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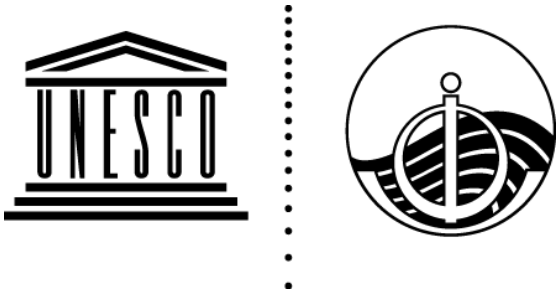

EXERCISE PACIFIC WAVE 11

A Pacific-wide Tsunami Warning and Communication Exercise

9–10 November 2011

Exercise Manual

Volume 1

UNESCO

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1. BACKGROUND

Most of the world's earthquakes and tsunamis occur in the Pacific Ocean and its marginal seas. On average, the Pacific is struck by a locally damaging tsunami every year or two, and by a major Pacific-wide tsunami a few times each century.

Over the past three years (2009–2011), the Pacific witnessed three destructive and deadly tsunamis that each placed PTWS (Pacific Tsunami Warning and Mitigation System) countries in various levels of warning for distant tsunamis. Locally, five 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 the largest deadly tsunami 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 tens of thousands of lives.

In the 11 March 2011 tsunami in Japan, arguably the most tsunami-prepared country in the world, more than 25,000 people lost their lives. In reviewing the Pacific Tsunami Warning System (IOC Technical Series, 92 [IOC/2010/TS/92] for 27 February 2010; and IOC Technical Series, 96 [IOC/2011/TS/96] for 11 March 2011), it can be said that while countries in general responded well to the 2010 and 2011 tsunamis as distant sources, there is still a need to reflect on how Member States can improve in responding to local tsunamis.

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 and tsunami that occurred off the coast of Chile, killing about 5,000 people locally and 138 persons, 22 hours later in Japan. 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 [IOC/INF-1124 rev.], Medium-Term Strategy 2009–2013 [ICG/PTWS-XXIII/3 (Rec. 5) and working document ICG/PTWS-XXIII/13]). 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 the PTWS and to identify changes that can improve its effectiveness. The first Pacific-wide exercise, "Exercise Pacific Wave 06" (IOC/INF-1244), was carried out on 16 and 17 May 2006 using Philippines and Chile tsunami sources. The second exercise "Exercise Pacific Wave 08" (IOC/2008/TS/82), was carried out from 28 to 30 October 2008 using a northeast Japan source.

At the Twenty-third Session of the ICG/PTWS held in Apia, Samoa, from 16 to 18 February 2009, Member States reviewed "Exercise Pacific Wave 08", its findings and recommendations. Acknowledging the common occurrence of large earthquakes in the Southwest Pacific and its ensuing tsunami hazard, and recognising exercises as a good vehicle to improve response readiness and publicise awareness of tsunamis, Member States recommended to hold a third Pacific-wide tsunami exercise to especially assist Pacific Island Countries in better preparing for the next tsunami.

At the Twenty-fourth Session of the ICG/PTWS held in Beijing, China, from 24 to 27 May 2011, Member States reviewed the proposal of the PTWS Exercise Task Team and approved the conduct of Exercise Pacific Wave 11 (Exercise Pacific Wave 11) on 9 and 10 November 2011

as a multi-scenario exercise to allow countries to improve their readiness for local and regional tsunamis (ICG/PTWS-XXIV/3, Rec. 3).

2. EXERCISE PURPOSE

The purpose (aim) of Exercise Pacific Wave 11 is to improve local and regional source tsunami warning and response capability in the Pacific.

The exercise provides an opportunity for Pacific countries to exercise their operational lines of communications, review their tsunami response procedures, and promote emergency preparedness. Regular exercises are important for maintaining staff readiness in case of a real event. This is especially true for tsunamis, which are infrequent, but when they occur, require a rapid response. Every Pacific country is encouraged to participate.

3. EXERCISE OBJECTIVES

There are three key objectives for Exercise Pacific Wave 11. Sub-objectives are noted as bullet points.

(i) To exercise and evaluate operations of the current PTWS:

- Validate the issuance of tsunami advice from the Pacific Tsunami Warning Center (PTWC), the Japan Meteorological Agency/Northwest Pacific Tsunami Advisory Center (JMA/NWPTAC) and the West Coast and Alaska Tsunami Warning Center (WCATWC).
- Validate receipt of this tsunami advice by Pacific Country Tsunami Warning Focal Points.

(ii) To begin a process of exposure to an initial test version of PTWC experimental products that are being developed to provide a more rapid and quantitative forecast of tsunami impacts:

- Review and evaluate PTWC experimental products that will be available in parallel with existing PTWC products for each scenario exercised.
- Provide feedback on the staging, format, and content of the experimental products.

(iii) To validate the readiness of Member States to respond to a local/regional source tsunami:

- Validate the operational readiness of the National Tsunami Warning Centre (NTWC), or similar in-country function, and/or the National Disaster Management Office (NDMO).
- Improve operational readiness. Before the exercise, ensure appropriate tools and response plan(s) have been developed, including public education materials.
- Validate dissemination of warnings and information/advice by National Tsunami Warning Centre to relevant in-country agencies and the public is accurate and timely.
- Validate the organisational decision-making process about public warnings and evacuations.
- Validate the methods used to notify and instruct the public are accurate and timely.

- Validate the elapsed time until the public would be notified and instructed/advised.

Countries may wish to consider additional objectives that take into account the use and value of public information material such as guiding response actions by the public to save their lives, especially in a local tsunami scenario. Validation of whether the public understands what to do, and whether authoritative messages to the public are useable and actionable (clear, concise and timely) are important to assess for effective tsunami warning.

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

4. EXPERIMENTAL PRODUCTS

In response to Recommendation ICG/PTWS-XXIII.1, Task Team on Enhancing Tsunami Warning Products, the PTWC has proposed new products based upon PTWC's improved capabilities in terms of its speed of response and growing ability to forecast impacts. Test products will be introduced with PacWave11, they will be developed and refined over the next two years, and then implemented operationally in 2013, after approval at the next session of the ICG/PTWS (ICG/PTWS-XXV).

Alerts will be threat-based rather than based strictly upon magnitude thresholds and time or distance to impact. Several levels of tsunami threat will be established, and forecast threat levels will be assigned to segments of extended coastlines or to island groups. The improvements should greatly reduce the number of areas warned unnecessarily and also provide some advance notice of potential local tsunamis. Details and PTWC experimental product explanations are provided in Annex I.

5. EXERCISE SCENARIO

Exercise Pacific Wave 11 will be held on 9 and 10 November 2011, and will involve multiple scenarios, played out in real time, to allow all Pacific countries to select and exercise a regional/local source tsunami event. Countries are recommended to choose only one scenario to exercise. However, countries may exercise more than one scenario simultaneously, if they wish. The exercise scenarios include major tsunamis generated by great earthquakes in the following areas:

- Kamchatka (Kuril–Kamchatka Trench)
- Ryukyu Islands (Nansei–Shoto Trench)
- Philippines–South China Sea (Manila Trench)
- Philippines–Pacific Ocean (Philippines Trench)
- Vanuatu (New Hebrides Trench)
- Tonga (Tonga Trench)
- Northern Chile (Peru–Chile Trench)
- Ecuador (Colombia–Ecuador Trench)
- Central America (Middle America Trench)
- Aleutian Islands (Aleutian Trench)

In each exercise scenario, the simulated tsunami will be propagate in real time. Each scenario will be started during the morning hours in the tsunami source region, and will last for approximately six to nine hours to simulate the earthquake occurrence, local/regional tsunami

propagation, and impact to nearby coasts. The scenarios and messages will terminate artificially since in real events most would continue for at least 24 hours.

The exercise will require Member State decision-making, including steps taken just prior to public notification. These steps may be played during the exercise dates in real time or in the following days. Member States may conduct the exercise through to the community level if they wish (however, this is not a requirement of the exercise).

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

A “How to Plan, Conduct and Evaluate Pacific Wave Exercises Guideline” (IOC/2011/MG/58) has been developed to aid countries in planning and conducting a tsunami exercise at a national and/or provincial level as part of Exercise Pacific Wave 11. This guideline is available at the PacWave11 website (www.pacwave.info).

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. ASSUMPTIONS

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

8. TYPES OF EXERCISES

Exercise Pacific Wave 11 will be carried out in a readiness style that aims to involve communication and decision making at government levels, without disrupting or alarming the general public. Individual countries, however, may at their discretion, elect to extend the exercise down to the level of actually notifying and evacuating the public. Stakeholder agencies involved in the end-to-end tsunami warning, including non-government agencies as well post-disaster response and the media, may be involved.

Exercises stimulate the development, training, testing, and evaluation of tsunami warning and emergency response plans and standard operating procedures. Exercise participants may use their own past tsunami or multi-hazard drills (e.g. flood, typhoon, earthquake, etc.) as a framework to conduct PacWave11.

Exercises can be conducted at various scales of magnitude and sophistication. The following are examples of types of exercises conducted by Disaster Management Agencies, in coordination with Tsunami Warning Centres.

8.1 ORIENTATION EXERCISE

An orientation exercise may also be referred to as a ‘walk through’, and it can be conducted through a workshop. It puts people in a place where they would work during a tsunami response, or uses them as participants in a demonstration of an activity. This type of exercise is used to familiarise the players with the activity.

An example of an orientation exercise would be setting up a mock welfare centre to take in tsunami evacuees, and walking staff through how the centre is organised.

8.2 DRILL EXERCISE

In a drill exercise, staff physically handle specific equipment or perform a specific procedure or a single operation. A drill usually focuses on a single organisation, facility, or agency such as a hotel, school, village, etc. The exercise usually has a time frame element and is used to test procedures. Performance is evaluated in isolation; a drill is a subset of a full-scale exercise.

An example of a drill exercise would be activating an Emergency Operations Centre or using alternative communications (such as radios) in a tsunami exercise. Within a warning centre, a drill might consist of the operations for a local tsunami warning, or just the communication notification procedures for a local tsunami.

8.3 TABLETOP EXERCISE

A tabletop exercise may also be 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 a 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 participants discussing their response to a tsunami threat in a particular area, where the only injects are tsunami messages from the international tsunami warning centres such as the PTWC in Hawaii, which describes the nature of the threat.

8.4 FUNCTIONAL EXERCISE

A functional exercise may be referred to as an ‘operational’ or a ‘tactical’ exercise. It takes place in an operational environment and requires participants to actually perform the functions of their roles.

A normally complex response activity is simulated, which may require multiple activities to carry out the response. Commonly, they involve the testing of standard operating procedures (SOPs) and internal/external communications between organisations. It lacks only the people "on the ground" to create a full-scale exercise.

Participants interact within a simulated environment through an exercise control group who provide prewritten injects and respond to questions and tasks developing out of the exercise.

An example of a functional exercise would be a multi-agency response to a devastating tsunami, where evacuation of a coastal community is required. Messages and injects are provided by exercise control and are handled by the participants in the way described in their standard operating procedures.

Functional exercises may also just focus on a specific aspect of warnings, such as command and control activities of emergency operations centres or the communications flow and procedures from international to national to provincial levels.

8.5 FULL-SCALE EXERCISE

A full-scale exercise may be referred to as a 'practical' or 'field' exercise. These include the movement or deployment of people and resources to include physical response 'on the ground' to a simulated situation. It could be labeled as the climax of a progressive exercise programme.

These exercises are typically used to test all aspects of a country's warning and emergency management systems and processes, using actual centres and communications methods. They can be 'ground' focused only or may include the higher-level response structures, and they can be simple (single agency) or complex (multi-agency, multi-levels of government from national to local).

Full-scale exercises are the largest, most costly, most-time consuming, and most complex to plan, conduct, and evaluate.

An example of a full-scale exercise would be a tsunami warning, dissemination, and emergency response with a school evacuating, volunteers portraying 'victims', and emergency services using real rescue equipment. Coordinated, multi-agency response to the event is exercised. Actual field mobilisation and deployment of response personnel are conducted.

