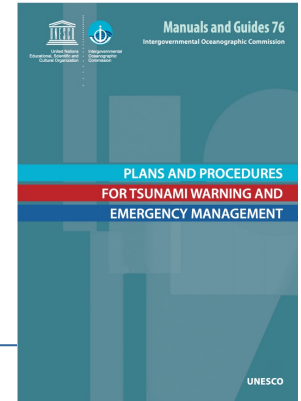




UNESCO/IOC – NOAA ITIC Training Program in Hawaii (ITP-Hawaii)
TSUNAMI EARLY WARNING SYSTEMS
AND THE PACIFIC TSUNAMI WARNING CENTER (PTWC) ENHANCED PRODUCTS
TSUNAMI EVACUATION PLANNING AND UNESCO IOC TSUNAMI READY PROGRAMME
7-18 August 2023, Honolulu, Hawaii USA

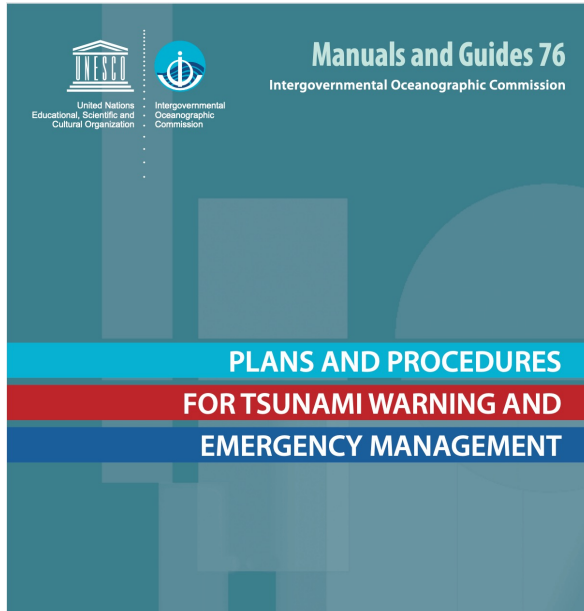
End To End Tsunami Warning Stakeholders, Roles & Responsibilities, SOPs, Linkages



Dr. Laura Kong
Director, ITIC



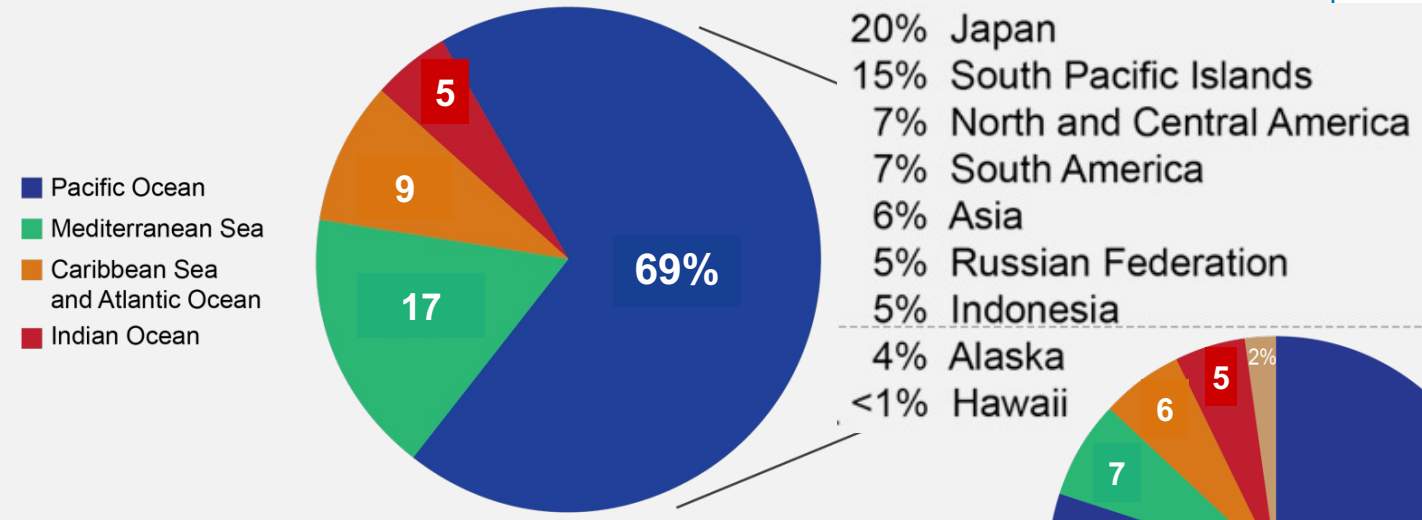
TWC and TER Standard Operating Procedures



Guidance for countries in strengthening tsunami warning and emergency response through the development of Plans and Standard Operating Procedures for their warning and emergency management authorities

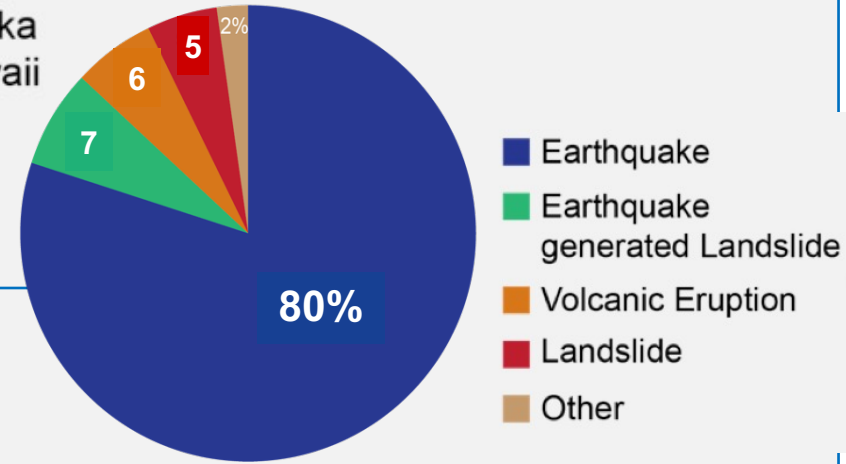
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DEADLY TSUNAMIS – GLOBAL (1620 B.C to A.D. 2022)



- 20% Japan
- 15% South Pacific Islands
- 7% North and Central America
- 7% South America
- 6% Asia
- 5% Russian Federation
- 5% Indonesia
- 4% Alaska
- <1% Hawaii

