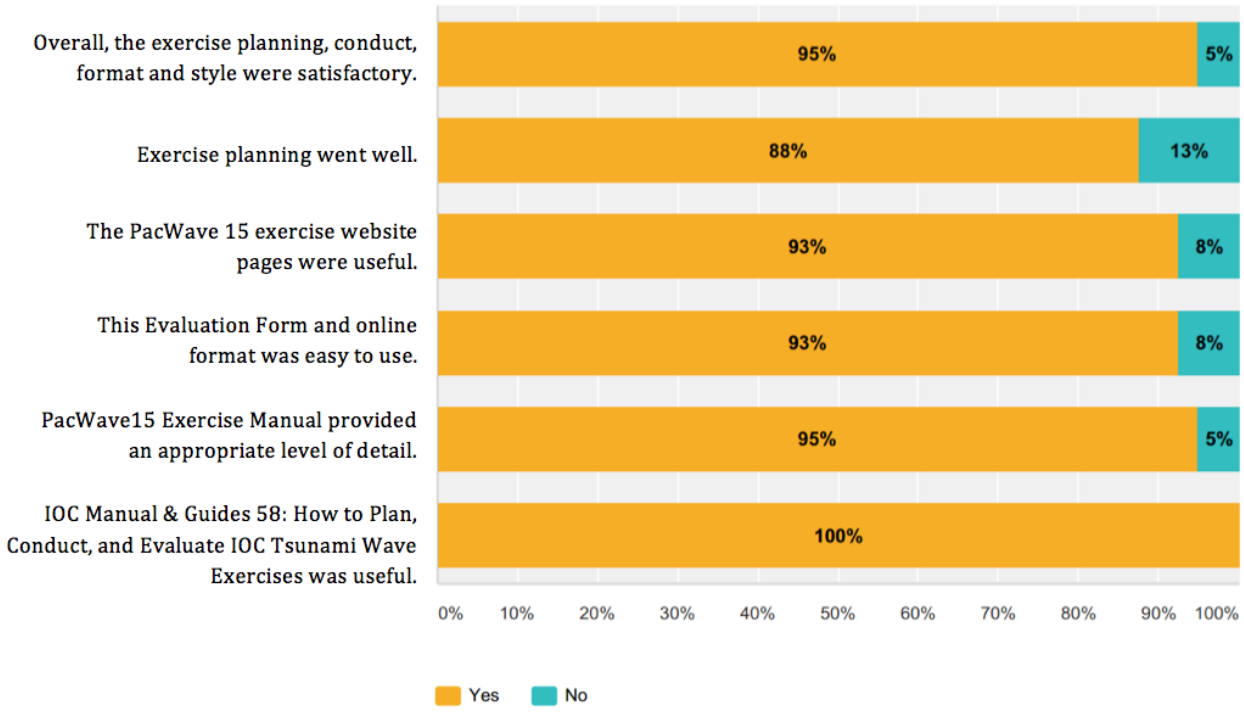


Figure 30: Overall assessment of the planning of the exercise.

Comments

- Scenarios and exercise messages should have been prepared earlier. (Japan)
- Overall we are satisfactory with the output of this Exercise because we relies that their still have many point in our SOP should be improve. (Thailand)
- Thanks to ITIC and PTWC staff for the information which are very useful. (Peru)
- Fully support to have this exercise future as we planned to run nationwide when it is planned. (Fiji)
- It was unclear until the actual exercise whether the PTWC dummy message would actually contain or not the graphical products. (France - New Caledonia)
- The table top style discussion exercise was held at a good level to enable learnings to be made. (New Zealand)
- Overall, everything was satisfactory. (El Salvador)
- Note from co-chair - there were no answers provided for Ex Planning went well and the evaluation forms was easy to use. I have selected no for these as there were definitely issues for Niue to input their evaluation form it had to be done manually by the Co-Chair. (Niue)
- Two indicator YES - evaluation and manual useful The other indicator - cannot answer due to no message received. (Nauru)
- ¿saben porque los mareografos de Honduras no aparecen en la COI. *Could you tell us why tide gauges in Honduras don't appear on IOC.* (Honduras)

Exercise Planning

- Products helped to properly plan the exercises. (Mexico)
- The communications with the people in charge of the PacWave15 exercise were fluently, permitting to carry out it without troubles. (El Salvador)