8.6 SAMPLE TIME FRAMES FOR EXERCISE DEVELOPMENT

The different exercise types require different amounts of preparation and conduct time. The following table provides a general idea of how much time is necessary.

Exercise Type	Preparation Period	Duration	Comments
Orientation Exercise	Simple, 1 week	1–2 hours	Single agency/department, cross-sectional staff.
Drill	Simple, 1–2 weeks	1–4 hours	Functional staff.
Tabletop Exercise	Complex, but inexpensive1–3 months	2–4 hours, or longer	Single or multiple agency, staff of the same level with a warning/response role.
Functional Exercise	Complex, but expensive, 6–18 months	4 hours to 1 or more days	Multiple Agency participation, all staff with warning/response roles for that function.
Full-scale Exercise	Complex, and the most expensive, 6–18 months	2 hours to 1 or more days	Multiple Agency (National and International), all or specific staff with warning/response roles.

9. EXERCISE PARTICIPATION

All Pacific countries are encouraged to participate in the exercise. However, it is up to each country to decide what level of governmental participation they will undertake. This could take the form of international to national, national to provincial, and/or provincial to local government.

Each country's lead agency and its PacWave11 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 PacWave11 Exercise Evaluation Form based on in-country feedback.

10. EXERCISE DOCUMENTATION

The Exercise Pacific Wave 1 planning should take into account the following documents:

- IOC Circular Letter No 2390: PTWS Pacific-wide Tsunami Exercise 'PacWave11', 9–10 November 2011, dated 13 May 2011.
- Exercise Pacific Wave 1, A Pacific-wide Tsunami Warning and Communication Exercise, including post-exercise evaluation forms (August 2011) (IOC/2011/TS/97)
- Exercise Pacific Wave 11 flyer
- ICG/PTWS-XXIII, Recommendation 2 on PTWS Exercises (2009)
- ICG/PTWS-XXIV, Recommendation 3 on PTWS Exercises (2011)
- 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 Tsunami Exercises, IOC Manuals and Guides No 58, July 2011.

All information related to Exercise Pacific Wave 11 is available at the exercise website: http://www.pacwave.info

11. EXERCISE PRODUCTS

All international products will be provided online at the Exercise Pacific Wave 11 website (http://www.pacwave.info) in advance to help countries plan and prepare. It is recommended to download from the PacWave11 website, the international products for the appropriate scenario prior to the day of the exercise. This is in order to be ready to further disseminate to other national, provincial and/or local government agencies during the actual exercise.

To avoid any possible misinterpretation, the only products issued by the international warning centres will be to start each scenario and they will be in a "dummy" exercise message format (Annexes II to IV) that will only indicate the start of a specific scenario.

All documentation and correspondence relating to this exercise is to be clearly identified as **Exercise Pacific Wave 11** and **For Exercise Purposes Only**.

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

12. EXERCISE DELIVERY/FORMAT

The international tsunami warning centres participating in Exercise Pacific Wave 11 will be the Pacific Tsunami Warning Center (PTWC) in Hawaii, USA, the West Coast and Alaska Tsunami Warning Center (WC/ATWC) in Alaska, USA, and the Northwest Pacific Tsunami Advisory Center (NWPTAC) in Tokyo, Japan.

Each scenario will start with a dummy 'Exercise Start Message' message disseminated from the appropriate international warning centre(s). Different scenarios start at different times and there will be a different start message for each scenario. No other messages will be disseminated by the international centres. Distribution of the series of simulated international messages for each scenario, available on the exercise website, will be the responsibility of each country.

Each Exercise Pacific Wave 11 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 Planning Team may choose to feed the bulletins into the exercise at times of their own choosing, or alternatively put them in envelopes with the time they must be opened written on each, with each key participant agency having their own set of envelopes.

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

Participant countries may elect to exercise according to their own timelines in order to achieve their particular objectives. For example, a particular country's Exercise Planning Team may decide to hold the exercise on another date to avoid conflict with other important national events.

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

The Master Schedule of Events List (MSEL) is a detailed sequence of events used by Exercise Control staff to ensure that the exercise runs smoothly. The Master Schedule of Events List should only be circulated to Exercise Control staff and not to exercise participants.

The International Master Schedule of Events List (MSEL) giving the timeline for issuance of international products, and the product types are given in Annex V, Table V.1. WMO product identifiers are given in Annex V, Table V.2.

Each country's Exercise Control Team will be responsible for executing their International and National Master Schedule of Events List. National level injects will be the responsibility of the National Exercise Control Team and provincial or local level injects should be the responsibility of the Provincial Exercise Control Team.

12.2 TRACKING PROGRESS/OUTPUTS OF INJECTS

Sustaining exercise activity is achieved by the continuous injection of exercise information to the participants. This needs to be closely monitored to ensure that the information is released

at an appropriate time. Depending on how well participants react to the injects, the rate of injects in addition to the tsunami warning products (international and national or local), may need to be increased or slowed down. It may be necessary to add or remove injects to suit the pace of the exercise.

Exercise Control staff will need to monitor and follow up injects to determine the extent to which the actions they generate have been achieved. Injects are linked to exercise objectives and key performance indicators. The Exercise Director has the discretion to speed up or slow down exercise play, as long as this does not interfere with the overall exercise objectives. If your agency is struggling to keep up with the pace of the exercise, inform the Exercise Control team at the next level. Note that the rate of International Tsunami Bulletins is locked in, and will not be modified.

13. POST-EXERCISE EVALUATION

All exercises should have a learning focus. Learning is maximised when there is a continuous process of review to draw out the lessons identified. Review is the process of evaluating and validating the exercise. The exercise should test an agency's Standard Operating Procedures (SOPs). Areas that agencies are encouraged to evaluate include, but are not limited to:

- Are there written SOPs for staff to follow?
- Are there templates or other pre-scripted communications to make the response faster and standardised?
- Have stakeholders been educated on what they should expect, when, and what they should do with the information your agency provides?

A review and hot and cold debrief should evaluate the effectiveness of arrangements in place and identify if there are any corrective actions. The hot and cold debriefs are then used to complete the Exercise Pacific Wave 11 evaluation forms.

All participating countries are asked to provide feedback through the PacWave11 Evaluation Form (Annex VI) within 90 days (by 12 February 2012) of the exercise. Forms should be submitted online by visiting https://www.surveymonkey.com/s/pacwave11_eval. This feedback will greatly assist in the evaluation of Exercise Pacific Wave 11 and assist in the development of subsequent exercises.

13.1 DEBRIEFING

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

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

Each agency that participates in PacWave11 is expected to conduct its own debriefs after the exercise. This may take the form of a hot debrief (or hotwash) on the day of the exercise, with each participating agency conducting its own cold (formal) debrief within the week(s) following the exercise.

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

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

A useful guide to debriefing is one used by New Zealand Ministry of Civil Defence & Emergency Management (ISBN 0-478-25467-9). It can be found at: http://www.civildefence.govt.nz/memwebsite.nsf/Files/Information_Series/$file/DeBriefing%20Info%20Book.pdf

13.2 VALIDATION

The final stage of the exercise process is to determine whether or not the exercise has met its objectives. Exercise Pacific Wave 11 validation compares the performance of the PTWS, countries, and/or agencies and participants during the exercise against performance expected. After validation, the PTWS, countries, or agencies may need to change or develop new plans, procedures, and training programmes. Exercise outcomes may be retested in future tsunami exercises, or new exercises written to meet newly identified needs.

13.3 EVALUATION CRITERIA

There will be two types of evaluation criteria. The first type will be international criteria based on the overall exercise objectives (see Section 3 above). These are provided in Annex VI. 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 will only require the international evaluation from each participating country.

13.4 EVALUATORS

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

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

13.5 OBSERVERS

Exercise Pacific Wave 11 may generate interest within the wider sector or local community. Visitors from other agencies (whether local or international) may be invited to observe various exercise activities. Media may also be invited to observe as a way of helping to increase tsunami awareness. Some media may also participate or be simulated, if they are part of the official warning and evacuation dissemination chain.

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

13.6 EVALUATION TOOLS

The goal of exercise evaluation is to validate strengths and identify opportunities for improvement within the participating organisations. This is to be accomplished by collating supporting data; analysing the data to compare effectiveness against requirements; and determining what changes need to be made by participating organisations, as well as the PTWS as a coordinating group to support effective tsunami warning and decision making.

Evaluation of this exercise will focus on the adequacy of plans, policies, procedures, assessment capabilities, communication, resources and inter-agency/inter-jurisdictional relationships that support effective tsunami warning and decision-making at all levels of government. Participants that choose to include additional objectives, for example by exercising public warning and/or response plans, can expand the evaluation form accordingly. The evaluation of such additional objectives will be for the use of the particular participating agency only, and is not required for the PTWS Exercise Pacific Wave 11 Summary Report.

The evaluation tool aims to inform and facilitate individual participant country evaluations as well as the Exercise Pacific Wave 11 Summary Report.

Official Exercise Evaluation Forms addressing the respective focus areas and objectives are included in Annex VI. It is requested that the Evaluation Form be completed online at:

https://www.surveymonkey.com/s/pacwave11_eval

All participant countries are required to complete the official Exercise Evaluation Form and return only this form electronically to the Exercise Task Team within 90 days after the exercise (by 12 February 2012). The form is available at:

https://www.surveymonkey.com/s/pacwave11_eval

It is recommended that independent and objective exercise evaluators/observers be appointed at all exercise points to support the collection of such data. Evaluators/observers are to be guided by the exercise objectives and the information required in the Exercise Evaluation Forms.

In completing evaluation forms, participating organisations must have the ability to note areas for improvement and the actions that they plan to take without concern that the information carries political or operational risks. Thus, the official Exercise Evaluation Form is designated as “For Official Use Only” and will be restricted for use by the Exercise Task Team for the sole purpose of compilation of the Exercise Pacific Wave 11 Summary Report. Some participant countries may, however, decide to share their individual evaluation outcomes with the public.

13.7 EXERCISE PACIFIC WAVE 11 SUMMARY REPORT

The Exercise Task Team will compile the Exercise Pacific Wave 11 Summary Report based on the Evaluation Forms received. The report will include the following:

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

In order to finalise the Summary Report, the PTWS PacWave11 Task Team will meet jointly with the PTWS Enhancing Products Task Team in May 2012.

The PacWave11 Summary Report will be submitted to the ICG/PTWS and IOC, and posted to the PTWS website. The Summary Report is expected to be completed in June 2012.

14. REAL EVENTS DURING EXERCISE PLAY

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

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

15. RESOURCING

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

16. MEDIA ARRANGEMENTS

The UNESCO Bureau of Public Information will issue an international Media Advisory one week before the development of the Exercise Pacific Wave 11 providing details of the exercise.

ICG/PTWS Member States should consider issuing one or two exercise press releases 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.

A second Member State press release, one week before the exercise, in conjunction with the UNESCO release, would provide a more detailed description of exercise activities to take place within that country.

Annex VII 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 PacWave11 website (www.pacwave.info).

ANNEX I

PTWC EXPERIMENTAL PRODUCTS

Recommendation ICG/PTWS-XXIII.1 (Enhancing Tsunami Warning Products) established a Task Team on Enhancing Tsunami Warning Products under PTWS Working Group 2 (WG2, Detection, Warning and Dissemination) to:

- Review current capabilities,
- Obtain customer feedback,
- Consider best practices,
- Develop recommendations to improve existing or create new products, and
- Improve dissemination for more effective, functional, and timely delivery.

At the Task Team 1 Meeting in March 2011 (see PTWS WG2 Report Annex for March Task Team WG2 Report), the Director of PTWC proposed new products based upon PTWC's improved capabilities in terms of its speed of response and growing ability to forecast impacts. These were approved by WG2.

Further discussion took place at the PTWC-JMA Coordination meeting in Honolulu, Hawai, from 11 to 13 April, with an agreement to the following general changes in an experimental phase starting with PacWave11, and be operationally ready in 2013. (ICG/PTWS-XXIV Annex V and Annex II).

