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IOC-UNESCO role in Global Coordination of Tsunami Early Warning and Mitigation System (TEWMS) and the Achievement of the Indian Ocean TEWMS

*UNESCO Office Jakarta
Masterclass Session on
Disaster Mitigation
30 August 2017*



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Acknowledgement:
Dr. Srinivasa Kumar Tummala,
Head, ICG/IOTWMS Secretariat
Dr. Thorkild Aarup,
Head, IOC-UNESCO Tsunami Unit

Some Initiatives for Regional Collaboration



- IOC-UNESCO Tsunami Warning and Mitigation System
- WMO Tropical Cyclone Programme
- UNISDR Global/Regional Platforms
- Climate Risk & Early Warning Systems (CREWS) initiative of WMO, UNISDR, World Bank GFDRR
- IN-MHEWS led by WMO
- ESCAP/WMO Typhoon Committee
- WMO/ESCAP Panel on Tropical Cyclones
- Regional Cooperative Mechanism for Drought Monitoring and Early Warning of ESCAP
- Asian and Pacific Centre for the Development of Disaster Information Management (APDIM)
- Regional Integrated Multi-hazard Early Warning System for Africa and Asia (RIMES)



2004 the world changes.....



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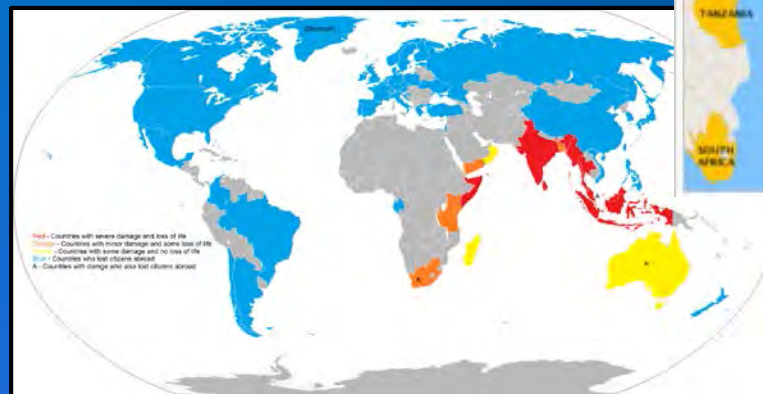
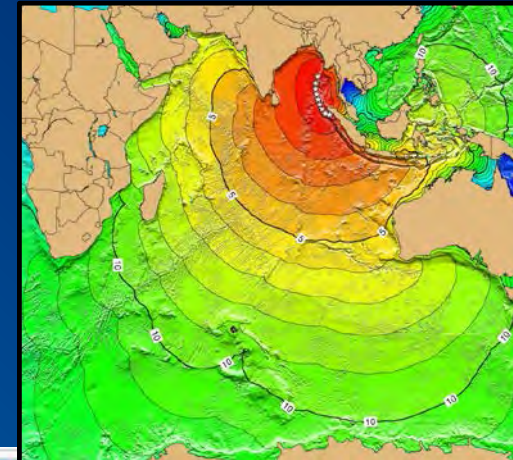
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Indian Ocean Tsunami

- 00:59 UTC, 26 December 2004
- Massive 9.1 magnitude undersea earthquake off the coast of Northern Sumatra, Indonesia near the city of Banda Aceh
- Megathrust, 1300km rupture, over 12 minutes
- Surface energy = 1500 x Hiroshima atomic bomb



The impact...

The world watches through unprecedented, live media as the deadly phenomenon spreads across the Indian Ocean



The losses...



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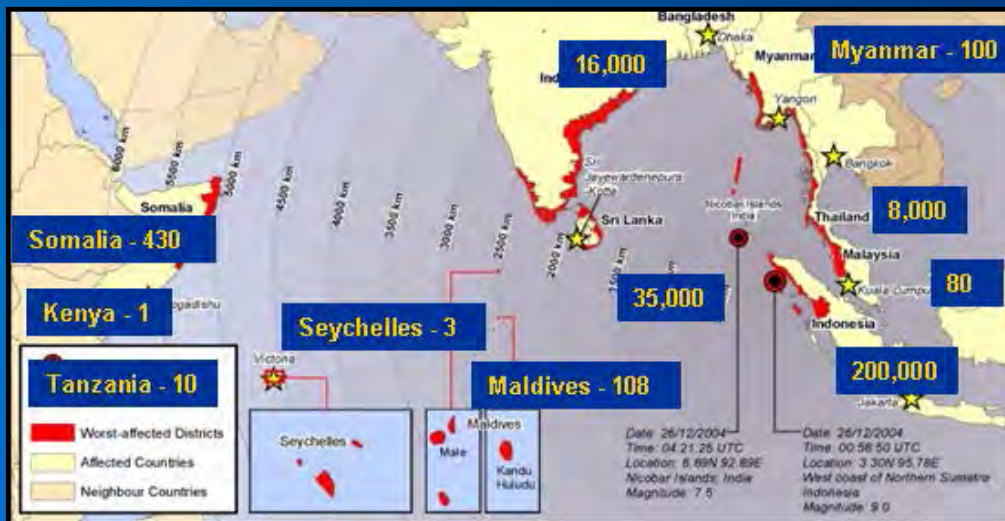
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Country where deaths occurred	Confirmed	Estimated ¹	Injured	Missing	Displaced
Indonesia	130,736	167,799	n/a	37,063	500,000+ ⁽⁵⁶⁾
Sri Lanka ²	35,322 ⁽⁵⁷⁾	35,322	21,411 ⁽⁵⁷⁾	n/a	516,150 ⁽⁵⁷⁾
India	12,405	18,045	n/a	5,640	647,599
Thailand	6,395 ⁽⁵⁸⁾	8,212	8,457 ⁽⁵⁸⁾	2,817 ⁽⁵⁸⁾	7,000
Somalia	78	289 ⁽⁵⁹⁾	n/a	n/a	5,000 ⁽⁶¹⁾
Myanmar (Burma)	61	400-600 ⁽⁶²⁾	45	200 ⁽⁶²⁾	3,200
Maldives	82 ⁽⁶⁰⁾	108 ⁽⁶⁰⁾	n/a	26	15,000+
Malaysia	68 ⁽⁶⁰⁾	75	299 ⁽⁶⁷⁾	6	5,000+
Tanzania	10 ⁽⁶⁰⁾	13	n/a	n/a	n/a
Seychelles	3 ⁽⁶⁰⁾	3	57 ⁽⁶⁰⁾	n/a	200 ⁽⁷⁰⁾
Bangladesh	2	2	n/a	n/a	n/a
South Africa	2 ⁽⁶⁷⁾	2	n/a	n/a	n/a
Yemen	2 ⁽⁷²⁾	2	n/a	n/a	n/a
Kenya	1	1	2	n/a	n/a
Madagascar	n/a	n/a	n/a	n/a	1,000+ ⁽⁷²⁾
Total	~184,167	~230,273	~125,000	~45,752	~1.69 million