PacWave 15 exercise website pages

- Website pages were not useful to China but they were to Hong Kong. (China (including Hong Kong))
- The lack of exercise details including the scenarios and the exact exercise dates till last minute significantly hampered the domestic planning, and caused grief to and criticism from many domestic participating agencies. Although understanding the logistic difficulties and workload with running multiple scenarios in real-time, countries would benefit from the real-time test of their procedures, not another PacWAVE13 desktop exercise! While the exercise page was useful, the non-updatedness of many materials till last minutes significantly reduced its functionality and usefulness. (Australia)
- Many documents from previous exercises kind of crowds the web page and makes it a little bit confusing to download the right files. (Papua New Guinea)

- The posting of the final threat maps in the IOC website, was just 3 day ahead of the exercise. Is recommended for the future exercise to post at least one week ahead of the exercise. (Nicaragua)

- Information at the web site was uploaded just a few days prior the exercise day. (Chile)

- Overall, exercise planning went well, although the provision of the scenario messages on the website earlier would have aided preparation. It would be preferable to have the website populated with all documents earlier. (New Zealand)

- The initial message and supplementary messages through email and fax should have been initiated during the PacWave 15 exercise. Although everything was provided through the website, we didn't get them on time. We also encountered issues with accessing some of the file formats. We recommend using format that is easy for everyone to use in accessing the files or if you could recommend which software to use to access these files. We had to convert some of the notepad files to MS Word. (Republic of Palau)

- We downloaded the information without troubles. (El Salvador)

Evaluation Form and online format

- Evaluation form failed and dropped out. (Timor-Leste)

- This Evaluation online Form is easy to use however it can be further improved in the following aspects: 1. Have password entry to be sure of only the authorized people can enter details. 2. Have a save button to be sure of the input content being saved 3. Allow for free back and forth check/edit of questions even if questions are not answered, without losing information already inputted! 4. Ensure that some questions conditioned on answering a prior question with a particular answer get skipped over automatically without being forced to make a choice. 5. Have a word version of the form so that people can prepare answers in word to be sure of a copy before copy and paste the content online. Refer to the IOWave14 online evaluation survey as an example of a survey with these features. (Australia)

- Some questions are not clearly formulated. (French Polynesia)

- The form is easy to use, although it could be improved and some questions were not clear. The ranking of products question repeated products and was not easy to complete in the template format. The word version template used for collating and drafting the responses did not match up nicely with the online version. (New Zealand)

- The evaluation form it´s clear to fulfil. (El Salvador)

PacWave 15 Exercise Manual

- The Exercise Manual contains essential information to assist with the exercise planning. Why has it now been removed from the IOC PacWave15 website? (Australia)

- In the exercise manual wasn´t too clear the bulletins configuration. It means we weren't sure about what message expects to start the exercise and the following ones. (Chile)

- The manual would have been more useful if the scenario information was included. (New Zealand)

- All scenarios and messages were well described. They were clear and easy to understand. (El Salvador)

IOC Manual & Guides 58

- The Pacwave15 exercise was carried out in agreement with the IOC Manual. (El Salvador)

EXERCISE PLANNING.

Please provide a general statement of what went well.

Overall, participants considered the exercise went well, with particular highlights being the choice of scenarios available, and the opportunity to work through and test tsunami response procedures.

Comments

- At the national level the exercise was useful to work through a scenario and explain plans and procedures. (New Zealand)

- The target for the exercise was planned well. The target was focused on how the SOP workflow and how the message can be received well by DMO and how they can react with the messages to forward it to the public. (Indonesia)

- The exercise planning smooth. (Malaysia)

- We knew the scenario very well. (Costa Rica)

Messages & Information

- llegaron los productos a tiempo. *Messages received on time.* (Honduras)

- The SMS sent from TWC to Digicel (local Telecom Company) to the recipients was well done. (Vanuatu)

- Provision of information was good. (Papua New Guinea)

- Choice of the scenarios for each country. Testing new experimental products (text product, energy and threat maps). Russian TWS received all training materials before Exercise Pacific Wave 15. All information related to Exercise Pacific Wave 11 was available at the exercise website. Russian TWS had possibility to consult with ITIC about Exercise Pacific Wave 15 before the drill. (Russian Federation)

