



UNESCO/IOC – NOAA ITIC Training Program in Hawaii (ITP-TEWS Hawaii)
TSUNAMI EARLY WARNING SYSTEMS
AND THE PACIFIC TSUNAMI WARNING CENTER (PTWC) ENHANCED PRODUCTS
TSUNAMI EVACUATION PLANNING AND UNESCO IOC TSUNAMI READY PROGRAMME
15-26 September 2025, Honolulu, Hawaii



2021
2030 United Nations Decade
of Ocean Science
for Sustainable Development

UN Decade for Ocean Science for Sustainable Development



Pacific
Community
Communauté
du Pacifique

***Dr. Laura Kong - Ardito Kodijat,
Indian Ocean Tsunami Information Centre (IOTIC)
International Tsunami Information Centre (ITIC)***

The Science We Need for the Ocean We Want

The United Nations
Decade of Ocean Science
for Sustainable Development
(2021-2030)



UNESCO/IOC-NOAA-JIOA
International Tsunami Information Center

THE OCEAN DECADE WILL
PROVIDE A 'ONCE-IN-A-LIFETIME'
OPPORTUNITY FOR NATIONS TO
WORK TOGETHER TO GENERATE
THE GLOBAL OCEAN SCIENCE
NEEDED TO SUPPORT THE
SUSTAINABLE DEVELOPMENT OF
OUR SHARED OCEAN.

Decade Challenge 6:
Increase community
resilience to ocean hazards
(e.g., early warning)

Decade Challenge 7:
Expand the global ocean
observing system

Societal Outcome 5:
Safe Ocean

Actions – Projects:

- SMART will strengthen
Tsunami Early Warning
System
- ⇒ Faster Detection
 - ⇒ Better Forecasts
 - ⇒ Faster warning save lives

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OCEAN DECADE TSUNAMI PROGRAMME

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NEWLY ENDORSED DECADE ACTION THE OCEAN DECADE TSUNAMI PROGRAMME



Lead Institution: Intergovernmental Oceanographic Commission - IOC-UNESCO

#OceanDecade



Unesco - Intergovernmental Oceanographic Commission
October 24 at 8:02 AM · 🌐

🌟 ANNOUNCEMENT 🌟

🌐 'The Ocean Decade Tsunami Programme' is our newly endorsed Decade Action! This Programme will focus on rapid #tsunami detection 📡, measurement and forecasting capabilities, implementation of #TsunamiReady communities & related capacity development efforts, specifically targeting #SIDS and #LDCs. 📄 <https://bit.ly/3gG331a>

📢 The Call for Decade Actions No. 04/2022 is open! 📢 'The #OceanDecade Tsunami Programme' is receiving project applications. 📄 Learn + 📄 <https://bit.ly/3sabYe8>

👍 13

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The Ocean Decade Tsunami Programme

Intergovernmental Oceanographic Commission of UNESCO, IOC-UNESCO

Focus:

Increase community resilience to ocean hazards, Indian Ocean, North Atlantic Ocean, North Pacific Ocean, Programme, South Atlantic Ocean, South Pacific Ocean

Programme actions are centred particularly in the fields of rapid tsunami detection, measurement and forecasting capabilities, implementation of TsunamiReady communities and related capacity development efforts, specifically targeting SIDS and LDCs.

Additionally, the emphasis is on capacity and where possible to ensure that steps are taken to improve the resilience of people and communities to the impacts of tsunamis.

1. Risk knowledge

- Enhance our understanding of the tsunami risk by expanding our knowledge of past tsunamis, coastal erosion
- Enhance our understanding of the impact of tsunamis on coastal communities and ecosystems

2. Monitoring and Warning

- Improve coastal and marine systems of early warning
- Enhance our understanding of the impact of tsunamis on coastal communities and ecosystems
- Enhance our understanding of the impact of tsunamis on coastal communities and ecosystems

3. Warning Communication and Communication

- Enhance our understanding of the impact of tsunamis on coastal communities and ecosystems
- Enhance our understanding of the impact of tsunamis on coastal communities and ecosystems

4. Resilient Capacity

- Enhance our understanding of the impact of tsunamis on coastal communities and ecosystems
- Enhance our understanding of the impact of tsunamis on coastal communities and ecosystems

5. Capacity Development and attention to SIDS and LDCs

- Enhance our understanding of the impact of tsunamis on coastal communities and ecosystems
- Enhance our understanding of the impact of tsunamis on coastal communities and ecosystems

Start Date: 01/01/2022

End Date: 31/12/2030

Lead Contact: Bernadette Azevedo (bernadette.azevedo@unesco.org)





