



Indian Ocean Tsunami Warning and Mitigation System (IOTWMS)

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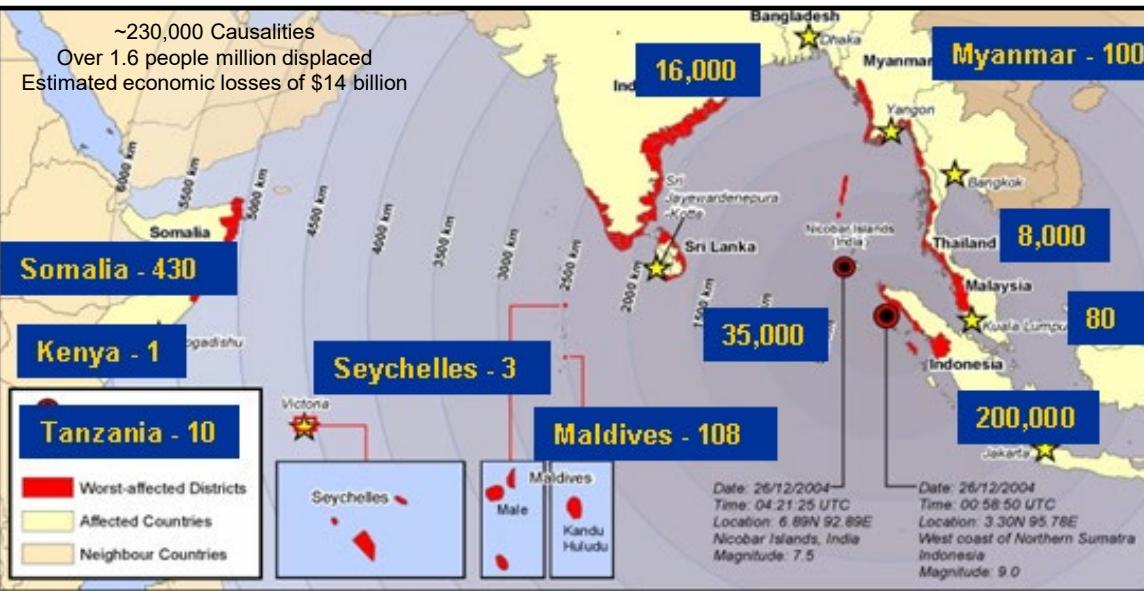
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*Indian Ocean Tsunami Warning and Mitigation System (IOTWMS) Secretariat
Intergovernmental Oceanographic Commission of the UNESCO*

*SEAMARCS Inception Workshop, Mombasa, Kenya
24 - 26 September 2025*

Global Tsunami Warning and Mitigation System

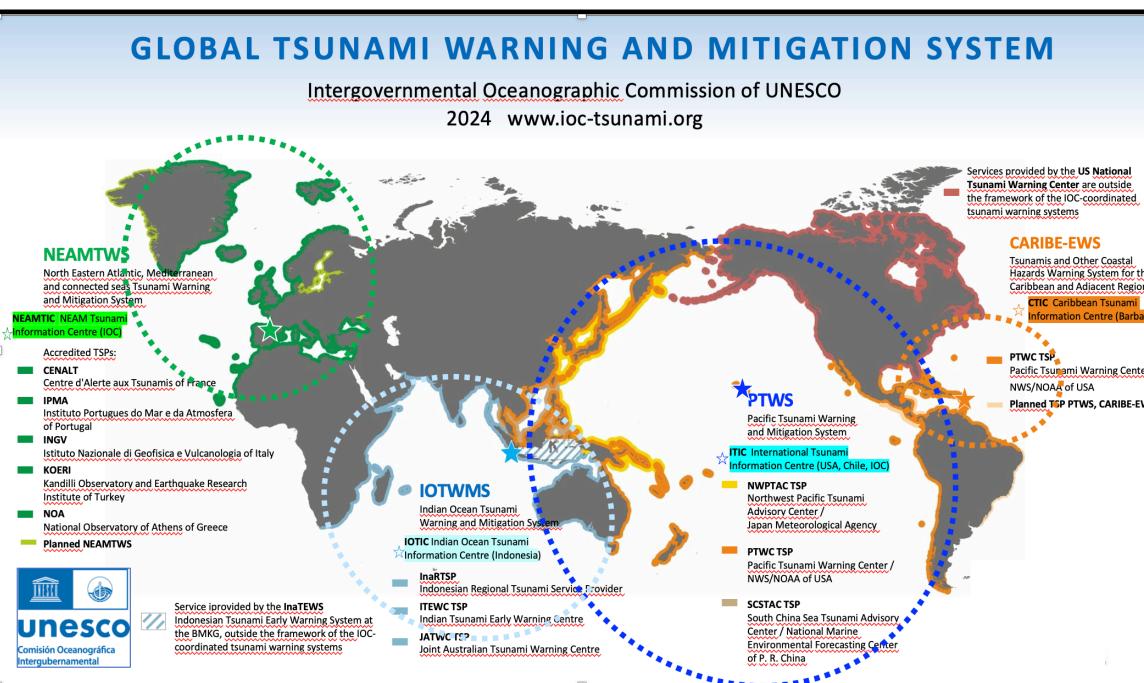


Progress since 2004 Indian Ocean Tsunami

- UNESCO IOC mandate
- 4 ICGs - IOTWMS, CARIBE EWS, NEAMTWS, PTWS (ITSU since 1965)
- Seismic & Sea Level Observing networks, models, computational, communication facilities, DSS and SOPs
- Tsunami Ready
- 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 to their citizens
- Successfully monitored and issued warnings for several events saving precious lives – Seismic, Regional Sources

Several challenges evidenced from recent events

- Uncertainties in tsunami warning
- SOPs and EW Chains
- Response capabilities
- Preparedness & response



The Key Elements

Risk Assessment and Reduction

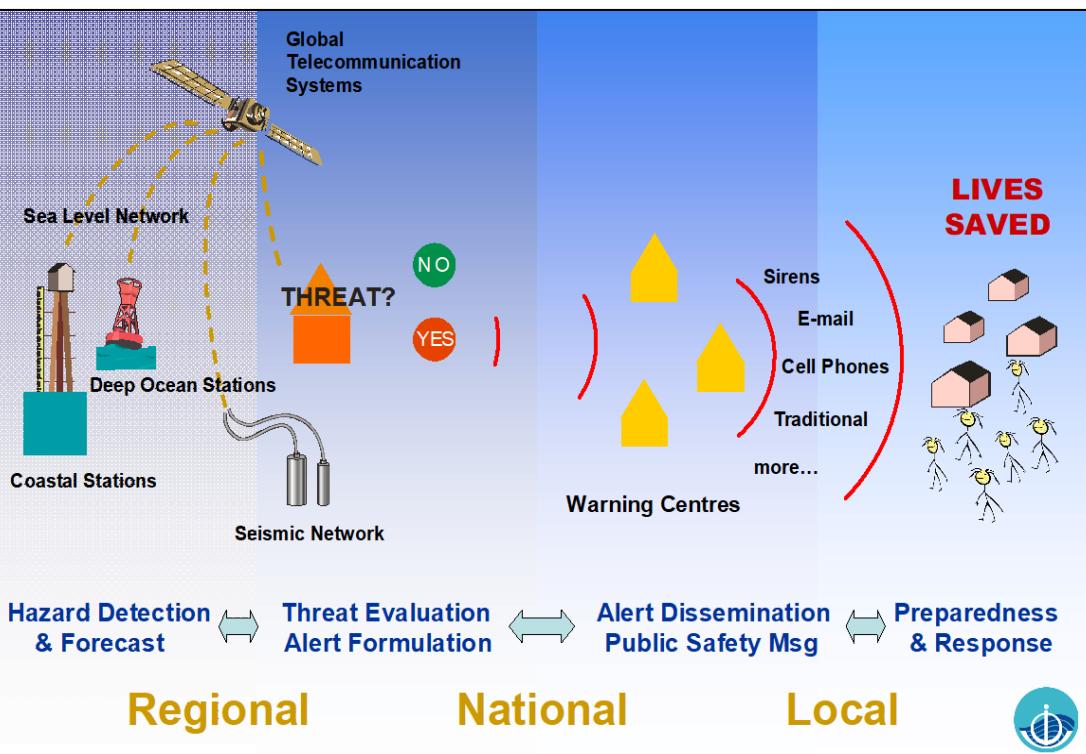
Systematically collect data and undertake risk assessments

