Tsunami Preparedness Within a Multi Hazard Context of the Indian & Pacific Ocean basins

September 2025

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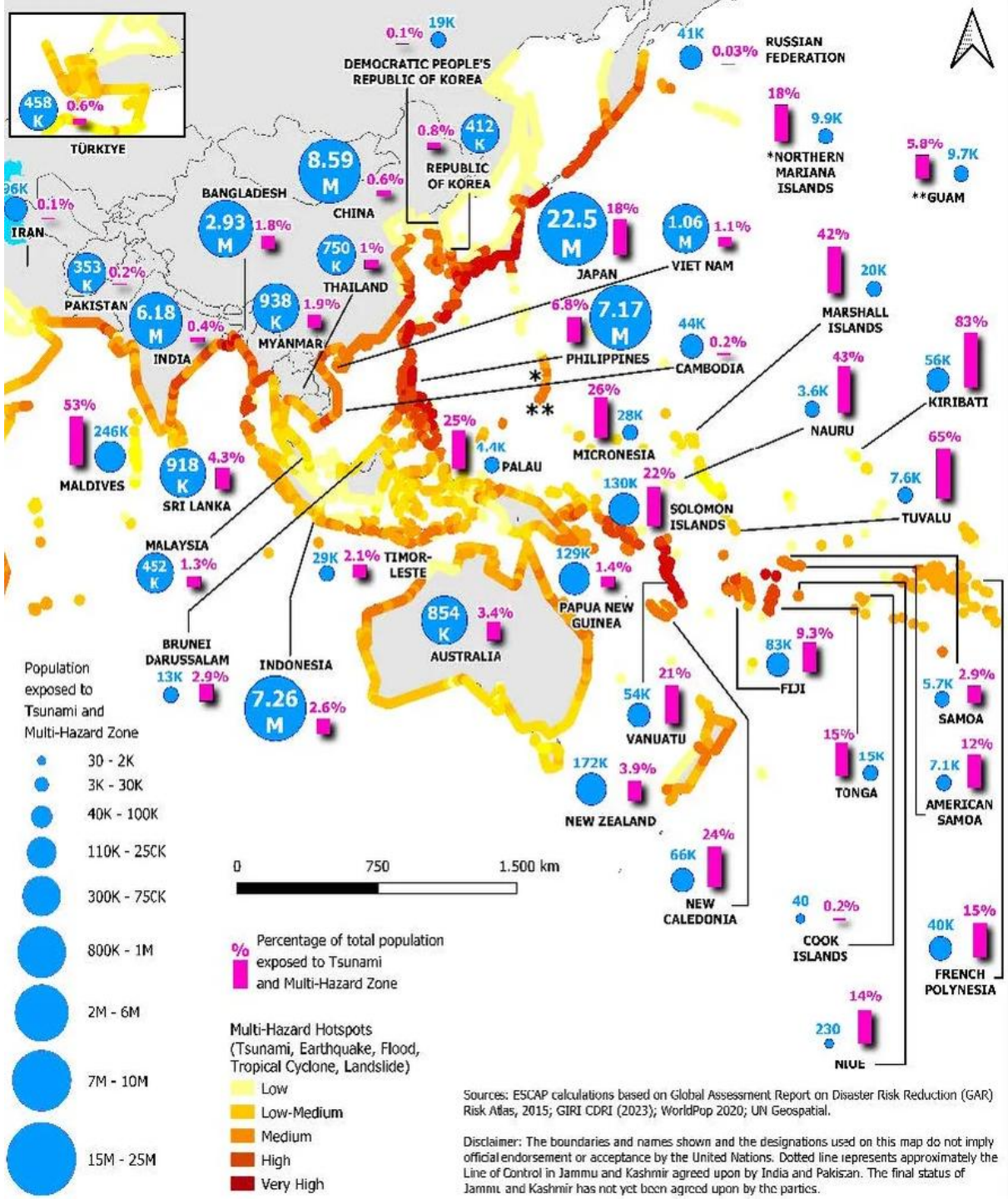
TRUST FUND FOR TSUNAMI, DISASTER AND CLIMATE PREPAREDNESS

