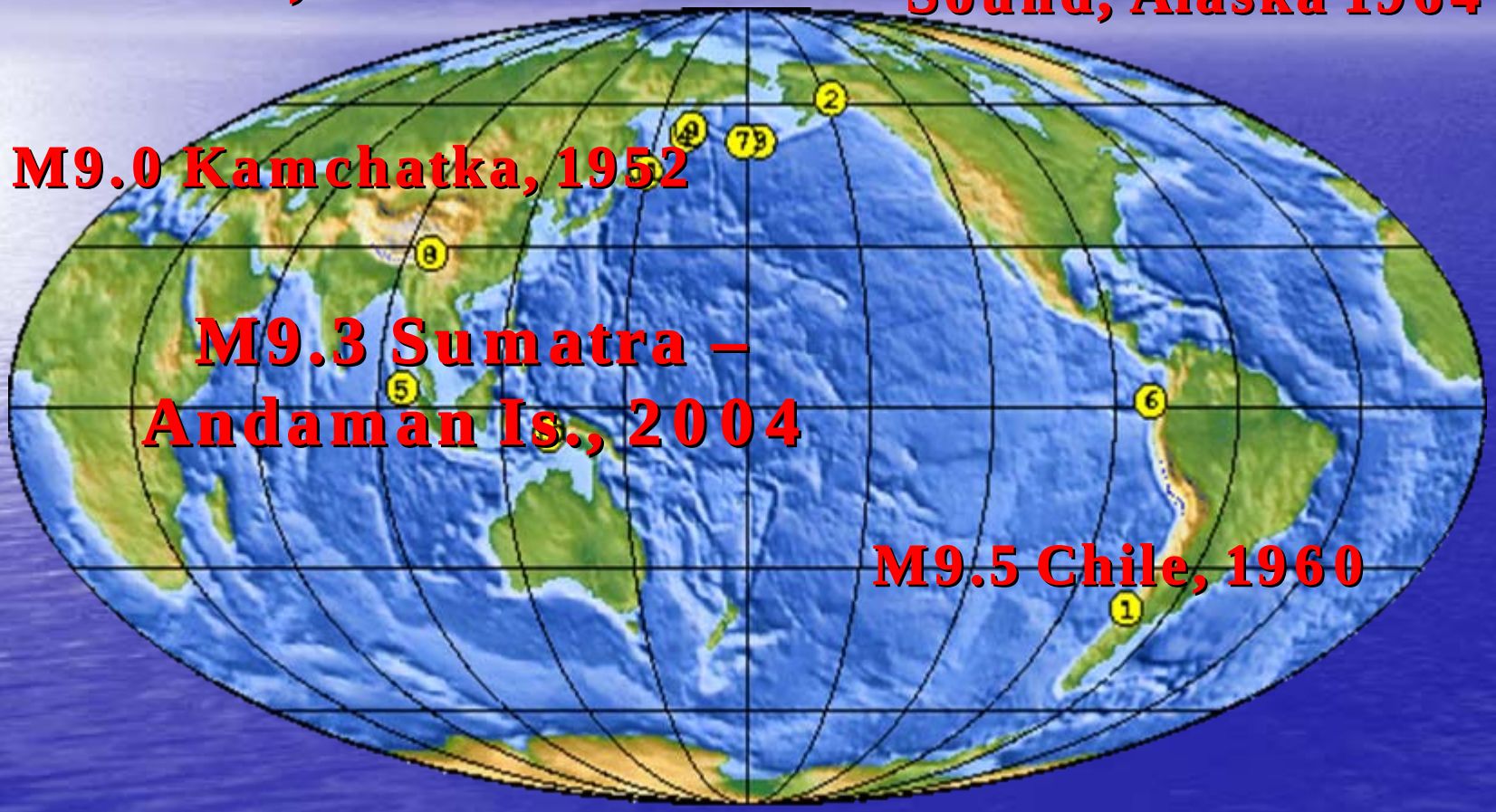
Tsunami Notification Procedures

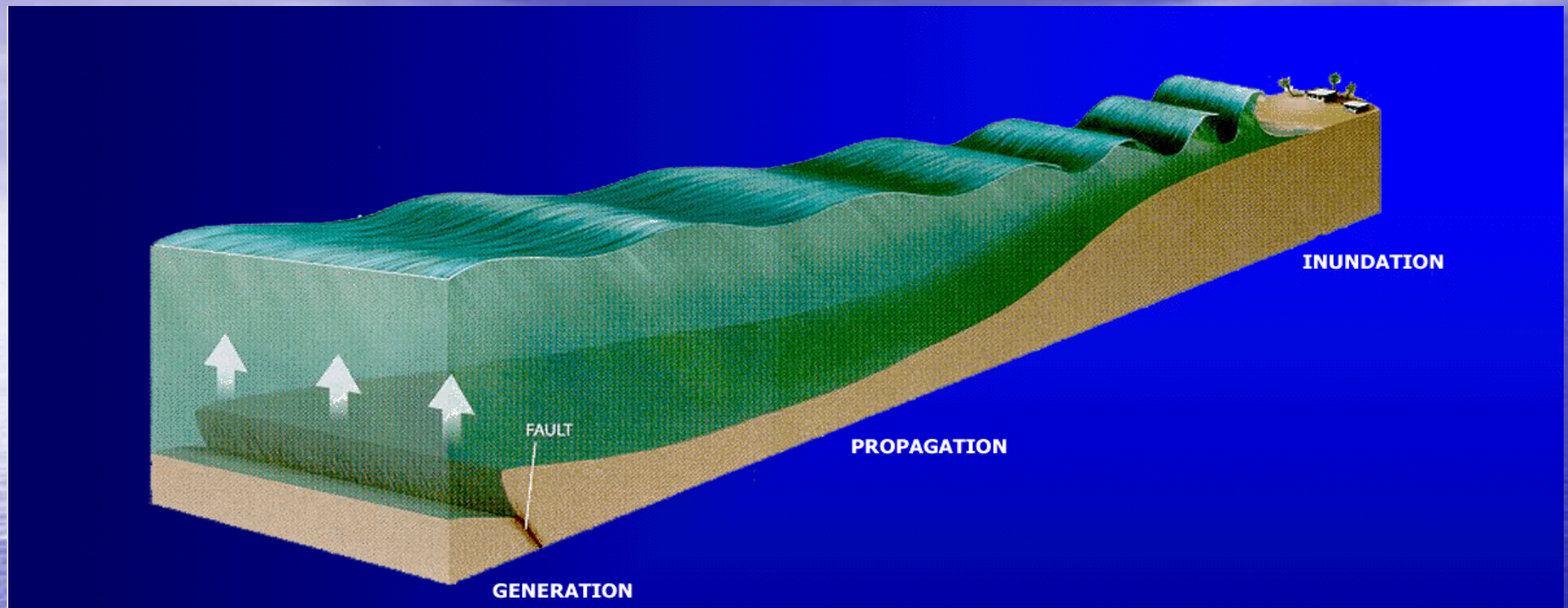
Brian Yanagi
Manager
International Tsunami Information Centre

Largest Earthquakes in the World Since 1900



USGS National Earthquake Information Center

Tsunami GENERATION



Three basic stages of tsunami behavior: generation, propagation and inundation

2 TSUNAMI THREATS

LOCAL / REGIONAL:

- ***Generated nearby***
- ***Strikes shore quickly (in minutes)***
  => NO TIME for official evacuation

➢ ***Education, Awareness***

➢ ***People-centered response – recognize / act immediately***

July 12, 1993,Japan Sea

DISTANT / OCEAN-WIDE:

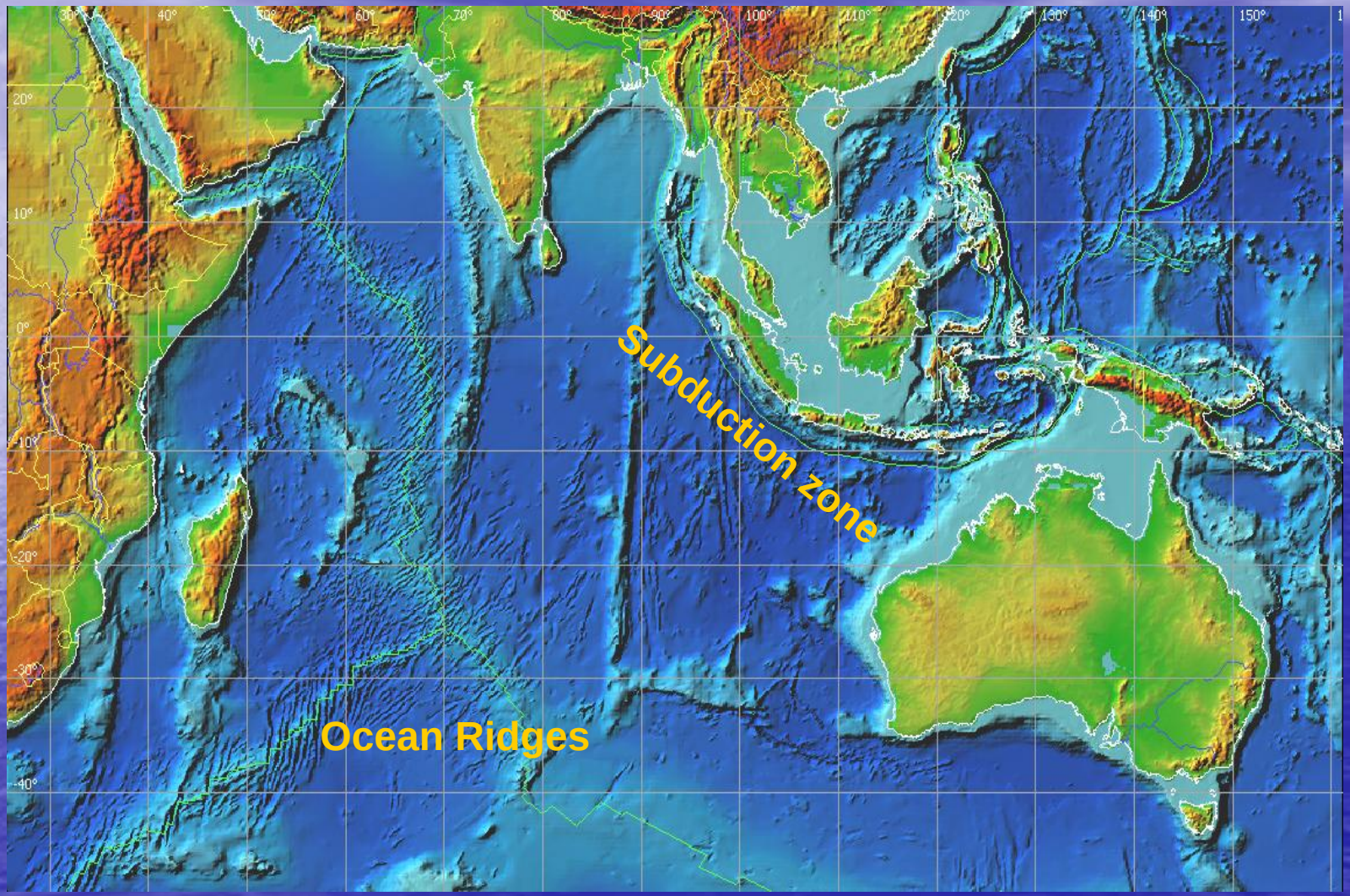
- ***Generated far away***
- ***Strikes shore later (2+ hours)***
  => TIME for official evacuation
- ***Widespread Damage***