ACTIONS

Meet all the endorsed Ocean Decade Actions

The Ocean Decade Tsunami Programme

Intergovernmental Oceanographic Commission of UNESCO, IOC-UNESCO - France

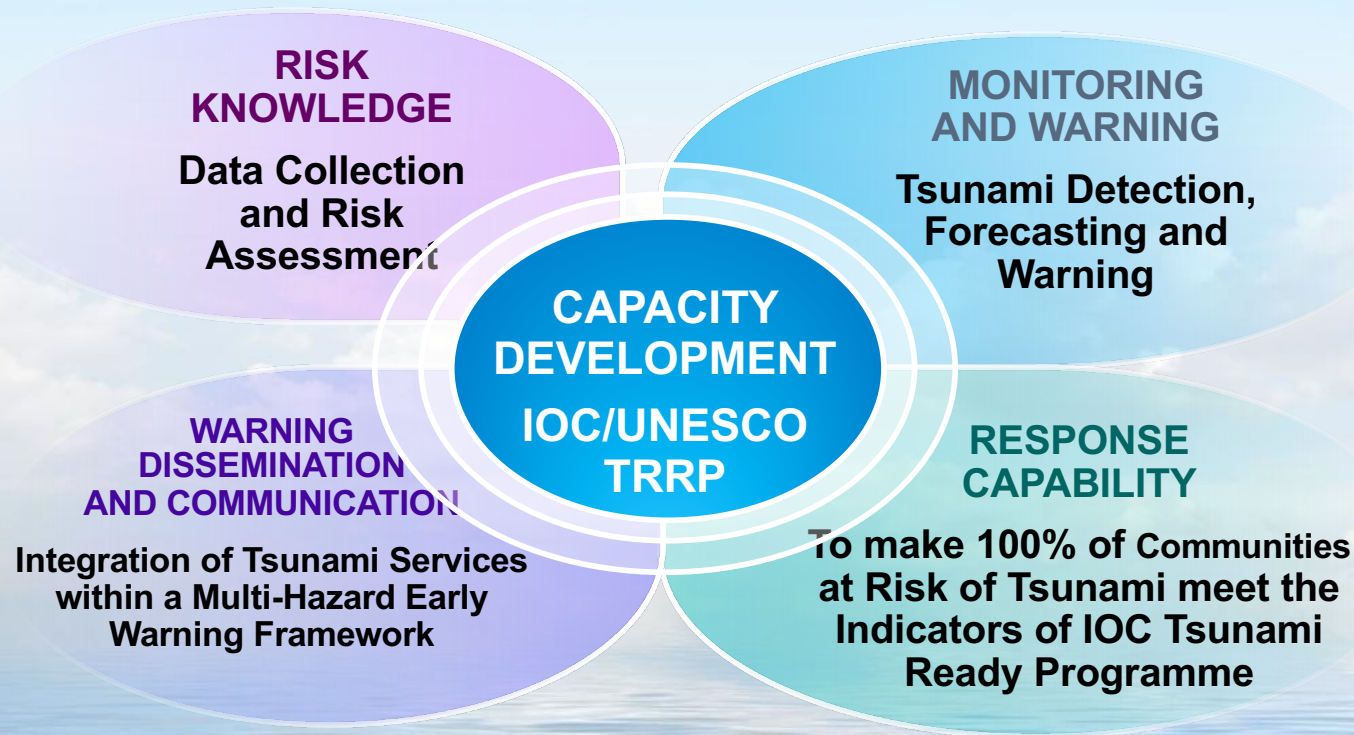
Increase community resilience to ocean hazards, Indian Ocean, North Atlantic Ocean, North Pacific Ocean, Programme, South Atlantic Ocean, South Pacific Ocean

Progress actions is envisioned particularly in the fields of rapid tsunami detection, measurement and forecasting capabilities, implementation of Tsunami Ready communities and related capacity development efforts, specifically targeting SIDS and LDCs.

Additionally, the ambition is to identify and advance specific actions that align with the components of UNDRR People-centered early warning systems including:

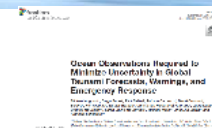
UN OCEAN DECADE TSUNAMI PROGRAMME

Components



Annex 1 to IOC Circular letter, 2825
“Protecting Communities from the World’s Most Dangerous Waves: A Framework for Action under the UN Decade of Ocean Science for Sustainable Development”
 (6 January 2021)

Angove M et al (2019)
Ocean Observations Required to Minimize Uncertainty in Global Tsunami Forecasts, Warnings, and Emergency Response. Front. Mar. Sci. 6:350. doi: 10.3389/fmars.2019.00350



OCEAN DECADE TSUNAMI PROGRAMME

Seeking Major Advances in SCIENCE and PREPAREDNESS

RESILIENCE!