- All the products provided by the PTWC were very useful for the exercise planning. (Panama)

- All exercise documents and products were provided. (Republic of Palau)

- With the information provided by the organizers, we could assign the specific tasks to all participants, such as the scenario and type of exercise to be carried out. (El Salvador)

Preparation

- No answer for China: but for HK - the local scheduled communication test and master scenario were well prepared. (China (including Hong Kong))
- Pre-planning and alerts. (Timor-Leste)
- Preparation for the exercise went well at NTWC. (Vietnam)
- Prepare for issuing the Tsunami Warning. (Republic of Korea)
- Was established a national working group to decide the level of participation and communication during the exercise. Was prepared the personal conditions, as technical as materials, to the participation in the table top exercise. (Nicaragua)
- Tsunami Working Group stared meeting before the exercise day. (Fiji)

Stakeholders & Communication

- The official s involved. All agreed to play their part in the exercise. (Niue)
- Getting in contact with disaster officers and getting the planning committee together. (FSM)
- Used all occasions to encourage participation, resulting in the maximum possible agency participation in the exercise despite being in the busy severe weather season. (Australia)
- We have plan to corporate with DDPM together with the Seismic Modeling Agency, Seismic Bureau, Thai Meteorological Department, Seismic Research Station, Royal Thai Navy to participating to in this Example. All those agencies have been enjoined. (Thailand)
- La practica fue excelente por parte de los operador técnicos del Centro de Monitorio Oceánico. *It was excellent practice for technical operators of the Center for Monitoring Oceans.* (Ecuador)
- Exercise plan allowed to regional countries (such as SEP) to choose its own scenarios. (Chile)
- There is a planning team being set-up to plan for the Exercise which is good. (Solomon Islands)
- Algunos aspectos con la comunicacion via email a la agencia de respuesta. *Some aspects related to email communication to the response agency.* (Guatemala)
- The participation of all the emergency management authorities and the armed forces to support of the population. (Mexico)

SOPs

- Nauru is still lacking behind in terms of SOPs guessing that Nauru is still not a member of IOC. (Nauru)
- Testing of new SOPs were fine - table-top exercise only. (Tuvalu)

- Coordination and follow SOPs. (Samoa)

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

This main area that did not go well during the exercise planning process was the late posting of exercise information on the PacWave website.

Messages and Information

- No estan llegando los pronostico de llegada en mapa. *The forecasts maps are not arriving to us.* (Honduras)
- The average time at which email messages and SMS texts were received was better than the last PacWave exercise conducted in 2011 or 2012. (Vanuatu)
- Just unfortunate that my office did not received the text message. Guess break of communication. (Nauru)
- The lack of the exercise essential details of date and scenario till a week prior caused huge grief and difficulty with planning. (Australia)
- Not all messages received (only one received) during exercise. (Vietnam)
- Information at the web site was uploaded just a few days prior the exercise day. (Chile)
- Didn't get all the documents and products on time. (Republic of Palau)
- The delay in the posting of exercise documentation put pressure on officials to put the exercise together during a time of competing priorities. (New Zealand)
- The scenario from PTWC should be prepared 1-2 weeks before exercise, so that we have more time to plan/to synchronize the content of our bulletin with PTWC bulletin. (Indonesia)
- The Manual was not available timely. (Costa Rica)

Stakeholders & Communication

- Members of Niue Disaster Council were invited to observe the exercise planning. (NIUE)
- No answer for China: but for HK: 1. Not all stakeholders in the emergency response plan took part in the exercise such that some of the response actions had to be simulated. 2. Some stakeholders, who had no experience in using the tsunami products, encountered difficulty in interpreting the tsunami forecasting aids/products. (China (including Hong Kong))
- Most stakeholders not clear with new changes/arrangements. (Tuvalu)
- Some important stakeholders were not available. (Fiji)
- Se tubo todo los medios de comunicación disponibles. *All the available communications methods.* (GUATEMALA)

- It was not possible to gather the public as for the undertaking of evacuations from potentially threatened areas in case of flooding as a result of a tsunami. (Mexico)

Preparation and Planning

- Late start for planning from our in-country perspective. (Papua New Guinea)
- Pre tsunami session with DMO needs to be well organized in advance. (Samoa)
- Prepare for contacting other governmental agencies. (Republic of Korea)
- The Exercise Planning Team commences planning for PAcWave15 very late. One week before the actual exercise. This can be improved and NDMO/SIMS are now working in strengthening the team. (Solomon Islands)

Evaluation

- Evaluation online. (Timor-Leste)

Please provide a general statement about what could be improved.