- *PTWC will lower its current initial warning advice threshold from magnitude 7.6 to magnitude 7.1 in order to provide some advance notice of potential local tsunamis.*
- *PTWC will begin using tsunami forecast models to classify the level of threat for sections of coast around the Pacific. Five levels of tsunami threat or potential threat will be established, and supplemental products will be issued.*

While the predictive capabilities of the forecast models are not perfect, they should be accurate enough to greatly reduce the number of areas warned unnecessarily, while also providing general guidance on the expected levels of impact to areas that are threatened.

At the ICG/PTWS-XXIV Meeting in May 2011, the ICG approved the recommendation of WG2 to move forward towards the implementation of these new products and it established the PTWS Enhancing Products Task Team to advise PTWC on their development (Recommendation ICG/PTWS-XXIV.1 on PTWS Governance). The initial step is to introduce the products to Member States for the scenarios of the PacWave11 Exercise and for the Task Team to review feedback and recommend changes or other improvements.

The following describes the essential features of the new products and their underlying procedures, at least as they are envisioned at this time.

PRODUCTS

The new suite of experimental products will include text as well as graphical products.

Standard Text Product

A standard text-only product, when fully implemented, will continue to be disseminated over the public and media accessible GTS circuit, as well as via AFTN, fax, email, EMWIN and other methods. It will contain key information about the forecast threat, the generating earthquake, estimated arrival times, and tsunami observations. The terms "warning" and "watch" that imply levels of alert will no longer be used, but will be replaced by discrete forecast threat levels. Text

products will continue to include the preliminary earthquake parameters – origin time, hypocentre (latitude, longitude, depth), and magnitude. They will continue to include the estimated arrival time of the first tsunami wave at key forecast points within threatened areas. They will also continue to include measurements of tsunami waves observed at coastal or deep-ocean gauges.

Other Text Products

More comprehensive and detailed tables of the forecast threat levels, arrival times, and observations, than those that appear in the standard text product, will only be available (when implemented) but only by dissemination methods such as email and/or a website that can handle the larger volume content of text content.

Graphical Products

The information created by numerical tsunami forecast models is probably most effectively communicated through the use of graphical products, particularly maps. These too can only be disseminated (when implemented) by methods such as email and/or a website that can handle that type of content.

Energy Map

One experimental graphical product will be a map of the Pacific region showing the location of the earthquake and the maximum tsunami amplitude at each point over the entire ocean, as indicated by a shaded color scale. Such plots provide a general sense of how the tsunami energy is directed away from the source and how it is focused or de-focused by bathymetric features as it crosses the ocean.

Threat Map

Another experimental graphical product will be a map of the Pacific region showing the expected threat level along coastal segments and for island groups, as indicated respectively by colored coastal line segments or oceanic areas shaded in color.

CRITERIA

The new criteria for designating threat levels in the experimental products will be based primarily upon numerical tsunami forecast models, rather than on the earthquake magnitude, the distance to the earthquake, or the time remaining until first tsunami arrival. It should be noted that because of the requirement for quick analysis, initial numerical tsunami forecasts will be based only on the preliminary seismic analysis, and therefore only a crude forecast is possible because the source is insufficiently constrained in this early time. As a consequence, the assignment of initial threat levels will be made very conservatively and limited to areas most immediately threatened or potentially threatened. Only after the numerical forecast models are sufficiently constrained and/or validated by later seismic analyses and tsunami wave observations can threat levels be assigned more wholely from the models and for zones covering up to the entire ocean basin, as appropriate.

PRODUCT STAGING

Tsunami warning operations must constantly strike a balance between the need to provide guidance as quickly as possible, and the need to provide guidance that is as accurate as possible. Consequently, the first message product will be designed to provide the quickest possible alert to areas closest to the earthquake and contain only a conservative, concise, and very preliminary analysis of the threat. Subsequent messages issued over approximately the next hour may significantly modify the threat levels due to changes in the earthquake parameters, or due to the initial sea level readings. Only after sufficient tsunami signals have been recorded on the nearest deep ocean sensors will the tsunami have been characterized

sufficiently that the threat levels should become stable. At this time, threat levels can be assigned and extended to far-reaching areas, if appropriate.

GUIDANCE ON HOW TO USE PRODUCTS IN PACWAVE 11

For Exercise Pacific Wave 11, the draft PTWC experimental products should be reviewed by all participants who normally receive and review the existing PTWC products during events.

However, it is recommended that countries continue to base their exercise actions on the existing PTWC products (e.g., Tsunami Information Bulletins, Watches and Warnings). This is because these experimental products are early in their development, and with country feedback, may change significantly over the next two years before they become official. Further, should an actual tsunami event occur before the new products become operational (planned in 2013/2014), Member State procedures and actions should continue to be based upon PTWC's existing products.

The purpose of distributing the experimental products for PacWave11 is to obtain feedback from participating Member States on the content, format, and staging of the proposed products to enable them to be as useful and effective as possible to each Member State. Information and feedback is requested in the Post-Exercise Evaluation Form (Annex VI) on the following questions:

- Is the use of threat levels and their criteria [no threat (<0.3m), potential threat, marine threat (0.3-1m), land threat (1-3m), major land threat (>3m)] versus warnings and watches useful and effective? Are these the right categories of threat?
- Does the suite of proposed products (standard text alerting product, energy distribution map, threat level map, comprehensive table of estimated first wave arrival times, and comprehensive table of threat levels for each coastal segment or island group) provide all the necessary information?
- What are the best way(s) to minimize any adverse effects should the forecast change significantly over the first hour or two as critical seismic and sea level data are received and analysed?
- How should extended coasts be divided into segments? How should boundaries to the segments be assigned? How should island groups be divided?
- How should changes in threat levels (as the forecast evolves with better data) be handled: a) Let threat levels change as the forecast dictates; b) Let threat levels increase, but not decrease prior to wave arrival; c) apply some other criteria automatically or manually?

FORECAST LIMITATIONS AND UNCERTAINTIES

Past PTWC procedures and criteria were developed prior to having the capability of producing tsunami forecasts in real time based on numerical models. Numerical forecast models now implemented at PTWC make it possible to more precisely define where a tsunami threat exists, as well as to assess the level of that threat. However, there are limitations. The two most critical unknowns in numerical forecasting are: 1) How the seafloor deformed (e.g., uplifted or dropped down in the vertical direction over different areas of seafloor near the earthquake epicentre) as this physically is the initiator of the tsunami wave; and 2) How the tsunami will be modified as it approaches the coast from deep water and then interacts in complex (non-linear) ways with the coastal bathymetry and topography.

Seafloor deformation can initially be estimated within a few minutes after the earthquake from the earthquake's location, depth, and magnitude. But, this is typically a crude estimate. Within about half-an-hour, the earthquake fault mechanism describing the faulting properties (e.g.,

how the two tectonic plates slipped or interacted) then becomes available, and this provides a better estimate of seafloor deformation. Finally, after one to two hours, tsunami observation readings from the nearest deep-ocean, sea-level gauges are received, and these then provide the most direct constraint on the area and size of seafloor deformation; but it is still just an estimate.

Using the estimated seafloor deformation at the source, and bathymetry of the ocean basin, an accurate tsunami simulation can be numerically generated and the wave propagated across the ocean basin fairly accurately as long as water depths are much, much less than the amplitude of the tsunami. However, as a tsunami wave shoals, the numerical problem becomes much more complex, and requires increasingly finer-scale grids of the coastal bathymetry and topography. The U.S. has been producing inundation forecast models based upon such gridded data for a limited number of domestic coastal locations identified as having a high tsunami risk. None, however, are available for international coasts.

To make estimates of tsunami amplitudes along international coasts, PTWC relies on “Green’s Law” (Synolakis, 1990) that relates the amplitude of a wave at one ocean depth to its amplitude at another ocean depth. The law is accurate for the situation of a uniformly decreasing ocean depth and a straight coastline. It is less accurate for complex near-shore bathymetry and/or irregular coastlines. The ‘Green’s Law’ approximation only provides an estimate of the maximum tsunami amplitude (how much above normal sea level the tsunami) at the coastline; it does not provide estimates of maximum run-up on shore, expected inundation limits, time of maximum, number of hazardous waves, etc. Nevertheless, for the recent major Pacific tsunamis (Samoa 2009, Chile 2010, and Japan 2011), this method did provide reasonable estimates of the general level of threat to the coastlines around the Pacific.

For users of the PTWC tsunami forecasts, it is important to understand these limitations. Knowledge about the source, upon which the forecast everywhere depends, is very limited initially (first 10 minutes) since only the earthquake location and magnitude are known, but characterization of the source typically improves after the first few hours as further seismic data and analysis and tsunami observations, are received. It is also very important to know that the estimates of the tsunami amplitude at the coast provide only the general level of threat, and that variations from the forecast may occur due to the limitations of the assumptions used.

SAMPLE PRODUCTS

The following are samples of the new experimental products. Some aspects of these products are still being finalized. Only a standard text product, tsunami energy map, and tsunami threat map are included here. The example products are for a great earthquake off the coast of Kamchatka, Russia, and a time of dissemination less than an hour after the earthquake. This is before the model source has been constrained by deep ocean observations, and therefore, before the threat levels have been extended across the entire Pacific.

All of the experimental products for the Exercise Pacific Wave 11 scenarios, as well as a complete description of their content and the procedures and criteria used in their creation, will be posted on the exercise website (http://www.pacwave.info) well in advance of the exercise.

Standard Text Product Sample

WEPA40 PHEB 092245
TSUPAC

TSUNAMI MESSAGE NUMBER 2
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
2245 UTC WED NOV 09 2011

THIS BULLETIN APPLIES TO AREAS WITHIN AND BORDERING THE PACIFIC OCEAN AND ADJACENT SEAS...EXCEPT ALASKA...BRITISH COLUMBIA... WASHINGTON...OREGON AND CALIFORNIA. FOR INFORMATION REGARDING THE TSUNAMI THREAT TO THOSE AREAS GO TO HTTP://WCATWC.ARH.NOAA.GOV

... A TSUNAMI THREAT IS CURRENTLY UNDERWAY ...

THERE IS THE HIGH PROBABILITY THAT A MAJOR TSUNAMI CAPABLE OF PRODUCING A WIDESPREAD HAZARD WAS GENERATED BY AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 9.0 THAT OCCURRED NEAR THE EAST COAST OF KAMCHATKA...RUSSIA AT 2200 UTC ON NOVEMBER 9, 2011.

THE FOLLOWING THREAT LEVELS ARE CURRENTLY FORECAST.

- MAJOR LAND INUNDATION THREAT
  RUSSIA

- LAND INUNDATION THREAT
  JAPAN / GUAM / HAWAII

- MARINE THREAT
  TAIWAN / PHILIPPINES / NORTHERN MARIANAS / YAP / POHNPEI / KOSRAE / CHUUK / BELAU / MARSHALL ISLANDS / MIDWAY ISLAND

- NO THREAT
  PDR KOREA / REP OF KOREA / CHINA / VIETNAM / CAMBODIA / THAILAND / MALAYSIA / BRUNEI

- STANDBY
  ALL OTHER AREAS OF THE PACIFIC REGION COVERED BY THIS MESSAGE

THREAT LEVELS ARE ISSUED AS ADVICE TO GOVERNMENT AGENCIES. ONLY NATIONAL AND LOCAL GOVERNMENT AGENCIES HAVE THE AUTHORITY TO MAKE DECISIONS REGARDING THE OFFICIAL STATE OF ALERT IN THEIR AREA AND ANY ACTIONS TO BE TAKEN IN RESPONSE. PERSONS IN THREATENED AREAS SHOULD FOLLOW INSTRUCTIONS FROM THEIR LOCAL GOVERNMENT OFFICIALS.