➢ ***Tsunami Warning Center, then***

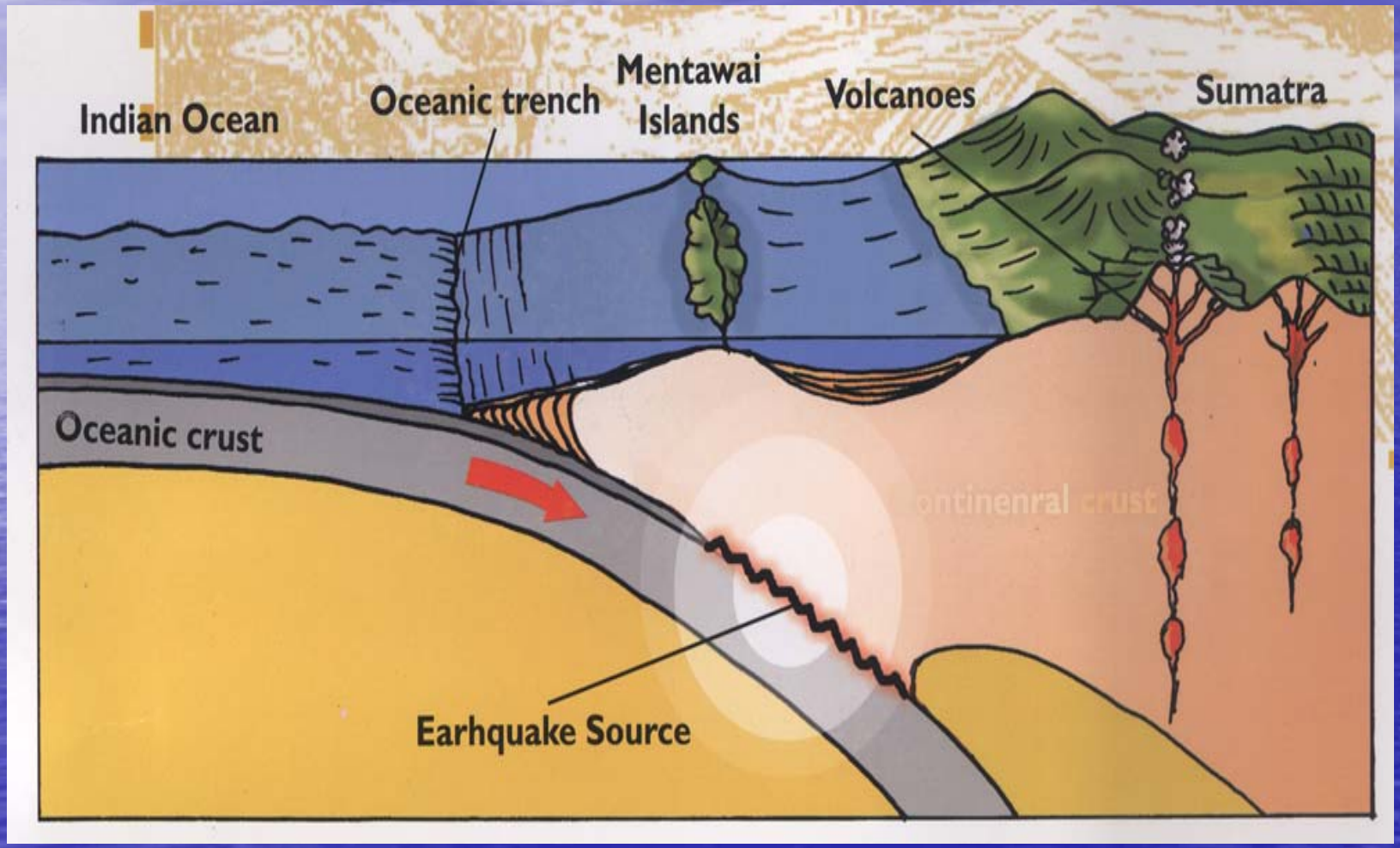
➢ ***People-centered response – locally-guided safety actions***

