KEY SLIDES

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PTWS Minimum Competencies for National Tsunami Warning Centers

2024-26 ITIC Training Pilot

PROGRESS REPORT

ICG/PTWS-XXXI, 7-11 April 2025, Beijing, China
UPDATED JUNE 2025
Laura Kong, ITIC Director

NTWC Minimum Competencies Framework

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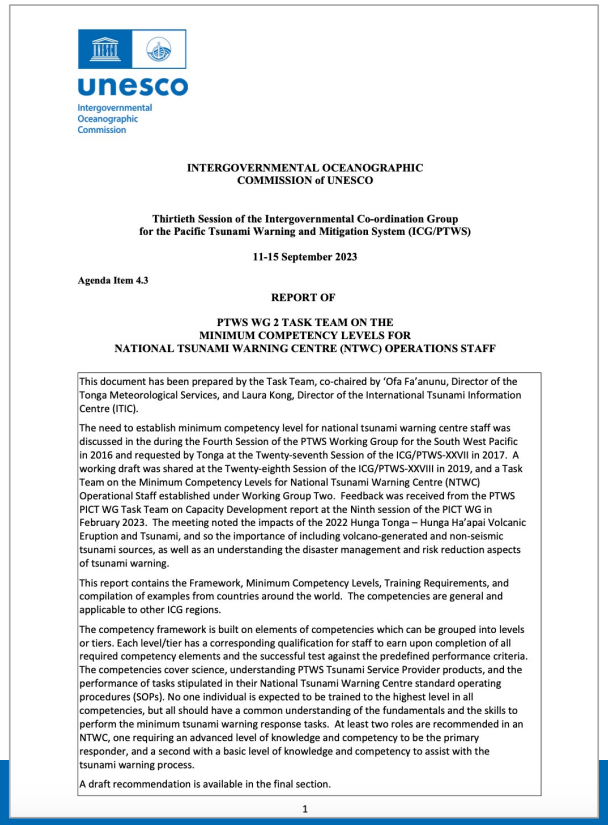
Minimum Competency Level for National Tsunami Warning Centre (NTWC) Operations Staff

- PTWS-XXVII (2017) – PICT identified staff need
- PTWS WG 2 (2018, Hawaii) – small group to draft
- PTWS-XXVIII (2019) – Incomplete framework, est. WG 2 TT on Minimum Competency Levels for NTWC Operations Staff
- Global TOWS WG TT-TWO and DMP (Feb 2022, 2023) – shared progress, interest in global harmonization
- PTWS-XXX (2023) – Approved
  Report of the PTWS WG-2 TT to ICG

  Content – 1. Minimum competency levels, 2. Framework for required competencies (e.g., multi-tiered system with different levels of knowledge and skills required depending on roles), 3. Training required, 4. Document existing schemes



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INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION of UNESCO

Thirtieth Session of the Intergovernmental Co-ordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS)

11-15 September 2023

Agenda Item 4.3

REPORT OF

PTWS WG 2 TASK TEAM ON THE MINIMUM COMPETENCY LEVELS FOR NATIONAL TSUNAMI WARNING CENTRE (NTWC) OPERATIONS STAFF

This document has been prepared by the Task Team, co-chaired by 'Ofa Fa'anunu, Director of the Tonga Meteorological Services, and Laura Kong, Director of the International Tsunami Information Centre (ITIC).

The need to establish minimum competency level for national tsunami warning centre staff was discussed in the during the Fourth Session of the PTWS Working Group for the South West Pacific in 2016 and requested by Tonga at the Twenty-seventh Session of the ICG/PTWS-XXVII in 2017. A working draft was shared at the Twenty-eighth Session of the ICG/PTWS-XXVIII in 2019, and a Task Team on the Minimum Competency Levels for National Tsunami Warning Centre (NTWC) Operational Staff established under Working Group Two. Feedback was received from the PTWS PICT WG Task Team on Capacity Development report at the Ninth session of the PICT WG in February 2023. The meeting noted the impacts of the 2022 Hunga Tonga – Hunga Ha'apai Volcanic Eruption and Tsunami, and so the importance of including volcano-generated and non-seismic tsunami sources, as well as an understanding the disaster management and risk reduction aspects of tsunami warning.

