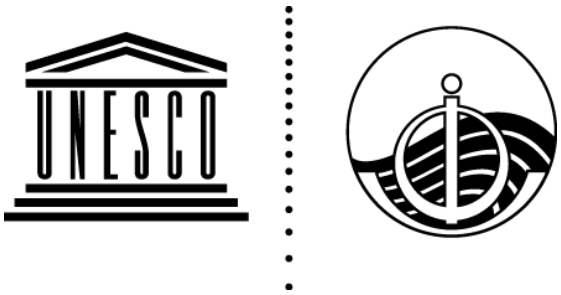
Intergovernmental Oceanographic Commission
Technical Series
126



EXERCISE PACIFIC WAVE 16

A Pacific-wide Tsunami Warning and Enhanced Products Exercise

1-5 February 2016

Exercise Manual

Volume 1

UNESCO

Intergovernmental Oceanographic Commission
Technical Series
126

EXERCISE PACIFIC WAVE 16

A Pacific-wide Tsunami Warning and Enhanced Products Exercise

1-5 February 2016

Exercise Manual

Volume 1

UNESCO 2015

IOC Technical Series, 126 (Volume 1)
Paris, 21 December 2015
English only

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

Exercise Pacific Wave 16. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1-5 February 2016. Volume 1: Exercise Manual. IOC Technical Series No 126. UNESCO/IOC 2015
(English only)

Report prepared by: The Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System

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

Printed in France

(IOC/2015/TS/126 Vol.1)

TABLE OF CONTENTS

page

1. BACKGROUND 1
2. EXERCISE AIM 1
3. EXERCISE OBJECTIVE 1
4. NEW ENHANCED PRODUCTS 2
5. EXERCISE DATES 3
6. EXERCISE SCENARIO 3
7. TYPE OF EXERCISE 4
8. FURTHER GUIDANCE – HOW TO PLAN, CONDUCT AND EVALUATE TSUNAMI EXERCISES GUIDELINE 4
9. ASSUMPTIONS 4
10. EXERCISE PARTICIPATION 4
11. EXERCISE DOCUMENTATION 5
12. EXERCISE PRODUCTS 5
13. EXERCISE DELIVERY/FORMAT 5
13.1 MASTER SCHEDULE OF EVENTS LIST (MSEL) – EXERCISE SCRIPT 6
14. POST-EXERCISE EVALUATION 6
14.1 DEBRIEFING 6
14.2 EXERCISE VALIDATION 7
14.3 EVALUATION CRITERIA 7
14.4 EVALUATORS 7
14.5 OBSERVERS 7
14.6 EVALUATION TOOLS 7
14.7 EXERCISE PACIFIC WAVE 2016 SUMMARY REPORT 8
15. REAL EVENTS DURING EXERCISE PLAY 8
16. RESOURCING 8
17. MEDIA ARRANGEMENTS 8

ANNEXES

I. FORECAST POINTS USED FOR EXERCISE PACIFIC WAVE 2016 9
II. EXERCISE PACIFIC WAVE 2016 - SCENARIOS 12
III. INTERNATIONAL MASTER SCHEDULE OF EVENTS LIST (MSEL) 13
IV. POST-EXERCISE EVALUATION 14
V. SAMPLE PRESS RELEASE 21
VI. LIST OF ACRONYMS 23

1. BACKGROUND

The Intergovernmental Oceanographic Commission (IOC) of UNESCO established the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) in 1965 in response to the 1960 earthquake off the coast of Chile that generated a tsunami killing 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 alerts, 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).

The US Pacific Tsunami Warning Center (PTWC), established in 1965 with the start of the Tsunami Warning System in the Pacific, serves as the Tsunami Service Provider (TSP) for the Pacific. In response to Member State requests for additional regional information, Japan began operation of its Northwest Pacific Tsunami Advisory Center (NWPTAC) in March 2005, and in April 2006 expanded on an interim basis to the South China Sea. The NWPTAC, which serves as the TSP for the northwest Pacific, provides timely alerts for earthquakes occurring in the northwest Pacific. As of October 2015, the NWPTAC has issued the advisories for 190 events in total since it started the service in March 2005.

A Pacific-wide tsunami exercise is an effective tool for evaluating the readiness of PTWS countries and to identify changes that can improve its effectiveness. The international tsunami exercises were first conceived and conducted in 2006 by the ICG/PTWS under the leadership of the PTWS Exercises Task Teams with strong contributions from the ITIC, PTWC, and JMA. Altogether there have been five IOC-coordinated international exercises, Exercise Pacific Wave 2006, 2008, 2011, 2013, and 2015. 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 2015 were additionally used to introduce and obtain feedback, test, and validate the PTWC new enhanced forecast products which became official on 1 October 2014.

At the 26th session the ICG/PTWS held in Honolulu, United States of America, from 22 to 24 April 2015 (ICG/PTWS-XXVI), it was agreed that the Northwest Pacific Tsunami Advisory Center (NWPTAC) should proceed with its development of enhanced products for the North West Pacific, targeting 2018 for its complete transition. At the session, it was also approved to conduct Exercise Pacific Wave 2016 (PacWave16) during the first quarter of 2016 as a regional exercise involving the sixteen countries that receive products of NWPTAC. The exercise intends to support the development of improved tsunami procedures and the NWPTAC Enhanced Products.

2. EXERCISE AIM

The aim of PacWave16 is to evaluate experimental NWPTAC Enhanced Products and identify necessary modifications.

3. EXERCISE OBJECTIVE

The overall objectives for PacWave16 are to:

- Objective 1. Evaluate the format and content of experimental NWPTAC Enhanced Products.
- Objective 2. Determine whether countries are prepared to officially receive and utilize the NWPTAC Enhanced Products.

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

4. NEW ENHANCED PRODUCTS

The Area of Coverage map and recipient countries of NWPTA is shown in Figure 1.
Regarding forecast points, updated ones which reflect the results of coordination among recipient countries up to October 2015 will be used. (ANNEX I)

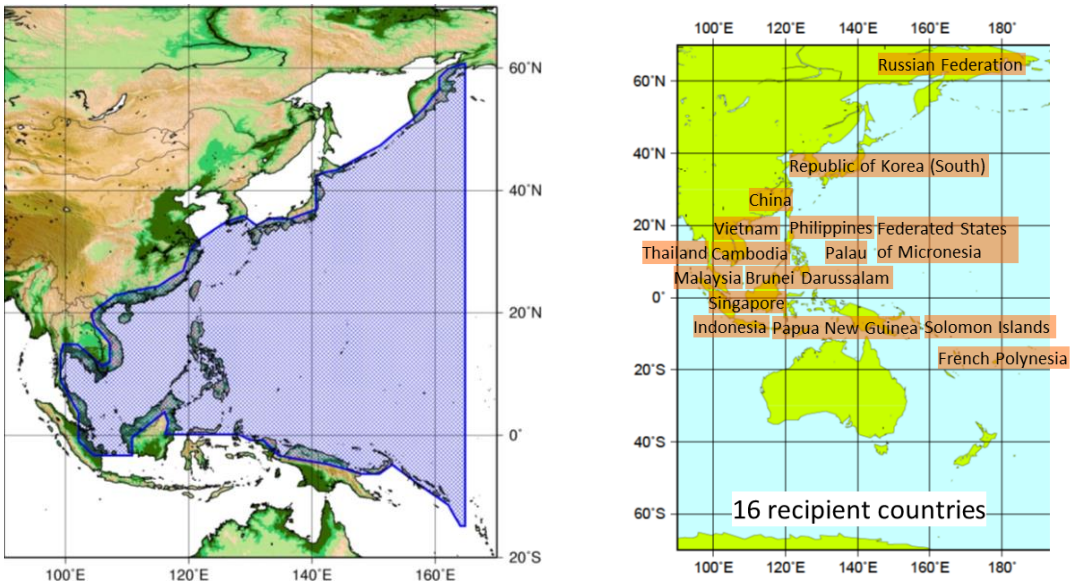


Figure 1. NWPTA will be issued to 16 recipient countries when the NWPTAC detects occurrence of an earthquake of magnitude 6.5 or greater in the blue-shaded area.

The NWPTAC new enhanced products consist of an initial text message prepared from a pre-established tsunami simulation database and followed by text messages and accompanied by graphical products based on real-time simulation techniques. The graphical products will be disseminated exclusively for national authorities of the recipient countries. There will be no change to the format of the text messages from the current format. Full changeover to the new enhanced products is planned for 2018, after approximately one year's parallel issuance of existing and enhanced products.

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

a. Text products

- Forecast method
  - Tsunami forecast database (the first message, without graphics)
  - Real-time simulation (the second and subsequent messages, with graphical products)
- Contents (basically no change from the current format)
  - Hypocentral parameters (origin time, location, magnitude)
  - Tsunamigenic potential
  - Coastal blocks
  - Forecast amplitude and arrival time

- Observed amplitude and arrival time

- Dissemination of products
  - GTS, FAX and E-mail

b. Graphical Products (Maps)

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

5. EXERCISE DATES

PacWave16 will be held within the period of 1-5 February 2016. PacWave16 is recommended to be a Tabletop Exercise and will not be a live exercise. All products will be available beforehand on the PacWave16 web site (http://www.pacwave.info). Participating countries may choose to run their exercise at any time between 1 to 5 Februally 2016, allowing flexibility to avoid conflict with other important national events.

6. EXERCISE SCENARIO

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

- Kuril-Kamchatka Trench
- Japan Trench
- Nansei-Shoto Trench
- Manila Trench
- Philippine Trench
- New Britain-San Cristobal trench

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

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

7. TYPE OF EXERCISE

It is recommended that PacWave16 be carried out in a tabletop format (also referred to as a 'discussion exercise', or 'DISCEX').

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

An example of a Tabletop Exercise may involve only key stakeholders, such as the National Tsunami Warning 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 Pacific Tsunami Service Providers, such as the PTWC in Hawaii and the regional NWPTAC in Japan, which describe the nature of the threat.

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

The IOC Manual and Guides 58, "How to Plan, Conduct and Evaluate IOC Tsunami Wave Exercises" (IOC/2011/MG/58, 2013, English, Spanish) has been developed to aid countries in planning, conducting, and evaluating a tsunami exercise at a national and/or provincial level. The guide is available at the PacWave16 website (http://www.pacwave.info).

9. ASSUMPTIONS

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

10. EXERCISE PARTICIPATION

All Pacific countries that receive products of the NWPTAC 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 PacWave16, it is recommended that the National Tsunami Warning Center and the National Disaster Management Office, participate.

Each country's lead agency and its PacWave16 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 PacWave16 Exercise Evaluation Form based on in-country feedback.

11. EXERCISE DOCUMENTATION

PacWave16 planning, conduct, and evaluation should take into account the following documents:

- IOC Circular Letter No 2588: Pacific Tsunami Warning and Mitigation System (PTWS) Tsunami Exercise "PacWave16", 1–5 February 2016, dated 11 August 2015
- Exercise Pacific Wave 16, A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1-5 February 2016. Exercise Manual, Volume 1, IOC Technical Series No 126. UNESCO/IOC 2015 (English)
- Draft Users Guide for the Northwest Pacific Tsunami Advisory Center Enhanced Products for the Pacific Tsunami Warning System. (English)
- 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.
- 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)

All information related to PacWave16 is available at the exercise website: http://www.pacwave.info

12. EXERCISE PRODUCTS

PacWave16 will NOT be played in real time, and thus will have no "dummy" kickoff exercise message. Participating countries should select a relevant scenario and its most convenient date and time to conduct the Tabletop Exercise within the 1-5 February 2016 time period. Participating countries may amend the exercise messages to suit their own timetable.

All NWPTAC products will be provided online at the PacWave16 website (http://www.pacwave.info) in advance to help countries plan and prepare. It is recommended to download from the PacWave16 website (http://www.pacwave.info), the NWPTAC products and messages for the appropriate scenario prior to the day of the exercise.

The earthquake origin time default date and time of the messages (e.g. 1 February 2016 @ 0100 hours) can be adjusted by participating countries to coincide with their selected Tabletop Exercise local date and time. Subsequent message issuance date and times, and earthquake and tsunami arrival times should then also be adjusted accordingly.

All documentation and correspondence relating to this exercise is to be clearly identified as **PacWave16** and **For Exercise Purposes Only**.

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

13. EXERCISE DELIVERY/FORMAT

Only the suite of experimental NWPTAC enhanced products are being reviewed in PacWave 16, and thus Pacific Tsunami Warning Center (PTWC) messages will be issued in the exercise for information purposes only. All messages are listed in the Master Scenario Events List (Annex II).

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

Each PacWave16 National Contact and their Exercise Planning Team should decide whether the exercise scenario messages are made known to the other national, provincial and local agencies prior to the exercise.

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

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

13.1 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 Tsunami Service Provider 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 the Master Schedule of Events List.

14. 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 (including a hot and cold debrief) should evaluate the effectiveness of arrangements and procedures 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 PacWave16 post-exercise evaluation form.

All participating countries are asked to provide feedback through the PacWave16 Evaluation Form (Annex III) by 26 February 2016. Forms should be submitted online by visiting https://www.surveymonkey.com/s/pacwave16_eval, noting only **one form per country** is permitted. This feedback will greatly assist in the evaluation of PacWave16.

14.1 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 PacWave16 is expected to conduct its own debrief after the exercise. This may take the form of a hot debrief (or hotwash) on the day of the exercise, with each participating agency conducting its own cold (formal) debrief within the week(s) following the exercise.

A formal exercise debrief inclusive of all participants in the respective countries will be required to facilitate a collective and official evaluation. The method (in person meeting, survey,

teleconference, or other means) used to collect the data required is to be decided upon by the individual participating countries.

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

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

14.2 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.

14.3 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.

14.4 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, communications, or in specific agency areas of responsibility.

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

14.5 OBSERVERS

PacWave16 may generate interest within the wider sector or local community. Visitors from other agencies (whether local or international) may be invited to observe various exercise activities. Media may also be invited to observe as a way of helping to increase tsunami awareness. Some media may also participate or be simulated, if they are part of the official warning and evacuation dissemination chain.

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

14.6 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 involve the

ICG/PTWS as the intergovernmental coordinating group supporting effective tsunami warning and decision making.

Evaluation of an exercise should focus on the adequacy of plans, policies, procedures, assessment of 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 PacWave16 Summary Report.

The evaluation tool aims to inform and facilitate individual participating country evaluations as well as the PacWave16 Summary Report.

All participating countries are asked to complete the official PacWave16 Exercise Evaluation Form (one per country) **(Annex III) by 26 February 2016**. Forms should be submitted online by visiting https://www.surveymonkey.com/s/pacwave16_eval.

14.7 EXERCISE PACIFIC WAVE 2016 SUMMARY REPORT

The Exercise Task Team will compile the Exercise Pacific Wave 2016 Summary Report based on the official Exercise Evaluation Forms received. The report will include the following:

- Exercise description
- Post-exercise evaluation summary and findings
- Recommendations based on a review of the Pacwave16 responses

15. 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, which will be given full priority.

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

16. 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.

17. MEDIA ARRANGEMENTS

The UNESCO Bureau of Public Information will issue an international Media Advisory before the PacWave16 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 PacWave16 website (http://www.pacwave.info).

ANNEX I. FORECAST POINTS USED FOR EXERCISE PACIFIC WAVE 2016

Table 1. Forecast points and coastal blocks of NWPTAC Enhanced Products for PacWave16.