Communities
respond to tsunami threats
by combining accurate

New
observational and
analysis technologies to
move from a
high-uncertainty
assumption-based capability
to a **low-uncertainty**
dynamic-based
capability

1. Real-time impact forecasts

with

2. Deep community preparedness

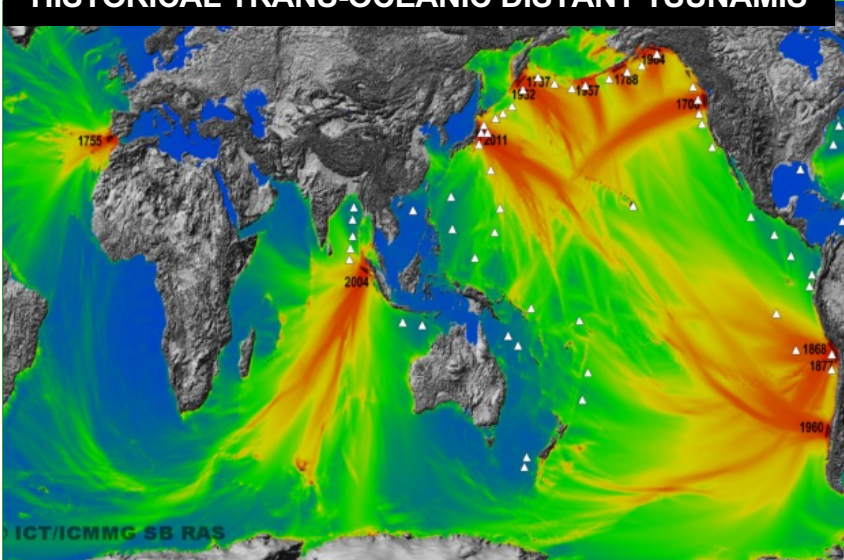
Tsunami disaster impacts
are minimized,
enabling rapid
restoration of critical
infrastructure and services

Comprehensive
institutional & community
preparedness
and capacity building
efforts aimed at achieving
IOC Tsunami Ready
designation across
all socio-economic
categories

