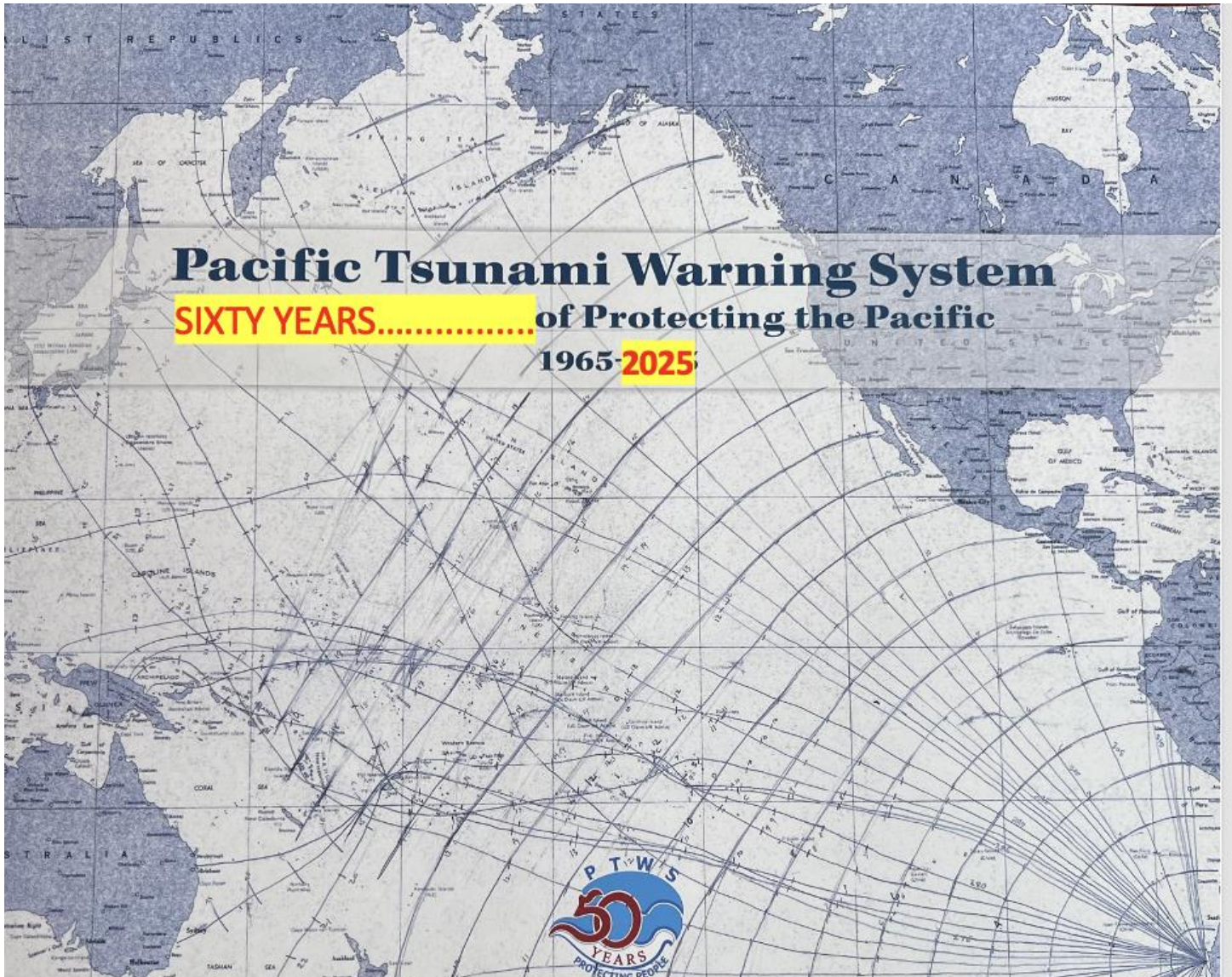
Historical perspectives on the PTWS

Eddie Bernard

Former Director of PTWC &
IUGG Tsunami Commission Chair



Outline

1. Advances since 1965

Global effort to reduce distant tsunami tsunami hazards through capacity building

2. Future Challenges – Saving Lives from Local Tsunamis

We have gone a long way…

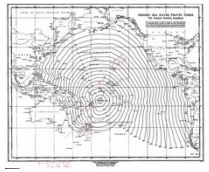
1948 the **Honolulu Magnetic Observatory**, under the US Coast and Geodetic Survey (USCGS)established

1952. The Japan Meteorological Agency started its national tsunami warning center

1965 - IOC Working Group on the International Aspects of the Tsunami Warning System in the Pacific, organized by the USCGS on behalf of the IOC, Honolulu, 27-30 April 1965

ITSU development

ITSU
IOC/IV-6, International Aspects of the Tsunami Warning System in the Pacific, Paris, November 1965



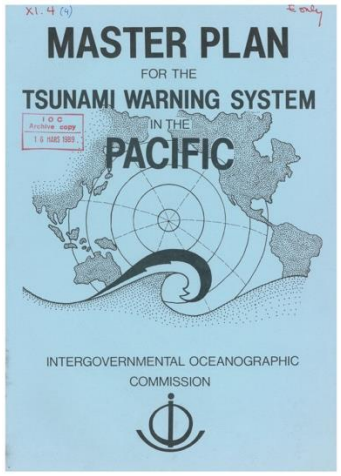
1965

The Honolulu Observatory renamed Pacific Tsunami Warning Center PTWC

1977

1989

First Master Plan



The tragedy brings world attention to the dangers of tsunamis in every nation and initiates the development of warning and mitigation systems in the Indian Ocean

Indian Ocean Tsunami

2004

2005

3 ICGs established

Indian Ocean (ICG/IOTWS), Caribbean and Adjacent Seas (ICG/CARIBE-EWS), Mediterranean and North Atlantic (ICG/NEAMTWS) (IOC/XXIII-11, 12, 13, **June 2005**)