This report contains the Framework, Minimum Competency Levels, Training Requirements, and compilation of examples from countries around the world. The competencies are general and applicable to other ICG regions.

The competency framework is built on elements of competencies which can be grouped into levels or tiers. Each level/tier has a corresponding qualification for staff to earn upon completion of all required competency elements and the successful test against the predefined performance criteria. The competencies cover science, understanding PTWS Tsunami Service Provider products, and the performance of tasks stipulated in their National Tsunami Warning Centre standard operating procedures (SOPs). No one individual is expected to be trained to the highest level in all competencies, but all should have a common understanding of the fundamentals and the skills to perform the minimum tsunami warning response tasks. At least two roles are recommended in an NTWC, one requiring an advanced level of knowledge and competency to be the primary responder, and a second with a basic level of knowledge and competency to assist with the tsunami warning process.

A draft recommendation is available in the final section.

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2023 Report of PTWS WG2 Task Team on Minimum Competency Levels for National Tsunami Warning Centre (NTWC) Operations Staff

ICG/PTWS-XXX, Agenda 4.3 (2023)

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Expert Task Team Report:

1. Established minimum competency levels required for NTWC operations staff.
2. Established framework for required competencies required by roles of a NTWC.
3. Established what training is required to ensure NTWC staff meets minimum competency levels.
4. Investigates and document what schemes are currently in existence and what guidelines and principles can be adapted for this purpose.

Task Team (Co-Chairs *): Wilfried Strauch (Nicaragua), Ofa Fa'anunu (Tonga) *, Yuelong Miao (Australia), Chip McCreery (USA), Lara Bland (NZ), Laura Kong (ITIC) *, and Ken Gledhill (NZ)

Piloting: PTWS Pacific Island Countries and Territories (PICT) WG Task Team on Capacity Development (PTWS-XXVIII.1, 2019)

1. Continue the development of competency framework for NTWC personnel and pilot it in Australia, Vanuatu, Fiji, Samoa and Tonga and report progress and lessons learnt to ICG/PTWS WG 1, 2, 3

Minimum Competencies – 2 Tiers of NTWC

1. ADVANCED (Comprehensive, Max), 2. CORE (Basic, Min)

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I. KNOWLEDGE Science

- CORE : Basic tsunami science / earthquake source knowledge
- ADVANCED : Adv tsunami science / earthquake source knowledge, tsunami forecast modelling

II. OPERATIONS competencies

- CORE
  - Understand / use TSP text / graphical products, core set of decision support tools. Perform all core NTWC SOPs
  - Identify potential regional, distant, and local source tsunami threats
- ADVANCED
  - Understand and produce tsunami threat maps
  - Explain relationship of tsunami warning products to evacuation maps and routes
  - Use a comprehensive set of decision support tools
  - Advanced practical seismology (locate / characterise EQs), sea-level observations: measure & interpret records

III. NATIONAL AGENCY competencies - CORE

- Provide national threat & impact assessment. Liaise with NDMO & response agencies. Monitor public enquiries, provide guidance. Conduct Post-event activities (post-tsunami survey)

Appendix 1. NTWC Competencies

The NTWC competencies are grouped into five categories:

1. Core science knowledge
2. Advanced science knowledge
3. Core operational competency
4. Advance operational competency
5. Core agency competencies

