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Status and Plans of Tsunami Watch Operations in the ICG/IOTWMS

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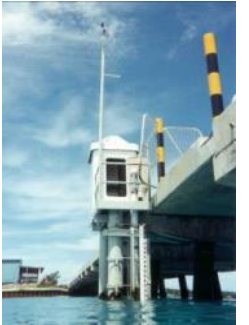
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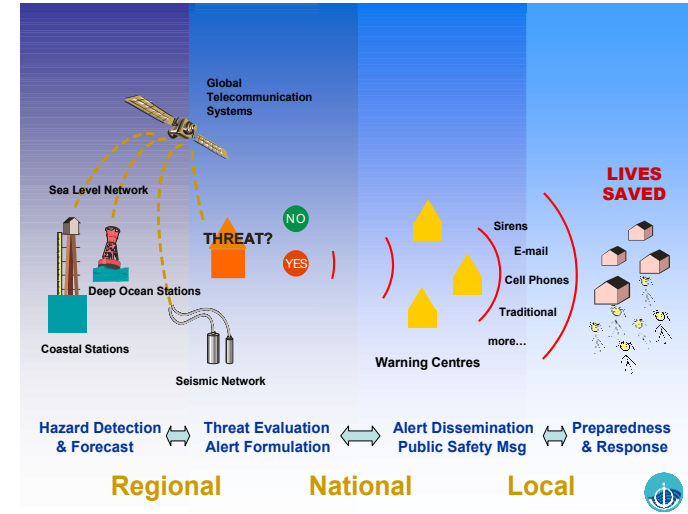
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Thanks to Dr Robert, Dr. Yedi, Dr. Srinivasa Kumar, Ms.Nora for their inputs



Detection, Warning and Dissemination – Current Status / Highlights

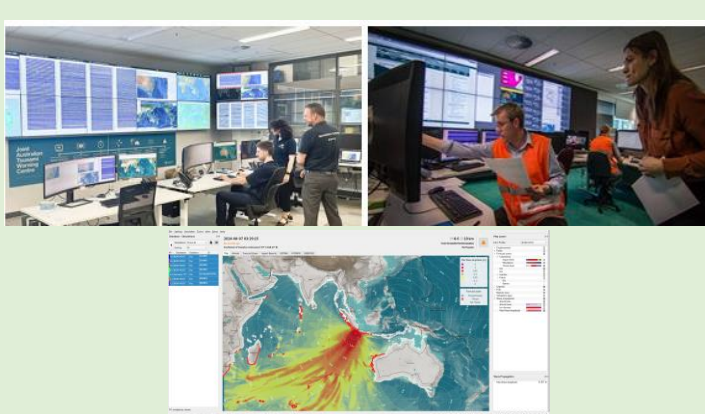
- Under ICG/IOTWMS, there are 3 Tsunami Service Providers (TSPs) (Australia, India, Indonesia) to provide tsunami threat information to National Tsunami Warning Centres (NTWCs)
- During the reporting period, the Indian Ocean witnessed 3 events of Magnitude 6.6 and caused No tsunami threat.
- NTWCs issue sovereign warnings to their at-risk communities
- NTWCs operate within multi-hazard frameworks.
- Threat information is now being provided for non-seismic source tsunamis
- TSPs implemented the NAVAREA tsunami messages generation capabilities.
- Competency training framework being developed for NTWCs




This block contains three main visual elements: a map of the Indian Ocean region, a screenshot of a 'Warning & Dissemination' software interface showing a data table, and a photograph of a control room with operators at computer workstations. The control room image includes flags for Australia, India, and Indonesia.

TSPs Progress Report

TSP Australia



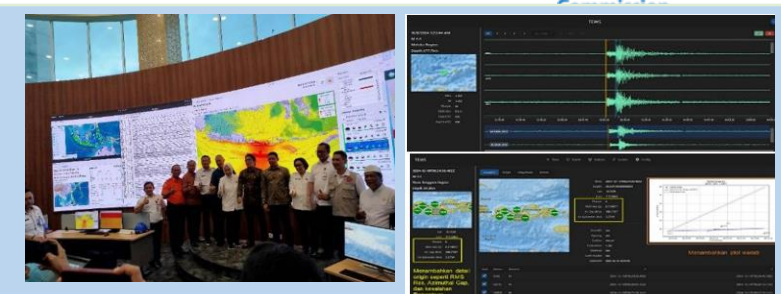
- NAVAREA & TGV Products: Implemented
- BOM-JATWC ISO 9001: Accredited 2020; re-accredited 2023 → valid to 2026
- Audits: Annual surveillance 2024; next July 2025
- Bureau-JATWC has implemented 2 minor updates to TOAST system. These updates contain bug fixes and ease of use features.
- DART Stations: Two Tasman Sea DARTs restored; 5 of 6 are online.
- GA-JATWC ISO 9001: Work underway toward ISO 9001:2015
- Upgraded to SeisComp6 & currently in testing
- Seismic Array: Real-time processor tested in parallel; performance assessment ongoing

