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Overview of the Indian Ocean Tsunami Warning and Mitigation System (IOTWMS)

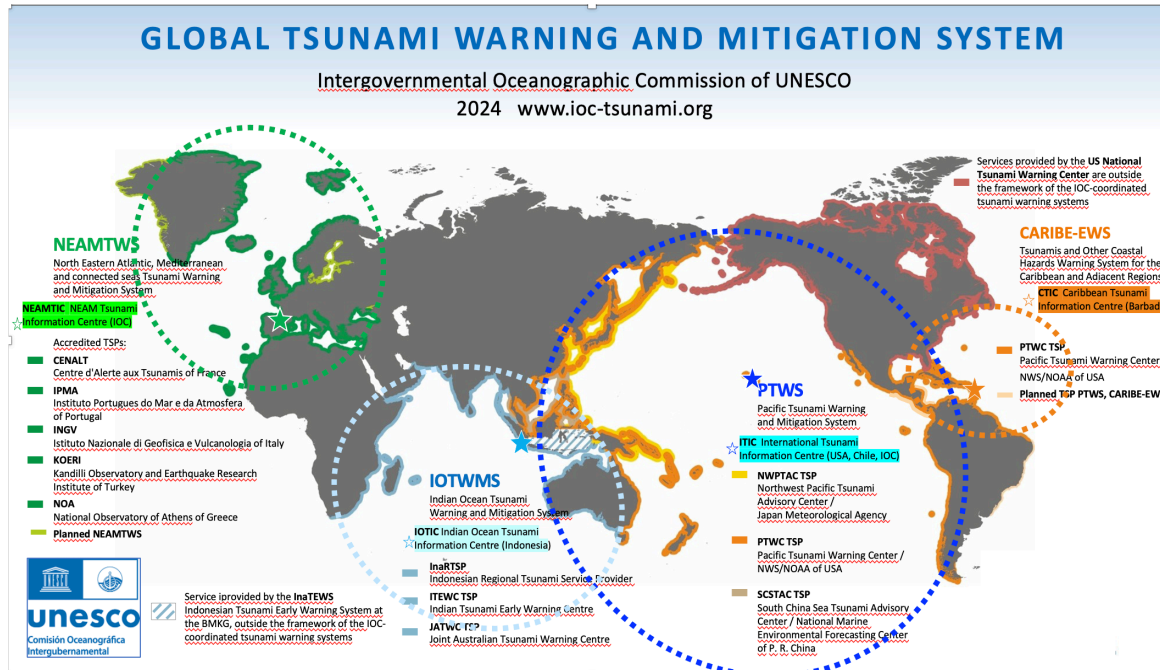
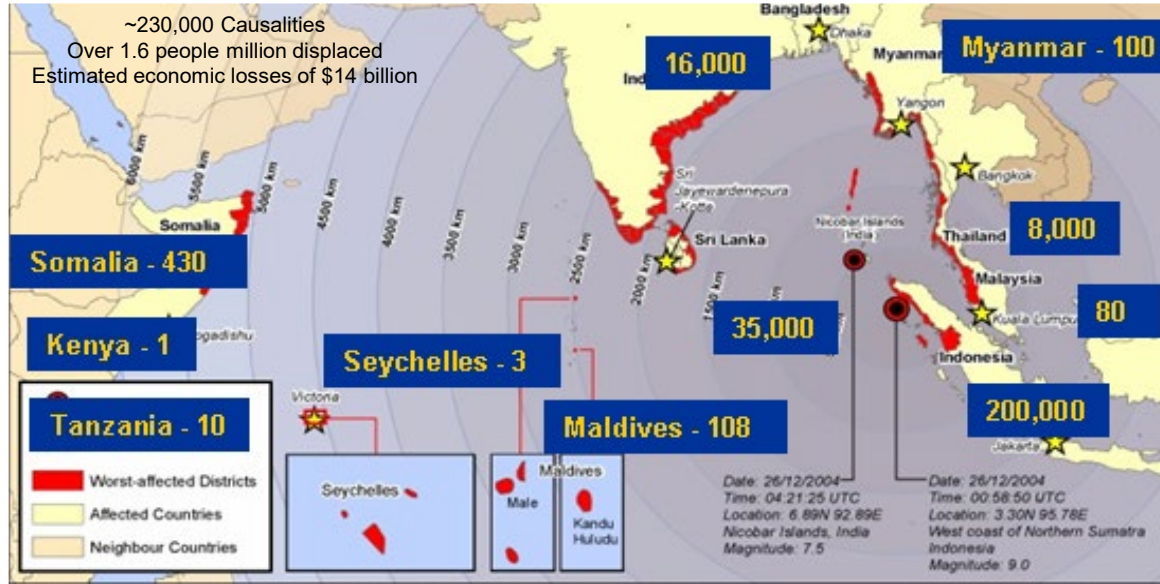
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Global Tsunami Warning and Mitigation System