Targeting Coastal Hotspots

Exploring Tsunami In Multi-Hazard contexts

- Most disaster impacted region. Since 1970, over two million people have lost their lives
- **The LDCs/SIDS accounts for mortality five times** as compared to the rest of the Asia-Pacific.
- **Economic damages from disasters are on the rise**
- By 2030 more than 50 per cent population is expected to be in 26 cities in extreme high-risk areas
- **Tsunamis remain a major threat for** coastal ESCAP members **Coastal risk hotspots exposing 68 million people and US$2.4 trillion building stock**

Population exposed to tsunami and multi-hazard hotspots in the Asia-Pacific Region (500-year return period)

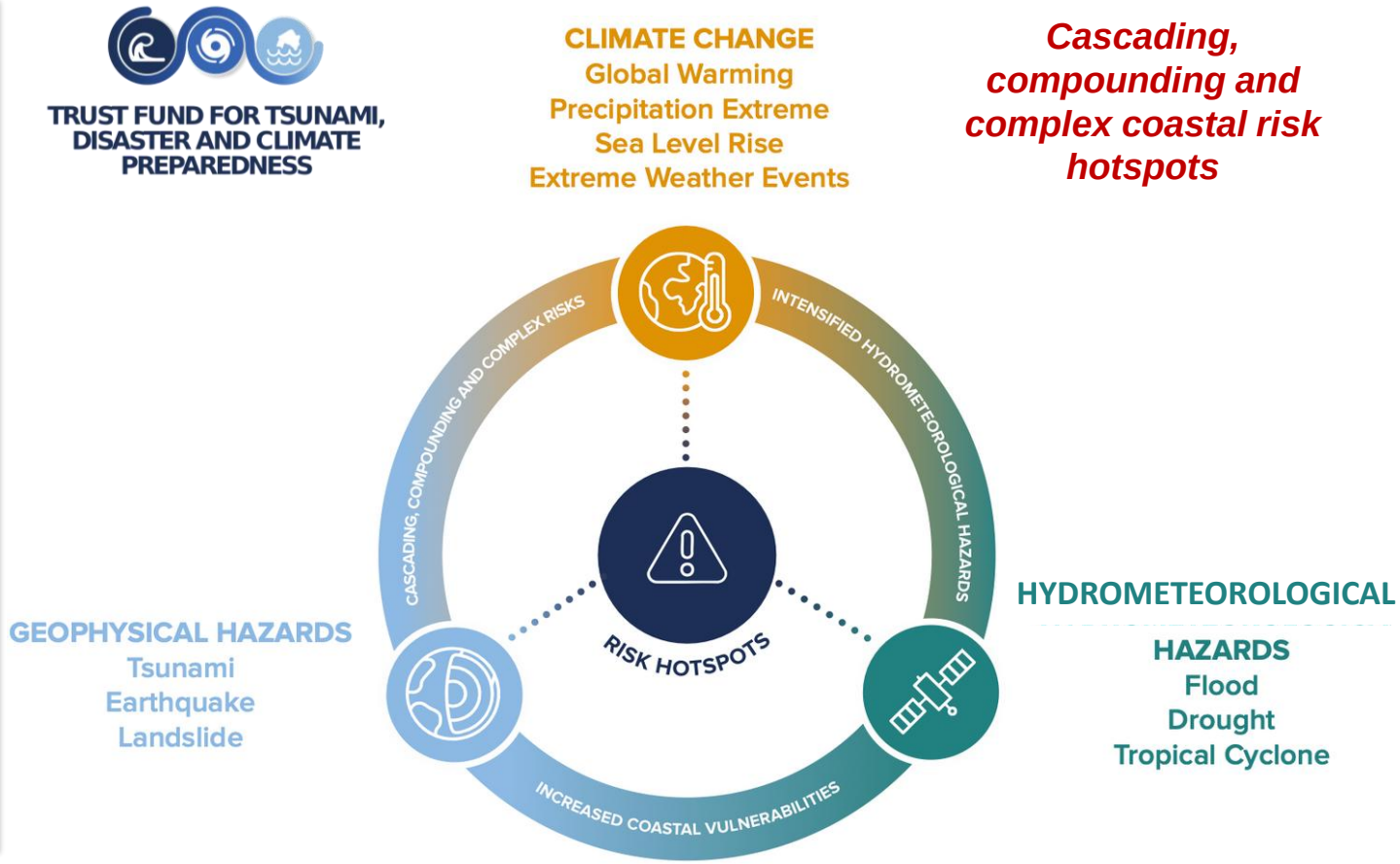


ESCAP's Trust Fund for Tsunami, Disaster and Climate Preparedness

Following the 2004 Indian Ocean tsunami, **the Multi-Donor Trust Fund for Tsunami, Disaster and Climate Preparedness** was established with a founding grant of $10 million from Thailand and soon joined by Sweden, **to address gaps in regional early warning systems**.

