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Introduction to TSP Services

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ICG Indian Ocean Tsunami Warning & Mitigation System SOP Workshops July 2023:
*Standard Operating Procedures (SOPs) for
National Tsunami Warning Centres (NTWCs) and
Disaster Management Organisations (DMOs)*

Presentation Overview



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- Vulnerability of Indian Ocean
- The Indian Ocean Tsunami
- What is Tsunami
- Tsunamigenic Sources of the Indian Ocean
- Global Tsunami Warning System
- Structure of each Regional TWS
- History of IOTWMS
- Tsunami Service Providers Roles and Responsibilities
- Operational Elements of TSPs
- TSP Service Levels

Vulnerability of the Indian Ocean Coastline to Oceanogenic Disasters

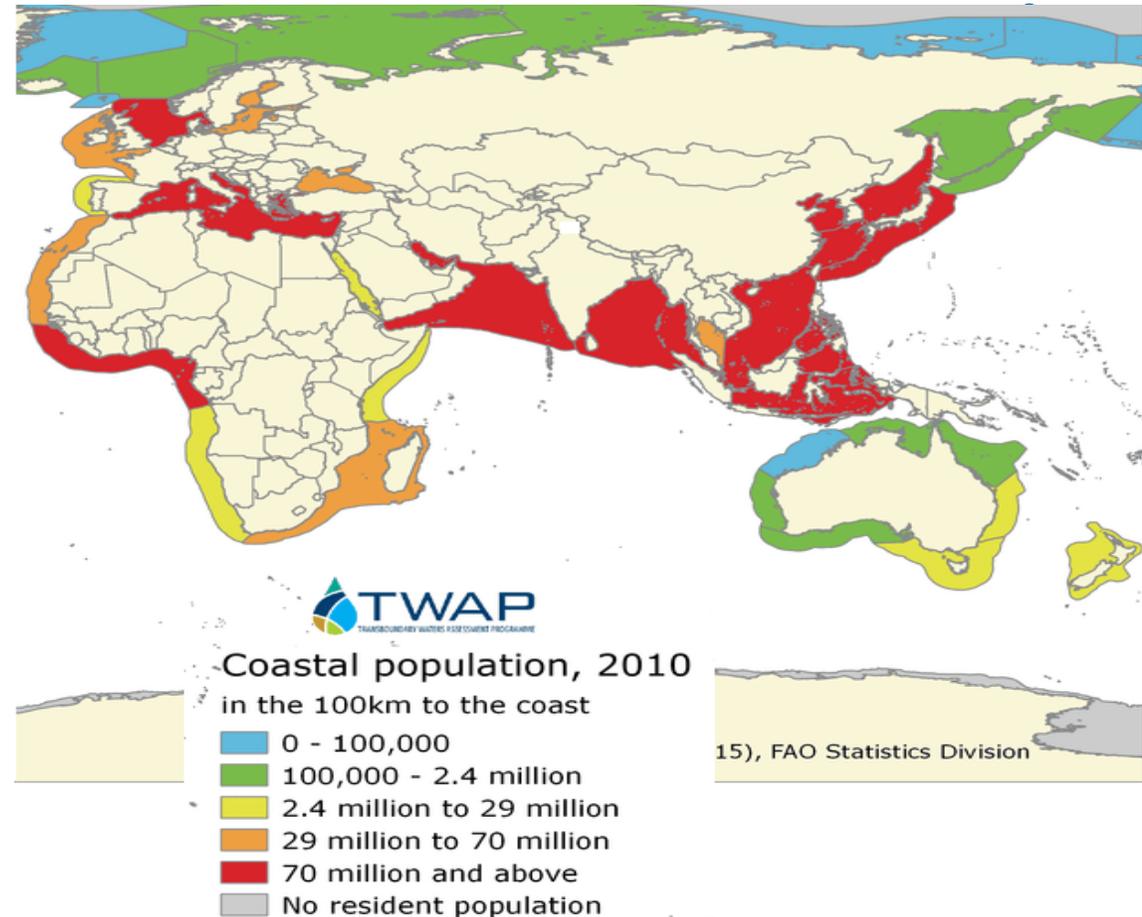


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- Around 40 Nations
- Many are Developing Countries
- More than 1.5 Billion Population
- More than 66,500 km coastline
- Most of the coastal areas are low lying and vulnerable to oceanogenic disasters such as Tsunamis, Storm Surges, Sea-level rise
- Frequent Cyclones - 13% of World's cyclones in the Seas around India
- Dec 26, 2004 Tsunami, one of the deadliest natural disasters in recorded history, devastated communities along the surrounding coasts of the Indian Ocean, killing ~230,000 people in 14 countries