Areas identified that could be improved are more proactive engagement with stakeholders earlier on in the planning process and earlier release of the exercise manual to provide greater guidance earlier for participants.

Comments

- Dirigir mas escenarios para los países de centro America. *More scenarios for Central American countries.* (Honduras)
- Pac wave was useful case studies of now it was used in other countries useful. (Timor-Leste)
- The date. It was very close to Christmas Holidays and CaribeWave exercise. (Costa Rica)

Stakeholders & Communication

- The exercise could involve a whole community to test their community response and evacuation plan. (Vanuatu)
- Encourage more stakeholders to participate in the exercise. (China (including Hong Kong))
- Involve media and business community at Mulinuu. (Samoa)
- Communicate with other governmental agencies. (Republic of Korea)
- The availability of various stakeholders when called as they are part of the working group. (Fiji)
- The next exercise should be prepared wider (more institutions can involve for the planning as well as the exercise). (Indonesia)

- Involucrar a mas instituciones del estado. *Involve more institutions from country.* (Guatemala)

- The participation of the population as for assessing the response capacity of the Emergency Management Authorities. (Mexico)

Release of Exercise Manual & Products

- Demonstrate, through webpage or email, the use of tsunami forecasting products before the exercise. (China (including Hong Kong))

- Earlier release of the national exercise manual which demands the similarly early release of the key exercise details such as scenario and the exact date. (Australia)

- The timeliness of the posting of documentation. (New Zealand)

Messages & Information

- Messages sending during exercise. (Vietnam)

- Indicate/inform NTWC as to the process of how the exercise will start. There was some confusion as to the number of messages received during the day of the exercise. We were not informed that we would be running the exercise on our own after receiving the first message and so we had to wait to see if any messages were sent from PTWS. We had some of our staff monitor emails but we never received any messages via emails. Only fax and it was just that one message (Msg#1). (Republic of Palau)

- For the GTS, NDWC wasn't the member for the WMO. So we have to asked to Thai Meteorological Department office offering the GTS information. Why shouldn't NWPTAC and PTWC asking ICG to support warning information to WIS with what the new generation information dissemination for the data exchange. (Thailand)

Planning

- Overall, the planning and decision making on what actions to take and what statements to release were efficient, but we can always improve on timing. The scenarios for Pohnpei, Chuuk and Kosrae were about 4 to 5 hours away so we have a lot of decision making time. We will try to run another local exercise with shorter ETA and see our response times. (FSM)

- We will need to start planning a little earlier than what we did for this exercise. (Papua New Guinea)

- Improve the dynamics plan of time-trial actions to accompany the execution of yearly exercises. (Nicaragua)

- Preparation work for the exercise, ample time is require. (Solomon Islands)

- In-country training. (Tuvalu)

EXERCISE CONDUCT

Please provide a general statement about what went well.

Areas that went well during the exercise included the enthusiasm of participants, the opportunity to practice using SOPs, and the opportunity to test procedures and understanding of the new enhanced products.

Comments

- Esta bien planificado. *Well planned.* (Honduras)
- No answer for China: but for HK - the exercise was well coordinated and smoothly conducted. All participants responded in a timely manner. (China (including Hong Kong))
- Exercise was carried out satisfactorily at all levels. (Russian Federation)
- Good. (Thailand)
- After several exercises and some effective warning, this last exercise was rather well conducted. (French Polynesia)
- Hubo tranquilidad durante el ejercicio. *Calmly went through exercise.* (Ecuador)
- The experience was positive for understanding the evolution of new bulletins and test the National Standard Operating Procedures. As well we test communications with SEP countries like Peru and Ecuador with satisfactory results. Such experiences help us improve our Procedures and Confidence. (Chile)
- It started well and finished ahead of time even though it was stressed in reality, it will take some time. (Fiji)
- All participants perform a simulation exercise seriously, enthusiasm, and attention to all directions. (Indonesia)
- Everything went according to NTWC & NDMO SOPs. (Malaysia)