SOURCE LOCATION



SOURCE GENERATION

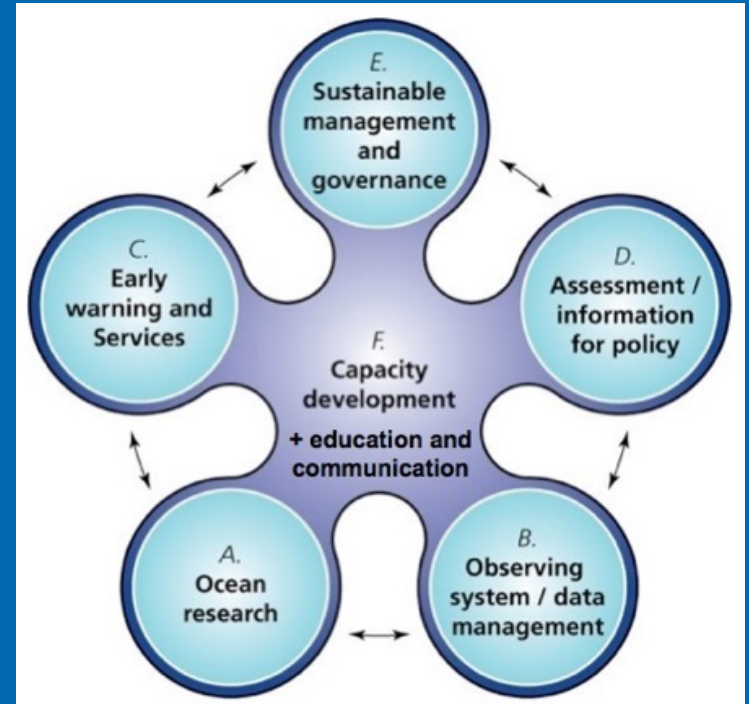
- ❑ 70% in Pacific, 9% Caribbean/Atlantic
- ❑ 90% fatalities from Local or Regional Tsunamis



Intergovernmental Oceanographic Commission (IOC) of UNESCO



- Only intergovernmental body of United Nations (UN) system for ocean science
- Established 1960, 150 Member States



UN – Global Partnerships

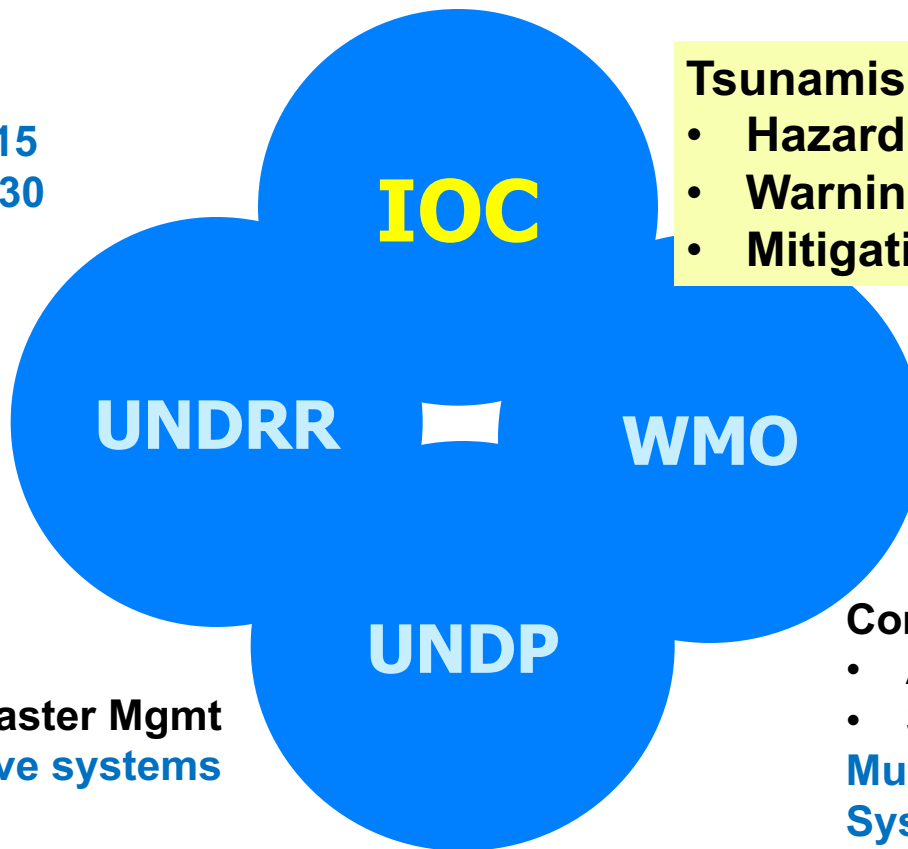
DRR platforms

- Hyogo 2005-2015
- Sendai 2015-2030

Awareness

- DRR Oct 13
- WTAD Nov 5

Disaster Mgmt
Institutional / Legislative systems



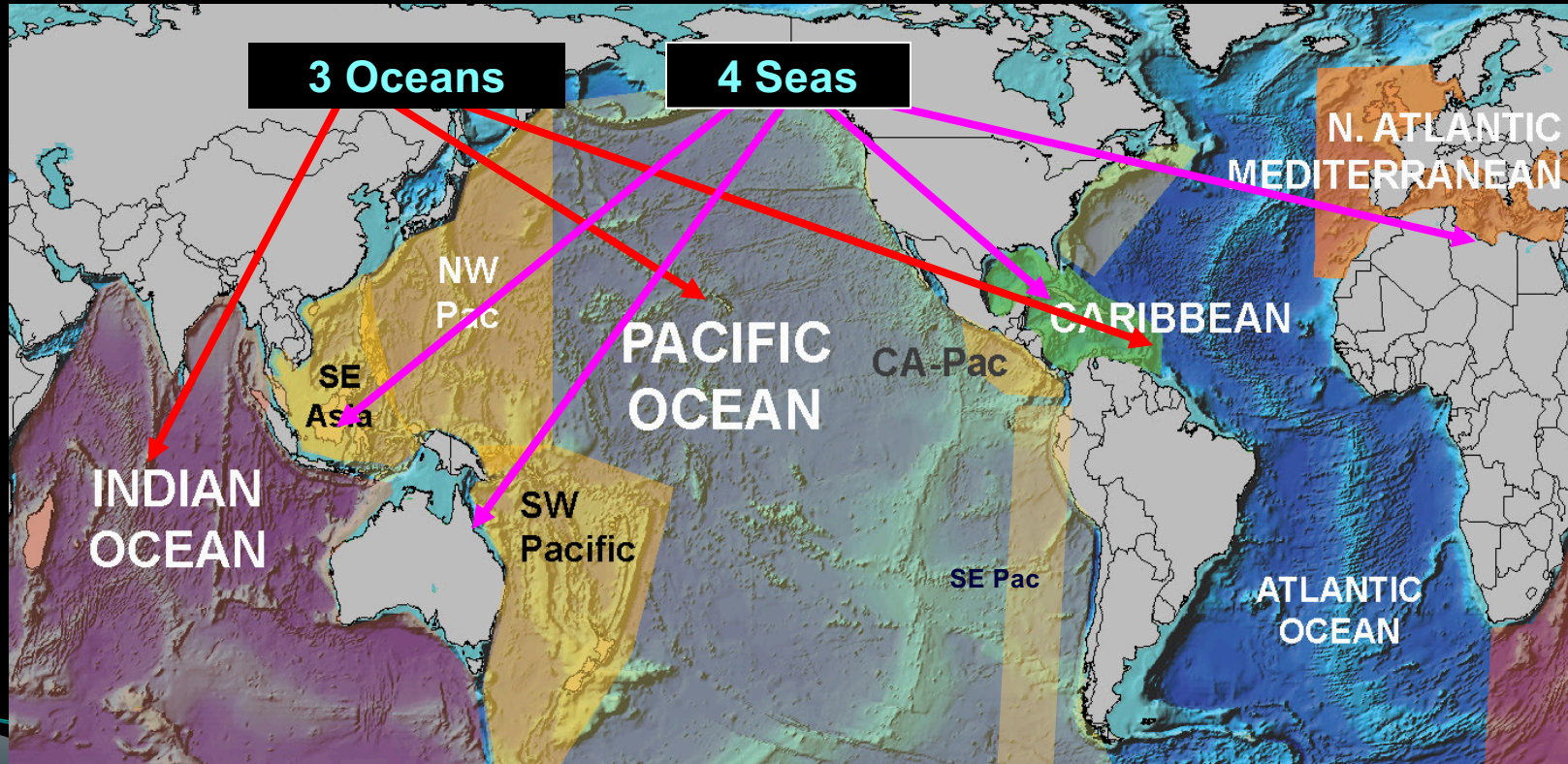
Tsunamis:

- Hazard Risk
- Warning guidance
- Mitigation, Preparedness

Communication (GTS)

- Alerts
 - Sea Level Data
- Multi-hazard Early Warning
Systems (MHEWS)

Designing a GLOBAL Tsunami Warning and Mitigation System



United Nations role

Define the proper scale of the problem and its solution.