A COMPREHENSIVE MAP AND TABLE OF TSUNAMI THREAT LEVELS FOR EACH COASTAL SEGMENT OR ISLAND GROUP COVERED BY THIS CENTER CAN BE FOUND AT HTTP://PTWC.WEATHER.GOV

&&

THREAT LEVEL DEFINITIONS

MAJOR LAND INUNDATION THREAT - SEA LEVEL IS CURRENTLY FORECAST TO RISE BY AT LEAST 3 METERS ABOVE NORMAL AT THE COAST DUE TO THE TSUNAMI WAVES. TSUNAMIS OF THIS SIZE ARE CAPABLE OF CAUSING GREAT DESTRUCTION AND LOSS OF LIFE IN AFFECTED COASTAL AREAS.

LAND INUNDATION THREAT - SEA LEVEL IS CURRENTLY FORECAST TO RISE BY AT LEAST 1 METER ABOVE NORMAL AT THE COAST, BUT GENERALLY NOT MORE THAN 3

METERS, DUE TO THE TSUNAMI WAVES. TSUNAMIS OF THIS SIZE ARE A SIGNIFICANT THREAT TO HUMAN LIFE AND ARE CAPABLE OF FLOODING COASTAL AREAS AND DAMAGING OR DESTROYING COASTAL STRUCTURES.

MARINE THREAT - SEA LEVEL IS CURRENTLY FORECAST TO RISE BY AT LEAST 0.3 METERS ABOVE NORMAL AT THE COAST, BUT NOT MORE THAN 1 METER, DUE TO TSUNAMI WAVES. TSUNAMIS OF THIS SIZE ARE A HAZARD FOR RECREATIONAL AND OTHER ACTIVITIES IN COASTAL WATERS DUE TO STRONG AND UNUSUAL CURRENTS. THEY CAN ALSO CAUSE STRONG CURRENTS AND MINOR FLOODING IN HARBORS

STANDBY - THESE AREAS MAY ALSO HAVE A TSUNAMI THREAT AND SHOULD STANDBY FOR FURTHER INFORMATION. THE FORECAST IS STILL BEING REFINED.

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PRELIMINARY EARTHQUAKE PARAMETERS

ORIGIN TIME - 2200Z 09 NOV 2011
COORDINATES - 52.5 NORTH 159.5 EAST
DEPTH - 20 KM
LOCATION - OFF EAST COAST OF KAMCHATKA
MAGNITUDE - 9.0

&&

TSUNAMI CHARACTERISTICS

A TSUNAMI IS A SERIES OF WAVES THAT CAN CAUSE SEA LEVEL TO RISE AND FALL MANY TIMES AT THE COAST OVER A PERIOD OF HOURS TO DAYS. THE FIRST WAVE MAY NOT BE THE LARGEST. THE TIME BETWEEN WAVES CAN RANGE FROM 5 MINUTES TO AN HOUR. THE SEAFLOOR MAY...OR MAY NOT...BECOME EXPOSED AT THE COAST PRIOR TO INUNDATION. TSUNAMI IMPACTS CAN VARY GREATLY ALONG A COAST DUE TO LOCAL EFFECTS. TSUNAMI WAVES CAN TRAVEL AT SPEEDS OF 800KM/HR OR MORE IN THE DEEP OCEAN...BUT ARE NOT A HAZARD IN DEEP WATER AND PASS UNNOTICED BY SHIPS AT SEA. TSUNAMI WAVES SLOW DOWN AND GROW IN AMPLITUDE AS THE DEPTH OF THE SEA DECREASES NEAR SHORE. THEY ARE VERY LONG WAVES THAT CAN EASILY WRAP AROUND ISLANDS AND AFFECT COASTS FACING ALL DIRECTIONS. TSUNAMIS CAN TRAVEL FOR A LONG DISTANCE UP RIVERS AND STREAMS AND CAUSE FLOODING ALONG THE BANKS.

&&

ESTIMATED ARRIVAL TIMES

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES AT POINTS WITHIN THE AREAS CURRENTLY FORECAST TO BE UNDER A TSUNAMI THREAT.

LOCATION	FORECAST POINT	COORDINATES	ARRIVAL TIME
RUSSIA	PETROPAVLOVSK_K	53.2N 159.6E	2230Z 09 NOV
	UST_KAMCHATSK	56.1N 162.6E	2251Z 09 NOV
	MEDNNY_IS	54.7N 167.4E	2314Z 09 NOV
	URUP_IS	46.1N 150.5E	2324Z 09 NOV
	SEVERO_KURILSK	50.8N 156.1E	2348Z 09 NOV
JAPAN	KUSHIRO	42.9N 144.3E	0010Z 10 NOV
	HACHINOHE	40.5N 141.5E	0050Z 10 NOV
	KATSUURA	35.1N 140.3E	0100Z 10 NOV
	SHIMIZU	32.8N 133.0E	0221Z 10 NOV
	OKINAWA	26.2N 127.8E	0337Z 10 NOV
MARCUS IS.	MARCUS_IS.	24.3N 154.0E	0149Z 10 NOV
MIDWAY IS.	MIDWAY_IS.	28.2N 182.6E	0207Z 10 NOV
WAKE IS.	WAKE_IS.	19.3N 166.6E	0229Z 10 NOV

N. MARIANAS	SAIPAN	15.3N 145.8E	0314Z 10 NOV
GUAM	GUAM	13.4N 144.7E	0334Z 10 NOV
MARSHALL IS.	ENIWETOK	11.4N 162.3E	0348Z 10 NOV
	KWAJALEIN	8.7N 167.7E	0400Z 10 NOV
	MAJURO	7.1N 171.4E	0422Z 10 NOV
HAWAII	NAWILIWILI	22.0N 200.6E	0357Z 10 NOV
	HONOLULU	21.3N 202.1E	0411Z 10 NOV
	KAHULUI	20.9N 203.5E	0417Z 10 NOV
	HILO	19.7N 204.9E	0435Z 10 NOV
TAIWAN	HUALIEN	24.0N 121.7E	0357Z 10 NOV
	HUALIEN	24.0N 121.6E	0358Z 10 NOV
	TAITUNG	22.7N 121.2E	0401Z 10 NOV
	CHILUNG	25.2N 121.8E	0429Z 10 NOV
	KAOHSIUNG	22.5N 120.3E	0444Z 10 NOV
	HOMEL	24.2N 120.4E	0628Z 10 NOV
JOHNSTON IS.	JOHNSTON_IS.	16.7N 190.5E	0400Z 10 NOV
YAP	YAP_IS.	9.5N 138.1E	0410Z 10 NOV
PHILIPPINES	PALANAN	17.1N 122.6E	0420Z 10 NOV
	LAOAG	18.2N 120.6E	0445Z 10 NOV
	LEGASPI	13.2N 123.8E	0451Z 10 NOV
	SAN_FERNANDO	16.6N 120.3E	0505Z 10 NOV
	DAVAO	6.8N 125.7E	0518Z 10 NOV
	ZAMBOANGA	6.9N 122.1E	0655Z 10 NOV
	ILOILO	10.7N 122.5E	0714Z 10 NOV
	MANILA	14.6N 121.0E	0723Z 10 NOV
	PUERTO_PRINCESA	9.8N 118.8E	0741Z 10 NOV
POHNPEI	POHNPEI_IS.	7.0N 158.2E	0420Z 10 NOV
KOSRAE	KOSRAE_IS.	5.5N 163.0E	0423Z 10 NOV
CHUUK	CHUUK_IS.	7.4N 151.8E	0449Z 10 NOV
BELAU	MALAKAL	7.3N 134.5E	0450Z 10 NOV

A COMPREHENSIVE TABLE OF ESTIMATED ARRIVAL TIMES CAN BE FOUND AT
HTTP://PTWC.WEATHER.GOV

&&

WE ADVISE ALL AREAS, INCLUDING THOSE NOT NAMED IN THE THREAT, TO MONITOR THE SITUATION CLOSELY. THE CURRENT FORECAST MAY CHANGE BASED ON ADDITIONAL DATA, MODIFYING THE AREA THREATENED AND/OR MODIFYING THE EXPECTED LEVEL OF THREAT.

MESSAGES WILL BE ISSUED HOURLY OR SOONER AS CONDITIONS WARRANT.

THE JAPAN METEOROLOGICAL AGENCY MAY ALSO ISSUE TSUNAMI MESSAGES FOR THIS EVENT TO COUNTRIES IN THE NORTHWEST PACIFIC AND SOUTH CHINA SEA REGION. IN CASE OF CONFLICTING INFORMATION... THE MORE CONSERVATIVE INFORMATION SHOULD BE USED FOR SAFETY.

THE WEST COAST/ALASKA TSUNAMI WARNING CENTER WILL ISSUE PRODUCTS FOR ALASKA...BRITISH COLUMBIA...WASHINGTON...OREGON...CALIFORNIA.

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Sample Tsunami Energy Forecast Map

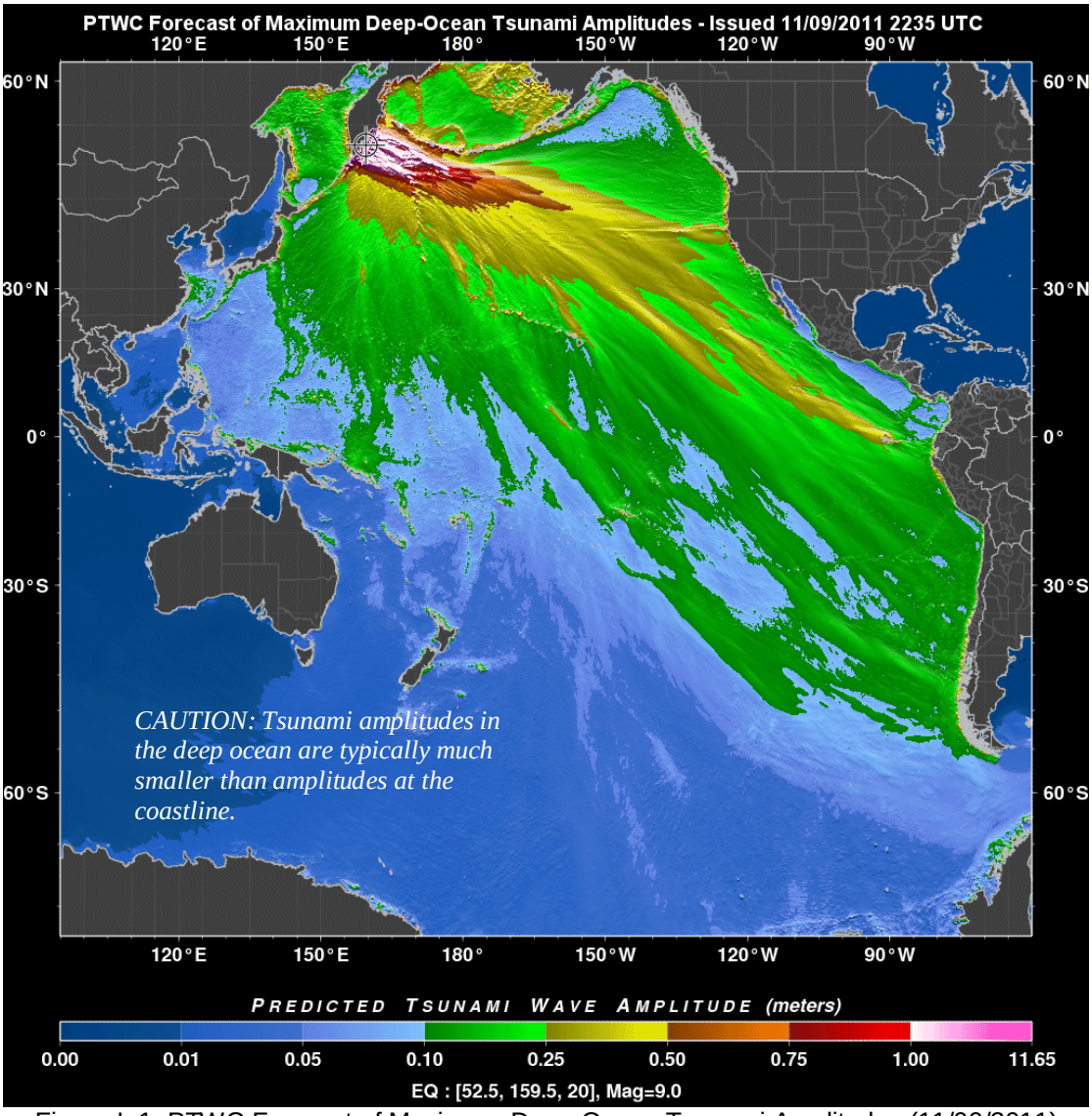

Figure I–1. PTWC Forecast of Maximum Deep-Ocean Tsunami Amplitudes (11/09/2011)

This map above shows, for the simulated tsunami, the maximum wave amplitudes across the Pacific. The amplitudes forecasted would be used by PTWC to assess and assign a threat level to different coastal segments. It is important to understand that the deep ocean amplitudes shown here are small compared with amplitudes at the coastline.