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



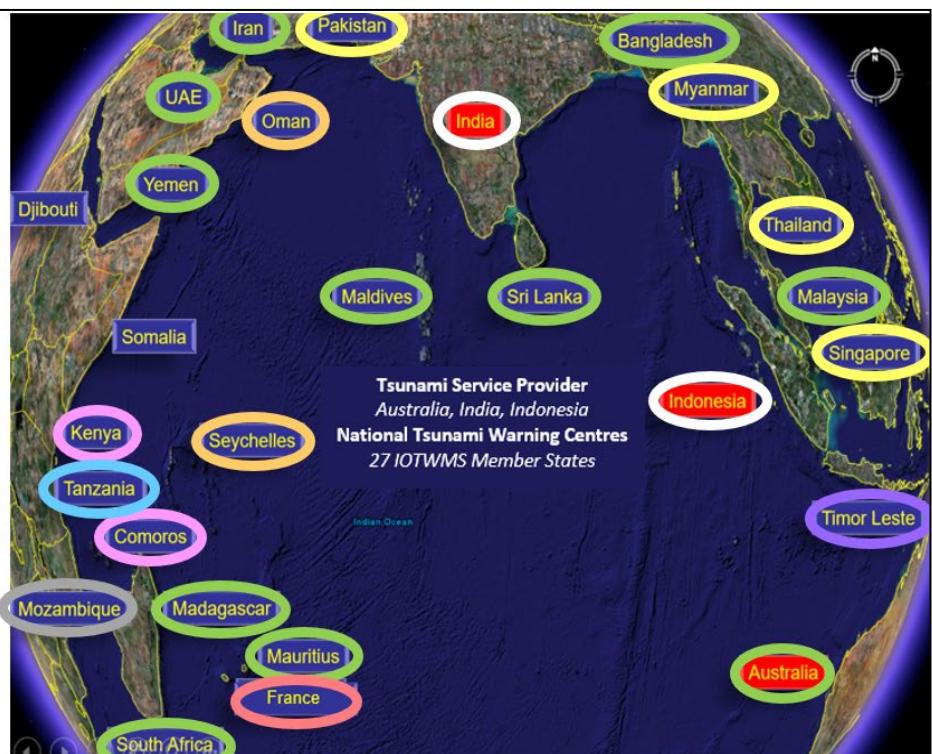
Member State Engagement

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

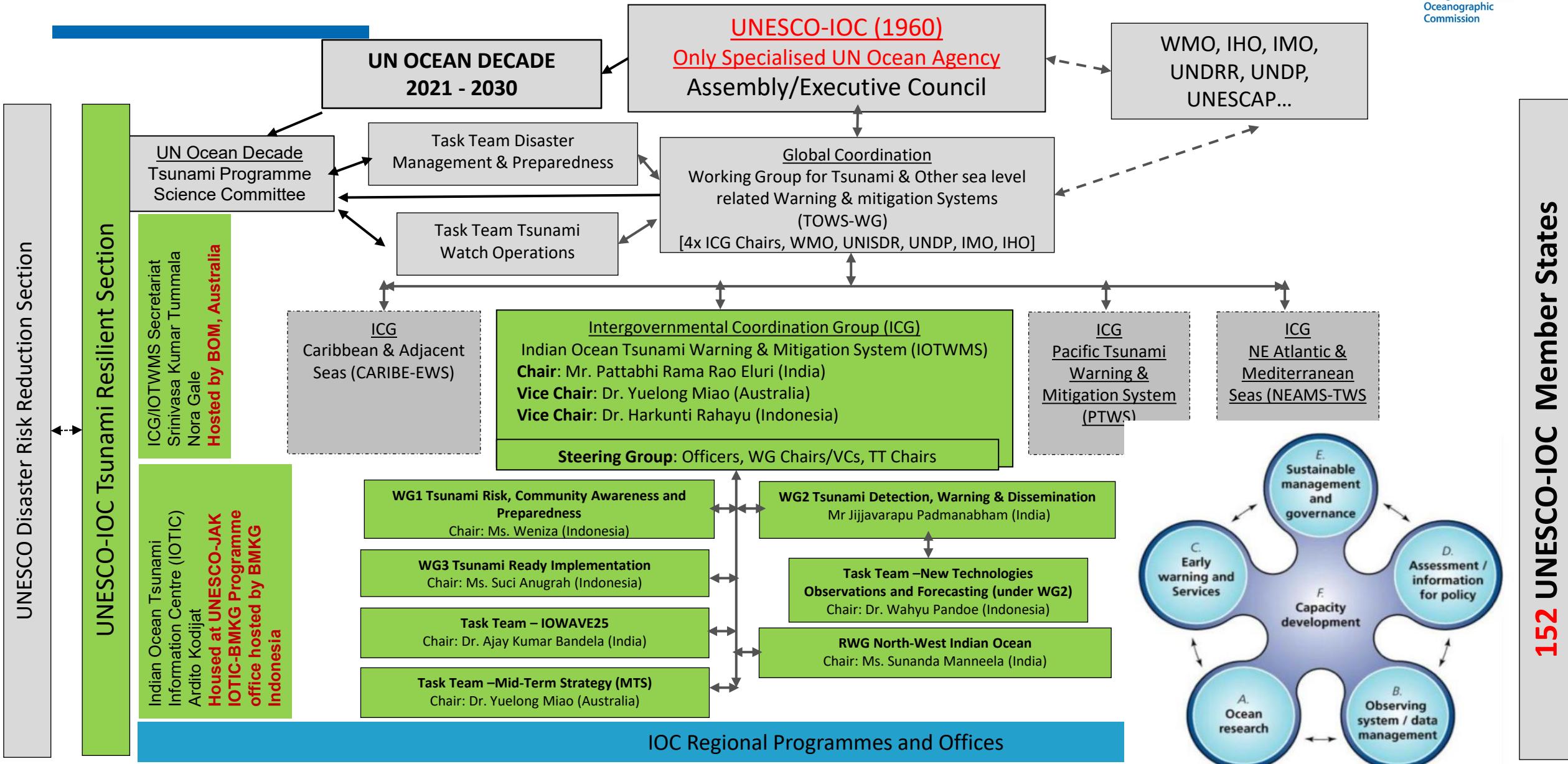
LEGEND	
All above activities	IOWave, CATP
IOWave, SOPs, TEMPP, CATP	TEMPP, SOPs
IOWave, TEMPP, CATP	TEMPP, CATP
IOWave, SOPs, CATP	IOWave
	CATP

Regional Collaborations

- IOC AFRICA (10)
- SIDS (6)
- Other ICGs (3)
- IOGOOS (14)
- IOC INDIO (9)
- WMO PTC (11)