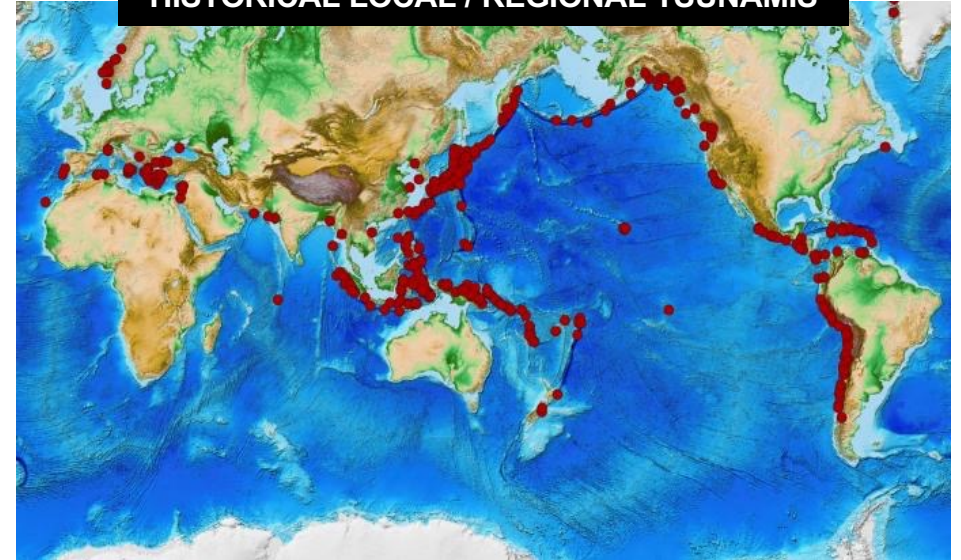


DEADLY TSUNAMIS – DISTANT to LOCAL

HISTORICAL TRANS-OCEANIC DISTANT TSUNAMIS



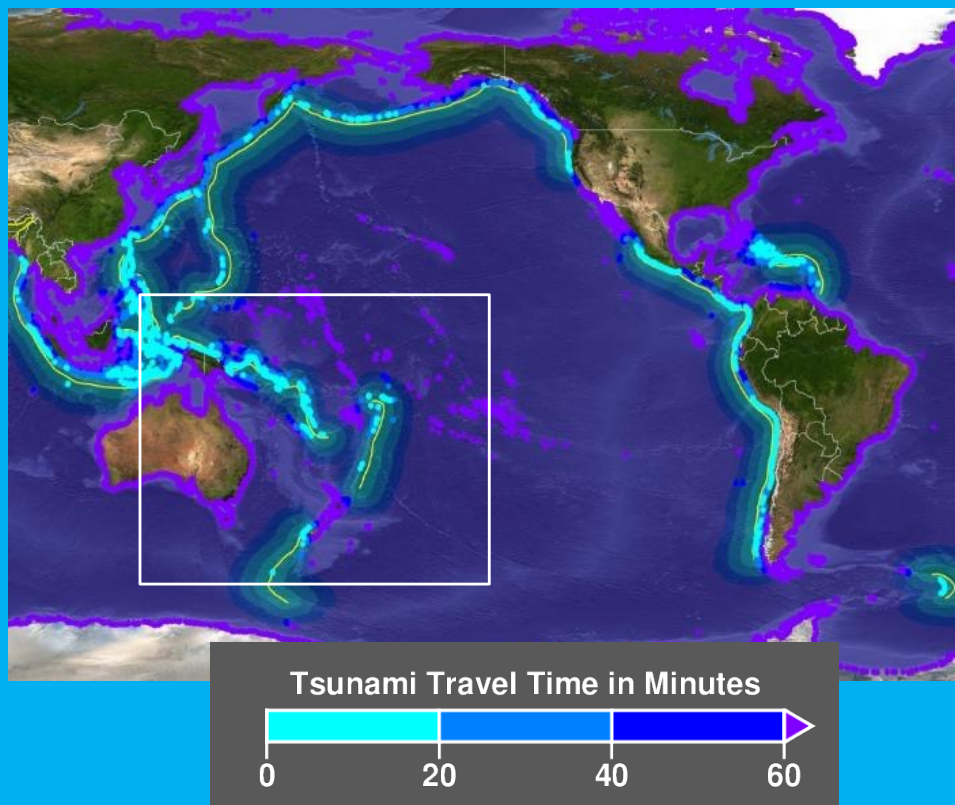
HISTORICAL LOCAL / REGIONAL TSUNAMIS



- ❑ Most tsunamis are local (< 1 hr) or regional (1-3 hrs)
- ❑ Globally, 90% of deaths from local or regional tsunamis