**Causalities totally
~230,000
Over 1.6 people
million displaced
Estimated
economic losses of
\$14 billion**

Includes many tourists from other countries around the world



Early Coordination Efforts

- Following the tragedy on 26 December 2004, the Nations of the region react.
- **IOC-UNESCO** given the mandate to develop and implement the establishment of Tsunami Warning and Mitigation System in the Indian Ocean following several international regional meetings:
 - World Conference on Disaster Risk Reduction (**Kobe, Japan, January 2005**)
 - Phuket Ministerial Meeting on Regional Cooperation on Tsunami Warning Arrangements (**Phuket, Thailand, January 2005**)
 - International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean within a Global Framework (**Paris, March 2005**)
 - Second International Coordination Meeting for the Development of a Tsunami Warning and Mitigation System for the Indian Ocean (**Grand Baie, Mauritius, April 2005**)

Global Coordination



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The 23rd IOC Assembly in June 2005, tsunami warning systems are established in four regions, the Pacific, the Indian Ocean, the Caribbean, and the North-East Atlantic and Mediterranean seas, which are **administered by intergovernmental coordination group (ICG) secretariats**. Within each region would also maintain a regional **tsunami information centre**.

→ **PTWS** (formally known as ICG/ITSU) first convened in 1968

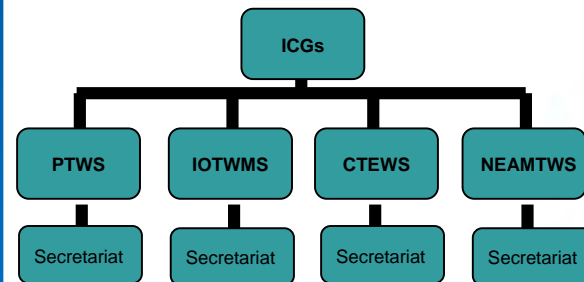
→ 1st session of ICG/IOTWMS held in Perth, August 2005 (11 Sessions)

Components

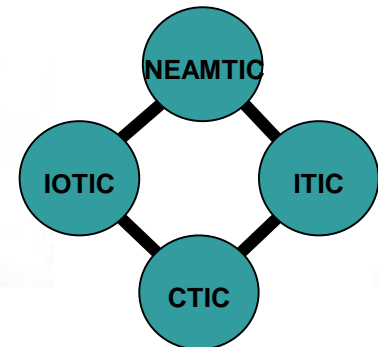
Structures



Cultures



PTWS Pacific Tsunami Warning System
IOTWMS Indian Ocean Tsunami Warning and Mitigation System
CEWS Caribbean Early Warning Centre
NEAMTWS North East Atlantic and Mediterranean Tsunami Warning System



ITIC: International Tsunami Information Centre
IOTIC: Indian Ocean Tsunami Information Centre
CTIC: Caribbean Tsunami Information Centre
NEAMTIC: North East Atlantic and Mediterranean Tsunami Information Centre



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Global TWS WARNING SYSTEMS



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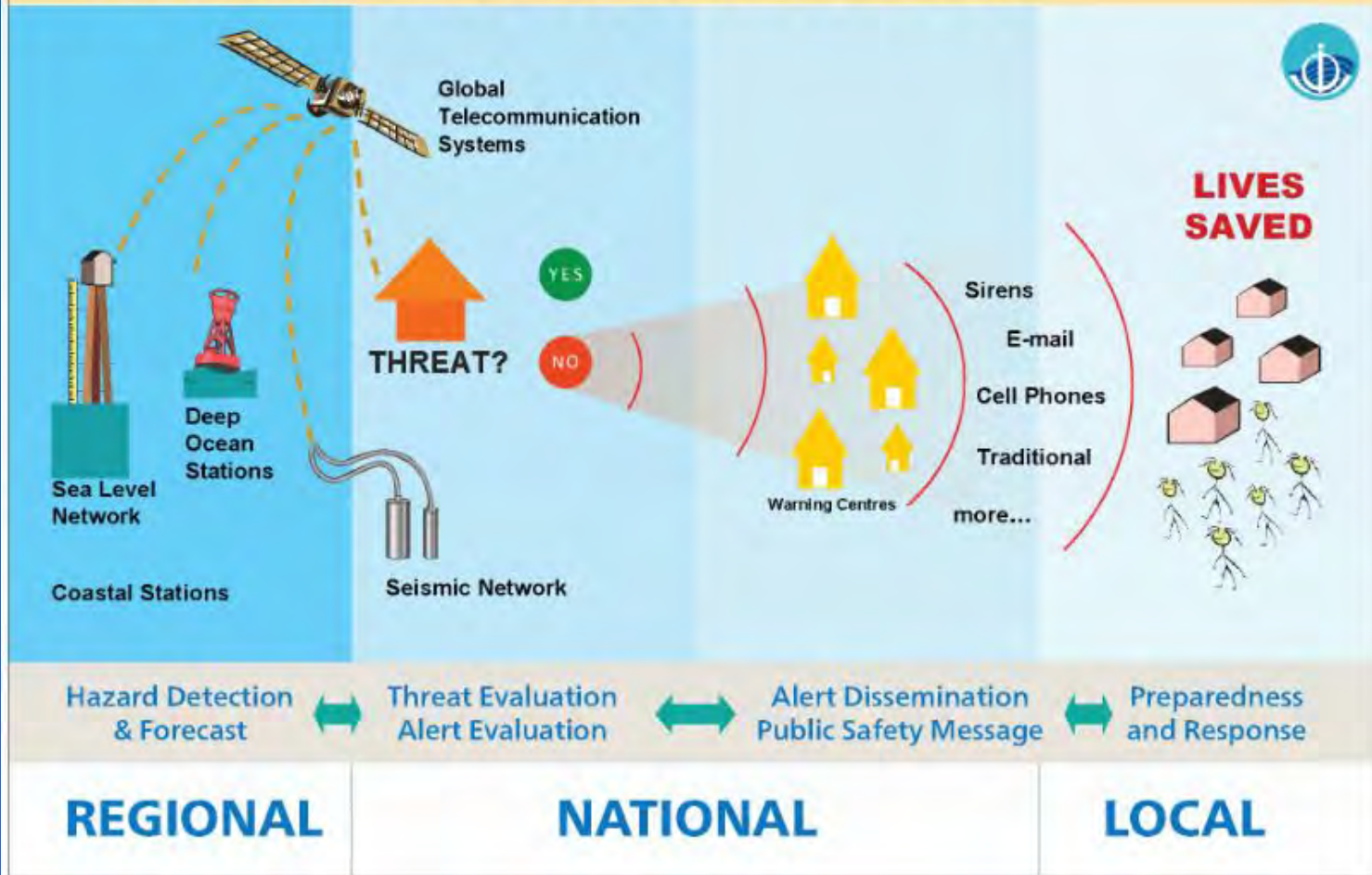