10 other donors have since contributed, for a currently **total of $17 million of regional commitment** to strengthen early warning systems, directly **benefitting 23 countries**.

Investments in tsunami preparedness can also **achieve economies of scale and scope** when adapted through a multi-hazard approach



THAILAND FOUNDING DONOR · SWEDEN FOUNDING DONOR · ADB · BANGLADESH · GERMANY · INDIA · ITALY · JAPAN · NEPAL · PHILIPPINES · SWITZERLAND · TÜRKIYE

No one country can do it alone

Cooperation is critical for seamless end-to-end MHEWS, especially for low-capacity countries, LDCs and SIDS

Cooperation mechanisms succeed in ***expanding*** **early action financing, early warning related technology, transboundary advocacy for resilience-building and essential early warning system service provision.**

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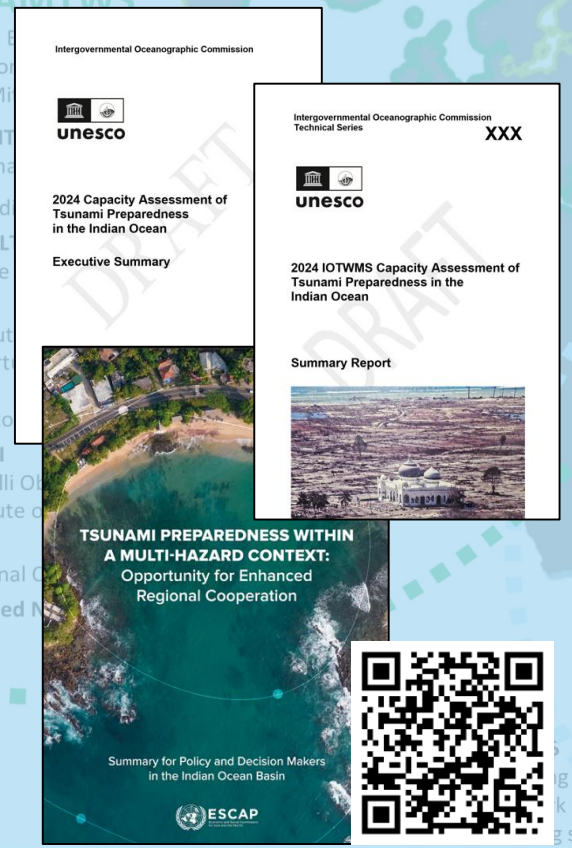
How Far Have We Come In The Last Two Decades?

Tsunami Preparedness Capacity Assessment in the Indian and Pacific Ocean basins 2024-2025

Global Tsunami Warning Systems

Indian TWS Capacity Assessment completed, 2024 (27 members)



Pacific TWS Capacity Assessment launching at UN ODTP 1st Conf Nov 2025 (46 members)

ADB

unesco
Intergovernmental Oceanographic Commission

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)