Messages, Manual, Information, and New Enhanced Product

- All the information is available for the exercise. (Niue)
- The dissemination of the information through newsletters issued by the Tsunami Warning Center was thoroughly carried out. (Mexico)
- Tsunami advisory bulletins were clear. (Vanuatu)
- For most part, the overall exercise went well. Products where received on a timely manner and the messages were generated and disseminated in an appropriate time frame. (FSM)
- Following and understanding SOPs. (Samoa)

- NEOC/SIMS staffs who are responsible for conducting tsunami threat assessments have the opportunity to familiarize them in assessing a tsunami using the New Enhanced Product. (Solomon Islands)

- Good to have both groups (MCDEM and GNS Science) in the room at the same time for this exercise. The discussion-based exercise was at a good level. The exercise was a good chance to look at the new products and see how the different products could be used. A number of action points were identified for improving processes and procedures. (New Zealand)

- The exercise was carried out in agreement with the plan. Our technicians wrote internal reports with the new PTWC products, in acceptable time. (El Salvador)

Communications

- Procedures tested successfully in real-time at JATWC and other agencies without causing unnecessary public panic. (Australia)

- Activities within NTWC. (Vietnam)

- Communications between TWFP, NDMO & Provinces generally went well. (Papua New Guinea)

- Issue the Tsunami Warning to local agencies. (Republic of Korea)

- During the exercise, INETER share with all participants the technical threshold for threat tsunami as well as, a tsunami models develop by technical advisor of INETER. (Nicaragua)

- Good collaboration between NTWC and NEMO is still maintained. (Republic of Palau)

- The conduct and the communication ways were well in time, for call and alert with the response agency in Guatemala. (Guatemala)

- Local authorities understood that it is possible a tsunami evacuation for Puntarenas city. (Costa Rica)

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

Areas that did not go so well during the exercise included some confusion about what messages were going to be received and what these messages would include, the lack of participation of some important stakeholders and some issues with the delivery of messages.

Exercise

- The Police department was confused about the starting time from 10 a.m. to 2 p.m. (Niue)

- There have been some last minute changes which are opted for trial and error especially on the procedure of the Tsunami Warning Dissemination. (Solomon Islands)

- The New Zealand Tsunami Focal Point had provided New Zealand's details before the exercise, however, this was not loaded. The Chatham Islands are missing from the Polygons map, and a number of the New Zealand geographic points listed in the tables

have been changed from those used previously, without MCDEM being advised. (New Zealand)

- The time line and the decision-making from DMO to the public still not went very well. (Indonesia)

Messages

- Did not get the actual (not DUMMY) PTWC messages in real-time, understanding the logistic difficulty to do so for multiple exercise scenarios. (Australia)

- Some messages went out a little late. Some confusion with terms used in information to Provinces and needed clarification. (Papua New Guinea)

- Encountered some confusion as to the start of the exercise since we only received that first initial message informing us of the earthquake. We were under the assumption that we would be receiving all messages from PTWS via fax and email for the whole duration of the exercise. After receiving the first message, no other messages were received. An initial message with the initial earthquake info should have been generated and a second message with supplementary data should have been sent. We were having issues accessing some of the products that were provided on the PacWave 15 site. Some of the file formats had to be converted for ease of access. (Republic of Palau)

- PTWC and NWPTAC bulletins were not received via the GTS and Fax. (Malaysia)

Communication

- The link of communication between NTWC and NDMO was coordinated well as VMGD and NDMO are housed in the same building. (Vanuatu)

- Coordination between NTWC and DMO in country. (Vietnam)

- The warning plan to contact the local focal technicals did not function appropriately. The local media attended the exercise but did not follow the protocols. (Nicaragua)

- Some important stakeholders did not participate. (Fiji)

- The communications between the NTWC and the national emergencies agency (SINAPROC). (Panama)

- Only local host communication but was available. (Guatemala)

- In some agencies, the lack of enthusiasm in taking part in the exercise, especially at local levels in some municipalities. (Mexico)

- Key authorities did not attend: Tourism business chamber and traffic police. (Costa Rica)

Please provide a general statement about what could be improved.