ITSU renamed

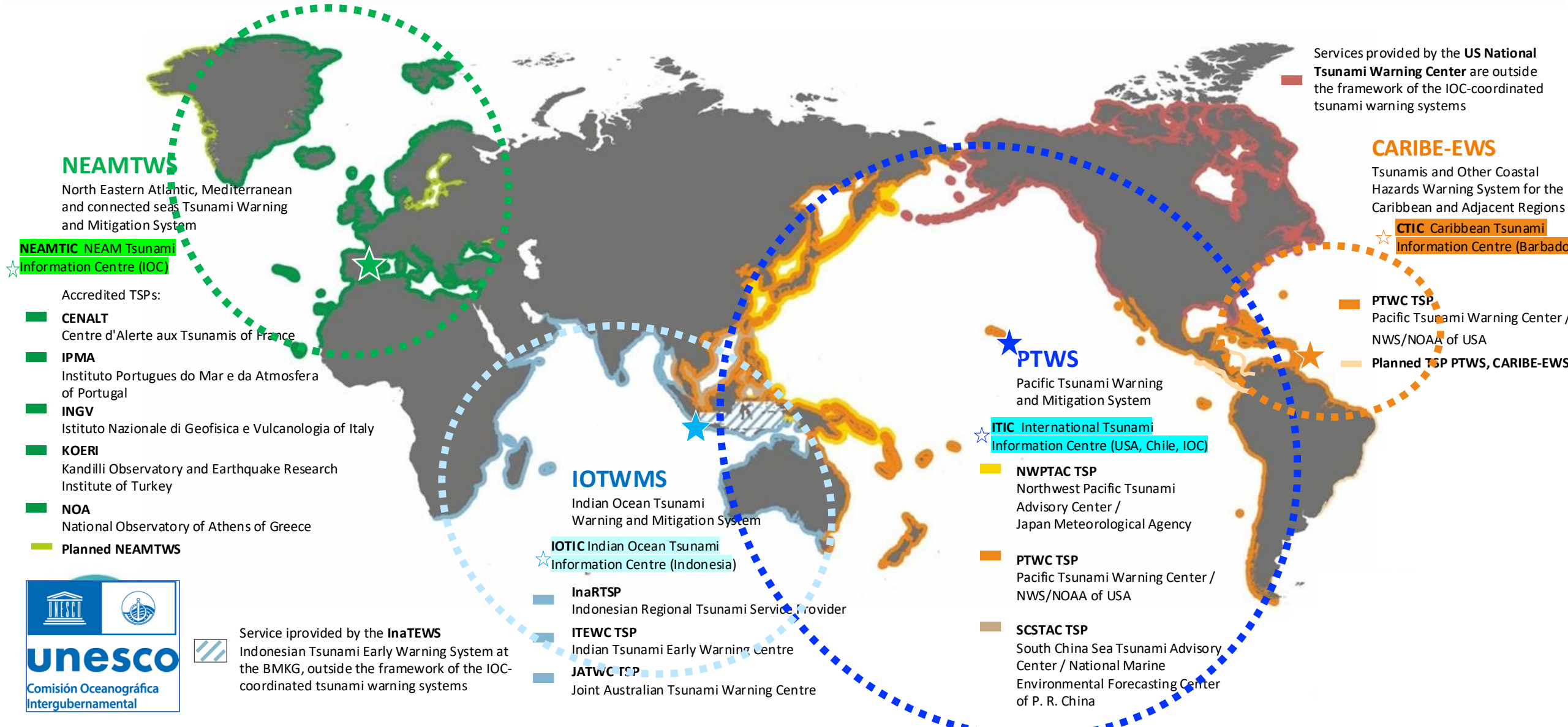
September 2005, Vina del Mar, Chile

The 20th Session of the ICG/PTWS-XX decides to change its name to the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System

GLOBAL TSUNAMI WARNING AND MITIGATION SYSTEM

Intergovernmental Oceanographic Commission of UNESCO

2024 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**

IOTWMS

Indian Ocean Tsunami Warning and Mitigation System

IOTIC Indian Ocean Tsunami Information Centre (Indonesia)

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

Service iprovided by the **InaTEWS** Indonesian Tsunami Early Warning System at the BMKG, outside the framework of the IOC-coordinated tsunami warning systems

PTWS

Pacific Tsunami Warning and Mitigation System

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

- **NWPTAC 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 (Barbado

- **PTWC TSP** Pacific Tsunami Warning Center / NWS/NOAA of USA
- **Planned TSP PTWS, CARIBE-EWS**

