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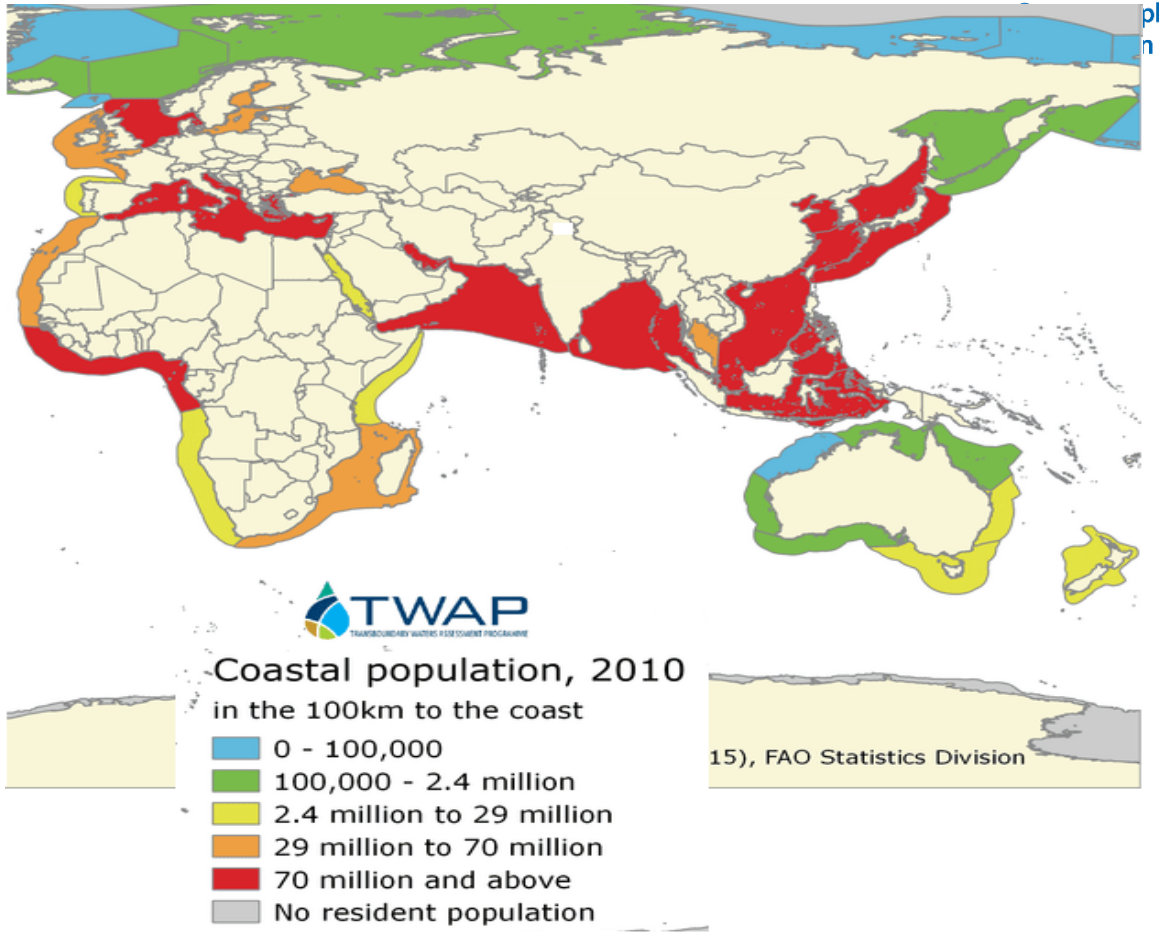
- Vulnerability of Indian Ocean
- The Indian Ocean Tsunami
- What is Tsunami
- Tsunamigenic Sources of the Indian Ocean
- Global Tsunami Warning System
- Structure of each Regional TWS
- History of IOTWMS
- Tsunami Service Providers Roles and Responsibilities
- Operational Elements of TSPs
- TSP Service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

Vulnerability of the Indian Ocean Coastline to Oceanogenic Disasters

- 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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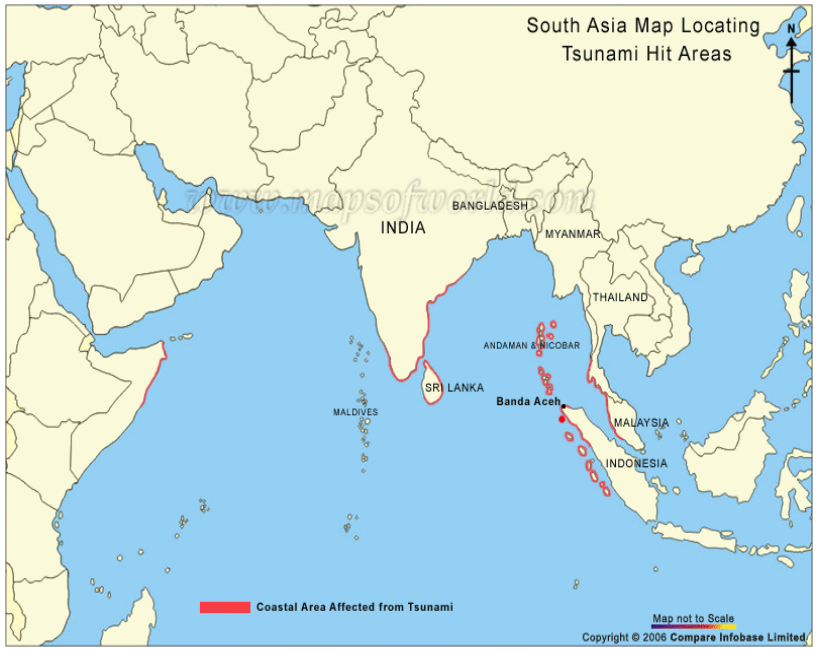

- December 26, 2004 - The worst tsunami in recorded history
- Magnitude 9.1 (third strongest earthquake ever recorded on a seismograph)
- Lasted about 10 minutes (longest-lasting earthquake in history)
- ~2,30,000 confirmed dead and estimated damage > $7 billion
- Including India Tsunami hit 14 countries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