For future exercises, some of the areas that could be improved included using different scenarios and further developing existing scenarios, clearer guidance on what kinds of messages will be disseminated during the exercise and more stakeholder participation.

Comments

- Updating of protocols and SOP locals. Continue with the training about the new enhanced products of PTWC. (Nicaragua)

- We suggest for future exercises, PTWC sends the bulletins which will make more realistic. (Chile)

- More regular tsunami exercising will continue to improve processes and procedures for all. (New Zealand)

- DMO need more exercise with different cases. Their SOP needs to be improved therefore they can be more confident. (Indonesia)

- Please let NTWC know what to expect during the exercise so that we do not encounter any delays. And if all PacWave information and products be posted on the website on time so that we have ample time to review all of them before the exercise begins. (Republic of Palau)

Scenarios

- Some scenarios required fine-tuning to better simulate the real environment. (China (including Hong Kong))

- Have fewer scenarios but each on separate exercise days to allow for the real-time actual message dissemination. (Australia)

Preparation

- Advance preparation and planning could have been much better if SOPs are clear. (Vanuatu)

Messages

- Awareness of technical terms at Provincial level. To simplify some wording of text messages to provinces. (Papua New Guinea)

- Hope to get the bulletins via GTS, fax and emails. (Malaysia)

Stakeholder

- We would like to have more stakeholders participate in the exercise, but we did get response from the agencies that are vital and needed to be informed. (FSM)

- DMO involvement. (Vietnam)

- Rope in more stakeholders and NGO's to make it more lively and real. (Fji)

- The participating agencies should take this kind of exercises more seriously, so they can identify strengths and weaknesses in their local emergency plans. (Mexico)

- Establishing the importance of this kind of exercises for ALL local authorities. (Costa Rica)

Communication

- The communications between NEOC and SIMS needs to be improved. (Solomon Islands)
- The communications need to be improved. (Panama)
- Direct coordination with the warning centres. (Guatemala)

Evaluation

- Se entendia bien el cuestionary. *The survey could be easier to understand.* (Honduras)

EXERCISE DEBRIEF OR EVALUATION

Please provide a general statement about what went well.

Aspects of the exercise evaluation that went well included individual countries producing their own action reports and identifying improvements to processes.

Comments

- Todo bien. *Everything is good.* (Honduras)
- Good. (Thailand)
- Overall the Exercise was excellent and our officers have done extremely well in doing the tsunami threat assessments and familiarization on the new products. (Solomon Islands)
- We plan to conduct more similar exercises in other coastal communities and follow-up on the results of this exercise. (Costa Rica)

Exercise

- Australia conducted a national debrief following the debrief sessions within each participating agency. A national summary report on the exercise is being prepared. (Australia)
- Valuable discussion of tsunami threat levels with a view to implement a local threat system using numbers based on tsunami amplitude. (Papua New Guinea)
- It was a simple and easy process, giving us the necessary time to develop it. (Chile)
- Timing and venue was ok. (Fiji)
- Generally, the exercise went well according to the SOPs. (Malaysia)

Messages & Bulletin

- No answer for China: but for HK - Exercise messages were promptly sent to all players through various communication channels including fax, email and government internal network. (China (including Hong Kong))

- Se emitió los boletines de acuerdo a los protocolos que tenemos establecido. *Alerts/bulletins issued according to our established protocols.* (Ecuador)

- The bulletin sent to all the different units was received in due time and proper form. New products from the PTWC were very useful for analyzing the information. Emergency meetings were held by the authorities before the tsunami threat. In some areas, the exercise was disclosed through the media. (Mexico)

Communication & Participation

- It was a good learning exercise to officials involved by sharing their experience before a decision was made. (Niue)

- The attendance was fine because there were representations of media, education, NDMO and VMGD, Redcross were good. (Vanuatu)

- Everyone participated. (Samoa)

- Issue the Tsunami Warning to local agencies. (Republic of Korea)

- Collaboration between NTWC and NEMO is still going strong. (Republic of Palau)

- The observers / facilitators observed and facilitated the exercise well. They have trying to give feedback to make exercise better in the future. (Indonesia)

Evaluation

- The evaluation was carried out with the integration of all participant institutions. Conclusions were drawn to improve the protocols in place for tsunami warning. (Nicaragua)

- The evaluation form provided a good framework for debriefing and evaluating the exercise. (New Zealand)

- Was well cause the necessarily information are in the evaluation. (Guatemala)

- Following recommendations, at the end of the exercise, we held an evaluation meeting, in order to identify strengths and weaknesses. (El Salvador)

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

Aspects of the evaluation that did not go so well included some difficulties with understanding and using the online evaluation form, the inability of some participants to attend the debrief and contribute to the evaluation, and having a gap between the end of the exercise and the debrief.