Coastal Block	Forecast Point	Latitude	Longitude	Number in Fig. 1
EAST COASTS OF KAMCHATKA PENINSULA	OSTROV_KARAGINSKIY	58.8N	164.5E	1
	UST_KAMCHATSK	56.1N	162.6E	2
	PETROPAVLOVSK_K	53.2N	159.6E	3
KURIL ISLANDS	SEVERO_KURILSK	50.8N	156.1E	4
	URUP_IS.	46.1N	150.5E	5
SOUTH COASTS OF KOREAN PENINSULA	BUSAN	35.1N	129.1E	6
	TONGYEONG	34.7N	128.4E	7
	NOHWA	34.2N	126.6E	8
	HEUKSANDO	34.6N	125.4E	9
	CHEJU_ISLAND	33.5N	127.0E	10
	SEOGWIPO	33.2N	126.5E	11
TAIWAN	CHILUNG	25.2N	121.8E	12
	HUALIEN	24.0N	121.6E	13
	TAITUNG	22.7N	121.2E	14
	KAOHSIUNG	22.5N	120.3E	15
	HOMEL	24.2N	120.4E	16
EAST COASTS OF PHILIPPINES	BASCO	20.4N	122.0E	17
	PALANAN	17.2N	122.6E	18
	LEGASPI	13.2N	123.8E	19
	LAOANG	12.6N	125.0E	20
	MADRID	09.2N	126.0E	21
	DAVAO	06.9N	125.7E	22
NORTH COASTS OF IRIAN JAYA	GEME	04.6N	126.8E	23
	BEREBERE	02.5N	128.7E	24
	PATANI	00.4N	128.8E	25
	SORONG	00.8S	131.1E	26
	MANOKWARI	00.8S	134.2E	27
	WARSA	00.6S	135.8E	28
	JAYAPURA	02.4S	140.8E	29
NORTH COASTS OF PAPUA NEW GUINEA	VANIMO	02.6S	141.3E	30
	WEWAK	03.5S	143.7E	31
	MADANG	05.2S	145.8E	32
	MANUS_IS.	02.0S	147.5E	33
	KAVIENG	02.5S	150.7E	34
	RABAUL	04.2S	152.3E	35
	ULAMONA	05.0S	151.3E	36
	KIMBE	05.6S	150.2E	37
	KIETA	06.1S	155.6E	38
MARIANA ISLANDS	SAIPAN	15.3N	145.8E	39
	GUAM	13.4N	144.7E	40
PALAU	MALAKAL	07.3N	134.5E	41

Table 1 --- continued

Coastal Block	Forecast Point	Latitude	Longitude	Number in Fig. 1
MICRONESIA	YAP_IS.	09.5N	138.1E	42
	CHUUK_IS.	07.4N	151.8E	43
	POHNPEI_IS.	07.0N	158.2E	44
	KOSRAE_IS.	05.5N	163.0E	45
MARSHALL ISLANDS	ENIWETOK	11.4N	162.3E	46
NORTH COASTS OF SOLOMON ISLANDS	PANGGOE	06.9S	157.2E	47
	GHATERE	07.8S	159.2E	48
	AUKI	08.8S	160.6E	49
	KIRAKIRA	10.4S	161.9E	50
SOLOMON SEA	AMUN	06.0S	154.7E	51
	FALAMAE	07.4S	155.6E	52
	MUNDA	08.4S	157.2E	53
	HONIARA	09.3S	160.0E	54
COASTS OF EAST CHINA SEA	SHANGHAI	31.2N	122.3E	55
	ZHOUSHAN	29.9N	122.5E	56
	WENZHOU	27.8N	121.2E	57
COASTS OF SOUTH CHINA SEA	QUANZHOU	24.8N	118.8E	58
	HONG_KONG	22.3N	114.2E	59
	HAINAN_ISLAND	18.8N	110.5E	60
	SANYA	18.2N	109.5E	61
COASTS OF GULF OF TONKIN	VINH	18.6N	105.7E	62
EAST COASTS OF INDO CHINA PENINSULA	QUI_NHON	13.7N	109.2E	63
	BAC_LIEU	09.3N	105.8E	64
GULF OF THAILAND	SIHANOUKVILLE	10.6N	103.6E	65
	PATTAYA	12.8N	100.9E	66
	PRACHUAP_KHIRI KHAN	11.8N	099.8E	67
	NAKHON_SI_THAMMARAT	08.4N	100.0E	68
NORTHWEST COASTS OF KALIMANTAN	KOTA_KINABALU	6.0N	116.0E	69
	MUARA	05.0N	115.1E	70
	BINTULU	03.2N	113.0E	71
WEST COASTS OF PHILIPPINES	LAOAG	18.2N	120.6E	72
	SAN_FERNANDO	16.6N	120.3E	73
	MANILA	14.6N	121.0E	74
SULU SEA	ILOILO	10.7N	122.5E	75
	PUERTO_PRINCESA	09.8N	118.8E	76
	SANDAKAN	05.9N	118.1E	77
	LAHAD_DATU	04.9N	118.4E	78
EAST COASTS OF MALAY PENINSULA	KUALA_TERENGGANU	05.3N	103.2E	79
	SINGAPORE	01.3N	103.9E	80

Table 1 --- continued

Coastal Block	Forecast Point	Latitude	Longitude	Number in Fig. 1
CELEBES SEA	COTABUTO_CITY	07.3N	124.2E	81
	ZAMBOANGA	06.9N	122.1E	82
	MAIMBUNG	05.9N	121.0E	83
	TARAKAN	03.3N	117.6E	84
	TABUKAN_TENGAH	03.6N	125.6E	85
	MANADO	01.6N	124.9E	86
	TOLITOLI	01.1N	120.8E	87
NATUNA SEA	KEPULAUAN_RIAU	04.0N	108.5E	88
	SINGKAWANG	01.0N	109.0E	89
	KUALA_INDRAGIRI	00.5S	103.8E	90
	PANGKALPINANG	02.1S	106.1E	91

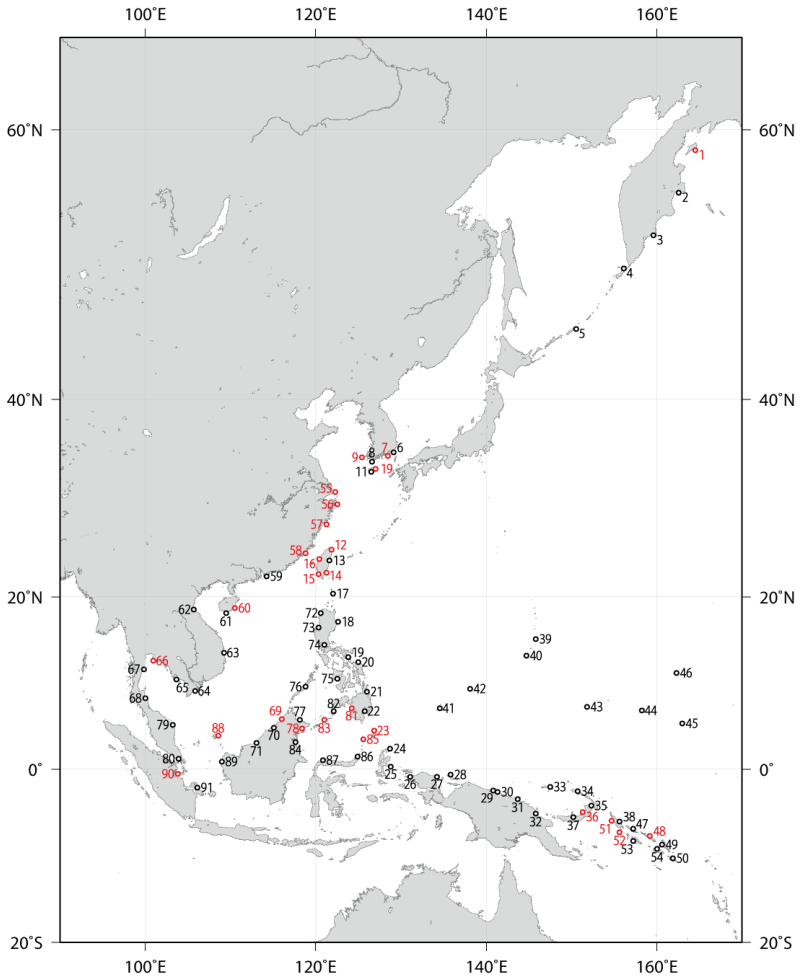


Figure 1. Forecast points of NWPTAC Enhanced Products for PacWave16. Changed points from current ones are indicated as red symbols.

ANNEX II. EXERCISE PACIFIC WAVE 2016 - SCENARIOS

Location	Latitude	Longitude	Depth	Magnitude	Past Exercise
Kuril-Kamchatka Trench (Kamchatka)	52.5 North	159.5 East	20km	9.0	PacWave11
Japan Trench (Off Northern Japan)	38.1 North	142.9 East	20km	9.0	PacWave13, 15
Nansei-Shoto Trench (Ryukyu Islands)	28.0 North	129.0 East	20km	9.0	PacWave11, 15
Manila Trench (Philippines - South China Sea)	17.0 North	119.0 East	20km	9.0	PacWave13, 15
Philippine Trench (Philippines - Pacific Ocean)	9.5 North	126.6 East	20km	9.0	PacWave11
New Britain-San Cristobal Trench (Solomon Islands)	7.3 South	156.0 East	20km	9.0	-

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

Date(UTC)	2/1				2/2				2/3				2/4				2/5				2/5			
Scenario →	Kuril-Kamchatka Trench				Japan Trench				Nansei-Shoto Trench				Manila Trench				Philippine Trench				New Britain-San Cristobal trench			
Center →	PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC	
Time (UTC)	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP
0100	Quake				Quake				Quake				Quake				Quake				Quake			
0107	1	TI			1	TI			1	TI			1	TI			1	TI			1	TI		
0120			**1**	**TI**			**1**	**TI**			**1**	**TI**			**1**	**TI**			**1**	**TI**			**1**	**TI**
0135	2	TFR			2	TFR			2	TFR			2	TFR			2	TFR			2	TFR		
0140			**2**	**TFR**			**2**	**TFR**			**2**	**TFR**			**2**	**TFR**			**2**	**TFR**			**2**	**TFR**
0200	3	TFP			3	TFP			3	TFP			3	TFP			3	TFP			3	TFP		
0230	4	TFH			4	TFH			4	TFH			4	TFH			4	TFH			4	TFH		
0310			**3**	**TS**			**3**	**TS**			**3**	**TS**			**3**	**TS**			**3**	**TS**			**3**	**TS**
0400	5	TS			5	TS			5	TS			5	TS			5	TS			5	TS		
0440			**4**	**TS**			**4**	**TS**			**4**	**TS**			**4**	**TS**			**4**	**TS**			**4**	**TS**
0530	6	TS			6	TS			6	TS			6	TS			6	TS			6	TS		
0610			**5**	**TS**			**5**	**TS**			**5**	**TS**			**5**	**TS**			**5**	**TS**			**5**	**TS**
0700	7	TS			7	TS			7	TS			7	TS			7	TS			7	TS		
0740			**6**	**TS**			**6**	**TS**			**6**	**TS**			**6**	**TS**			**6**	**TS**			**6**	**TS**
0830	8	TS			8	TS			8	TS			8	TS			8	TS			8	TS		
0910			**7**	**TS**			**7**	**TS**			**7**	**TS**			**7**	**TS**			**7**	**TS**			**7**	**TS**
1000	9	TS			9	TS			9	TS			9	TS			9	TS			9	TS		
1040			**8**	**TS**			**8**	**TS**			**8**	**TS**			**8**	**TS**			**8**	**TS**			**8**	**TS**
1130	10	TS			10	TS			10	TS			10	TS			10	TS			10	TS		
1210			**9**	**TS**			**9**	**TS**			**9**	**TS**			**9**	**TS**			**9**	**TS**			**9**	**TS**
1300	11	TS			11	TS			11	TS			11	TS			11	TS			11	TS		
1340			**10**	**TS**			**10**	**TS**			**10**	**TS**			**10**	**TS**			**10**	**TS**			**10**	**TS**
1430	12	TS			12	TS			12	TS			12	TS			12	TS			12	TS		
1510			**11**	**TS**			**11**	**TS**			**11**	**TS**			**11**	**TS**			**11**	**TS**			**11**	**TS**
1600	13	TS			13	TS			13	TS			13	TS			13	TS			13	TS		
1640			**12**	**TS**			**12**	**TS**			**12**	**TS**			**12**	**TS**			**12**	**TS**			**12**	**TS**
1730	14	TS			14	TS			14	TS			14	TS			14	TS			14	TS		
1810							**13**	**TS**							**13**	**TS**								
1900	15	TS			15	TS			15	TS			15	TS			15	TS			15	TS		
1940							**14**	**TS**							**14**	**TS**								
2030	16	TS			16	TS			16	TS			16	TS			16	TS			16	TS		
2110							**15**	**TS**							**15**	**TS**								
2200	17	TS			17	TS			17	TS			17	TS			17	TS			17	TS		
2240							**16**	**TS**							**16**	**TS**								
2330	18	TS			18	TS			18	TS			18	TS			18	TS			18	TS		
(next day) 0040							**16**	**TS**							**16**	**TS**								
0130	19	TL			19	TL			19	TL			19	TL			19	TL			19	TL		

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

ANNEX IV. POST-EXERCISE EVALUATION

Exercise evaluation forms are to be completed by each participating agency and forwarded to the country PacWave16 National Contact, or the country Tsunami National Contact. **The PacWave16 National Contact will compile the country Evaluation Form and complete and submit this online no later than 26 February 2016.**

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

The PacWave16 Evaluation Form can be found at
https://www.surveymonkey.com/s/pacwave16_eval.

Alternatively, the country evaluation forms can be submitted by email or fax to the Exercise PacWave 16 Task Team Chairs:

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

Exercise Pacific Wave 16 Instructions on how to complete this Evaluation Form		
Step	**Who completes this step?**	**Description**
1	Each participating Agency/Country	Decide if your agency/country will include additional evaluation questions for each objective. Country/agency evaluation questions can be added at the **end** of each section. However, do NOT change the reference numbers to the questions.
2	Each participating Agency/Country	Print this form and mark your evaluation answers on it.
3	Each participating Agency/Country	• Answer each statement with either Y (Yes), N (No). • Comments should be used to explain/expand upon your Yes or No answer.. • Write your comments on the page following the evaluation questions. Note the question number in the left column and write your comments alongside.
4	Each participating Agency/Country	Send completed agency evaluation form to country PacWave16 National Contact so he/she can compile to complete Country PacWave16 Evaluation Form (this URL).
5	PacWave16 National Contact	PacWave16 National Contact should complete and submit the PacWave16 Evaluation Form by **26 February 2016** (https://www.surveymonkey.com/s/pacwave16_eval.). If there are problems or questions, please contact the PacWave16 Task Team co-Chairs (Laura Kong, laura.kong@noaa.gov; Jo Guard, jo.guard@dpmc.govt.nz; Tomoaki Ozaki, hokusei@eqvol2.kishou.go.jp)

EXERCISE PACIFIC WAVE 2016 EVALUATION FORM

CONTACT DETAILS

- Country: _____
- Agency: _____
- Contact Name: _____
- Contact Position: _____
- Contact Phone: _____
- Contact Mobile: _____
- Contact E-mail: _____

COUNTRY EXERCISE SCENARIO

Select Scenario Used:

___ Kuril-Kamchatka Trench (Kamchatka)

___ Japan Trench (Off Northern Japan)

___ Nansei-Shoto Trench (Ryukyu Islands)

___ Manila Trench (Philippines - South China Sea)

___ Philippine Trench (Philippines - Pacific Ocean)

___ New Britain-San Cristobal trench (Solomon Islands)

OBJECTIVE 1

Evaluate the format and content of experimental NWPTAC Enhanced Products for each scenario exercised.

1.1 Are the following products useful in helping you assess your national tsunami threat? Indicate Yes or No, and provide comments as needed. Please explain why it is/is not useful.

___ Y ___ N Text Message

___ Y ___ N Deep Ocean Tsunami Amplitude Forecast Map

___ Y ___ N Tsunami Travel Time Map

___ Y ___ N Coastal Tsunami Amplitude Forecast Map

Comments:

1.2 Please rank the usefulness of each product, where .1=most useful and 4=least useful.

___ Text Message

___ Deep Ocean Tsunami Amplitude Forecast Map

___ Tsunami Travel Time Map

___ Coastal Tsunami Amplitude Forecast Map

Comments:

1.3 Format and Content: Is your country satisfied with the format and content of experimental NWPTAC Enhanced Products?
Indicate Yes or No, and provide comments as needed. If your answer is No, please provide comments on what improvements are needed.

___ Y ___ N Text Message

___ Y ___ N Deep Ocean Tsunami Amplitude Forecast Map

___ Y ___ N Tsunami Travel Time Map

___ Y ___ N Coastal Tsunami Amplitude Forecast Map

Comments:

1.4 Do any features, other than listed above, need to be changed or added?
If Yes, please comment.

___ Y ___ N

Comments:

1.5 Are any parts of the NWPTAC text message or graphical products, other than the actual values of the wave forecasts, confusing or in conflict with the PTWC Enhanced Products?
If Yes, please comment

___ Y ___ N
Comments:

OBJECTIVE 2

Determine whether counties are prepared to officially receive and utilize the NWPTAC Enhanced Products.

2.1 Does your National Tsunami Warning Centre (NTWC) understand the contents of the NWPTAC Enhanced Products, how to use the Products, and the limitations of the Products? Indicate Yes or No.

___ Y ___ N

Comments:

2.2 Does your National Disaster Management Office (NDMO) understand the contents of the NWPTAC Enhanced Products, how to use the Products, and the limitations of the Products? Indicate Yes or No.

___ Y ___ N

Comments:

2.3 Will your country's NTWC (and NDMO) be prepared to utilize the NWPTAC Enhanced Products in 2018? Your NTWC should be prepared to issue appropriate national alerts (e.g., Warning/Watch/Cancellations) based on the current PTWC Enhanced Products and/or NWPTAC Enhanced Products. Indicate Yes or No, and provide comments as needed on country status.

___ Y ___ N Currently ready.

___ Y ___ N Will be ready in 2018.

___ Y ___ N Need to develop new or revise existing SOPs.

___ Y ___ N Need to inform and prepare other key stakeholders

___ Y ___ N Need NTWC or NDMO to conduct training for their national and local stakeholders

___ Y ___ N Need international experts to conduct more training for national stakeholders

Comments:

GENERAL EXERCISE OBSERVATIONS

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. If Y, please provide details.