The system must be:

- **Fully owned by countries in region**
- **Based on international multilateral cooperation**
- **Based on open and free exchange of data**
- **Protect all countries in region**
- **Transparent and accountable to all members**

UN Global Tsunami System – How Does it Function?

□ Governance

- UNESCO/IOC through region Intergovernmental Coordination Groups (ICGs).
- **ICGs meet regularly** (annual, bi-annual) to coordinate and improve system. Member States represented by Tsunami National Contact (TNC), Tsunami Warning Focal Point (TWFP), National Tsunami Warning Center (NTWC)
- Saving lives from tsunami requires '**End-to-End**' system – people-centred
- IOC region **Tsunami Information Centres** (TIC) support Member States

□ Tsunami Alerting

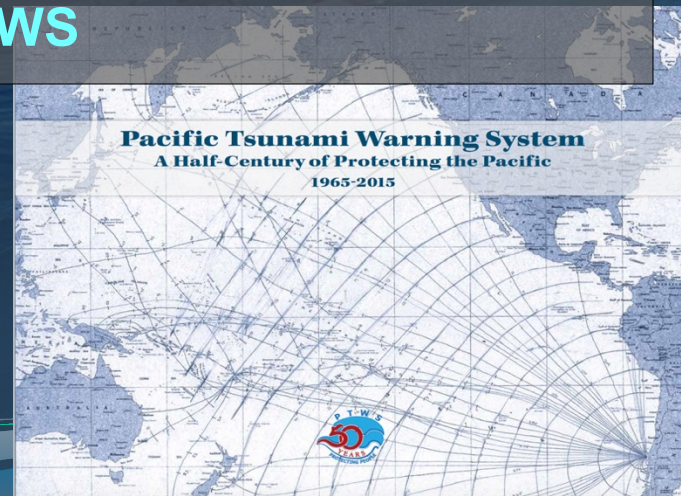
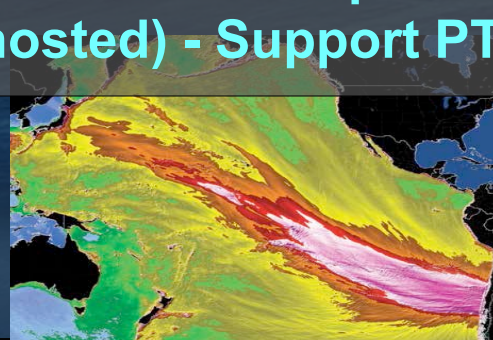
- UNESCO/IOC Tsunami Service Providers (**TSPs**) **monitor 24x7**
Provide timely Tsunami Threat **advice** for region
- Based on **joint operation** of international networks connected with NTWCs
- **Each nation is responsible for issuing warnings** in their territory and protect its own population.
- National **warning centres** must have **strong links with emergency preparedness authorities** (national, provincial, local)

1960 Deadly Basin-wide Tsunami - Pacific

1960 9.5 Mw Chile earthquake generated a tsunami that killed 2000 in Chile, then hundreds in Hawaii, Japan, and the Philippines
=> No international warning

=> 1965 Pacific Tsunami Warning System (PTWS) est (UNESCO IOC)

- PTWC (NOAA) – 1965 - PTWS Operational Center HQ
- ITIC (IOC, NOAA hosted) - Support PTWS



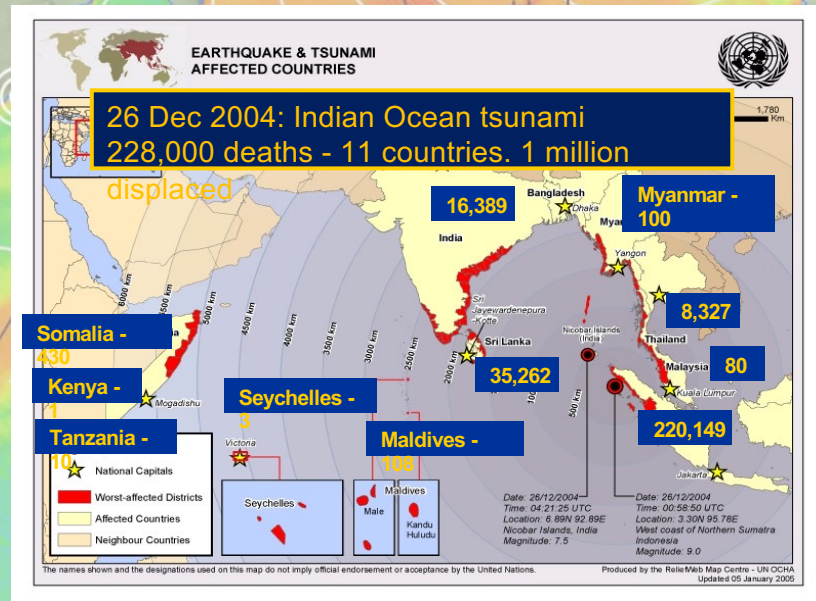
2004 Deadly Basin-wide Tsunami – Indian Ocean

2004 9.3 Mw Indonesia earthquake generated a tsunami that killed 180,000 in Indonesia, and in total 228,000 in 11 Indian Ocean countries over 12 hours. Nearly no one knew what a tsunami was ...

=> No international warning

=> 2005 Indian Ocean, Caribbean, North Eastern Atlantic and Mediterranean Tsunami Warning and Mitigation Systems established under UNESCO / IOC