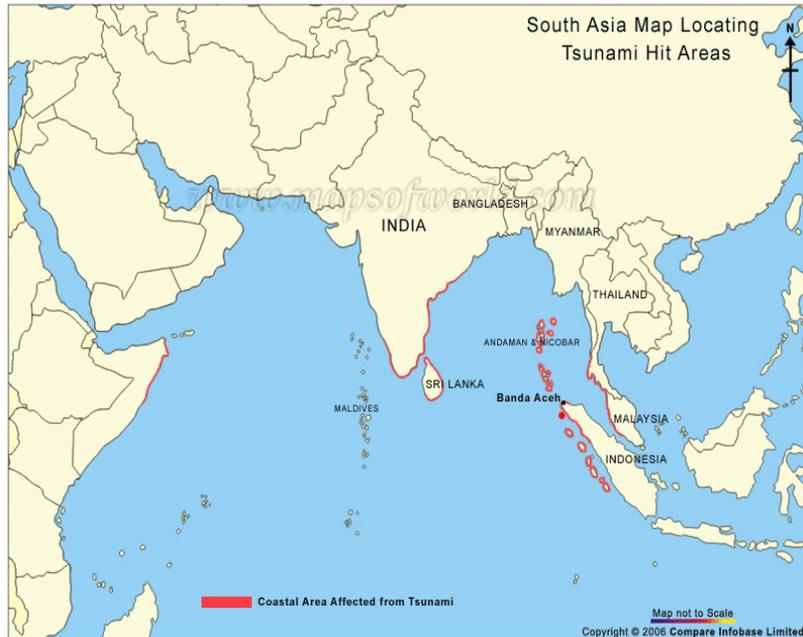


Indian Ocean Tsunami of December 26, 2004



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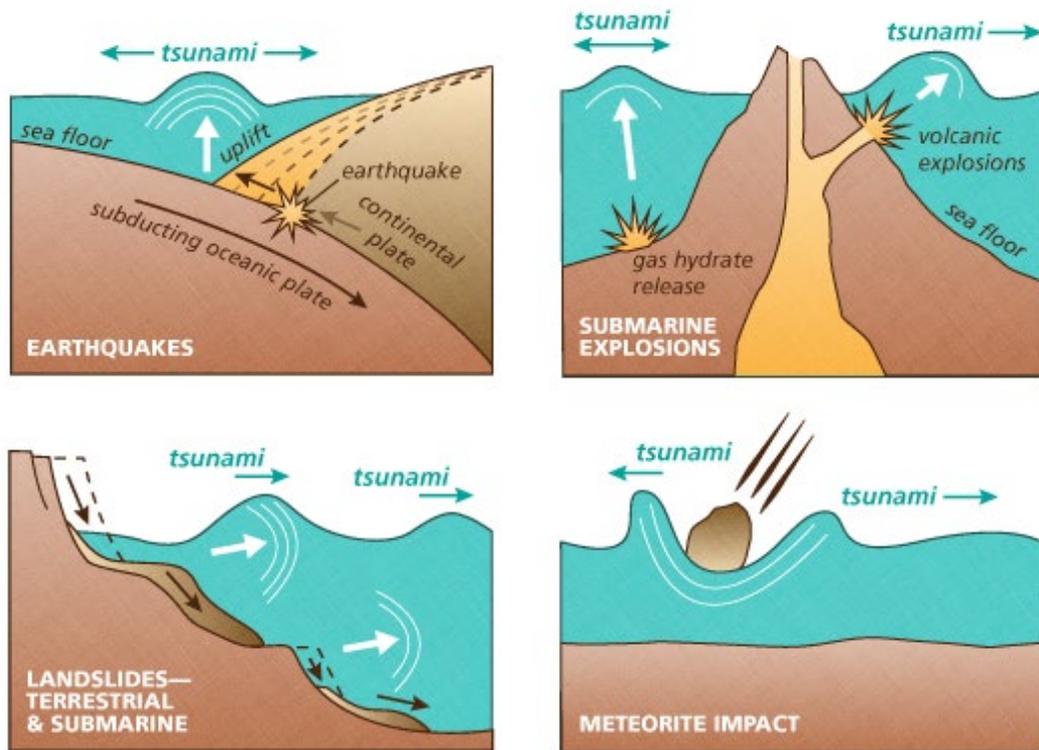
- December 26, 2004 - The worst tsunami in recorded history
- Magnitude 9.1 (third strongest earthquake ever recorded on a seismograph)
- Lasted about 10 minutes (longest-lasting earthquake in history)
- ~2,30,000 confirmed dead and estimated damage > \$7 billion
- Including India Tsunami hit 14 countries
- Energy released equivalent to 23,000 Hiroshima-sized atomic bombs

Reasons for huge loss.....

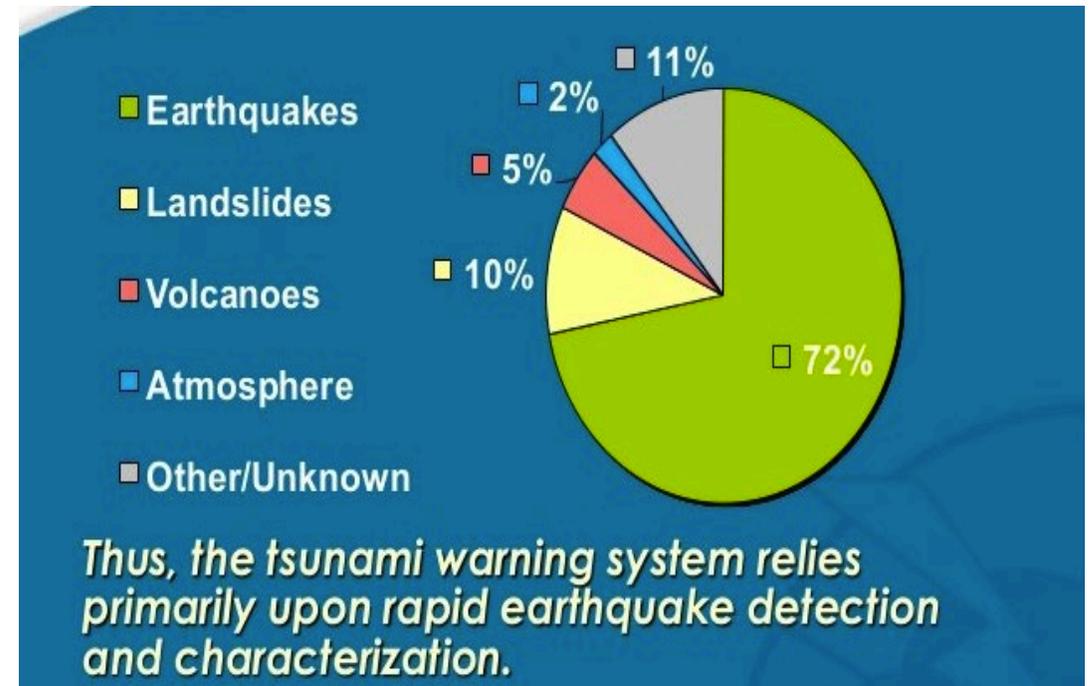
- Many nations in the Indian Ocean did not even recognize the word “tsunami”
- None had tsunami preparedness programs in place
- Absence of a Tsunami Early Warning System (TEWS) in the India Ocean
- Ignorance of the natural signs of a tsunami led to inappropriate actions

What is Tsunami?

