



United Nations
Educational, Scientific and
Cultural Organization

Organisation
des Nations Unies
pour l'éducation
la science et la culture

Organización
de las Naciones Unidas
para la Educación
la Ciencia y la Cultura

Организация
Объединенных Наций по
вопросам образования
науки и культуры

• Intergovernmental
Oceanographic
Commission

• Commission
océanographique
intergouvernementale

• Comisión
Oceanográfica
Intergubernamental

• Межправительственная
океанографическая
комиссия

Tsunami Warning Systems in the North-West Indian Ocean(NWIO)

Intergovernmental Oceanographic Commission (IOC) of UNESCO

The only intergovernmental body
of the UN system specializing in
**ocean science, services,
observations, data exchange,
and capacity development**

Established 1960, **150** Member States

Strategic Plan 2021-2029:

High-level Objectives:

1. Healthy ocean and sustained ocean ecosystem services;
2. **Effective warning systems & preparedness for tsunamis & other ocean related hazards;**
3. Resilience to climate change and contribution to its mitigation;
4. Scientifically-founded services for the sustainable ocean economy; and
5. Foresight on emerging ocean science issues.



Achieving Objective 2: Early Warning for Ocean Hazards

The IOC will help coastal communities and operators at sea to manage risks from ocean-related hazards and to increase preparedness for them.