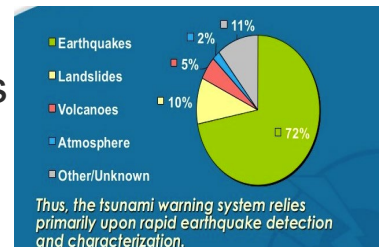


Great progress since 2004

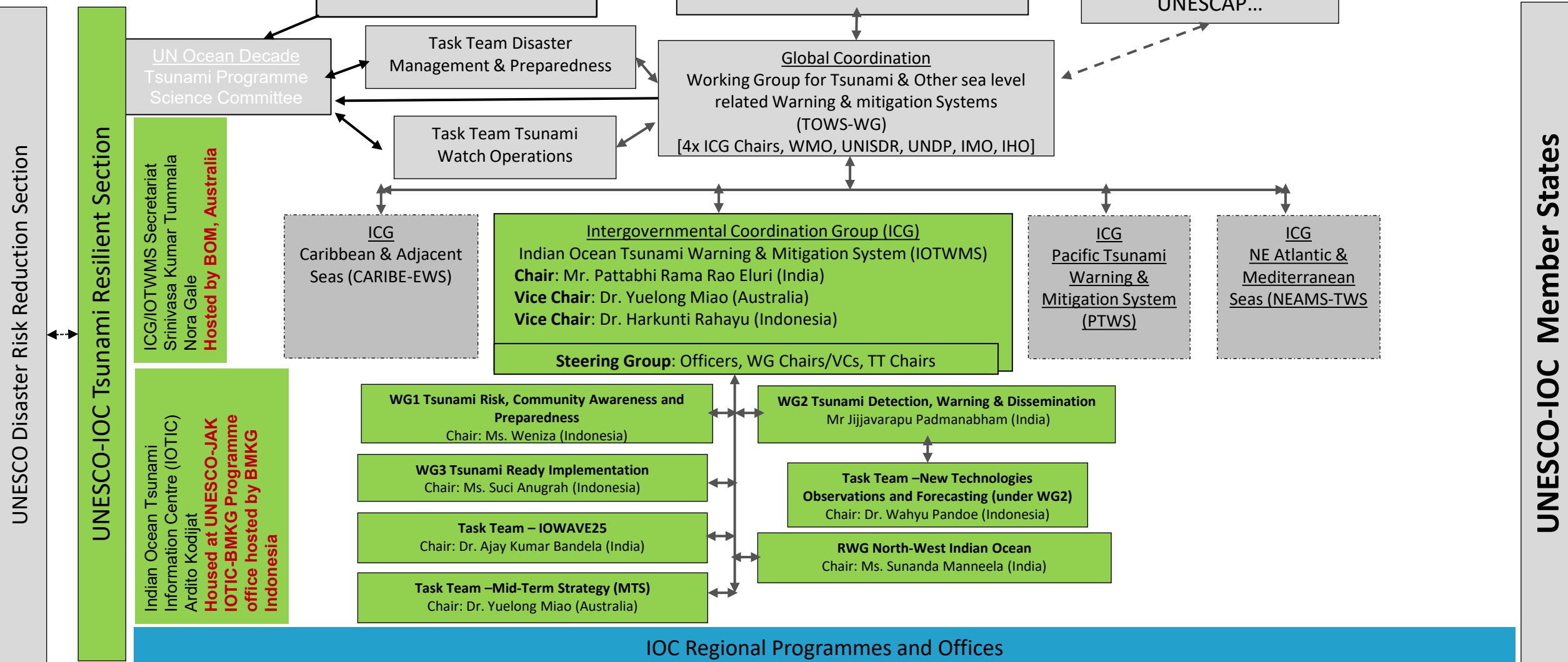
- 4 Regional Systems coordinated by the IOC UNESCO - PTWS, IOTWMS, CARIBE EWS, NEAMTWS
- Operate as inter-operable “system-of-systems”
- Network of NTWC/TWFPs receiving tsunami forecast information from one/more TSPs
- Sovereign responsibility of NTWCs/TWFPs to provide warnings, watches, and advisories to their citizens
- Seismic & Sea Level Observing networks, models, computational, communication facilities, DSS and SOPs
- Tsunami Ready Recognition Programme
- Successfully monitored several events

Several challenges evidenced from recent events

- Tsunami warning is race against time - Uncertainties in tsunami warning
- Gaps in Warning and Response capabilities, specially for non-seismic and near-field sources
- Gaps in SOPs and Early Warning Chains
- Gaps in preparedness & response



IOTWMS Governance



IOTWMS: The Key Elements

Risk Assessment and Reduction

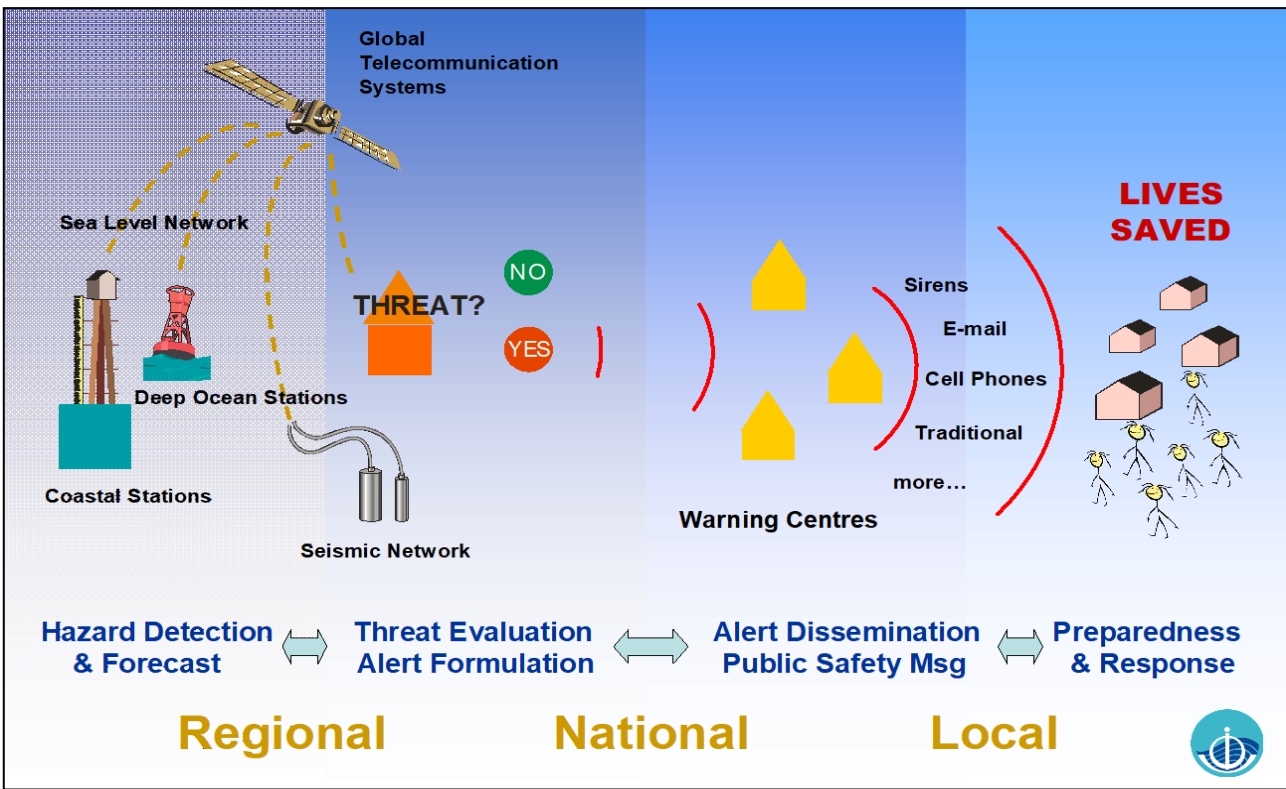
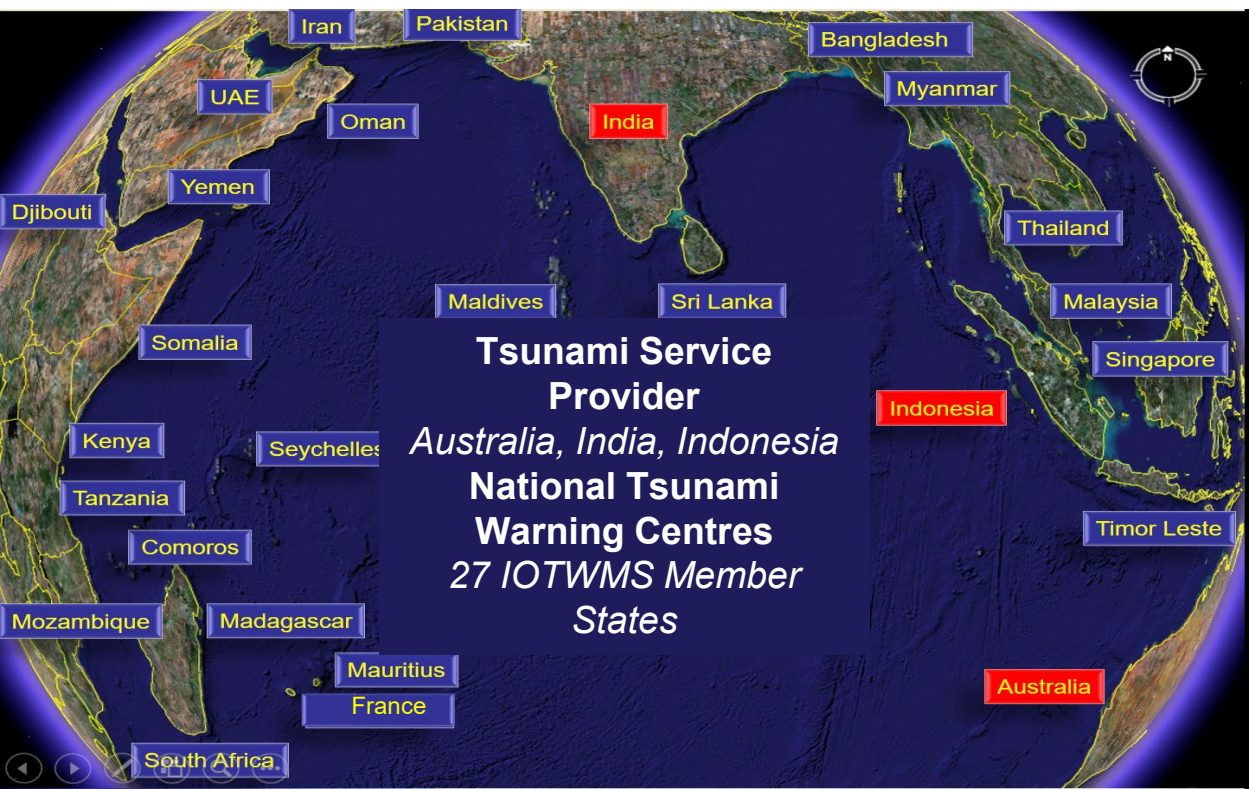
Systematically collect data and undertake risk assessments