TSP India



- NAVAREA & TGV Products: Implemented
- Maintaining CFZs Layers for IOTWMS
- Established 15 new tide gauges with co-located GPS along Indian coast.
- Upgraded SeisComp7 and operational.
- HPC facility "TARANG" at INCOIS - Dedicated to real-time tsunami inundation modeling, operational oceanography, and advanced simulations.
- INCOIS (TSP India) is contributing to the ODP goals through various projects like PCTWIN, SMART Cables, Tsunami Ready at Odisha, etc.
- INCOIS is also contributing for the ESCAP Phase-3 project of NWIO region.
- India hosted TEMPP, and UNESCO-TRRP training workshop during 15-23 April 2025;

TSP Indonesia



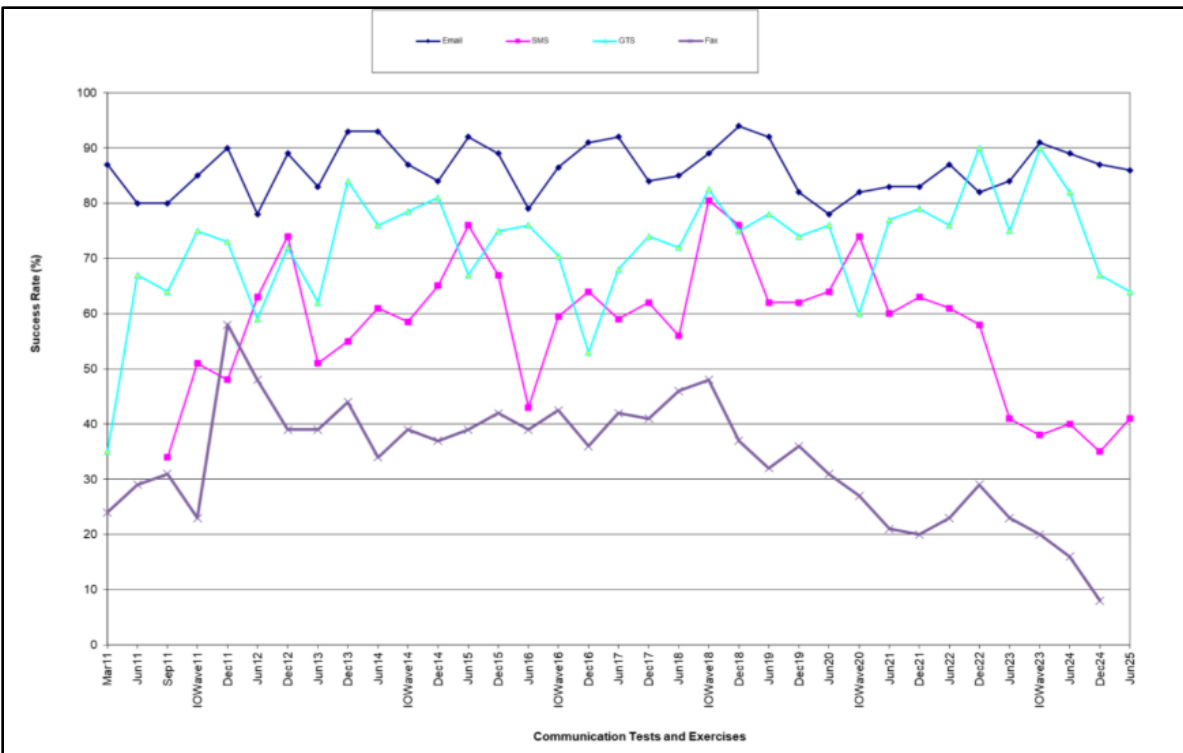
Mbmkg Formula:

$$M_{bmkg} = \log(A_{max}) + 1.342 * \log(R) + 0.0002305 * R - 1.353$$

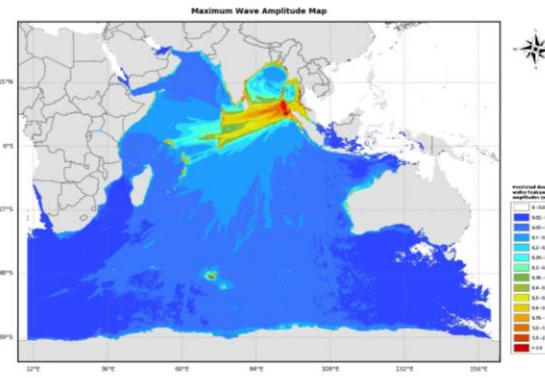
- Tested NAVAREA & TGV Products
- Backup Operational Center of InaTEWS at Bali launched on 14 June 2025 by BMKG equipped with Base Isolator Technology to ensure earthquake resilience and operational continuity;
- Experimenting AI-based earthquake processing and ~10,000 tsunami scenarios for faster, more comprehensive warnings.
- Develop a New Magnitude Formula Mbmkg
- Expanded Sunda Zone tsunami database with 1,800 new pre-calculated scenarios (Mw 7.1–7.3), including 'odd' magnitudes from West Sumatra to Sumbawa

IOTWMS Communication Tests

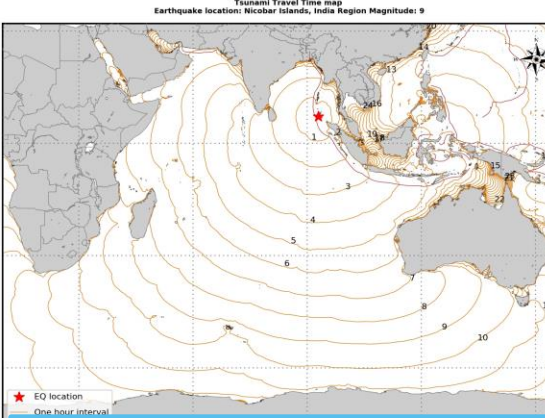
- As of today, 7 IOWave Exercises and 29 Communication Tests were conducted.
- During the reporting period, 1 COMMS test was conducted (June 2025)



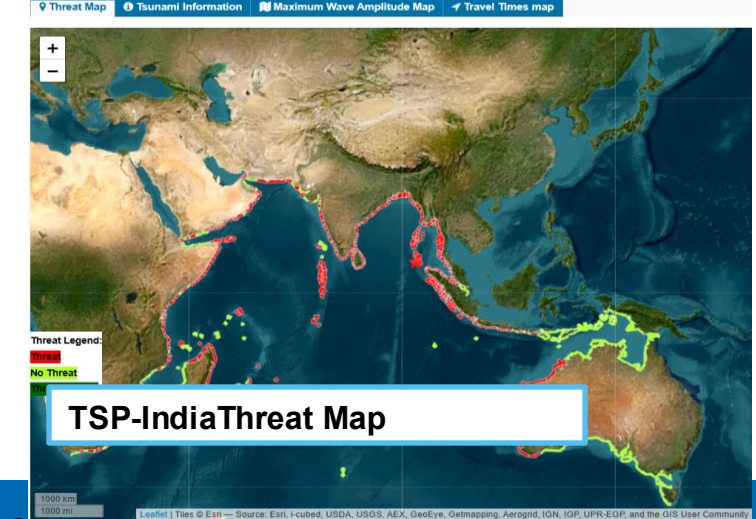
COMMS TESTS Statistics



Directivity Map



Tsunami Travel Time Map



IOWave25 Scenarios

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	Non-Seismic TGV	Ear NAVAREA Messaging
Magnitude	~M9.0	~M9.0	n/a	~M
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

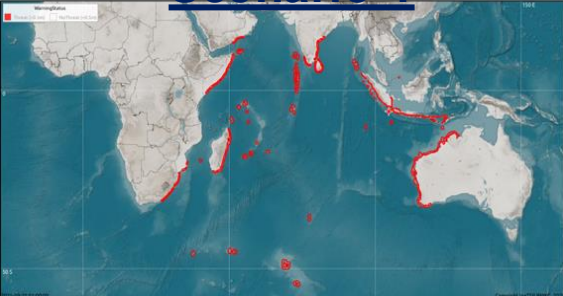
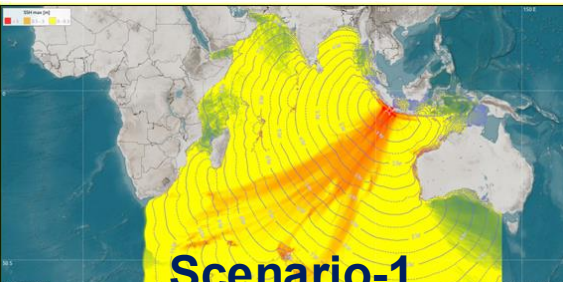


Figure 2. Threat Map example for Scenario 1, Sunda Trench, for a magnitude 9.0 earthquake.