1.0 Core science competencies

1.1 Have basic tsunami science knowledge

1.1.1 List all known causes of tsunami.
1.1.2 Describe how undersea earthquake ca
1.1.3 Explain the basics of tsunami propaga
1.1.4 Describe the process of tsunami atten
1.1.5 Explain how tsunami wavelength, amp
shallower water.
1.1.6 Explain the key differences between '
1.1.7 Identify the order of magnitude of tsunami properties in deep and shallow wate
speed, wavelength and period.
1.1.8 Describe the difference between crest-first and tough-first tsunami in terms of f
on the coast.
1.1.9 Describe how inundation is affected by the bathymetry, coastal properties and l
conditions.
1.1.10 Explain run-up and the difficulties of forecasting the extent
1.1.11 Explain how sea-level gauges measure tsunami.
1.1.12 Outline the limitations of sea-level gauges.
1.1.13 Describe the use and advantages of deep sea tsunameters (
1.1.14 Describe how tsunami amplitudes can be dampened or amp

1.2 Have basic earthquake source knowledge

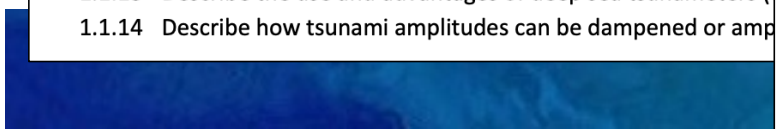
1.2.1 Describe the three earthquake fault types and where they are most likely to be found.
1.2.2 Explain which earthquake fault types are most likely to cause tsunami.
1.2.3 Explain the difference between the basic earthquake terms of epicentre, hypocentre, location and depth.
1.2.4 Describe how earthquake intensity is measured and why it may be useful for tsunami.
1.2.5 Explain how earthquake depth affects the potential for tsunami to be generated.
1.2.6 Explain the earthquake
tsunami.
1.2.7 Explain why a magnitud
generation.

2.1 Advanced tsunami science knowledge

2.1.1 List all known causes of tsunami, and demonstrate a detailed knowledge o
2.1.2 Describe how undersea earthquake cause tsunami, providing detail of the
2.1.3 Explain the basics of tsunami propagation in deep water and be able to de
dependencies.
2.1.4 Describe the various processes of tsunami attenuation and why they occu
2.1.5 Explain in detail why tsunami wavelength, amplitude and speed change as

2.2 Advanced earthquake source knowledge

2.2.1 Describe the three earthquake fault types and where they are most likely to be found, bot
within the Pacific and within the national region.
2.2.2 Explain which earthquake fault types are most likely to cause tsunami, giving reasons and exceptions.
2.2.3 Explain the difference between the basic earthquake terms of epicentre, hypocentre,



3.0 Core operational competencies

3.1 Can understand and use TSP text and graphical products

The list of competencies will depend on the TSP. The PTWC Enha
example since these products are issued to all PTWS Member Sta
TSPs may need to be added by each country

3.1.1 Is familiar with TSP products, and the timing(s) with whic
an event.

3.1.2 Acquire, understand, interpret, and use the PTWC Public
national tsunami threat.

3.1.3 A
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3.1.4 U
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3.2 Can use a core set of decision support tools

These are specific to each NTWC and depend on the level of complexity operated by each. The to
aid in the performance of each NTWC's SOPs, and cover the core NTWC activities

List of Competencies

3.2.1 Acquire event source information from specified providers and/or website/applications.
earthquakes, example providers are the USGS NEIC website and/or CISN Display.

3.2.2 Apply source information to the predefined threshold table, factoring their limitations.

3.3 Can perform all core activities in the National Tsunami Warning Centre's SOPs

The core NTWC activities are

1. Rapid and reliable operational services. The NTWC must respond
always be operating around-the-clock, every day of the year. The
the same level and quality of service -- for every potentially tsunan
big, and seismic and non-seismic.
2. Detection and characterization of potential tsunami event sources
are seismic sources (large earthq
volcanoes, and meteorological ts
earthquakes or earthquake-trigg
3. Forecast of tsunami arrival times
(hydrodynamic models), includin
4. Detection and monitoring of tsu
or through eyewitness observati

y specific locations by running own application
heir limitations.