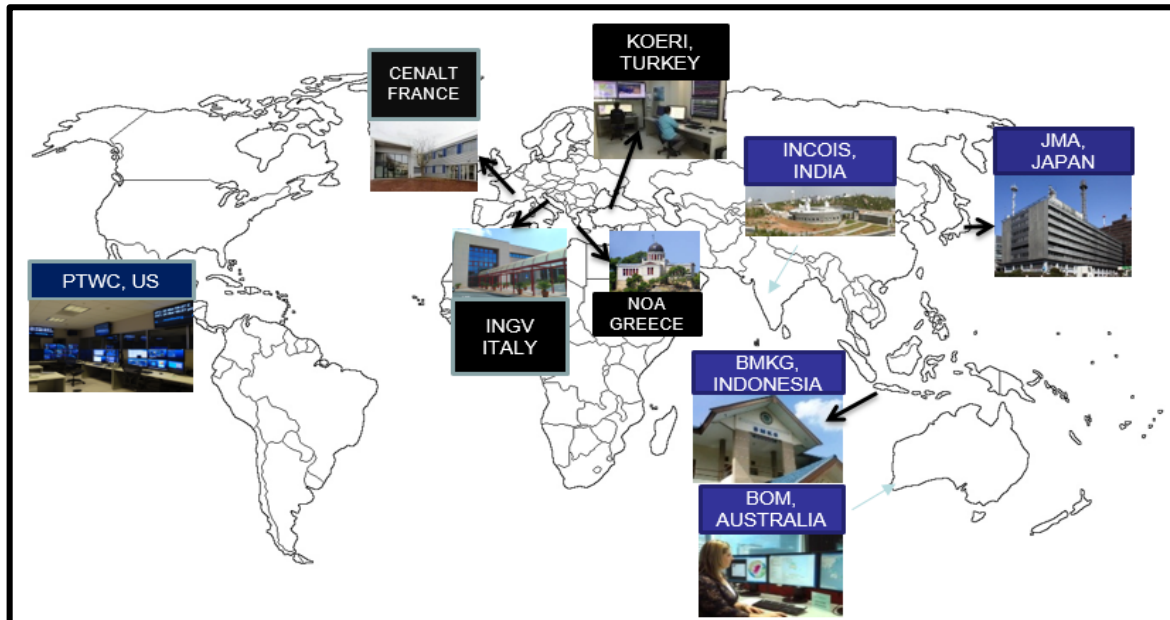
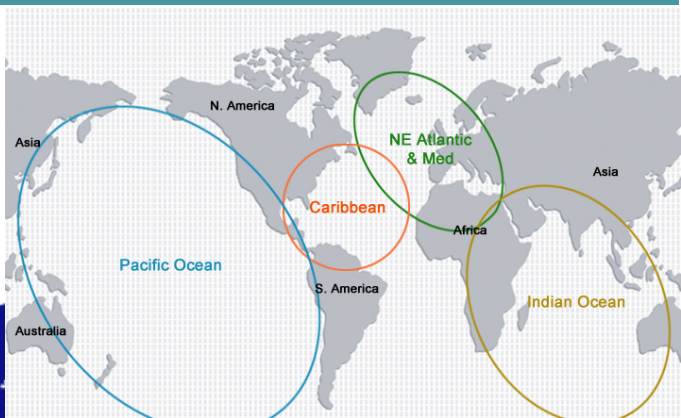
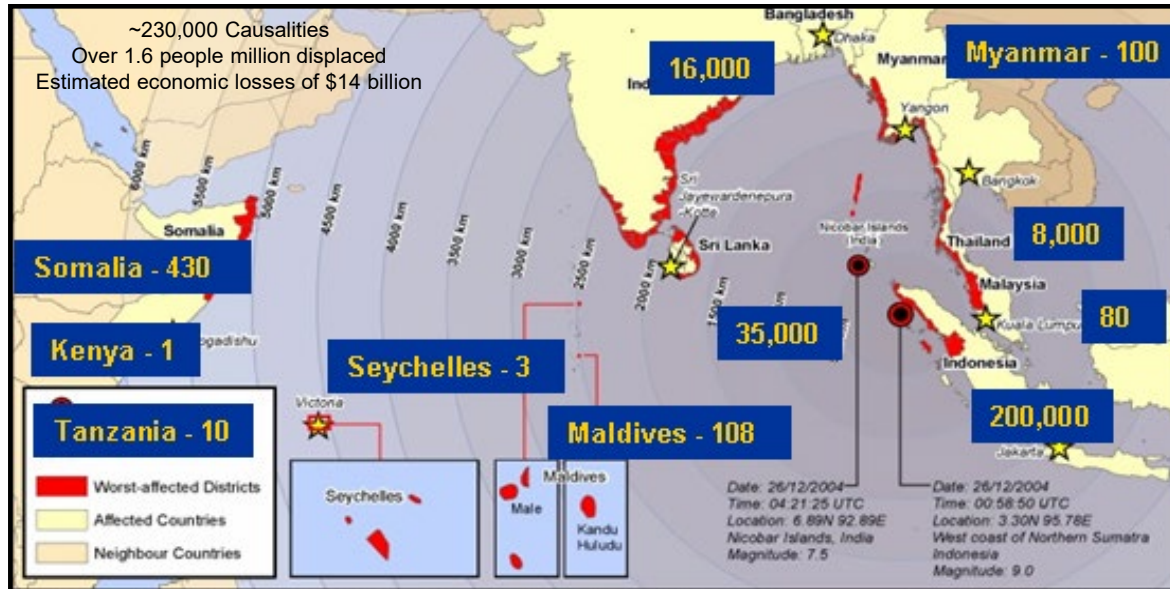
IOC will work with Member States and UN partners to increase the understanding of ocean-related risks and to implement effective multi-hazard early warning systems.