The map gives an indication of the directionality of the tsunami from the source, how the tsunami energy is focused and defocused by bathymetric features, how amplitudes decay with distance from the source by spreading, and areas shadowed from the tsunami by intervening land masses.

It is important to understand that the deep-ocean tsunami amplitudes shown here are small compared with amplitudes at the coastline.

Sample Coastal Tsunami Threat Map

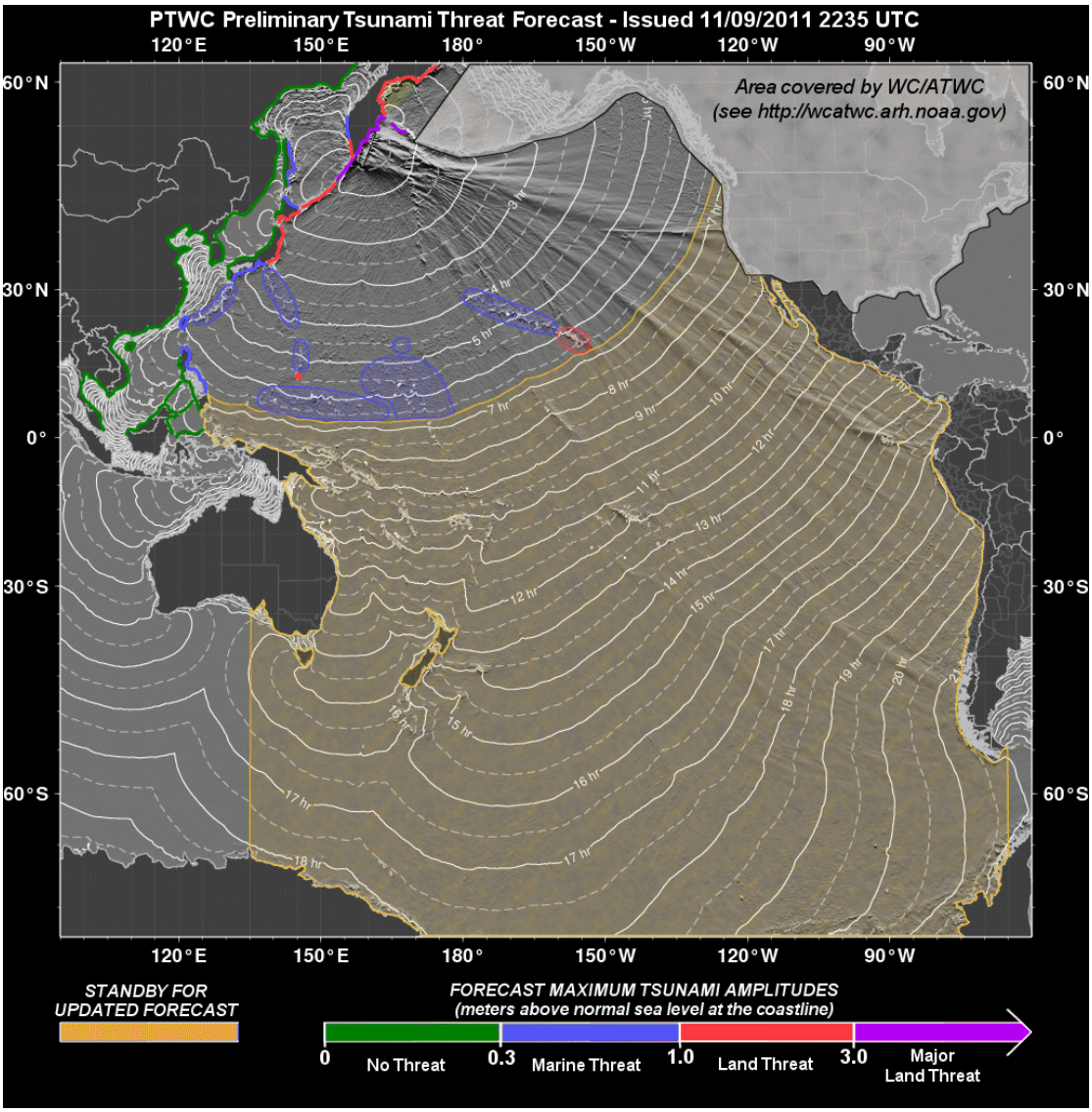

Figure I–2. PTWC Preliminary Tsunami Threat Forecast (11/09/2011)

This example threat map (Figure I–2) is intended to be a map that could be created just 35 minutes after the earthquake. At this time, the forecast model would be based only on the earthquake parameters, and not yet compared to, or constrained by sea level observations. For that reason, the area of forecast issued by PTWC would be limited to coasts located within about 6 hours travel time of the first tsunami wave, and to coasts where no threat would reasonably be expected (such as inside the South China Sea). All other areas are requested to standby for an updated forecast that is expected to be more accurate.

ANNEX II

PTWC DUMMY EXERCISE MESSAGE

The following is an example of the dummy message that will be issued by the Pacific Tsunami Warning Center during Exercise Pacific Wave 11. The dummy messages serve as substitutes for the first actual bulletin that would be issued by PTWC for each scenario. Only one message, this first dummy message, will be issued for each scenario.

All actual bulletins for each scenario are posted on the PacWave11 website (http://www.pacwave.info). They will include the current PTWS message products (from PTWC, JMA/NWPTAC, WCATWC) as well as the PTWC experimental products.

Please download messages for your scenario from the website. The country's Exercise Control Team is responsible for issuing all remaining PTWC bulletins according to the timetable after the PTWC dummy message triggers Bulletin 1

SAMPLE PTWC DUMMY MESSAGE

```
TEST... PACWAVE 11 TSUNAMI EXERCISE MESSAGE ...TEST
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
1308 UTC WED NOV 9 2011

TO:  PARTICIPANTS OF THE PACWAVE 11 TSUNAMI EXERCISE.
     ALL OTHERS PLEASE IGNORE.

SUBJECT:  EXERCISE PACWAVE 11 – NORTHERN CHILE SCENARIO

THIS MESSAGE IS A PROXY FOR PTWC BULLETIN 1 OF THE PACWAVE 11 EXERCISE
NORTHERN CHILE SCENARIO. IT IS ONE OF A SERIES OF MESSAGES THAT ARE BEING
ISSUED BY THE PACIFIC TSUNAMI WARNING CENTER FOR EACH EXERCISE SCENARIO.
THE EXERCISE IS DESIGNED TO TEST COMMUNICATIONS AND ACTIONS OF THE PACIFIC
TSUNAMI WARNING SYSTEM THAT WOULD BE NEEDED IN THE EVENT OF AN ACTUAL
TSUNAMI.

PARTICIPANTS IN THE EXERCISE SHOULD REFER TO THE PACWAVE 11 EXERCISE
MANUAL AND PACWAVE 11 EXERCISE WEB SITE FOR PTWC BULLETIN 1 OF THE
NORTHERN CHILE SCENARIO. SEE WWW.PACWAVE.INFO – USE LOWER CASE FOR WEB
SITE.

THIS IS ONLY AN EXERCISE.

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ANNEX III

WC/ATWC DUMMY EXERCISE MESSAGE

The following message is the first exercise message that will be issued by the West Coast and Alaska Tsunami Warning Center during Exercise Pacific Wave 11.

Subsequent messages for each scenario are posted on the PacWave11 website (http://www.pacwave.info). Messages will consist of existing PTWS message products (PTWC, JMA/NWPTAC, WCATWC) and PTWC experimental products.

Please download messages for your scenario from the website. The country's exercise control team is responsible for issuing the remaining messages after WCATWC Bulletin 1.

SAMPLE WC/ATWC DUMMY MESSAGE.

```
WEPA41 PAAQ 231805
TSUWCA

TEST...TSUNAMI MESSAGE NUMBER 1...TEST
NWS WEST COAST/ALASKA TSUNAMI WARNING CENTER PALMER AK
0145 PM PDT TUE NOV 10 2011

... PACWAVE 11 TSUNAMI EXERCISE MESSAGE. REFER TO
    WCATWC MESSAGE 1 AT THE EXERCISE WEB SITE.
    THIS IS AN EXERCISE ONLY...

THIS MESSAGE IS BEING USED TO START OFF THE PACWAVE 11 TSUNAMI EXERCISE.
THE EXERCISE IS DESIGNED TO TEST COMMUNICATIONS AND ACTIONS THAT WOULD BE
NEEDED IN THE EVENT OF AN ACTUAL TSUNAMI.

PARTICIPANTS IN THE EXERCISE SHOULD REFER TO THE EXERCISE PACWAVE 11
EXERCISE MANUAL AND PACWAVE11 WEB SITE FOR SCENARIO WC/ATWC BULLETIN 1 AT
WWW.PACWAVE.INFO - USE LOWER CASE FOR WEB SITE.

THIS IS ONLY AN EXERCISE.

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ANNEX IV

NWPTAC DUMMY EXERCISE MESSAGE

The following message is the first exercise message that will be issued by the Northwest Pacific Tsunami Advisory Center (NWPTAC) during Exercise Pacific Wave 11.

Subsequent messages for each scenario are posted on the PacWave11 website (http://www.pacwave.info). Messages will consist of existing PTWS message products (PTWC, JMA/NWPTAC, WCATWC) and PTWC experimental products.

Please download messages for your scenario from the website. The country's Exercise Control Team is responsible for issuing the remaining messages after NWPTAC Bulletin 1.