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END TO END TSUNAMI EARLY WARNING SYSTEM

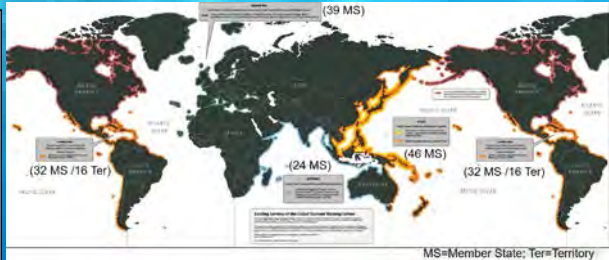




Intergovernmental Oceanographic Commission
Tsunami Programme



IOC Secretariat, Tsunami Unit



UNESCO/IOC
 Assembly/Executive Council

WMO, IHO, IMO,
 UNISDR, UNDP...

Working Group for Tsunami & Other sea level
 related Warning & mitigation Systems
 (TOWS-WG)
 [4x ICG Chairs, WMO, UNISDR, UNDP, IMO, IHO]

Task Team Tsunami
 Watch Operations

Task Team Disaster Management
 & Preparedness

ICG
 Caribbean & Adjacent
 Seas (CARIBE-EWS)

Intergovernmental Coordination Group
 Indian Ocean Tsunami Warning &
 Mitigation System (IOTWMS)
 Steering Group: Officers, WG Chairs/VCs

Intergovernmental Coordination Group
 Pacific Tsunami Warning & Mitigation
 System (PTWS)
 Steering Committee: Officers, WG Chairs/VCs

ICG
 NE Atlantic &
 Mediterranean
 Seas (NEAMS-TWS)

WG1 Tsunami Risk, Community
 Awareness and Preparedness

Task Team
 IOWAVE16

Task Team
 PacWAVE17

WG1 Tsunami Hazard
 Assessment

WG2 Tsunami Detection, Warning
 & Dissemination

Task Team
 Capacity
 Assessment of
 Tsunami
 Preparedness

Task Team Goals &
 Performance Monitoring

WG2 Tsunami Detection, Warning
 & Dissemination

1x Regional WG:
 NW Indian Ocean

4x Regional WGs:
 SW Pacific, SE Pacific,
 Central American Pacific
 South China Sea

WG3 Tsunami Disaster
 Management, Preparedness &
 Risk Reduction



ICG/IOTWMS Structure



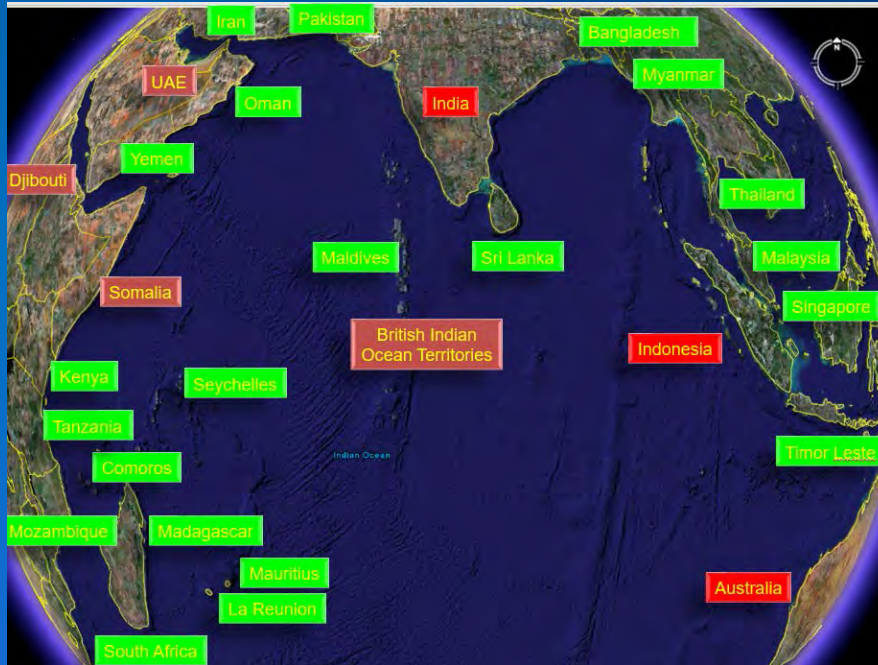
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Elected Officers



Dr. Andi Eka Sakya
Chair (Indonesia)



Dr. Juma Al-Maskari
Vice-Chair (Oman)



Dr. Sam Hettiarachchi
Vice-Chair (Sri Lanka)

Tsunami Service Providers

Australia, India, Indonesia



National Tsunami Warning Centres

24 Active Member States

Working Groups

Task Teams

Steering Group

Executive Secretary, IOC

– Tsunami Unit (Paris)

• ICG/IOTWMS Secretariat (Perth)

IOTWMS Guiding Principles

- International and multilateral cooperation with strong governance provided by IOC
- System-of-Systems
 - Fully inter-operable network of TSPs and NTWCs
- Defined Roles & responsibilities
- Strong Policy-basis
 - Fully owned by the countries, protects all countries, free & open data exchange
 - TSPs only advice (Threat/No Threat)
 - Warnings sovereign responsibility of NTWCs
- Performance Monitoring

Several Partners

Australia, IFIT, MFIT, UN-ISDR, UNDP, UNEP, UNESCAP, WMO, Indonesia, Norway, Finland, Italy, Germany, Ireland, EU, Japan, Canada, USA, Belgium, Israel, Korea, France, Czech Republic, New Zealand, Spain **And Many more!!**