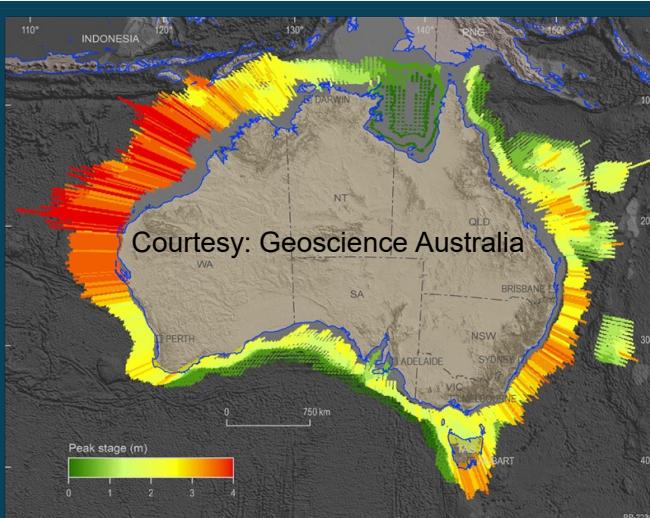
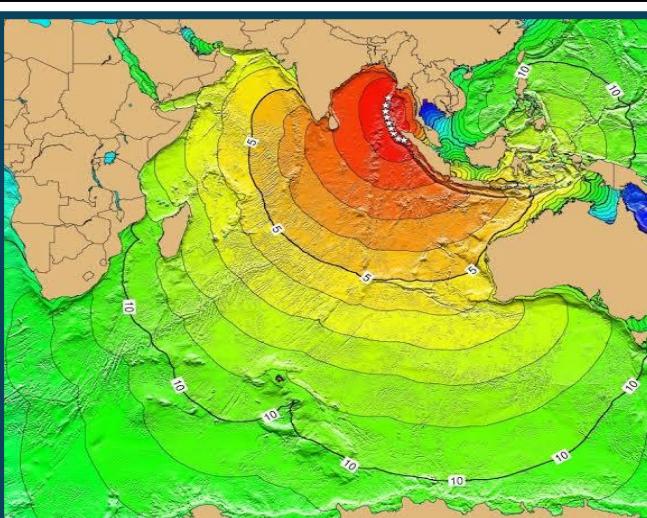
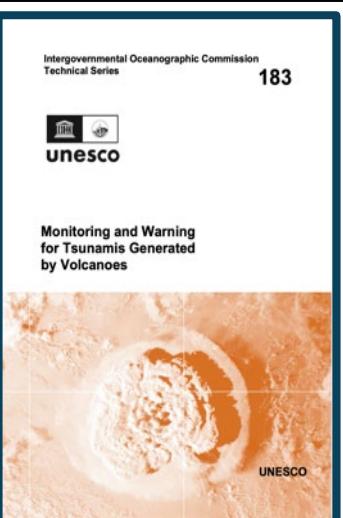
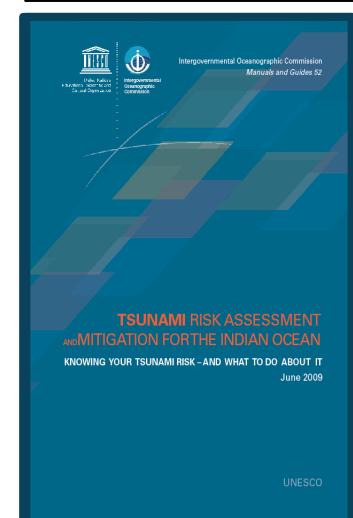
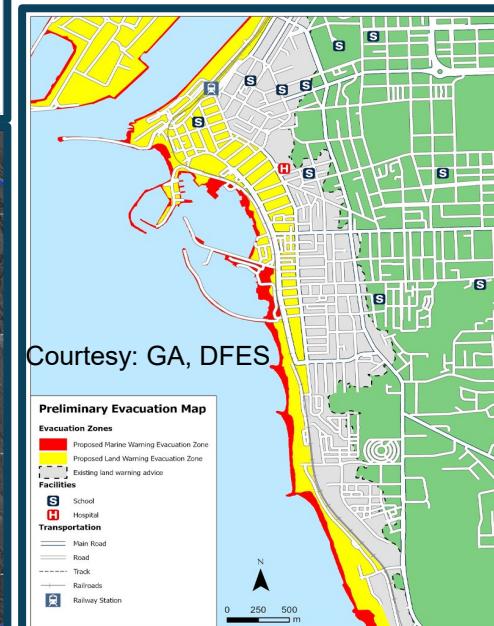
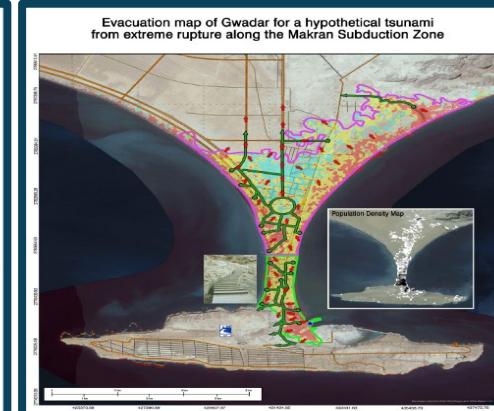
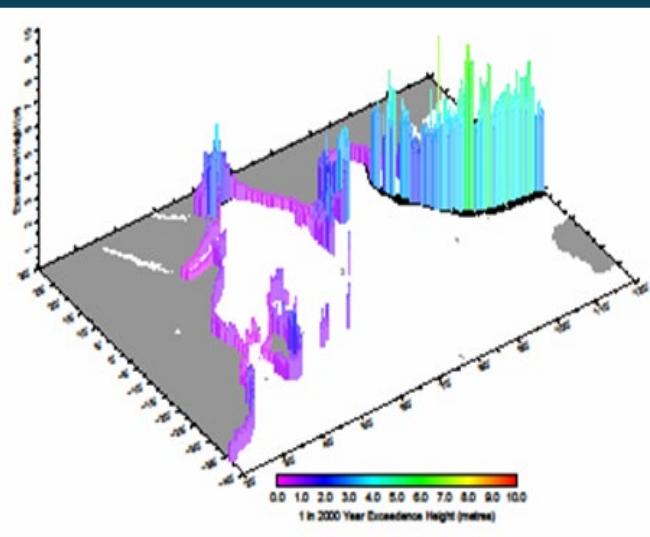
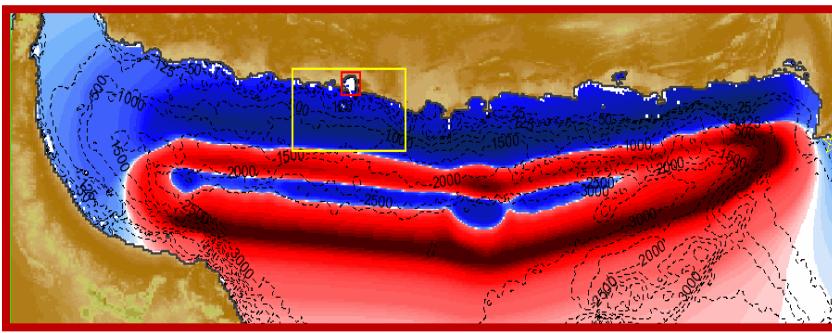
Governance of the ICG/IOTWMS



Risk Assessment and Reduction

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

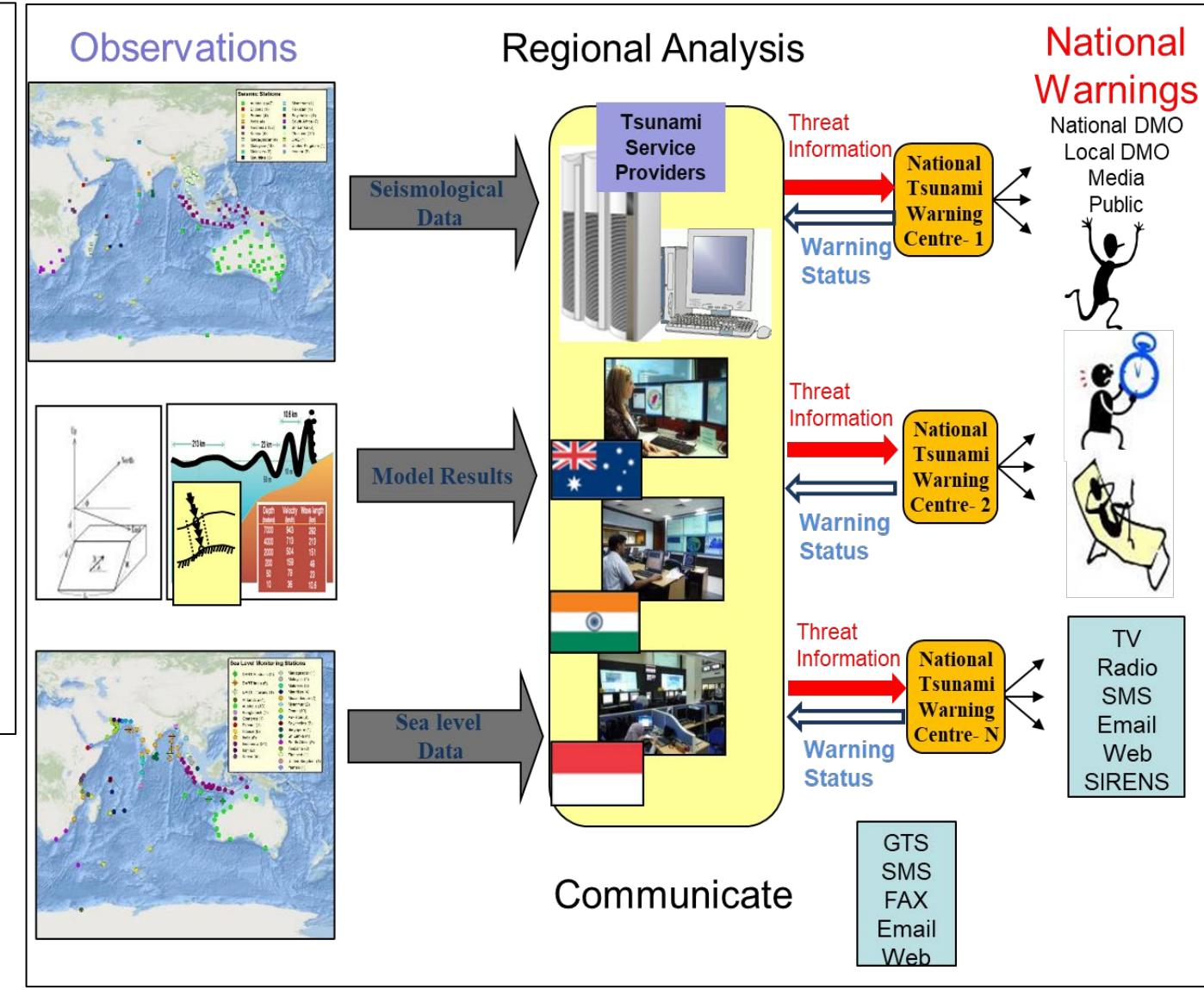
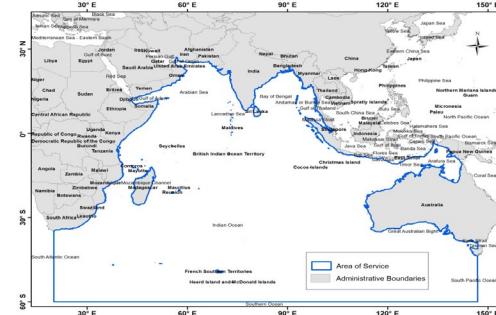
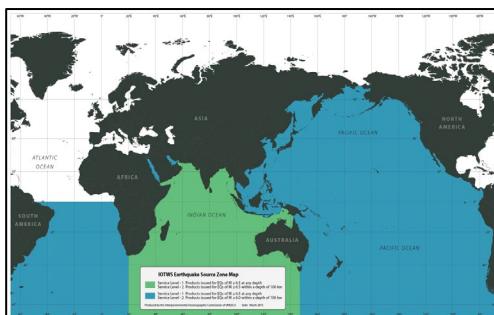
- **Seismic** - Sunda Arc, Makran Trench, **Non-seismic** – Volcano, Landslides
- Impact times – **Minutes to Hours**
- **Tools, Methods & Guidelines** for Tsunami Risk Assessment
- Indian Ocean Regional **Probabilistic Tsunami Hazard Maps**
- Assessment and Awareness of **Makran Tsunami Hazards**
- **Regional Workshops** on Tsunami Risk Assessment, Inundation Modelling, Evacuation Planning
- Enhancing Tsunami Risk Assessment and Management, **Strengthening Policy Support** and Developing Guidelines for Tsunami Exercises in Indian Ocean Countries
- **Australian PTHA 2018, UNESCAP Makran, UKRI PCTWIN**