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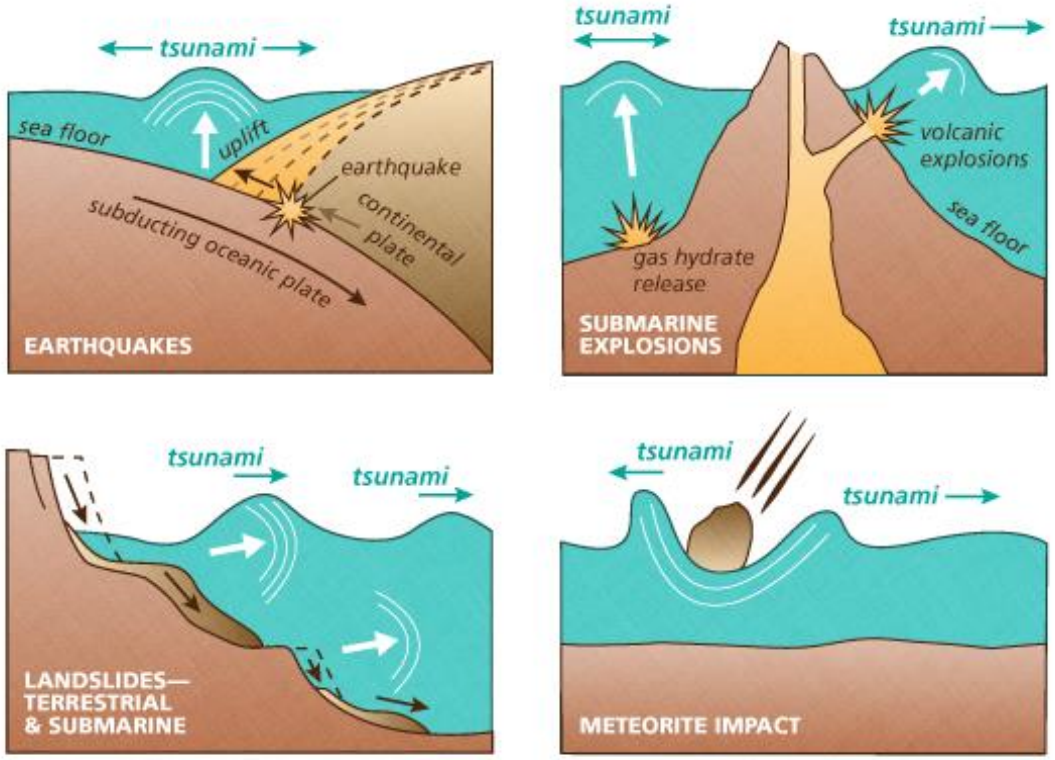
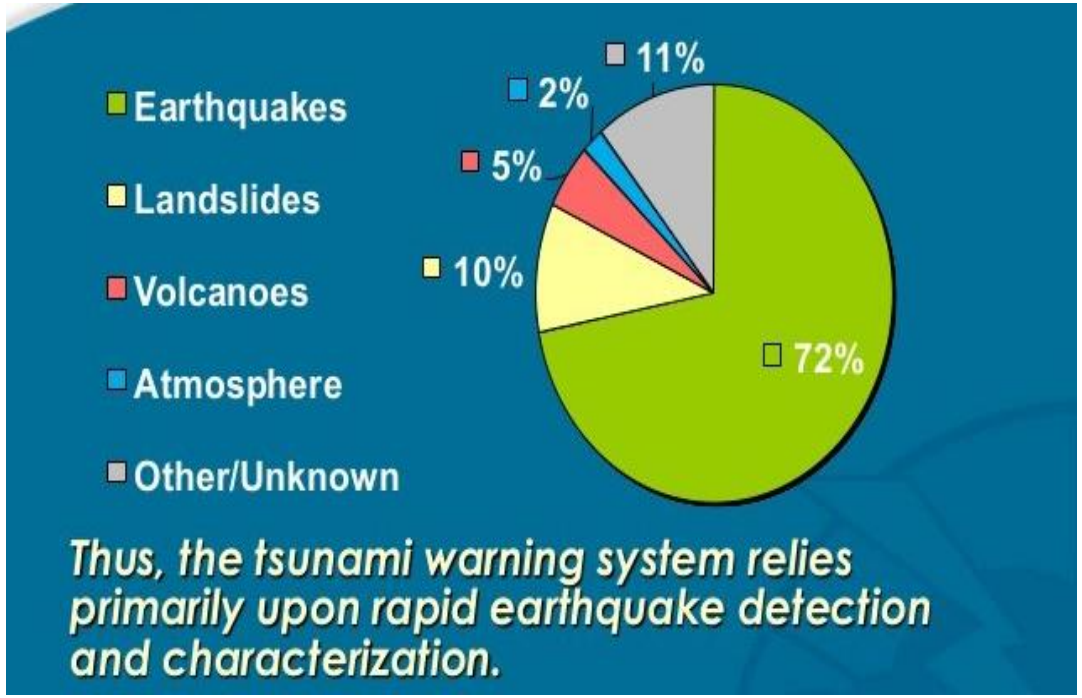
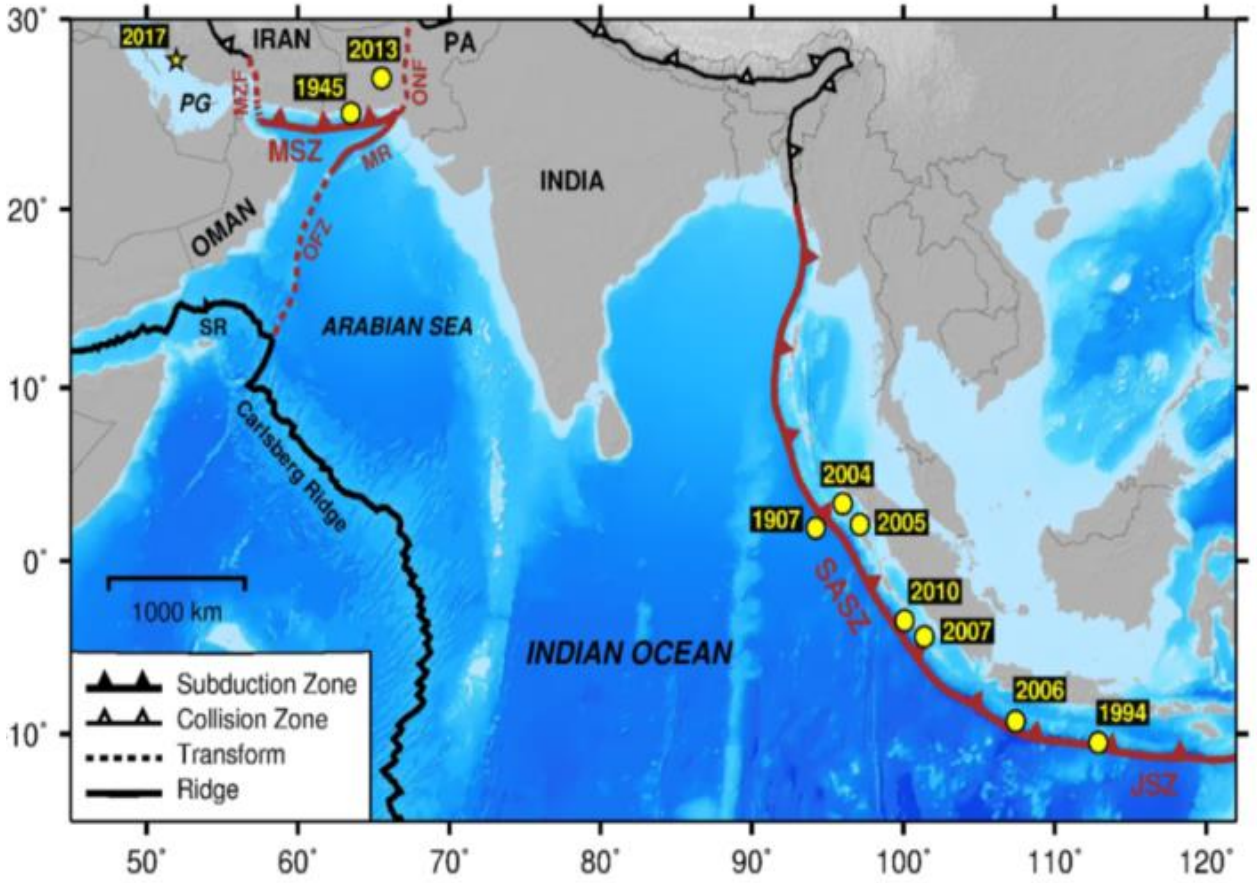
Tsunami is a series of long period waves created by an abrupt disturbance that displaces a large amount of water