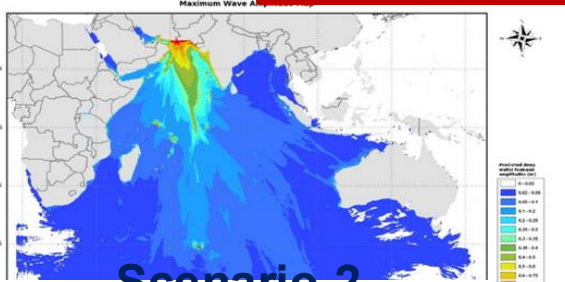


Figure 5. Threat Map example for Scenario 2, Makran Trench, for a magnitude 9.0 earthquake

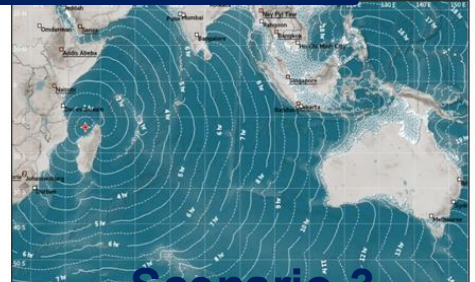


Figure 8. Threat Map example for Scenario 3, Fani Maore Volcano.

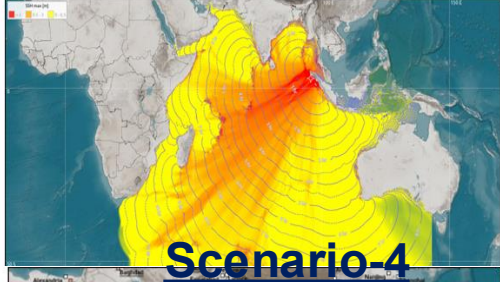


Figure 10. Threat Map example for Scenario 4, Sumatra Trench, for a magnitude ~9.2 earthquake.

Common Alert Protocol Status – ICG/IOTWMS

National Focus

- CAP implementation rests with **NTWCs**, in line with their sovereign authority to issue official warnings.
- **Integration of tsunami warnings into national CAP systems** is encouraged.

Regional Role

- **TSPs** generate regional forecasts and stage them on password-protected websites.
- TSPs provide **forecast guidance only**; TSP-level CAP is not appropriate due to legal and multi-layered architecture.

Guidelines Development

- Priority is on developing *Guidelines for CAP Implementation at the National Level for Tsunami Early Warnings* (IOTWMS WG-2).
- ITU to provide guidance on optimal CAP-based tsunami warning dissemination architecture for NTWCs.

Collaboration & Pilot Initiatives

- UNESCO-IOC ICG/IOTWMS is engaging with **ITU** and **WMO**.
- **30 EW4All countries** supported for CAP national implementation.
- Jointly identifying a small set of **ICG Member States** to pilot CAP for tsunami warnings and strengthen end-to-end early warning chains (SOPs, TSPs, NTWCs, NDMOs, LDMOs, communities).