Exercise

- En este caso no llegan los pronosticos de llegada en le mapa. *This time we did not receive forecast maps.* (Honduras)
- Debrief not done immediately. (Papua New Guinea)
- Preparation for the Exercise. (Solomon Islands)
- Should have synchronized both NTWC and NEMO time so that we would know at what time both agency received messages. (Republic of Palau)
- The inject cards (problems/cases) should prepare more variety with many possibility problems that can occur during the exercise. (Indonesia)
- It was a long test. (Guatemala)
- Evacuation protocols are needed before an imminent danger of tsunami. This was presented as the greatest weakness of the units responsible for civil protection. (Mexico)

Participants

- TV Niue was not available to do a coverage for the exercise. (Niue)
- Others like Police were unable to attend as the debriefing had been delayed to the second week due to work commitment. (Vanuatu)
- Unavailability of very important stakeholders. (Fiji)

Evaluation

- Online evaluation survey is not as user friendly as it could be. (Australia)

Please provide a general statement about what could be improved.

The evaluation process could be improved by holding a debrief immediately after the conclusion of the exercise, improving the usability of the online evaluation form and allowing more time for the completion of the evaluation form.

Comments

- Municipalities suggest more sirens to be installed, response time to be practised, communication link to be improved. (Fiji)
- Gaps identified and will work closely with NEMO to improve them. (Republic of Palau)
- The creation of maps that include evacuation routes in case of tsunami. Updating of evacuation plans with the participation of local authorities. (Mexico)
- The NTWC SOP needs improvement in some areas of dissemination. (Malaysia)
- The exercise was very useful for our country since we are fairly new in tsunami preparedness and response plan. From this exercise we can evaluate and find areas that we need to improve or add on to our proposed national plan. (FSM)

- Improvement in the online evaluation survey as detailed in question 41. (Australia)

Exercise

- Incluir talvez kmz en el pronostico para ver el google heart otro toempo de llegada. *Include the kmz forecast file to see on Google Earth the wave arrival time.* (Honduras)

- Straight after the exercise, it would be better to gather the results and the debriefing should be organized as early as possible. (Vanuatu)

- Debrief to be done immediately but with inputs from Provincial personnel. (Papua New Guinea)

- Solomon Islands will have to review its Tsunami Sub-Plan and SOP, and also upgrade its MOST Software to ensure that it aligns with the PTWC New Enhanced Products. (Solomon Islands)

- More time for upload the online test or that we can receipt or download previously to be completed. (Guatemala)

Stakeholders

- To have more stakeholders involved and familiarisation with the new products. (Niue)

- Coordination among NTWC, DMO, the facilitators and the Observers should be done well before the exercise, so that all roles can give an input related with the exercise. (Indonesia)

Evaluation Form

- Parts of the evaluation form could be improved for better usability – this has been noted further in the general exercise observations section. (New Zealand)

ANNEX IV

REPORT PREPARATION / FINAL REPORT

The planning, conduct, and evaluation of Exercise PacWave15 were coordinated by the PTWS Exercise PacWave15 Task team (TT). The Exercise PacWave15 Summary Report and Annex III were compiled by Ms Jo Guard and Ms Sara Leighton (Ministry of Civil Defence & Emergency Management, New Zealand), Dr Laura Kong and Brian Yanagi (International Tsunami information Center), and Madoka Iba (University of Tokyo). Translation of Annex III evaluation comments from Spanish to English was provided by Nicolas Arcos (ITIC).