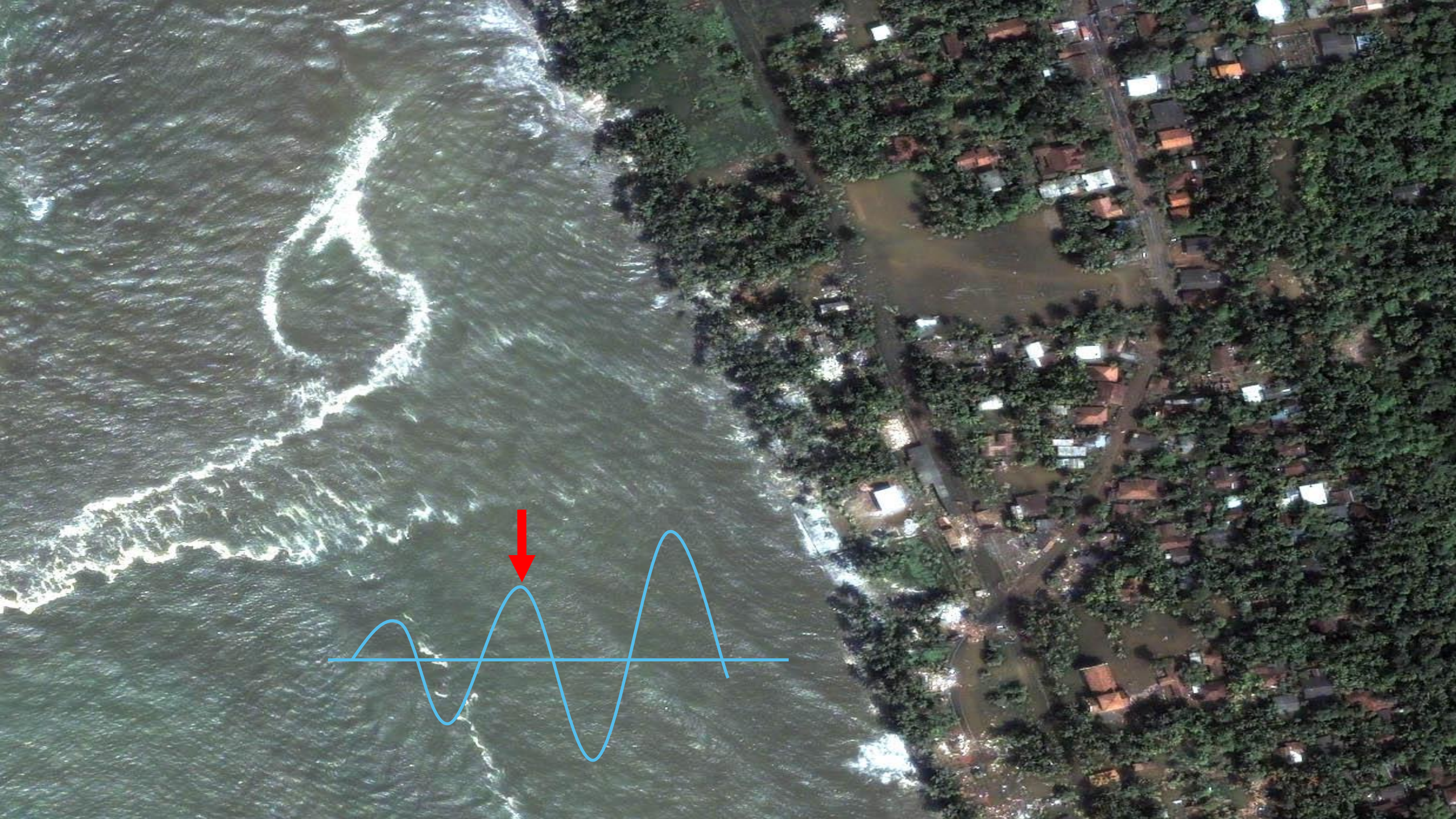
Tsunami generation sources



Tsunamigenic Sources in The Indian Ocean



- 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