The Three Pillars



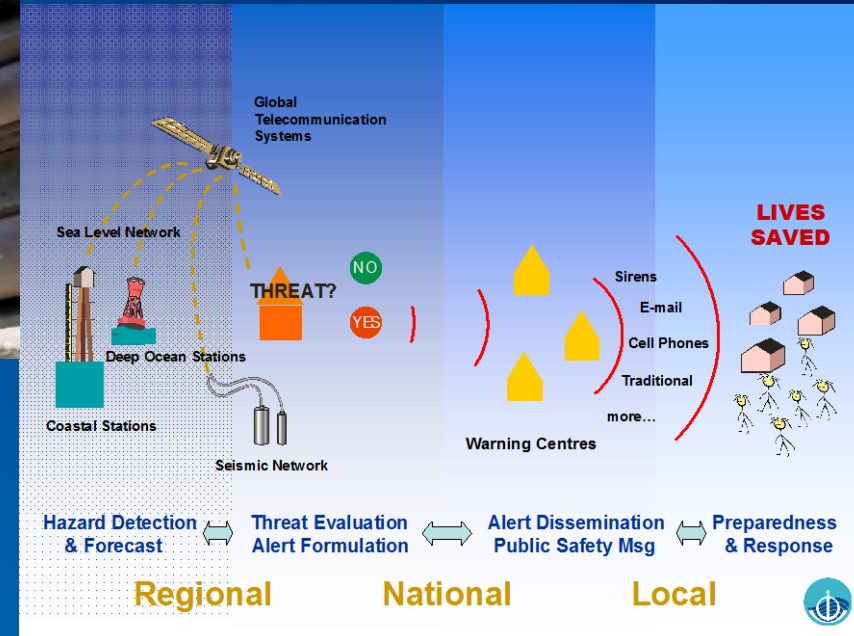
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Risk Assessment and Reduction

Systematically collect data and undertake risk assessments

Detection Warning and Dissemination

Develop hazard detection, monitoring and early warning services

Communicate threat information and early warnings

Awareness and Response

Build national and community response capabilities

Pilar 1: Risk Assessment & Reduction



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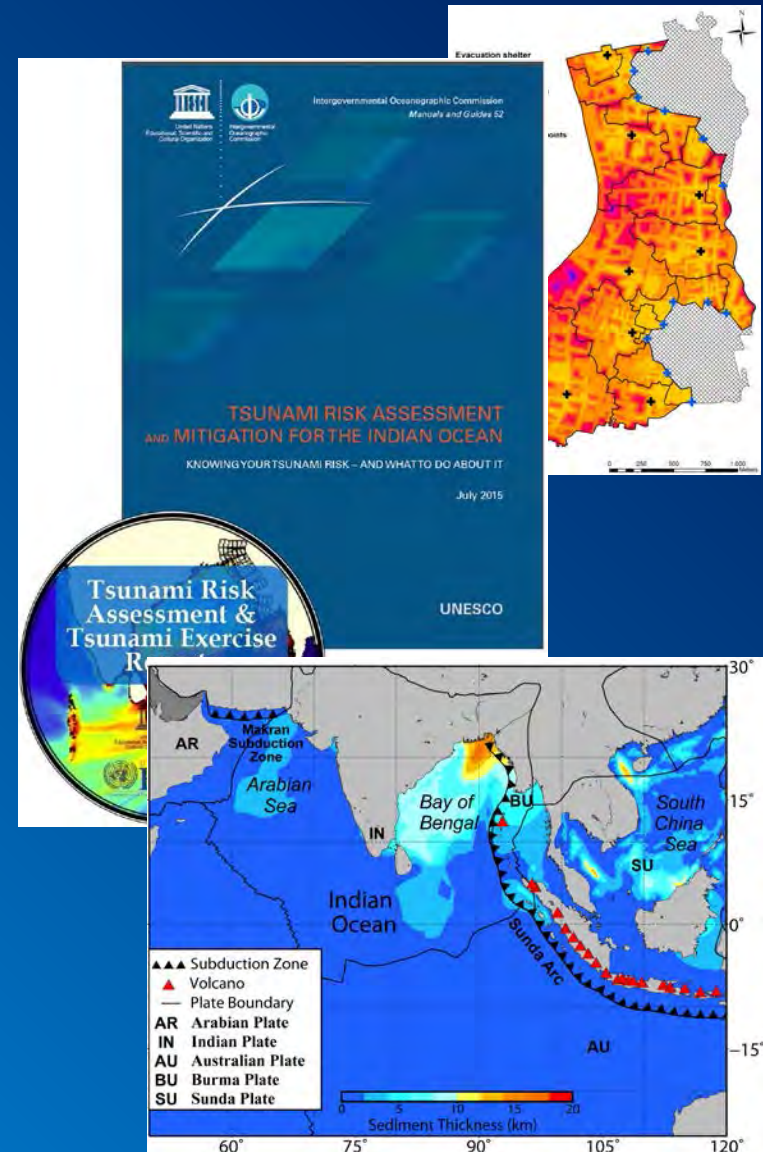


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- **Tools, Methods & Guidelines** for Tsunami Risk Assessment published
- Indian Ocean Probabilistic Regional **Tsunami Hazard Maps** published
- Assessment and awareness of **Makran tsunami hazards**
- Regional **Workshops** on Tsunami Risk Assessment and Modelling
- Enhancing Tsunami Risk Assessment and Management, **Strengthening Policy Support** and Developing Guidelines for Tsunami Exercises in Indian Ocean Countries



Pillar 2: Detection, Warning & Dissemination



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- **Service Definition:** AoS, Stations, Products, Thresholds, CFZs, Formats
- **Tsunami Service Framework**
 - 3 inter-operable Tsunami Service Providers (Australia, India, Indonesia)
 - Network of NTWCs
- Greatly 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
- **Interim Service** – JMA, PTWC