Detection, Warning and Dissemination

Develop hazard detection, monitoring and warning services
Communicate threat information and early warnings

Awareness and Response

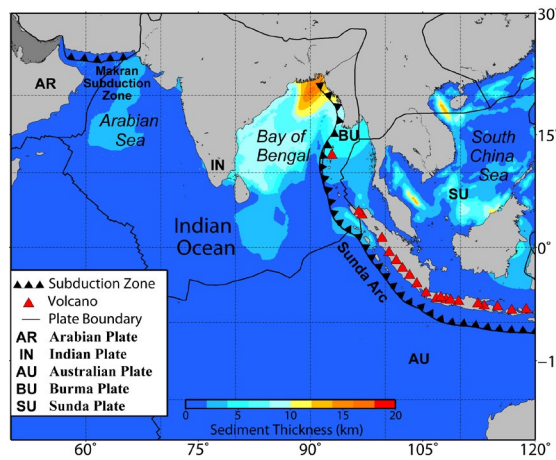
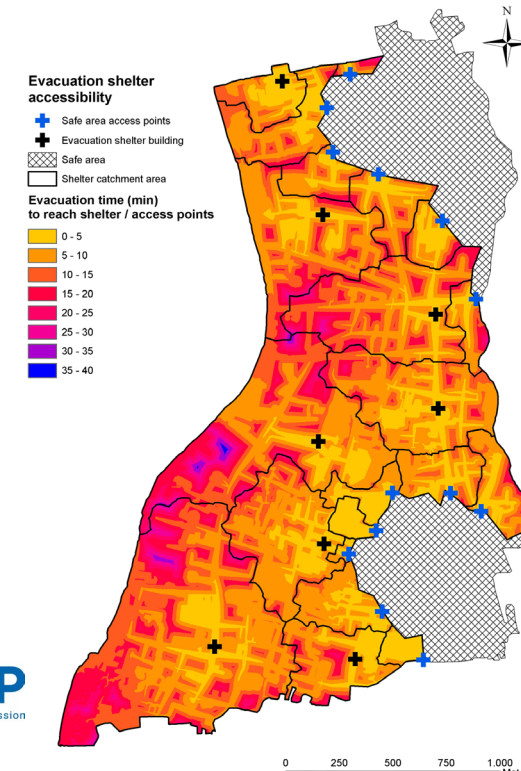
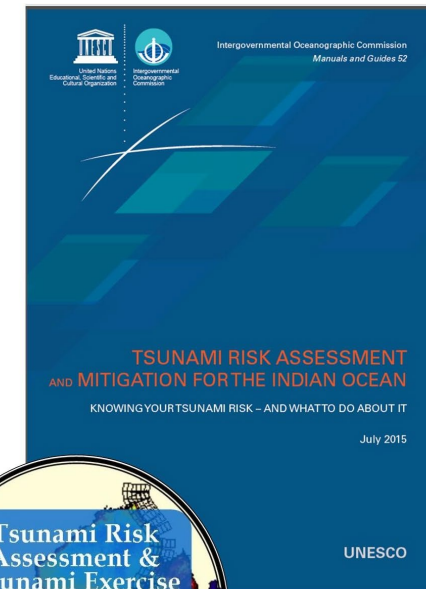
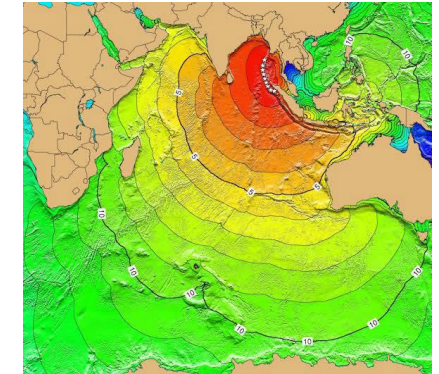
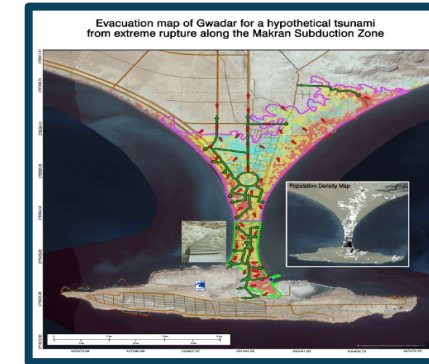
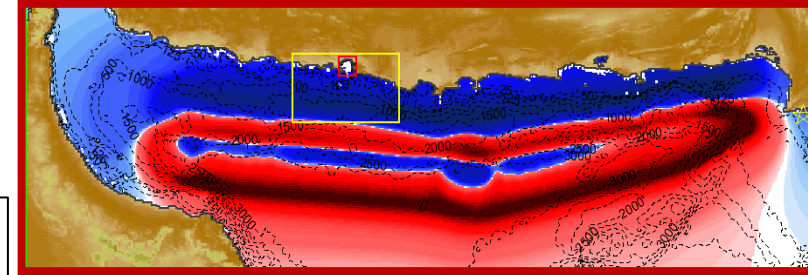
Build national and community response capabilities