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

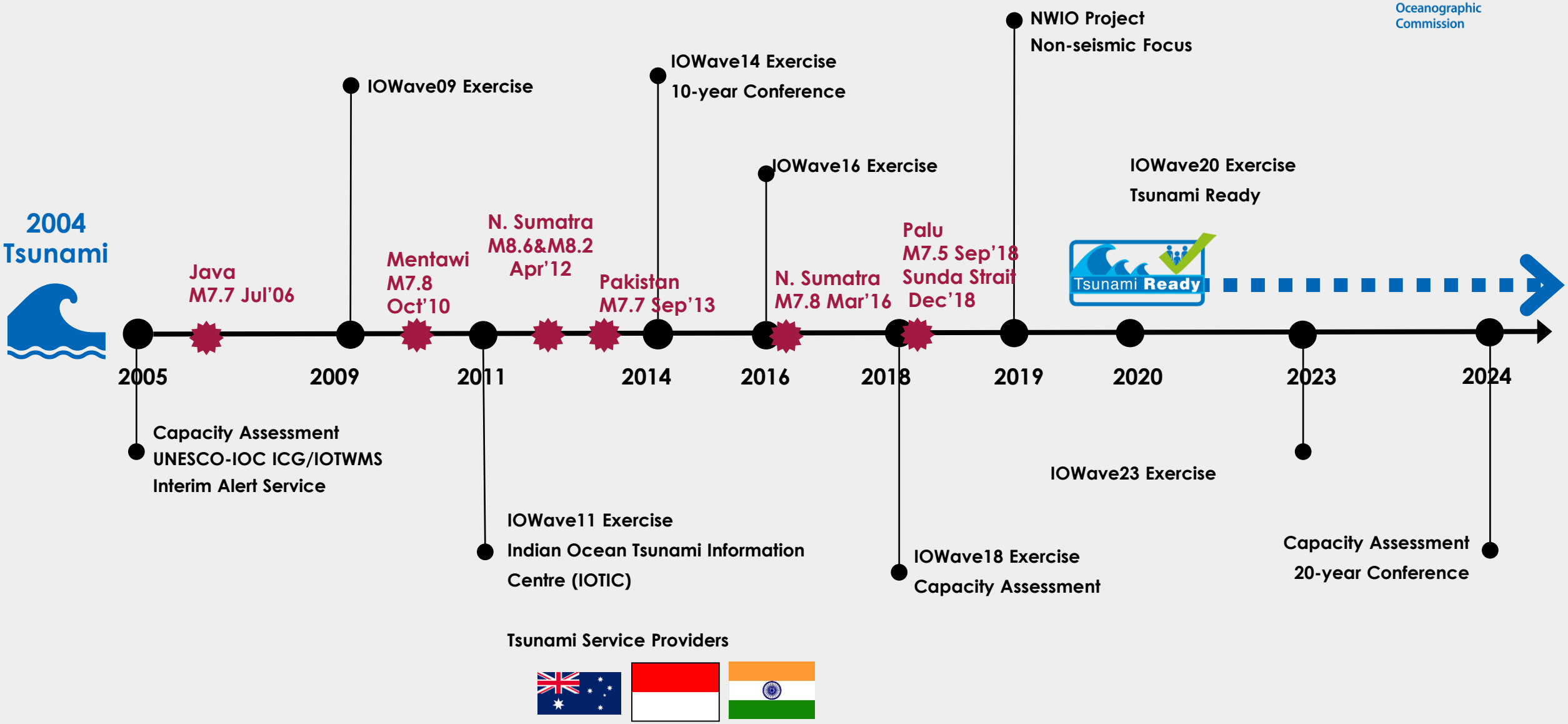
Pacific Tsunami Warning Center / NWS/NOAA of USA

Planned TSP PTWS, CARIBE-EWS

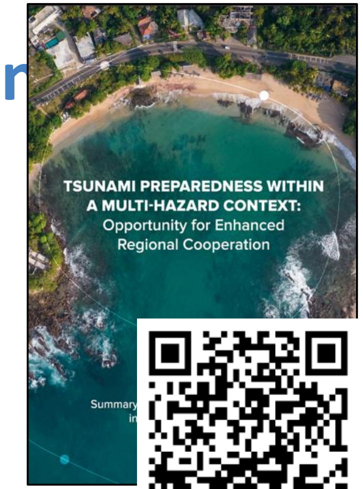
unesco
Intergovernmental Oceanographic Commission

Indian Ocean Tsunami Warning System (IOTWMS)

unesco
Intergovernmental Oceanographic Commission



Tsunami Preparedness within a Multi-Hazard Context: Summary for In[dian] Ocean basin countries



Significa[nt] ... 5 years
there ha[ve] ...
prepare[d]... plateaued.

Pillar 1: Disa[ster] ... [communi]cation

✓ Increase[d] ...
assessm[ent] ... [a]t 24/7 operational capacity. Most countries

❑ Low lev[el] ...