TT-TWO & TOWS-WG Recommendations and it's Status in ICG/IOTWMS



Recommendation	Status
<p>Organize online webinars for each ICG involving relevant Volcano Observatories and Volcanic Ash Advisory Centers (VAACs)</p>	<ul style="list-style-type: none"> • The <i>Webinar on Monitoring and Warning for Tsunamis Generated by Volcanoes</i>, organized by the Tsunami Resilience Section of UNESCO-IOC, was held on 16 April 2025 (09:00–10:30 UTC) and 23 April 2025 (20:00–21:30 UTC). • The sessions presented the findings and recommendations of IOC/2024/TS/183 and initiated discussions on strengthening coordination between NTCs, Volcano Observatories, VAACs, and Tsunami Service Providers for volcano-generated tsunami events affecting multiple Member States. From IOTWMS, Dr. Robert Greenwood has presented the TSP-Australia experience on TGVs.
<p>Dissemination of the specialized TSP bulletins for the maritime community is tested in CARIBE-EWS, IOTWMS and NEAMTWS by at least one TSP either through the planned communication tests or planned tsunami exercises.</p>	<p>TSPs (Australia, India and Indonesia) has implemented the capability to generate the NAVAREA messages and trailed the dissemination during IOWAVE25.</p>
<p>Develop SOPs for volcanoes with a tsunamigenic potential within their Earthquake Source Zone (ESZ).</p>	<p>TSP Australia and India have developed SOPs to handle the TGV events.</p>
<p>CAP template for TSPs to facilitate exchange of bulletins between basin TSPs and their NTCs, between TSPs of different basins, and for public TSP bulletins</p>	<p>Discussion!</p>
<p>Multi-purpose sea level monitoring stations to support MHEWS</p>	<p>On going</p>

Capacity Building and Other activities in ICG/IOTWMS

- ❑ **Capacity Building:** On-the-Job Trainings for Oman operators were conducted in collaboration with DGMET Oman by ITCOO–INCOIS (Nov 2025, Hyderabad, **India**) and BMKG (Sept 2025, **Indonesia**), respectively, as part of bilateral/MoU arrangements to strengthen tsunami warning and DRR in the Indian Ocean.
- ❑ **First ODTP Conference :** INCOIS-India co-organized with UNESCO-IOC during 10–11 Nov 2025, at Hyderabad , focused on co-designing disaster-resilient coastal communities; strong IOTWMS participation.
- ❑ **ITS-2025:** 32nd International Tsunami Symposium at INCOIS united global experts to advance tsunami science, AI/ML early warning, and Tsunami Ready community resilience.
- ❑ **PCTWIN Project:** 8–11 April 2025, Kochi – linked IOTWMS delegates with PCTWIN work packages for regional early warning improvements.
- ❑ **TEMPP & TRRP Training:** 15–23 April 2025 at INCOIS in collaboration with IOTIC & IOTWMS; 54 delegates trained on tsunami evacuation, maps, procedures, and Tsunami Ready recognition across Indian Ocean countries.





ODTP Endorsed Initiatives

People Centred Tsunami Early Warning for the Indian Coastlines (PCTWIN)

UK-INDIA Project (2024 – 2028)



Project Leads: Fatemeh Jalayer, University College London; T.M. Balakrishnan Nair (Director) ; Indian National Centre for Ocean Information Services (INCOIS)

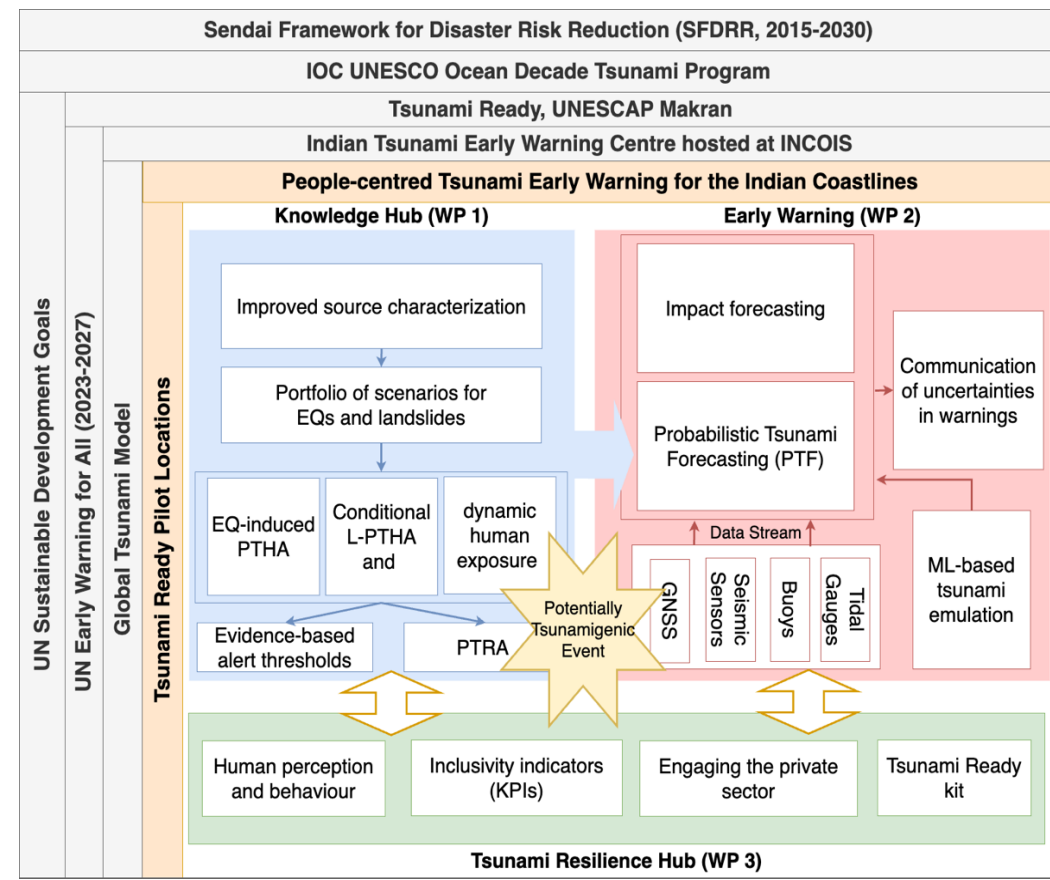
A project funded by NERC UKRI and the Ministry of Earth Sciences (MOES)