May 22, 1960, Chile tsunami in Hilo

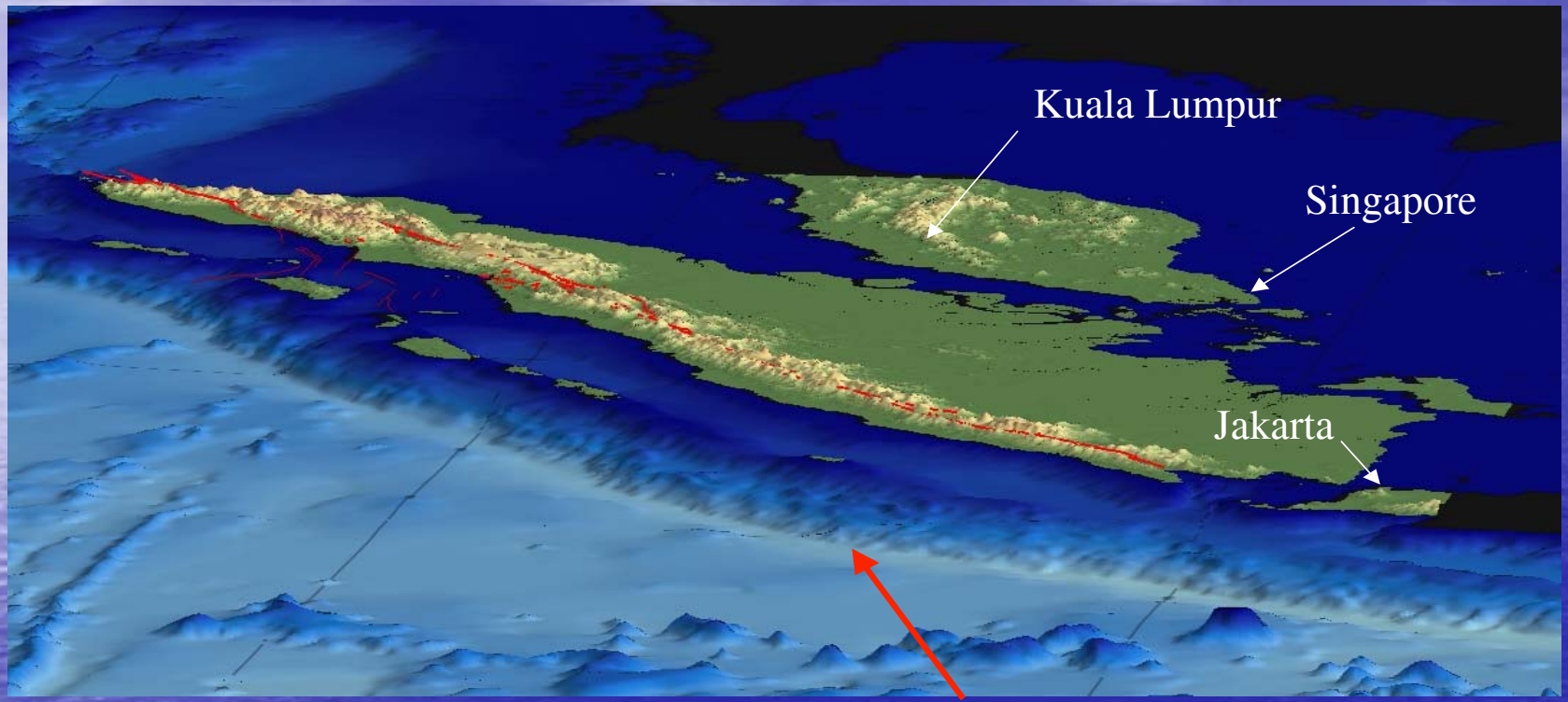
Indian Ocean Bathymetry



Sumatra Subduction Zone: Cross-Section



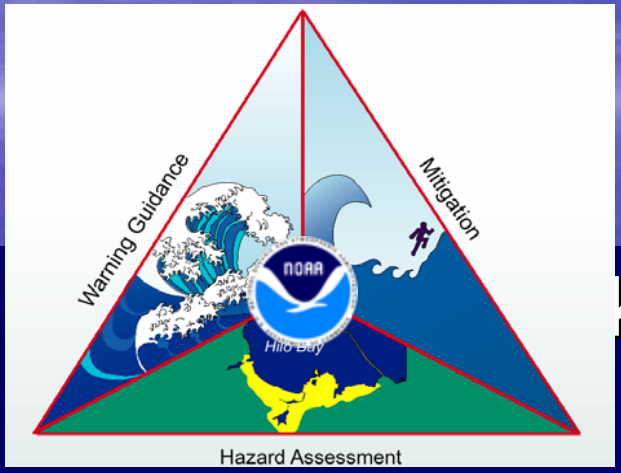
Sumatra Geological Model



TWS SYSTEM COMPONENTS

END-TO-END SYSTEM MUST EXIST!

Develop National and Regional Capacity to:



1. Assess **national tsunami (Hazard assessment)**
2. Establish **national / regional** warning center **against local and regional tsunamis (Warning guidance)**
3. Promote education/preparedness **and risk reduction against tsunami hazard (Mitigation and Public Awareness)**

Overview

- Emergency planners and managers, mostly at the local level, are responsible for developing response actions for different types of tsunami bulletins.
- Well executed procedures will ensure that warning messages are clearly and quickly communicated to the public.
- Strong understanding of the various types of tsunami bulletins ensures that Tsunami Warning Center information is directly linked to emergency response plans.

Interim Indian Ocean Tsunami Advisory System

- Since 2005, Pacific Tsunami Warning Center (PTWC) and Japan Meteorological Agency (JMA) have been monitoring earthquakes and coordinating the dissemination of Tsunami Bulletins to Indian Ocean countries.
- Tsunami Bulletins are transmitted to Indian Ocean country designated 7x24 Tsunami Focal Point contacts.

INDIAN OCEAN TSUNAMI BULLETIN

Earthquakes < 100 km depth

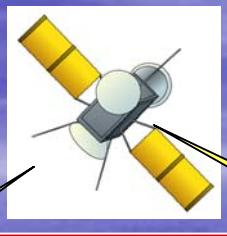
Mw less than 6.5 (Mw: Moment Magnitude)	Earthquake Message Only
Mw 6.5 to 7.0	Tsunami Information Bulletin
Mw 7.1 to 7.5	Local Tsunami Watch
Mw 7.6 to 7.8	Regional Tsunami Watch
Mw > 7.8	Ocean-wide Tsunami Watch

Overview

- Once a Tsunami Bulletin is issued, the message needs to reach people rapidly.
- Highly efficient notification and alert systems that use multiple communication channels ranging from the mass media; sirens; to police and citizen-based patrols have been developed by coastal communities exposed to earthquakes and tsunamis. Each community must decide how to develop its own evacuation system based on available technology, resources, and funding.
- For example, in Japan, earthquake information is immediately issued by JMA through the mass media, starting within 30 seconds of an earthquake. The media continues to broadcast updated reports.