Detection, Warning and Dissemination

Need for provision of timely tsunami warnings

- **Service Definition:** AoS, Stations, Products, Thresholds, CFZs, Formats
- **Tsunami Service Framework:** TSPs / NTWCs
- Expanded seismic and sea level networks
- Harmonised threat information by TSPs
- **National warnings Sovereign responsibility of authorized national agencies**
- Performance assessments against **Key Performance Indicators**
- Communications tests & Tsunami Drills
- **Ongoing Work on Non-Seismic Tsunamis & Maritime Products**



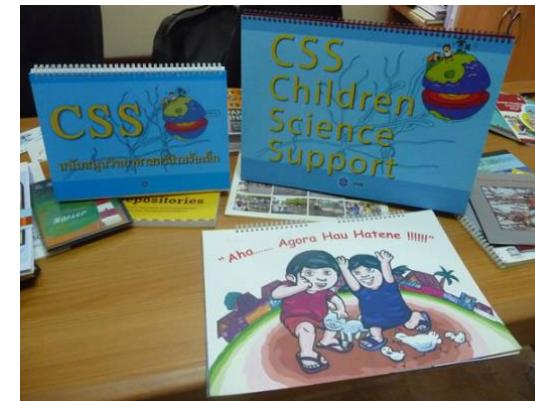
Awareness and Response

A good warning is not useful unless stakeholders and public are unaware how to respond

- Indian Ocean Tsunami Information Centre and IOTIC BMKG Programme
- Indian Ocean-wide (IOWave) exercises held every two years
- UNESCO-IOC Tsunami Ready Recognition Programme (TTRP)
- 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
- 70th Anniversary of 1945 Makran & 20th Anniversary of 2004 Indian Ocean (Aceh) Tsunami
- World Tsunami Awareness Day (WTAD) – 05 November
- Tsunami United sessions for high school students & WTAD Youth Talk Show



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

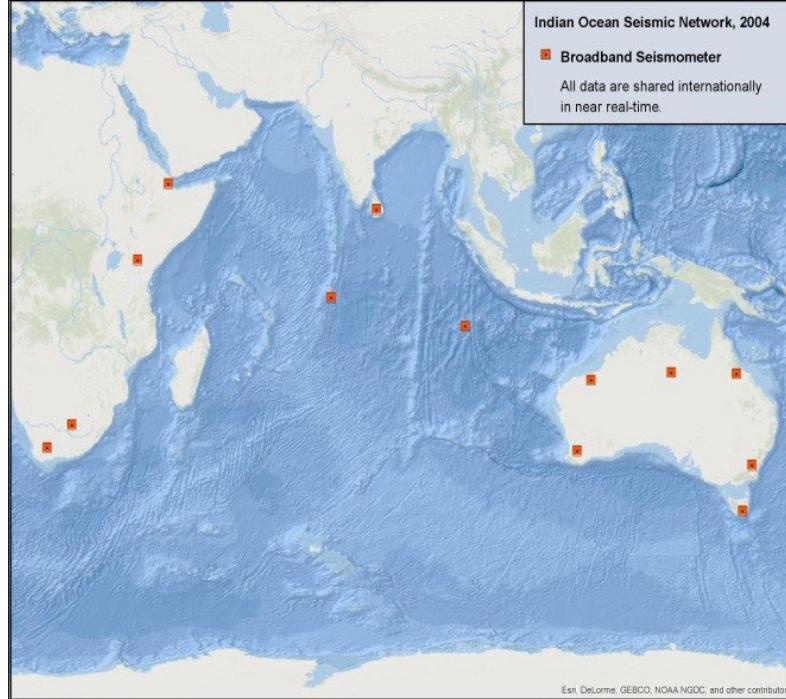


Emergency Services

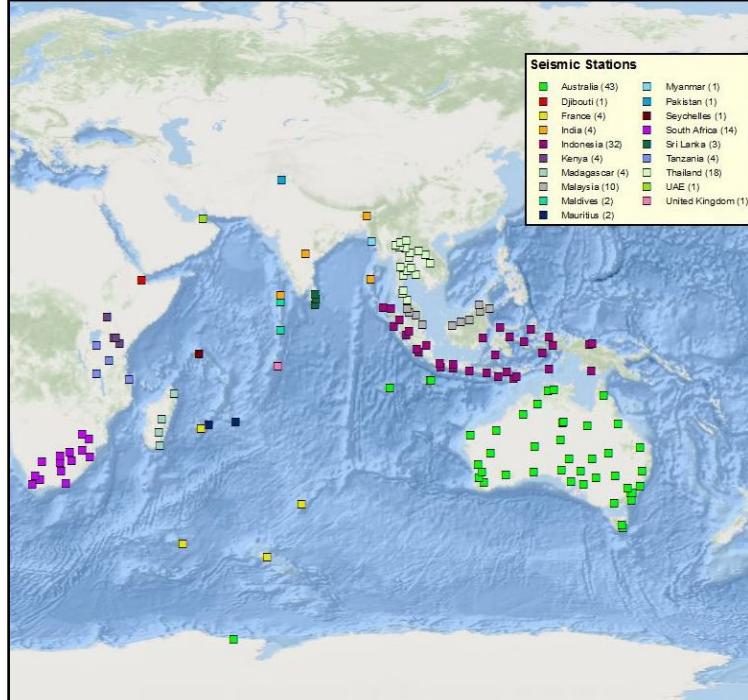


Evacuation Planning

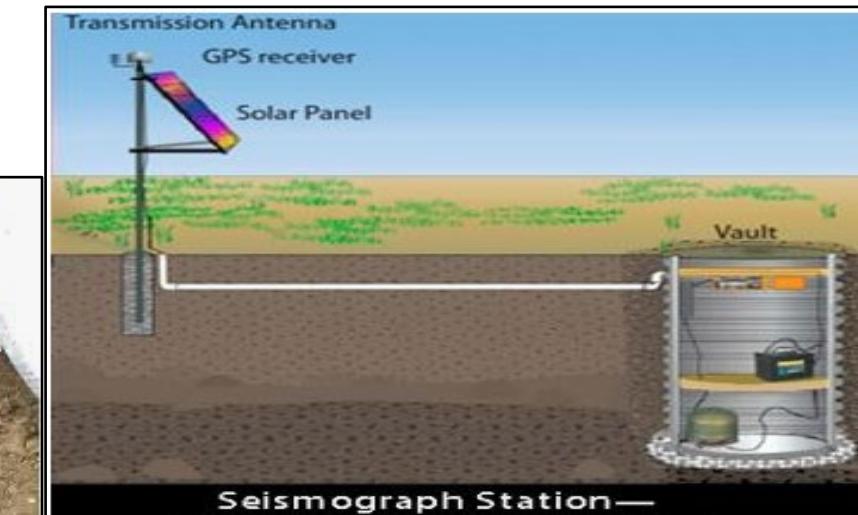
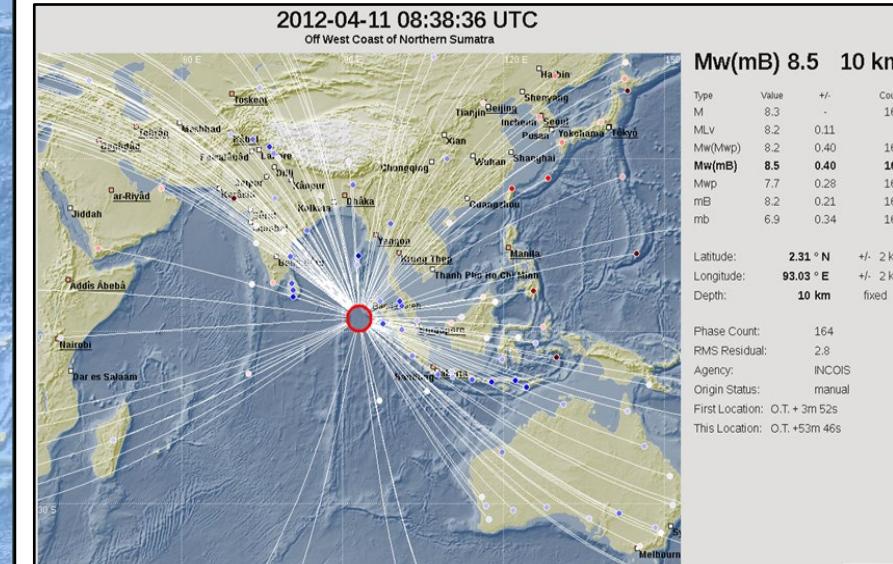
Earthquake Monitoring Networks