Tsunami is a series of long period waves created by an abrupt disturbance that displaces a large amount of water



Tsunami generation sources

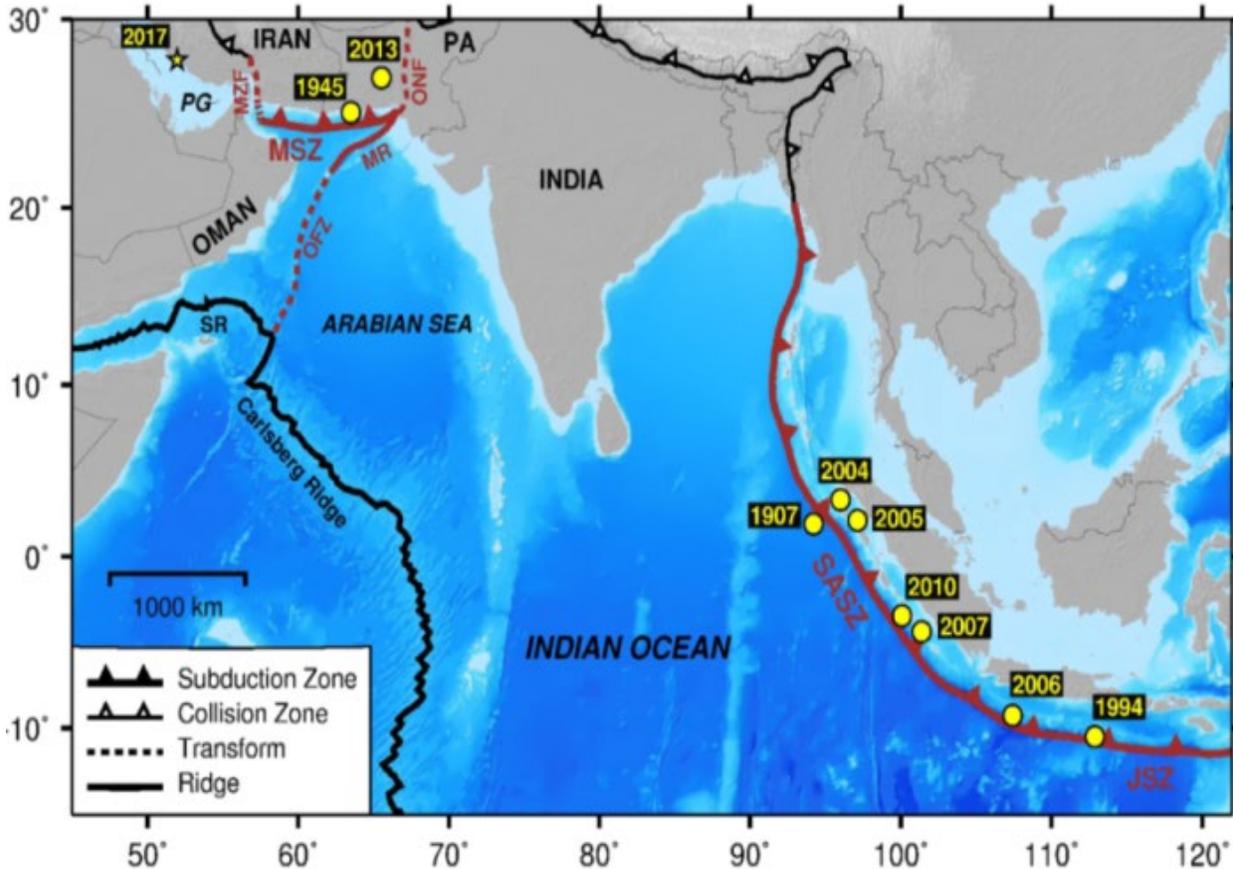


Tsunamigenic Sources in The Indian Ocean



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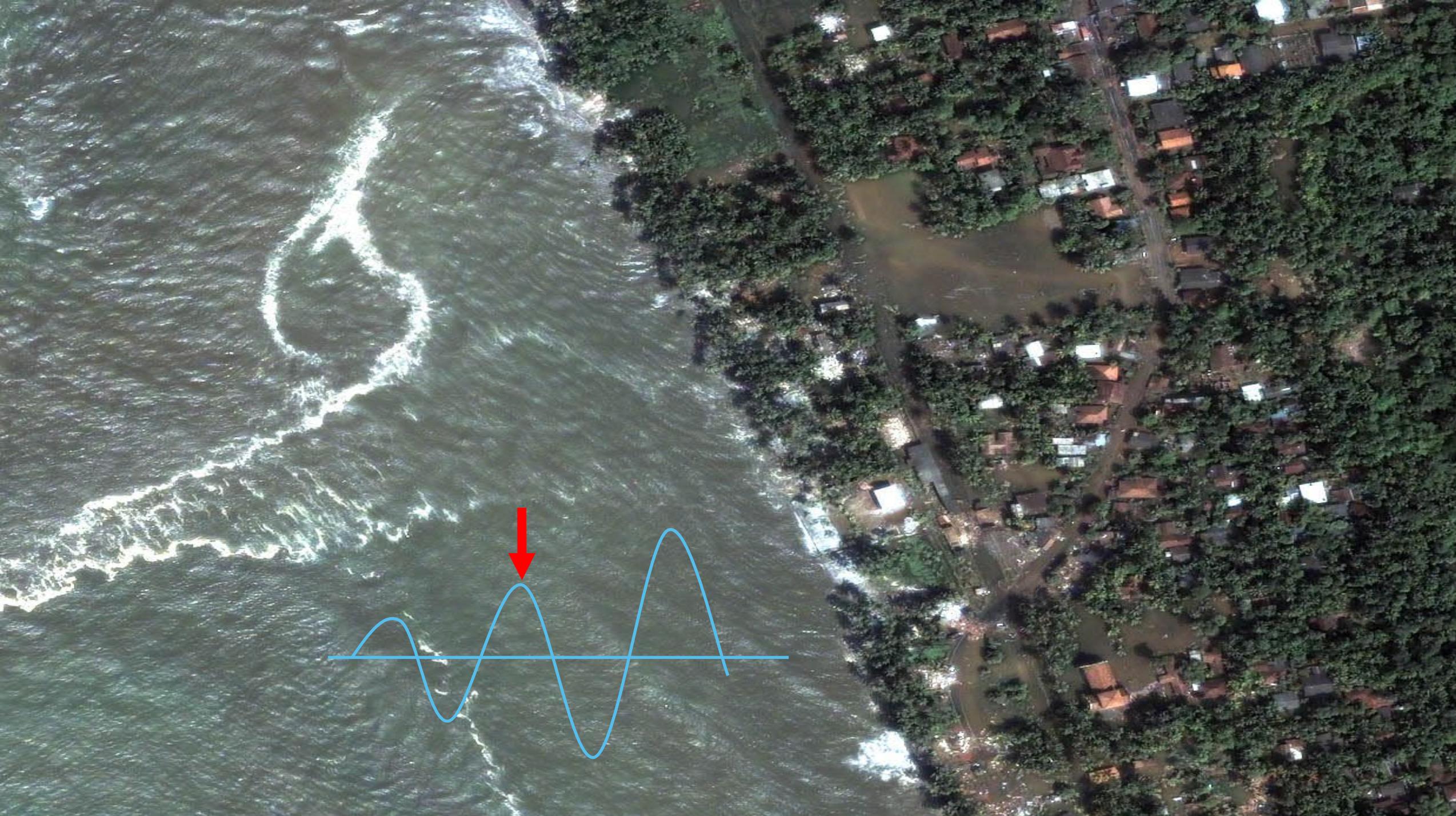
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- Subduction Zone: Indian and Australian plates are moving north and eastward relative to Eurasian plate forming a convergent boundary
- Major Subduction Zones
 - Sumatra Andaman Subduction Zone ~6000 km
 - Makran Subduction Zone ~900 km
- Sumatra Andaman Subduction Zone (SASZ) – From Himalayan front southward through Myanmar, Andaman and Nicobar Islands, Sumatra, Java and the Sunda Islands (Sumba, Timor), to the north of Western Australia
- Makran Subduction Zone (MSZ) – lies between southeastern Iran and southwestern Pakistan