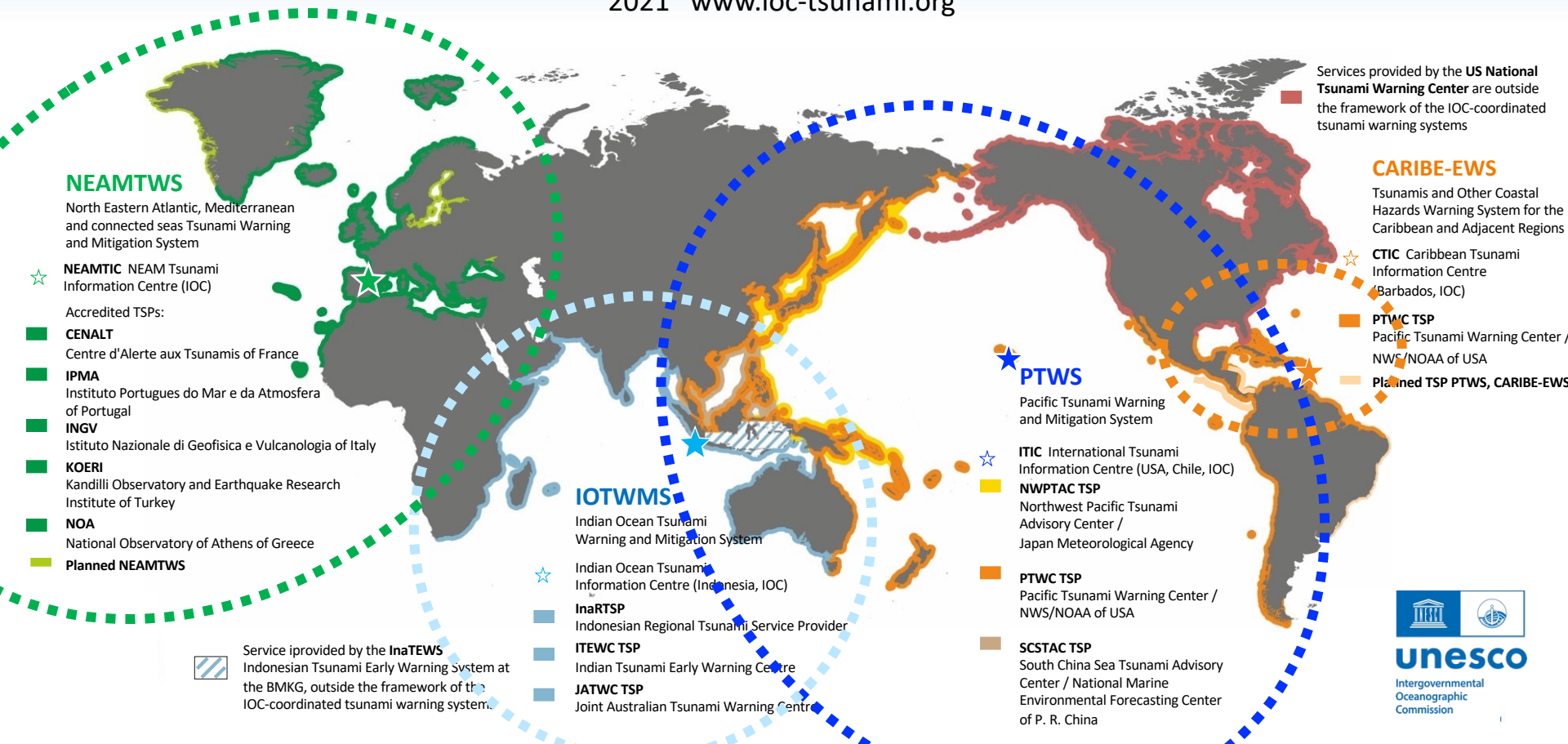
1. IOC Tsunami Service Providers - 24x7 alerts for region
2. IOC Tsunami Information Centres - TEWS support to countries



GLOBAL TSUNAMI WARNING AND MITIGATION SYSTEM

Coordinated by Intergovernmental Oceanographic Commission of UNESCO

2021 www.ioc-tsunami.org



NEAMTWS

North Eastern Atlantic, Mediterranean and connected seas Tsunami Warning and Mitigation System

☆ NEAMTIC NEAM Tsunami Information Centre (IOC)

Accredited TSPs:

- CENALT
Centre d'Alerte aux Tsunamis of France
- IPMA
Instituto Portugues do Mar e da Atmosfera of Portugal
- INGV
Istituto Nazionale di Geofisica e Vulcanologia of Italy
- KOERI
Kandilli Observatory and Earthquake Research Institute of Turkey
- NOA
National Observatory of Athens of Greece
- Planned NEAMTWS

▨ Service provided by the InaTEWS Indonesian Tsunami Early Warning System at the BMKG, outside the framework of the IOC-coordinated tsunami warning system.

IOTWMS

Indian Ocean Tsunami Warning and Mitigation System

☆ Indian Ocean Tsunami Information Centre (Indonesia, IOC)

- InaRTSP
Indonesian Regional Tsunami Service Provider
- ITEWC TSP
Indian Tsunami Early Warning Centre
- JATWC TSP
Joint Australian Tsunami Warning Centre

PTWS

Pacific Tsunami Warning and Mitigation System

☆ ITIC International Tsunami Information Centre (USA, Chile, IOC)

- NWPATAC TSP
Northwest Pacific Tsunami Advisory Center / Japan Meteorological Agency

■ PTWC TSP
Pacific Tsunami Warning Center / NWS/NOAA of USA

■ SCSTAC TSP
South China Sea Tsunami Advisory Center / National Marine Environmental Forecasting Center of P. R. China

Services provided by the US National Tsunami Warning Center are outside the framework of the IOC-coordinated tsunami warning systems

CARIBE-EWS

Tsunamis and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions

☆ CTIC Caribbean Tsunami Information Centre (Barbados, IOC)

■ PTWC TSP
Pacific Tsunami Warning Center / NWS/NOAA of USA

■ Planned TSP PTWS, CARIBE-EWS



Intergovernmental Oceanographic Commission

Tsunami Alerting – Two Types of Centres

1. IOC Global Service - Tsunami Service Providers (TSPs)

- ❑ Provide **INFORMATION / ADVICE** on **THREAT**.
Since 2014, do not issue tsunami warnings to countries
- ❑ Capability to detect and assess tsunami threats over a large region, covering multiple member state.
- ❑ Has been accepted by the Intergovernmental Coordination Group (ICG) to disseminate threat assessment to other member states.

Tsunami Service Providers (TSPs) - PTWS

- ❑ **PTWC (Pacific Tsunami Warning Center) – USA – 1965**
(since 2006 interim, permanent 2013 CARIBE-EWS)
- ❑ **NWPTAC (Northwest Pacific Tsunami Advisory Center, Japan Meteorological Agency (JMA) – 2006**
- ❑ **SCSTAC (South China Sea Tsunami Advisory Center) – China - 2019**
- ❑ **CATAC (Central America Tsunami Advisory Centre) – Nicaragua – interim**



Tsunami Alerting – Two Types of Centres

2. National Tsunami Warning Centers (NTWC)

- ❑ A center operated by a Member State that has the **authority by law or otherwise to issue tsunami warnings** for the coasts of that Member State.
- ❑ Ideally, NTWC should have some technical capability to aid decisions making.