Risk Assessment and Reduction

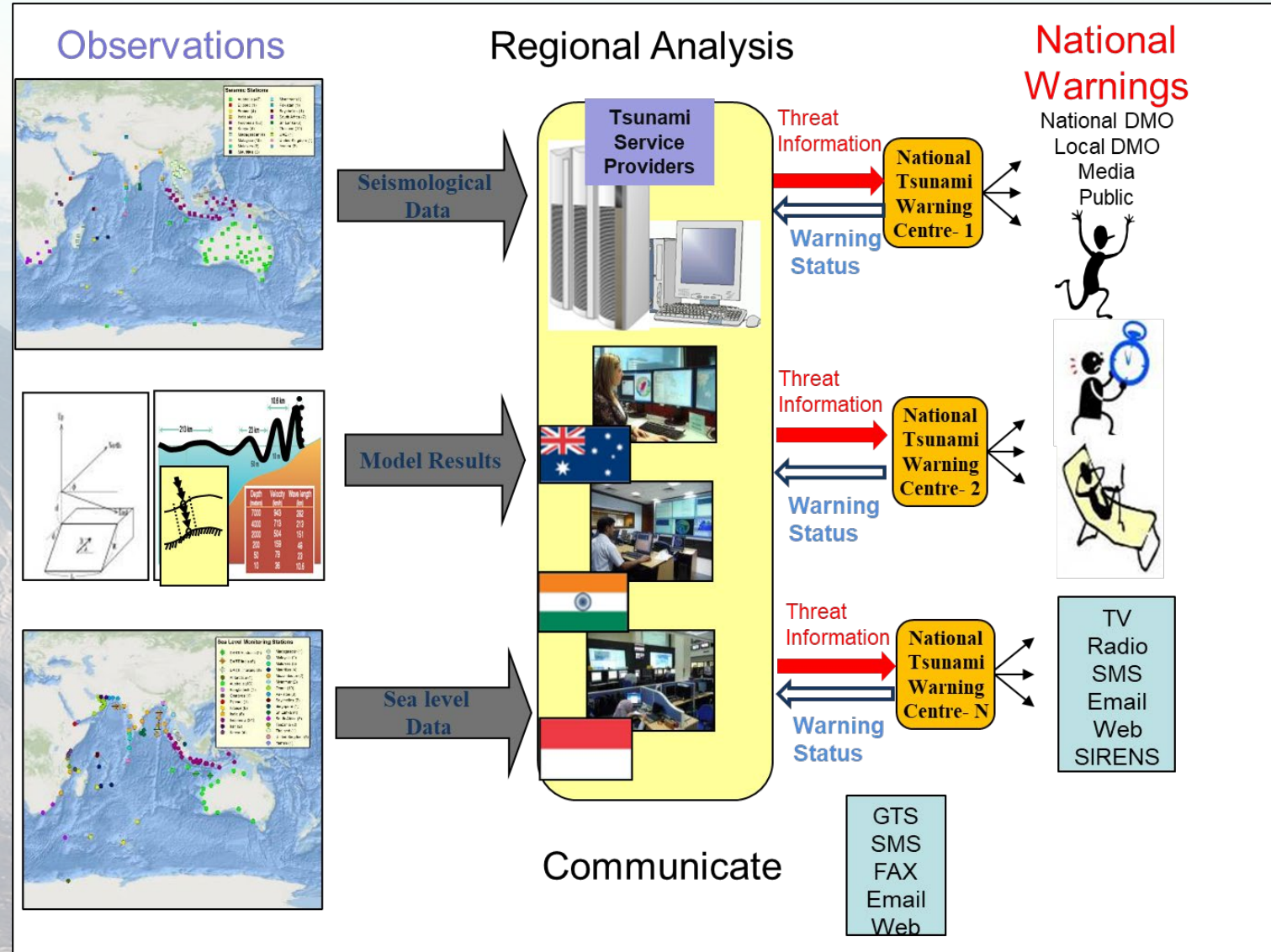
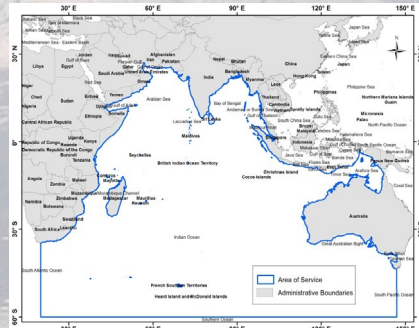
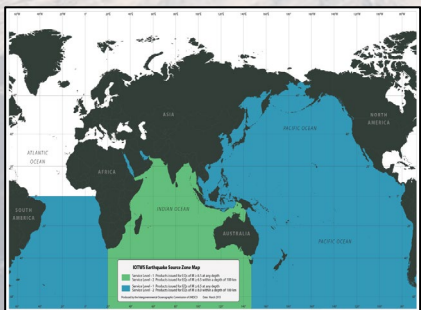
The first step is to scientifically assess the tsunami hazard and potential risk