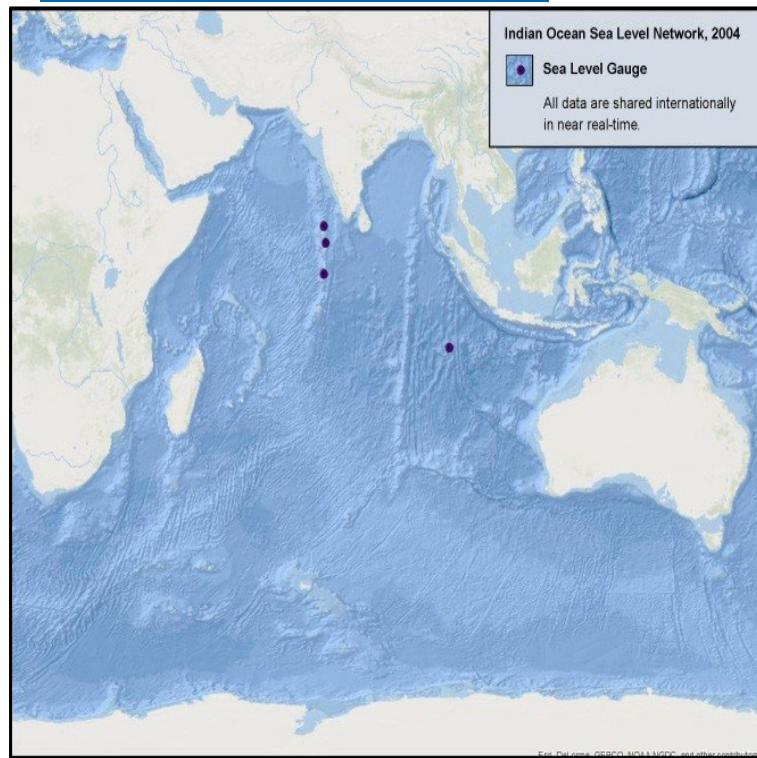
2004



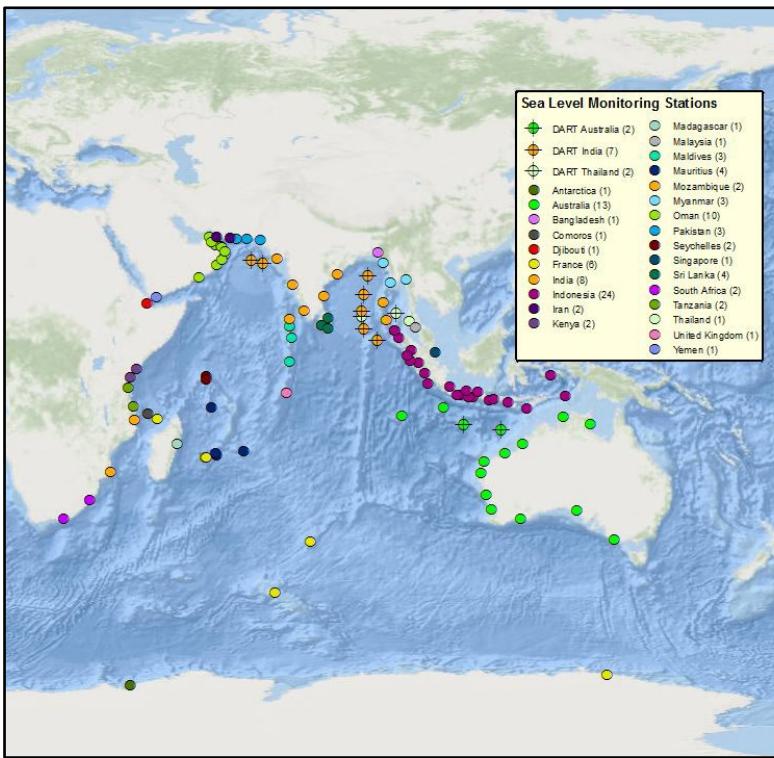
2018



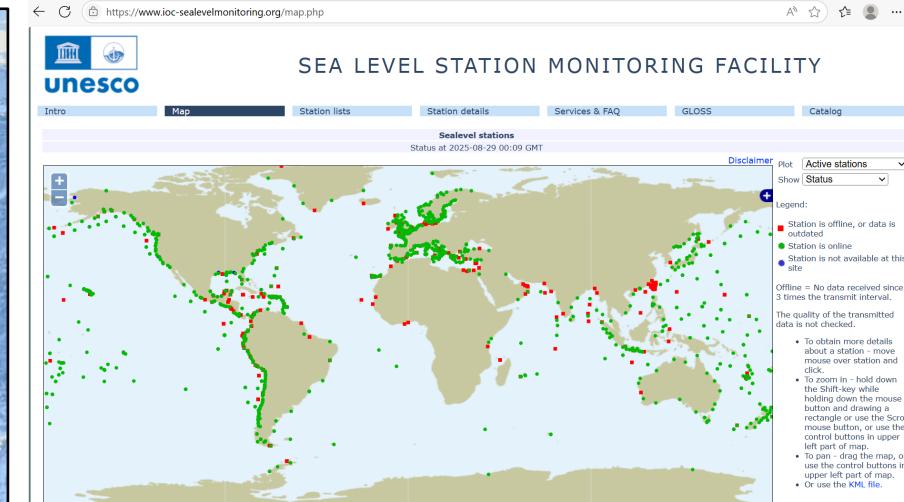
Sea Level Monitoring Networks



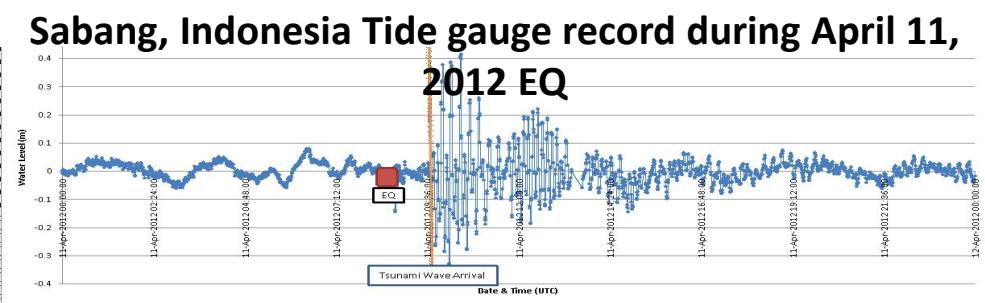
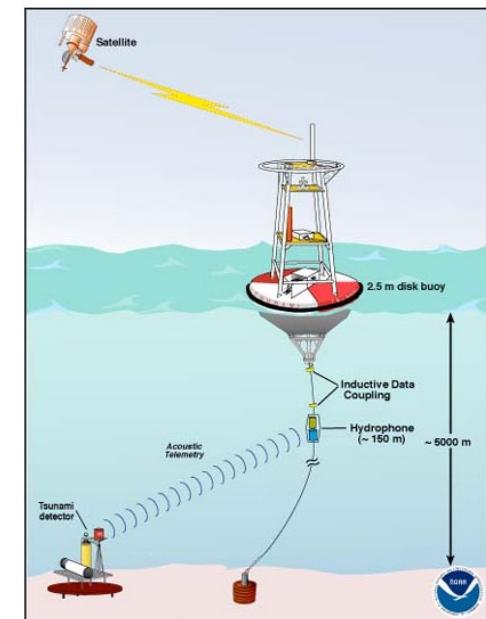
2004