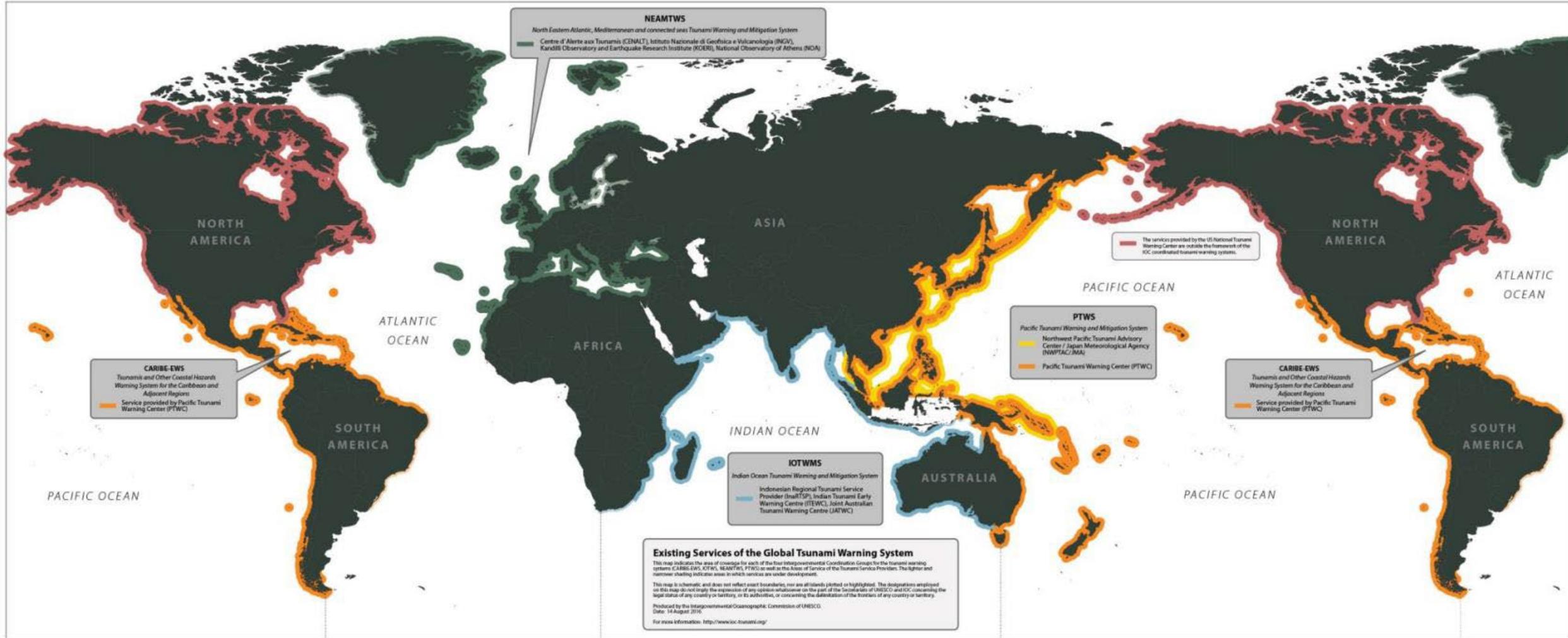








Global Tsunami Warning System



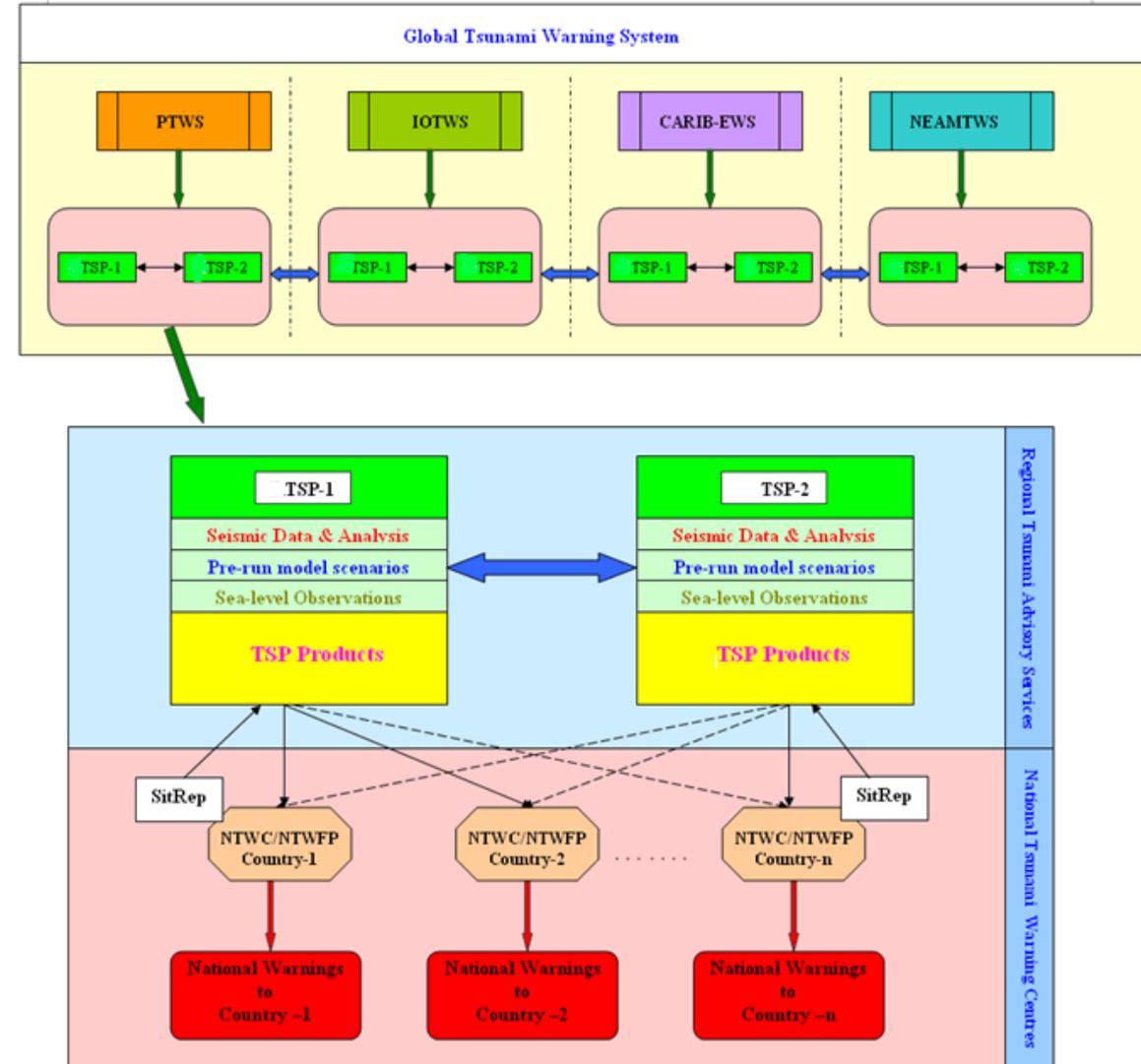
Structure of Each Regional Tsunami Warning System



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- Regional Tsunami Warning Systems operating in each Intergovernmental Coordination Group (viz. IOTWMS, PTWS, NEAMTWS, CARIBE-EWS) are the building blocks of a global TWS.
- Each TWS consists of one or more Tsunami Service Providers (TSPs) and multiple National Tsunami Warning Centres (NTWCs) e.g. IOTWMS has 3 TSPs and 27 NTWCs
- TSPs generate real-time products for NTWCs within their region.
- Having multiple TSPs provides redundancy for NTWCs ("system of systems" concept)
- NTWCs are solely responsible for providing warnings to their citizens based on their analysis of the situation
- IOTWMS TSP products are harmonized:
 - Consistent bulletin types, formats, information content and terminology
 - Consistent tsunami wave threat threshold and coastal zone definitions for whole Indian Ocean
 - Consistent content in TSP websites (but different "looks")