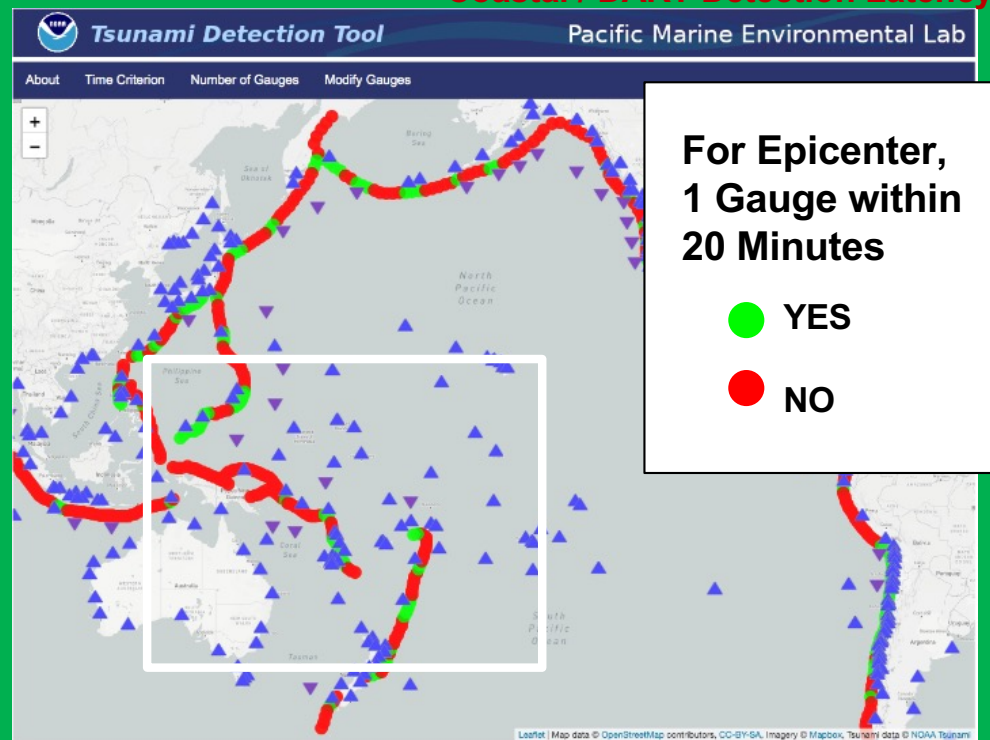
EARLY WARNING FOR LOCAL TSUNAMIS

How much time until wave arrives? < 20 min



UNESCO/IOC-NOAA JIOF
International Tsunami Information Center

Coastal / DART Detection Latency



How fast you find out if wave is severe? < 20 min

R&D ODTP

Intergovernmental Oceanographic Commission
Technical Series



Research, Development and
Implementation Plan for the Ocean
Decade Tsunami Programme

180

1. Risk Knowledge

2. Detection, Analysis, and Forecasting of
Tsunamis

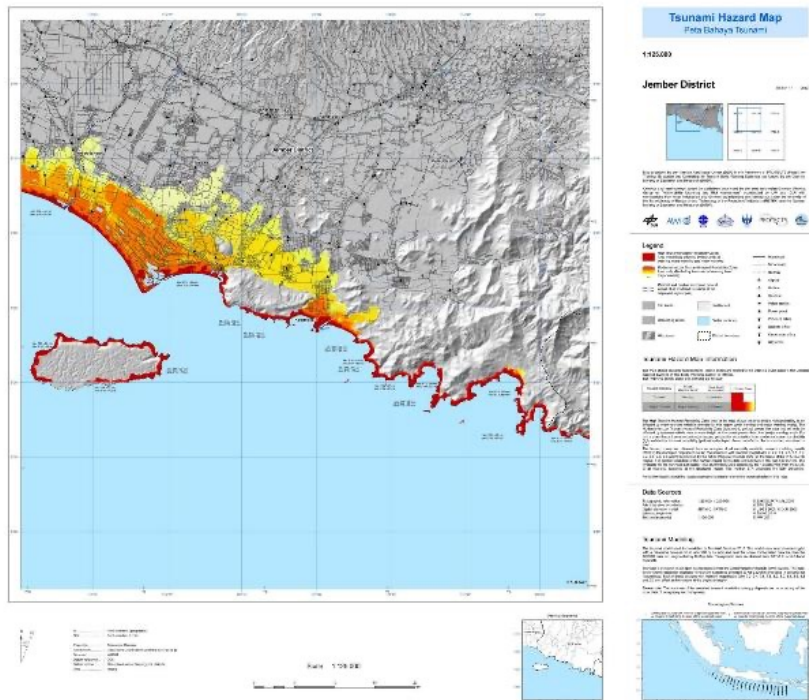
3. Warning Dissemination and Communication