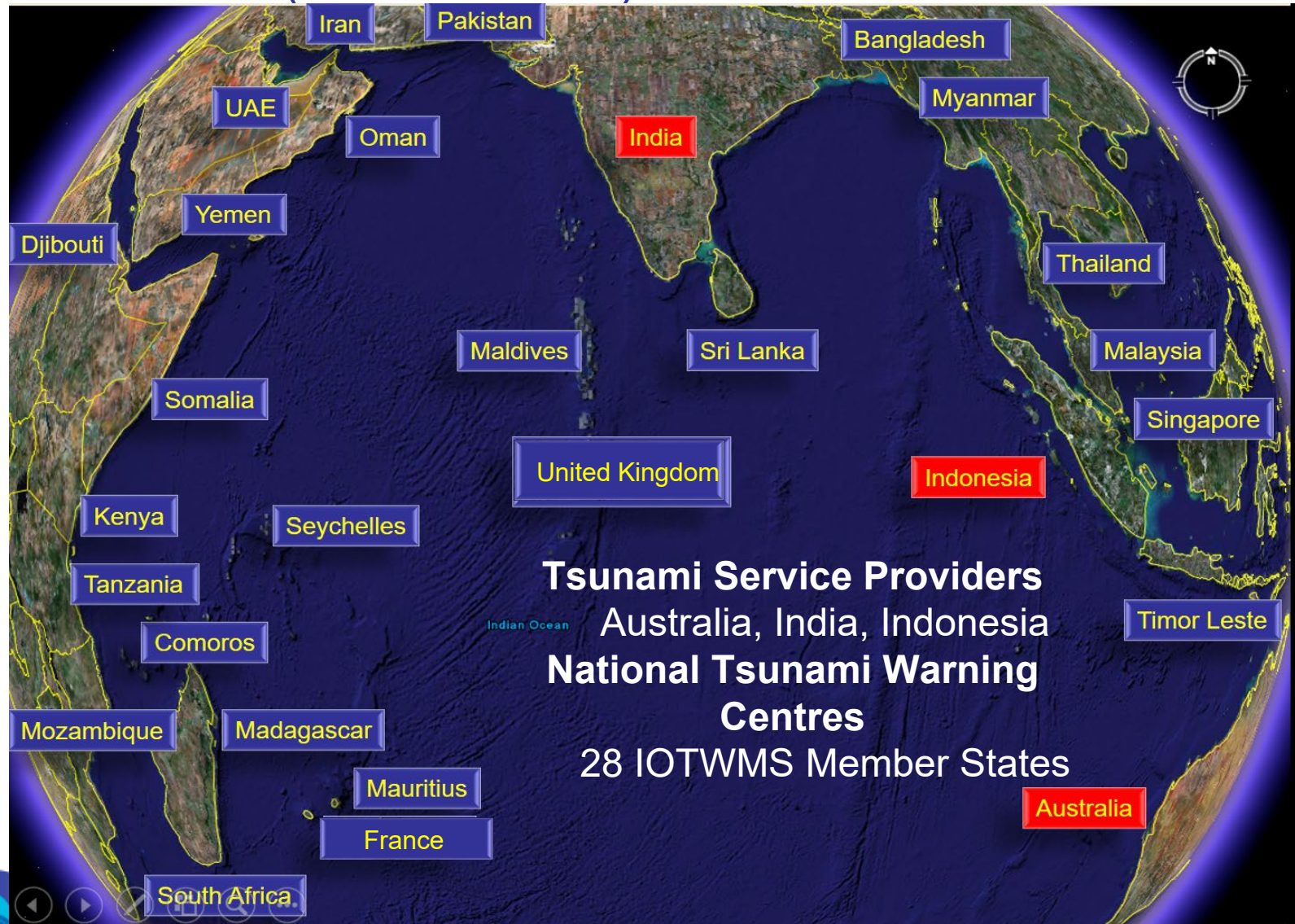
Regional Tsunami Warning Systems

2004 Indian Ocean Tsunami casualties...more than 230,000

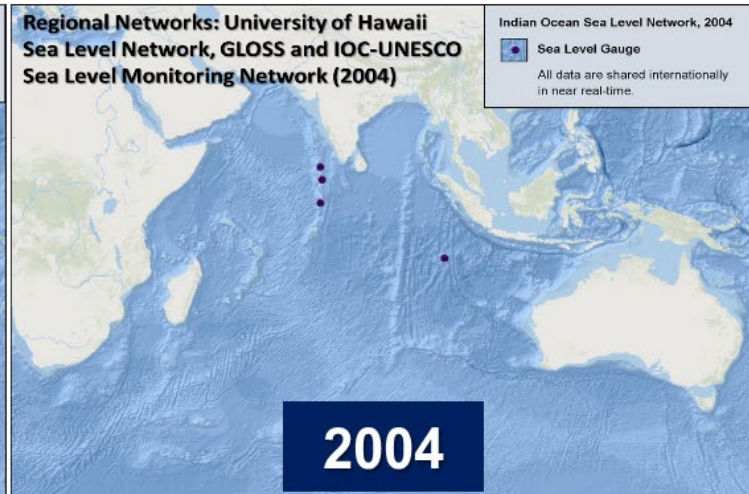
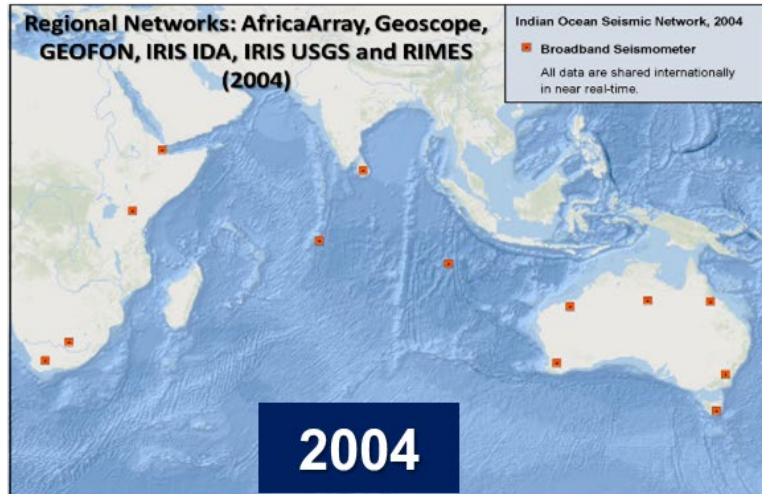
- Pacific TWS since 1965 with two Tsunami Services Providers
- 2004 Indian Ocean Tsunami illustrated need for more