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- Mr Tetsuyuki Ueyama Japan, Japan Meteorological Agency (JMA)
- LCDR Carlos A. Zúñiga, Chile, Servicio Hidrográfico y Oceanográfico de la Armada de Chile (SHOA)

ANNEX V

LIST OF ACRONYMS

DISCEX	Discussion Exercise or Tabletop 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 Centre (Japan)
PTWC	Pacific Tsunami Warning Center (USA)
SOP	Standard Operating Procedures
TT	Task Team
TNC	Tsunami National Contact
TWFP	Tsunami Warning Focal Point
UNESCO	United Nations Educational, Scientific & Cultural Organization
WC/ATWC	West Coast/Alaska 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

(continued)

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
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 (8^{th} training-through-research cruise, June-August 1998). 1999	E only
55	Bruun Memorial Lectures, 1999: Ocean Predictability. 2000	E only
56	Multidisciplinary Study of Geological Processes on the North East Atlantic and Western Mediterranean Margins (9^{th} training-through-research cruise, June-July 1999). 2000	E only
57	Ad hoc Benthic Indicator Group - Results of Initial Planning Meeting, Paris, France, 6-9 December 1999. 2000	E only
58	Bruun Memorial Lectures, 2001: Operational Oceanography – a perspective from the private sector. 2001	E only
59	Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters. 2001	E only
60	Interdisciplinary Approaches to Geoscience on the North East Atlantic Margin and Mid-Atlantic Ridge (10^{th} training-through-research cruise, July-August 2000). 2001	E only
61	Forecasting Ocean Science? Pros and Cons, Potsdam Lecture, 1999. 2002	E only
62	Geological Processes in the Mediterranean and Black Seas and North East Atlantic (11^{th} training-through-research cruise, July- September 2001). 2002	E only

63	Improved Global Bathymetry – Final Report of SCOR Working Group 107. 2002	E only
64	R. Revelle Memorial Lecture, 2006: Global Sea Levels, Past, Present and Future. 2007	E only
65	Bruun Memorial Lectures, 2003: Gas Hydrates – a potential source of energy from the oceans. 2003	E only
66	Bruun Memorial Lectures, 2003: Energy from the Sea: the potential and realities of Ocean Thermal Energy Conversion (OTEC). 2003	E only
67	Interdisciplinary Geoscience Research on the North East Atlantic Margin, Mediterranean Sea and Mid-Atlantic Ridge (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

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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 *(under preparation)*	
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)	*Under preparation*
95.	International Post-Tsunami Survey for the 25 October 2010 Mentawai, Indonesia Tsunami	*Under preparation*
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	*Under preparation*
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. Vol. 1 Exercise Manual. 2012 Vol. 2 Evaluation Report. 2014	E only
103.	Exercise NEAMWAVE 12. A Tsunami Warning and Communication Exercise for the North-eastern Atlantic, the Mediterranean, and Connected Seas Region, 27–28 November 2012. Vol. 1: Exercise Manual. 2012 Vol. 2: Evaluation Report. 2013	E only
104.	Seísmo y tsunami del 27 de agosto de 2012 en la costa del Pacífico frente a El Salvador, y seísmo del 5 de septiembre de 2012 en la costa del Pacífico frente a Costa Rica. Evaluación subsiguiente sobre el funcionamiento del Sistema de Alerta contra los Tsunamis y Atenuación de sus Efectos en el Pacífico. 2012	Español solamente (resumen en inglés y francés)
105.	Users Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System, August 2014. Revised Edition. 2014	E, S
106.	Exercise Pacific Wave 13. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1–14 May 2013. Vol. 1 Exercise Manual. 2013 Vol. 2 Summary Report. 2013	E only
107.	Tsunami Public Awareness and Educations Strategy for the Caribbean and Adjacent Regions. 2013	E only
108.	Pacific Tsunami Warning and Mitigation System (PTWS) Medium-Term Strategy, 2014−2021. 2013	E only
109.	Exercise Caribe Wave/Lantex 14. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 26 March 2014. Vol. 1 Participant Handbook. 2014	E/S
110.	Directory of atmospheric, hydrographic and biological datasets for the Canary Current Large Marine Ecosystem. 2014	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*	*In preparation*
113.	*Exercise Indian Ocean Wave 2014: An Indian Ocean-wide Tsunami Warning and Communication Exercise.*	*In preparation*
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. I Manual	E only
115.	*Transboundary Waters Assessment Programme (TWAP) Assessment of Governance Arrangements for the Ocean*	*In preparation*
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

(continued)

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