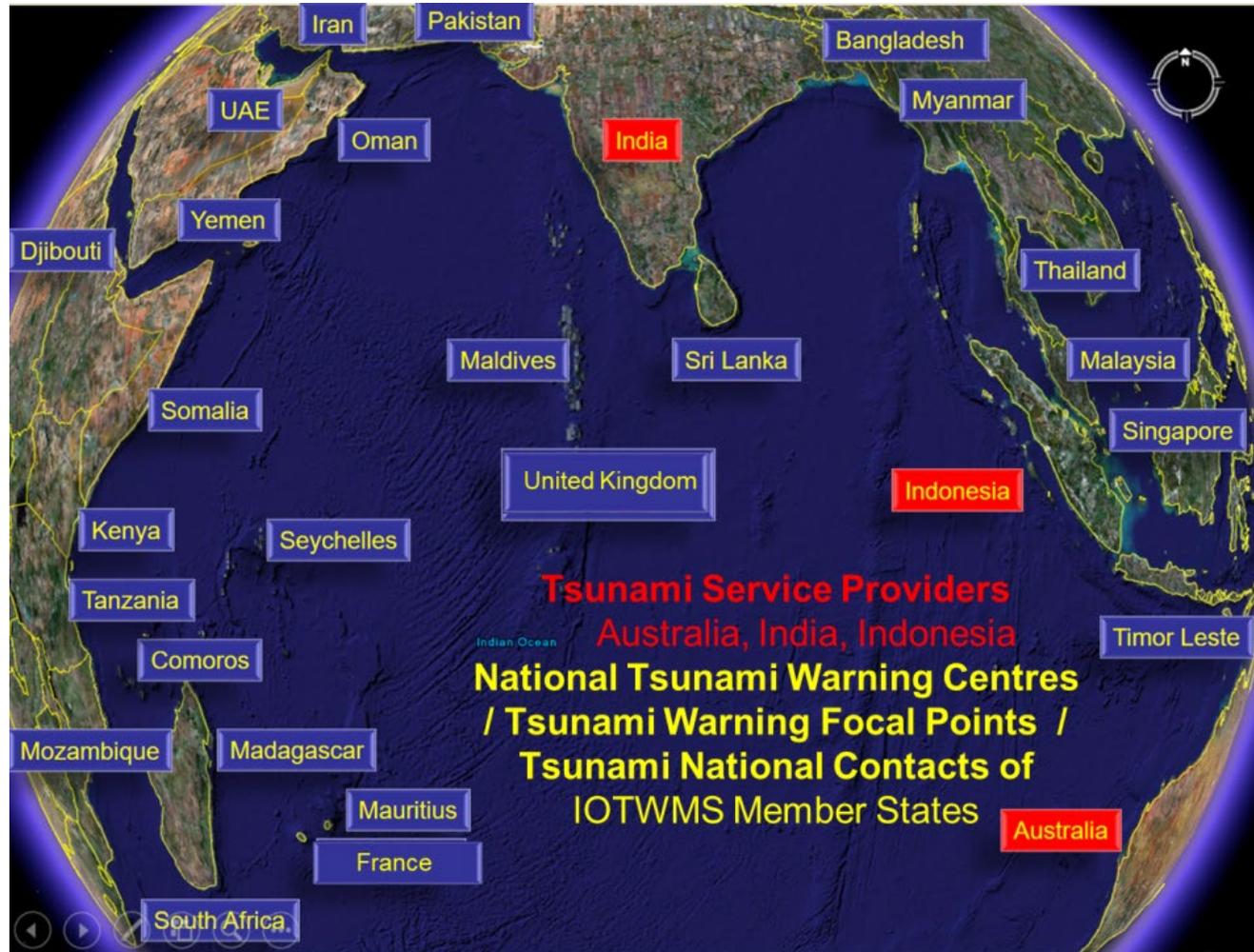


Indian Ocean Tsunami Warning and Mitigation System



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Indian Ocean Tsunami Warning Service History



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- **2005 to 31 March 2013**: Interim Advisory Service (IAS), provided by:
 - Pacific Tsunami Warning Centre (Hawaii)
 - Northwest Pacific Tsunami Advisory Centre (Tokyo)
- **12 October 2011 onwards**: Indian Ocean Tsunami Warning and Mitigation Service (IOTWMS), provided by:
 - 3 TSPs: Australia (JATWC), India (ITEWC), Indonesia (InaTEWS)
 - 27 NTWCs (including the 3 TSPs)