Comments:

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 PacWave16 exercise website pages were useful.

___ Y ___ N This evaluation form was easy to use.

___ Y ___ N PacWave16 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:

EXERCISE PACIFIC WAVE 16 EXPERIENCE

Please provide general statements on your Exercise Pacific Wave 16 experience.

- EXERCISE PLANNING

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

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

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

- EXERCISE CONDUCT

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

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

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

- EXERCISE DEBRIEF OR EVALUATION

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

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

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

ANNEX V. 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 2016

(Insert country name) will join over 15 other countries around the northwest Pacific region as a participant in a mock tsunami scenario during 1-5 February 2016. The purpose of this Pacific-wide exercise is to exercise country tsunami decision-making procedures using the experimental enhanced forecast products of the Northwest Pacific Tsunami Advisory Center (NWPTAC) in Japan. 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, 2013 Solomon Islands, 2014 Chile, and the September 2015 Chile tsunamis have increased our need to be more prepared for such events," said (insert name of appropriate official). "This important exercise will validate NWPTAC's enhanced products for future official use by countries of the Pacific Tsunami Warning and Mitigation System.

The exercise, titled Exercise Pacific Wave 2016 (PacWave16), will simulate Pacific countries being put into a Tsunami Warning situation requiring government decision-making. It is the sixth such exercise with the first having been carried out in May 2006, the second in October 2008, the third in November 2011, the fourth in May 2013 and the fifth in February 2015. Participating countries will select from six different northwest 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 Japan's NWPTAC 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 16 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

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

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

US National Tsunami Warning Center: http://wcatwc.arh.noaa.gov/

[Insert country URLs]

ANNEX VI. 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 Center (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
34	Bruun Memorial Lectures, 1987: Recent Advances in Selected Areas of Ocean Sciences in the Regions of the Caribbean, Indian Ocean and the Western Pacific. 1988	Composite E, F, S
35	Global Sea-Level Observing System (GLOSS) Implementation Plan. 1990	E only

(continued)

36	Bruun Memorial Lectures 1989: Impact of New Technology on Marine Scientific Research. 1991	Composite E, F, S
37	Tsunami Glossary - A Glossary of Terms and Acronyms Used in the Tsunami Literature. 1991	E only
38	The Oceans and Climate: A Guide to Present Needs. 1991	E only
39	Bruun Memorial Lectures, 1991: Modelling and Prediction in Marine Science. 1992	E only
40	Oceanic Interdecadal Climate Variability. 1992	E only
41	Marine Debris: Solid Waste Management Action for the Wider Caribbean. 1994	E only
42	Calculation of New Depth Equations for Expendable Bathymerographs Using a Temperature-Error-Free Method (Application to Sippican/TSK T-7, T-6 and T-4 XBTS. 1994	E only
43	IGOSS Plan and Implementation Programme 1996-2003. 1996	E, F, S, R
44	Design and Implementation of some Harmful Algal Monitoring Systems. 1996	E only
45	Use of Standards and Reference Materials in the Measurement of Chlorinated Hydrocarbon Residues. 1996	E only
46	Equatorial Segment of the Mid-Atlantic Ridge. 1996	E only
47	Peace in the Oceans: Ocean Governance and the Agenda for Peace; the Proceedings of *Pacem in Maribus* XXIII, Costa Rica, 1995. 1997	E only
48	Neotectonics and fluid flow through seafloor sediments in the Eastern Mediterranean and Black Seas - Parts I and II. 1997	E only
49	Global Temperature Salinity Profile Programme: Overview and Future. 1998	E only
50	Global Sea-Level Observing System (GLOSS) Implementation Plan-1997. 1997	E only
51	L'état actuel de 1'exploitation des pêcheries maritimes au Cameroun et leur gestion intégrée dans la sous-région du Golfe de Guinée *(cancelled)*	F only
52	Cold water carbonate mounds and sediment transport on the Northeast Atlantic Margin. 1998	E only
53	The Baltic Floating University: Training Through Research in the Baltic, Barents and White Seas - 1997. 1998	E only
54	Geological Processes on the Northeast Atlantic Margin (8th training-through-research cruise, June-August 1998). 1999	E only
55	Bruun Memorial Lectures, 1999: Ocean Predictability. 2000	E only
56	Multidisciplinary Study of Geological Processes on the North East Atlantic and Western Mediterranean Margins (9th training-through-research cruise, June-July 1999). 2000	E only
57	Ad hoc Benthic Indicator Group - Results of Initial Planning Meeting, Paris, France, 6-9 December 1999. 2000	E only
58	Bruun Memorial Lectures, 2001: Operational Oceanography – a perspective from the private sector. 2001	E only
59	Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters. 2001	E only
60	Interdisciplinary Approaches to Geoscience on the North East Atlantic Margin and Mid-Atlantic Ridge (10th training-through-research cruise, July-August 2000). 2001	E only
61	Forecasting Ocean Science? Pros and Cons, Potsdam Lecture, 1999. 2002	E only
62	Geological Processes in the Mediterranean and Black Seas and North East Atlantic (11th training-through-research cruise, July- September 2001). 2002	E only
63	Improved Global Bathymetry – Final Report of SCOR Working Group 107. 2002	E only
64	R. Revelle Memorial Lecture, 2006: Global Sea Levels, Past, Present and Future. 2007	E only
65	Bruun Memorial Lectures, 2003: Gas Hydrates – a potential source of energy from the oceans. 2003	E only
66	Bruun Memorial Lectures, 2003: Energy from the Sea: the potential and realities of Ocean Thermal Energy Conversion (OTEC). 2003	E only

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

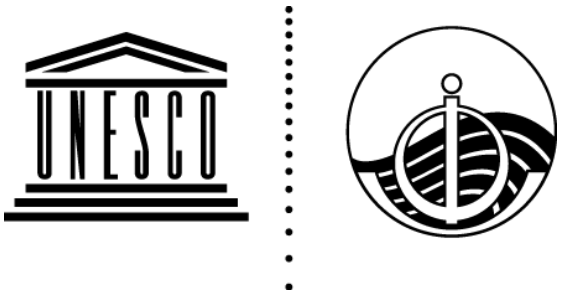
(continued)

87.	Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS) – Second Edition. 2011	E only
88.	Exercise Indian Ocean Wave 2009 (IOWave09) – An Indian Ocean-wide Tsunami Warning and Communication Exercise – 14 October 2009. 2009	E only
89.	Ship-based Repeat Hydrography: A Strategy for a Sustained Global Programme. 2009	E only
90.	12 January 2010 Haiti Earthquake and Tsunami Event Post-Event Assessment of CARIBE EWS Performance. 2010	E only
91.	Compendium of Definitions and Terminology on Hazards, Disasters, Vulnerability and Risks in a coastal context	*Under preparation*
92.	27 February 2010 Chile Earthquake and Tsunami Event – Post-Event Assessment of PTWS Performance (Pacific Tsunami Warning System). 2010	E only
93.	Exercise CARIBE WAVE 11 / LANTEX 11—A Caribbean Tsunami Warning Exercise, 23 March 2011	
	Vol. 1 Participant Handbook / Exercise CARIBE WAVE 11 —Exercice d'alerte au tsunami dans les Caraïbes, 23 mars 2011. Manuel du participant / Ejercicio Caribe Wave 11. Un ejercicio de alerta de tsunami en el Caribe, 23 de marzo de 2011. Manual del participante. 2010	E/F/S
	Vol. 2 Report. 2011	E only
	Vol. 3 Supplement: Media Reports. 2011	E/F/S
94.	Cold seeps, coral mounds and deep-water depositional systems of the Alboran Sea, Gulf of Cadiz and Norwegian continental margin (17th training-through-research cruise, June–July 2008)	*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.	E only
	Vol. 1 Exercise Manual. 2012	
	Vol. 2 Evaluation Report. 2014	
103.	Exercise NEAMWAVE 12. A Tsunami Warning and Communication Exercise for the North-eastern Atlantic, the Mediterranean, and Connected Seas Region, 27–28 November 2012.	E only
	Vol. 1: Exercise Manual. 2012	
	Vol. 2: Evaluation Report. 2013	
104.	Seísmo y tsunami del 27 de agosto de 2012 en la costa del Pacífico frente a El Salvador, y seísmo del 5 de septiembre de 2012 en la costa del Pacífico frente a Costa Rica. Evaluación subsiguiente sobre el funcionamiento del Sistema de Alerta contra los Tsunamis y Atenuación de sus Efectos en el Pacífico. 2012	Español solamente (resumen en inglés y francés)
105.	Users Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System, August 2014. Revised Edition. 2014	E, S

106.	Exercise Pacific Wave 13. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1–14 May 2013. Vol. 1 Exercise Manual. 2013 Vol. 2 Summary Report. 2013	E only
107.	Tsunami Public Awareness and Educations Strategy for the Caribbean and Adjacent Regions. 2013	E only
108.	Pacific Tsunami Warning and Mitigation System (PTWS) Medium-Term Strategy, 2014−2021. 2013	E only
109.	Exercise Caribe Wave/Lantex 14. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 26 March 2014. Vol. 1 Participant Handbook. 2014	E/S
110.	Directory of atmospheric, hydrographic and biological datasets for the Canary Current Large Marine Ecosystem. 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. 1 Manual Vol. 2 Evaluation Report – Supplement: Evaluation by Message Providers and Civil Protection Authorities	E only
115.	Oceanographic and Biological Features in the Canary Current Large Marine Ecosystem. 2015	E only
116.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Third Enlarged Communication Test Exercise (CTE3), 1st October 2013. Vol. 1 Exercise Manual Vol. 2 Evaluation Report	E only
117.	Exercise Pacific Wave 15. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 2–6 February 2015 Vol. 1: Exercise Manual; Vol. 2: Summary Report	E only
118.	Exercise Caribe Wave/Lantex 15. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 25 March 2015 (SW Caribbean Scenario) Vol. 1: Participant Handbook	E only
119.	Transboundary Waters Assessment Programme (TWAP) Assessment of Governance Arrangements for the Ocean Vol 1: Transboundary Large Marine Ecosystems Vol 2: Areas Beyond National Jurisdiction	*In preparation*
120.	Status and Trends in Primary Productivity and Chlorophyll from 1996 to 2014 in Large Marine Ecosystems and the Western Pacific Warm Pool, Based on Data from Satellite Ocean Colour Sensors	*In preparation*
121.	Exercise Indian Ocean Wave 14, an Indian Ocean wide Tsunami Warning and Communications Exercise, 9–10 September 2014	*In preparation*
122.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Sixth Communication Test Exercise (CTE6), 29 July 2015. Vol. 1: Exercise Manual Vol. 2: Evaluation Report	E only
123		In preparation
124		In preparation
125	Caribe Wave 2016 Exercise in the Caribbean and Adjacent Regions, 19–21 January and 1-3 March 2016 Volume 1: Participant Handbook	E only
126	Exercise Pacific Wave 16. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1-5 February 2016. Volume 1: Exercise Manual.	E only

Intergovernmental Oceanographic Commission
Technical Series

126



EXERCISE PACIFIC WAVE 2016

A Pacific-wide Tsunami Warning and Enhanced Products Exercise

1-5 February 2016

Summary Report

Volume 2

UNESCO 2016

IOC Technical Series, 126 (Volume 2)
Honolulu and Paris 2016
English only

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

Exercise Pacific Wave 2016. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1-5 February 2016. Volume 2: *Summary report.* IOC Technical Series No 126. UNESCO/IOC 2016 (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 Exercises,
International Tsunami Information Center, and
New Zealand Ministry of Civil Defence and Emergency Management

Published in 2016
by United Nations Educational, Scientific
and Cultural Organization
7, Place de Fontenoy, 75352 Paris 07 SP

(IOC/2015/TS/126 Vol.2)

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

1. INTRODUCTION 3

1.1 INTERNATIONAL TSUNAMI EXERCISES 3

1.2 NORTHWEST PACIFIC TSUNAMI WARNING CENTER NEW ENHANCED PRODUCTS 4

2. EXERCISE PACIFIC WAVE 2016 5

2.1 OVERVIEW 5

2.2 COUNTRY PARTICIPATION 5

3. CONCEPT OF THE EXERCISE 6

3.1 PURPOSE 6

3.2 OBJECTIVES 6

3.3 EXERCISE CONCEPT 6

3.4 EXERCISE DELIVERY/FORMAT 7

3.5 EXERCISE SCENARIO AND DATE 7

3.6 SCENARIOS 7

3.7 EXERCISE TYPE 8

3.8 EXERCISE DOCUMENTATION 8

4. EVALUATION 8

4.1 EVALUATORS 8

4.2 OBSERVERS 8

4.3 EVALUATION TOOLS 9

5. POST-EXERCISE EVALUATION FINDINGS 9

6. RECOMMENDATIONS 10

ANNEXES

I. FORECAST POINTS USED FOR EXERCISE PACIFIC WAVE 2016 1

II. EXERCISE PACIFIC WAVE 2016 - SCENARIOS 5

III. INTERNATIONAL MASTER SCHEDULE OF EVENTS LIST (MSEL) 7

IV. POST-EXERCISE EVALUATION 9

V. POST-EXERCISE EVALUATION COMPILATION 15

VI. EXERCISE EVALUATION RESPONSES 17

VII. SAMPLE PRESS RELEASE 33

VIII. REPORT PREPARATION / FINAL REPORT 35

IX. LIST OF ACRONYMS 37

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 2016 (PacWave16) is the sixth Pacific-wide drill in a regular schedule of Pacific exercises. PacWave16 evaluated the first version of the new enhanced tsunami products of the North West Pacific Tsunami Warning Center (NWPTAC) scheduled to go live in 2018.

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

A total of 12 countries including one sub-national entity participated in the exercise. The majority of responding countries expressed a positive view of the new products and will be ready to transition to these in 2018. Exercise objectives were exercised, evaluated and reported, thus enabling NWPTAC recommendations and lessons learned to be formulated. PacWave16 provided valuable feedback from countries on the newly introduced NWPTAC enhanced products. PacWave16 reinforced the integration of NWPTAC 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 NWPTWC 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.

The findings from PacWave16 are as follows:

- All respondents ranked the text message as the most useful product, followed by the coastal amplitude forecast map. Moderately useful products were the travel time map and the deep ocean energy forecast map.

- All respondents agreed that the format and content of PTWC enhanced products were clear and easy to understand.

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

- Overall, respondents indicated that the format and content of the new enhanced products was satisfactory. Some changes were suggested by two respondents and these will be assessed by NWPTAC.

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

- The majority of respondents will be ready for the transition to the new enhanced products in 2018. However, nearly half of respondents will need to develop new SOPs, inform and prepare key stakeholders and conduct training in order to be ready.

- All respondents felt that exercise planning and conduct went well, the website was useful, the evaluation form was easy to use and the manual provided an appropriate level of detail. There was, however, one comment that some manuals were too large and there was some difficulty downloading them.

Based on a review of the PacWave16 responses, the following recommendations are made:

(i) **Format and content of experimental NWPTAC Enhanced Products**

Issue: Almost all respondents indicated that the format and content of the new enhanced products was satisfactory.

Recommendation: NWPTAC is recommended to proceed with the preparation of NWPTAC Enhanced Products as planned, taking into account several suggestions indicated through the post-exercise evaluation.

(ii) **Preparation for officially receiving and utilizing the NWPTAC Enhanced Products**

Issue: About a half of the responding countries need to develop new or revise existing SOPs and to inform and prepare other key stakeholders.

Recommendation: Member states are recommended to proceed with the preparation of receiving and utilising NWPTAC Enhanced Products targeting for the planned start of issuance in 2017 and full changeover in 2018.

(iii) **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 180 days prior to the exercise, and distribute the exercise manual at least 90 days prior as indicated in the Terms of Reference of the Task Team on PacWave Exercises. Tsunami Service Providers should make available tsunami products at least one month prior to the exercise.

(iv) **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.

1. INTRODUCTION

1.1 INTERNATIONAL TSUNAMI EXERCISES

Historically, from 1610 B.C. to A.D. 2016, seventy-one percent of the worlds' confirmed tsunamis have occurred in the Pacific Ocean and its marginal seas. Of the 249 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 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 eight years (2009–2016), the Pacific witnessed six destructive and deadly tsunamis that each placed PTWS (Pacific Tsunami Warning and Mitigation System) countries in various levels of warning for regional or distant tsunamis. Locally, a number of countries were impacted nearly immediately 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 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 International Tsunami Information Center (ITIC), Pacific Tsunami Warning Center (PTWC), and Japan Meteorological Agency (JMA). Altogether there have been six IOC-coordinated international exercises, Exercise Pacific Wave 2006, 2008, 2011, 2013, 2015 and 2016. The exercises, using a multitude of Pacific scenarios and accompanied by tsunami message products from the Pacific Tsunami Warning

Center, 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 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.