- **Tools, Methods & Guidelines** for Tsunami Risk Assessment published
- Indian Ocean Probabilistic Regional **Tsunami Hazard Maps** published
- Assessment and Awareness of **Makran Tsunami Hazards**
- Regional **Workshops** on Tsunami Risk Assessment and Modelling
- Enhancing Tsunami Risk Assessment and Management, **Strengthening Policy Support** and Developing Guidelines for Tsunami Exercises in Indian Ocean Countries
- PTHA - **UNESCAP Makran** & **UKRI PC-TWIN** Projects



Detection, Warning and Dissemination

- **Service Definition:** AoS, Stations, Products, Thresholds, CFZs, Formats
- **Tsunami Service Framework**
 - 3 inter-operable Tsunami Service Providers (Australia, India, Indonesia)
 - Network of NTWCs, TNCs, TWFPs
- **Expanded seismic and sea level monitoring networks**
- **Harmonised threat information** by TSPs
- **National warnings Sovereign responsibility** of authorized national agencies
- Several Events handled - Yearly performance assessments against **Key Performance Indicators**
- 6-monthly communications test to identify and fix any issues
- **Ongoing Work on Non-Seismic Tsunami SOPs & Maritime Products**
- Webinars on **Monitoring and Warning for Tsunamis Generated by Volcanoes** (April 2025)



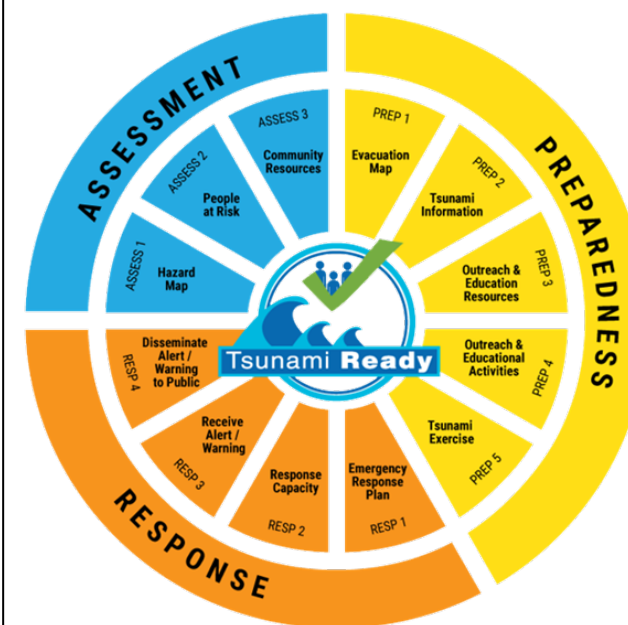
Awareness and Response

Even the most accurate warning holds limited value unless stakeholders and the public are informed and know how to respond.

- **Indian Ocean Tsunami Information Cente (IOTIC) and IOTIC BMKG Programme**
- **Indian Ocean-wide (IOWave) exercises** held every two years
- **UNESCO-IOC Tsunami Ready Recognition Programme (TTRP)** – 48 Communities in India and Indonesia
- **Education Material** for NTWCs, emergency managers, communities, schools, tourism, etc.
- **Capacity Building Programmes** – TEMPP and SOPs for NTWC, DMO, staff and/or Media
- **Documenting the impacts** of past Tsunamis - Makran, Ambon, etc.
- 70th Anniversary of 1945 Makran Tsunami commemorative events
- 20th Anniversary of 2004 Indian Ocean (Aceh) Tsunami commemoration
- **World Tsunami Awareness Day (WTAD)** – 05 November
- **Tsunami United** sessions for high school students & WTAD Youth Talk Show

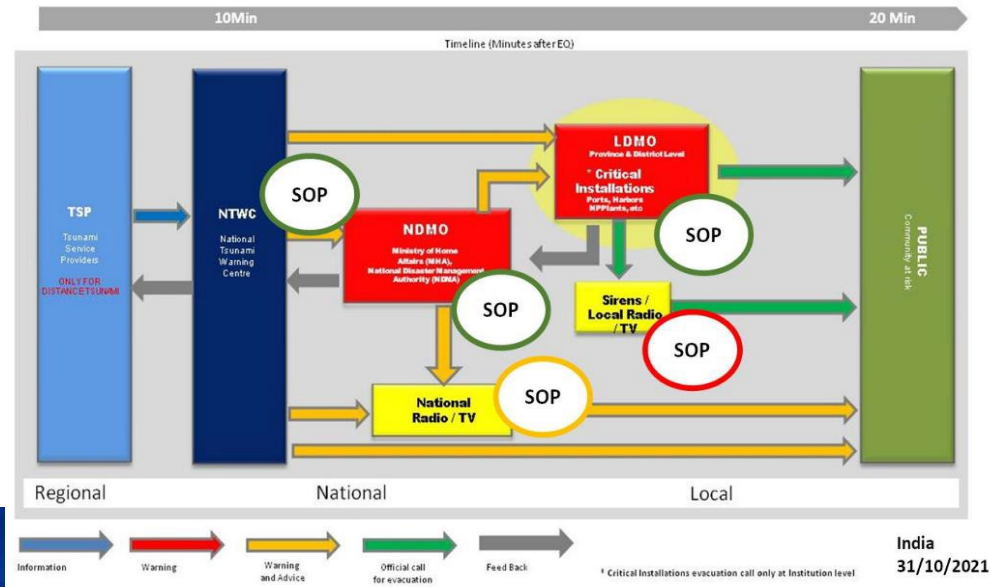


2021
2030 United Nations Decade
of Ocean Science
for Sustainable Development



Early Warning Chains and SOPs

- Three training workshops in the western, eastern, and north-west Indian Ocean regions for the NTWCs and DMOs:
 - Western Indian Ocean Member States, 3-6 Jul 2023 & 11-13 Aug 2025
 - Eastern Indian Ocean Member States, 10-13 Jul 2023 & 04-06 Aug 2025
 - North-West Indian Ocean Member States, 7-8 Aug 2023 & 04-06 Aug 2025
- Online regional workshops and in-person national workshops.
- Member States refine their tsunami SOPs and Early Warning Chains in the lead-up to Exercise IOWave23 & IOWave25
- Sensitized to the new TSP Australia products for non-seismic tsunami sources.



