



# U.S. Tsunami Warning System

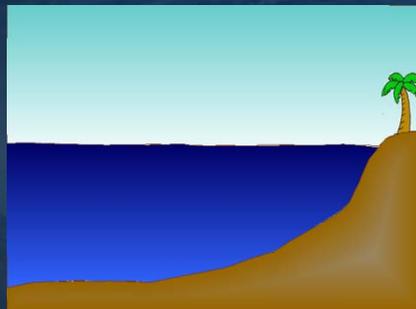
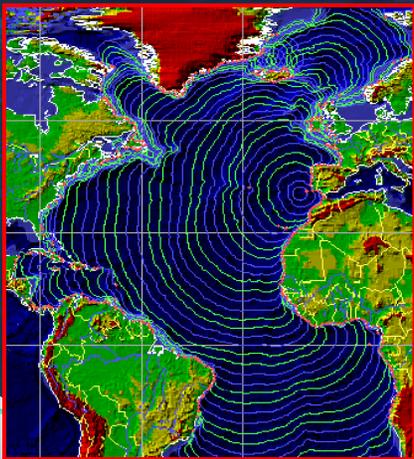
**Jenifer Rhoades**  
**NWS Tsunami Program Manager**  
**March 21, 2011**

# Overview

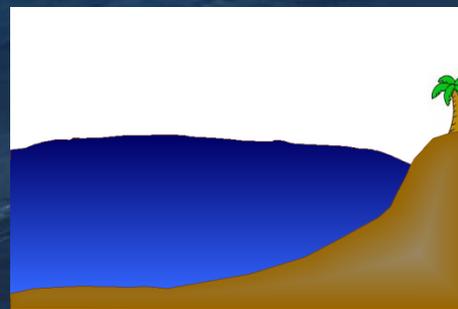
- What is a Tsunami?
- NOAA's Tsunami Program
- Japan Tsunami Time-Line

# What Is A Tsunami?

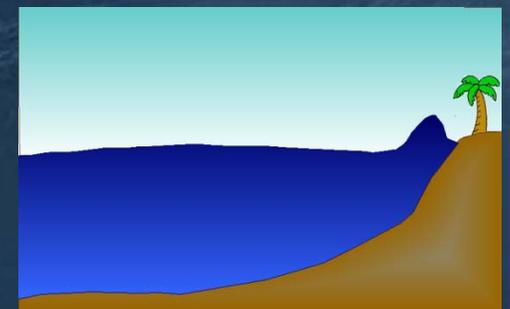
- Series of ocean waves generated by earthquakes, landslides, or volcanic activity
- In deep ocean, a tsunami moves at up to 600 mph and may only be a few inches high
- At coasts, water and energy are focused into potentially powerful waves
- Tsunamis can travel large transoceanic distances