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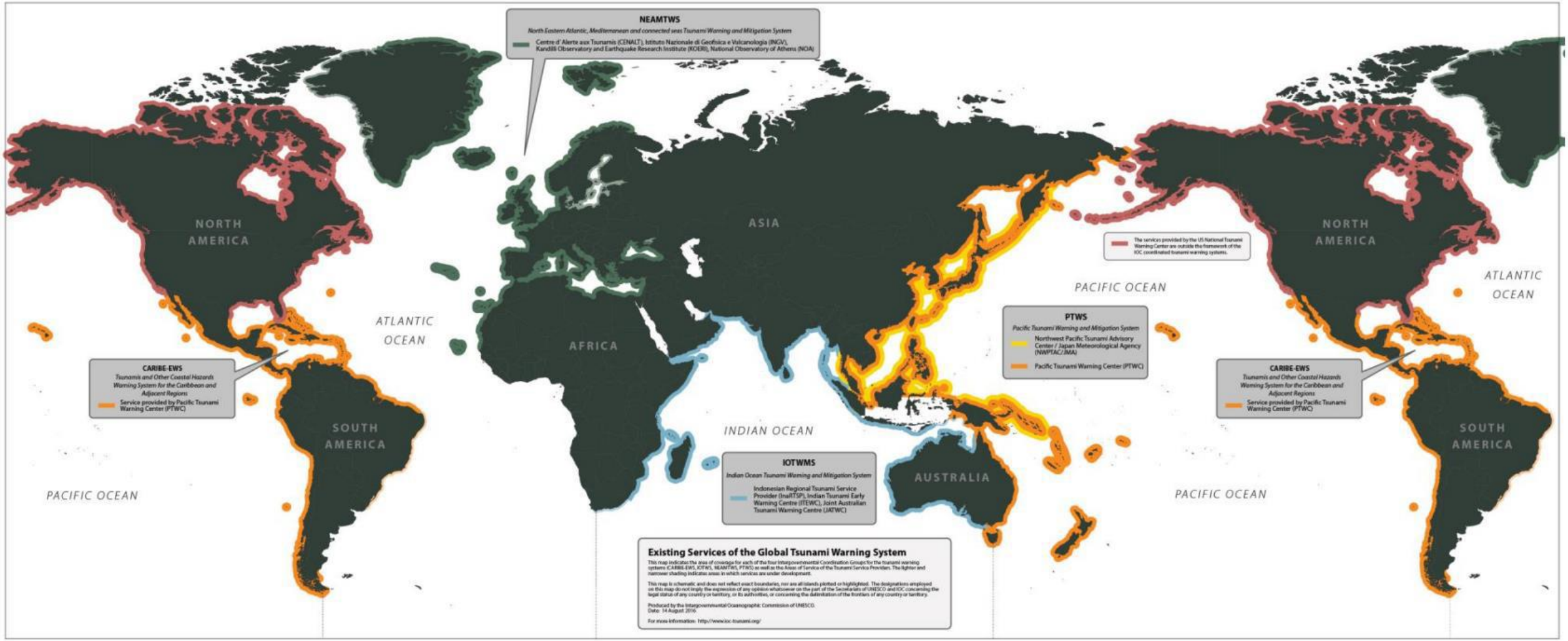
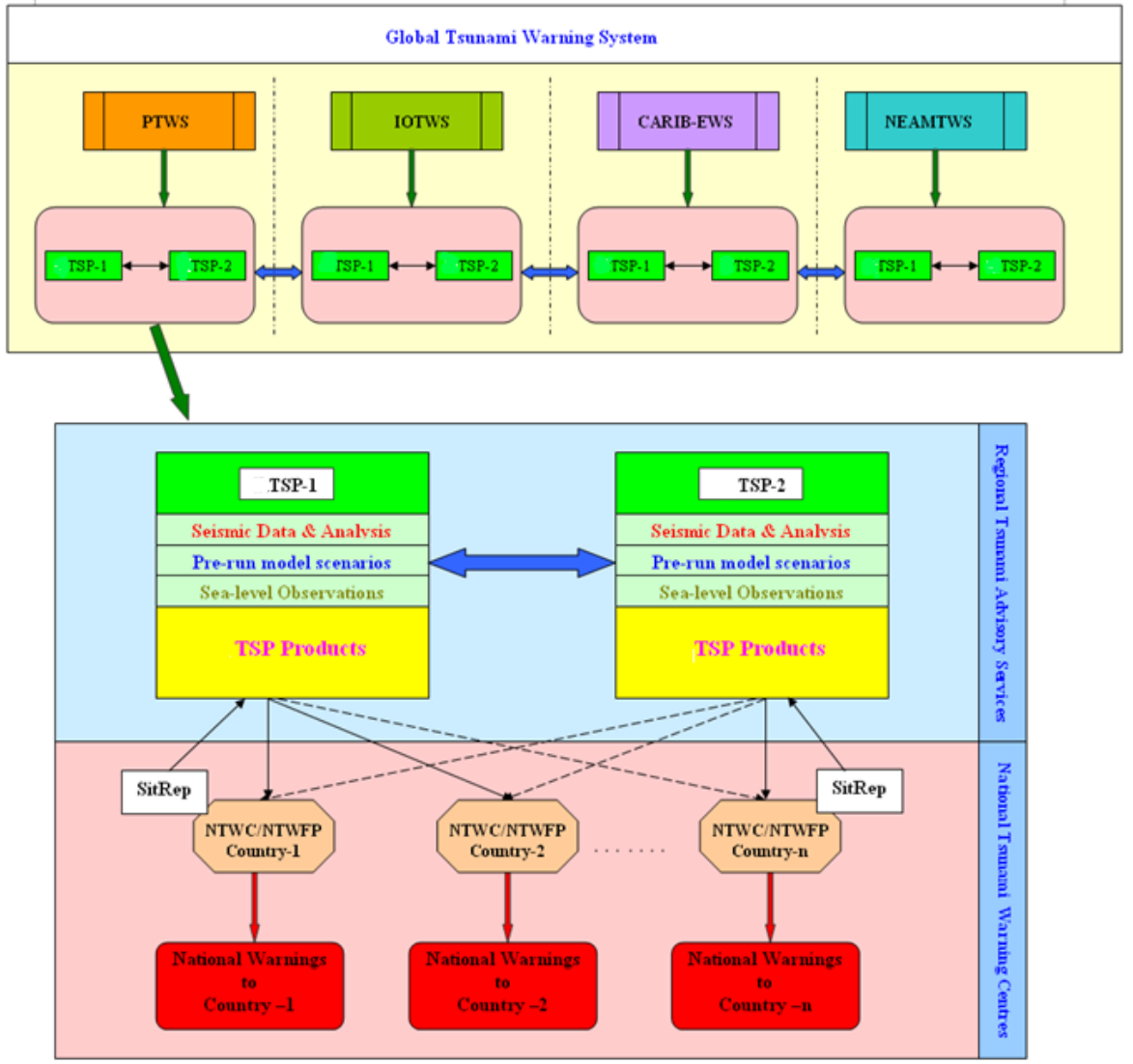