- The IAS and the IOTWMS operated in parallel from **12 October 2011 to 31 March 2013**, then the IAS ceased

TSP Service Definition Document



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Technical Series

146

Definition of Services provided by Tsunami Service Providers of the IOTWMS

Version 4.0

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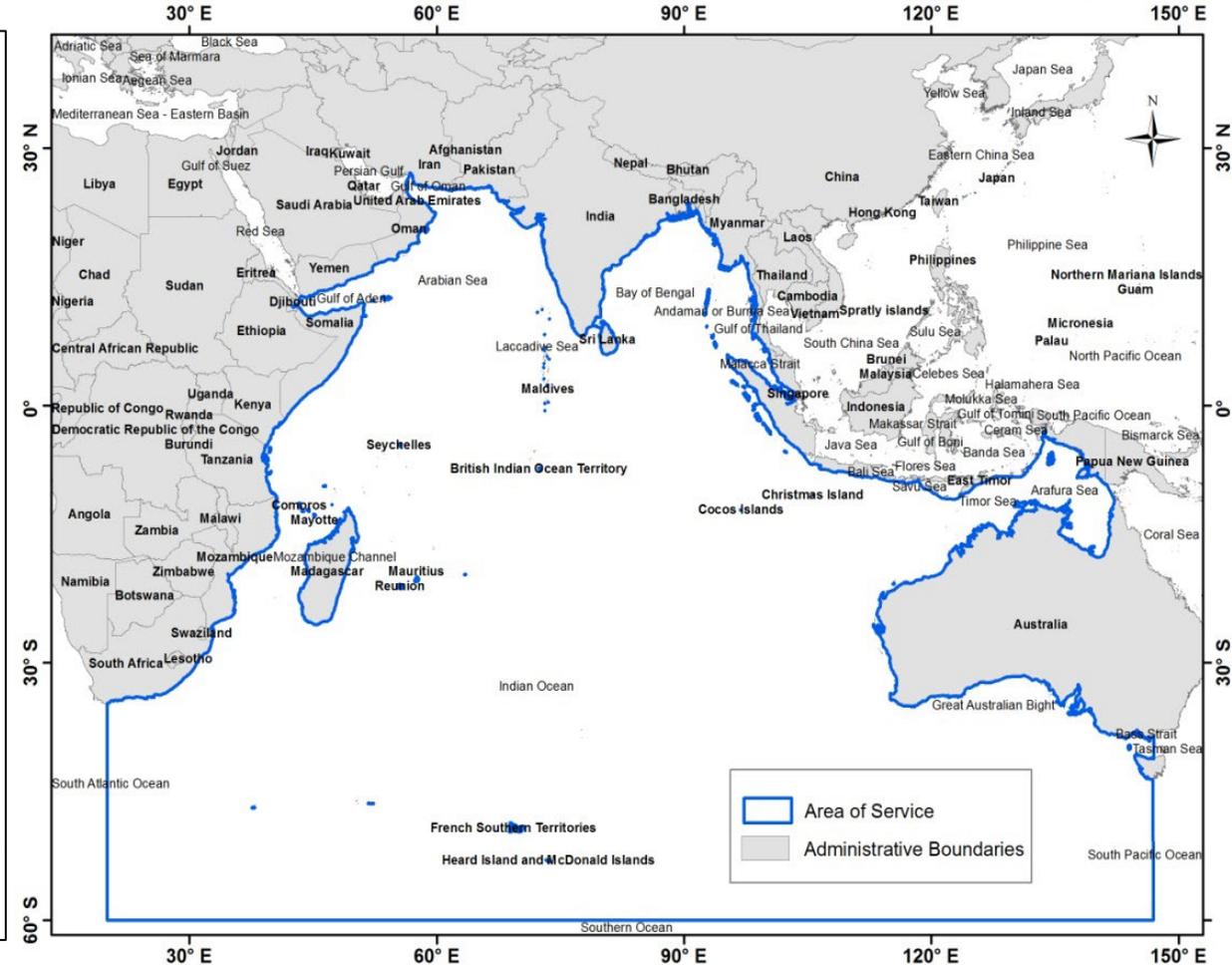
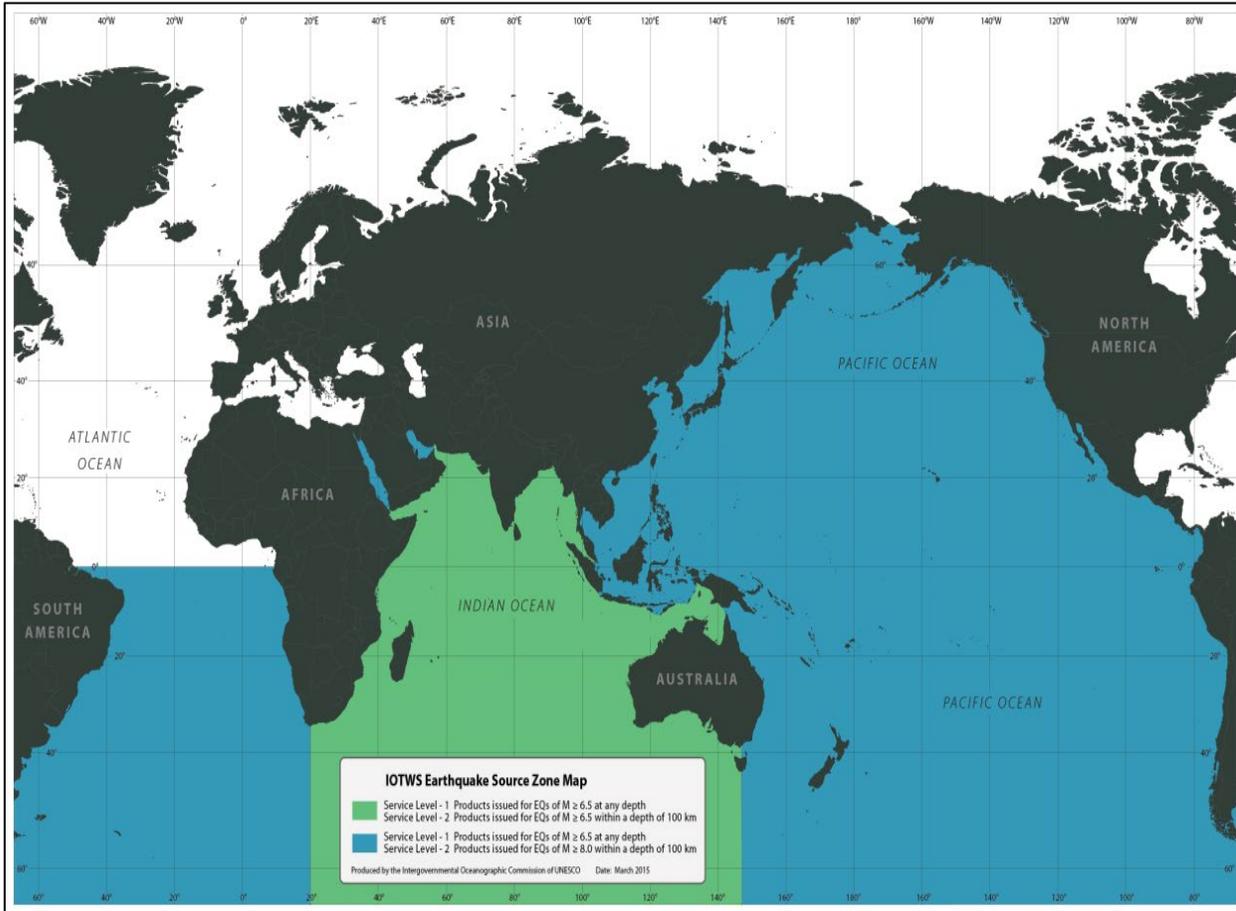
I	IOTWMS TSP AREA OF SERVICE (AOS) MAP AND GLOBAL AREA OF SERVICE MAP OF ICGS
II	IOTWMS EARTHQUAKE SOURCE ZONE (ESZ) MAP
III	TSP PERFORMANCE REPORTING TEMPLATE EXAMPLE
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VIII	DOCUMENT CONTROL
IX	LIST OF ACCRONYMS