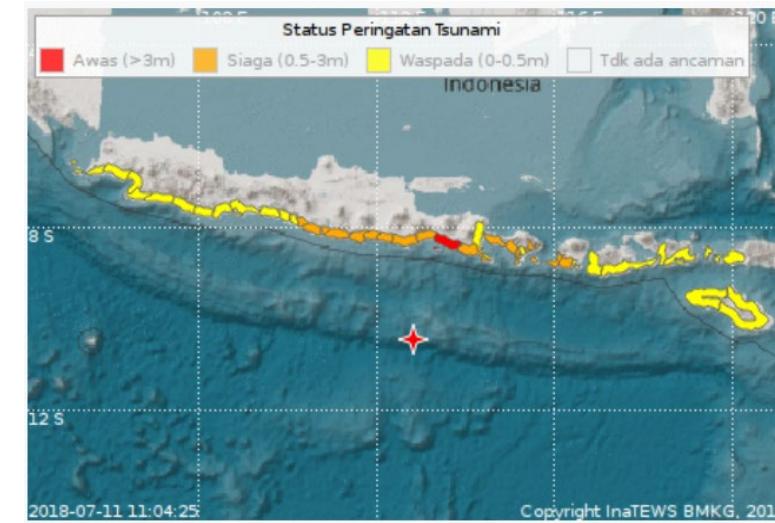
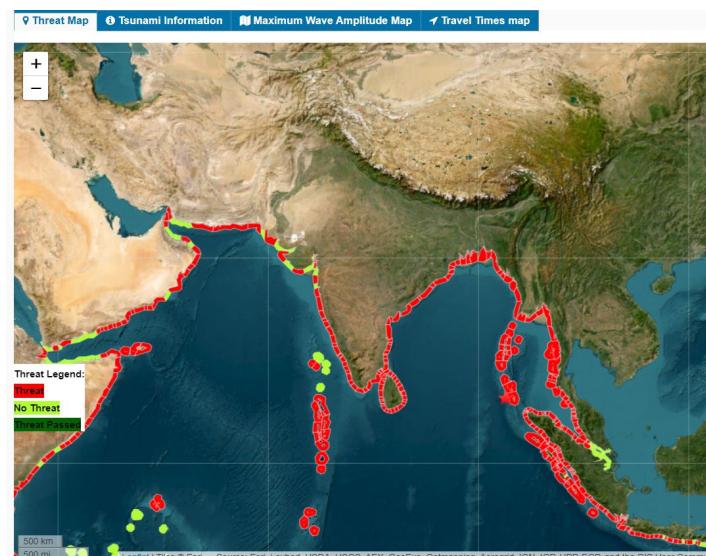
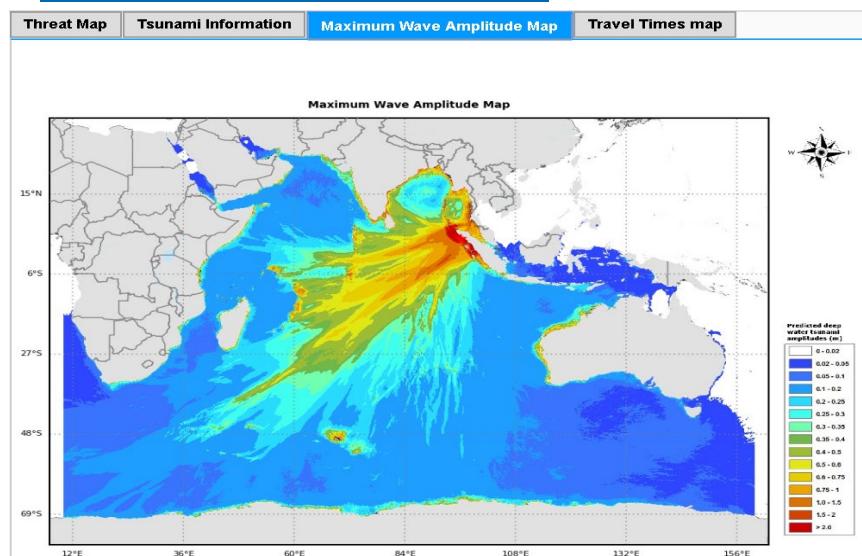
2018



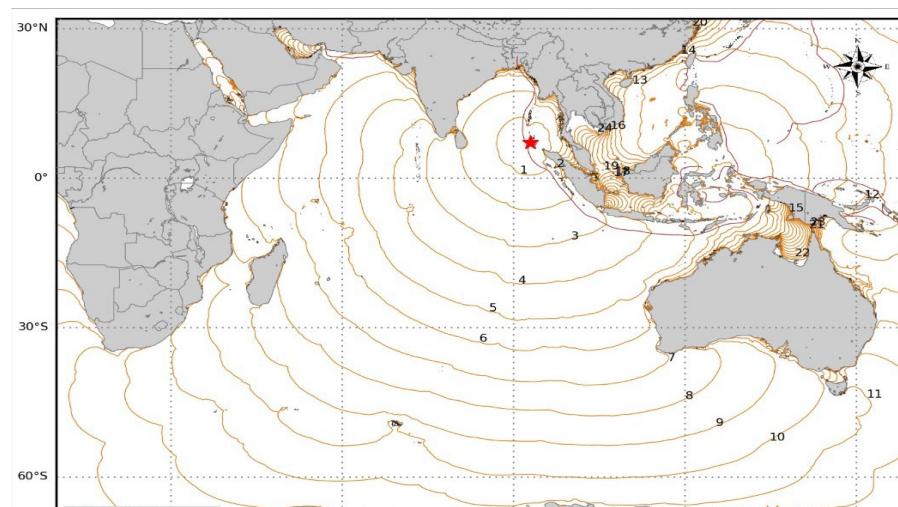
Today



Modelling & Forecasting Systems



Tsunami Modelling Systems



Regional Information

Filter by

Country	State/Territory	Zone	T1(UTC)	T2(UTC)	T3(UTC)	T4(UTC)	Amplitude(m)	Threat Status
INDIA	ANDAMAN AND NICOBAR	INDIRA POINT	07-Jun-2023 06:02	07-Jun-2023 06:02	07-Jun-2023 06:08	08-Jun-2023 06:58	12.5	Threat
INDIA	ANDAMAN AND NICOBAR	KOMATRA & KATCHAL ISLAND	07-Jun-2023 06:02	07-Jun-2023 06:02	07-Jun-2023 06:08	08-Jun-2023 07:00	9.6	Threat
INDIA	ANDAMAN AND NICOBAR	CAR NICOBAR	07-Jun-2023 06:04	07-Jun-2023 06:04	07-Jun-2023 06:17	08-Jun-2023 06:54	6.9	Threat
INDONESIA	NANGGROE ACEH DARUSSALAM	NAD ACEH-JAYA	07-Jun-2023 06:18	07-Jun-2023 06:20	07-Jun-2023 06:07	08-Jun-2023 07:00	6.1	Threat
INDONESIA	NANGGROE ACEH DARUSSALAM	NAD ACEH-BESAR P.BREUEH	07-Jun-2023 06:20	07-Jun-2023 06:21	07-Jun-2023 06:25	08-Jun-2023 06:40	7.6	Threat
INDONESIA	NANGGROE ACEH DARUSSALAM	NAD ACEH-BESAR B	07-Jun-2023 06:22	07-Jun-2023 06:23	07-Jun-2023 06:32	08-Jun-2023 07:00	10.1	Threat
INDONESIA	NANGGROE ACEH DARUSSALAM	NAD KOTA-BANDA-ACEH	07-Jun-2023 06:20	07-Jun-2023 06:23	07-Jun-2023 06:47	08-Jun-2023 07:00	9.4	Threat
INDONESIA	NANGGROE ACEH DARUSSALAM	NAD KOTA-SABANG P.WEH	07-Jun-2023 06:24	07-Jun-2023 06:27	07-Jun-2023 06:31	08-Jun-2023 06:28	3.9	Threat
INDONESIA	NANGGROE ACEH DARUSSALAM	NAD ACEH-BESAR P.PENASI	07-Jun-2023 06:27	07-Jun-2023 06:29	07-Jun-2023 06:32	08-Jun-2023 06:10	5.9	Threat
INDIA	ANDAMAN AND NICOBAR	LITTLE ANDAMAN	07-Jun-2023 06:29	07-Jun-2023 06:33	07-Jun-2023 06:40	08-Jun-2023 07:00	9.6	Threat
INDONESIA	NANGGROE ACEH DARUSSALAM	NAD ACEH-BARAT	07-Jun-2023 06:32	07-Jun-2023 06:38	07-Jun-2023 10:33	08-Jun-2023 06:40	3	Threat
INDONESIA	NANGGROE ACEH DARUSSALAM	NAD SIMEULUE P.SIMEULUE	07-Jun-2023 06:35	07-Jun-2023 06:41	07-Jun-2023 06:54	08-Jun-2023 07:00	3.4	Threat

National Warnings

Recomendation and Instruction based on Warning Level :