Quiet



Tsunami at Sea

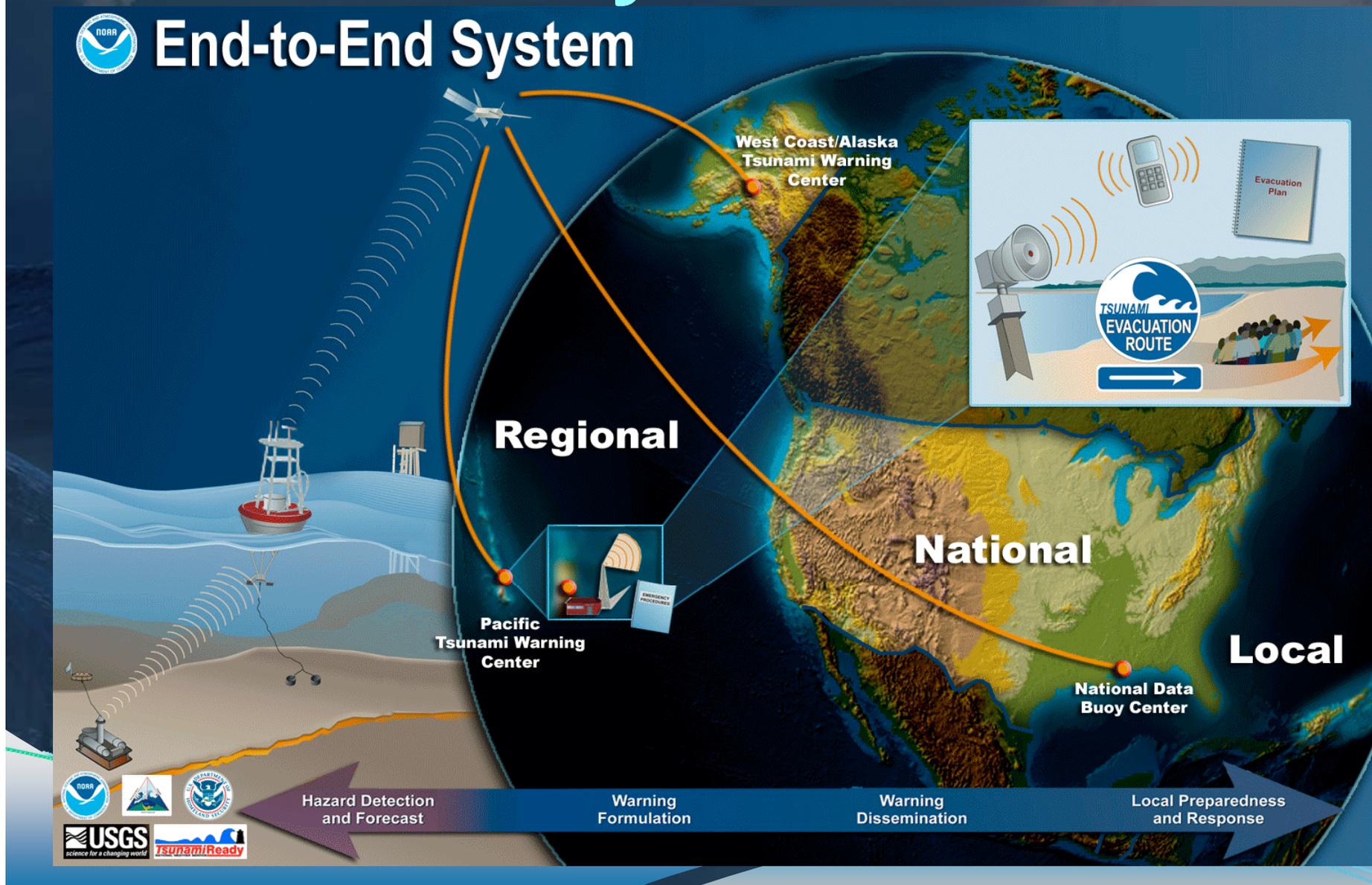


Tsunami Approaching  
Shoreline

# U.S. Tsunami Warning System

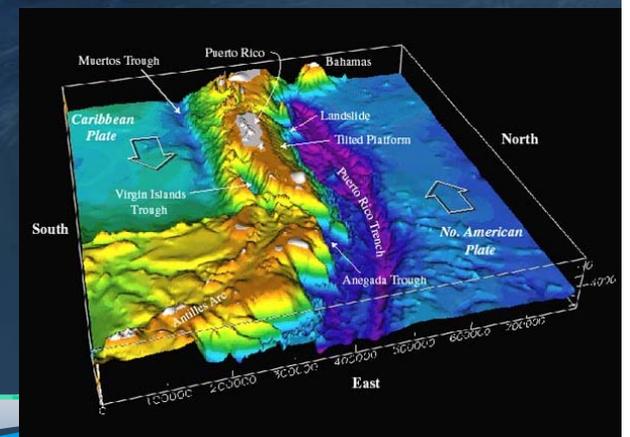


## End-to-End System



# NOAA's Warning System

- 24/7 Tsunami Warning Centers
- Detection and Evaluation of Earthquakes
  - *Seismic Networks*
- Detection and Evaluation of Tsunami Waves
  - *39 DART Stations (Atlantic, Caribbean, & Pacific)*
  - *164 Water-level Stations*
- Forecasting the Tsunami Threat
  - *Modeling*
- Product Generation and Dissemination
  - *Warnings, Watches, Advisories and Bulletins*



# NOAA's Tsunami Outreach and Education

## ● TsunamiReady Program

- Improves community awareness, preparation, and education
- Strengthens local Emergency Operations
- 83 local communities in U.S.