Exercise Pacific Wave 2016 was used to introduce and obtain feedback on the NWPTWC new enhanced forecast products.

1.2 NORTHWEST PACIFIC TSUNAMI WARNING CENTER NEW ENHANCED PRODUCTS

The Area of Coverage map and recipient countries of NWPTA is shown in Figure 1. Regarding forecast points, updated ones which reflect the results of coordination among recipient countries up to October 2015 will be used. (Annex I).

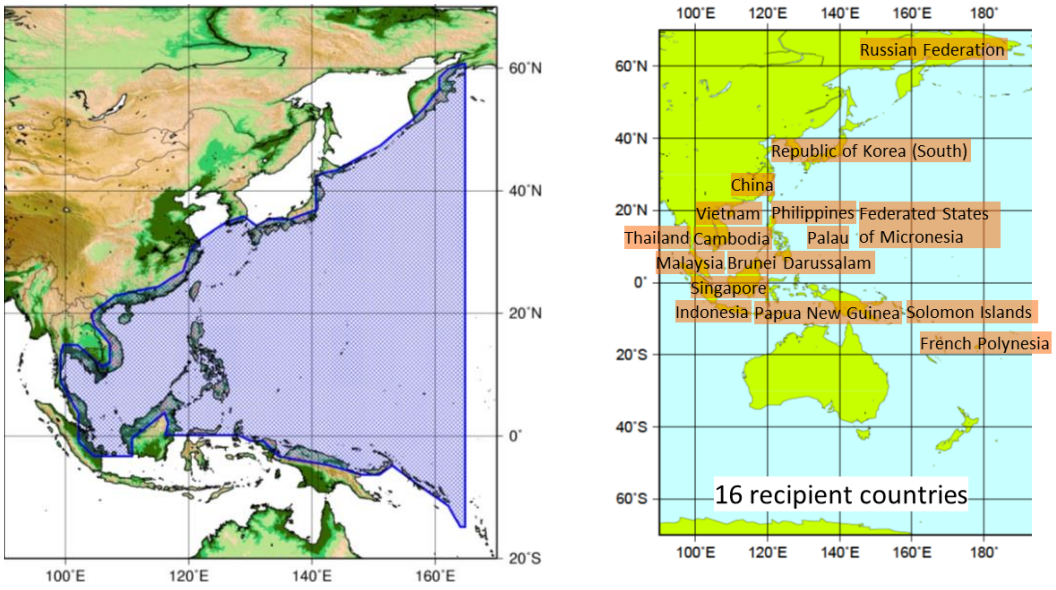


Figure 1. NWPTA will be issued to 16 recipient countries when the NWPTAC detects occurrence of an earthquake of magnitude 6.5 or greater in the blue-shaded area.

The NWPTAC new enhanced products consist of an initial text message prepared from a pre-established tsunami simulation database and followed by text messages and accompanied by graphical products based on real-time simulation techniques. The graphical products are disseminated exclusively for national authorities of the recipient countries. There is no change to the format of the text messages from the current format. Full changeover to the new enhanced products is planned for 2018, after approximately one year's parallel issuance of existing and enhanced products.

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

a. Text products

- Forecast method
  - Tsunami forecast database (the first message, without graphics)
  - Real-time simulation (the second and subsequent messages, with graphical products)

- Contents (basically no change from the current format)
  - Hypocentral parameters (origin time, location, magnitude)
  - Tsunamigenic potential
  - Coastal blocks
  - Forecast amplitude and arrival time
  - Observed amplitude and arrival time
- Dissemination of products
  - GTS, FAX and E-mail

b. Graphical Products (Maps)

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

At the 26th session the ICG/PTWS held in Honolulu, United States of America, from 22 to 24 April 2015 (ICG/PTWS-XXVI), it was agreed that the Northwest Pacific Tsunami Advisory Center (NWPTAC) should proceed with its development of enhanced products for the North West Pacific, targeting 2018 for its complete transition. At the session, it was also approved to conduct Exercise Pacific Wave 2016 (PacWave16) during the first quarter of 2016 as a regional exercise involving the sixteen countries that receive products of NWPTAC. The exercise intends to support the development of improved tsunami procedures and the NWPTAC Enhanced Products.

2. EXERCISE PACIFIC WAVE 2016

2.1 OVERVIEW

2.2 COUNTRY PARTICIPATION

A total of 12 countries including one sub-national entity participated in Exercise Pacific Wave 2016 (PacWave16). A summary compiling the exercise evaluation responses is provided at Annex V. Pacific countries that participated are noted in the list below. Countries noted with a star (*) did not submit an evaluation form:

- Brunei*
- China (including Hong Kong)
- France – French Polynesia
- Indonesia
- Malaysia
- Papua New Guinea
- Russian Federation

- Samoa
- Singapore
- Solomon Islands
- Republic of Korea
- Vietnam

This Exercise Pacific Wave 2016 Summary Report is based on the post-exercise evaluation data as compiled by the PacWave16 Task Team.

3. CONCEPT OF THE EXERCISE

3.1 PURPOSE

The aim of PacWave16 was to evaluate experimental NWPTAC Enhanced Products and identify necessary modifications.

The exercise also provided an opportunity for Pacific countries to use 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 NWPTAC recipient country was encouraged to participate.

3.2 OBJECTIVES

The overall objectives for Exercise Pacific Wave 2016 were to:

- Objective 1. Evaluate the format and content of experimental NWPTAC Enhanced Products.
- Objective 2. Determine whether countries are prepared to officially receive and utilize the NWPTAC Enhanced Products.

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

3.3 EXERCISE CONCEPT

PacWave16 was not played in real time, and therefore had no “dummy” kickoff exercise message. Participating countries were requested to select a relevant scenario and its most convenient date and time to conduct the Tabletop Exercise within the 1-5 February 2016 time period. Participating countries were welcome to amend the exercise messages to suit their own timetable.

All NWPTAC products were provided online at the PacWave16 website (http://www.pacwave.info) in advance to help countries plan and prepare. It was recommended to download from the PacWave16 website (http://www.pacwave.info), the NWPTAC products and messages for the appropriate scenario in advance of the exercise.

The earthquake origin time default date and time of the messages (e.g. 1 February 2016 @ 0100 hours) was able to be adjusted by participating countries to coincide with their selected Tabletop Exercise local date and time. Subsequent message issuance date and time, and earthquake and tsunami arrival times were also able to be adjusted accordingly.

All documentation and correspondence relating to this exercise was to be clearly identified as **PacWave16** 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 NWPTWC New Enhanced Products were reviewed in PacWave16. Distribution of the series of international messages for each scenario, available on the exercise website, was the responsibility of each country.

Each Exercise Pacific Wave 2016 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 2016 was held within the period of 1-5 February 2016. Participant countries could choose to run their exercise any time between 1-5 February 2016, allowing flexibility to avoid conflict with other important national events.

PacWave16 was recommended to be a table top exercise with each participating country using the NWPTAC messages downloaded from the PacWave website between 1 and 5 February 2016.

3.6 SCENARIOS

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

- Kuril-Kamchatka Trench
- Japan Trench
- Nansei-Shoto Trench
- Manila Trench
- Philippine Trench
- New Britain-San Cristobal trench

The exercise required Member State evaluation of experimental NWPTAC enhanced products, issuing of appropriate country specific alerts by National Tsunami Warning Centres, decision-making, including steps taken just prior to public notification. Member States could 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 Pacific Wave 2016 (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 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 Service Providers such as the NWPTAC in Japan, which describe the nature of the threat.

3.8 EXERCISE DOCUMENTATION

It was recommended that participating countries refer to the following documentation in planning their exercise:

- IOC Circular Letter No 2588: Pacific Tsunami Warning and Mitigation System (PTWS) Tsunami Exercise "PacWave16", 1–5 February 2016, dated 11 August 2015
- Exercise Pacific Wave 2016, A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1-5 February 2016. Exercise Manual, Volume 1, IOC Technical Series No 126. UNESCO/IOC 2015 (English)
- Draft Users Guide for the Northwest Pacific Tsunami Advisory Center Enhanced Products for the Pacific Tsunami Warning System. (English)
- 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 PacWave16 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 2016 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 Pacific Wave 2016 Summary Report.

All participating countries were asked to complete the official Exercise Pacific Wave 2016 Evaluation Form (Annex II) by 26 February 2016. Forms were submitted online by visiting https://www.surveymonkey.com/s/pacwave16_eval.

5. POST-EXERCISE EVALUATION FINDINGS

A total of 12 countries, including one sub-national entity, participated in the exercise and eleven submitted evaluation forms. A summary of the findings from the completed evaluation forms is provided in Annex III. JMA NWPTAC message dissemination summaries can be found in the International Master List of Events table found in Annex III.

All responding countries expressed a positive view of the planning and conduct of PacWave16. PacWave16 provided valuable feedback from countries on the new enhanced NWPTAC products.

Countries found the new enhanced products clear and understandable 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.

The findings from PacWave16 are as follows:

- All respondents ranked the text message as the most useful product, followed by the coastal amplitude forecast map. Moderately useful products were the travel time map and the deep ocean energy forecast map.
- All respondents agreed that the format and content of PTWC enhanced products were clear and easy to understand.
- The majority of respondents indicated the National Tsunami Warning Centers (NTWCs) and National Disaster Management Offices (NDMOs) understand the content of the enhanced products.
- Overall, respondents indicated that the format and content of the new enhanced products was satisfactory. Some changes were suggested by two respondents and these will be assessed by NWPTAC.
- Overall, respondents indicated that stakeholder agencies now have a better understanding of their goals, responsibilities and roles in tsunami emergencies. A number of respondents indicated gaps have been identified.

- The majority of respondents will be ready for the transition to the new enhanced products in 2018. However, nearly half of respondents will need to develop new SOPs, inform and prepare key stakeholders and conduct training in order to be ready.

- All respondents felt that exercise planning and conduct went well, the website was useful, the evaluation form was easy to use and the manual provided an appropriate level of detail. There was, however, one comment that some manuals were too large and there was some difficulty downloading it.

6. RECOMMENDATIONS

Based on a review of the PacWave16 responses, the following recommendations are made:

(i) Format and content of experimental NWPTAC Enhanced Products

Issue: Almost all respondents indicated that the format and content of the new enhanced products was satisfactory.

Recommendation: NWPTAC is recommended to proceed with the preparation of NWPTAC Enhanced Products as planned, taking into account several suggestions indicated through the post-exercise evaluation.

(ii) Preparation for officially receiving and utilizing the NWPTAC Enhanced Products

Issue: About a half of the responding countries need to develop new or revise existing SOPs and to inform and prepare other key stakeholders.

Recommendation: Member states are recommended to proceed with the preparation of receiving and utilizing NWPTAC Enhanced Products targeting for the planned start of issuance in 2017 and full changeover in 2018.

(iii) 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 180 days prior to the exercise, and distribute the exercise manual at least 90 days prior as indicated in the Terms of Reference of the Task Team on PacWave Exercises. Tsunami Service Providers should make available tsunami products at least one month prior to the exercise.

(iv) 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 nighttime or weekend hours.

ANNEX I. FORECAST POINTS USED FOR EXERCISE PACIFIC WAVE 2016

Table 1. Forecast points and coastal blocks of NWPTAC Enhanced Products for PacWave16.

Coastal Block	Forecast Point	Latitude	Longitude	Number in Fig. 1
EAST COASTS OF KAMCHATKA PENINSULA	OSTROV_KARAGINSKIY	58.8N	164.5E	1
	UST_KAMCHATSK	56.1N	162.6E	2
	PETROPAVLOVSK_K	53.2N	159.6E	3
KURIL ISLANDS	SEVERO_KURILSK	50.8N	156.1E	4
	URUP_IS.	46.1N	150.5E	5
SOUTH COASTS OF KOREAN PENINSULA	BUSAN	35.1N	129.1E	6
	TONGYEONG	34.7N	128.4E	7
	NOHWA	34.2N	126.6E	8
	HEUKSANDO	34.6N	125.4E	9
	CHEJU_ISLAND	33.5N	127.0E	10
	SEOGWIPO	33.2N	126.5E	11
TAIWAN	CHILUNG	25.2N	121.8E	12
	HUALIEN	24.0N	121.6E	13
	TAITUNG	22.7N	121.2E	14
	KAOHSIUNG	22.5N	120.3E	15
	HOMEL	24.2N	120.4E	16
EAST COASTS OF PHILIPPINES	BASCO	20.4N	122.0E	17
	PALANAN	17.2N	122.6E	18
	LEGASPI	13.2N	123.8E	19
	LAOANG	12.6N	125.0E	20
	MADRID	09.2N	126.0E	21
	DAVAO	06.9N	125.7E	22
NORTH COASTS OF IRIAN JAYA	GEME	04.6N	126.8E	23
	BEREBERE	02.5N	128.7E	24
	PATANI	00.4N	128.8E	25
	SORONG	00.8S	131.1E	26
	MANOKWARI	00.8S	134.2E	27
	WARSA	00.6S	135.8E	28
	JAYAPURA	02.4S	140.8E	29
NORTH COASTS OF PAPUA NEW GUINEA	VANIMO	02.6S	141.3E	30
	WEWAK	03.5S	143.7E	31
	MADANG	05.2S	145.8E	32
	MANUS_IS.	02.0S	147.5E	33
	KAVIENG	02.5S	150.7E	34
	RABAUL	04.2S	152.3E	35
	ULAMONA	05.0S	151.3E	36
	KIMBE	05.6S	150.2E	37
	KIETA	06.1S	155.6E	38
MARIANA ISLANDS	SAIPAN	15.3N	145.8E	39
	GUAM	13.4N	144.7E	40
PALAU	MALAKAL	07.3N	134.5E	41

Table 1 --- continued

Coastal Block	Forecast Point	Latitude	Longitude	Number in Fig. 1
MICRONESIA	YAP_IS.	09.5N	138.1E	42
	CHUUK_IS.	07.4N	151.8E	43
	POHNPEI_IS.	07.0N	158.2E	44
	KOSRAE_IS.	05.5N	163.0E	45
MARSHALL ISLANDS	ENIWETOK	11.4N	162.3E	46
NORTH COASTS OF SOLOMON ISLANDS	PANGGOE	06.9S	157.2E	47
	GHATERE	07.8S	159.2E	48
	AUKI	08.8S	160.6E	49
	KIRAKIRA	10.4S	161.9E	50
SOLOMON SEA	AMUN	06.0S	154.7E	51
	FALAMAE	07.4S	155.6E	52
	MUNDA	08.4S	157.2E	53
	HONIARA	09.3S	160.0E	54
COASTS OF EAST CHINA SEA	SHANGHAI	31.2N	122.3E	55
	ZHOUSHAN	29.9N	122.5E	56
	WENZHOU	27.8N	121.2E	57
COASTS OF SOUTH CHINA SEA	QUANZHOU	24.8N	118.8E	58
	HONG_KONG	22.3N	114.2E	59
	HAINAN_ISLAND	18.8N	110.5E	60
	SANYA	18.2N	109.5E	61
COASTS OF GULF OF TONKIN	VINH	18.6N	105.7E	62
EAST COASTS OF INDO CHINA PENINSULA	QUI_NHON	13.7N	109.2E	63
	BAC_LIEU	09.3N	105.8E	64
GULF OF THAILAND	SIHANOUKVILLE	10.6N	103.6E	65
	PATTAYA	12.8N	100.9E	66
	PRACHUAP_KHIRI KHAN	11.8N	099.8E	67
	NAKHON_SI_THAMMARAT	08.4N	100.0E	68
NORTHWEST COASTS OF KALIMANTAN	KOTA_KINABALU	6.0N	116.0E	69
	MUARA	05.0N	115.1E	70
	BINTULU	03.2N	113.0E	71
WEST COASTS OF PHILIPPINES	LAOAG	18.2N	120.6E	72
	SAN_FERNANDO	16.6N	120.3E	73
	MANILA	14.6N	121.0E	74
SULU SEA	ILOILO	10.7N	122.5E	75
	PUERTO_PRINCESA	09.8N	118.8E	76
	SANDAKAN	05.9N	118.1E	77
	LAHAD_DATU	04.9N	118.4E	78
EAST COASTS OF MALAY PENINSULA	KUALA_TERENGGANU	05.3N	103.2E	79
	SINGAPORE	01.3N	103.9E	80

Table 1 --- continued

Coastal Block	Forecast Point	Latitude	Longitude	Number in Fig. 1
CELEBES SEA	COTABUTO_CITY	07.3N	124.2E	81
	ZAMBOANGA	06.9N	122.1E	82
	MAIMBUNG	05.9N	121.0E	83
	TARAKAN	03.3N	117.6E	84
	TABUKAN_TENGAH	03.6N	125.6E	85
	MANADO	01.6N	124.9E	86
	TOLITOLI	01.1N	120.8E	87
NATUNA SEA	KEPULAUAN_RIAU	04.0N	108.5E	88
	SINGKAWANG	01.0N	109.0E	89
	KUALA_INDRAGIRI	00.5S	103.8E	90
	PANGKALPINANG	02.1S	106.1E	91