Pillar 2: Obs[ervation] ... [servic]es

✓ All cou[ntries] ... [awarene]ss materials, guidelines, school programmes,
forecast[ing] ... [a]nd testing. Requests for public awareness and

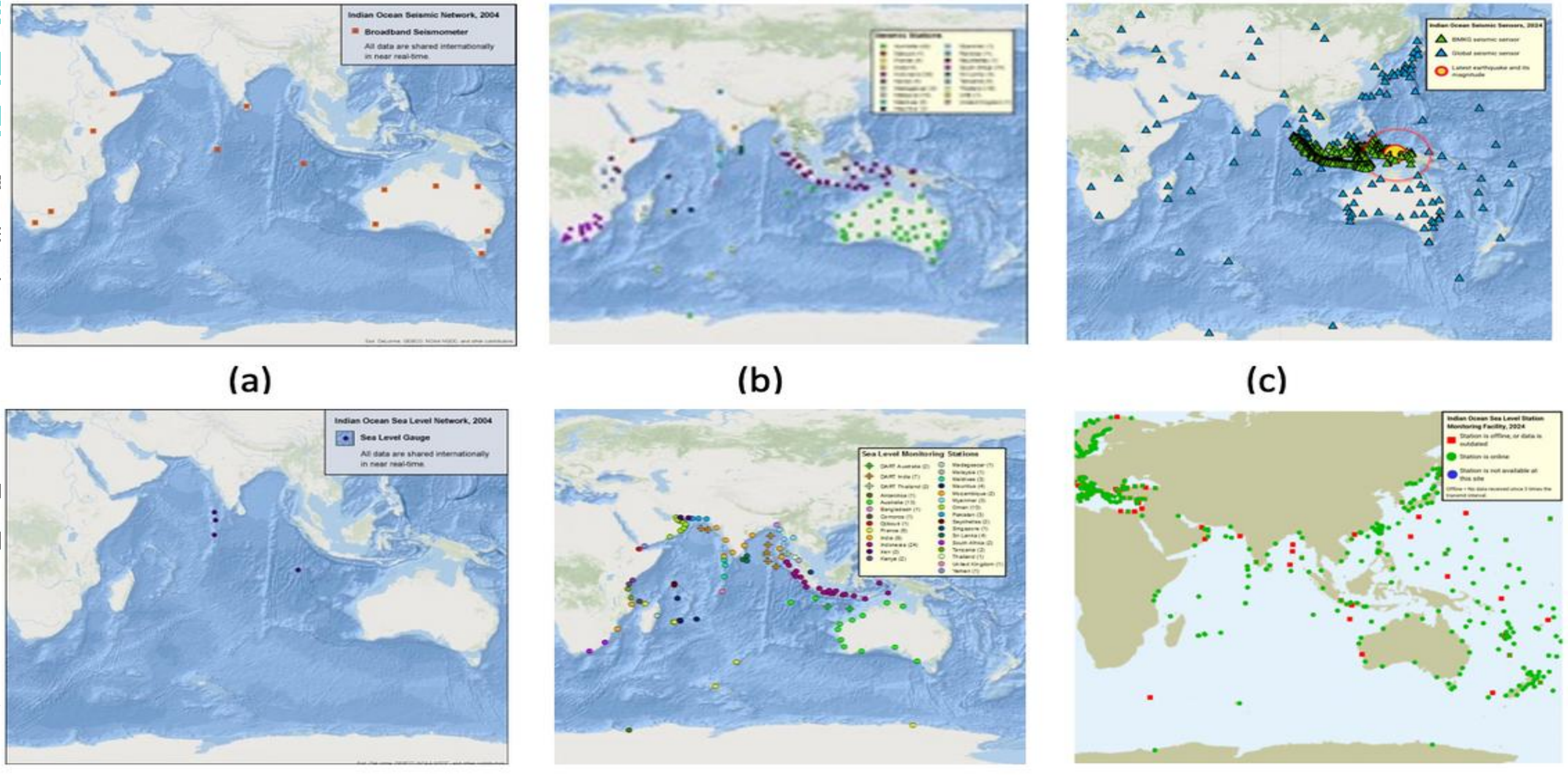
❑ Decline ...