- In 2005, the IOC was mandated by the UN to establish three more TWS
 - Indian Ocean
 - Caribbean
 - NE Atlantic & Mediterranean
- 4 Regional TWS with 7 New TSPs



Intergovernmental Coordination Group for Indian Ocean Tsunami Warning & Mitigation System (ICG/IOTWMS) Member States

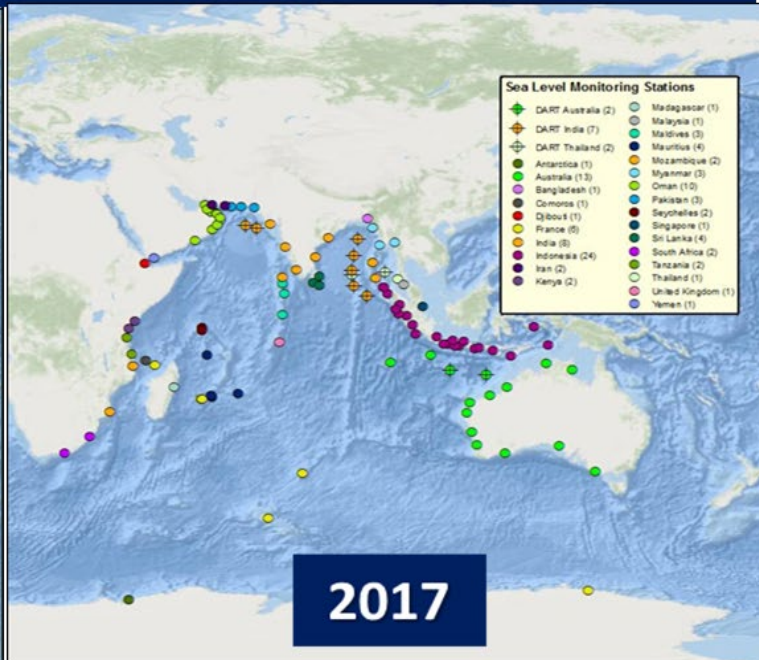
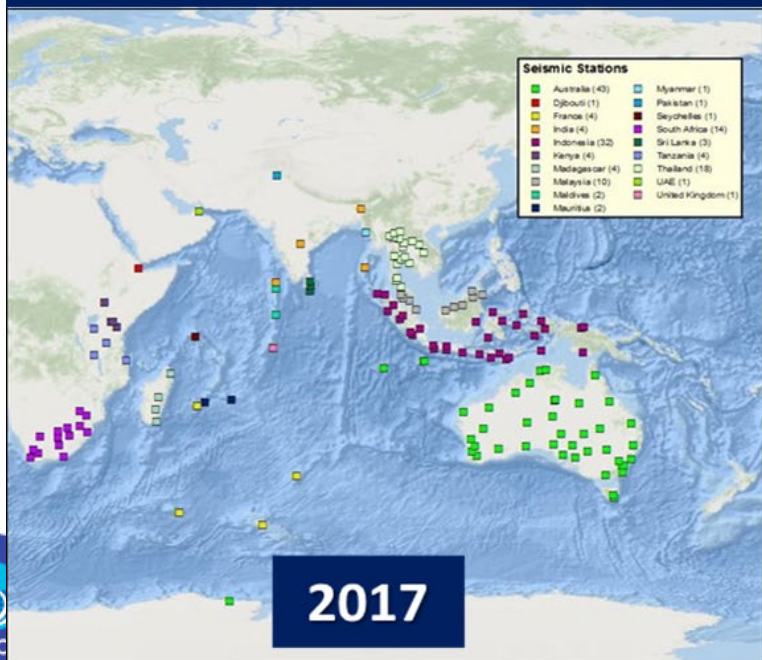