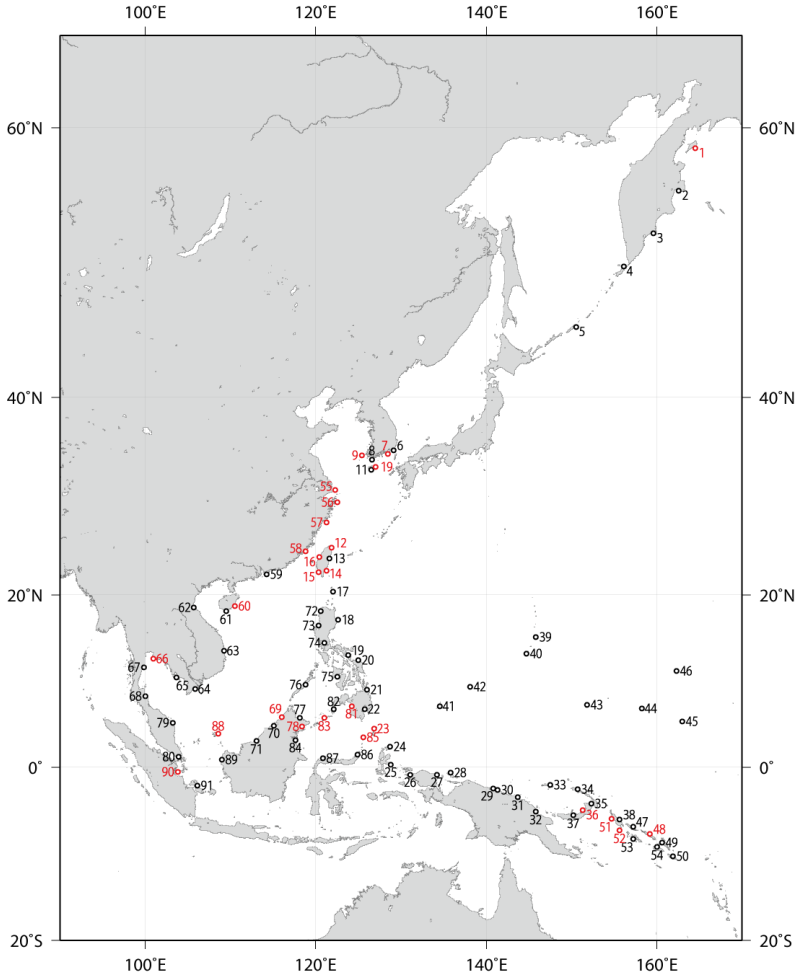


Figure 1. Forecast points of NWPTAC Enhanced Products for PacWave16. Changed points from current ones are indicated as red symbols.

ANNEX II. EXERCISE PACIFIC WAVE 2016 - SCENARIOS

Location	Latitude	Longitude	Depth	Magnitude	Past Exercise
Kuril-Kamchatka Trench (Kamchatka)	52.5 North	159.5 East	20km	9.0	PacWave11
Japan Trench (Off Northern Japan)	38.1 North	142.9 East	20km	9.0	PacWave13, 15
Nansei-Shoto Trench (Ryukyu Islands)	28.0 North	129.0 East	20km	9.0	PacWave11, 15
Manila Trench (Philippines - South China Sea)	17.0 North	119.0 East	20km	9.0	PacWave13, 15
Philippine Trench (Philippines - Pacific Ocean)	9.5 North	126.6 East	20km	9.0	PacWave11
New Britain-San Cristobal Trench (Solomon Islands)	7.3 South	156.0 East	20km	9.0	-

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

Date(UTC)	2/1				2/2				2/3				2/4				2/5				2/5			
Scenario →	Kuril-Kamchatka Trench				Japan Trench				Nansei-Shoto Trench				Manila Trench				Philippine Trench				New Britain-San Cristobal trench			
Center →	PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC	
Time (UTC)	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP
0100	Quake				Quake				Quake				Quake				Quake				Quake			
0107	1	TI			1	TI			1	TI			1	TI			1	TI			1	TI		
0120			**1**	**TI**			**1**	**TI**			**1**	**TI**			**1**	**TI**			**1**	**TI**			**1**	**TI**
0135	2	TFR			2	TFR			2	TFR			2	TFR			2	TFR			2	TFR		
0140			**2**	**TFR**			**2**	**TFR**			**2**	**TFR**			**2**	**TFR**			**2**	**TFR**			**2**	**TFR**
0200	3	TFP			3	TFP			3	TFP			3	TFP			3	TFP			3	TFP		
0230	4	TFH			4	TFH			4	TFH			4	TFH			4	TFH			4	TFH		
0310			**3**	**TS**			**3**	**TS**			**3**	**TS**			**3**	**TS**			**3**	**TS**			**3**	**TS**
0400	5	TS			5	TS			5	TS			5	TS			5	TS			5	TS		
0440			**4**	**TS**			**4**	**TS**			**4**	**TS**			**4**	**TS**			**4**	**TS**			**4**	**TS**
0530	6	TS			6	TS			6	TS			6	TS			6	TS			6	TS		
0610			**5**	**TS**			**5**	**TS**			**5**	**TS**			**5**	**TS**			**5**	**TS**			**5**	**TS**
0700	7	TS			7	TS			7	TS			7	TS			7	TS			7	TS		
0740			**6**	**TS**			**6**	**TS**			**6**	**TS**			**6**	**TS**			**6**	**TS**			**6**	**TS**
0830	8	TS			8	TS			8	TS			8	TS			8	TS			8	TS		
0910			**7**	**TS**			**7**	**TS**			**7**	**TS**			**7**	**TS**			**7**	**TS**			**7**	**TS**
1000	9	TS			9	TS			9	TS			9	TS			9	TS			9	TS		
1040			**8**	**TS**			**8**	**TS**			**8**	**TS**			**8**	**TS**			**8**	**TS**			**8**	**TS**
1130	10	TS			10	TS			10	TS			10	TS			10	TS			10	TS		
1210			**9**	**TS**			**9**	**TS**			**9**	**TS**			**9**	**TS**			**9**	**TS**			**9**	**TS**
1300	11	TS			11	TS			11	TS			11	TS			11	TS			11	TS		
1340			**10**	**TS**			**10**	**TS**			**10**	**TS**			**10**	**TS**			**10**	**TS**			**10**	**TS**
1430	12	TS			12	TS			12	TS			12	TS			12	TS			12	TS		
1510			**11**	**TS**			**11**	**TS**			**11**	**TS**			**11**	**TS**			**11**	**TS**			**11**	**TS**
1600	13	TS			13	TS			13	TS			13	TS			13	TS			13	TS		
1640			**12**	**TS**			**12**	**TS**			**12**	**TS**			**12**	**TS**			**12**	**TS**			**12**	**TS**
1730	14	TS			14	TS			14	TS			14	TS			14	TS			14	TS		
1810							**13**	**TS**							**13**	**TS**								
1900	15	TS			15	TS			15	TS			15	TS			15	TS			15	TS		
1940							**14**	**TS**							**14**	**TS**								
2030	16	TS			16	TS			16	TS			16	TS			16	TS			16	TS		
2110							**15**	**TS**							**15**	**TS**								
2200	17	TS			17	TS			17	TS			17	TS			17	TS			17	TS		
2240							**16**	**TS**							**16**	**TS**								
2330	18	TS			18	TS			18	TS			18	TS			18	TS			18	TS		
(next day) 0040							**16**	**TS**							**16**	**TS**								
0130	19	TL			19	TL			19	TL			19	TL			19	TL			19	TL		

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

Time for issuance of PTWC messages are shown for information though they will not be provided in the exercise.

ANNEX IV. POST-EXERCISE EVALUATION

Exercise evaluation forms are to be completed by each participating agency and forwarded to the country PacWave16 National Contact, or the country Tsunami National Contact. **The PacWave16 National Contact will compile the country Evaluation Form and complete and submit this online no later than 26 February 2016.**

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

The PacWave16 Evaluation Form can be found at
https://www.surveymonkey.com/s/pacwave16_eval.

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

- Laura Kong (email: laura.kong@noaa.gov, fax: +1 808 532 5576), or
- Jo Guard (email: jo.guard@dpmc.govt.nz), or
- Tomoaki Ozaki (email: hokusei@eqvol2.kishou.go.jp).

Exercise Pacific Wave 2016 Instructions on how to complete this Evaluation Form		
Step	**Who completes this step?**	**Description**
1	Each participating Agency/Country	Decide if your agency/country will include additional evaluation questions for each objective. Country/agency evaluation questions can be added at the **end** of each section. However, do NOT change the reference numbers to the questions.
2	Each participating Agency/Country	Print this form and mark your evaluation answers on it.
3	Each participating Agency/Country	• Answer each statement with either Y (Yes), N (No). • Comments should be used to explain/expand upon your Yes or No answer.. • Write your comments on the page following the evaluation questions. Note the question number in the left column and write your comments alongside.
4	Each participating Agency/Country	Send completed agency evaluation form to country PacWave16 National Contact so he/she can compile to complete Country PacWave16 Evaluation Form (this URL).
5	PacWave16 National Contact	PacWave16 National Contact should complete and submit the PacWave16 Evaluation Form by **26 February 2016** (https://www.surveymonkey.com/s/pacwave16_eval.). If there are problems or questions, please contact the PacWave Exercises Task Team co-Chairs (Laura Kong, laura.kong@noaa.gov; Jo Guard, jo.guard@dpmc.govt.nz; Tomoaki Ozaki, hokusei@eqvol2.kishou.go.jp)

EXERCISE PACIFIC WAVE 2016 EVALUATION FORM

CONTACT DETAILS

- Country: _____
- Agency: _____
- Contact Name: _____
- Contact Position: _____
- Contact Phone: _____
- Contact Mobile: _____
- Contact E-mail: _____

COUNTRY EXERCISE SCENARIO

Select Scenario Used:

___ Kuril-Kamchatka Trench (Kamchatka)

___ Japan Trench (Off Northern Japan)

___ Nansei-Shoto Trench (Ryukyu Islands)

___ Manila Trench (Philippines - South China Sea)

___ Philippine Trench (Philippines - Pacific Ocean)

___ New Britain-San Cristobal trench (Solomon Islands)

OBJECTIVE 1

Evaluate the format and content of experimental NWPTAC Enhanced Products for each scenario exercised.

1.1 Are the following products useful in helping you assess your national tsunami threat? Indicate Yes or No, and provide comments as needed. Please explain why it is/is not useful.

___ Y ___ N Text Message

___ Y ___ N Deep Ocean Tsunami Amplitude Forecast Map

___ Y ___ N Tsunami Travel Time Map

___ Y ___ N Coastal Tsunami Amplitude Forecast Map

Comments:

1.2 Please rank the usefulness of each product, where .1=most useful and 4=least useful.

___ Text Message

___ Deep Ocean Tsunami Amplitude Forecast Map

___ Tsunami Travel Time Map

___ Coastal Tsunami Amplitude Forecast Map

Comments:

1.3 Format and Content: Is your country satisfied with the format and content of experimental NWPTAC Enhanced Products?
Indicate Yes or No, and provide comments as needed. If your answer is No, please provide comments on what improvements are needed.

___ Y ___ N Text Message

___ Y ___ N Deep Ocean Tsunami Amplitude Forecast Map

___ Y ___ N Tsunami Travel Time Map

___ Y ___ N Coastal Tsunami Amplitude Forecast Map

Comments:

1.4 Do any features, other than listed above, need to be changed or added?
If Yes, please comment.

___ Y ___ N

Comments:

OBJECTIVE 2

Determine whether counties are prepared to officially receive and utilize the NWPTAC Enhanced Products.

2.1 Does your National Tsunami Warning Centre (NTWC) understand the contents of the NWPTAC Enhanced Products, how to use the Products, and the limitations of the Products?
Indicate Yes or No.

___ Y ___ N

Comments:

2.2 Does your National Disaster Management Office (NDMO) understand the contents of the NWPTAC Enhanced Products, how to use the Products, and the limitations of the Products?
Indicate Yes or No.

___ Y ___ N

Comments:

2.3 Will your country's NTWC (and NDMO) be prepared to utilize the NWPTAC Enhanced Products in 2018? Your NTWC should be prepared to issue appropriate national alerts (e.g., Warning/Watch/Cancellations) based on the current PTWC Enhanced Products and/or NWPTAC Enhanced Products. Indicate Yes or No, and provide comments as needed on country status.

___ Y ___ N Currently ready.

___ Y ___ N Will be ready in 2018.

___ Y ___ N Need to develop new or revise existing SOPs.

___ Y ___ N Need to inform and prepare other key stakeholders

___ Y ___ N Need NTWC or NDMO to conduct training for their national and local stakeholders

___ Y ___ N Need international experts to conduct more training for national stakeholders

Comments:

GENERAL EXERCISE OBSERVATIONS

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. If Y, please provide details.

Comments:

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 PacWave16 exercise website pages were useful.

___ Y ___ N This evaluation form was easy to use.

___ Y ___ N PacWave16 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:

EXERCISE PACIFIC WAVE 2016 EXPERIENCE

Please provide general statements on your Exercise Pacific Wave 2016 experience.

EXERCISE PLANNING

Please provide a general statement about what went well.

Insert comments

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

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

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

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

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

EXERCISE DEBRIEF OR EVALUATION
Please provide a general statement about what went well.
Insert comments

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

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

ANNEX V. POST-EXERCISE EVALUATION COMPILATION

This Annex contains a compilation of the responses provided by countries to the Exercise Pac Wave16 post-exercise evaluation form. Altogether, 12 countries and one sub national entity submitted evaluation forms by June 2016.

Surveys were completed online through the Survey Monkey online survey and questionnaire tool, or submitted by transmission of the completed survey file to the PacWave Exercises 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/pacwave16_eval.

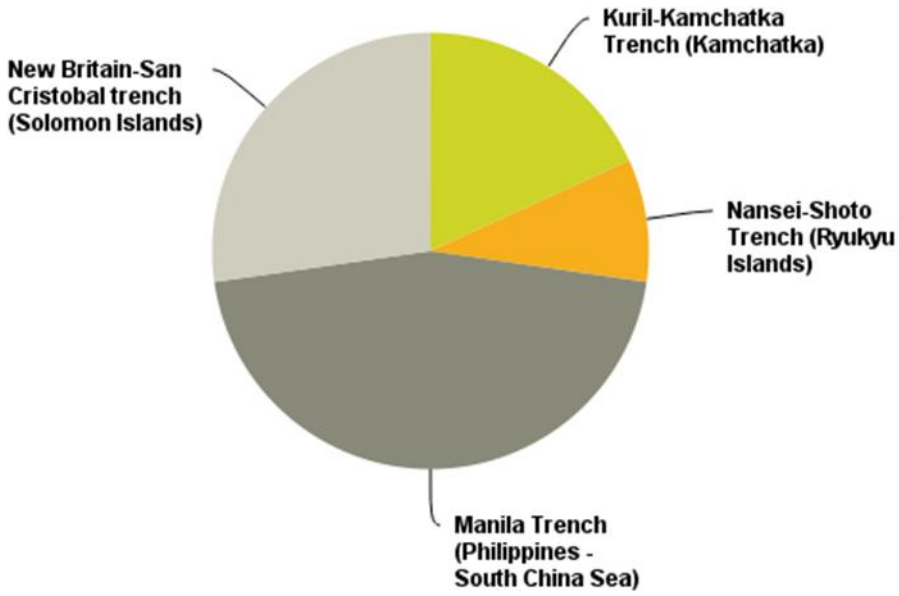
For each question, a short statement is provided that summarises the responses, and this is followed by comments provided by the countries.