Structure of Each Regional Tsunami Warning System

- 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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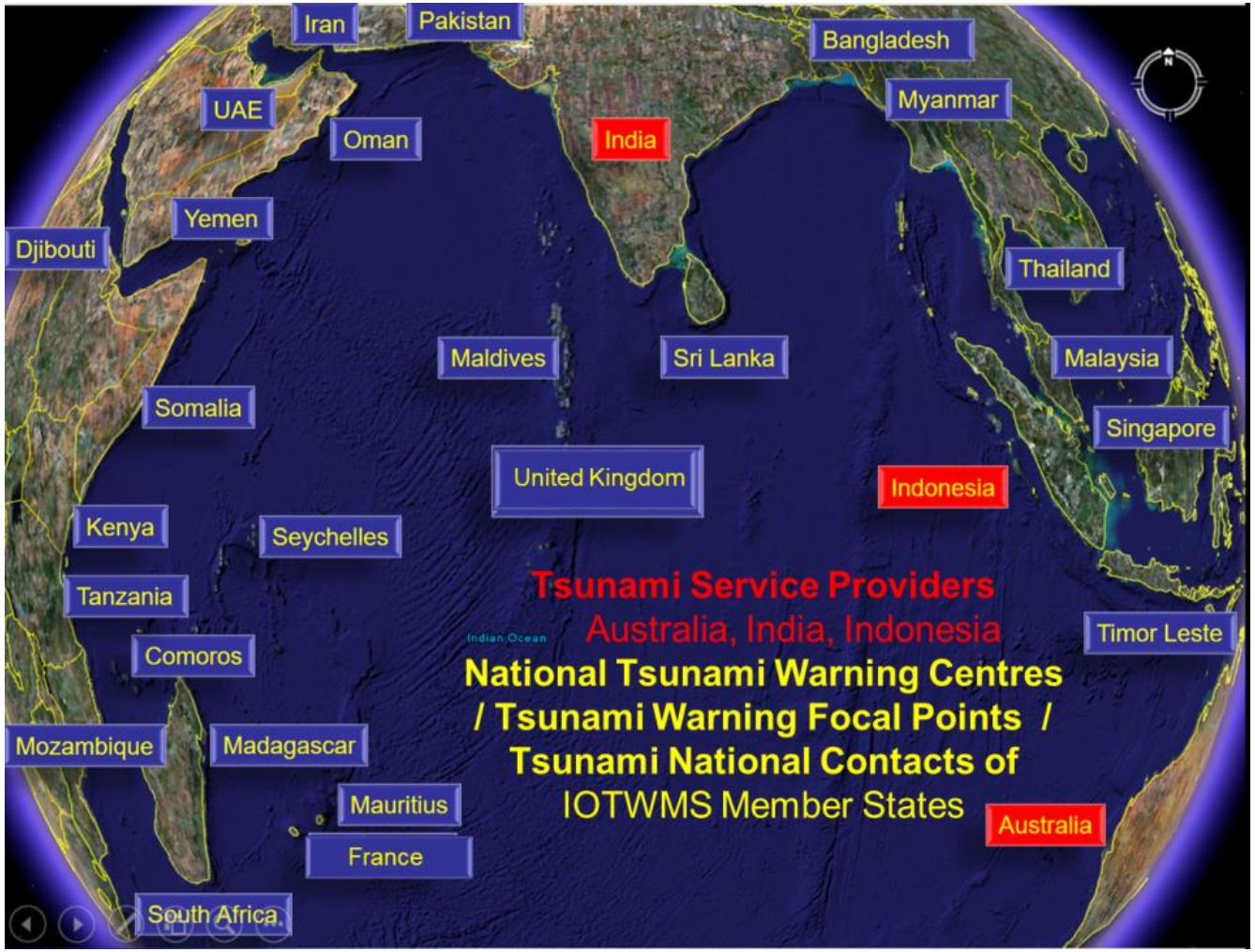

Indian Ocean Tsunami Warning Service History

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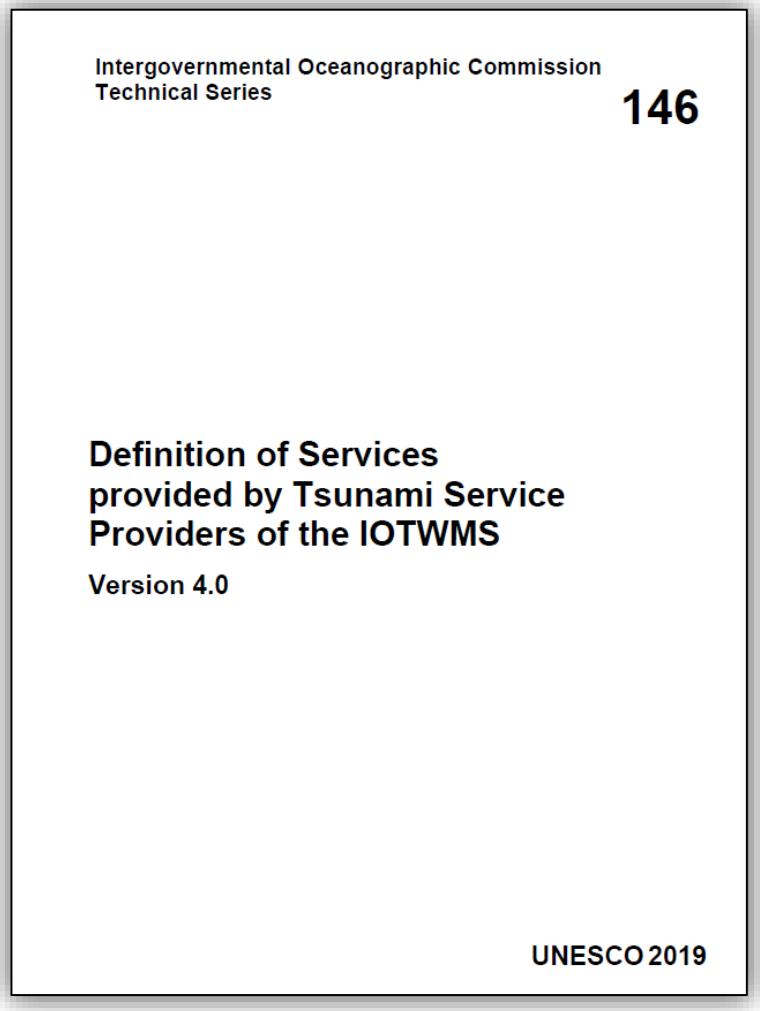
- 2005 to 31 March 2013: Interim Advisory Service (IAS), provided by:
  - Pacific Tsunami Warning Centre (Hawaii)
  - Northwest Pacific Tsunami Advisory Centre (Tokyo)