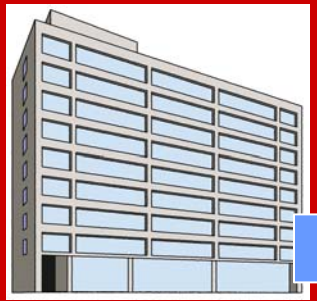
TSUNAMI Early Warning Overview

Earthquake
Tsunami



Tsunami Warning Center

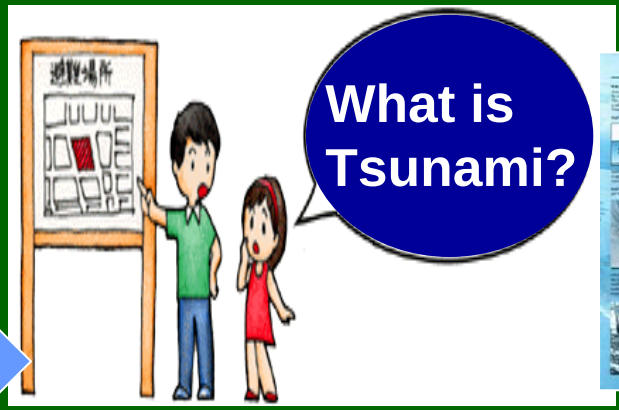
National Government → Local Government

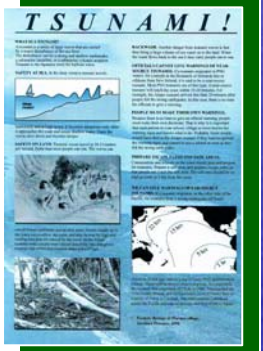


Mass Media

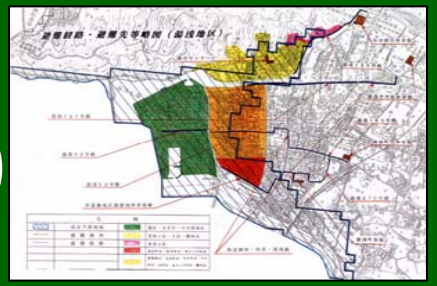
International - Regional Framework

National Warning System





Where is Evacuation Route?



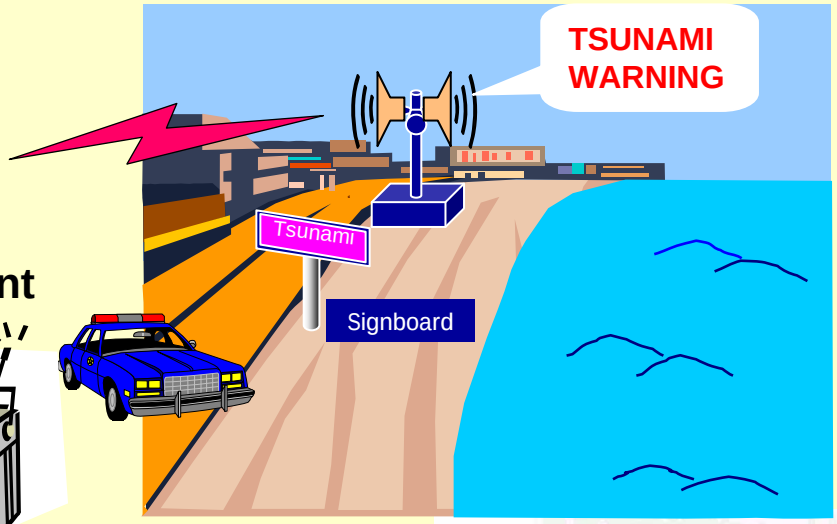
Public Awareness

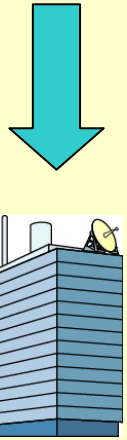
Cabinet Office Japan

Communication & Transmission of Tsunami Warning to Localities & Civil Defense Authorities