SAMPLE NWPTAC DUMMY MESSAGE

```
WEPA40 RJTD 092210
(STX)
TEST...PACWAVE 11 TSUNAMI EXERCISE MESSAGE NUMBER 001...TEST
ISSUED BY NWPTAC (JMA)
ISSUED AT 2210Z 09 NOV 2011

PACWAVE 11 TSUNAMI EXERCISE - KAMCHATKA SCENARIO.
REFER TO NWPTAC BULLETIN 1 OF THE KAMCHATKA SCENARIO AT THE
EXERCISE WEB SITE.

THIS IS ONLY AN EXERCISE.

THIS MESSAGE IS A PROXY FOR NWPTAC BULLETIN 1 OF THE PACWAVE 11
EXERCISE KAMCHATKA SCENARIO. THE EXERCISE IS DESIGNED TO TEST
COMMUNICATIONS AND ACTIONS THAT WOULD BE NEEDED IN THE EVENT OF
AN ACTUAL TSUNAMI.

PARTICIPANTS IN THE EXERCISE SHOULD REFER TO THE PACWAVE 11
EXERCISE MANUAL AND PACWAVE 11 WEB SITE FOR NWPTAC BULLETIN 1
OF THE KAMCHATKA SCENARIO AT WWW.PACWAVE.INFO – USE LOWER CASE FOR WEB
SITE.

THIS IS ONLY AN EXERCISE.
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(ETX)
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ANNEX V

INTERNATIONAL MASTER SCHEDULE OF EVENTS LIST (MSEL)

Scenario		North Chile		Ecuador		Central Amer.		Aleutian Islands				Tonga Trench		Vanuatu		Kamchatka				Ryukyu Trench				Philippine Trench				Manila Trench			
Centre		PTWC		PTWC		PTWC		PTWC		WCATWC		PTWC		PTWC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC		PTWC		NWPTAC	
Date (UTC)	Time (UTC)	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP	#	TYP
11/09	13:00	Quake																													
11/09	13:08	**1**	**RW**																												
11/09	13:45	2	RW																												
11/09	14:00			Quake																											
11/09	14:08			**1**	**RW**																										
11/09	14:45	3	PW	2	RW																										
11/09	15:00					Quake																									
11/09	15:08					**1**	**RW**																								
11/09	15:45	4	PW	3	PW	2	RW																								
11/09	16:45	5	PW	4	PW	3	PW																								
11/09	17:45	6	PW	5	PW	4	PW																								
11/09	18:00							Quake																							
11/09	18:05									**1**	**WW**																				
11/09	18:10							**1**	**RW**																						
11/09	18:45	7	PW	6	PW	5	PW	2	RW	2	WW																				
11/09	19:15									3	WW																				
11/09	19:45	8	PW	7	PW	6	PW	3	PW	4	WW																				
11/09	20:15									5	WW																				
11/09	20:45	9	PW	8	PW	7	PW	4	PW	6	WW																				
11/09	21:00											Quake																			
11/09	21:08											**1**	**RW**																		
11/09	21:15									7	WW																				
11/09	21:45	10	PW	9	PW	8	PW	5	PW	8	WW	2	RW																		
11/09	22:00													Quake		Quake															
11/09	22:08													**1**	**RW**	**1**	**RW**														
11/09	22:10																	**1**	**TAB**												
11/09	22:15									9	WW																				
11/09	22:45			10	PW	9	PW	6	PW	10	WW	3	PW	2	RW	2	RW														
11/09	22:50																	2	TAB												
11/09	23:00																			Quake											
11/09	23:05																					1	TAB								
11/09	23:10																			1	RW										
11/09	23:15									11	WW																				
11/09	23:45					10	PW	7	PW	12	WW	4	PW	3	PW	3	PW	3	TAB	2	RW										
11/09	23:50																					2	TAB								
11/10	00:00																							Quake							
11/10	00:08																							1	RW						
11/10	00:10																									1	TAB				
11/10	00:15									13	WW																				
11/10	00:45							8	PW	14	WW	5	PW	4	PW	4	PW	4	TAB	3	PW	3	TAB	2	RW						
11/10	00:50																									2	TAB				
11/10	01:15									15	WW																				
11/10	01:45							9	PW	16	WW	6	PW	5	PW	5	PW	5	TAB	4	PW	4	TAB	3	PW	3	TAB				
11/10	02:00																													Quake	
11/10	02:08																											1	RW		
11/10	02:10																													1	TAB
11/10	02:15									17	WW																				
11/10	02:45							10	PW	18	WW	7	PW	6	PW	6	PW	6	TAB	5	PW	5	TAB	4	PW	4	TAB	2	RW		
11/10	02:50																													2	TAB
11/10	03:45											8	PW	7	PW	7	PW	7	TAB	6	PW	6	TAB	5	PW	5	TAB	3	SW	3	TAB
11/10	04:45											9	PW	8	PW	8	PW	8	TAB	7	PW	7	TAB	6	PW	6	TAB	4	SW	4	TAB
11/10	05:45											10	PW	9	PW	9	PW	9	TAB	8	PW	8	TAB	7	PW	7	TAB	5	SW	5	TAB
11/10	06:45													10	PW	10	PW	10	TAB	9	PW	9	TAB	8	PW	8	TAB	6	SW	6	TAB
11/10	07:45																			10	PW	10	TAB	9	PW	9	TAB	7	SW	7	TAB
11/10	08:45																							10	PW	10	TAB				

Table V–1. All Scenarios – International Master Schedule of Event List

A Dummy Message will only be issued from the participating Centres for Bulletin 1 of each scenario.

Legend Table V–1:

Centres		
PTWC	US NWS Pacific Tsunami Warning Center	
WCATWC	US NWS West Coast and Alaska Tsunami Warning Center	
NWPTAC	JMA Northwest Pacific Tsunami Advisory Center	
Bulletin Types (TYP)		
PTWC	RW	Regional Warning Watch
	PW	Pacific-Wide Warning
WC/ATWC	WW	Warning Watch Advisory
NWPTAC	TAB	Tsunami Advisory Bulletin

Product types and dissemination methods for Dummy Exercise Bulletins:

Center	WMO Product ID	GTS	AFTN	EMWIN	Fax	Email
NWPTAC	WEPA40 RJTD	Yes	No	No	Yes	Yes
PTWC	WEPA40 PHEB	Yes	Yes	Yes	Yes	Yes
WC/ATWC	WEPA41 PAAQ	Yes	Yes	Yes	Yes	Yes
	WEAK51 PAAQ	Yes	Yes	Yes	Yes	Yes

Table V–2. Product Types and Dissemination Methods

ANNEX VI

POST-EXERCISE EVALUATION

Exercise evaluation forms are to be completed by each participating agency and forwarded to the country Exercise Pacific Wave 11 National Contact, or the country Tsunami National Contact. The PacWave11 National Contact will compile the country Evaluation Form and complete and submit this online no later than 12 February 2012 (within 90 days of exercise).

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

The PacWave11 Evaluation Form can be found at
https://www.surveymonkey.com/s/pacwave11_eval

Alternatively, the country evaluation forms can be submitted by email or fax to the Exercise PacWave 11 Task Team Chairs:

- Laura Kong (email: l.kong@unesco.org, fax: +1 808 532 5576), or
- Jo Guard (email: jo.guard@dia.govt.nz, fax: +64 4 473 9596).

Exercise Pacific Wave 11 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. **Note:** Objectives will be completed before, during and/or after the exercise. This information is noted at the top of each page for each objective. Make sure you are familiar with when each objective should be evaluated.
3	Each participating Agency/Country	• Answer each statement with either Y (Yes), N (No), or Not Applicable (N/A) by ticking the relevant box. • Comments should be used to explain/expand your Yes, No, or Not Applicable answers. • Tick the C (Comment) box to indicate if you are providing comments. • Write your comments on the page following the evaluation questions. Note the question number in the left column and write your comments alongside. **Example:** ☑ Y ☐ N ☑ C ☐ NA **Ref No.Comment** 1 C.7 The national public safety decision-making and dissemination point received information at 14:35 UTC.
4	Each participating Agency/Country	Send completed agency evaluation form to country PacWave11 National Contact so he/she can compile to complete Country PacWave11 Evaluation Form (this URL).
5	PacWave11 National Contact	PacWave11 National Contact should complete and submit the PacWave11 Evaluation Form by 12 February 2012 (https://www.surveymonkey.com/s/pacwave11_eval). If there are problems or questions, please contact the PacWave11 Task Team co-Chairs (Laura Kong, l.kong@unesco.org; Jo Guard, jo.guard@dia.govt.nz)

Exercise Pacific Wave 11 Evaluation Form Contact Details			
Agency:		**Country:**	
Contact Name:		**Contact Position:**	
Contact Phone:		**Contact Mobile:**	
Contact E-Mail:			

Country Exercise Scenario	
Scenario Used:	**Tick Scenario(s) used during PacWave11:** O Kamchatka (Kuril–Kamchatka Trench) O Ryukyu Islands (Nansei–Shoto Trench) O Philippines – South China Sea (Manila Trench) O Philippines – Pacific Ocean (Philippines Trench) O Vanuatu (New Hebrides Trench) O Tonga (Tonga Trench) O Northern Chile (Peru–Chile Trench) O Ecuador (Colombia–Ecuador Trench) O Central America (Middle America Trench) O Aleutian Islands (Aleutian Trench)

OBJECTIVE 1

To exercise and evaluate operations of the current PTWS.

The evaluation of this objective must be completed **during** PacWave 11.

SUB OBJECTIVE 1A

Validate the issuance of tsunami advice from the PTWC, JMA/NWPTAC and WCATWC.

Who should complete this part of the form?

International Tsunami Warning Centres ONLY

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
1A.1	The information issued by the relevant international Tsunami Warning Centres was according to standard operating procedures.	Y	N	C	NA
1A.2	What time was the initial PTWC, NWPTAC and/or WCATWC Exercise PacWave11 scenario exercise start message issued to the national tsunami warning centres? Please note the time using 24 hour clock and UTC, e.g., 14:35 UTC.	*Note time on the following comment page*			
1A.3	The initial PTWC, NWPTAC and/or WCATWC Exercise Pacific Wave 11 scenario exercise start message was sent to national tsunami warning centres by the following methods. Please tick all methods that apply: O GTS O AFTN O EMWIN O Fax O Email O CISN(Real-Time Earthquake Display) O RANET Heads-up SMS O Other (Please specify):	*Note other methods on the following comment page*			

You may add additional individual agency evaluation statements in the section below. Insert as many lines as you need.

	Y	N	C	NA
	Y	N	C	NA

Please reference each comment with the relevant reference number from the previous page.
If you require more room use additional blank sheets.

Ref No	Comments
1A.2	
1A.3	

OBJECTIVE 1

To exercise and evaluate operations of the current PTWS.

The evaluation of this objective must be completed **during** PacWave 11.

SUB OBJECTIVE 1B

Validate the receipt of tsunami advice by PTWS Tsunami Warning Focal Points (TWFP).

Who should complete this part of the form? All agencies/countries

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
1B.1	The information issued by your country national Tsunami Warning Focal Point was according to standard operating procedures.		Y		N		C		NA
1B.2	The information issued by our national tsunami warning centre was timely.		Y		N		C		NA
1B.3	The information issued by our national public-safety, decision-making and dissemination point was timely.		Y		N		C		NA
1B.4	Is the national public-safety, decision-making and dissemination point different to the national tsunami warning centre?		Y		N		C		NA
1B.5	The initial PTWC, NWPTAC and/or WCATWC PacWave11 scenario exercise start message was received by our country TWFP.		Y		N		C		NA
1B.6	What time was the initial PTWC, NWPTAC and/or WCATWC PacWave11 scenario exercise start message received by our TWFP? Please indicate the time from each international TWC. Please note time using 24 hour clock and UTC, e.g., 14:35 UTC. – PTWC: – NWPTAC – WCATWC	*Note time on the following comment page*			
1B.7	How did the TWFP receive the international message(s)? Please indicate for each international TWC if they are different.	*Note other methods and TWCs on the following comment page*			

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
	Please tick all methods that apply: O GTS O AFTN O EMWIN O Fax O Email O CISN (Real-Time Earthquake Display) O RANET Heads-up SMS O Other (Please specify):				
1B.8	If the national public-safety, decision-making and **dissemination point** is different to the country/national TWFP, what time did the national public-safety, decision-making and **dissemination point receive the information**?Please indicate the time from each international TWC. Please note the time using 24 hour clock and UTC, e.g., 14:35 UTC.			*Note time on the following comment page*	
1B.9	How did the national public safety decision-making and dissemination point receive the international message(s)? Please indicated for each international TWC if they are different. Please tick all methods that apply: O GTS O AFTN O EMWIN O Fax O Email O CISN (Real-Time Earthquake Display) O RANET Heads-up SMS O Other (Please specify):			*Note other methods and TWCs on the following comment page*	
1B.10	Were there any problems with the receipt of initial PTWC, NWPTAC and/or WCATWC Exercise PacWave11 scenario exercise start message(s)? Please specify in comments on following page.		*Y*		*N*		*C*		*NA*
1B.11	Information provided in the relevant international warning centre messages was understood by the National Tsunami Warning Centre (NTWC)/National Disaster Management Office (NDMO).		*Y*		*N*		*C*		*NA*

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
1B.12	The information provided assisted with decision making, e.g., warning levels, earthquake parameters, estimated arrival times, forecast wave heights, etc.	Y	N	C	NA
1B.13	The information provided was fully utilised by the NTWC/NDMO.	Y	N	C	NA
1B.14	Existing in-country hazard information/local data was utilised.	Y	N	C	NA
1B.15	Additional in-country local/regional expert advice was utilised.	Y	N	C	NA
1B.16	If you answered yes to Q1B.15, what agency or agencies did you consult?	*Note agencies on the following comment page*			

You may add additional individual agency evaluation statements in the section below. Insert as many lines as you need.				
	Y	N	C	NA
	Y	N	C	NA

Please reference each comment with the relevant reference number from the previous page.
If you require more room use additional blank sheets.

Ref No	Comments
1B.6 – 9, 15	

OBJECTIVE 2

To begin a process of exposure to an initial test version of PTWC experimental products.

This objective must be completed **during** PacWave11.

SUB OBJECTIVE 2A

Review and evaluate PTWC experimental products that will be available in parallel with existing PTWC products for each scenario exercised.

Who should complete this part of the form? All agencies/countries