3.4 Can identify potential regional and distant source tsunami threats

List of best practice competencies. This will depend on TSP and be locally tail

3.4.1 Recognize TSP alert messages for distant and regional source events.

3.4.2 Identify each type of TSP message (information, threat information).

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5.0 Core agency competencies

The list of competencies will depend on local systems and procedures. Examples are included below.

5.4.1 Describe the role of NTWC in the end-to-end tsunami warning system.

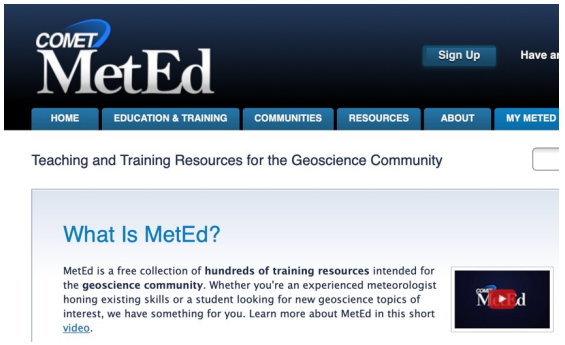
5.4.2 Evoke internal communication and notification protocol including escalation to senior staff (e.g. the Chief Meteorologist or NTWC Director).

PTWS NTWC Minimum Staff Competencies Training - Pilot

- **PTWS NTWC Minimum Staff Competencies Training**
  - ITIC create training, with advanced TWC country partners
  - Funding: USAID funding (initial only), IOC Ocean Training Interns (Q4 2024)
- **Series of courses - from self-paced to in-person housed under OTGA**
  - In order to take next Lesson, must pass previous Lesson and Course. Start with OTGA UNESCO-IOC Tsunami Awareness and Tsunami Ready
  - Modules (to be individual OTGA courses, or US COMET MetEd courses)
    1. Core Science (multiple Lessons)
    2. Core Operations Knowledge (multiple Lessons)
    3. Core Agency (multiple Lessons) – National actions
  - Final training will be in-person (3-4 weeks at ITIC/PTWC)
- **Finish Training and pilot in 2026 with 1 small cohort (PIC)**

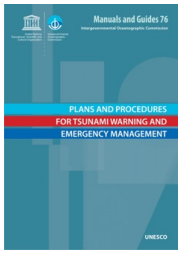
PTWS NTWC Minimum Staff Competencies Training – Project Team

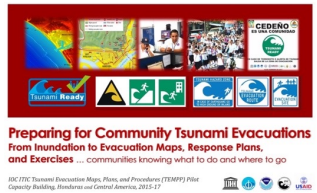
- **Project Team**
  - Lead – Laura Kong (ITIC)
  - ITIC consultants (Tony Elliott (IOTWMS Secr ret), Ken Gledhill (NZ GNS ret), Marie Eble (NOAA PMEL ret), Hannah Weinstein (former PTWC)
  - ITIC Interns (Oct–Dec 2024) – Muhammad Harvan (Indonesia BMKG), Taniela Takeifanga (Tonga MS)
  - Adv NTWC Countries: Australia (BOM, GA), New Zealand (GNS), USA (PMEL, PTWC), Others welcome
- **Partner Agencies:** OTGA (IOC), UCAR COMET (USA)
- **Consultation with:**
  - PTWS PICT WG TT Capacity Development
  - PTWS WG 2 on Warning and Dissemination
  - TOWS WG TT Tsunami Watch Operations
  - Other countries and experts

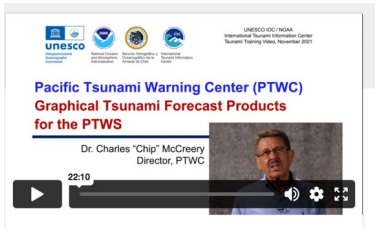


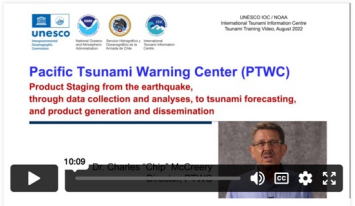
Available Resources – Existing

- **Existing schema** (PTWS Minimum Competency Level for NTWC report, 2023) Australia, Chile, NZ, India, NZ, USA
- **Standard Training based on IOC Manual and Guides**
  - TWC / TER SOP (MG 76); Evac Planning (TEMPP, MG 82)
  - 145+ trainings since 2005
- **Ocean Teacher Global Academy (OTGA) – online and hybrid**
  Plan: TEWS, SOPs, TEMPP, Tsunami Ready
- **PTWC Products training videos**