4. Preparedness and Response Capabilities

5. Capacity Development

6. Governance

1. Risk Knowledge



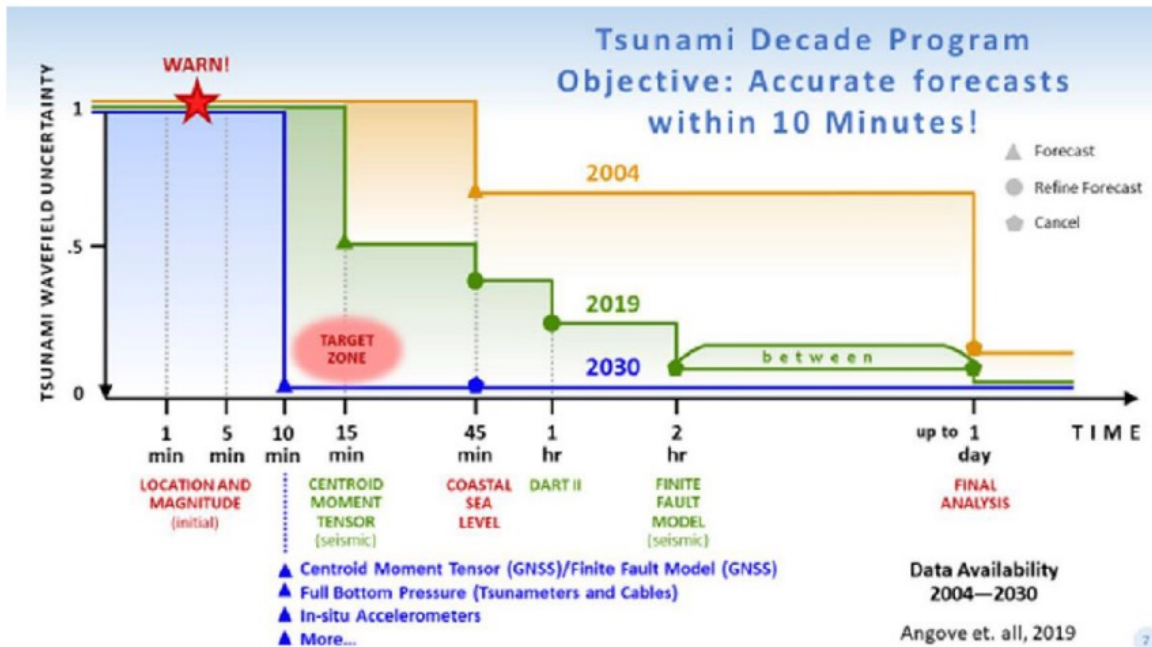
Tsunami Hazard

- Probabilistic Tsunami Hazard Assessment
- Methodology to define Tsunami Parameters
- Data for Tsunami Hazard Assessment

Cascading Risk

- Quantitative and Qualitative Scenario Based Method
- Probabilistic and Deterministic Tsunami Risk Assessment Method
- Physical Process that Caused Tsunami
- Tsunami that caused cascading risk

2. Detection, Analysis and Forecasting



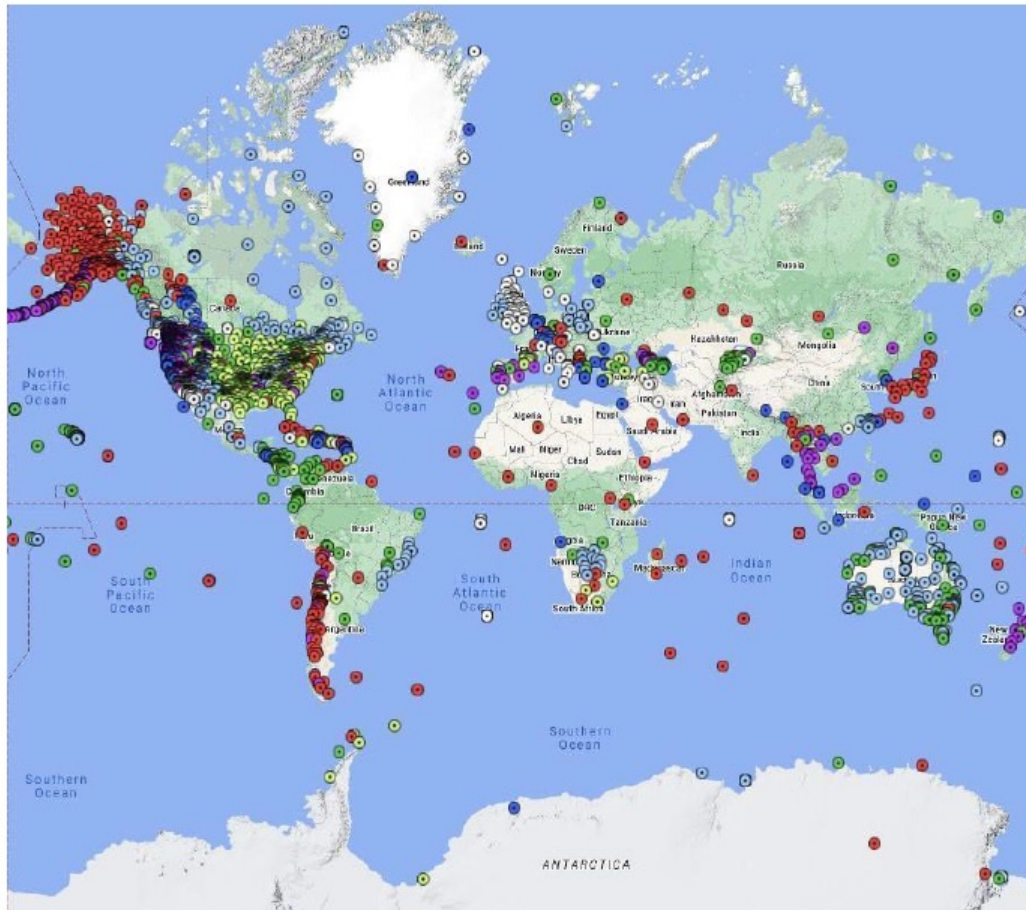
Maximizing current capabilities and instrumentation