1. Country and Agency

	Country	**Agency**
1	Brunei*	
2	China (including Hong Kong)	Tsunami Warning Center of State Oceanic Administration and Hong Kong Observatory
3	France (French Polynesia)	Laboratoire de Géophysique de Tahiti (CEA)
4	Indonesia	Agency for Meteorology Climatology and Geophysics (BMKG)
5	Malaysia	Malaysian Meteorological Department
6	Papua New Guinea	Port Moresby Geophysical Observatory (PMGO)
7	Russian Federation	Sakhalin Tsunami Warning Center, Federal Service of Russia for hydrometeorology and environmental monitoring
8	Samoa	Ministry of Natural Resources & Environment
9	Singapore	Meteorological Service Singapore
10	Solomon Islands	Solomon Islands Government
11	Republic of Korea	Korea Meteorological Administration
12	Vietnam	Earthquake Information and Tsunami Warning Center, Institute of Geophysics

ANNEX VI. EXERCISE EVALUATION RESPONSES

Country Exercise Scenario (Select scenario used)

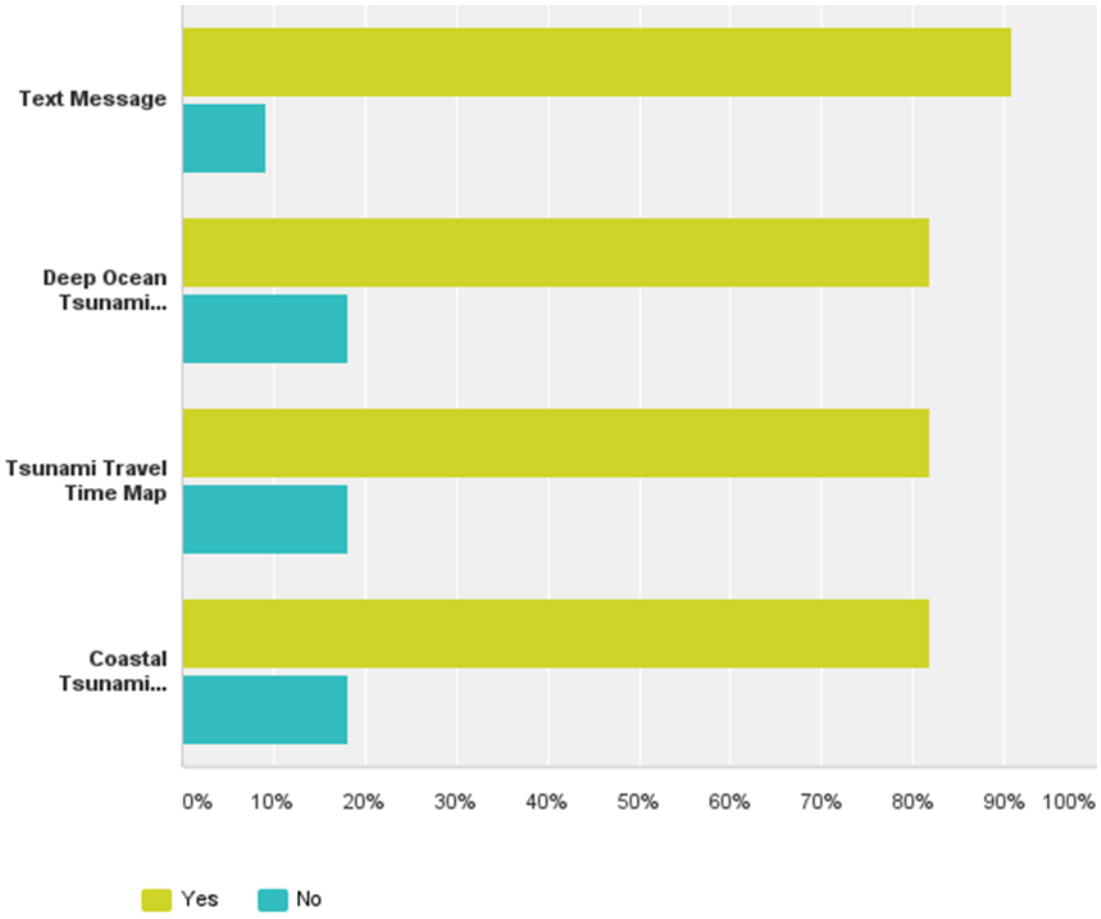


Answer Choices	Responses	
Kuril-Kamchatka Trench (Kamchatka)	18.18%	2
Japan Trench (Off Northern Japan)	0.00%	0
Nansei-Shoto Trench (Ryukyu Islands)	9.09%	1
Manila Trench (Philippines - South China Sea)	45.45%	5
Philippine Trench (Philippines - Pacific Ocean)	0.00%	0
New Britain-San Cristobal trench (Solomon Islands)	27.27%	3
Total		**11**

Comments

- Solomon Islands is picking this scenario to try a test of our arrangements and response occuring within just hours of the tsunami generated. We have been trying out long distance tsunamis in many of the past PacWave and Aelauwave exercises. (Solomon Islands)
- KMA planned the exercise scenario based on the tsunami record in Korea. Boundary between Eurasian and North American plates (East Sea). (Republic of Korea)
- This is the closest source to Samoa and its also identified in National Tsunami Threshold Standard. (Samoa)
- There is tsunami threat if a major earthquake occurs there. (Malaysia)
- Wanted to test reactions to a proximal event. (Papua New Guinea)

Are the following products useful in helping you assess your national tsunami threat? Indicate Yes or No, and provide comments as needed. Please explain why it is/is not useful.



	Yes	No	Total	Weighted Average
Text Message	**90.91%** 10	**9.09%** 1	11	1.09
Deep Ocean Tsunami Amplitude Forecast Map	**81.82%** 9	**18.18%** 2	11	1.18
Tsunami Travel Time Map	**81.82%** 9	**18.18%** 2	11	1.18
Coastal Tsunami Amplitude Forecast Map	**81.82%** 9	**18.18%** 2	11	1.18

Comments

Text Message

- Any indication of next bulletin. (Solomon Islands)
- It helps understand potential impact on Samoa given the forecasted points in neighbouring countries. (Samoa)

- It gives detailed information. (Malaysia)
- The NWPTAC Product (text message) is very useful to compare with BMKG Products. (Indonesia)
- Useful to compare our preliminary seismic parameters to others warning system. (French Polynesia)

Deep Ocean Tsunami Amplitude Forecast Map

- The Eastern Parts and Southern Parts of Solomon Islands is not fully covered. Not whole area of Solomon Islands. (Solomon Islands)
- It does not assist in the issuance of early warning. (Malaysia)
- The NWPTAC Product (Amplitude Forecast Map) is very useful to compare with BMKG Products. (Indonesia)
- Very interesting in a first step to evaluate and compare with our model about Tsunami height and seismic fault parameters. Especially the two run using the two faults of the focal mechanism given in the legend. That is very useful. (French Polynesia)

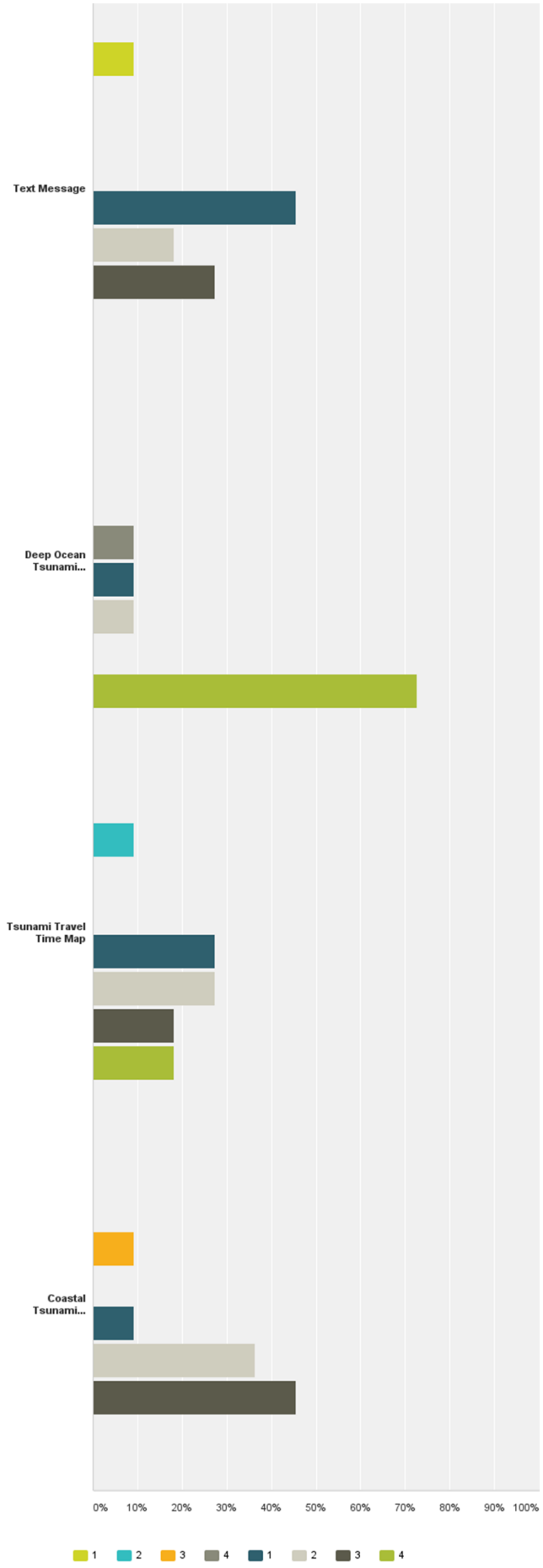
Tsunami Travel Time Map

- Coverage is not for whole of Solomon Islands. (Solomon Islands)
- Helps in determining whether there would be any impact or not given other factors such as high tide, swells and surges on given day and time. (Samoa)
- It provides an estimate of the tsunami arrival time and can be used in the issuance of tsunami early warning. (Malaysia)
- The NWPTAC Product (Tsunami Travel Time Map) is very useful to compare with BMKG Products. (Indonesia)
- We have our own products dedicated for all the French Polynesian islands. (French Polynesia)

Coastal Tsunami Amplitude Forecast Map

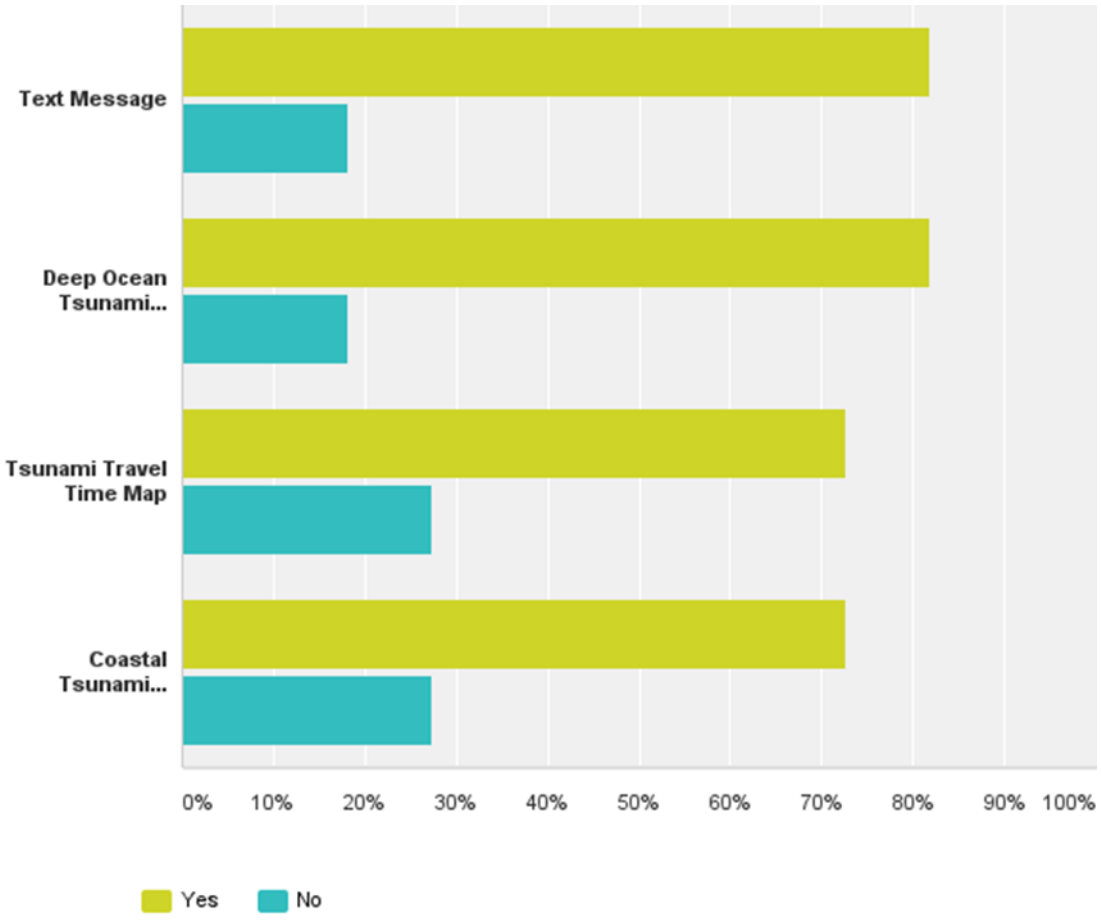
- Not for whole of Solomon Islands. (Solomon Islands)
- Helps is making a decision on potential impact on coastal areas and therefore the type of warning or alert to be issued. (Samoa)
- Provides possible tsunami threat. (Malaysia)
- The NWPTAC Product (Coastal Tsunami Amplitude) is very useful to compare with BMKG Products. (Indonesia)
- NWPTAC coastal tsunami forecast map does not cover French Polynesia. Moreover we have also our own products and tools that forecast tsunami height over the 5 archipelagos. (French Polynesia)

Please rank the usefulness of each product, where .1=most useful and 4=least useful.



	1	2	3	4	1	2	3	4	Total	Score
Text Message	9.09% 1	0.00% 0	0.00% 0	0.00% 0	45.45% 5	18.18% 2	27.27% 3	0.00% 0	11	3.64
Deep Ocean Tsunami Amplitude Forecast Map	0.00% 0	0.00% 0	0.00% 0	9.09% 1	9.09% 1	9.09% 1	0.00% 0	72.73% 8	11	1.82
Tsunami Travel Time Map	0.00% 0	9.09% 1	0.00% 0	0.00% 0	27.27% 3	27.27% 3	18.18% 2	18.18% 2	11	3.09
Coastal Tsunami Amplitude Forecast Map	0.00% 0	0.00% 0	9.09% 1	0.00% 0	9.09% 1	36.36% 4	45.45% 5	0.00% 0	11	2.91

Is your country satisfied with the format and content of experimental NWPTAC Enhanced Products? Indicate Yes or No, and provide comments as needed. If your answer is No, please provide comments on what improvements are needed.



	Yes	No	Total	Weighted Average
Text Message	81.82% 9	18.18% 2	11	1.18
Deep Ocean Tsunami Amplitude Forecast Map	81.82% 9	18.18% 2	11	1.18
Tsunami Travel Time Map	72.73% 8	27.27% 3	11	1.27
Coastal Tsunami Amplitude Forecast Map	72.73% 8	27.27% 3	11	1.27

Comments

Text message

- Does not really indicated when is the next bulletin issuing time. (Solomon Islands)
- Southern half of PNG not included. (Papua New Guinea)
- Useful to compare our preliminary seismic parameters to others warning system. (French Polynesia)

Deep Ocean Tsunami Amplitude Forecast Map

- Partial coverage. (Solomon Islands)
- As above. (Papua New Guinea)
- Very interesting in a first step to evaluate and compare with our model about Tsunami height and seismic fault parameters. Especially the two run using the two faults of the focal mechanism given in the legend. That is very useful. (French Polynesia)

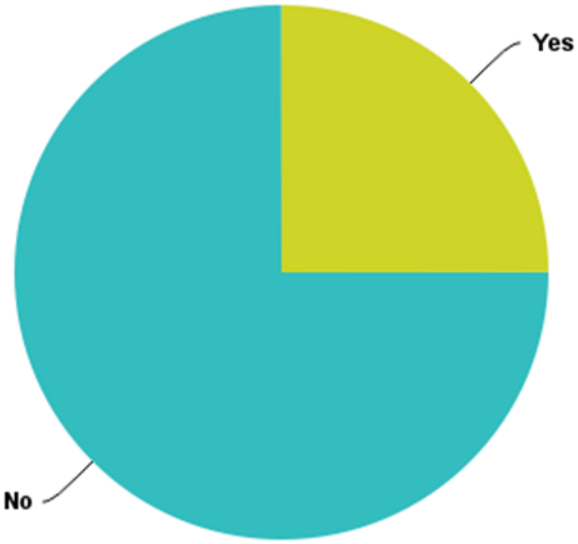
Tsunami Travel Time Map

- Partial coverage. (Solomon Islands)
- As above. (Papua New Guinea)
- We have our own products dedicated for all the French Polynesian islands. (French Polynesia)

Coastal Tsunami Amplitude Forecast Map

- Partial coverage. (Solomon Islands)
- It would be better if regional map showing coasts of South China Sea could be introduced. (Hong Kong)
- As above. (Papua New Guinea)
- NWPTAC coastal tsunami forecast map does not cover French Polynesia. Moreover we have also our own products and tools that forecast tsunami height over the 5 archipelagos. (French Polynesia)

Do any features, other than listed above, need to be changed or added? If Yes, please comment.