Province/District/City governments that are at MAJOR WARNING level are expected to pay attention to this warning and immediately guide their communities for full evacuation



Province/District/City governments that are at WARNING level are expected to pay attention to this warning and immediately guide their communities for evacuation



Province/District/City governments that are at ADVISORY level are expected to pay attention to this warning and immediately guide their communities to move away from the beach and river banks

Indian Ocean Wave Exercises & Comms Tests

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

- Once every 2 years (7 exercises to date)
- 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 engage TR Communities
- SOP Workshops in Aug - 400 experts from 23 countries

Communication Tests

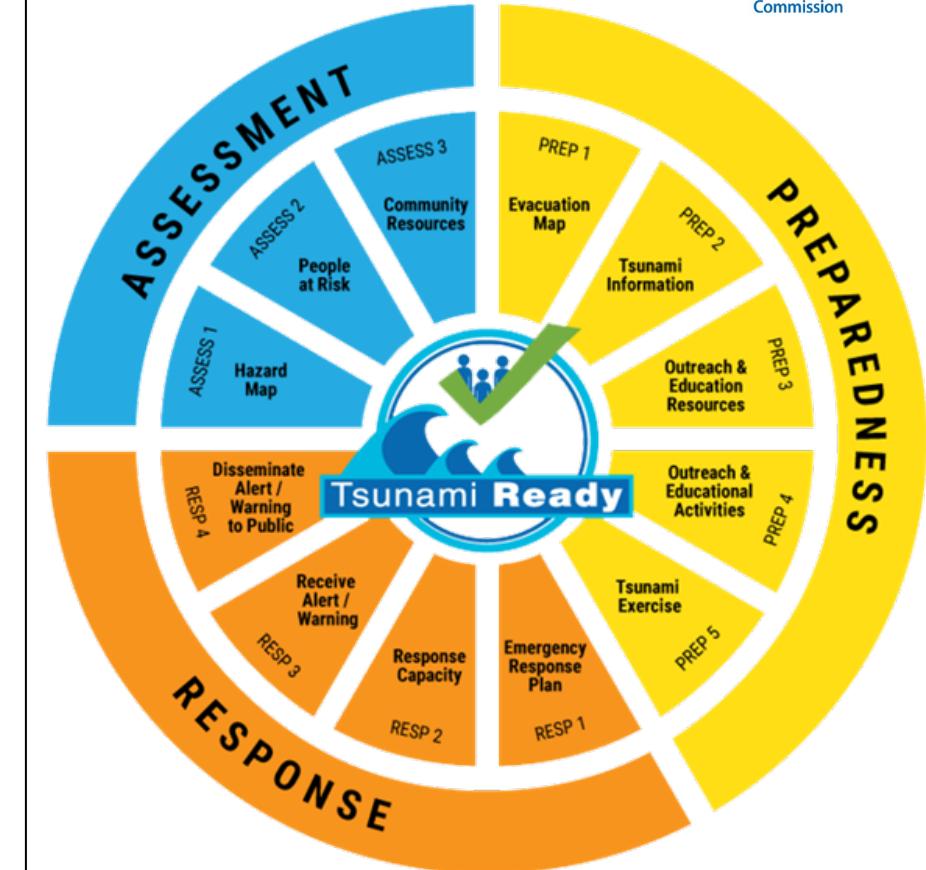
- 6 monthly (29 tests to date)
- Email most reliable followed by GTS & SMS
- Fax service ceased

IOWave25 Participation (18): Australia, Bangladesh, India, Indonesia, Madagascar, Maldives, Mauritius, Mozambique, Oman, Pakistan, Seychelles, Singapore, South Africa, Sri Lanka, Tanzania, Thailand, Timor Leste and UAE.

- Scenario 1: Sunda Trench - 25 September 2025 (4)** - Australia, Indonesia, Thailand and Timor Leste.
- Scenario 2: Makran Trench - 15 October 2025 (7)** - India, Madagascar, Mauritius, Mozambique, Oman, Pakistan and UAE.
- Scenario 3: Fane Maore Volcano - 25 October 2025 (3)** - Madagascar, Seychelles and South Africa.
- Scenario 4: Sumatra Trench - 5 November 2025 (13)** - Australia, Bangladesh, India, Indonesia, Madagascar, Maldives, Mozambique, Seychelles, Singapore, South Africa, Sri Lanka, Tanzania and Timor Leste

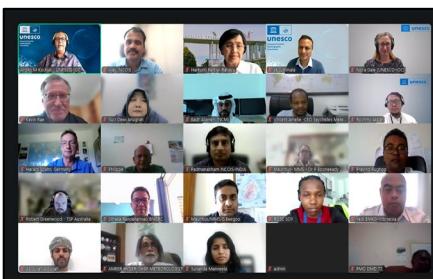
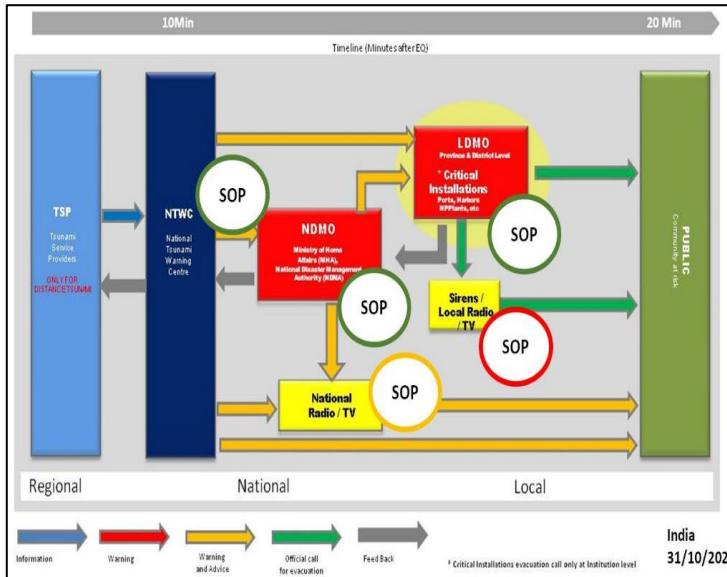
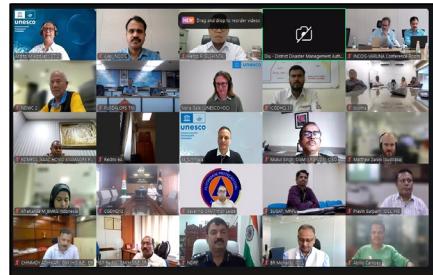
Tsunami Ready Recognition Programme

- Community **performance-based recognition programme** that facilitates tsunami preparedness as an active collaboration of the community, community leaders, and national and local emergency management agencies.
- Structured and **systematic approach** for community preparedness.
- 12 Indicators** of Assessment, Preparedness, and Response
- TEMPP & TRRP Trainings**
- 19 National Tsunami Ready Focal Points**
- 3 National Tsunami Ready Boards** - India, Indonesia and Seychelles
- 48 IOTWMS Communities** - 26 in India and 22 in Indonesia
- 100 Communities from 39 Countries**



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 2024 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

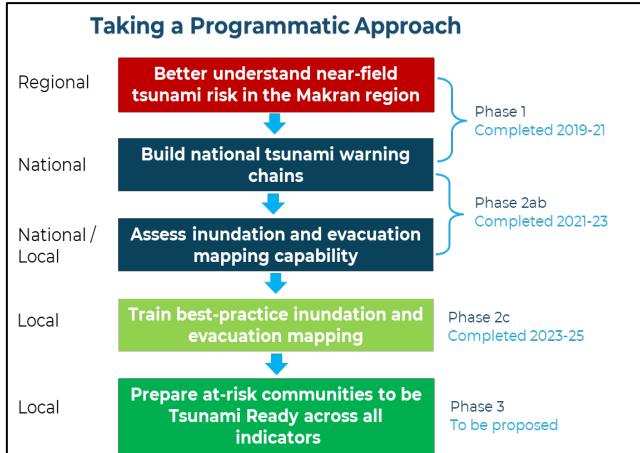
Seychelles,
November 2023

Maldives,
August 2024

Strengthening tsunami warning in the North-West Indian Ocean through regional cooperation: Phase 3



Intergovernmental
Oceanographic
Commission



Objective 6: Improved community capacities for tsunami preparedness and response that are in line with the set of indicators of the UNESCO Tsunami Ready Recognition Programme

Support the strengthening of Tsunami Ready Indicators

6.1
Build the capacity of Maldives and Sri Lanka on Tsunami Inundation Modelling and Mapping

6.4
Strengthening local DMO warning SOPs and coming up with recommendations for a multi-hazard framework

6.5
Further research on non-seismic and complex sources of tsunami generation in the Makran Subduction Zone

6.2
Strengthening the capacities of the national, local, and community facilitators

6.3
Support pilot communities to strengthen their capacity to meet the UNESCO-IOC TR Indicators and apply for the recognition process