Expansion of Supporting Capabilities

Identifying capabilities that exist but are not currently applied to tsunami

Identifying new capabilities that require development

Maximizing current capabilities and instrumentation



International Tsunami Information Center

Seismic Networks

Tsunameters Networks

Coastal Sea Level Gauge Networks

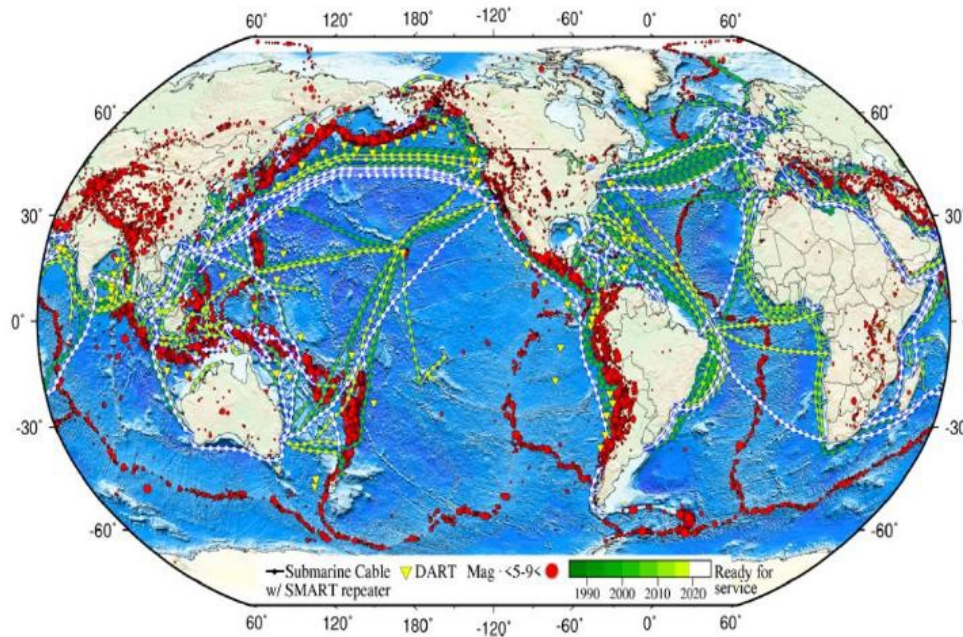
Global Navigation Satellite System

Dedicated Tsunami Observatories

FASTER, BETTER EARTHQUAKE MONITORING: UNDERSEA SMART CABLES, GNSS NETWORK

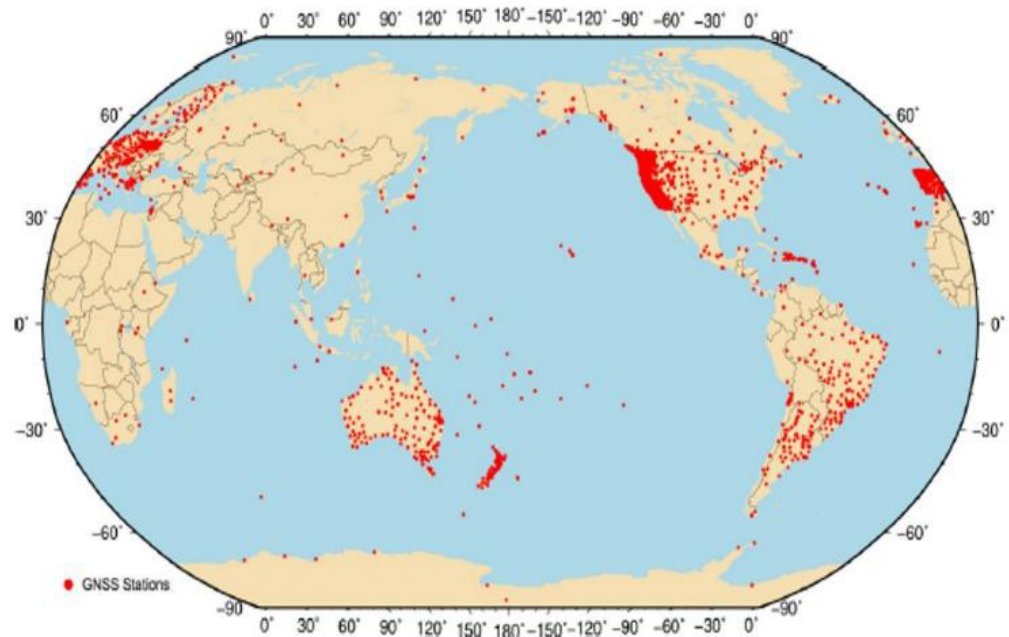
Historical seismicity (red), DART tsunami buoys (yellow triangles)

Current / planned (green/white) submarine cables
SMART repeaters shown every 300 km



Angove, M . et. al, 2019

Real-time GNSS stations (public networks, n=2,260)