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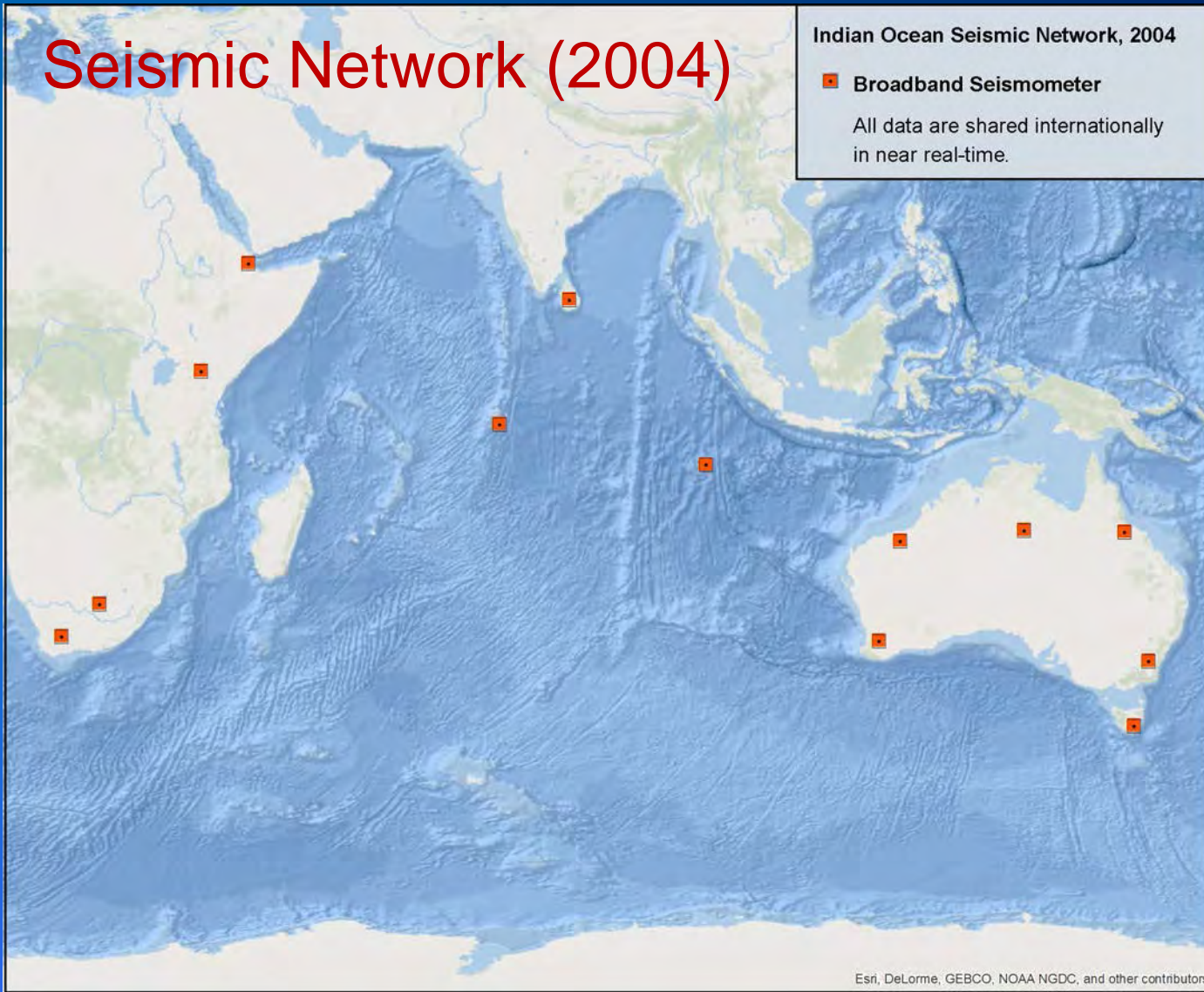
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Seismic Network (2004)

Indian Ocean Seismic Network, 2004

■ Broadband Seismometer

All data are shared internationally
in near real-time.



Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors



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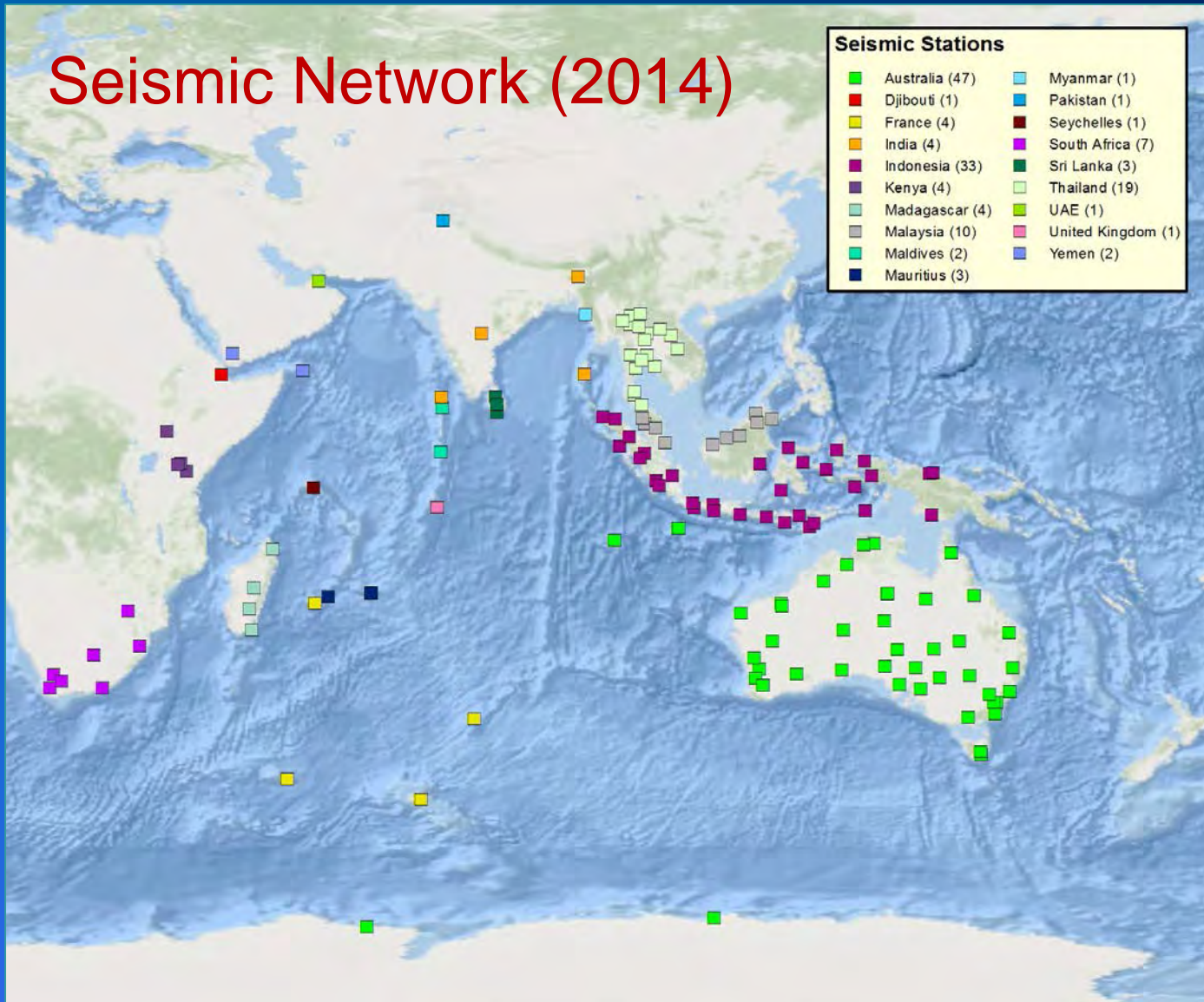


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Seismic Network (2014)