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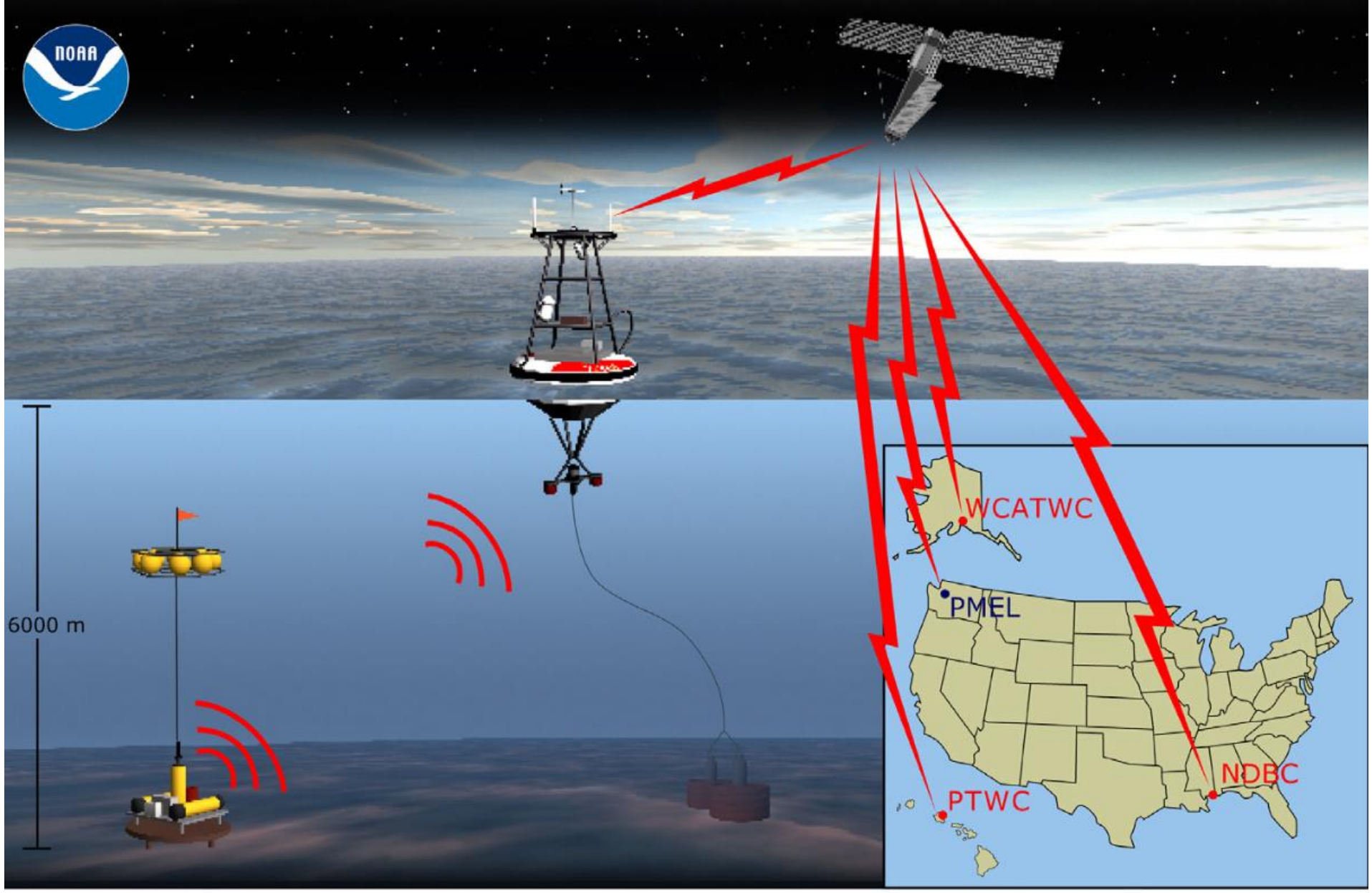
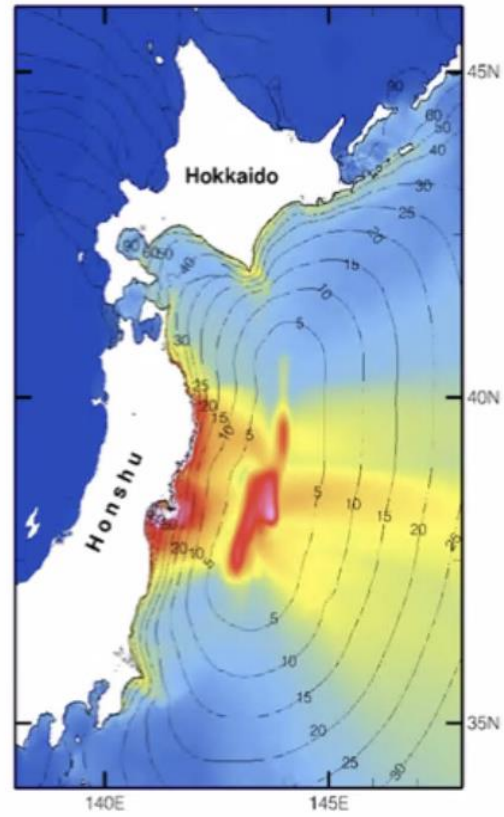
Comisión Oceanográfica Intergubernamental

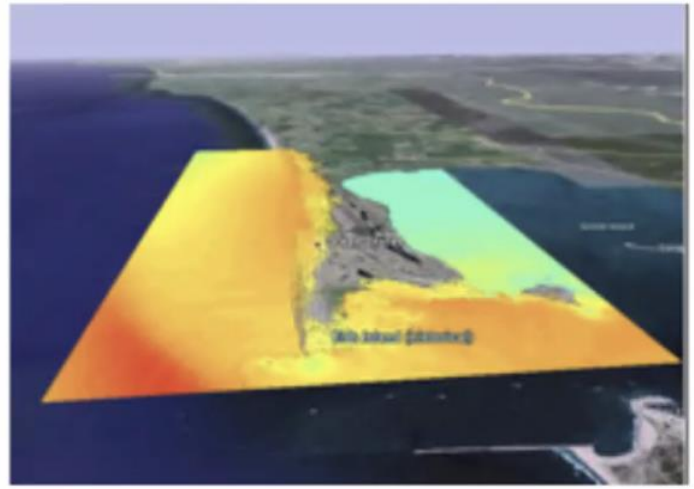


Deep-ocean Assessment and Reporting for Tsunamis (DART)

Tsunami Forecast “Holy Grail”