Tsunami Evacuation Maps, Plans and Procedures

- Several TEMPP Trainings organised focusing on a) Tsunami Inundation Modelling, b) Tsunami Evacuation Maps, Plans and Procedures & c) the UNESCO-IOC Tsunami Ready Recognition Programme
 - 4 Regional trainings in India and Indonesia since 2017. Latest held at INCOIS, Hyderabad during 15 – 23 April 2025 with 35 Participants from 17 countries and 14 trainers from UNESCO-IOC, India, and Indonesia.
 - 1 Sub-regional training in Oman
 - 3 National trainings held in Maldives, Seychelles & Timor Leste



Timor Leste,
July 2023

Oman,
April 2024

Seychelles,
November 2023

Maldives,
August 2024

Indian Ocean Wave Exercises & Comms Tests



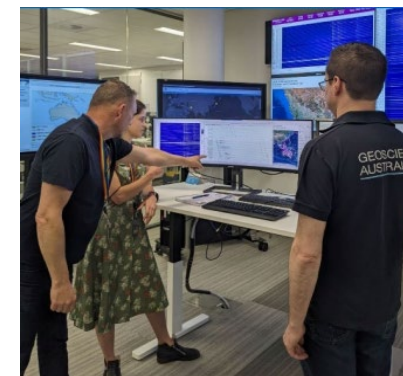
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Scenario	1. Sunda Trench	2. Makran Trench	3. Fani Maore Volcano	4. Sumatra Trench
Date	25 September 2025 (Thursday)	15 October 2025 (Wednesday)	25 October 2025 (Saturday)	05 November 2025 (Wednesday)
Time	01:00 UTC	06:00 UTC	15:00 UTC (eruption at 14:00 UTC)	03:00 UTC
Source	Earthquake	Earthquake	Volcano	Earthquake
Magnitude	~M9.0	~M9.0	n/a	~M9.2
Depth	10 km	10 km	n/a	10 km
Latitude	6.94S	24.80N	12.92S	3.30N
Longitude	104.70E	62.20E	45.72E	95.96E
Location	Sunda Strait, Indonesia	Off Coast of Pakistan	Mozambique Channel	Northern Sumatra, Indonesia

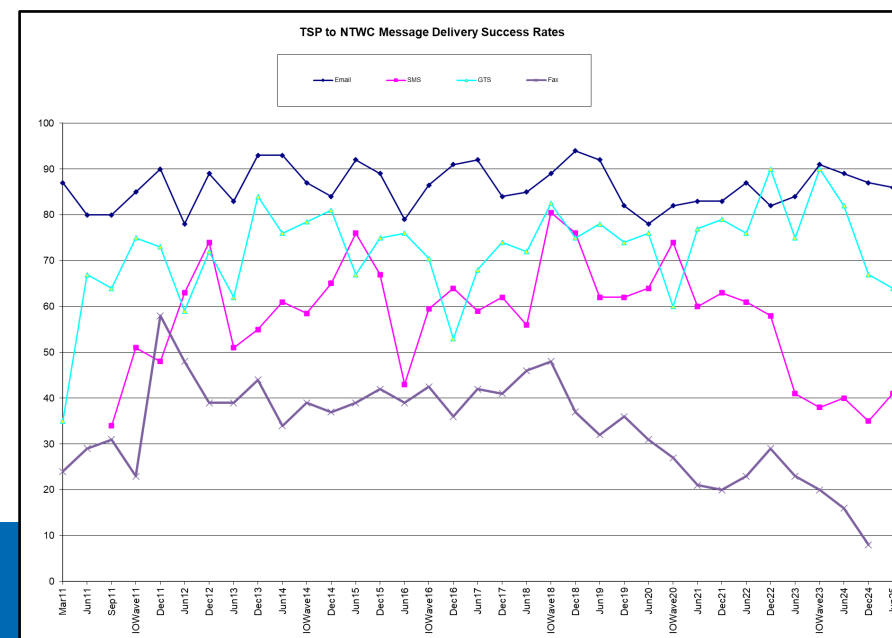
IOWave25

- 25 September to 05 November 2025
- 4 Scenarios = 3 earthquake & 1 volcanic event
- Testing outside of working hours (Scenario 3)
- Non-seismic and NAVAREA products
- Encourage the Member States to ensure the participation of TR recognised communities
- Pre-IOWave SOP Workshops held in early August with 400 participants from 23 countries.



Communication Tests

- 6 monthly
- 29 tests to date
- Email most reliable
- GTS & SMS follow
- Fax service ceased on 31 March 2025



IOTWMS Capacity Assessment of Tsunami Preparedness

Global Tsunami Symposium

IOTWMS Capacity Assessment 2024: Significant progress since 2004. In the last 5 years there has been considerable progress in downstream community awareness and preparedness initiatives while the upstream warning and detection system has plateaued

Banda Aceh Statement: Global Tsunami Warning and Mitigation: Building Sustainability for The next decade through Transformation and Innovation. UNESCO and its partners call on States and civil society to drastically step up their investments and efforts to achieve 100% of Tsunami Ready Communities across the world by 2030.