Regional Networks: AfricaArray, Geoscope, GEOFON, IRIS IDA, IRIS USGS and RIMES



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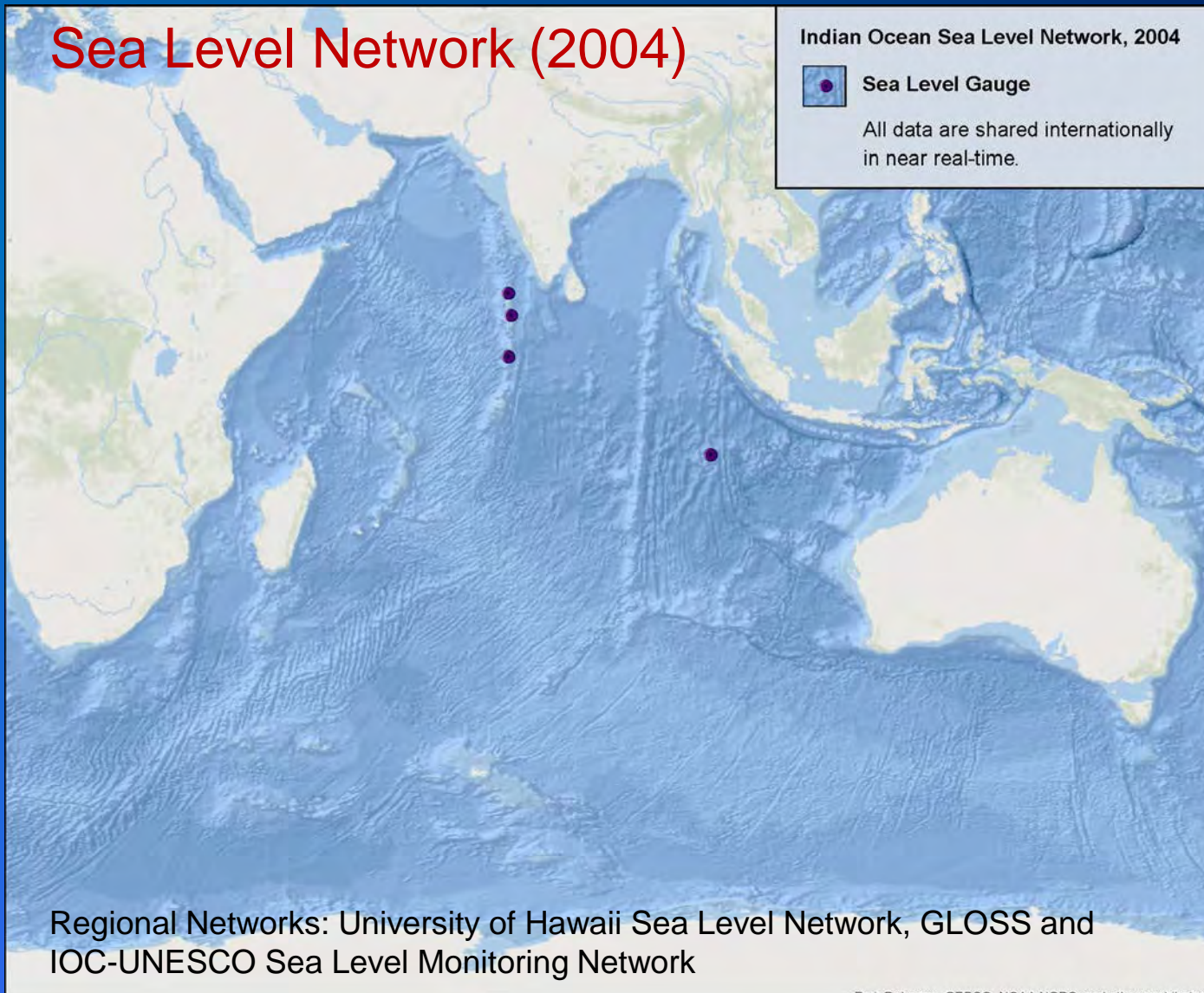
Sea Level Network (2004)

Indian Ocean Sea Level Network, 2004



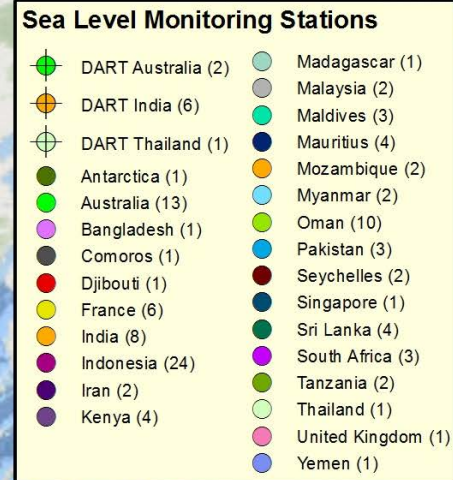
Sea Level Gauge

All data are shared internationally
in near real-time.



Regional Networks: University of Hawaii Sea Level Network, GLOSS and
IOC-UNESCO Sea Level Monitoring Network

Sea Level Network (2014)



Regional Networks: University of Hawaii Sea Level Network, GLOSS and IOC-UNESCO Sea Level Monitoring Network



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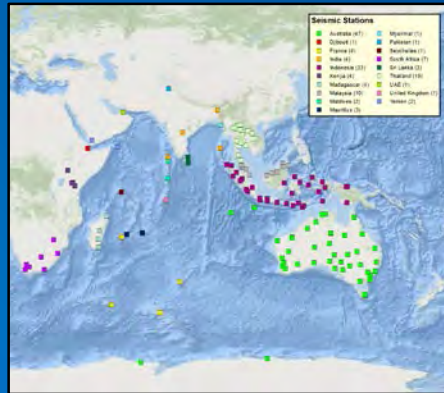


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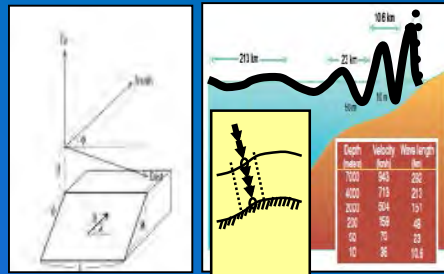


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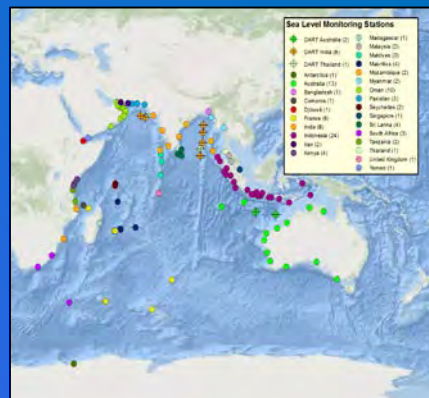
Operational Elements of TSP Service