- 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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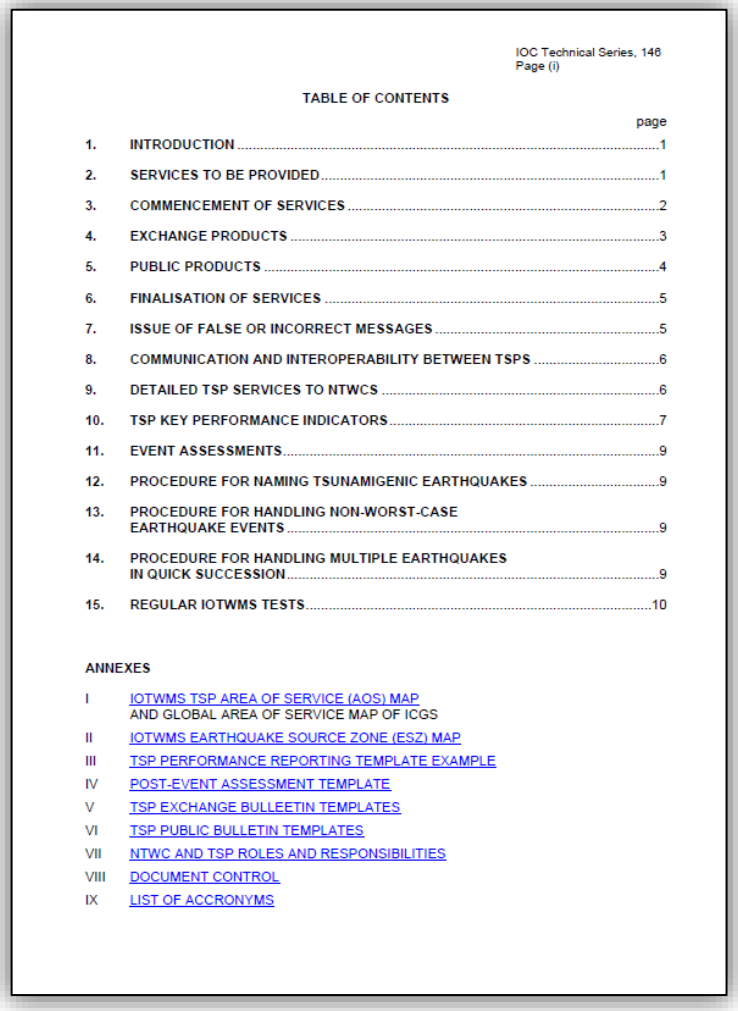
Definition of Services provided by Tsunami Service Providers of the IOTWMS