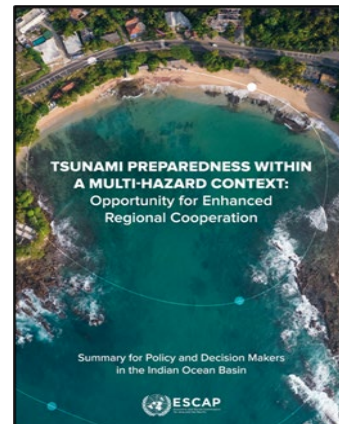
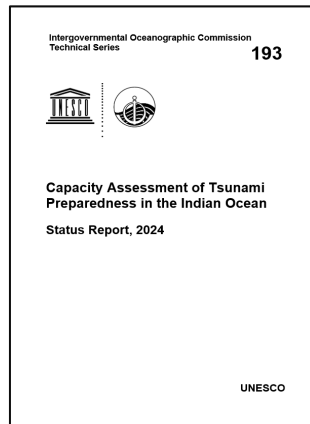
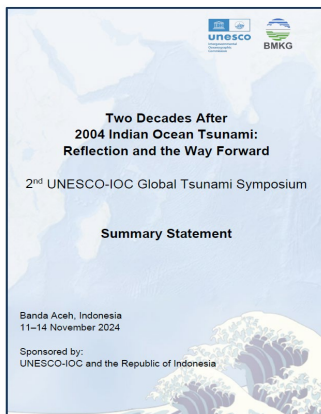
GTS Banda Aceh

32 Countries
682 in-person
170 online
1200 YouTube

IOTWMS CATP

22 Countries

UNESCAP Summary for Policy Makers



Governance, Policies, Plans & Guidelines

- Globally, 4 IOC coordinated ICGs established. Strong collaboration with global and regional partners
- 91% of reporting IO countries have national tsunami policies, but only 50 % have community-level tsunami plans
- Secure sustainable funding; Strengthen regional and subnational partnerships; Integration of tsunami policies and plans into multi-hazard DRR frameworks

Tsunami Risk Assessment & Reduction

- Major advances in seismic modeling, probabilistic assessments, and risk mapping.
- 96% of reporting IO countries conducted hazard assessments but at varying spatial scales.
- Build capacity for PTHA, local level risk mapping & improve data availability (historical events, bathymetry)

Tsunami Detection, Warning & Dissemination

- Seismic and sea-level monitoring and modeling improved,
- All IO countries can assess tsunami threats. 91% operate 24/7 NTWCs with SOPs and less than 50% have robust dissemination systems
- Build capabilities for non-seismic tsunamis; implement GNSS and SMART cables; real-time data sharing, last-mile communication, NTWC training

Tsunami Awareness, Preparedness & Response

- Awareness improved through WTAD, 96% of reporting IO countries participated in IOWave, SOP & TEMPP Trainings
- Only 2 IO Countries implemented TRRP, many communities lack local SOPs and signages
- Expand training on evacuation planning, TRRP implementation, Drills and community-based risk education.

ICG Key Decisions & Projects



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14th Session of ICG/IOTWMS

Banten, Indonesia (17-19 Nov 2024)

- Appreciated the contributions of stakeholders
- Continued existing Working Groups and established new Task Teams on IOWave25, New/Emerging Technologies and MTS
- Approved IOWave23 and 2024 Capacity Assessment reports
- Continue Capacity Development related to SOPs, TEMPP, TRRP and on-the-job training
- Conduct IOWave25
- Design optimal sea level and seismic networks
- Extend the TSP services to tsunamis generated by non-seismic and complex sources
- Continue expansion of TRRP
- Prioritise the needs of SIDS, LDCs, Africa and recommendations of governing bodies and capacity assessment results in workplans.

19th Meeting of the Steering Group

Jakarta, Indonesia (17-19 Jun 2025)

- Approved the 2025-26 WG/TT work plans and activities.
- Progressed work on the medium-term strategy.
- Define methodology for optimal monitoring networks.
- Organise regional webinars on TGV and NAVAREA.
- Conduct Exercise IOWave25 and pre/post-exercise workshops
- Implement TSP Bulletins for NAVAREAS
- Finalise TSP SOPs for non-seismic tsunamis and update the SDD and NTWC User Guide
- Progress TRRP equivalency, assessment tool for downstream warning, and tsunami early warning chain work process.
- Explore new technologies for tsunami detection
- Appreciated the contributions of Ardito M Kodijat and requests UNESCO and IOC to prioritise recruitment

ODTP Endorsed Initiatives

- Tsunami Ready Odisha
- People Centered Tsunami Early Warning for India (PCTWIN)
- Tsunami Potential Coastal Area of Indonesia Mountain Anak Krakata, Banten, Sunda Strait
- INCOIS Submarine Cable Multi-Parameter Observatory

New Project Proposals

- Flanders UNESCO Science Trust Fund project on Strengthening Community Resilience to ocean hazards through implementation of TRRP in SIDS and Africa (Madagascar & Seychelles)
- Phase 3 UNESCAP Trust Fund Project on Strengthening Tsunami Warning in the North-West Indian Ocean through Regional Cooperation (India, Iran, Maldives, Pakistan, Sri Lanka + Oman, UAE)



2023-2025 Key Activities: Snapshot of Member State Engagement

IOTWMS Member States

- Exercise IOWave23 (20)
- Standard Operating Procedure Training (17)
- TEMPP Training (17)
- Capacity Assessment of Tsunami Preparedness (22)
- TRRP Implementation (2)