Cross-cuttin[g] ... [and] financing

✓ Tsunam[i] ... [en]sures sustainability of the tsunami warning
drills at ... [f]or shared infrastructure; untapped potential

❑ More focus required at local level and multi-sectoral ... of public-private-partnership

Comparison of Seismic observation and sea level observations available to a) 2004 b) 2014 and c) 2024



Indian Ocean Seismic Network, 2004
Broadband Seismometer
All data are shared internationally in near real-time
Indian Ocean Seismic Sensors, 2024
BMKG seismic sensor
Global seismic sensor
Latest earthquake and its magnitude
Indian Ocean Sea Level Network, 2004
Sea Level Gauge
All data are shared internationally in near real-time
Sea Level Monitoring Stations
Indian Ocean Sea Level Station Monitoring Facility, 2024
Station is offline, or data is outdated
Station is online
Station is not available at this site

(a) (b) (c)

(a) (b) (c)

Source: UNESCO IOC and IOTWMS – BMKG (Indonesia)

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Tsunami Preparedness within a Multi-Hazard Context: Summary for Pacific Ocean basin countries

Pillar 1: Disaster Risk Knowledge

- ✓ Increase in tsunami hazard and risk assessments, including integration into multi-hazard frameworks
- ❑ Persistent gaps in capacity, local-level assessments, and public access to data

Pillar 2: Observation Monitoring and Forecasting

- ✓ Significant progress in tsunami monitoring, detection networks, and Regional Tsunami Service Providers
- ❑ Persistent gaps in multi-hazard forecasting, data sharing, subregional coverage, and NTWC staff capacity

Cross-cutting Pillar: Governance and Institutional Arrangements

- ✓ Mature governance through ICG/PTWS and increasing national integration of tsunami risk into multi-hazard policies and plans
- ❑ Persistent gaps in local-level policies, institutional coherence, and state–non-state collaboration for effective early warning systems

Pillar 3: Warning Dissemination and Communication

- ✓ Significant advances in multi-channel communication systems and SOPs to deliver timely alerts
- ❑ Persistent gaps in reaching remote and marginalized communities, CAP adoption, and infrastructure resilience

Pillar 4: Preparedness and Response capabilities

- ✓ Progress in SOPs, evacuation planning, public education, and the Tsunami Ready Recognition Programme
- ❑ Significant capacity gaps remain in local preparedness, awareness campaigns, evacuation infrastructure, and TRRP implementation

Cross-cutting Pillar: Sustained cooperation and financing

- ✓ Global, regional, and national cooperation is essential to share resources, data, and knowledge for effective tsunami and multi-hazard preparedness
- ❑ Significant investment gaps, slow progress on community preparedness, and uneven private sector engagement limit full implementation and resilience

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Recommendations for supporting resilient coastal communities

Country-specific recommendations

High-capacity countries

Innovative technology: Integrate advanced tools such as GIS, satellite observation, SMART cables, GNSS, machine learning, and AI-enabled modelling for risk assessment, monitoring, and early detection. Expand real-time, cross-border data sharing to strengthen early warning capabilities and regional cooperation.

Robust systems: Develop inclusive, multi-channel dissemination systems (SMS, satellite, radio, sirens, and social media) tailored to local cultural and linguistic contexts. Embed tsunami preparedness and multi-hazard risk reduction in urban planning, coastal management, and infrastructure investment, prioritizing resilient design and regular community evacuation drills.

Public-private partnerships: Incentivize private sector investment in early warning system upgrades, resilient infrastructure, and insurance/risk transfer mechanisms. Support regional collaboration and knowledge exchange in hazard monitoring, forecasting, and preparedness.

Medium-capacity countries

Community engagement: Update hazard and evacuation maps and integrate local-level risk assessments into national disaster risk reduction frameworks. Establish culturally and linguistically appropriate community warning systems (e.g., radio, loudspeakers, local networks).

Capacity building: Provide systematic training for local leaders, volunteers, and officials. Focus on inclusive evacuation planning that accounts for marginalized and remote groups. Conduct multi-hazard drills to strengthen coordination across NTWCs, NDMOs, and communities.

International collaboration: Leverage regional and international funds and partnerships, including with the private sector and the PTWS/IOTWMS, to upgrade infrastructure and enhance monitoring, detection, and communication systems.

Low-capacity countries

Foundational systems: Establish basic monitoring and observation capacities (seismic, hydrological, and tide gauges) in high-risk coastal areas with international assistance. Develop affordable, community-driven warning dissemination systems (SMS, radio, loudspeakers) to ensure broad reach.

Local empowerment: Train community leaders, schools, and volunteers in basic response, evacuation protocols, and tsunami education. Develop inclusive evacuation plans that prioritize the needs of vulnerable groups, leveraging available local resources.

Global support: Actively participate in international programmes such as the UNESCO-IOC Tsunami Ready Recognition Programme (TRRP) to build community-level ownership, improve preparedness standards, and ensure sustainability of disaster risk reduction efforts.