Version 4.0

UNESCO 2019



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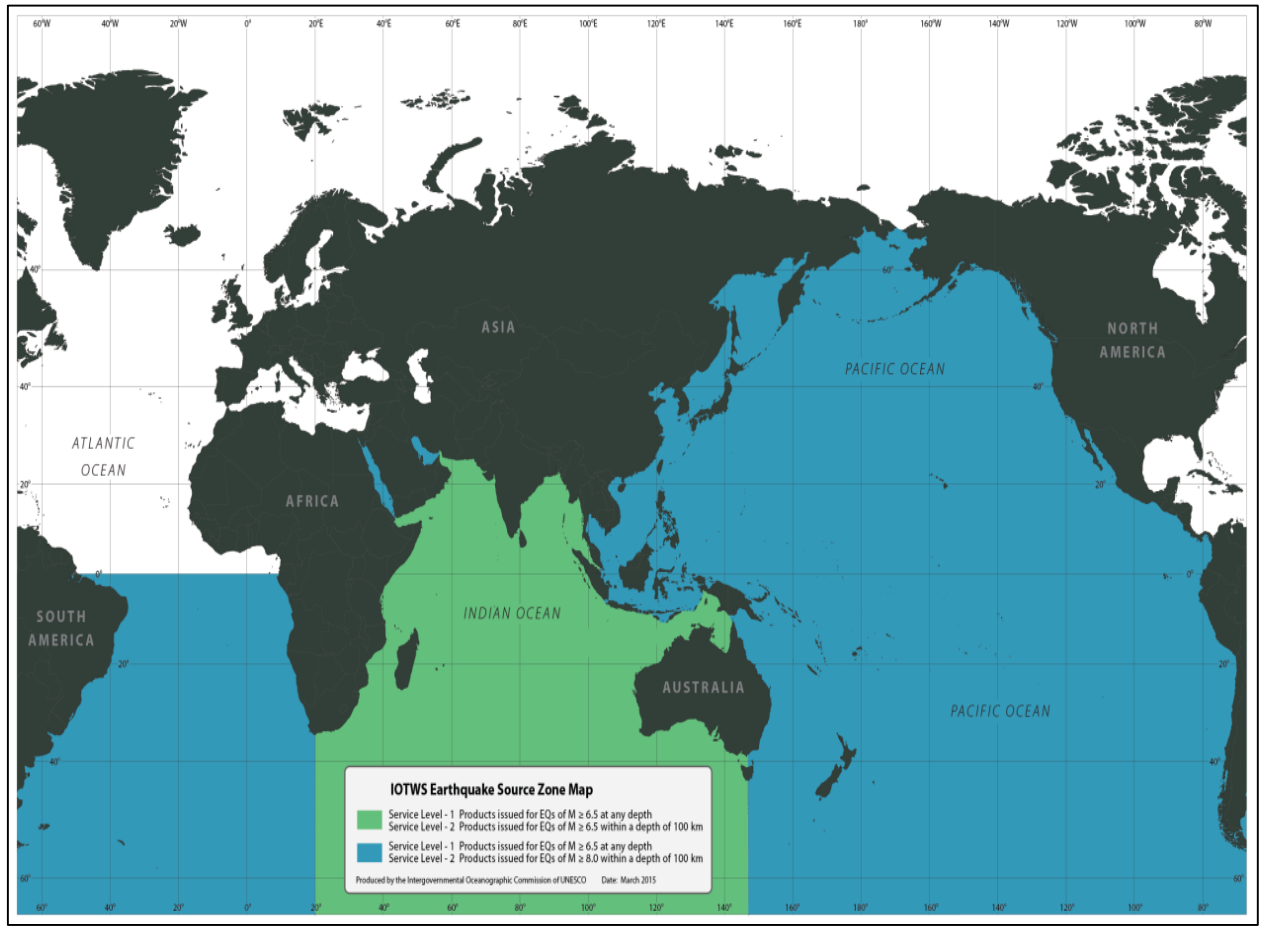
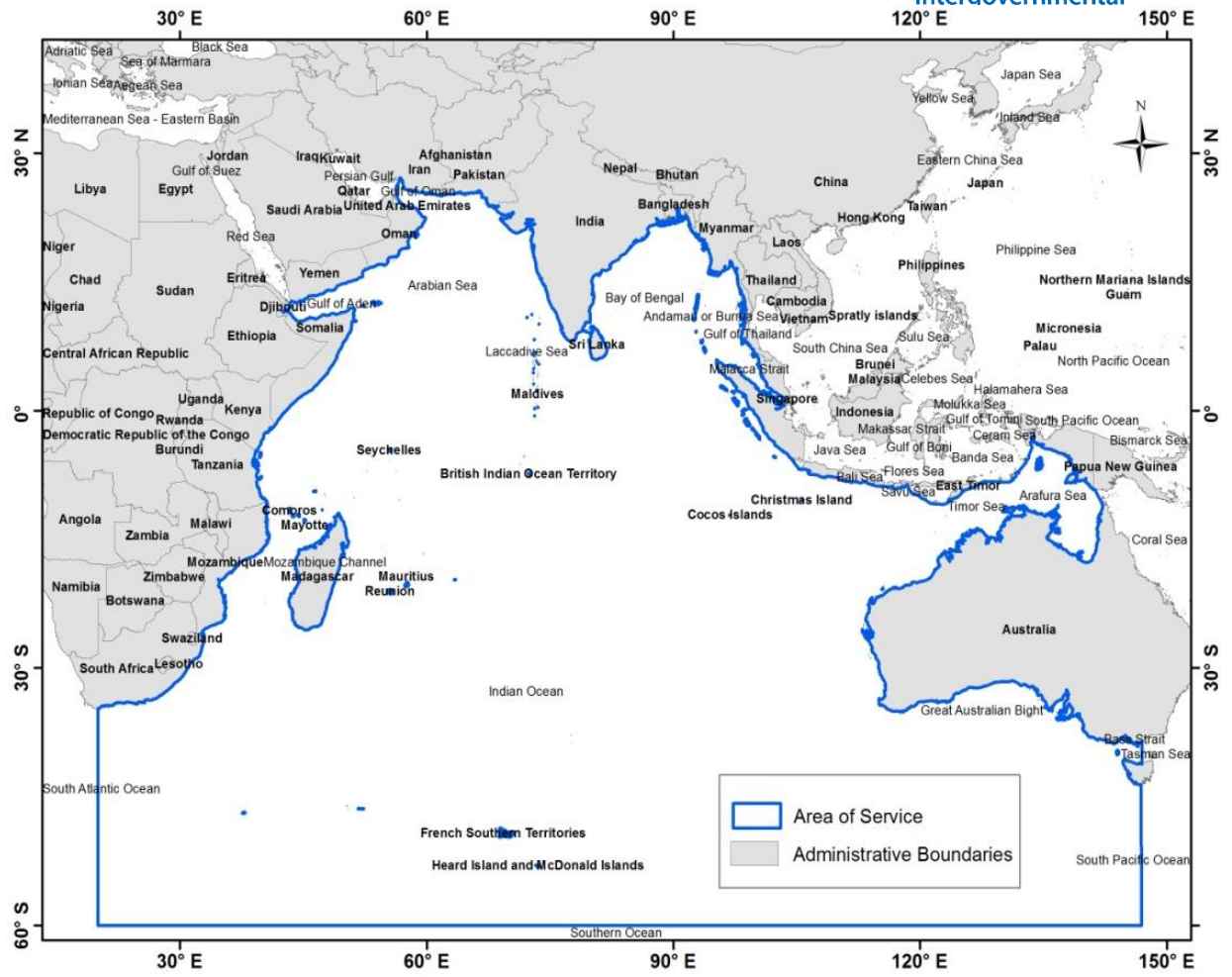
IOTWMS Earthquake Source zone and Area of Service