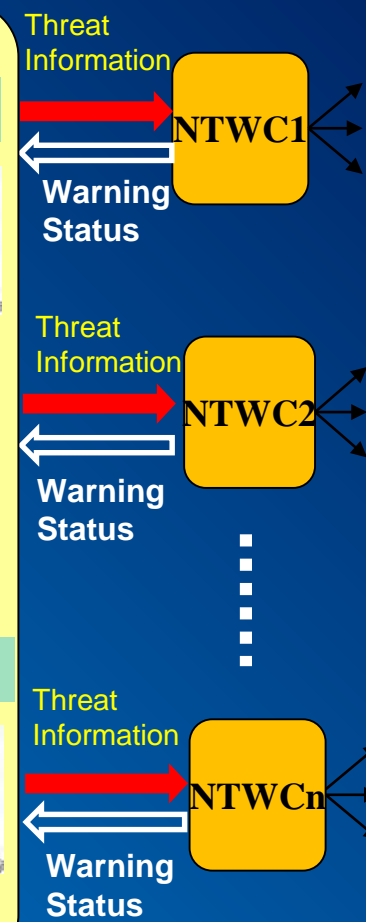
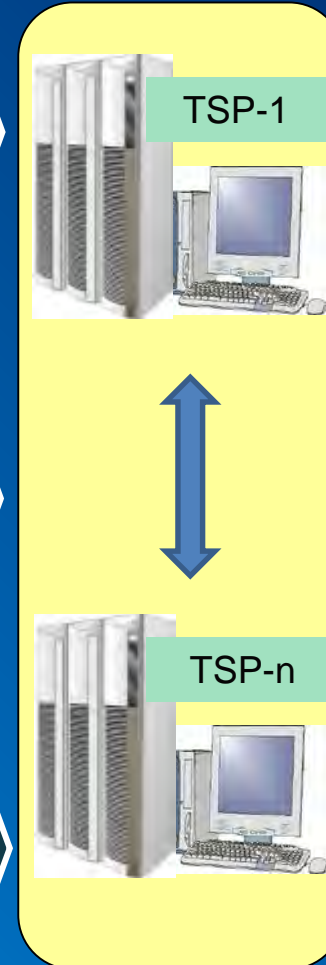
Seismological
Data



Model Results



Sea level
Data



Warnings
NDMO
LDMO
Media
Public



GTS
SMS
FAX
Email
Web

TV
Radio
SMS
Email
Web
SIRENS

Pilar 3: Awareness & Response



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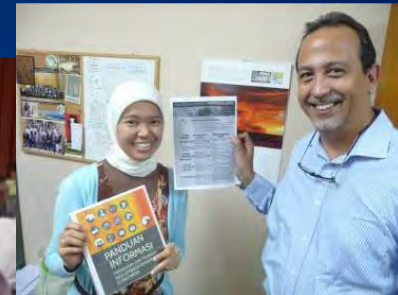
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- **Education Material** for NTWCs, emergency managers, communities, schools, tourism, etc in multiple languages including posters, booklets, videos, comics, stickers, guidebooks and leaflets.
- Over 100 **capacity development workshops on Standard Operating Procedures** for NTWC, DMO, staff and/or Media
- **Indian Ocean Tsunami Information Center (IOTIC)** in Jakarta hosted by BMKG
- 70th Anniversary of **1945 Makran tsunami** commemorative events held in Iran, Pakistan, India and Oman
- **Indian Ocean-wide (IOWave)** exercises held every two years
- **World Tsunami Awareness Day (WTAD)**



**AIR TURUN NAIK
DI TIGA NEGERI**
MENGINGAT TSUNAMI AMBON 1950



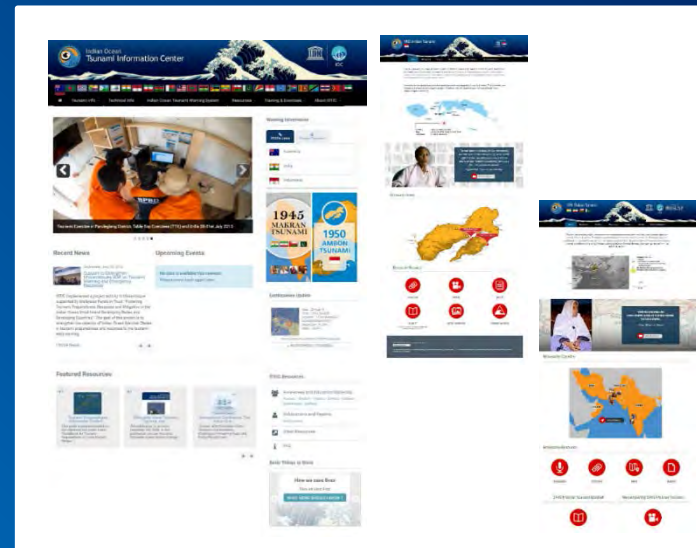
Remembering the 1945 Makran Tsunami
Interviews with Survivors Beside the Arabian Sea



Indian Ocean Tsunami Information Centre (IOTIC)

The IOTIC is an IOC UNESCO entity housed in UNESCO office Jakarta and a programme office at BMKG Indonesia. IOTIC serves as information resource to support the Indian Ocean member states in capacity building, education, awareness and preparedness for an effective tsunami warning and mitigation system in the region.

- **Indian Ocean Tsunami Ready Programme and Recognition**
- **Tsunami Evacuation Maps Plans, Procedures for Indian Ocean Member States**
- **End to end Tsunami Exercise and Drills (community and schools)**
- **Preserving the Past to Save the Future**




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Indonesian
Fund-in-Trust

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Malaysia
Funds-in-Trust



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A. Trainings/Workshops, Seminars, Conferences

1. Tsunami Risk Reduction Policies
2. TEWS Standard Operating Procedures
3. Coastal Hazard Risk Assessment (Tsunami)
4. How To conduct Plan, and Implement Tsunami Exercises

B. Booklet/Module

1. Where the First Wave Arrives in Minutes
2. Remembering the 1945 Makran Tsunami
3. Remembering the 1950 Ambon Tsunami
4. Training Module on Policy Support for Tsunami Risk Reduction and on Tsunami Exercise

C. Videos

1. VISUS Adaptation in Indonesia
2. TEWS Animated Video
3. Makran Tsunami Interview Video (UNESCO Islamabad)
4. ADDRESS Video
5. Tsunami Preparedness Animation Videos (4 series)



Indian Ocean Wave Exercise



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- In the Indian Ocean, **four IOWave Exercises** have been conducted in 2009, 2011, 2014 and 2016.
- All **24 Indian Ocean Member States** involved their NTWCs and **12 involved Communities** in IOWave16
- **59,000 persons** evacuated.
- 92% involved **NDMOs**, 79% involved **Local DMOs** and 63% involved **Media**.
- IOC-UNESCO conducted **on online assessment** that was co-ordinated in-country by the IOWave16 National Contacts.
- **UNISDR** deployed **international observers** and film crews in India and Seychelles.
- **UNESCAP** helped **develop outreach materials** and supported a post-IOWave16 workshop (Bandung, December 2016).
- **IOWave18** in September 2018



a) Indian school children preparing for Exercise Indian Ocean Wave 2016 in Odisha, India.



b) Member States that undertook community evacuations during Exercise Indian Ocean Wave 2016.