Status of Monitoring Networks



SEISMIC NETWORKS

SEA LEVEL NETWORKS



IOTWMS Detection, Warning & Dissemination



- Coordinated regional tsunami warning system
 - 3 inter-operable Tsunami Service Providers (Australia, India, Indonesia)
 - Network of National Tsunami Warning Centres (NTWCs), Tsunami National Contacts (TNCs), Tsunami Warning Focal Points (TWFPs)
- Greatly expanded seismic and sea level monitoring networks
- Harmonised threat information by TSPs
- National warnings are the Sovereign responsibility of authorized national agencies
- Yearly performance assessments against Key Performance Indicators
- 6-monthly communications tests to identify and fix any issues

Operational Elements of Tsunami Warning

Observations

Seismic Stations

● Australia (47)	● Myanmar (1)
● Bhutan (1)	● Nepal (1)
● France (4)	● Sri Lanka (2)
● India (2)	● South Africa (2)
● Indonesia (28)	● Sri Lanka (2)
● Japan (1)	● Thailand (1)
● Madagascar (4)	● UAE (1)
● Malaysia (1)	● United Kingdom (2)
● Myanmar (1)	● Vietnam (2)
● Myanmar (1)	● Vietnam (2)

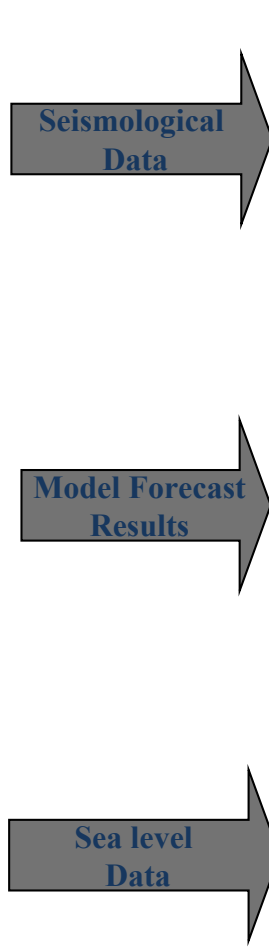
Model Forecast Results

Depth (m)	Velocity (km/h)	Wave length (m)
7000	943	282
4000	719	219
2000	534	151
1000	350	96
500	175	48
10	98	10.8