Roles and Responsibilities of TSPs

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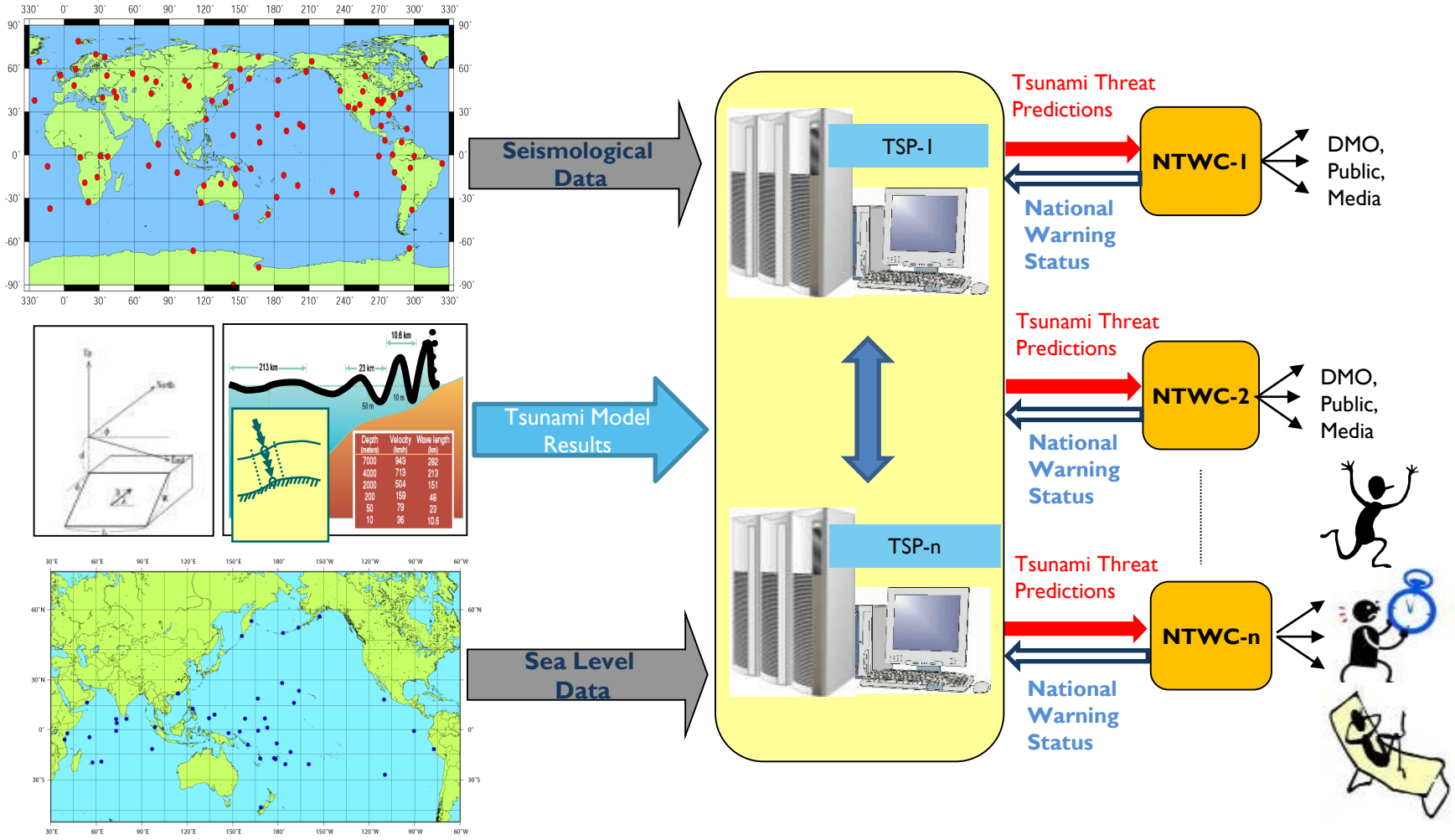
- Monitor earthquakes and provide timely initial magnitude and location information for those that could generate a tsunami (i.e. "potentially tsunamigenic")
- Generate specific coastal-zone threat information for all Indian Ocean countries using tsunami wave propagation models based on the earthquake 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



TSP Service Levels for IOTWMS

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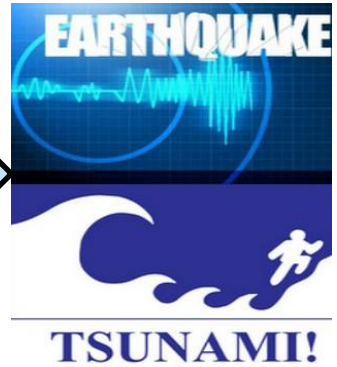
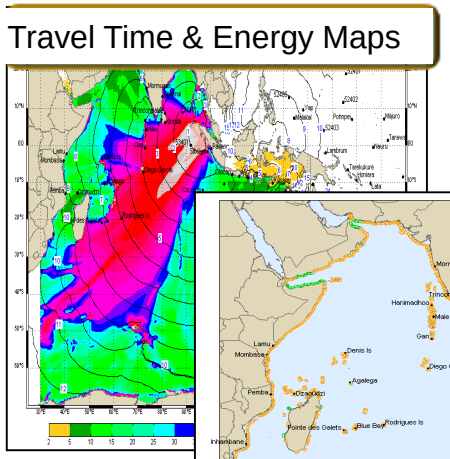
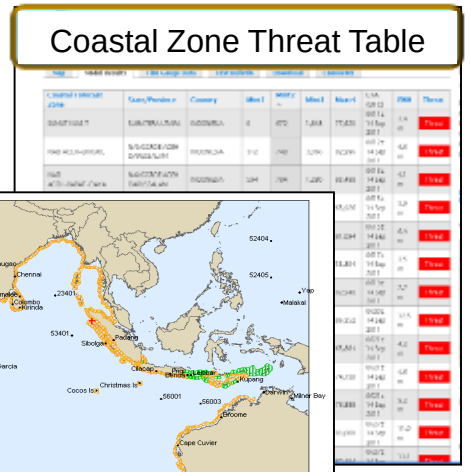
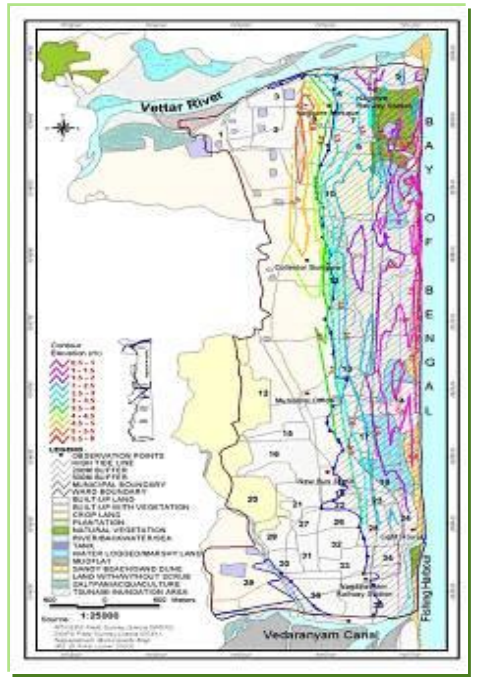
- **Service Level 1** – Earthquake Bulletins (in operation since 2009)
- **Service Level 2** – Tsunami Threat Bulletins and Threat Maps (in operation since 2011)
- **Service Level 3** – Inundation Mapping (not yet in operation)









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THANK YOU