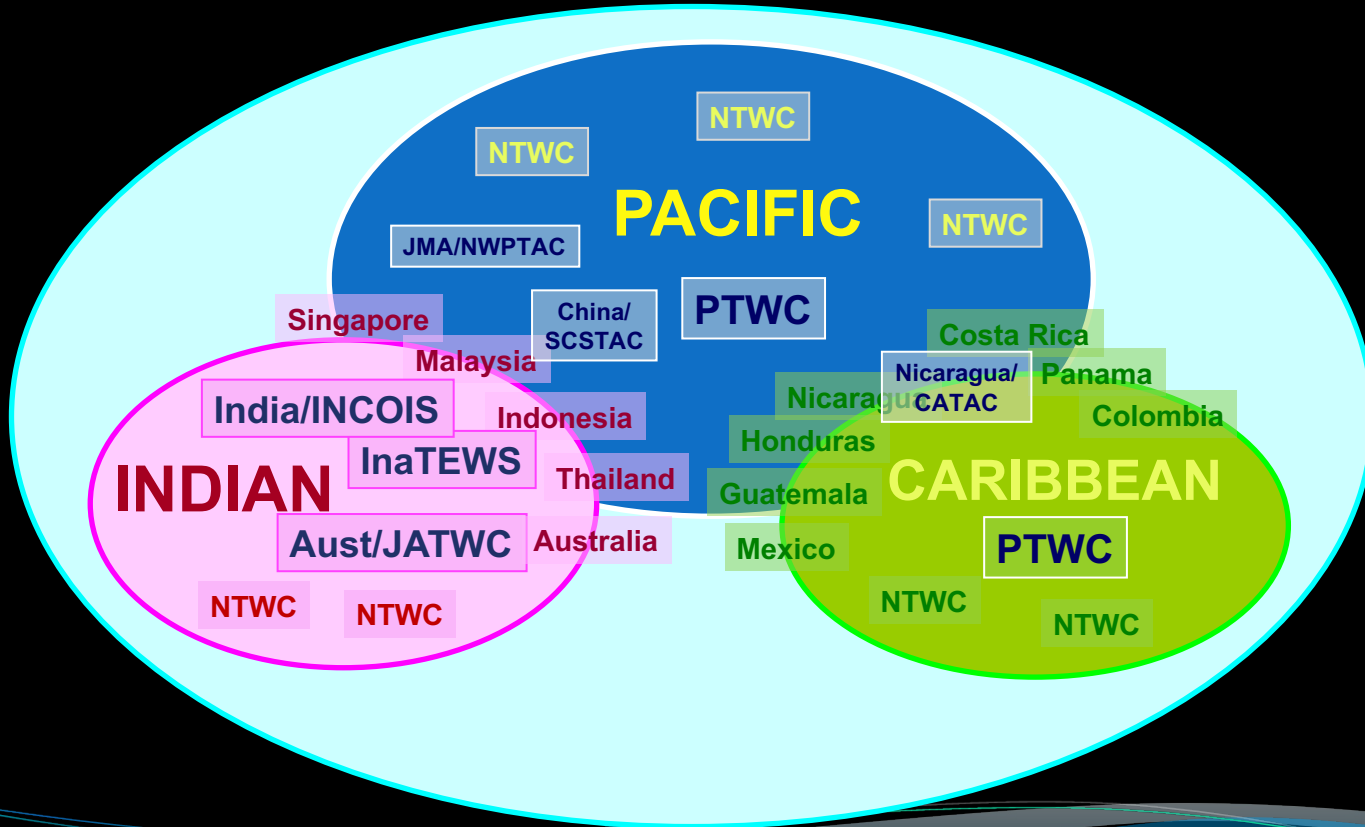


Tonga



Peru

Regional, Sub-regional, National TWC



IOC Tsunami Information Centers



tsunamiwave.org

PTWS : ITIC

USA NOAA – IOC Partnership
1965
Chili SHOA Associate Director
1998



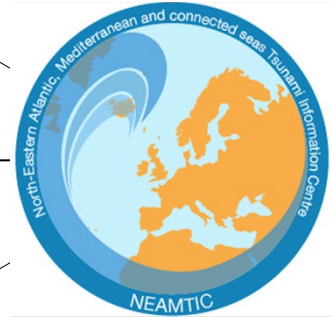
NEAMTWS
EC DG ECHO
France, Greece, Italy,
Portugal
2011-13



IOTWS
Indonesia – IOC Partnership 2012
(formerly JTIC since 2006)



CARIBE-EWS
Barbados– IOC Partnership
2015 (approved 2007)



ITIC – INTERNATIONAL IOC Mandate & Functions (1977)

- ❑ **Monitor / Recommend Improvements** to PTWS and other tsunami warning systems – communications, data networks, evaluations, dissemination
- ❑ **Assist in establishing** regional and national tsunami systems – comprehensive risk reduction
- ❑ Serve as **technology transfer** resource;
Encourage research to improve evaluations;
Conduct **trainings to build capacity**
- ❑ Serve as an information resource for **preparedness / education; Develop, publish, distribute materials**
- ❑ Serve as an information resource on **historical tsunamis – database, post-event surveys**