Sea Level Monitoring Stations

● DART Australia (2)	● Malaysia (2)
● DART India (4)	● Myanmar (2)
● DART Thailand (1)	● Myanmar (2)
● Antarctica (1)	● Myanmar (2)
● Australia (1)	● Myanmar (2)
● Bangladesh (1)	● Oman (1)
● Canada (1)	● Pakistan (1)
● Cyprus (1)	● Seychelles (2)
● France (4)	● Singapore (1)
● India (8)	● Sri Lanka (1)
● Indonesia (2)	● South Africa (2)
● Iran (2)	● Thailand (1)
● Japan (1)	● United Kingdom (1)
● Korea (1)	● Vietnam (1)

Analysis



Tsunami Service Providers

Australia

India

Indonesia

Warnings

National Tsunami Warning Centre-1

Threat Information →

← Warning Status

India, Iran, Oman, Pakistan, UAE

National Tsunami Warning Centre-2

Threat Information →

← Warning Status

National Tsunami Warning Centre-N

Threat Information →

← Warning Status

Disseminate

GTS, SMS, FAX, Email, Web

TV, Radio, SMS, Email, Web, SIRENS

National DMO
Local DMO
Media
Public

Example of Regional snapshot national tsunami warning status

Australian Government
Bureau of Meteorology

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[Bureau Home](#) > [Joint Australian Tsunami Warning Centre](#) > Status of Tsunami Warnings in the Indian Ocean
TSP Australia Public Webpage **Status of Tsunami Warnings in the Indian Ocean**

This website is maintained by the [Joint Australian Tsunami Warning Centre](#) for the Indian Ocean Tsunami Warning & Mitigation System (IOTWMS) as a Tsunami Service Provider (TSP).

No Tsunami Currently Affecting Indian Ocean

About | FAQ | Latest Public Bulletin

Warning Status

Australia	Bangladesh	Comoros	Djibouti
France (Indian Ocean Territories)	India	Indonesia	Iran
Kenya	Madagascar	Malaysia	Maldives
Mauritius	Mozambique	Myanmar	Oman
Pakistan	Seychelles	Singapore	Somalia
South Africa	Sri Lanka	Tanzania	Thailand
Timor-Leste	UAE	UK (Indian Ocean Territories)	Yemen

Legend: Unknown Level 0 Level 1 Level 2 Level 3 Cancel

Earthquakes

Event	Date	Mag.	Location
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Tsunami Wave Observations

#	Location	MAX	Date	Ev.
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National Tsunami Warning Centres
[Australia](#) [Bangladesh](#) [France \(Indian Ocean Territories\)](#) [India](#) [Indonesia](#) [Kenya](#) [Madagascar](#) [Malaysia](#) [Maldives](#) [Mauritius](#) [Mozambique](#) [Myanmar](#) [Oman](#) [Pakistan](#) [Seychelles](#) [Singapore](#) [Sri Lanka](#) [Tanzania](#) [Thailand](#) [Timor Leste](#) [UAE](#)

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WARNINGS

WATER | CLIMATE | ENVIRONMENT

Tropical Cyclones

Radar Sat Maps

MetEye™

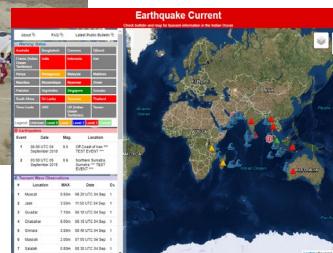
National Weather Services
Aviation Weather Services
Defence Services

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<http://www.bom.gov.au/tsunami/iotwms/>

Exercise Indian Ocean Wave 2018



- In the Indian Ocean, five IOWave Exercises have been conducted in 2009, 2011, 2014, 2016 and 2018
- IOWave18 during Sep 2018 - All 24 Indian Ocean Member States involved their NTWCs and 11 involved Communities in IOWave18
- ~ 116,000 persons evacuated
- India and Oman evaluated their community preparedness against Indian Ocean Tsunami Ready Indicators
- International Observers in Iran (APDIM-UNESCAP) and Sri Lanka (Univ. of Huddersfield)
- TSP Australia launched a public website to display the summary of national tsunami warnings issued by countries in the Indian Ocean was launched during the Exercise.
- IOC-UNESCO conducted an online assessment that was co-ordinated in-country by the IOWave18 National Contacts.