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Aligning with EW4All and UN ODTP

UN Ocean Decade: 100% of at-risk communities to be tsunami ready by 2030

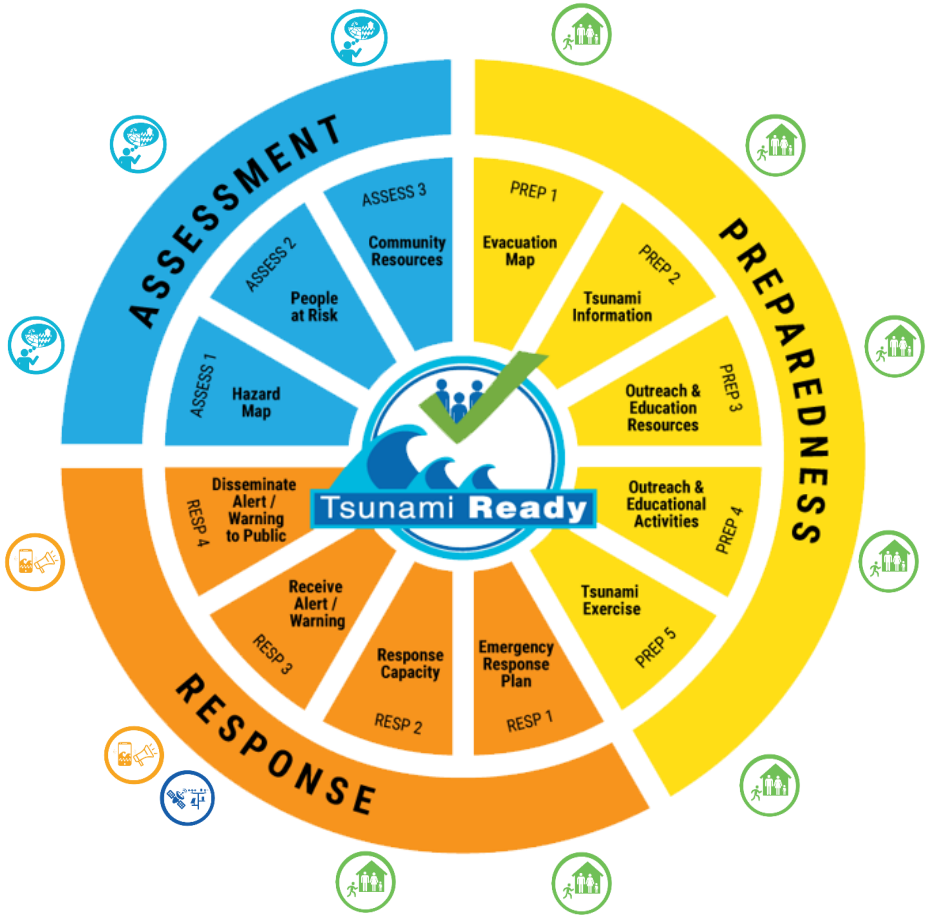
Tsunami Ready consists of 12 key indicators designed to strengthen local tsunami risk reduction capacity.

EW4All: "*for every person on Earth to be protected by early warning systems within five years*" – UN Secretary General, 2022

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Early Warnings for All

- Disaster Risk Knowledge
- Warning Detection
- Warning Dissemination
- Preparedness and Response



SUSTAINABLE DEVELOPMENT GOALS

SENDAI FRAMEWORK FOR DISASTER RISK REDUCTION 2015-2030

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Key messages

Coastal risks are expanding: Tsunami preparedness delivers high-value co-benefits for broader multi-hazard resilience.

Life-saving progress: Collective tsunami warning systems and community preparedness initiatives have proven effective.

Local gaps remain: Many countries face limited local capacity, weak institutional coherence, and challenges reaching remote and marginalized communities.

Tech opportunities: Detection, monitoring, warning progress can be accelerated by leveraging technological advancements.

Sustained investment is essential: Operating and upgrading early warning systems requires political will, financing, private sector engagement, and continued multilateral commitment.

Cooperation drives resilience: No country can do it alone, global initiatives and regional cooperation are vital for LDCs and SIDS. (Ocean Decade Tsunami Programme, EW4All, Trust Fund, IOTWMS/PTWS available to foster progress)

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