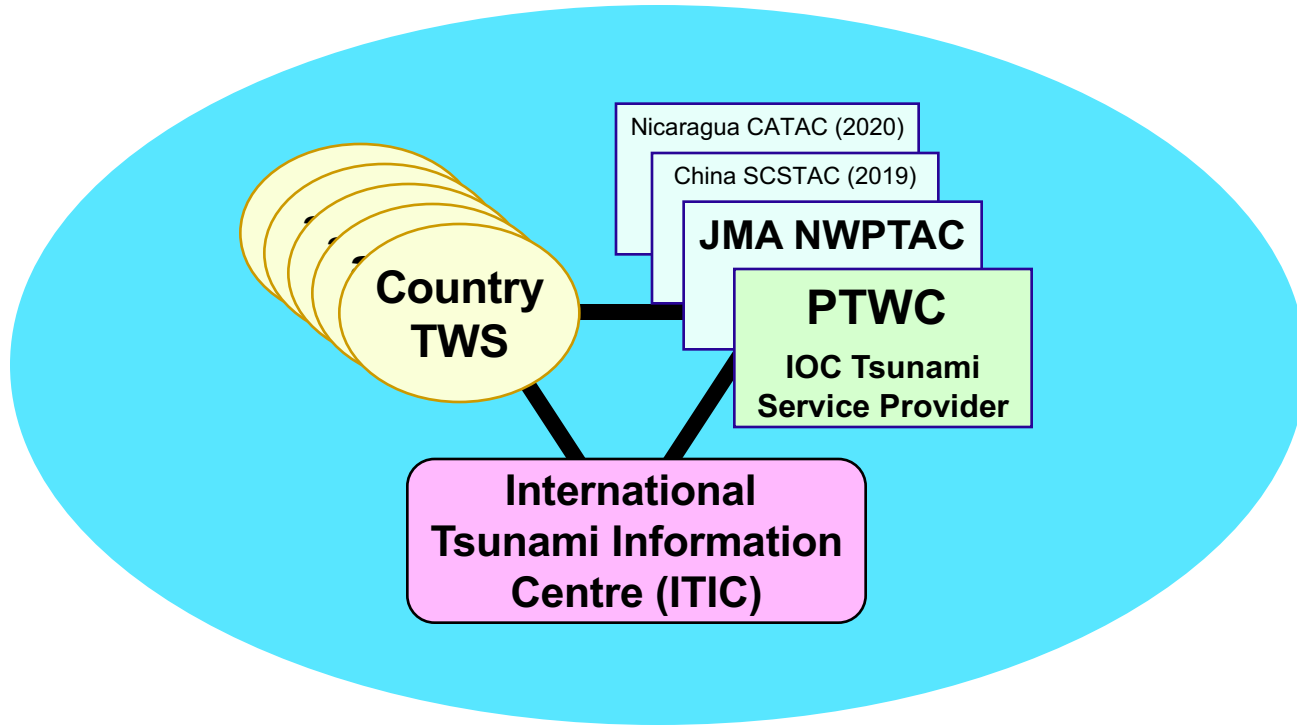


<https://vimeo.com/192771669>

Click for
video

PACIFIC TSUNAMI WARNING & MITIGATION SYSTEM

ICG/PTWS: FOUNDATIONAL ELEMENTS





SAVING LIVES BY EARLY WARNING

**EQ
Tsunami**

EQ
TSU
FORECAST

TWC - Science

Intl / Natl

Country Alert System

Emergency Alert System & Mass Media

DMO / EMA – Safety

Natl / Prov / Local Govt

**TSUNAMI WARNING!
EVACUATE**

TSUNAMI HAZARD ZONE
IN CASE OF EARTHQUAKE, GO TO HIGH GROUND OR INLAND

Public

Community

**EQ
T=0**

Race against Time

LIVES
SAVED

**WAVE
T=20 min**

End-to-End Tsunami Warning - Stakeholders

- ❑ **Tsunami Service Providers (TSP)**
- ❑ **Tsunami Warning Focal Points (TWFP)**
National Tsunami Warning Centres (NTWC)
- ❑ **Disaster Management Offices (DMO)/Local Authorities**
- ❑ **Emergency Services / First Responders**
- ❑ **Media**
- ❑ **Public**

TWFP, NTWC – Roles and Responsibilities

□ Tsunami Warning Focal Points (TWFP)

- 7x24 contact person, or official point of contact or address, designated by government for receiving and issuing tsunami event information.
- Receives international tsunami information from TSPs.
- Responsibility to notify emergency authority of event characteristic
- Requires 7x24 telephone, facsimile, or e-mail information

□ National Tsunami Warning Centres (NTWC)

- Receives, directly or through TWFP earthquake and tsunami information from TSP(s), and optionally, independently monitor seismicity and tsunamis in real time.
- Analyses information and assess tsunami threat for country.
- Issues timely warnings or cancellations to EMAs and stakeholder agencies according to National Tsunami Warning and Emergency Response Plan

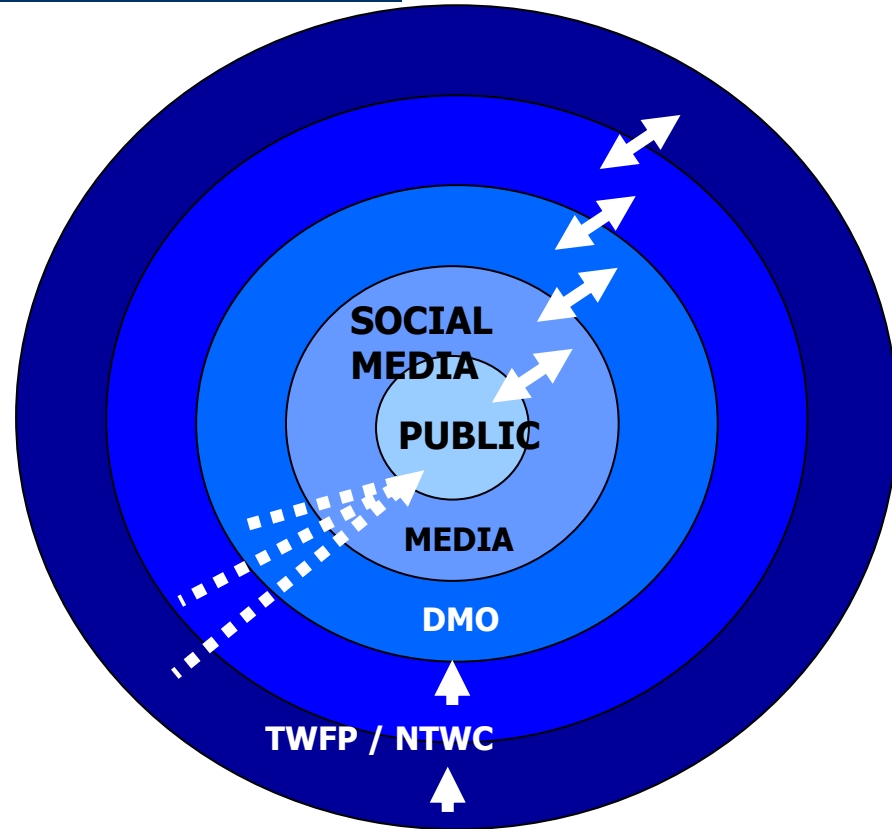
End-to-End Tsunami Warning

Stakeholder
Relationships

Linear

Non-linear

Simultaneous

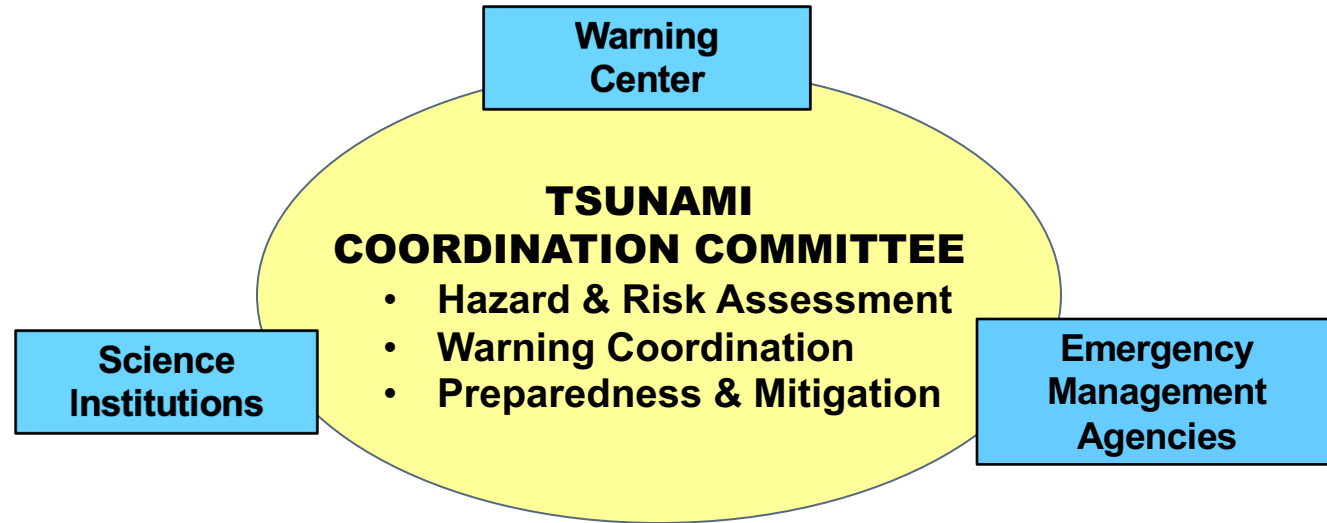


TSP (PTWC, NWPTAC, SCSTAC, CATAAC)

Within a Country, Stakeholders Work Together

- **Sustain Public Awareness**
 - What is a tsunami
 - Recognizing when it is dangerous
 - How to escape a tsunami
- **Sustain Preparedness Programs**
 - Public (including special needs populations)
 - Government Officials (all levels)
- **Tsunami Warning**
 - Monitor and Assess Threat
 - Ensure Public Safety (evacuate)

Stakeholder Coordination is Essential



Civil Society & NGOs

- **Community organizations** (social, gender, cultural, age, language, religious ...)
- Trade, business organizations
- Disaster response & relief