Central Government

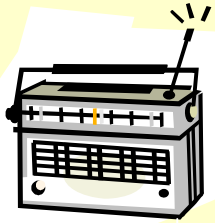
Local government





TV / Radio Station

TSUNAMI
WARNING



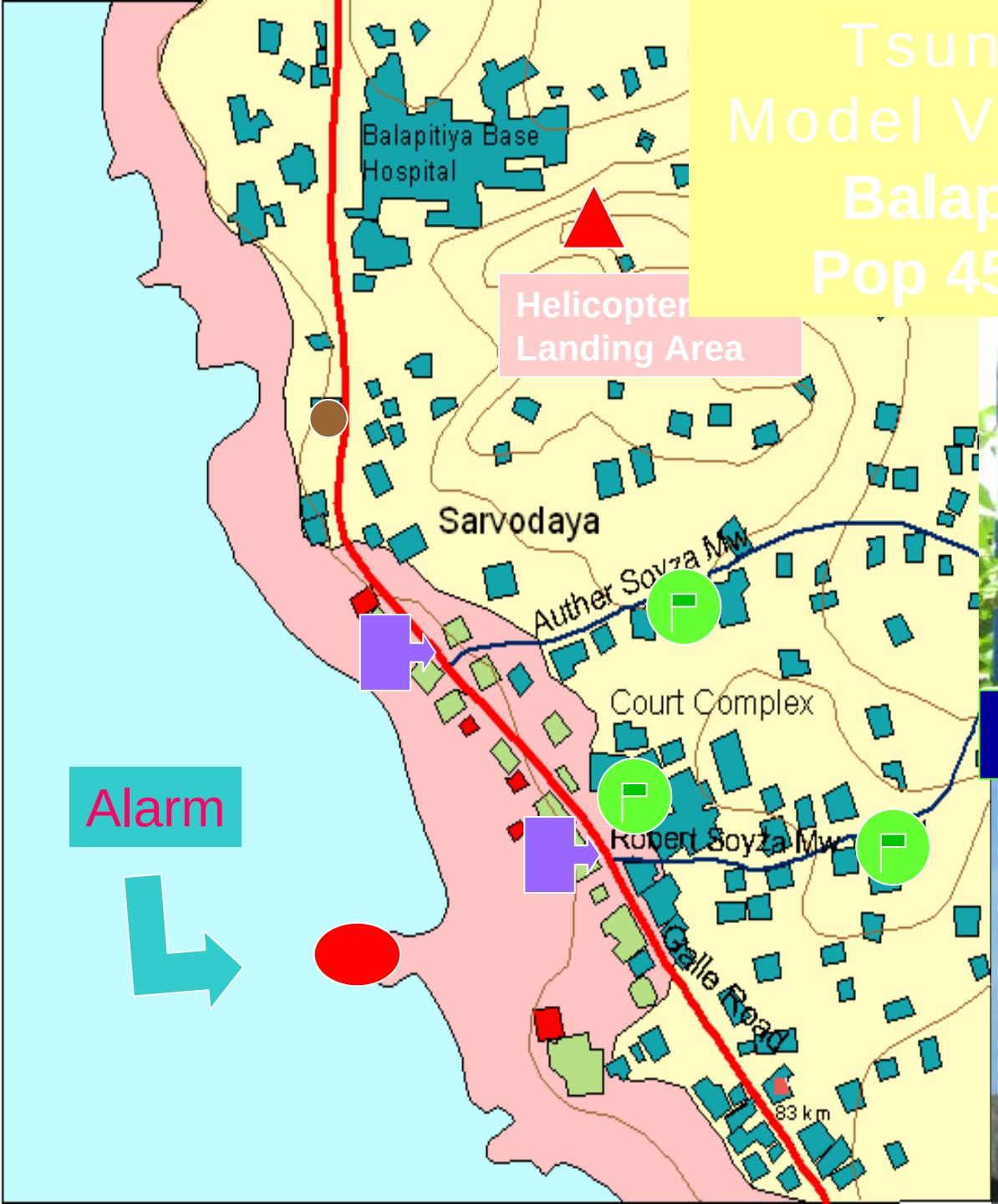
Radio

TV (Telops, Warning maps)