IOTWMS Earthquake Source zone and Area of Service



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Roles and Responsibilities of TSPs



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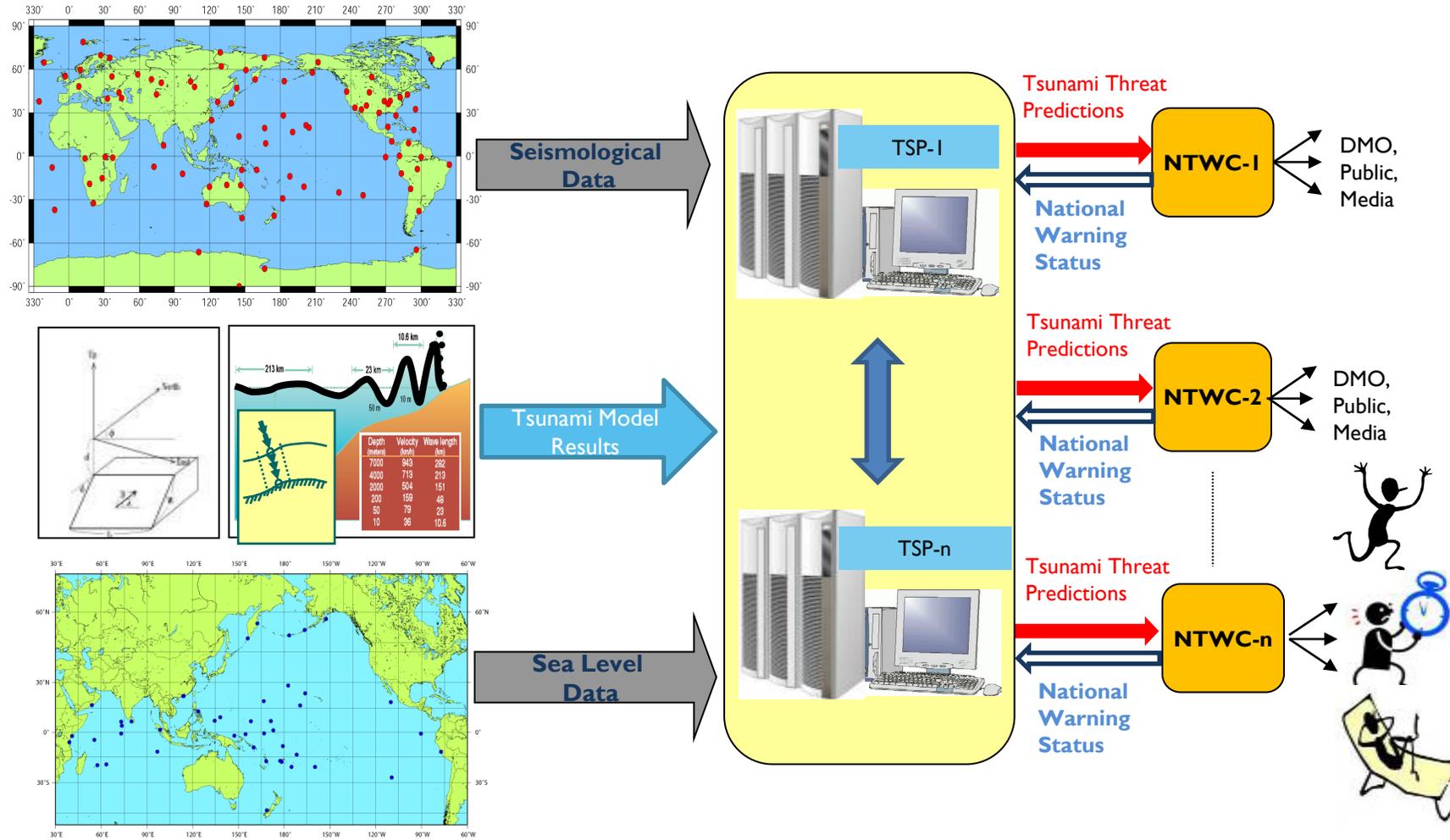
- **Monitor earthquakes** and **provide timely initial magnitude and location information** for those that could generate a tsunami (i.e. "potentially tsunamigenic")
- **Generate specific coastal-zone threat information** for all Indian Ocean countries using tsunami wave propagation models based on the earthquake information, and later confirmed or adjusted based on sea level observations
- **Generate timely tsunami Exchange Bulletins and Threat Maps** for use by NTWCs in their preparation and issuing of national tsunami warnings for their countries
- Monitor tsunami propagation and **report updated tsunami wave amplitude observations**
- Receive **National Warning Status Reports from NTWCs** and **display on TSP Public Webpages**
- **Issue Public Bulletins** containing details of the earthquake, national warning statuses as reported by the NTWCs, and tsunami wave observations
- Serve as a backup centre to other TSPs and as an NTWC for its own country