## ● National Tsunami Hazard Mitigation Program

- Partnership among Federal and State Agencies
- Enhance National Tsunami Outreach and Education Efforts
- Promotes a Culture of Tsunami Preparedness and Response

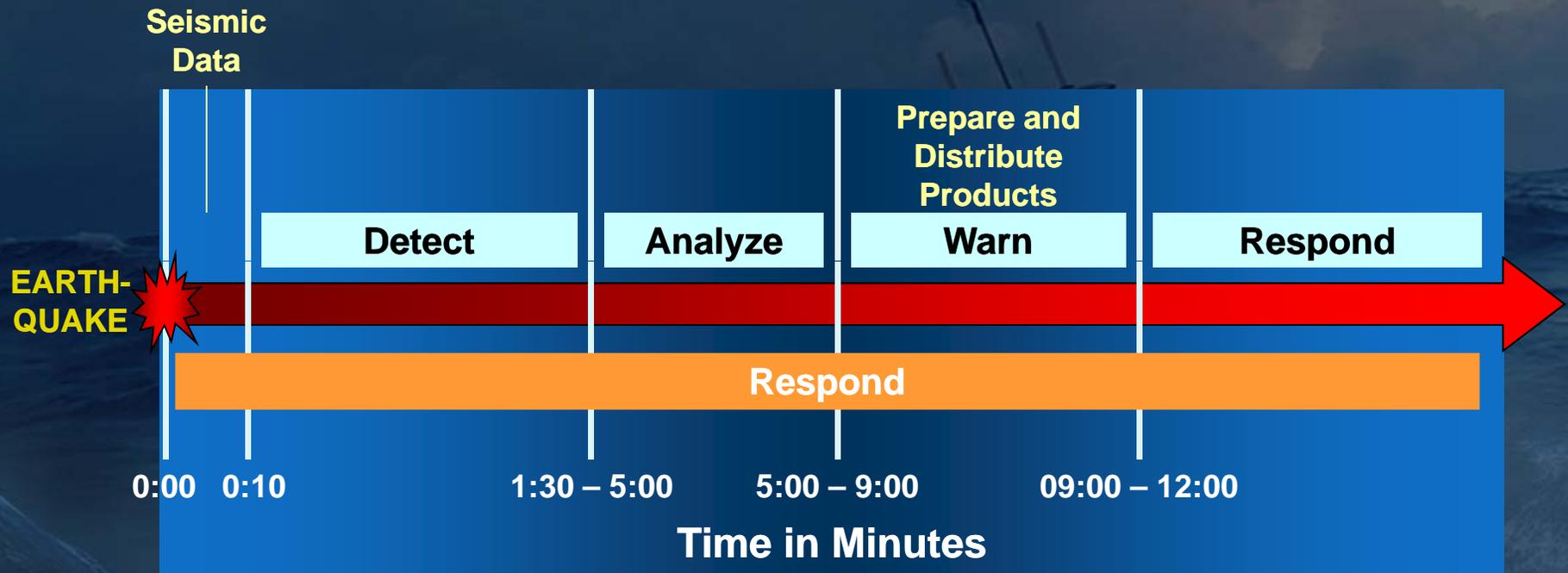
## ● Outreach activities for public and partners