Support for the planning and implementation of Tsunami Ready indicators in pilot communities



Pilot communities

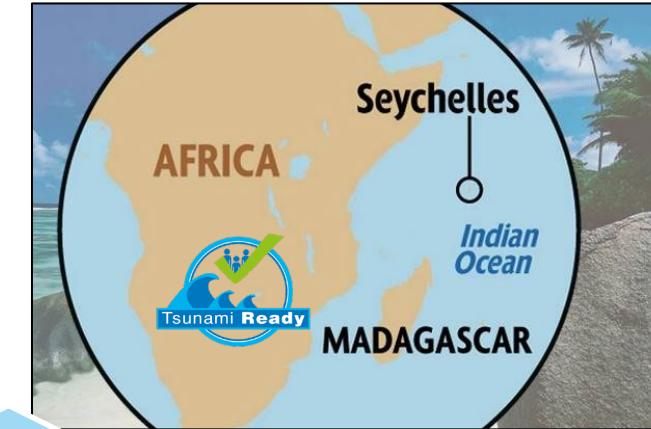
India: Purakkad; Alappad / Okha; Pingleshwar
Iran: Chabahar, Jask
Pakistan: Gwadar, Karachi
Maldives: Diffushi, Fuvahmulah
Sri Lanka: Ambalangoda
Oman: Alhail North
UAE: Fujairah

Strengthening Community Resilience to Ocean Hazards through implementation of Tsunami Ready in Indian Ocean SIDS and Africa

Complements the Projects on Strengthening Sea Level Monitoring and Data Management in East Africa for Coastal Resilience and Community Safety (SEAMARCS) - Kenya, **Madagascar**, Mozambique, **Seychelles**

- Project duration: 18 Months
- Budget: ~ USD 50,000
- Funding Agency: Flanders UNESCO Science Trust Fund (FUST)

- IOTIC & IOTWMS Secretariat
- IOTWMS Working Group – 3
- TNCs / TRFPs / Stakeholders - **Madagascar, Seychelles**



Objective 1
Capacity Building
on TIMM for
Madagascar &
Seychelles

Objective 2
Capacity building
for Tsunami Ready
Communities in
Madagascar &
Seychelles

Objective 3
Tsunami Ready
Communities are
recognized by
UNESCO-IOC

Support for the planning and implementation of Tsunami Ready indicators in pilot communities

Activity 1.1
On-the-job training
at INCOIS on TIMM
for two experts
each from
Madagascar and
Seychelles

Activity 1.2
Identification of
Pilot Sites (1 each
in Madagascar &
Seychelles) for
Tsunami Ready
Implementation

Activity 2.1
Support the National
Stakeholders to
coordinate and
facilitate the
establishment of the
NTRB

Activity 2.2
National Tsunami
Ready Training for
stakeholders and
facilitators in
Madagascar

Activity 2.3
Support on
Community
Capacity Building
on UNESCO-IOC 12
Tsunami Ready
Indicators

Key Contacts



Kenya



Tsunami Warning Focal Point / National Tsunami Warning Center

Kenya Meteorological Department

[official site](#) →



Dr David Gikungu
Tsunami National Contact
Director
Kenya Meteorological Department



Dr Phillip Okello Ochieng
Tsunami Ready Focal Point
Principal Meteorologist - Marine
Kenya Meteorological Department



Country	Tsunami Evacuation Maps, Plans and Procedures Training, Hyderabad, India, April 2025	
	Participants (Organisations)	Evacuation Maps
Kenya	Getrude Tausi Leshamta (KMD) Athman Salim Hussein (KMFRI)	Faza Island, Lamu archipelago
Madagascar	Andriamiranto Raveloson (IOGA)	Toamasina Seaport
Mozambique	Marta Antonio Mbeve (INAM) could not attend	-
Seychelles	Elpha Catherina Bonnelame (DRMD) Doreen Lugemalila Ikula (SMA)	Anse Royale, Mahe Island



Madagascar



Tsunami Warning Focal Point / National Tsunami Warning Centre

Institute and Observatory of Geophysics of Antananarivo

[official site](#) →



Prof Solofoarisoa Rakotonaina
Tsunami National Contact
Director
Institute Observatory of Geophysics of Antananarivo



Mr Adriamiranto Raveloson
Tsunami Ready Focal Point
Senior Seismologist
Institute and Observatory of Geophysics in Antananarivo



Mozambique



Tsunami Warning Focal Point / National Tsunami Warning Centre
Senior Seismologist
National Institute of Meteorology

[official site](#) →



Mr Mussa Mustafa
Tsunami National Contact
Chief, Weather Forecasting
National Institute of Meteorology



Mr Agnaldo Emanuel Bila
Tsunami Ready Focal Point
Head of Information and Communication Technologies Department
National Institute for Disaster Risk Reduction



Seychelles



Tsunami Warning Focal Point / National Tsunami Warning Centre
Seychelles Meteorological Authority

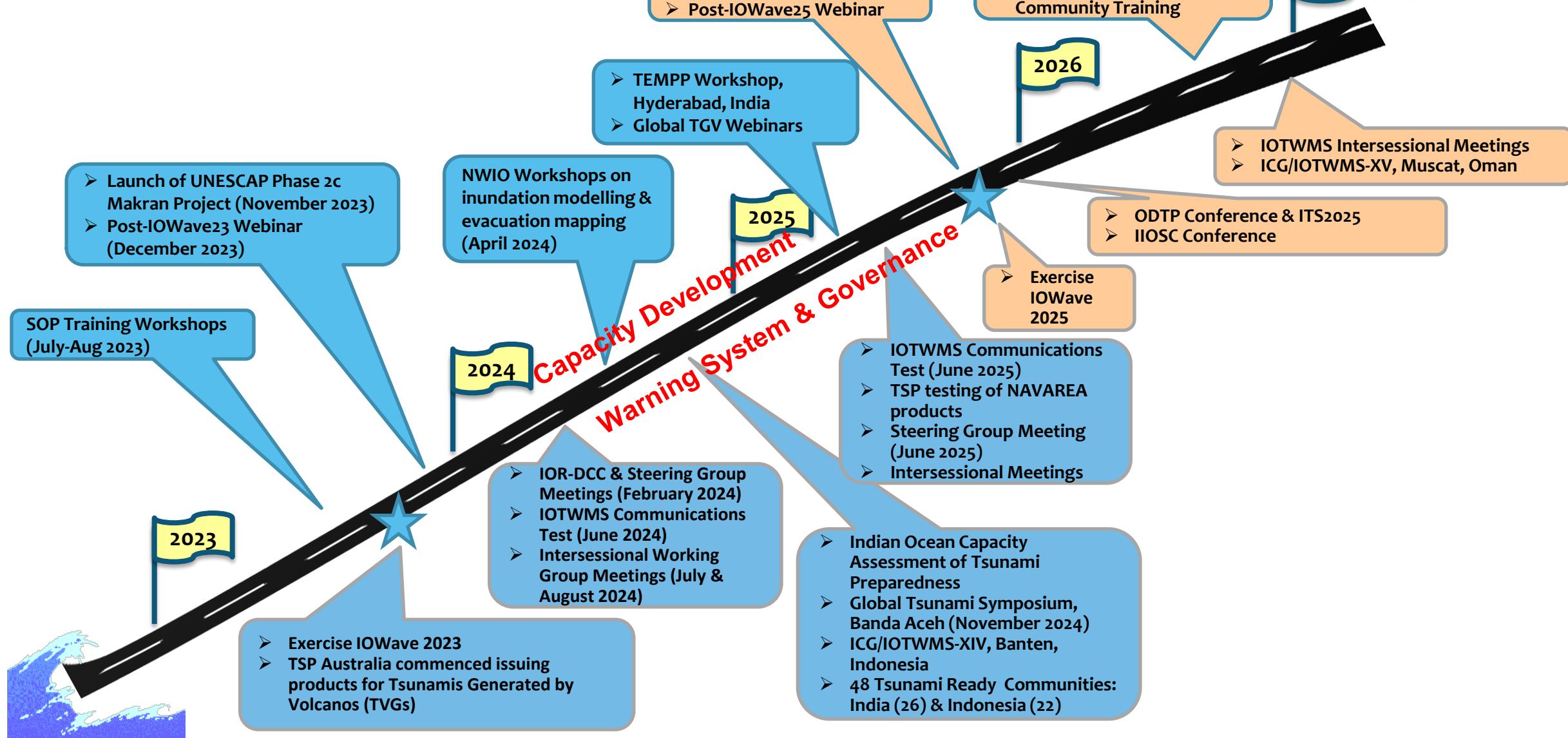
[official site](#) →



Mr Robert Ernesta
Tsunami National Contact & Tsunami Ready Focal Point
Director General
Disaster Risk Management Division



Roadmap 2025-2026



THANK YOU