WP1 Knowledge Hub(Lead NGI) will unravel the fundamental physics and processes of earthquake and landslide tsunamis, to improve baseline tsunami hazard, exposure, and risk information.

WP2 Early Warning (lead INCOIS) is the operational core of the project. It aims to improve and boost the technical and operational capabilities of ITEWC at the national level and the IOTWMS at the regional level.

WP3 Resilience Hub (Lead UCL) focuses on participatory activities aiming at increasing public awareness and the level of preparedness of communities to respond to tsunamis.



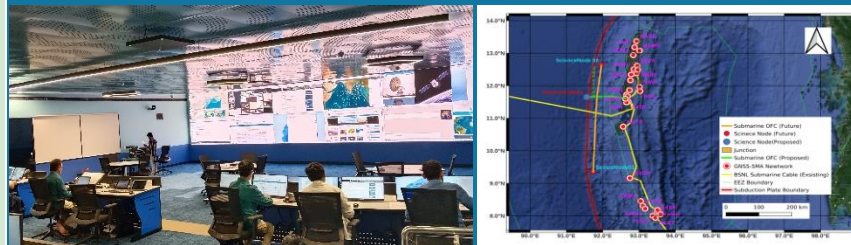
TSP Future Plans

TSP Australia



- ❑ Bureau-JATWC has plans for TOAST updates, including updating the national service to contain an additional land inundation threat tier for use by emergency services only.
- ❑ There is no change to the public-facing service.
- ❑ Bureau-JATWC will be transitioning its national tsunami warnings to a new Bureau public facing website.
- ❑ JATWC to engage in the recently approved national project which is to develop a volcanically generated tsunami source scenario database with potential tsunami impact to Australia.
- ❑ JATWC to work toward adapting Tsunami products to meet the Australian Warning System requirements.

TSP India



- ❑ Utilizing GNSS & SMA for precise rupture characterization.
- ❑ Establishing the GPS co-located tide Gauges for the remaining Indian Stations
- ❑ PTHA results of makaran region to be made accessible over web.
- ❑ Establishing new technologies (Under sea cable) for rapid tsunami detection
- ❑ Providing on-the-job trainings for IO member states.
- ❑ Working towards the Service Level 3 products such as inundation information and impact forecast.
- ❑ Participation on the Regular IOTWMS Communication Test and IOWAVE Exercise

TSP Indonesia



- ❑ Expanding Pre-Calculated Tsunami Database
- ❑ Continuing the contribution of WRS-TSP Indonesia as a real-time system to alert NTWCs
- ❑ Participation on the Regular IOTWMS Communication Test and IOWAVE Exercise
- ❑ Continue to do the research on non-seismic tsunami and SOP.
- ❑ Continue to support on job training for the IO member states.
- ❑ Continue to establish of the National Consortium of the earthquake and tsunami experts.

ICG Key Decisions & Projects

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. - Completed
- Conduct Exercise IOWave25 and pre/post-exercise workshops - completed
- Implement TSP Bulletins for NAVAREAS - Trailed
- 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

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)



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Thank You

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Mr. Nasser Said AL-ISMAILI (Oman)

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