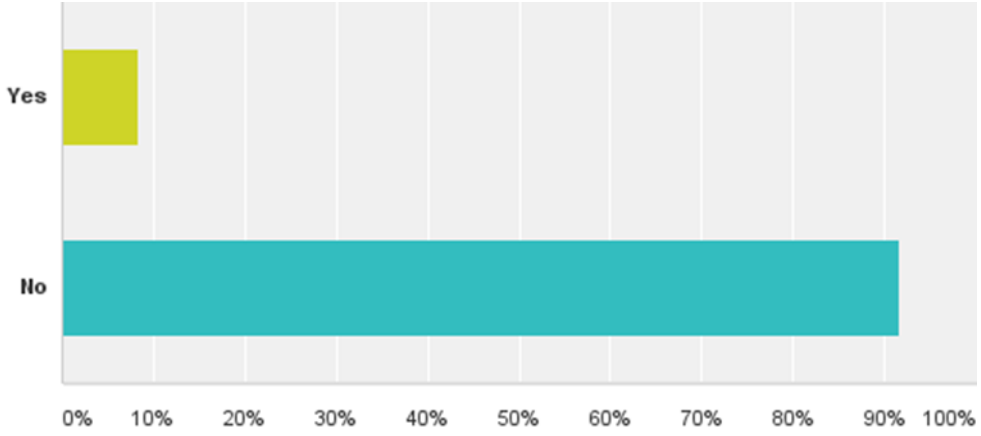


Answer Choices	Responses	
Yes	25.00%	3
No	75.00%	9
Total		12

Comments

- Include Solomon Islands Eastern and Southern region. (Solomon Islands)
- If possible, Keyhole Markup Language (KML) file could be provided for displaying relevant tsunami information on Google Earth, Maps or other geospatial software. (Hong Kong)
- Add an item Bering Island for calculating the time lag and wave height forecast. Nikolskoye (Bering isl) 55,120° N 165,590° E. (Russian Federation)

Are any parts of the NWPTAC text message or graphical products, other than the actual values of the wave forecasts, confusing or in conflict with the PTWC Enhanced Products? If Yes, please comment

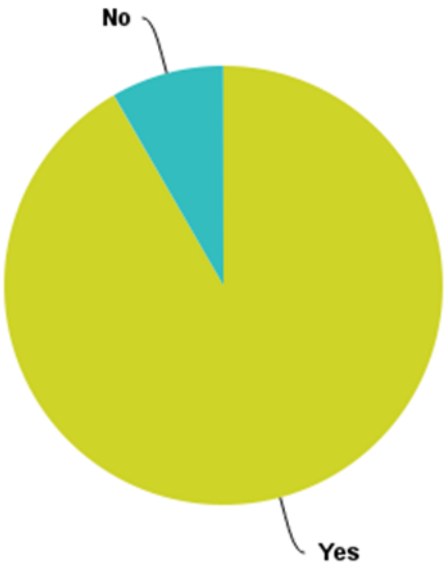


Answer Choices	Responses	
Yes	8.33%	1
No	91.67%	11
Total		12

Comments

- The graphical products, tsunami travel time and all the others does not include one of our provinces, ie the boundary cuts between Temotu Proviince but does not include Rennell and Bellona. (Solomon Islands)

Does your National Tsunami Warning Centre (NTWC) understand the contents of the NWPTAC Enhanced Products, how to use the Products, and the limitations of the Products? Indicate Yes or No.

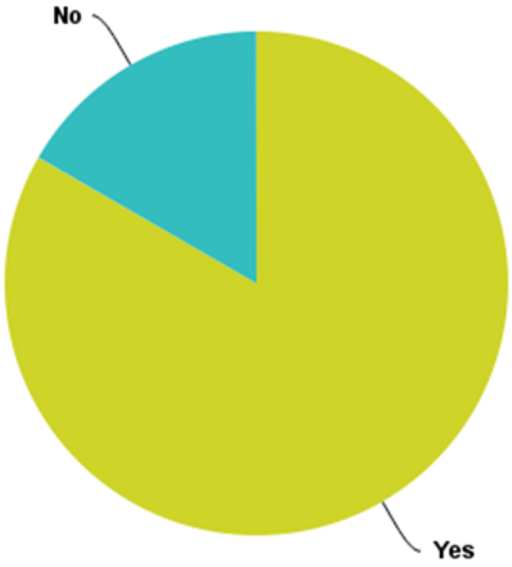


Answer Choices	Responses	
Yes	91.67%	11
No	8.33%	1
Total		12

Comments

- Except that the graphical products does not include one of our Provinces ie. Rennell and Bellona. (Solomon Islands)
- NTWC is PMGO. (Papua New Guinea)

Does your National Disaster Management Office (NDMO) understand the contents of the NWPTAC Enhanced Products, how to use the Products, and the limitations of the Products? Indicate Yes or No.

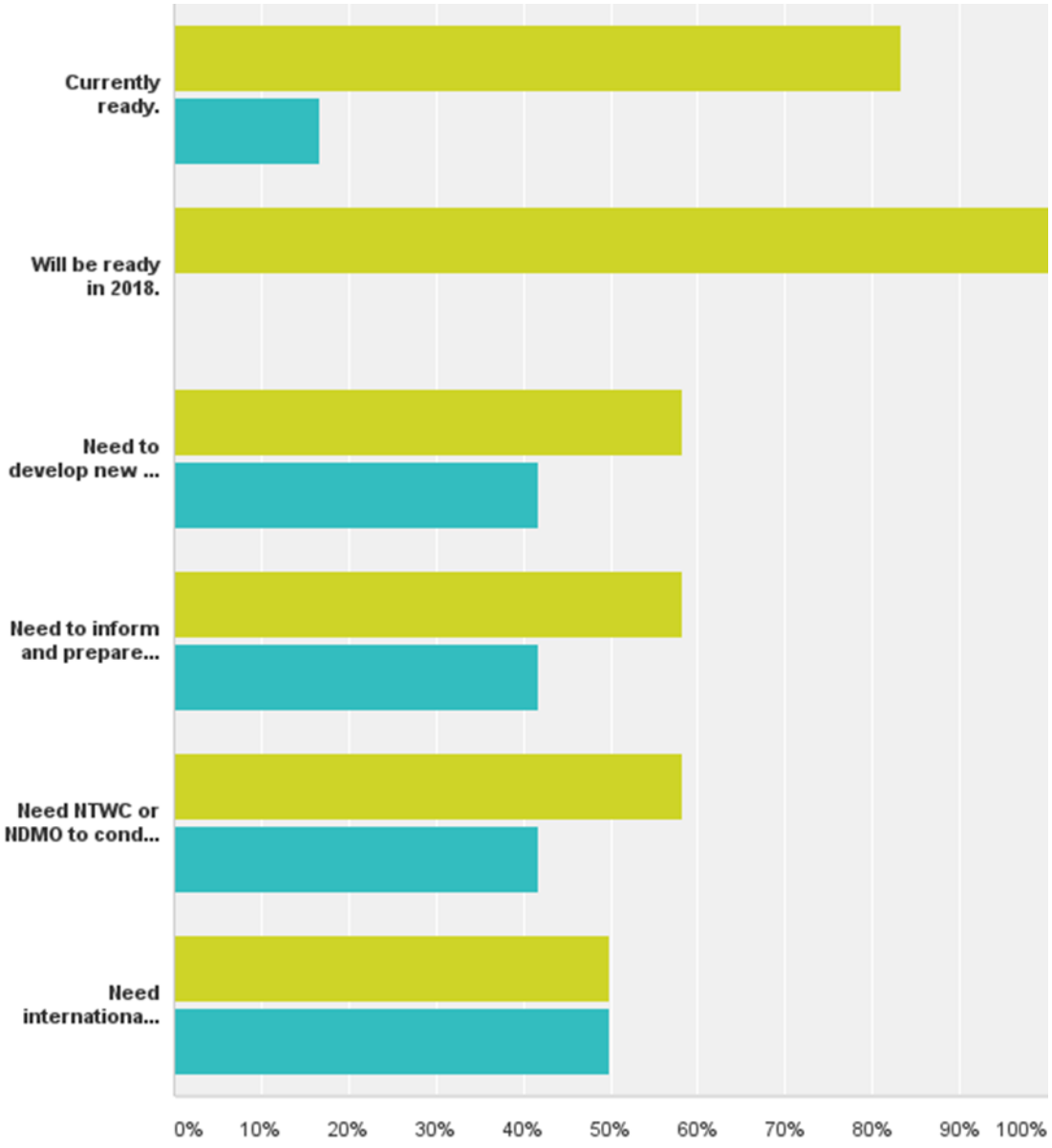


Answer Choices	Responses	
Yes	83.33%	10
No	16.67%	2
Total		12

Comments

- Except that the graphical products does not include one of our Provinces ie. Rennell and Bellona. (Solomon Islands)
- Poor communication between NTWC and NDMO. (Vietnam)
- This exercise was not include NDMO, only TTX in operational room (NTWC). (Indonesia)

Will your country's NTWC (and NDMO) be prepared to utilize the NWPTAC Enhanced Products in 2018? Your NTWC should be prepared to issue appropriate national alerts (e.g., Warning/Watch/Cancellations) based on the current PTWC Enhanced Products and/or NWPTAC Enhanced Products. Indicate Yes or No, and provide comments as needed on country status.



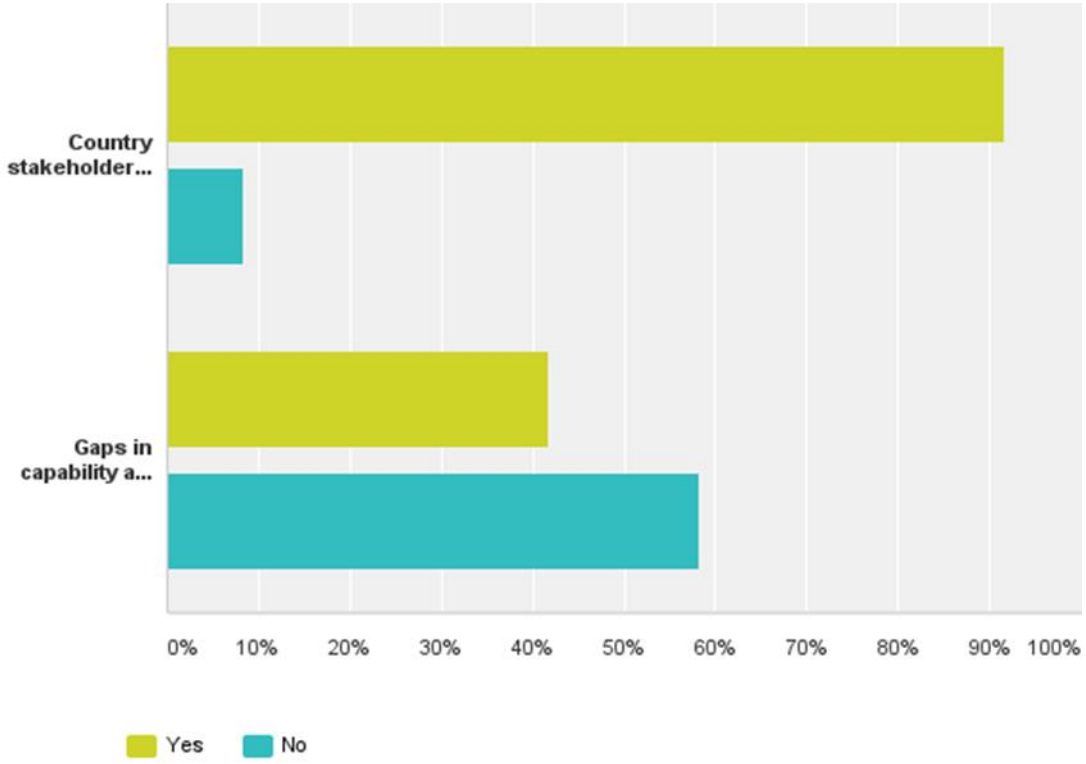
	Yes	No	Total
Currently ready.	**83.33%** 10	**16.67%** 2	12
Will be ready in 2018.	**100.00%** 12	**0.00%** 0	12
Need to develop new or revise existing SOPs.	**58.33%** 7	**41.67%** 5	12
Need to inform and prepare other key stakeholders	**58.33%** 7	**41.67%** 5	12
Need NTWC or NDMO to conduct training for their national and local stakeholders	**58.33%** 7	**41.67%** 5	12
Need international experts to conduct more training for national stakeholders	**50.00%** 6	**50.00%** 6	12

Comments

- The last question is marked yes/no. The reason being if relevant materials are provided training is done for national EOC & SIMS, then no need for international experts to come and conduct stakeholders training. If yes, then international experts can provide support to the local team. Note from Co-Chair: the question about being ready in 2018 was not answered. (Solomon Islands)

- Training is useful for new officers to learn about the Enhanced Products and how to use them. (Malaysia)

OVERALL ASSESSMENT. Please provide comments as needed.



	Yes	No	Total	Weighted Average
Country stakeholder agencies have a better understanding of the goals, responsibilities and roles in tsunami emergencies.	**91.67%** 11	**8.33%** 1	12	1.08
Gaps in capability and capacity have been identified. If Yes, please provide details.	**41.67%** 5	**58.33%** 7	12	1.58

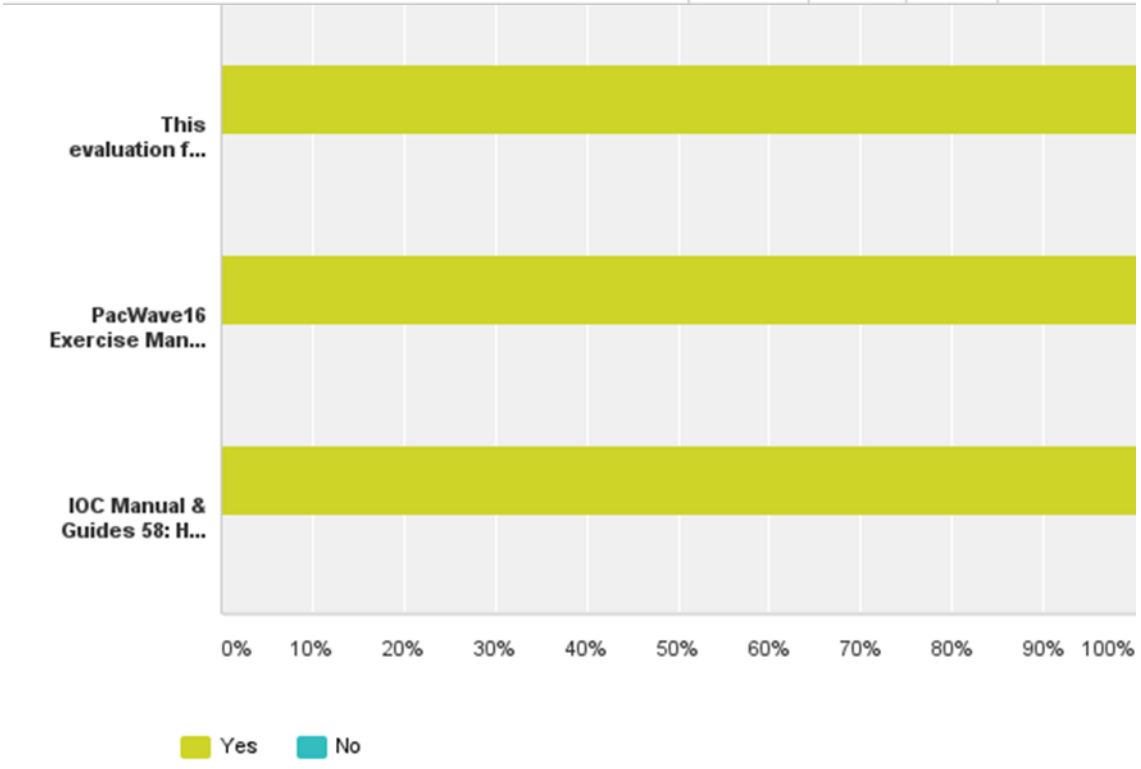
Comments

- One of our major gaps will be in an event when the telecom/internet service providers are shut down. This will affect receiving and disseminating of warnings, ie PTWC to SIMS/NDMO, and SIMS/NDMO to the public. Therefore, EMWIN system must be considered as a backup. (Solomon Islands)

- NTWC staff training to continue to improve their analytical skills, understanding the products, SOPs, to reduce response time. (Samoa)
- The National Disaster Management Agency is newly formed (take over from the National Security Council) in late 2015 and this exercise has helped to familiarise the personnel with regards to the Tsunami SOP and response. (Malaysia)
- PMGO capacity issue - staff shortage. (Papua new Guinea)
- No practise in tsunami response in the country ever. (Vietnam)

EXERCISE PLANNING. Please provide comments as needed.

	Yes	No	Total	Weighted Average
Overall, the exercise planning, conduct, format and style were satisfactory.	**100.00%** 12	**0.00%** 0	12	1.00
Exercise planning went well.	**100.00%** 12	**0.00%** 0	12	1.00
The PacWave16 exercise website pages were useful.	**100.00%** 12	**0.00%** 0	12	1.00
This evaluation form was easy to use.	**100.00%** 12	**0.00%** 0	12	1.00
PacWave16 Exercise Manual provided an appropriate level of detail.	**100.00%** 12	**0.00%** 0	12	1.00
IOC Manual & Guides 58: How to Plan, Conduct, and Evaluate IOC Tsunami Wave Exercises was useful.	**100.00%** 12	**0.00%** 0	12	1.00



Comments

- WE however, simplified the whole document and make our own ex document with only our chosen scenario, built in injects and so on. This allows us to integrate our Eksasaes Aelan Weiv together with the PacWave. (Solomon Islands)
- We have actually used the PACWAVE Exercise Manual format to develop our national and location based exercise manuals. (Samoa)
- Some of the manuals were too large and have some trouble downloading. (Malaysia)

EXERCISE PLANNING. Please provide comments as needed.