Operational Elements of TSPs



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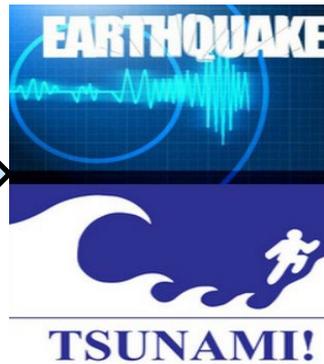
TSP Service Levels for IOTWMS



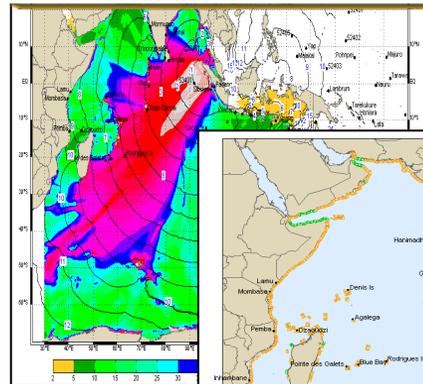
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- **Service Level 1** – Earthquake Bulletins (in operation since 2009)
- **Service Level 2** – Tsunami Threat Bulletins and Threat Maps (in operation since 2011)
- **Service Level 3** – Inundation Mapping (**not yet in operation**)

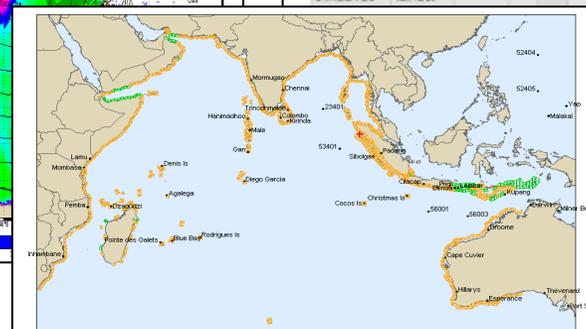


Travel Time & Energy Maps

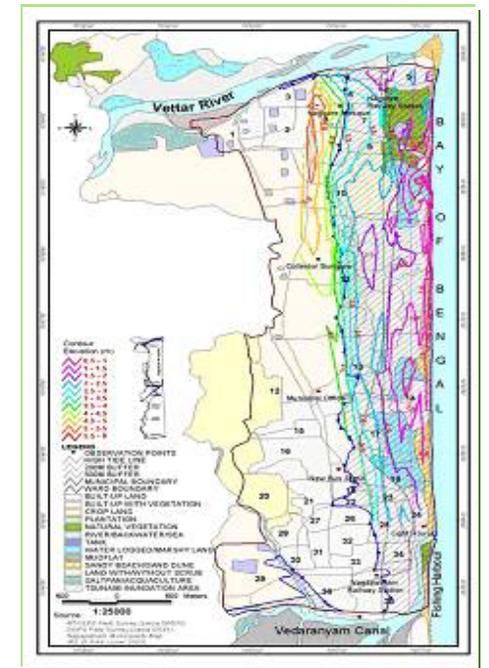


Coastal Zone Threat Table

Zone	Name	Country	Area (km²)	Pop. (Mill)	Value (Mill USD)	Threat
Coastal Zone	East Africa	India	1,200	1.2	1,200	High
Coastal Zone	West Africa	India	1,200	1.2	1,200	High
Coastal Zone	South Africa	India	1,200	1.2	1,200	High
Coastal Zone	North Africa	India	1,200	1.2	1,200	High
Coastal Zone	East Africa	India	1,200	1.2	1,200	High
Coastal Zone	West Africa	India	1,200	1.2	1,200	High
Coastal Zone	South Africa	India	1,200	1.2	1,200	High
Coastal Zone	North Africa	India	1,200	1.2	1,200	High



Coastal Zone Threat Map





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THANK YOU