Member State	Evacuations (# of persons)
India	104,326
Sri Lanka	4,147
Oman	3,225
Indonesia	2,941
Mauritius	553
Tanzania	300
Thailand	300
Kenya	200
Iran	200
Pakistan	55
Seychelles	12
TOTAL	115,959

Future IOTWMS Enhancements



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



"The United Nations Decade of Ocean Science for Sustainable Development is a unique opportunity to engage the ocean science community in achieving the Sustainable Development Goals - globally, regionally and locally."



Vladimir Ryabinin
Executive Secretary of the
Intergovernmental Oceanographic
Commission of UNESCO

UN Decade of Ocean Science for Sustainable Development (2021 – 2030): Safe Oceans Component

Includes development of Science Plan for tsunami warning & mitigation system global enhancements. The vision is based on two overarching aspects:

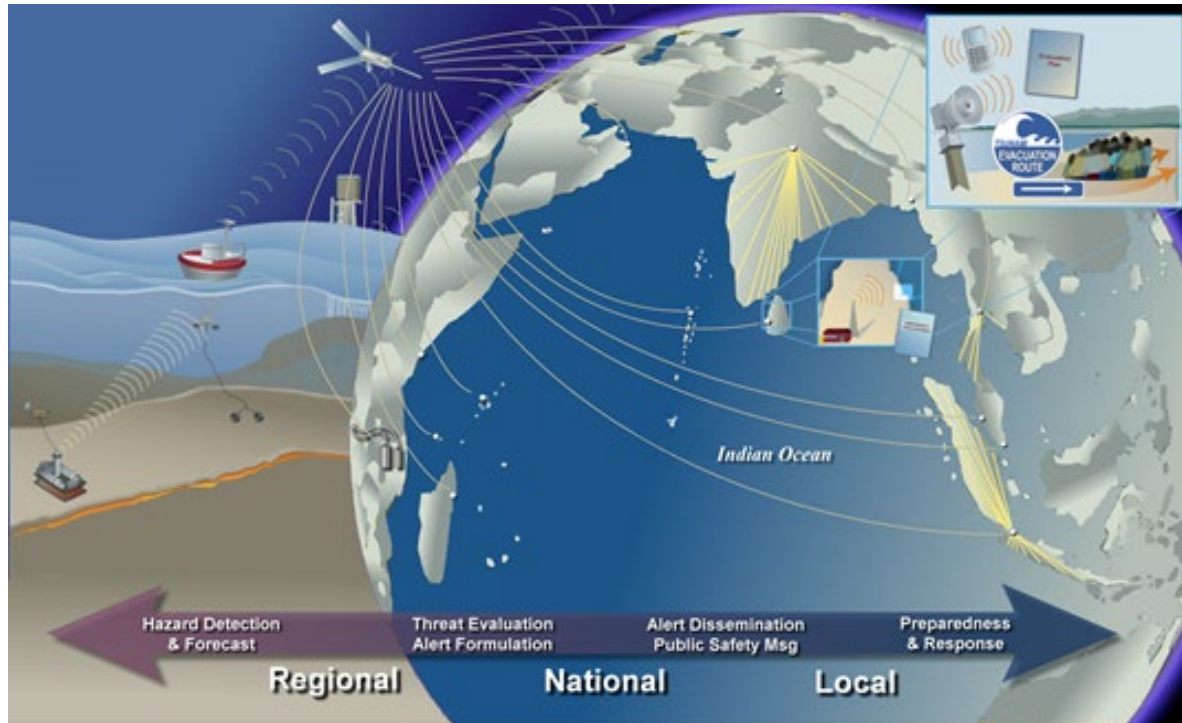
1. Fully explore technological and observational advances that will allow us to move from a capability based largely on seismic assumptions and large uncertainties to one based on real-time dynamic assessment and low uncertainties.
2. Match these capability advancements with improved community preparedness efforts, including striving for 100% Tsunami Ready or comparable recognition of all at-risk coastlines.



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for more information
www.ioc-tsunami.org/iotwms