Pacific Northwest Geodetic
Array/Central Washington University

Expansion of Supporting Capabilities

- Coastal Bathymetry
- Sensor Siting Analysis
- Global Digital Synthetic Database
- Comparison of Modelling codes
- Identification of potential tsunami sources
- The Science to Practice Challenges
- Training on Tsunami Warning Operations

Identifying capabilities that exist but are not currently applied to tsunami

- Coastal Radars
- Passive/active Remote Sensing
- Infrasound

Identifying new capabilities that require development

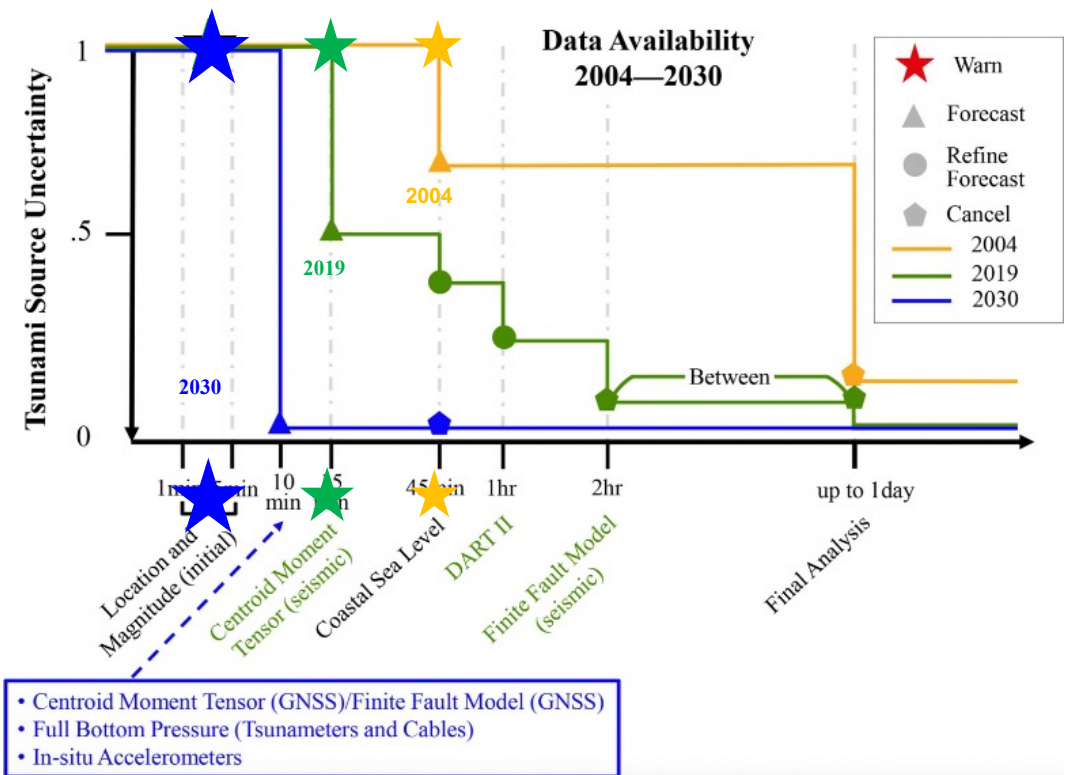
- Ship-based GNSS Observations
- Ionospheric Tomography
- Fibre Optic Application

- Global Threat Database
- Artificial Intelligence applications combined observations to potential outcomes and probabilistic tsunami forecasting
- Rapid Update Cycle Model

3. Waring Dissemination and Communication

- **Effective decision making to Warn**
- **Effective construction of warnings**
- **Effective dissemination and communication of warnings**

IMPROVEMENT IN EARLY WARNING (SMART, GNSS)



**2021
2030** United Nations Decade
of Ocean Science
for Sustainable Development



OCEAN DECADE TSUNAMI PROGRAMME

A SAFE OCEAN

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
- **Capacity Development:** augmented through IOC Ocean Teacher Global Academy (OTGA) ==> Global reach, deep curricula

UN OCEAN DECADE TSUNAMI PROGRAMME:

100% AT-RISK COMMUNITIES TSUNAMI READY



UNESCO IOC 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 is publicly displayed
6	PREP-2. Outreach and public awareness and education resources are available and distributed
7	PREP-3. Outreach or educational activities <u>are held at least three times a year</u>
8	PREP-4. A community tsunami exercise is conducted at least every two years
III RESPONSE (RESP)	
9	RESP-1. A community tsunami emergency response plan (ERP) 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**



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Thank You



Pacific
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