Predict tsunami inundation before tsunami arrival





1. Use direct tsunami observations in deep

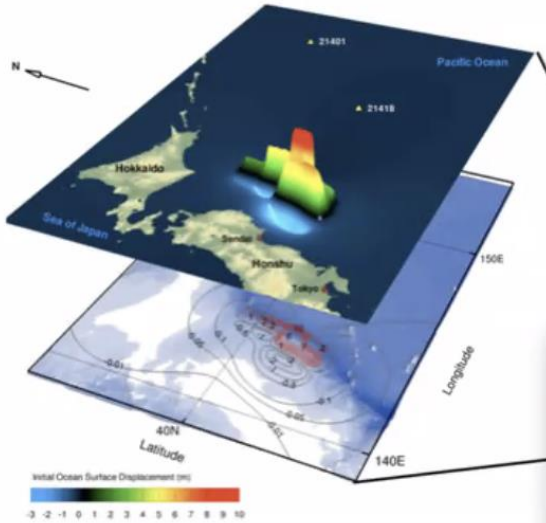
2. Assess tsunami source

3. Use real-time high-resolution models to

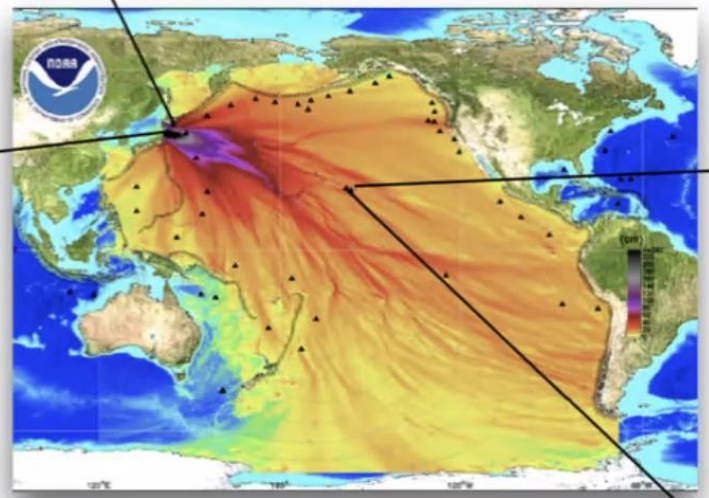
Tsunami Forecast Tested

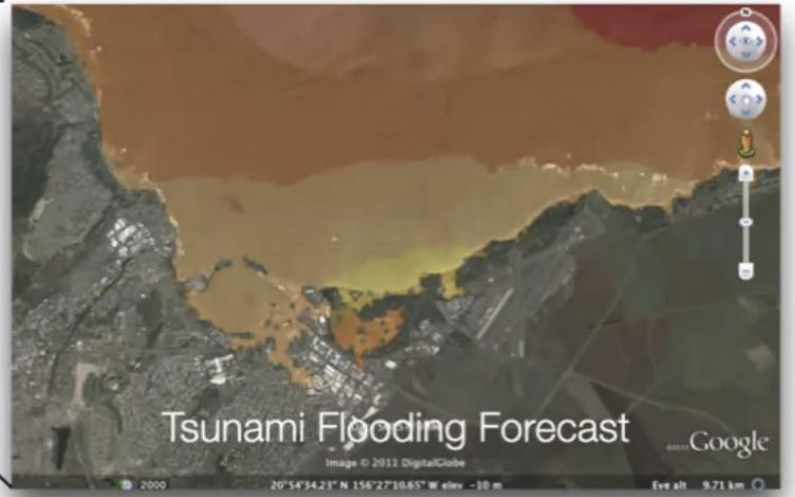
2011 Tohoku tsunami

Tsunami Source

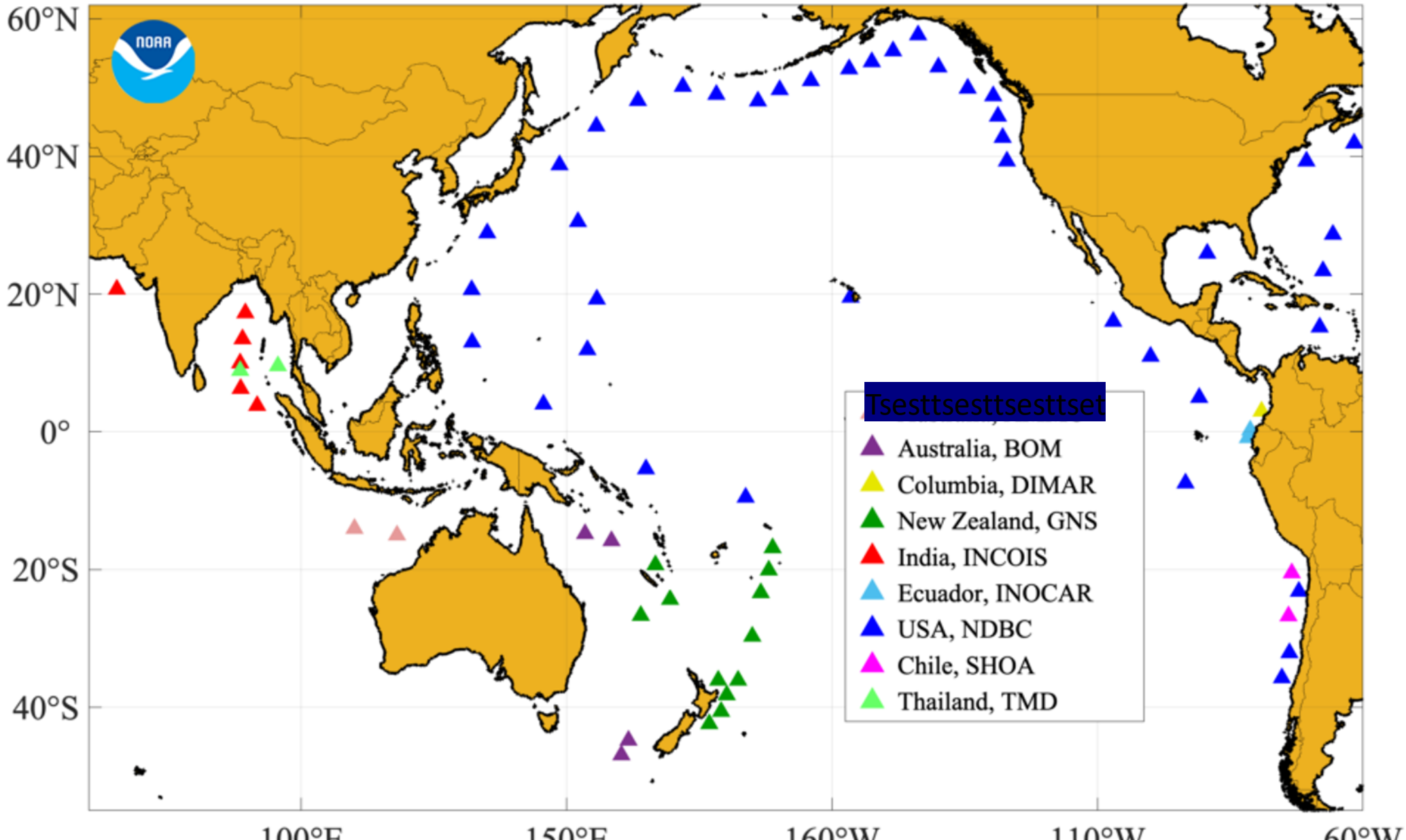


Propagation





DART Global Network, May 2024



Milestones of the IUGG-Tsunami Commission

1960-present- Symposium every 2 years, published proceedings, developed tsunami data base and tsunami glossary

1990- IDNDR-Tsunami Inundation Modeling Exchange (TIME)
Tohoku U transferred technology to 14 institutions in 9 nations
Producing 73 tsunami inundation maps

2004- NOAA web-based inundation modeling training began.
400 scientists from 60 nations have passed 30 training sessions

Today- Titov will discuss NOAA web-based inundation forecasting

OCEAN DECADE TSUNAMI PROGRAMME

A SAFE OCEAN

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

unesco Intergovernmental Oceanographic Commission

THE MAIN SOCIETAL OUTCOME

TO MAKE 100%

OF COMMUNITIES AT RISK OF TSUNAMI PREPARED FOR AND RESILIENT TO TSUNAMIS

BY 2030

- ***Tsunami Coalition***: *collaborative with critical UN stakeholders, civil protection, others ==> Raise profile. Facilitate resourcing*

CHAIR is LAURA KONG

- ***Capacity Development***: *"Tsunami Ready" training, augmented by online IOC Ocean Teacher Global Academy (OTGA) ==> Global reach, deep curricula*

ITIC is OTGA STC

UN OCEAN DECADE TSUNAMI PROGRAMME:

100% AT-RISK COMMUNITIES TSUNAMI READY