Tsunami-Prepared Model Village, April 2005

Balapitiya, Sri Lanka

Pop 450, Casualties 12



Rescue shelters

Evacuation routes

Disabled persons

State Evacuation Map
Shows routes for Safe Public Exit

**IF YOU FEEL THE GROUND SHAKE,
MOVE QUICKLY TO HIGHER GROUND
AND SAFETY!
DO NOT WAIT FOR AN OFFICIAL WARNING!**

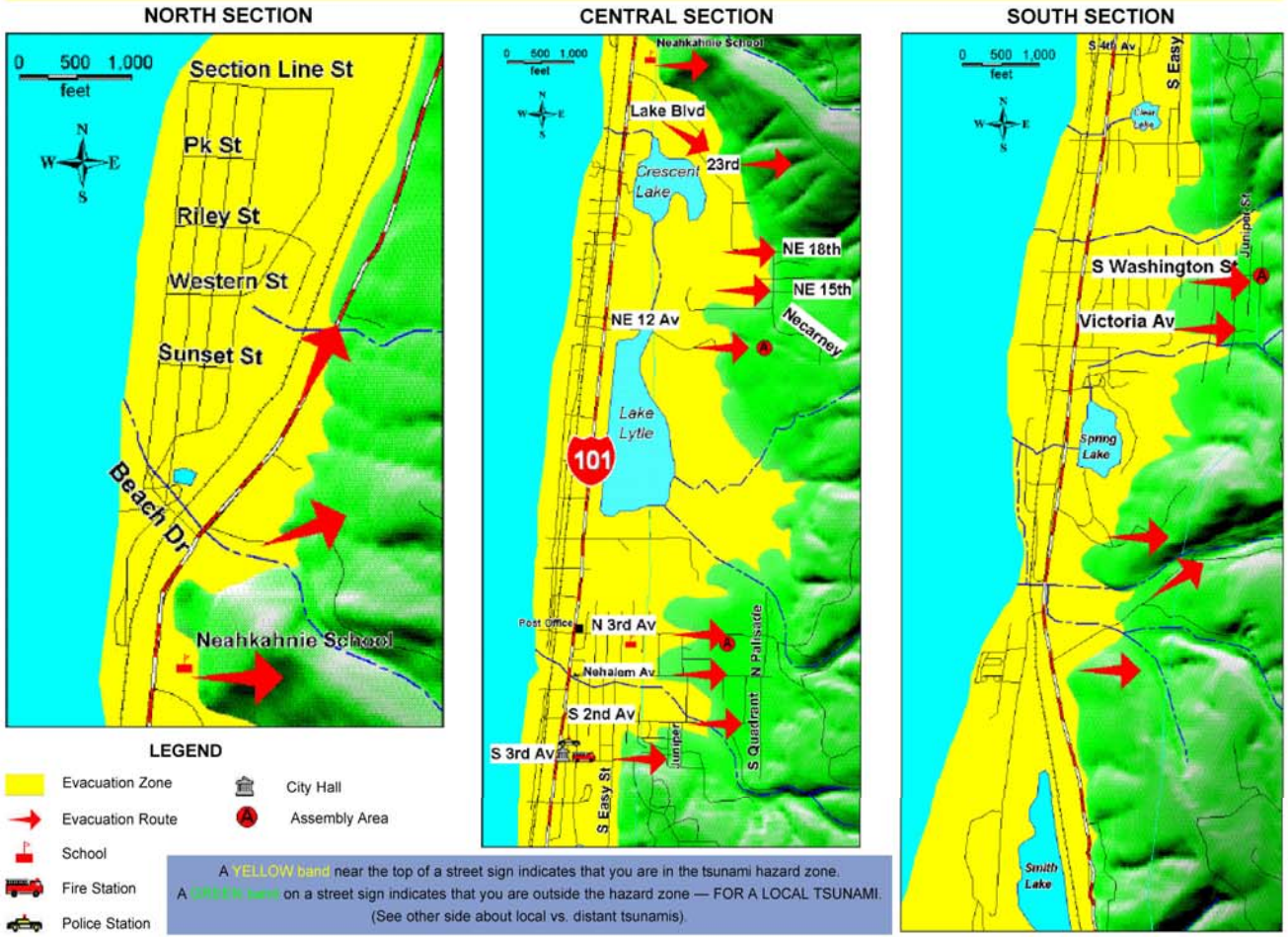
TSUNAMI EVACUATION ROUTE

NOTICE

The evacuation zone on this map was developed by the Oregon Department of Geology and Mineral Industries in consultation with local officials. It is intended to represent a worst-case scenario for a tsunami caused by an undersea earthquake near the Oregon coast. Evacuation routes were developed by local officials and reviewed by the Oregon Department of Emergency Management.

The Oregon Department of Geology and Mineral Industries is publishing this brochure because the information furthers the mission of the Department. The map is intended for emergency response and should not be used for site-specific planning.

Tsunami Evacuation Map
Rockaway Beach



Alerting the Public – How?

- Ultimately, the success of any tsunami early warning system will be measured by its ability to move people out of harms way.
- The key is to educate and communicate a warning message to every person on the coast to move inland to higher ground to escape the destructive waves.
- Sustainable communications are the foundation for early warning. Every community has different requirements and challenges. There is no single solution, but all solutions must work together.
- There are different communication methods available for alerting the public. Some require high levels of technology and communications infrastructure such as satellite broadcasts. Others use simple means such as bicycles and loudspeakers to communicate the alert.
- Special Case: Local Tsunamis. Public awareness and education (i.e. oral history and traditional knowledge)

Types of Notification Systems

- Use of Mass Media (Radio, Television)
- Siren Towers
- First Responders (i.e. Police, Fire, Lifeguards)
- Public Loudspeakers
- SMS Text Messaging – Telephone Companies
- Emergency Telephone Call Lists (public and private sectors)
- Amateur Radio – Amateur Radio Organizations
- Highway Electronic Signs
- People on Bicycles / Church Bells
- Military Resources / Helicopters and Aircraft
- US NOAA Weather Radio
- All Hazard Alert Broadcasting (AHAB) Radio
- RANET – *USAID / US National Weather Service*

Alert & Warning

Technology assists people-based warnings

- ***Getting warning to responders***
- ***Getting warning to public***
- ***Use drills and exercises for training***
- ***Conduct drills in the community***
- ***Test the notification systems***

When can the Public Return? "All Clear"

- Once the public has evacuated a coastline, local public officials must also inform everyone when it is safe to return by broadcasting an "All Clear."
- If a coastal area has received little or no damage, a tsunami "All Clear" can be broadcast after a Final Tsunami Bulletin has been issued.
- However, if an area has been severely damaged by a tsunami, it can be many hours or days before a community is allowed back to the coastlines. Debris make the roads impassable, gas and electric lines may be down, and search and rescue operations may be carried out.

SOCIAL SCIENCE PERPSECTIVES: FROM AWARENESS TO PREPAREDNESS COMMUNITY EMPOWERMENT

Level of preparation and readiness to act sensitive to several psychological variables:

- ***Perceived responsibility – Am I at risk?***
- ***Response efficiency – Do I know how to act?***
- ***Sense of community – Disaster Planning?***
- ***Next Tsunami – Memories fade between events.***

IGNS