Please provide a general statement about what went well.

- SIGOUT, Private sectors and NGOs participated. The use of power palets effects in the TTX. Actual feedback from key agencies. (Solomon Islands)
- Our NTWC(KMA) and NDMO(MPSS, Ministry of Public Safety and Security) of Korea have made the exercise plan since December 2015, reflecting the domestic state from the regional tsunami. (Republic of Korea)
- Continue to improve the ability of staff in NDMO and NTWC to plan any exercise, coordination of planning between DMO and NTWC went well. (Samoa)
- Meetings were held among the relevant agencies prior to the exercise. Press statement regarding the exercise was posted a few days earlier. (Malaysia)
- The local scheduled communication test and master scenario were well prepared. (Hong Kong)
- Good cooperation between PMGO and NDC. (Papua New Guinea)
- Information on the exercise Pacific Wave 2016 was available and timely. (Russia Federation)
- Information fully received. (Vietnam)
- Well prepared in scenario, time line (rundown), personal (operators, facilitator, observer). (Indonesia)
- NTWC planed and organized local agencies to take part in the exercise. (China)
- We were well informed of the date of the PacWave 2016 exercise. (French Polynesia)

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

- Some key response agencies did not attend. (Solomon Islands)
- In general, the exercise with our own scenario went well but there might be some problems if the tsunami events occurred in southern region from Korea. (Republic of Korea)
- Lack of information for S half of PNG. (Papua New Guinea)

Please provide a general statement about what could be improved.

- The already established Ex planning Team needs to be resourced or wider circulation of the draft amongst team members before the TTX. (Solomon Islands)
- The cooperation between our NTWC and NDMO could strengthen more for local action especially. (Republic of Korea)
- Need to involve more agencies in planning PACWAVE17. (Samoa)

- Need complete info for all of PNG. (Papua New Guinea)

EXERCISE CONDUCT. Please provide comments as needed.

Please provide a general statement about what went well.

- Good number of key agencies participated. (Solomon Islands)
- We made the exercise plan and conducted by reflecting the domestic state from the regional tsunami. (Republic of Korea)
- Exercise facilitation and the presentation including injects were quite clear. (Samoa)
- On the day of the exercise, everyone were ready. (Malaysia)
- The exercise was well coordinated and smoothly conducted. (Hong Kong)
- Good communications between PMGO and NDC. (Papua New Guinea)
- Exercising passed accurately and without interruption. The use of new products has made substantial assistance in the assessment of tsunami risk for the region. (Russia Federation)
- Scenario materials were good and well understood. (Vietnam)
- Went well in overall exercise. (Indonesia)
- All forecasters produced bulletins. (China)
- We played the exercise in real time based on the timeline of pacwave 2016 but shifted to the 3th of February at 18:00 UTC. (French Polynesia)

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

- Some agencies like the Police did not turn up. (Solomon Islands)
- In general, the exercise with our own scenario went well but there might be some problems if the tsunami events occurred in southern region from Korea. (Republic of Korea)
- Participants from first response agencies did not have prior knowledge of TWS internal procedures and PTWC. (Samoa)
- Technical problems with the facsimile communications. (Malaysia)
- Forced omission of half of PNG due to lack of info. (Papua New Guinea)
- Linkage between NTWC and NDMO. (Vietnam)
- Not all the forecasters executed procedures well. (China)

Please provide a general statement about what could be improved.

- It could have been better if an exercise team which did not consist of NDMO/SIMS be running the exercise. Preferably PTWC/UNESCO to consider a regional team in this will allow NDMO/SIMS officers not to engage in running the exercise, but involve as participants in the exercise. (Solomon Islands)
- Tsunami warning system of Korea could be updated to analyze more distant tsunami events. (Republic of Korea)
- Need to continue to improve information sharing between NTWC and first responders. (Samoa)
- Should have multiple mode of communications. (Malaysia)

- Need complete info for all of PNG. Forecast points to include Misima, Alotau, Port Moresby, Lae - others? (Papua New Guinea)
- Coordination between NTWC and NDMO. (Vietnam)
- Some procedures exercises should be conduct in NTWC. (China)
- To simulate nwptac and ptwc FAX receive as real. (French Polynesia)

EXERCISE DEBRIEF OR EVALUATION.

Please provide a general statement about what went well.

- Some key opportunities and gaps are being identified. Eg. This is the first time the tourism sector is involved. (Solomon Islands)
- The 12 NTWC reports on tsunami observation and 33 NDMO feedback reports were made promptly. (Republic of Korea)
- Well facilitate hot debrief immediately after the exercise a number of areas that require the attention of the NTWC and DMO. (Samoa)
- A meeting was held and the various agencies made a report. (Malaysia)
- Debrief was conducted immediately after the exercise. (Hong Kong)
- Good understanding of exercise at both PMGO and NDC. The need to act quickly was reinforced by this exercise. (Papua New Guinea)
- Exercising Pacific Wave makes a significant contribution for development of joint Action in the event of a real threat of a tsunami. (Russia Federation)
- Awareness on tsunami threat improved. (Vietnam)
- The evaluation succeed and as expected. (Indonesia)
- All local agencies responded. (China)
- Debriefing the NWPTAC new products between all partakers immediately. (French Polynesia)

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

- The debriefing was done very quickly (approx an hour) after the TTX. As such feedback was limited not allowing time for proper discussion. (Solomon Islands)
- Some agencies spent a long time to response. (China)

Please provide a general statement about what could be improved.

- Conduct it a day after the TTX, PTWC to fund. (Solomon Islands)
- Detailed reports on local damage condition could be made. (Republic of Korea)
- Need to monitor implementation of recommendations from this exercise. (Samoa)
- We could expand the TTX to BMKG stations. (Indonesia)
- Local agency should improve awareness. (China)

ANNEX VII. 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 2016

(Insert country name) will join over 15 other countries around the northwest Pacific region as a participant in a mock tsunami scenario during 1-5 February 2016. The purpose of this Pacific-wide exercise is to exercise country tsunami decision-making procedures using the experimental enhanced forecast products of the Northwest Pacific Tsunami Advisory Center (NWPTAC) in Japan. 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, 2013 Solomon Islands, 2014 Chile, and the September 2015 Chile tsunamis have increased our need to be more prepared for such events," said (insert name of appropriate official). "This important exercise will validate NWPTAC's enhanced products for future official use by countries of the Pacific Tsunami Warning and Mitigation System.

The exercise, titled Exercise Pacific Wave 2016 (PacWave16), will simulate Pacific countries being put into a Tsunami Warning situation requiring government decision-making. It is the sixth such exercise with the first having been carried out in May 2006, the second in October 2008, the third in November 2011, the fourth in May 2013 and the fifth in February 2015. Participating countries will select from six different northwest 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 Japan's NWPTAC 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 2016 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 Center:
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 VIII. REPORT PREPARATION / FINAL REPORT

The planning, conduct, and evaluation of Exercise Pacific Wave 2016 was coordinated by the PTWS PacWave Exercises Task team (TT). The Exercise Pacific Wave 2016 Summary Report and Annex III were compiled by Ms Jo Guard (Ministry of Civil Defence & Emergency Management, New Zealand), Dr Laura Kong (International Tsunami information Center), and Mr Tamoaki Ozaki (Japan Meteorological Agency).

Task Team Members (official):

- Ms Jo Guard, New Zealand, Ministry of Civil Defence & Emergency Management, Task team Co-Chair
- Dr Laura Kong, USA, ITIC Director, Task team Co-Chair
- Mr Tamoaki Ozaki, Japan, Japan Meteorological Agency
- Mr Anthony Blake, Fiji, SPC-SOPAC Division
- Ms Silvia Chacón Barrantes, Costa Rica, Universidad Nacional
- Mr David Coetzee, New Zealand, Ministry of Civil Defence & Emergency Management
- Dr Charles McCreery, USA, PTWC
- Dr Yuelong Miao, Australia, Bureau of Meteorology
- Mr H Y Mok, China, Hong Kong Observatory
- Mr Rajendra Prasad, Fiji, UNESCO/IOC Tsunami Unit
- Mr Tetsuyuki Ueyama Japan, Japan Meteorological Agency (JMA)
- LCDR Carlos A. Zúñiga, Chile, Servicio Hidrográfico y Oceanográfico de la Armada de Chile

ANNEX IX. 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
34	Bruun Memorial Lectures, 1987: Recent Advances in Selected Areas of Ocean Sciences in the Regions of the Caribbean, Indian Ocean and the Western Pacific. 1988	Composite E, F, S
35	Global Sea-Level Observing System (GLOSS) Implementation Plan. 1990	E only

(continued)

36	Bruun Memorial Lectures 1989: Impact of New Technology on Marine Scientific Research. 1991	Composite E, F, S
37	Tsunami Glossary - A Glossary of Terms and Acronyms Used in the Tsunami Literature. 1991	E only
38	The Oceans and Climate: A Guide to Present Needs. 1991	E only
39	Bruun Memorial Lectures, 1991: Modelling and Prediction in Marine Science. 1992	E only
40	Oceanic Interdecadal Climate Variability. 1992	E only
41	Marine Debris: Solid Waste Management Action for the Wider Caribbean. 1994	E only
42	Calculation of New Depth Equations for Expendable Bathymerographs Using a Temperature-Error-Free Method (Application to Sippican/TSK T-7, T-6 and T-4 XBTS. 1994	E only
43	IGOSS Plan and Implementation Programme 1996-2003. 1996	E, F, S, R
44	Design and Implementation of some Harmful Algal Monitoring Systems. 1996	E only
45	Use of Standards and Reference Materials in the Measurement of Chlorinated Hydrocarbon Residues. 1996	E only
46	Equatorial Segment of the Mid-Atlantic Ridge. 1996	E only
47	Peace in the Oceans: Ocean Governance and the Agenda for Peace; the Proceedings of *Pacem in Maribus* XXIII, Costa Rica, 1995. 1997	E only
48	Neotectonics and fluid flow through seafloor sediments in the Eastern Mediterranean and Black Seas - Parts I and II. 1997	E only
49	Global Temperature Salinity Profile Programme: Overview and Future. 1998	E only
50	Global Sea-Level Observing System (GLOSS) Implementation Plan-1997. 1997	E only
51	L'état actuel de 1'exploitation des pêcheries maritimes au Cameroun et leur gestion intégrée dans la sous-région du Golfe de Guinée *(cancelled)*	F only
52	Cold water carbonate mounds and sediment transport on the Northeast Atlantic Margin. 1998	E only
53	The Baltic Floating University: Training Through Research in the Baltic, Barents and White Seas - 1997. 1998	E only
54	Geological Processes on the Northeast Atlantic Margin (8th training-through-research cruise, June-August 1998). 1999	E only
55	Bruun Memorial Lectures, 1999: Ocean Predictability. 2000	E only
56	Multidisciplinary Study of Geological Processes on the North East Atlantic and Western Mediterranean Margins (9th training-through-research cruise, June-July 1999). 2000	E only
57	Ad hoc Benthic Indicator Group - Results of Initial Planning Meeting, Paris, France, 6-9 December 1999. 2000	E only
58	Bruun Memorial Lectures, 2001: Operational Oceanography – a perspective from the private sector. 2001	E only
59	Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters. 2001	E only
60	Interdisciplinary Approaches to Geoscience on the North East Atlantic Margin and Mid-Atlantic Ridge (10th training-through-research cruise, July-August 2000). 2001	E only
61	Forecasting Ocean Science? Pros and Cons, Potsdam Lecture, 1999. 2002	E only
62	Geological Processes in the Mediterranean and Black Seas and North East Atlantic (11th training-through-research cruise, July- September 2001). 2002	E only
63	Improved Global Bathymetry – Final Report of SCOR Working Group 107. 2002	E only
64	R. Revelle Memorial Lecture, 2006: Global Sea Levels, Past, Present and Future. 2007	E only
65	Bruun Memorial Lectures, 2003: Gas Hydrates – a potential source of energy from the oceans. 2003	E only
66	Bruun Memorial Lectures, 2003: Energy from the Sea: the potential and realities of Ocean Thermal Energy Conversion (OTEC). 2003	E only

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

(continued)

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

106.	Exercise Pacific Wave 13. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1–14 May 2013. Vol. 1 Exercise Manual. 2013 Vol. 2 Summary Report. 2013	E only
107.	Tsunami Public Awareness and Educations Strategy for the Caribbean and Adjacent Regions. 2013	E only
108.	Pacific Tsunami Warning and Mitigation System (PTWS) Medium-Term Strategy, 2014−2021. 2013	E only
109.	Exercise Caribe Wave/Lantex 14. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 26 March 2014. Vol. 1 Participant Handbook. 2014	E/S
110.	Directory of atmospheric, hydrographic and biological datasets for the Canary Current Large Marine Ecosystem, 2nd edition: revised and expanded. 2016	E only
111.	Integrated Regional Assessments in support of ICZM in the Mediterranean and Black Sea Basins. 2014	E only
112.	11 April 2012 West of North Sumatra Earthquake and Tsunami Event - Post-event Assessment of IOTWS Performance	E only
113.	Exercise Indian Ocean Wave 2014: An Indian Ocean-wide Tsunami Warning and Communication Exercise.	E only
114.	Exercise NEAMWAVE 14. A Tsunami Warning and Communication Exercise for the North-Eastern Atlantic, the Mediterranean, and Connected Seas Region, 28–30 October 2014 Vol. 1 Manual Vol. 2 Evaluation Report – Supplement: Evaluation by Message Providers and Civil Protection Authorities	E only
115.	Oceanographic and Biological Features in the Canary Current Large Marine Ecosystem. 2015	E only
116.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Third Enlarged Communication Test Exercise (CTE3), 1st October 2013. Vol. 1 Exercise Manual Vol. 2 Evaluation Report	E only
117.	Exercise Pacific Wave 15. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 2–6 February 2015 Vol. 1: Exercise Manual; Vol. 2: Summary Report	E only
118.	Exercise Caribe Wave/Lantex 15. A Caribbean and Northwestern Atlantic Tsunami Warning Exercise, 25 March 2015 (SW Caribbean Scenario) Vol. 1: Participant Handbook	E only
119.	Transboundary Waters Assessment Programme (TWAP) Assessment of Governance Arrangements for the Ocean Vol 1: Transboundary Large Marine Ecosystems Vol 2: Areas Beyond National Jurisdiction	E only
120.	Status and Trends in Primary Productivity and Chlorophyll from 1996 to 2014 in Large Marine Ecosystems and the Western Pacific Warm Pool, Based on Data from Satellite Ocean Colour Sensors	*In preparation*
121.	Exercise Indian Ocean Wave 14, an Indian Ocean wide Tsunami Warning and Communications Exercise, 9–10 September 2014	*In preparation*
122.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas. Sixth Communication Test Exercise (CTE6), 29 July 2015. Vol. 1: Exercise Manual Vol. 2: Evaluation Report	E only
123	Preparing for the next tsunami in the North-Eastern Atlantic, the Mediterranean and Connected Seas – Ten years of the Tsunami Warning System (NEAMTWS)	*In preparation*
124	Indicadores Marino Costeros del Pacífico Sudeste / Coastal and Marine Indicators of the Southeast Pacific (SPINCAM)	E/S
125	Exercise CARIBE WAVE 2016: A Caribbean and Adjacent Regions Tsunami Warning Exercise, 17 March 2016 (Venezuela and Northern Hispaniola Scenarios) Volume 1: Participant Handbook	E only

(continued)

126	Exercise Pacific Wave 16. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 1-5 February 2016. Volume 1: Exercise Manual. Volume 2: Summary Report	E only
127	How to reduce coastal hazard risk in your community – A step by step approach	E only
128.	Exercise Indian Ocean Wave 2016: An Indian Ocean-wide Tsunami Warning and Communications Exercise, 7–8 September 2016 Vol 1: Participant Manual Vol. 2: Evaluation report (with supplements)	E only
129	What are Marine Ecological Time Series telling us about the Ocean – A status report	E only
130	Tsunami Watch Operations – Global Service Definition Document	E only
131	Exercise Pacific Wave 2017. A Pacific-wide Tsunami Warning and Enhanced Products Exercise, 15-17 February 2017. Volume 1: Exercise Manual	E only
132.	*In preparation*	
133.	Exercise CARIBE WAVE 17. A Caribbean and Adjacent Regions Tsunami Warning Exercise, 21 March 2017 (Costa Rica, Cuba and Northeastern Antilles Scenarios). Volume 1: Participant Handbook	E only