Government Agencies:

- Planning & Development
- Transportation
- Health & Education
- Coastal Management
- Social Services

Other:

- Media
- Utilities
- Tourism
- International Agencies

Disaster Management Offices - National & Local Authorities

- Preparing the Public
 - Education, awareness,
 - Mitigation activities
 - Translate science and technology
- Identifying Hazard & Vulnerable Populations
 - With coop of technical institutions inform public in understandable manner
- Ensure Information Flow
 - From NTWC/TWFP to public in timely manner
- Build Stakeholder Coordination
- Implement people-centered warning & mitigation system
- High-level advocacy

Disaster Management Offices - National & Local Authorities

- ❑ Receive Warnings/Alerts from NTWC/TWFP
- ❑ Activate local public alert systems as needed
- ❑ Decide on & manage Evacuations/Response
- ❑ Determine and Communicate 'All Clear' (safe to return)
- ❑ Signage
- ❑ Public Education (with other stakeholders)



Emergency Services

- Support DMO/Local Authorities with
 - Public alerting
 - Evacuation
 - Law & Order
 - Response after tsunami has struck
(Search and Rescue, etc)



Media (radio, television)

- ❖ Convey Official Warnings (National & Local)

But also:

- Convey Unofficial Warnings

Therefore:

- Can cause or counter public response

International media can mis-report warning regions/countries causing public confusion

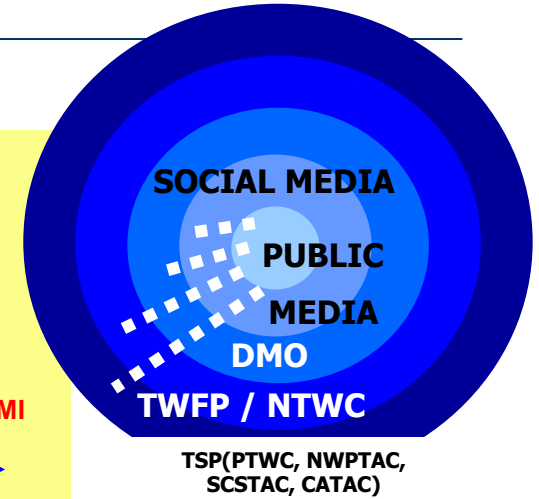
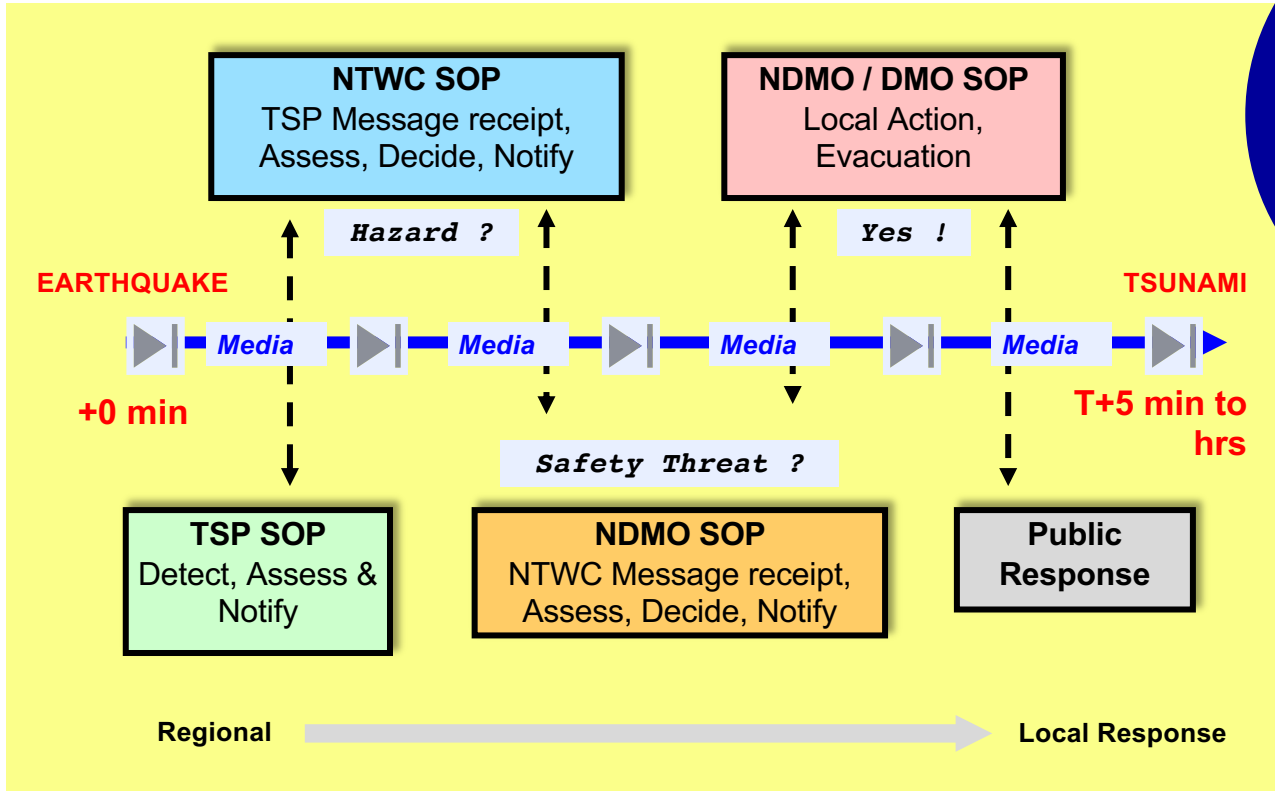


Public

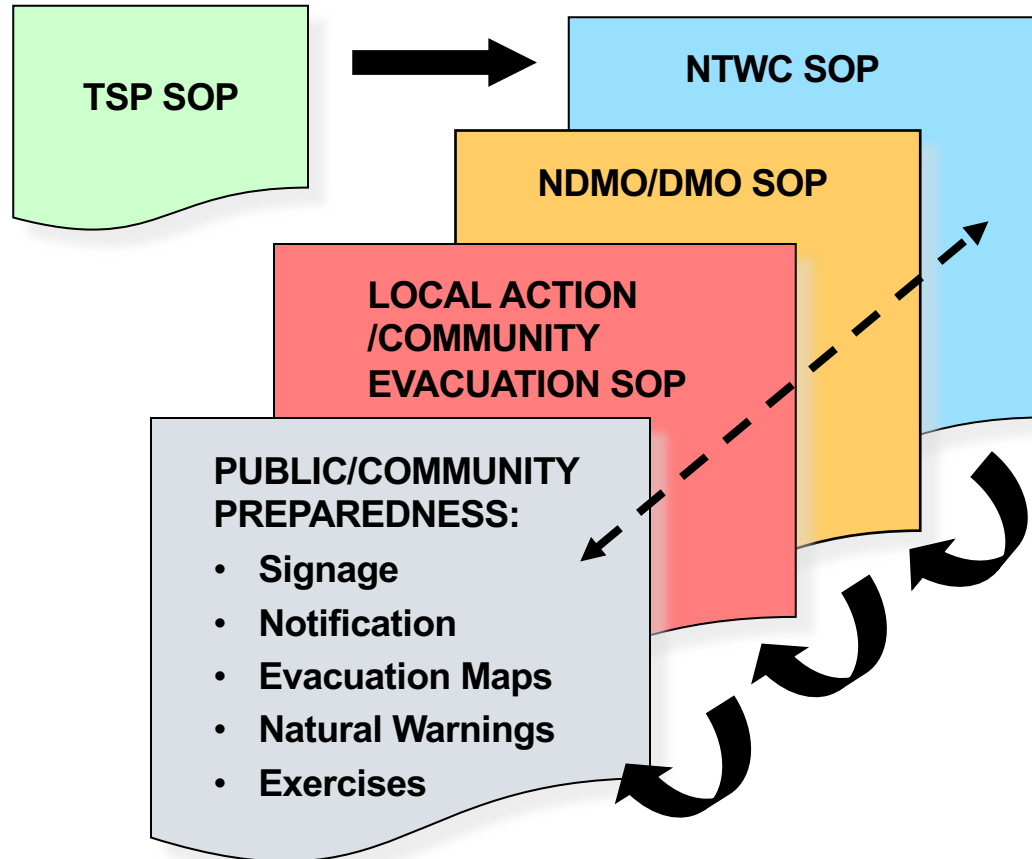
- ❑ End Receiver of Warnings/Alerts
- ❑ Convey Official and Unofficial Warnings
- ❑ To minimize their confusion, they must be educated to understand:
 - Official Warnings (how will they be warned)
 - Natural Warnings (what to look out for)
 - Where and What to do
 - ❑ Evacuation zones
 - ❑ Routes & Safe zones
 - How to respond if evacuation zones are not defined