	TSUNAMI READY INDICATORS
I	**ASSESSMENT (ASSESS)**
1	**ASSESS-1**. Tsunami hazard zones are mapped and designated.
2	**ASSESS-2**. The number of people at risk in the tsunami hazard zone is estimated.
3	**ASSESS-3**. Economic, infrastructural, political, and social resources are identified.
II	**PREPAREDNESS (PREP)**
4	**PREP-1**. Easily understood tsunami evacuation maps are approved.
5	**PREP-2**. Tsunami information including signage is publicly displayed.
6	**PREP-3**. Outreach and public awareness and education resources are available and distributed.
7	**PREP-4**. Outreach or educational activities are held at least 3 times a year.
8	**PREP-5**: A community tsunami exercise is conducted at least every two years.
III	**RESPONSE (RESP)**
9	**RESP-1**. A community tsunami emergency response plan is approved.
10	**RESP-2**. The capacity to manage emergency response operations during a tsunami is in place.
11	**RESP-3**. Redundant and reliable means to timely receive 24-hour official tsunami alerts are in place.
12	**RESP-4**. Redundant and reliable means to timely disseminate 24-hour official tsunami alerts to the public are in place.

- **STRATEGY:**
  Be Aware, Be Prepared
- **FRAMEWORK:**
  - Harmonized global guidelines UNESCO IOC Tsunami Ready
  - Performance-based Community Recognition
- **ACTION:**
  National programs empower Communities
- **GLOBAL MEASURE**

unesco
Intergovernmental Oceanographic Commission

Standard Guidelines for the Tsunami Ready Recognition Program, UNESCO IOC TS 74

Congratulations

PTWS has led the way to a global tsunami warning system that protects coastal communities from distant tsunamis