LEGEND

All above activities

IOWave, SOPs, TEMPP, CATP

IOWave, TEMPP, CATP

IOWave, SOPs, CATP

IOWave, CATP

TEMPP, SOPs

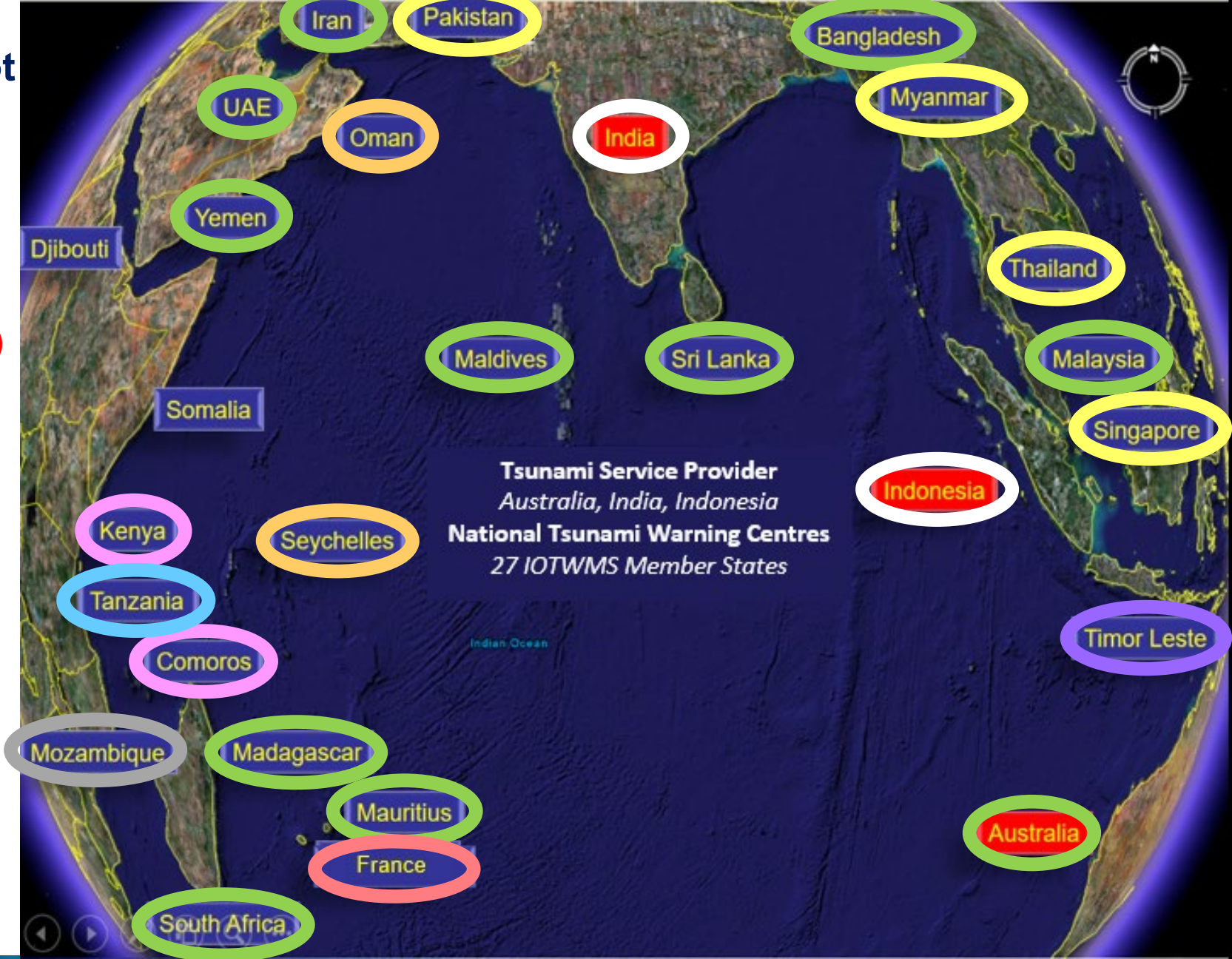
TEMPP, CATP

IOWave

CATP

Regional Collaborations

- IOCAFRICA (10)
- SIDS (6)
- Other ICGs (3)
- IOGOOS (14)
- IOCINDIO (9)
- WMO PTC (11)

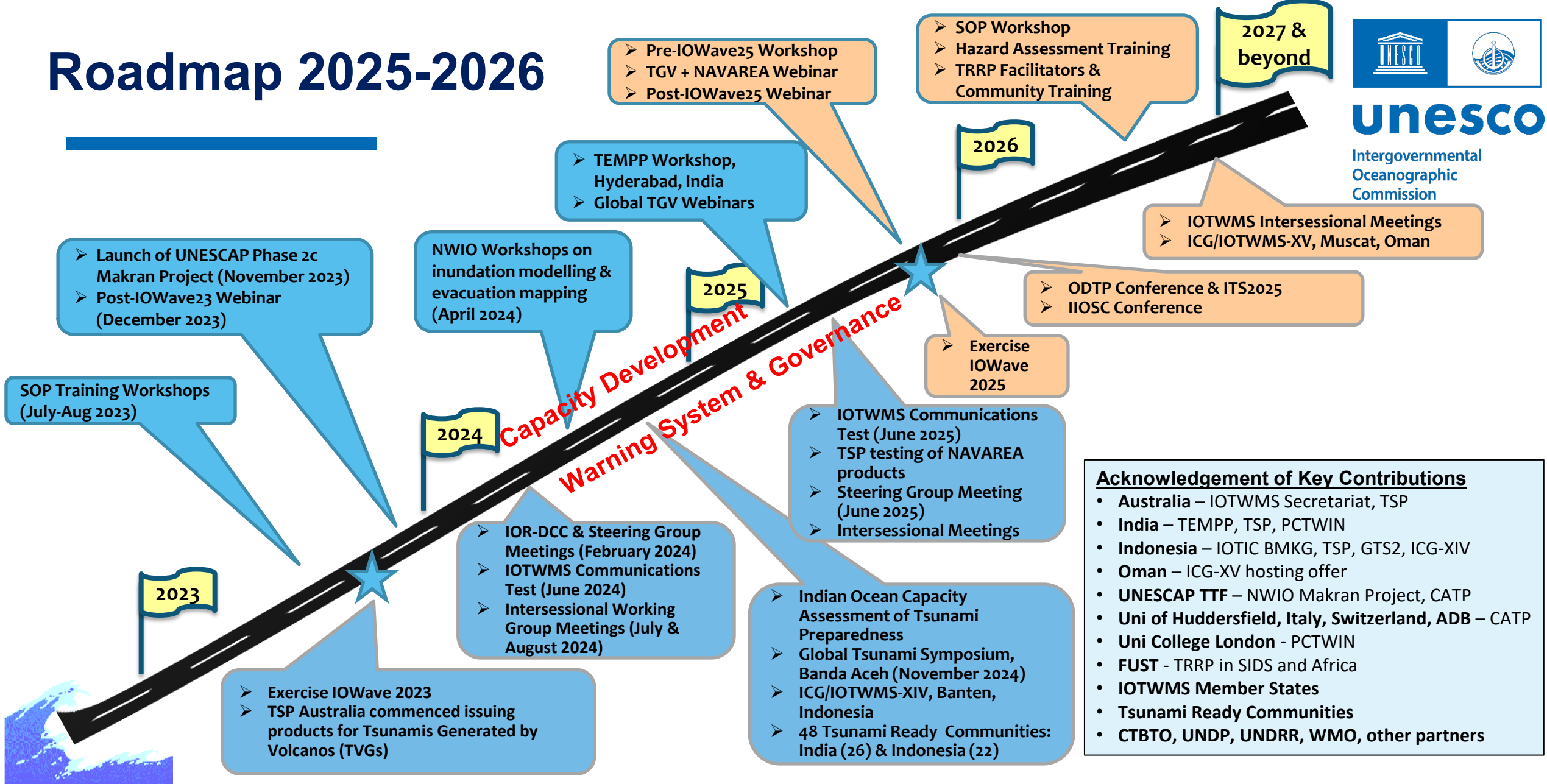


Roadmap 2025-2026



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THANK YOU