Ref No	Evaluation Statements / Questions	Yes	No	Comment	Not applicable
2A.1	The information contained in the experimental products is understandable.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
2A.2	The information contained in the experimental products helps with your decision-making.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
2A.3	What features of the experimental products are most useful? (*Note on the following comment page)*	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
2A.4	What if any, features need to be changed?	*Note on the following comment page*			
2A.5	What if any new features should be added in the experimental products?	*Note on the following comment page*			

You may add additional individual agency evaluation statements in the section below. Insert as many lines as you need.				
	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*

SUB OBJECTIVE 2A

Review and evaluate PTWC experimental products that will be available in parallel with existing PTWC products for each scenario exercised.

Who should complete this part of the form? All agencies/countries

Ref No	Comments
2A.3	
2A.4	
2A.5	

OBJECTIVE 2
To begin a process of exposure to an initial test version of PTWC experimental products.
This objective must be completed **during** PacWave11.
SUB OBJECTIVE 2B
Provide feedback on the staging, format and content of the experimental products
Who should complete this part of the form? All agencies/countries

Ref No	Evaluation Statements / Questions	Yes		No		Comment		Not applicable	
2B.1	Staging: Should forecast threat levels be included in the initial first product, knowing that forecasts are likely to change over the first hour as later-arriving seismic data and sea level data are received and analysed?		*Y*		*N*		*C*		*NA*
2B.2	Staging: Should forecast threat levels be given only for coasts within 6 hours of the estimated tsunami arrival time in initial products, knowing that initial forecasts will be based only upon the seismic parameters?		*Y*		*N*		*C*		*NA*
2B.3	Format: Does the primary text product contain the right information? If not, please specify what additional information is wanted. Consider information on the earthquake and the tsunami, and whether the evaluation description is adequate.		*Y*		*N*		*C*		*NA*
2B.4	Format: Does the proposed suite of products– primary text product, energy map, threat map, table of threat levels, table of arrival times– provide all the necessary information?Please note on comment page.		*Y*		*N*		*C*		*NA*
2B.5	Content: Are there other information or products that should be included in the suite of products? Consider earthquake and tsunami information, and/or threat assessment products. Please note on comment page.		*Y*		*N*		*C*		*NA*
2B.6	Content: Are the proposed forecast zones appropriate? If not, please suggest better zonations.		*Y*		*N*		*C*		*NA*
2B.7	Content: Are the proposed forecast levels: 0–0.3m, 0.3–1m, 1–3m, >3m adequate?		*Y*		*N*		*C*		*NA*
2B.8	Content: Should there be a 5th level to describe for extreme tsunamis (e.g., 2004 Sumatra or 2011 Tohoku)? If yes, please specify the forecast level.		*Y*		*N*		*C*		*NA*

You may add additional individual agency evaluation statements in the section below. Insert as many lines as you need.

☐ *Y* ☐ *N* ☐ *C* ☐ *NA*

Please reference each comment with the relevant reference number from the previous page.
If you require more room use additional blank sheets.

Ref No	Comments

OBJECTIVE 3

To validate the readiness of Member States to respond to a local/regional source tsunami.

This objective must be completed **before** PacWave11.

SUB OBJECTIVE 3A

Validate the operational readiness of the National Tsunami Warning Centre (NTWC) (or like function) and/or the National Disaster Management Office (NDMO).

Who should complete this part of the form? **All agencies/countries**

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
3A.1	The NTWC/NDMO has an activation and response process (standard operating procedures) in place for the receipt of tsunami warnings.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
3A.2	The NTWC/NDMO knows its specific response role in the event of a tsunami.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
3A.3	The NTWC/NDMO has, prior to the exercise, engaged in tsunami response planning.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
3A.4	The NTWC/NDMO has undertaken activity to increase its capacity and capability to support a national tsunami response (for example, training, exercise, etc)–Note activities in Comment section.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
3A.5	The NTWC/NDMO has an appropriate management structure identified and documented to support tsunami response.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
3A.6	The NTWC/NDMO has a tsunami mass coastal evacuation plan.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*

You may add additional individual agency evaluation statements in the section below. Insert as many lines as you need.								
	☐	*Y*	☐	*N*	☐	*C*	☐	*NA*

Ref No	Comments

OBJECTIVE 3

To validate the readiness of Member States to respond to a local/regional source tsunami.
This objective must be completed **before** PacWave11.

SUB OBJECTIVE 3B

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

Who should complete this part of the form? All agencies/countries

Ref No	Evaluation Statements / Questions	Yes	No	Comment	Not applicable
3B.1	Arrangements to assemble the in-country disaster management group relevant to decision-making on tsunami warning and response were in place **before** the exercise.	*Y*	*N*	*C*	*NA*
3B.2	A country tsunami emergency response plan (standard operating procedures) for regional/local tsunamis exists.	*Y*	*N*	*C*	*NA*
3B.3	Public education materials were developed and disseminated prior to the exercise.	*Y*	*N*	*C*	*NA*
3B.4	Regional/local tsunami exercises are routinely conducted in-country. Note last exercise in Comments section.	*Y*	*N*	*C*	*NA*
3B.5	Tsunami-related curriculum programmes are in place for all levels of education. Note which levels in Comments section.	*Y*	*N*	*C*	*NA*
3B.6	Communities have tsunami evacuation maps, routes, evacuation signs and assembly points for evacuation areas? Please note any gaps and future plans to fill gaps.	*Y*	*N*	*C*	*NA*

You may add additional individual agency evaluation statements in the section below. Insert as many lines as you need.					
	Y	*N*	*C*	*NA*	

Ref No	Comments
3B.4–6	

OBJECTIVE 3

To validate the readiness of Member States to respond to a local/regional source tsunami.

This objective must be completed **during** PacWave11.

SUB OBJECTIVE 3C

Validate dissemination of warnings and information/advice by National Tsunami Warning Centres to relevant in-country agencies and the public is accurate and timely.

Who should complete this part of the form? All agencies/countries

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
3C.1	The response activation process was followed when the initial PTWC, NWPATC and/or WCATWC Exercise PacWave11 scenario exercise start message was received.	*Y*	*N*	*C*	*NA*
3C.2	The warning was disseminated to:				
	• Emergency services	*Y*	*N*	*C*	*NA*
	• Other national government agencies	*Y*	*N*	*C*	*NA*
	• Science agencies/universities involved in assessment	*Y*	*N*	*C*	*NA*
	• Local government: provincial/regional level	*Y*	*N*	*C*	*NA*
	• Local government: city/district level.	*Y*	*N*	*C*	*NA*
	• Public				
3C.3	What time was the initial PTWC, NWPATC and/or WCATWC Exercise PacWave11 scenario exercise start message sent to the agency or agencies listed in Q3.C2? Please note the time using 24 hour clock and UTC, e.g., 14:35 UTC.	*Note time on the following comment page*			
3C.4	How did you send the initial PTWC, NWPATC and/or WCATWC Exercise PacWave11 scenario exercise start message to the agency or agencies listed in Q3.C2?	*Note methods on the following comment page*			

SUB OBJECTIVE 3C

Validate dissemination of warnings and information/advice by National Tsunami Warning Centres to relevant in-country agencies and the public is accurate and timely.

Who should complete this part of the form? All agencies/countries

Ref No	Evaluation Statements / Questions	Yes	No	Comment	Not applicable
3C.5	The method of communication <u>from</u> our public-safety, national decision-making and dissemination point to us was sufficient (timely, clear, accurate) to support decision-making.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
3C.6	The method of communication between our public safety national decision making and dissemination point and individual response agencies and provinces/local jurisdictions was sufficient to support national information requirements and decision-making.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
3C.7	Did a management group responsible for decision-making on tsunami warning and response assemble during the exercise?	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
3C.8	If you answered yes to Q 3C.7 (above), how many minutes/hours did it take for your management group to assemble after receiving the initial Exercise PacWave11 exercise start message?	*Note time on the following comment page*			
3C.9	If you answered yes to Q 3C.7 (above), was this timely to facilitate good decision-making?	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*

You may add additional individual agency evaluation statements in the section below. Insert as many lines as you need.				
	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*

Please reference each comment with the relevant reference number from the previous page.
If you require more room use additional blank sheets.

Ref No	Comments
3C.3	
3C.4	
3C.8	
3C.9	

OBJECTIVE 3

To validate the readiness of Member States to respond to a local/regional source tsunami.

This objective must be completed **during** PacWave11.

SUB OBJECTIVE 3D

Validate the organisational decision-making process about public warnings and evacuations.

Who should complete this part of the form? All agencies/countries

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
3D.1	Did the national disaster management organisation (or equivalent) maintain communication with the National Tsunami Warning Centre throughout the event?				
3D.2	If you answered yes to Q3D.1, what was the nature of the communication **between the national disaster management organisation** (or equivalent) with the **national tsunami warning centre** throughout the event?	*Note answer on the following comment page*			
3D.3	Did the national disaster management organisation (or equivalent) maintain communication with local/regional disaster management organisations (or equivalent)?				
3D.4	If you answered yes to Q3D.3, what was the nature of the communication **between the national disaster management organisation** (or equivalent) **with local/regional** disaster management organisations (or equivalent)?	*Note answer on the following comment page*			
3D.5	Were any areas evacuated?				
3D.6	If you answered yes to Q3D.5, please specify the following: • The area(s) evacuated (name of the town or community) • The time they were evacuated (use 24-hour clock in UTC time) • Estimated number of people evacuated	*Note answer on the following comment page*			
3D.7	Were tsunami **inundation** maps available for evacuated areas?				
3D.8	Were tsunami **evacuation** maps available for evacuated areas?				
3D. 9	Did your tsunami warning centre use any numerical model tsunami scenarios during the exercise (e.g., Deep-ocean propagation and/or coastal inundation models?)				

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
3D.10	How did your country assess the tsunami threat during the exercise? Please tick as many as apply: O National tsunami experts O National tsunami coordination committee O National tsunami historical database O NGDC/WDC-MGG tsunami historical database (web) O TsuDig historical database GIS tool (NGDC/ITIC offline) O National pre-computed tsunami scenarios O National tsunami forecasts O International tsunami forecasts. Note source of forecasts (PTWC, NWPTAC, WC/ATWC) in Comments. O Communication with outside sources (such as ITIC, media, other).Please specify:			*Note answer on the following comment page*	

You may add additional individual agency evaluation statements in the section below. Insert as many lines as you need.								
	☐	*Y*	☐	*N*	☐	*C*	☐	*NA*

Please reference each comment with the relevant reference number from the previous page.
If you require more room use additional blank sheets.

Ref No	Comments
3D.2	
3D.4	
3D.6	
3D.10	

OBJECTIVE 3

To validate the readiness of Member States to respond to a local/regional source tsunami.
This objective must be completed **during** PacWave11.

SUB OBJECTIVE 3E Validate the methods used to notify and instruct the public are accurate and timely.
Who should complete this part of the form? **All agencies/countries**

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
3E.1	Was a tsunami warning and/or information issued to the public?	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
3E.2	If you answered yes to Q3E.1 note: • Type of information that was released to the public (no action, prepare, evacuate). • Whom it was issued by, and • The time it was issued (use 24 hour clock in UTC time).	*Note answer on the following comment page*			