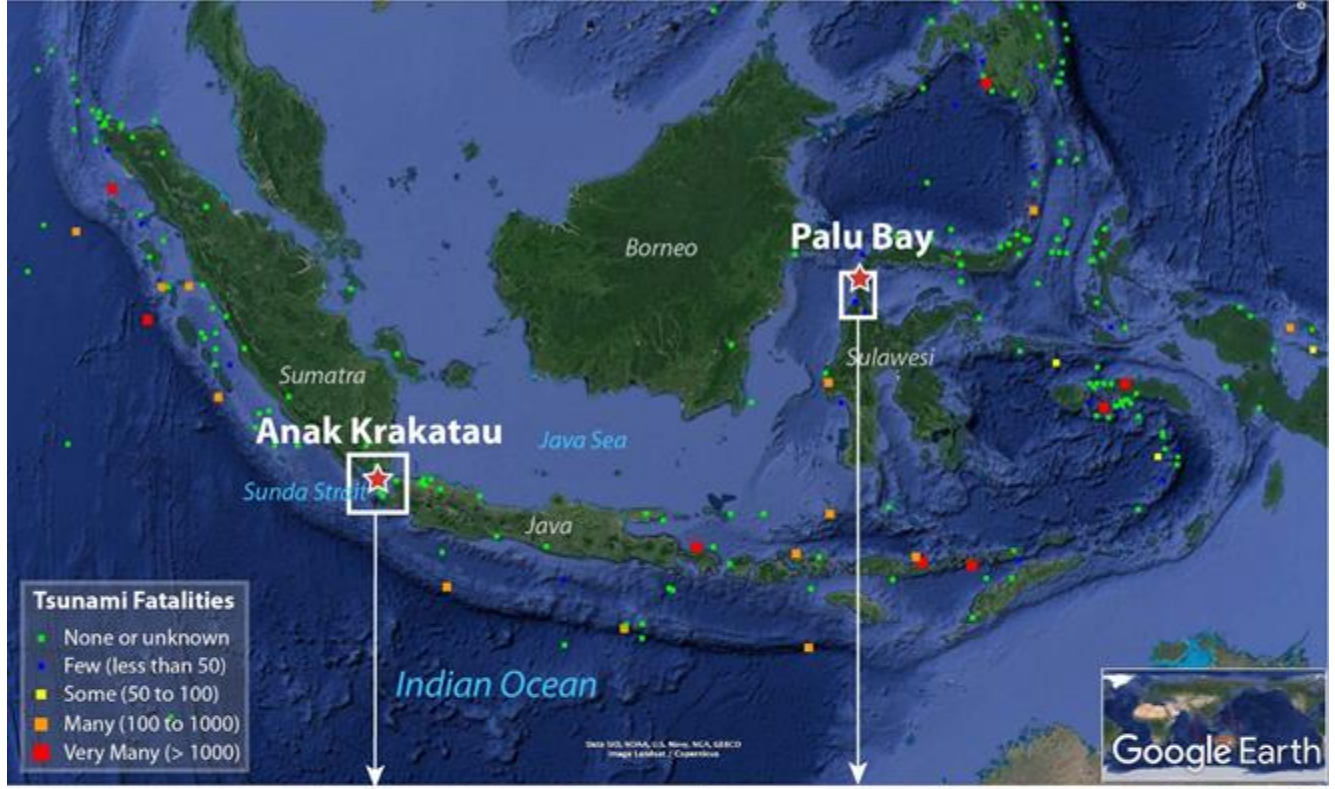
However, Local Tsunamis Continue to Kill

- 2018 Indonesian Tsunamis Killed about 2,500 people

- Palu Bay tsunami was underestimated due to unusual earthquake source- 2,000 deaths

Sirens Failed

- Earthquake-centric system was not designed for the volcanic tsunami -500 deaths