Overview of Training Programme - OTGA

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Prerequisites

- Tsunami Awareness
- Tsunami Ready

Core Science

Knowledge
- Tsunami science
- Earthquake science
- Tsunami Forecasting Science

Source material:
- BOM
- COMET module to be updated and modified
- PTWC
- ComMIT

Core Operations

- Understand and use TSP messages and products
- Perform NTWC core activities

Source material:
- SOP PPTs
- IOC M&Gs
- PTWC products training videos
- SOP Exercise Documents
- TEMPP training material

Decision Support Tools

- CISN
- Tidetool
- IOC SLMF
- Websites
- TTT
- TsuCAT
- Others

Communicating Threats & Impacts

- Putting core operational knowledge into practice

Source material:
- COMET Module on NTWC Operations to be developed

Hybrid TWC SOP Training

- Using TWC material from SOP training courses
- Focus on use of PTWC (TSP) products
- Design and conduct exercises

In Person training

- Cohort of 4-6
- Must have completed all pre-requisite courses and hybrid training
- Lectures & hands-on TWC operations practicums
- Observing PTWC duty staff activities
- Simulated Event Exercises

Progress to date

- **OTGA platform – project team lead**
  - Core science competencies training material available from BOM, GA, COMET and OTGA Tsunami Awareness course – Review completed and gaps identified
  - New module: Core Tsunami Science knowledge - Development ongoing
  - New module: Core Earthquake Source knowledge - Draft completed
  - New module: Core Tsunami Forecasting knowledge – to based on existing ComMIT
- **COMET platform – project team working with COMET team**
  - Existing module update, COMET: "Tsunamis" - include events since 2017 and ensure materials applicable for US domestic and international - Work ongoing, complete Q2 2025.
  - New module, COMET: NTWC Decision-making: "Communicating Threats and Impacts during Tsunami Events" – based around COMET's existing US NTWC, but focus on PTWC Products, with NWPTAC where appropriate (SW Pacific scenario)
  - Due to US govt funding situation, active work paused by most of project team – timeline for completion not certain (sometime 2026)

OTGA Core Tsunami Science Competencies

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- Based on BOM training course supplemented by material from GA, OTGA Tsunami Awareness, COMET and other sources as needed.
- Focus on job requirements of TWC staff, i.e, on science needed to support operational decision-making.
- BOM course is general entry-level covering tsunami science for duty forecasters at the Bureau National Operations Centre (BNOC). It is focused on the Australian AOR
- BOM course covers:
  - Generation – 4 lessons
  - Propagation – 6 lessons
  - Impact – 4 lessons

The Bureau of Meteorology

Welcome to the Tsunami Science Course!

This course is divided into three topics:

- **Generation**
- **Propagation**
- **Impact**

OTGA Core Earthquake Science Knowledge

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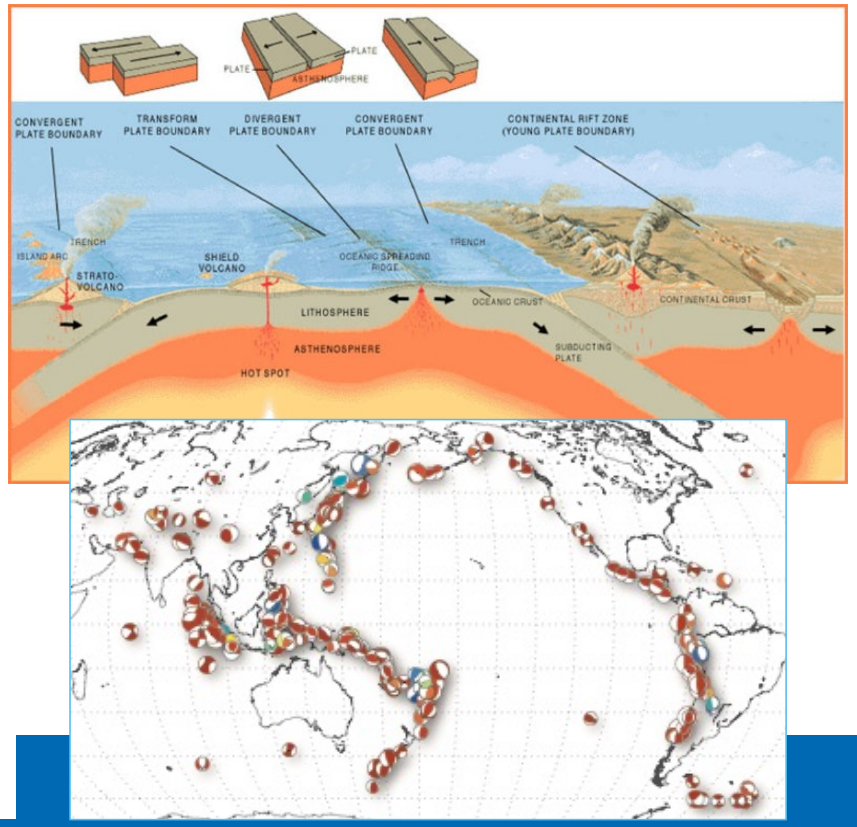
- Draft completed December 2024
- Material gathered from COMET, BOM, GA, USGS, IRIS, and OTGA training modules
- Covers:
  - Plate tectonics
  - Fault types
  - EQ parameters
  - EQ magnitude types
  - EQ intensity
  - Beachball diagrams
  - Tsunamigenic EQs
- Currently available in MS Word format
- Requires editing and review and conversion to HTML5 format, possibly as PPTs



COMET “Tsunamis” course

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- 6 Modules:
  - Introduction
  - Generation
  - Initiation
  - Propagation
  - Inundation
  - Long-term effects
- Last updated December 2017
- Very good overview of tsunami science
  but requires general update and inclusion of events such as Palu 2018 tsunami and Hunga Tonga 2022 eruption and tsunami

https://www.meted.ucar.edu/education_training/lessons/831

COMET NTWC Operations decision-making course

- Based on module for US TWC: "Communicating Threats and Impacts During Tsunami Events"
  - Introduction
  - TWC product alerts
  - Local information from WFOs
  - Tsunami event exercise
  - Summary of promising practices

https://www.meted.ucar.edu/tsunami/tsunami_dss/index.htm

- Launched in July 2022
- Current course is US-centric and requires extensive modification to be suitable for a IOC Pacific regional / international audience (TSP products)
- Will focus on NTWC SOPs using PTWC messages and products (NWPTAC if needed)
- Tsunami event exercise interactive and will be modified for role play as local, regional and distant tsunami TWC operational staff

2025 - 2026

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- ITIC is committed to finish the Training Pilot
- Work on updating COMET “Tsunamis” module continues - aim to complete by end of Q3 2025
- Work on OTGA Core Tsunami Science and Earthquake modules ongoing - aim to complete by end of Q3 2025
- Work on OTGA Core Tsunami Science For”casting module – aim to complete by end of Q1 2026
- Work on COMET NTWC Operations “Communicating Threats and Impacts during Tsunami Events” module by end of Q1 2026
- Hybrid and in-person training planned for 2nd half 2026 – dates depend on progress on pre-requisite modules. Timeline to be revisited at end of Q3 2025.

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PTWS Minimum Competencies for National Tsunami Warning Centers

2024-26 ITIC Training Pilot

THANK YOU!

Laura Kong, ITIC Director