End-to-End Warning Chain

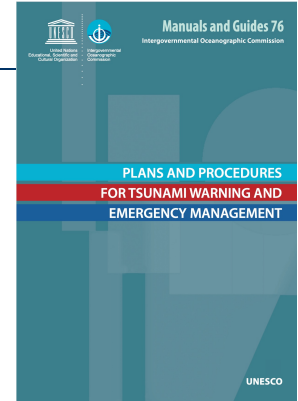


Warning Chain – set of linked SOPs

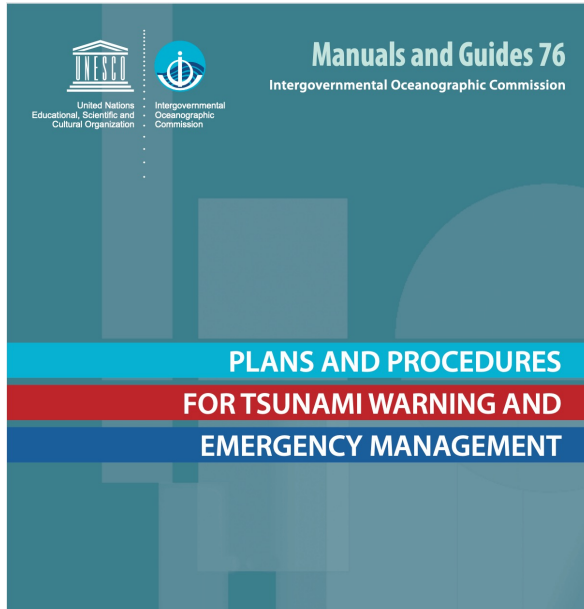


Course Materials

- TWC/TER SOPs: IOC MG 76 (2017)
Plans and Procedures for Tsunami Warning and Emergency Management
- Evacuation Planning: IOC MG 82 (2019)
Preparing for Community Tsunami Evacuations:
from inundation to evacuation maps, response plans and exercises



TWC and TER Standard Operating Procedures



Guidance for countries in strengthening tsunami warning and emergency response through the development of Plans and Standard Operating Procedures for their warning and emergency management authorities

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TSUNAMI WARNING CHAIN (M9.5 Chile)

UNESCO IOC – NOAA outreach video

Pacific Tsunami Warning & Mitigation System

Tsunami Warning!



English: <https://vimeo.com/124650777>
Spanish: <https://vimeo.com/125109150>
French: <https://vimeo.com/125109148>



Pacific Tsunami Warning & Mitigation System

Tsunami Warning!

When a major undersea earthquake occurs near the coast, tsunamis can occur that will hit nearby coasts in minutes, and also travel across the ocean, causing damage 2000 or more miles away and up to 24 hours later. To alert far-away coasts, internationally coordinated tsunami early warning systems such as the Pacific Tsunami Warning and Mitigation System (PTWS), have been established to quickly provide tsunami warnings to coastal areas.

2011 marks the 50th year of the PTWS. The System was established in 1965 in response to the 1964 M9.5 earthquake off South-central Chile that generated tsunami waves that hit the Pacific Ring of Fire islands in Hawaii, Japan, and the Philippines. The PTWS has been built up over the decades through international cooperation and the contributions of countries and organizations under the UNESCO IOC banner.

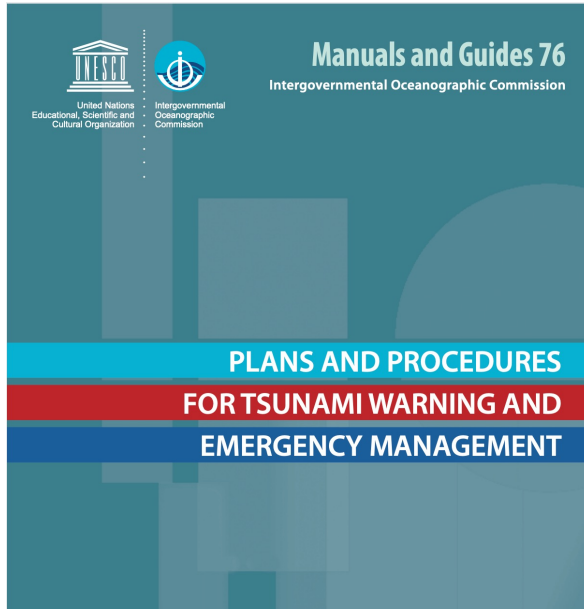
To reduce vulnerability to the danger of tsunamis, we educate the public on how the PTWS works to disseminate information approaching tsunamis, the IOC in cooperation with Chile has produced a tsunami outreach video. The video is intended to share the public and stakeholders across interdisciplinary and multidisciplinary domains that have roles and reduce property damage.

This video chronicles the tsunami warning chain for a M9.5 earthquake off northern Chile. Pacific Tsunami Warning Center (PTWC) staff quickly produce tsunami and sea level data, forecast tsunami wave heights, and disseminate their threat assessments to coastal National Tsunami Hazard Mitigation Center (NTHC) members. The NTHCs then issue public alerts via sirens, highlighting tsunami warning and emergency response actions by citizens and communities during immediate after the death quake in Chile and Peru, and other receiving the PTWS alerts in Samoa and Hawaii, and in Australia, Japan, Indonesia, and the Philippines.

www.tsunamiwatch.info

Produced by International Tsunami Information Center (ITIC) in collaboration with the UNESCO Tsunami Program, Science Hydrology & Oceanography to be Annals of the United States Government Oceanographic Commission IOC of UNESCO. PTWS: IOC tsunamiwatch.info

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7-18 August 2023, Honolulu, Hawaii USA

Thank You

Dr. Laura Kong
Director, ITIC