UNISDR

The United Nations Office for Disaster Risk Reduction



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ESCAP

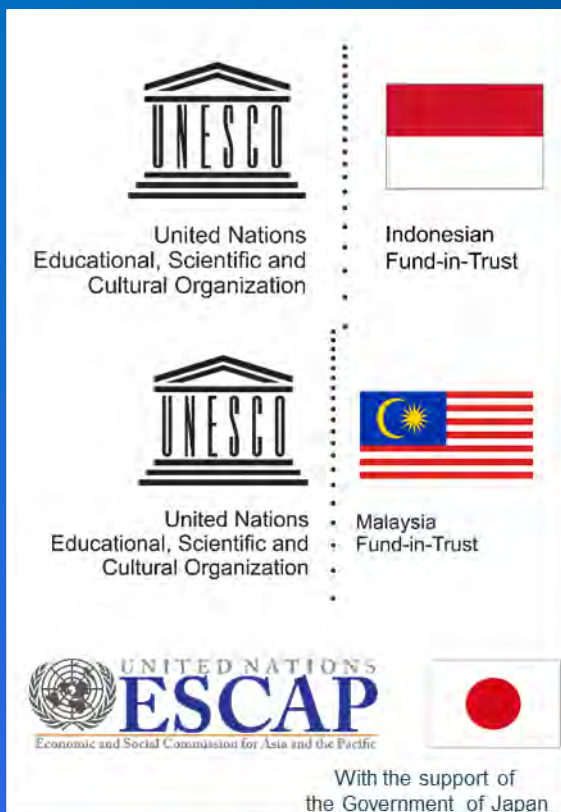
Economic and Social Commission for Asia and the Pacific

<http://iowave.org/>

CURRENT STATUS

Funding Support

- Regular Programme Support from IOC-UNESCO;
- IOTWMS Secretariat & Program activities supported by BoM, Government of Australia;
- IOTIC Programme activities supported by BMKG, Government of Indonesia.



Extra budgetary Funding Support – 2016

Project on Building Model for Disaster Resilient City in Indonesia: Tsunami Hazard (2014-2016)

Project on Fostering Tsunami Preparedness, Response and Mitigation in the Indian Ocean Small Island Developing States and Developing Countries (2015 – 2017)

Communication, Documentation, and Lessons Learned of IOWave16 (2016)

ICG/IOTWMS-XI Key Outcomes

Putrajaya, Malaysia, April 2017



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- **Greater emphasis on community awareness and preparedness** to help ensure more appropriate responses to tsunami warning information.
- Indian Ocean Wave Exercises should encourage increased participation from coastal communities – **IOWave18 in September 2018**
- **Capacity assessment of tsunami preparedness** to be carried out in all Member States
- Guidelines on **tsunami ready** to be developed for Indian Ocean Member States and a pilot project to be implemented
- The Northwest Indian Ocean region should continue collaborative efforts on better warning and mitigation of the **Makran subduction zone**
- Continue **Capacity Development Workshops** for development of **integrated NTWC-DMO-Media SOPs**

Challenges and Way Forward



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- **Documented the Achievements**
 - Indian Ocean **much safer against tsunami threat**
- **Identified the Gaps**
 - **Improve hazard & risk assessment** including vulnerability & exposure
 - **Communication of warnings** to public in easily understandable format
 - **Regional cooperation** for Makran region
 - **Capacity building at national level** for public awareness & preparedness for **self protection**
- **Sustainability**
 - **System Maintenance**
 - **Sustain observation network**
 - **International collaboration** to share resources
 - **Regional perspective to be fed to national plans**
 - **Financial Resources**
 - Annual costs of TSPs – US\$ 5-8 million
 - Annual total cost of IOTWS (regional & national) excluding mitigation – US\$ 90 million ± 10 million
 - **Political commitment**
 - **National plans for TWS with mandated budgets, codified in law & Key functions institutionalized**

To be sustainable in long term, Tsunami warning systems should:

- **Link to the disaster management community**
- Be part of a **multi-hazard warning system** including tropical cyclones and storm surges
- Have **stronger downstream part** - Integration of TEW into national & local DM, public and private sector; stronger client orientation
- Focus on “**Last Mile**”

Intergovernmental Coordination

- Complex, multi-national, multi-agency system
- **Continue to build on Intergovernmental arrangements through IOC UNESCO**
- IOC UNESCO should continue to lead the coordination towards **globally harmonized, workable & sustainable TWS** with partner organisations such as WMO, IHO, ISDR, ESCAP...
- **International organisations are key players to develop national capacities**
- Integrate with broader **international frameworks**

In Conclusion: Fostering Regional Cooperation



- Establishment of **inter-governmental and regional cooperation platforms** across common ocean basins for tropical cyclone and tsunami, and in river basins for floods has **deepened regional cooperation**
 - good regional **observation networks**
 - early warning systems established for each **specific hazards**
 - **enhanced regional/national capacities** for generation of warnings and information sharing
- **Efforts needed** to strengthen and expand the warning systems already built and make them part of an integrated **multi-hazard approach**
 - **Gaps in “last-mile”** (Awareness & Response) - Warning chains, SOPs, etc.
 - **Large differences remain in the capacities** of countries, especially LDCs and SIDS
 - Enhance efforts to **transform existing cooperation mechanisms into multi-hazard platforms** with extended range of products and services that are sustainable
- **Strong policy support at the national level**
 - to ensure **multi-hazard early warning systems are well-integrated** within the overall framework of **national disaster risk reduction plans**
 - **commitment towards regional collaboration** with earmarked funding (through national investments/national foreign-aid funding/regional mechanisms/UN agencies, etc...)



Thank you

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IOTIC-BMKG Programme Office*

*Disaster Risk Reduction and Tsunami
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