Outline

1. Advances since 1965

Global effort to reduce distant tsunami hazards through capacity building

2.Future Challenges – Saving Lives from Local Tsunamis

Tsunami Casualties of At-Risk Population

Japan – Best Tsunami Prepared Country in the World

- **2011** about 3% casualties in tsunami hazard areas

Banda Ache, Indonesia- Unprepared for Tsunami

- **2004** about 25% casualties in tsunami hazard areas

Projected Casualties from the Next Tsunami

3% to 25% of people living/working in tsunami hazard areas

Preferred Options for Tsunami Survival

Currently there are two (2) recommended options

1. Horizontal Evacuation

On Foot, Bicycle, Vehicle to Communal Shelters

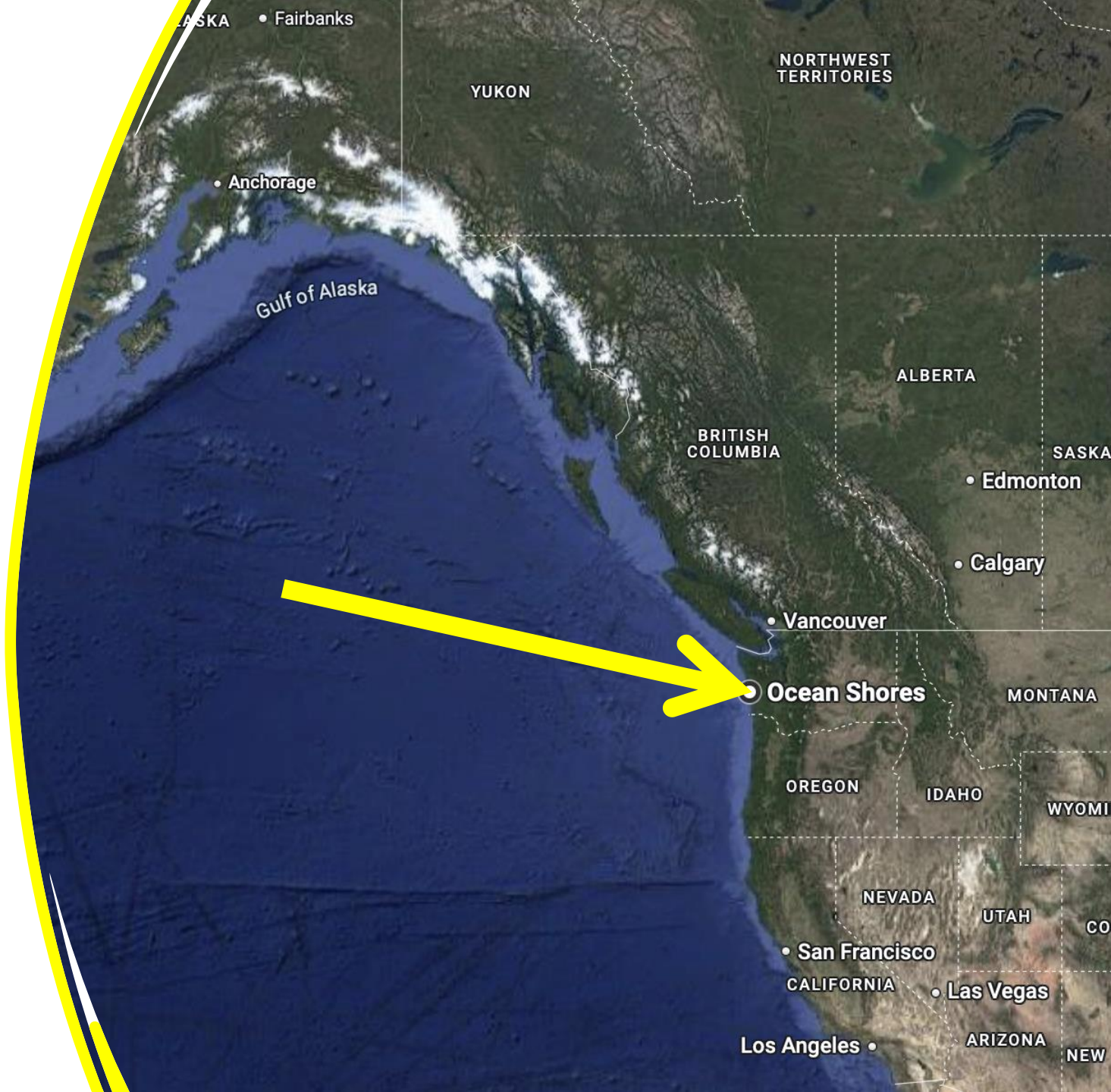
2. Vertical Evacuation

Communal Towers or Reinforced Concrete Buildings

- **However, there are problems with both options because people are either unable or unwilling to evacuate to communal facilities**

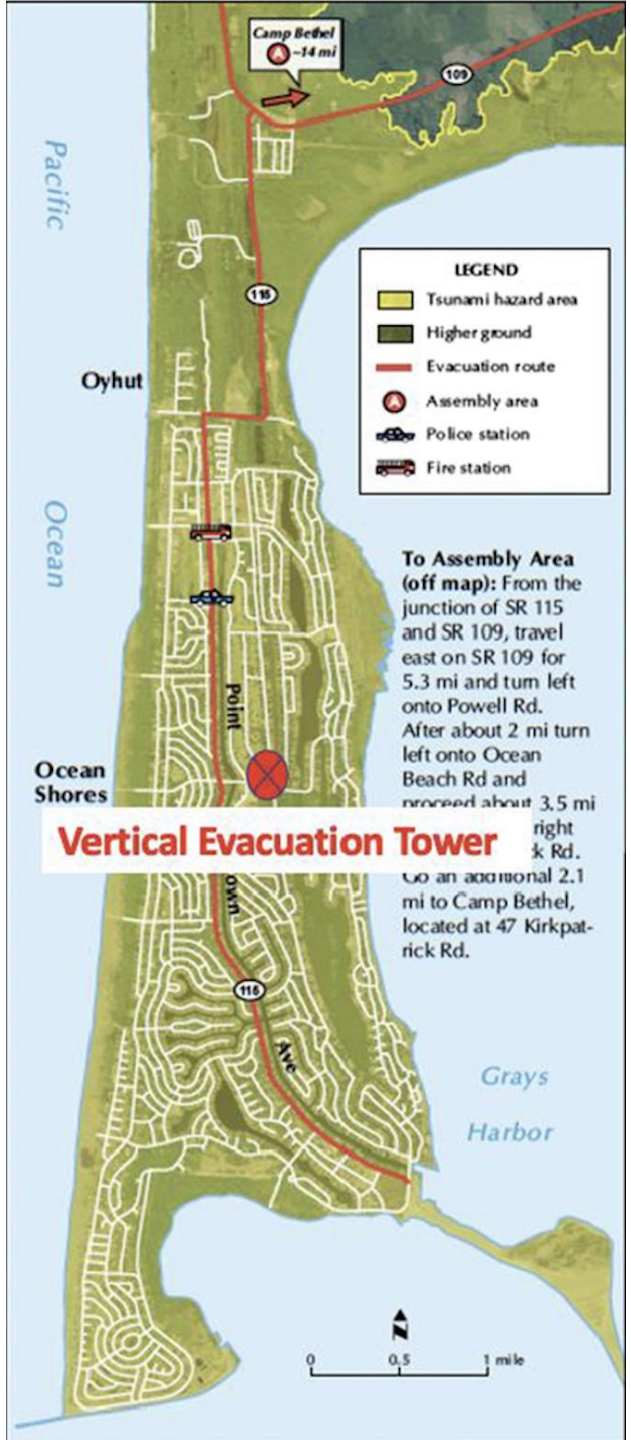
Case Study:

Ocean Shores, Washington, USA



Study Area: Ocean Shores, Washington

TsunamiReady®
NATIONAL WEATHER SERVICE



Ocean Shores Estimated Casualties

7034 out of total population of 7167

Or

98%

Vertical Evacuation Tower

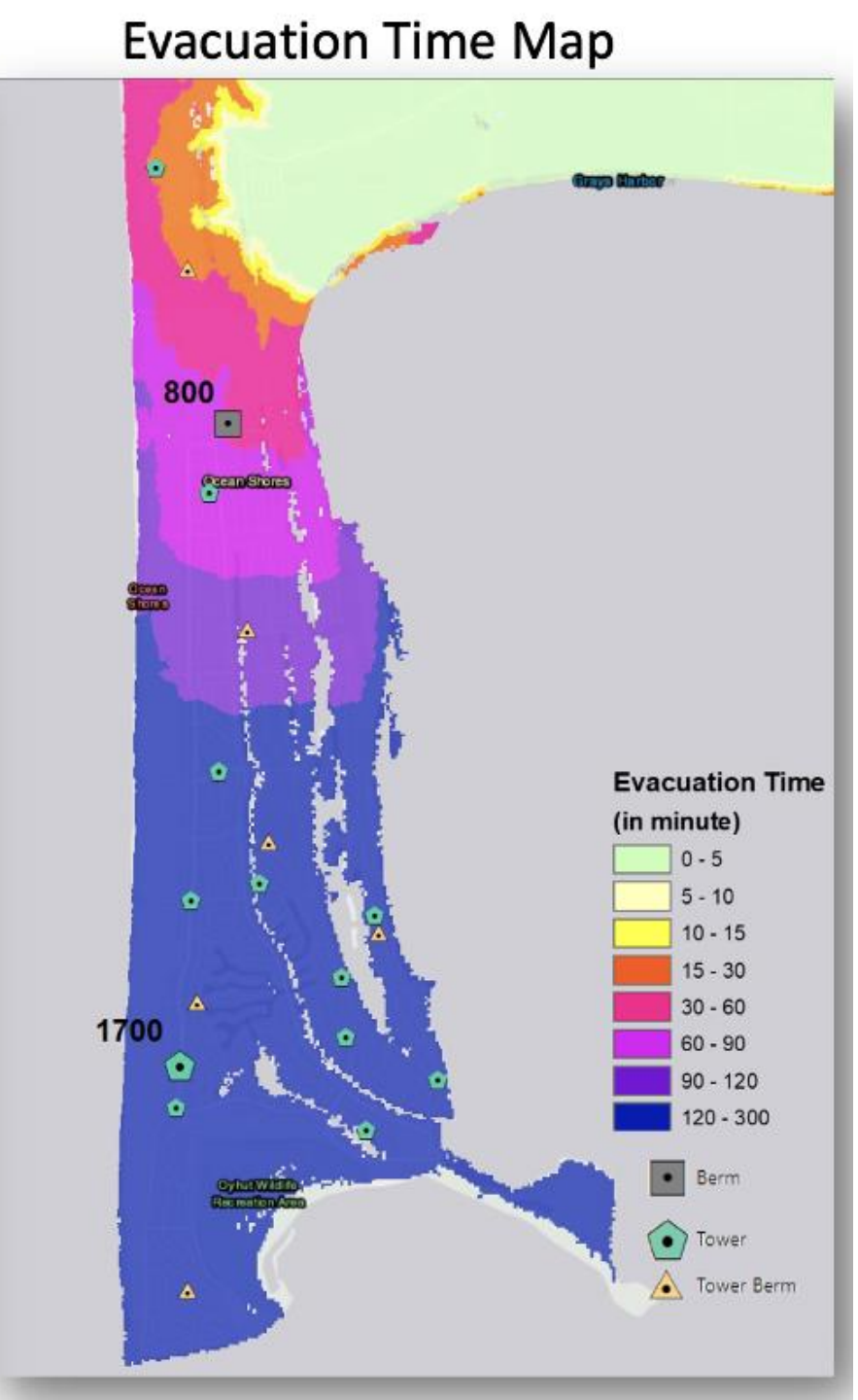
800 Person Capacity

18m (60 feet) high

Sprinkler System

Disability compatible

$12,800,000 per tower



Cost of 10 Vertical Evacuation Towers

(800-person capacity/tower)

2023 Estimates

$128,000,000

Original Plan was proposed in 2004. FEMA Mitigation Funds were secured for 1 tower. Pandemic interrupted plans, costs tripled.

Tower was cancelled.

None are planned.

Ocean Shores is TsunamiReady for Evacuation

However,

NOT TsunamiReady for Survival

Third Option:
Shelter-in-Place (Japan)

- **Immediate access** – **evacuation time is less than 3 minutes**.

Shelter is located at residence or business

Based on medical exams of 2011 casualties, must protect occupants from

- **Drowning**
- **Being hit or crushed by floating objects**
- **Being burned by fires**
- **Hypothermia (exposure to cold water)**
- **Swallowing toxic dirt mixed in tsunami water**
- **Contagious diseases (post pandemic)**

Japanese Tsunami Lifeboats
(Meet Japanese Guidelines that were developed by lifeboat industry)

- **Japanese guidelines for lifeboats**

https://www.mlit.go.jp/maritime/maritime_tk5_000024.html

- **Requires about 30 square meter footprint plus special support structure**

Shelter-in-Place – Safe Shelter (Japan)

- Water-tight: It floats to protect from drowning, being crushed or hit by floating objects, or ingesting silt laden tsunami water
- Insulated to protect from cold water
- Storage for personal items, food, and water
- Made of Fiber Reinforced Plastics that may melt in fires and produce toxic fumes
- Provides shelter after tsunami subsides

NOT EXPOSED TO DISEASES

20-person

8-person

Example Of Laydown

Enhanced vertical evacuation tower

Shelter-in-Place (5 sq m footprint)- Survival Capsule (U.S.)

The capsule is a protective shell has been specifically ***Designed, Analyzed and Tested using aerospace engineering technology*** to protect occupants from tsunami forces, punctures and fires

- **Water-tight: It floats to protect from drowning, being crushed or hit by floating objects, or ingesting silt laden tsunami water**

- **Aircraft grade aluminum to protect from being crushed , punctured or fires**
- **Insulated to protect from cold water or fires**

- **Storage for personal items, food, and water**
- **Provides shelter after tsunami subsides**

NOT EXPOSED TO DISEASES

Shelter-in-Place Summary

- **The next tsunami will kill between 3% and 25% of people who live or work within the tsunami hazard areas using only horizontal and vertical evacuation options.**

- **Incorporating shelter-in-place options to complement existing horizontal and vertical evacuation practices can reduce or eliminate the number of deaths from the next tsunami.**

Conclusions

Advances in tsunami resilience since the 2004 tsunami have been significant and effective.
Warning systems and Tsunami Ready programs need continued support

However, Local tsunamis continue to kill

Shelter-in-place options should be incorporated into existing evacuation plans for those unable or unwilling to evacuate

Need: International Guidelines for Shelter-in-Place products besides lifeboats

Questions?

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