- Through the media
- Community Presentations
- Brochures and Websites

**Outreach** and **Education** of tsunami threat are key for residents to safely respond to Tsunami Events

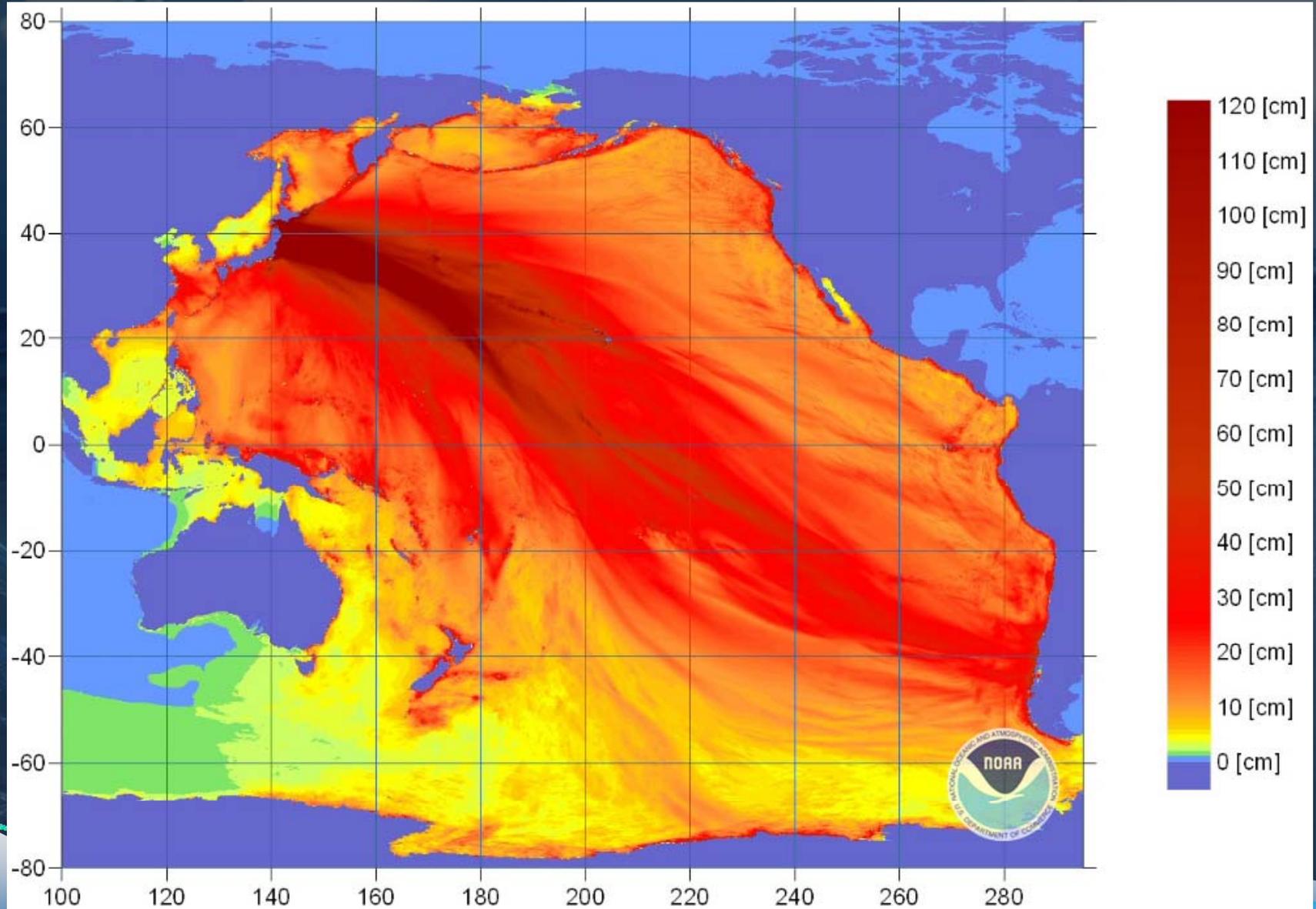