3E.3	If you answered yes to Q3E.1, how was the warning/information communicated with the public? Please tick as many as apply: ____Telephone ____ SMS ____Cell/mobile phone broadcast ____Public radio ____ Public TV ____Twitter ____Facebook ____ RSS ____Websites ____Sirens ____ Public Announcement systems ____Police ____ Public call centre ____Door-to-door announcements ____Other (please specify):	*Note answer on the following comment page*			

You may add additional individual agency evaluation statements in the section below. Insert as many lines as you need.				
	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*

Please reference each comment with the relevant reference number from the previous page. If you require more room use additional blank sheets.

Ref No	Comments
3E.2	
3E.3	

OBJECTIVE 3 **To validate the readiness of Member States to respond to a local/regional source tsunami.** This objective must be completed **during** PacWave11.

SUB OBJECTIVE 3F
Validate the elapsed time until the public would be notified and instructed/advised.

Who should complete this part of the form? All agencies/countries

Ref No	Evaluation Statements/Questions	Yes	No	Comment	Not applicable
3F.1	The public were officially notified prior to the scenario wave arrival time	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*

You may add additional individual agency evaluation statements in the section below. Insert as many lines as you need.				
	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*

Please reference each comment with the relevant reference number from the previous page.
If you require more room use additional blank sheets.

Ref No	Comments

GENERAL OBSERVATIONS
Please complete this section **after** Exercise Pacific Wave 11.

Ref No	Evaluation Statements / Questions	Yes	No	Comment	Not applicable
	Overall assessment				
4.1	The Agency has a better understanding of the goals, responsibilities and roles in civil defence emergencies.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
4.2	Gaps in capability and capacity have been identified.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
4.3	The Agency enhanced its external relationships and identified its interdependencies as a result of the exercise.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
	Exercise planning (please make comments on the following page to all of the statements below)	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
4.4	Overall, the exercise planning, conduct, format and style were satisfactory.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
4.5	Exercise planning at the **international level** went well.	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*
4.6	Exercise planning at the **national level**	☐ *Y*	☐ *N*	☐ *C*	☐ *NA*

Ref No	Evaluation Statements / Questions	Yes	No	Comment	Not applicable
	went well.				
4.7	Exercise planning at the **provincial/local level** went well.	*Y*	*N*	*C*	*NA*
4.8	The PacWave11 exercise website pages were useful.	*Y*	*N*	*C*	*NA*
4.9	The PacWave11 exercise website pages were updated in a timely manner.	*Y*	*N*	*C*	*NA*
4.10	This evaluation form was easy to use.	*Y*	*N*	*C*	*NA*
4.11	PacWave11 Exercise Manual provided an appropriate level of detail.	*Y*	*N*	*C*	*NA*
4.12	The How to Plan, Conduct, and Evaluate Tsunami Exercises guideline was useful.	*Y*	*N*	*C*	*NA*

Please provide a general statement on your Exercise Pacific Wave 11 experience.
You may comment about international, national, provincial and/or local level aspects.

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

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)

THIRD PACIFIC-WIDE TSUNAMI DRILL SET FOR NOVEMBER

(Insert country name) will join over (insert number) other countries around the Pacific Rim as a participant in a mock tsunami scenario during 9–10 November 2011. The purpose of this Pacific-wide exercise is to increase preparedness, evaluate response capabilities in each country and improve coordination throughout the region to a regional or local source tsunami.

"The recent events of the 2009 Samoa Islands, 2010 Chile and the March 2011 Japan tsunamis have increased our need to be more prepared for such events," said (insert name of appropriate official). "This important exercise will test the current procedures of the Pacific Tsunami Warning System and help identify operational strengths and weaknesses in each country."

The exercise, titled Exercise Pacific Wave 11 (PacWave11), will simulate Pacific countries being put into a Tsunami Warning situation requiring government decision-making. It is the third such exercise with the first having been carried out in May 2006 and the second in October 2008.

The exercise can be divided into two stages. The exercise will consist of 9 different scenarios to allow each participating country to respond to a regional or local source tsunami event. In the first stage, a destructive local tsunami will be simulated by international notifications from Japan's Northwest Pacific Tsunami Advisory Center (NWPTAC), the U.S. Pacific Tsunami Warning Center (PTWC) and the U.S. West Coast and Alaska Tsunami Warning Center (WC/ATWC). Bulletins will be transmitted from these tsunami warning centres to focal points designated by each country that are responsible for that country's tsunami response.

In the second stage, conducted simultaneously in response to receipt of the international messages and any national tsunami detection, analysis, and forecasting capabilities, government officials will simulate decision-making and alerting procedures down to the last step before public notification. Notification of emergency management and response authorities for a single coastal community will be used as a measure of the end-to-end warning and response process of the entire country for purposes of this exercise. Due care will be taken to ensure the public is not inadvertently alarmed.

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.

Should any actual tsunami threat occur during the time period of the exercise, the drill will be terminated.

Following the exercise, a review and evaluation will be conducted by all participants. "We see this exercise as an essential element in the routine maintenance of the Pacific Tsunami

Warning and Mitigation System," said (insert name of appropriate official). "Our goal is to ensure a timely and effective early warning of tsunamis, educate communities at risk about safety preparedness, and improve our overall coordination. We will evaluate what works well, where improvements are needed, make necessary changes, and continue to practice."

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)

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On the Web:

Exercise Pacific Wave 11 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

West Coast / Alaska Tsunami Warning Center: http://wcatwc.arh.noaa.gov/

[Insert country URLs]

ANNEX VIII

LIST OF ACRONYMS

AFTN	Aeronautical Fixed Telecommunications Network
DISCEX	Discussion Exercise' or Tabletop exercise
EMWIN	Emergency Managers Weather Information Network
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 Center
NWPTAC	Northwest Pacific Tsunami Advisory Center (Japan)
PTWC	Pacific Tsunami Warning Center (USA)
SOP	Standard Operating Procedures
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

No.	Title	Languages
1	Manual on International Oceanographic Data Exchange. 1965	(out of stock)
2	Intergovernmental Oceanographic Commission (Five years of work). 1966	(out of stock)
3	Radio Communication Requirements of Oceanography. 1967	(out of stock)
4	Manual on International Oceanographic Data Exchange - Second revised edition. 1967	(out of stock)
5	Legal Problems Associated with Ocean Data Acquisition Systems (ODAS). 1969	(out of stock)
6	Perspectives in Oceanography, 1968	(out of stock)
7	Comprehensive Outline of the Scope of the Long-term and Expanded Programme of Oceanic Exploration and Research. 1970	(out of stock)
8	IGOSS (Integrated Global Ocean Station System) - General Plan Implementation Programme for Phase I. 1971	(out of stock)
9	Manual on International Oceanographic Data Exchange - Third Revised Edition. 1973	(out of stock)
10	Bruun Memorial Lectures, 1971	E, F, S, R
11	Bruun Memorial Lectures, 1973	(out of stock)
12	Oceanographic Products and Methods of Analysis and Prediction. 1977	E only
13	International Decade of Ocean Exploration (IDOE), 1971-1980. 1974	(out of stock)
14	A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines. 1976	E, F, S, R
15	Bruun Memorial Lectures, 1975 - Co-operative Study of the Kuroshio and Adjacent Regions. 1976	(out of stock)
16	Integrated Ocean Global Station System (IGOSS) General Plan and Implementation Programme 1977-1982. 1977	E, F, S, R
17	Oceanographic Components of the Global Atmospheric Research Programme (GARP) . 1977	(out of stock)
18	Global Ocean Pollution: An Overview. 1977	(out of stock)
19	Bruun Memorial Lectures - The Importance and Application of Satellite and Remotely Sensed Data to Oceanography. 1977	(out of stock)
20	A Focus for Ocean Research: The Intergovernmental Oceanographic Commission - History, Functions, Achievements. 1979	(out of stock)
21	Bruun Memorial Lectures, 1979: Marine Environment and Ocean Resources. 1986	E, F, S, R
22	Scientific Report of the Interealibration Exercise of the IOC-WMO-UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open Ocean Waters. 1982	(out of stock)
23	Operational Sea-Level Stations. 1983	E, F, S, R
24	Time-Series of Ocean Measurements. Vol.1. 1983	E, F, S, R
25	A Framework for the Implementation of the Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment. 1984	(out of stock)
26	The Determination of Polychlorinated Biphenyls in Open-ocean Waters. 1984	E only
27	Ocean Observing System Development Programme. 1984	E, F, S, R
28	Bruun Memorial Lectures, 1982: Ocean Science for the Year 2000. 1984	E, F, S, R
29	Catalogue of Tide Gauges in the Pacific. 1985	E only
30	Time-Series of Ocean Measurements. Vol. 2. 1984	E only
31	Time-Series of Ocean Measurements. Vol. 3. 1986	E only
32	Summary of Radiometric Ages from the Pacific. 1987	E only
33	Time-Series of Ocean Measurements. Vol. 4. 1988	E only

(continued)

No.	Title	Languages
34	Bruun Memorial Lectures, 1987: Recent Advances in Selected Areas of Ocean Sciences in the Regions of the Caribbean, Indian Ocean and the Western Pacific. 1988	Composite E, F, S
35	Global Sea-Level Observing System (GLOSS) Implementation Plan. 1990	E only
36	Bruun Memorial Lectures 1989: Impact of New Technology on Marine Scientific Research. 1991	Composite E, F, S
37	Tsunami Glossary - A Glossary of Terms and Acronyms Used in the Tsunami Literature. 1991	E only
38	The Oceans and Climate: A Guide to Present Needs. 1991	E only
39	Bruun Memorial Lectures, 1991: Modelling and Prediction in Marine Science. 1992	E only
40	Oceanic Interdecadal Climate Variability. 1992	E only
41	Marine Debris: Solid Waste Management Action for the Wider Caribbean. 1994	E only
42	Calculation of New Depth Equations for Expendable Bathymerographs Using a Temperature-Error-Free Method (Application to Sippican/TSK T-7, T-6 and T-4 XBTS. 1994	E only
43	IGOSS Plan and Implementation Programme 1996-2003. 1996	E, F, S, R
44	Design and Implementation of some Harmful Algal Monitoring Systems. 1996	E only
45	Use of Standards and Reference Materials in the Measurement of Chlorinated Hydrocarbon Residues. 1996	E only
46	Equatorial Segment of the Mid-Atlantic Ridge. 1996	E only
47	Peace in the Oceans: Ocean Governance and the Agenda for Peace; the Proceedings of *Pacem in Maribus* XXIII, Costa Rica, 1995. 1997	E only
48	Neotectonics and fluid flow through seafloor sediments in the Eastern Mediterranean and Black Seas - Parts I and II. 1997	E only
49	Global Temperature Salinity Profile Programme: Overview and Future. 1998	E only
50	Global Sea-Level Observing System (GLOSS) Implementation Plan-1997. 1997	E only
51	L'état actuel de 1'exploitation des pêcheries maritimes au Cameroun et leur gestion intégrée dans la sous-région du Golfe de Guinée *(cancelled)*	F only
52	Cold water carbonate mounds and sediment transport on the Northeast Atlantic Margin. 1998	E only
53	The Baltic Floating University: Training Through Research in the Baltic, Barents and White Seas - 1997. 1998	E only
54	Geological Processes on the Northeast Atlantic Margin (8^{th} training-through-research cruise, June-August 1998). 1999	E only
55	Bruun Memorial Lectures, 1999: Ocean Predictability. 2000	E only
56	Multidisciplinary Study of Geological Processes on the North East Atlantic and Western Mediterranean Margins (9^{th} training-through-research cruise, June-July 1999). 2000	E only
57	Ad hoc Benthic Indicator Group - Results of Initial Planning Meeting, Paris, France, 6-9 December 1999. 2000	E only
58	Bruun Memorial Lectures, 2001: Operational Oceanography – a perspective from the private sector. 2001	E only
59	Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters. 2001	E only
60	Interdisciplinary Approaches to Geoscience on the North East Atlantic Margin and Mid-Atlantic Ridge (10^{th} training-through-research cruise, July-August 2000). 2001	E only
61	Forecasting Ocean Science? Pros and Cons, Potsdam Lecture, 1999. 2002	E only

No.	Title	Languages
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 2008. 2008	E only

(continued)

No.	Title	Languages
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)*	
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 —A Caribbean Tsunami Warning Exercise 23 March 2011	
	Vol.1 Participant Handbook / Exercise CARIBE WAVE 11 —Exercice d'alerte au tsunami dans les Caraïbes. 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
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