# Tsunami Response for 11 March 2011 Japan Tsunami

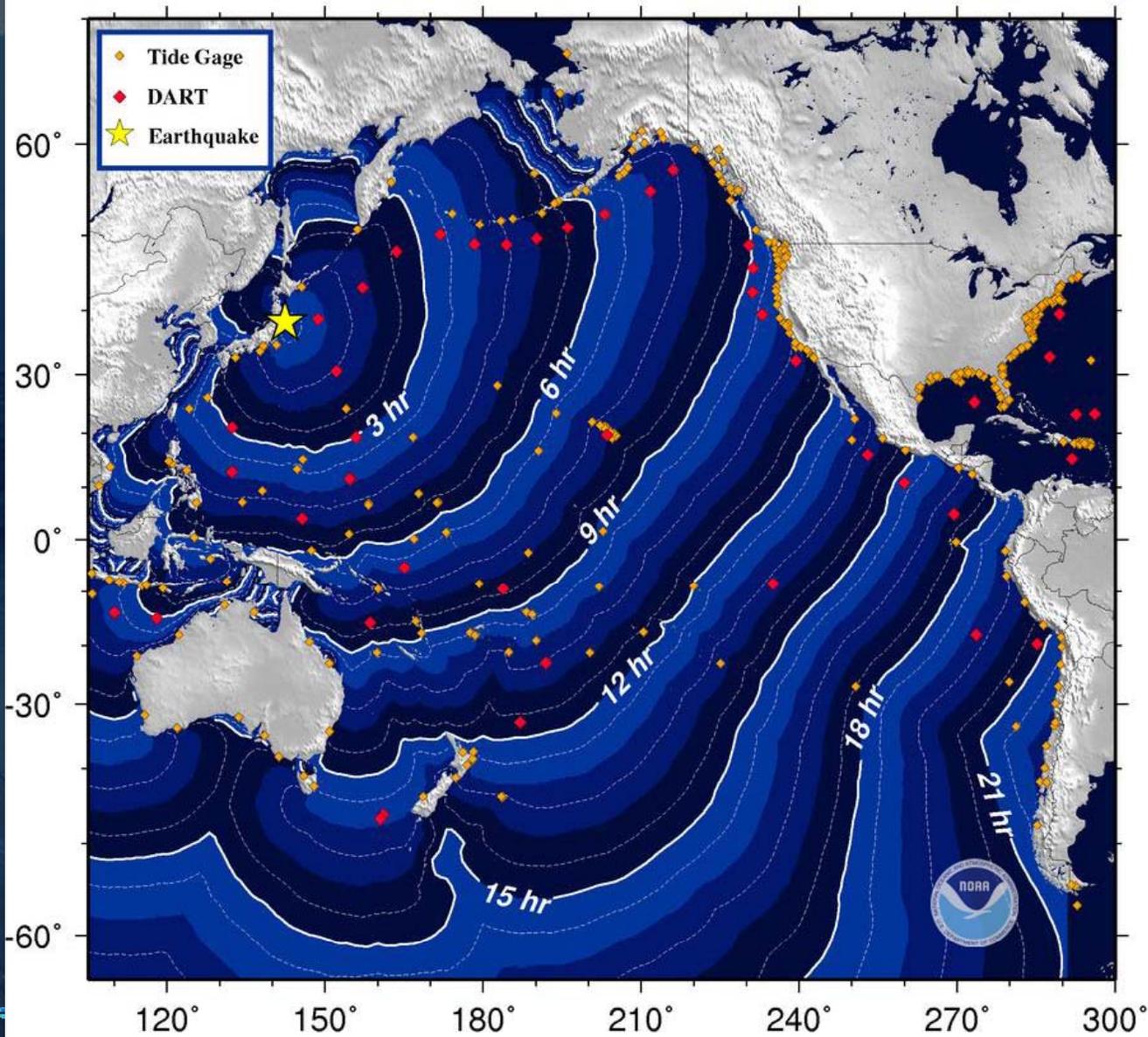


Note: DART Data was received approximately 45 minutes after the earthquake.

# Japan Tsunami

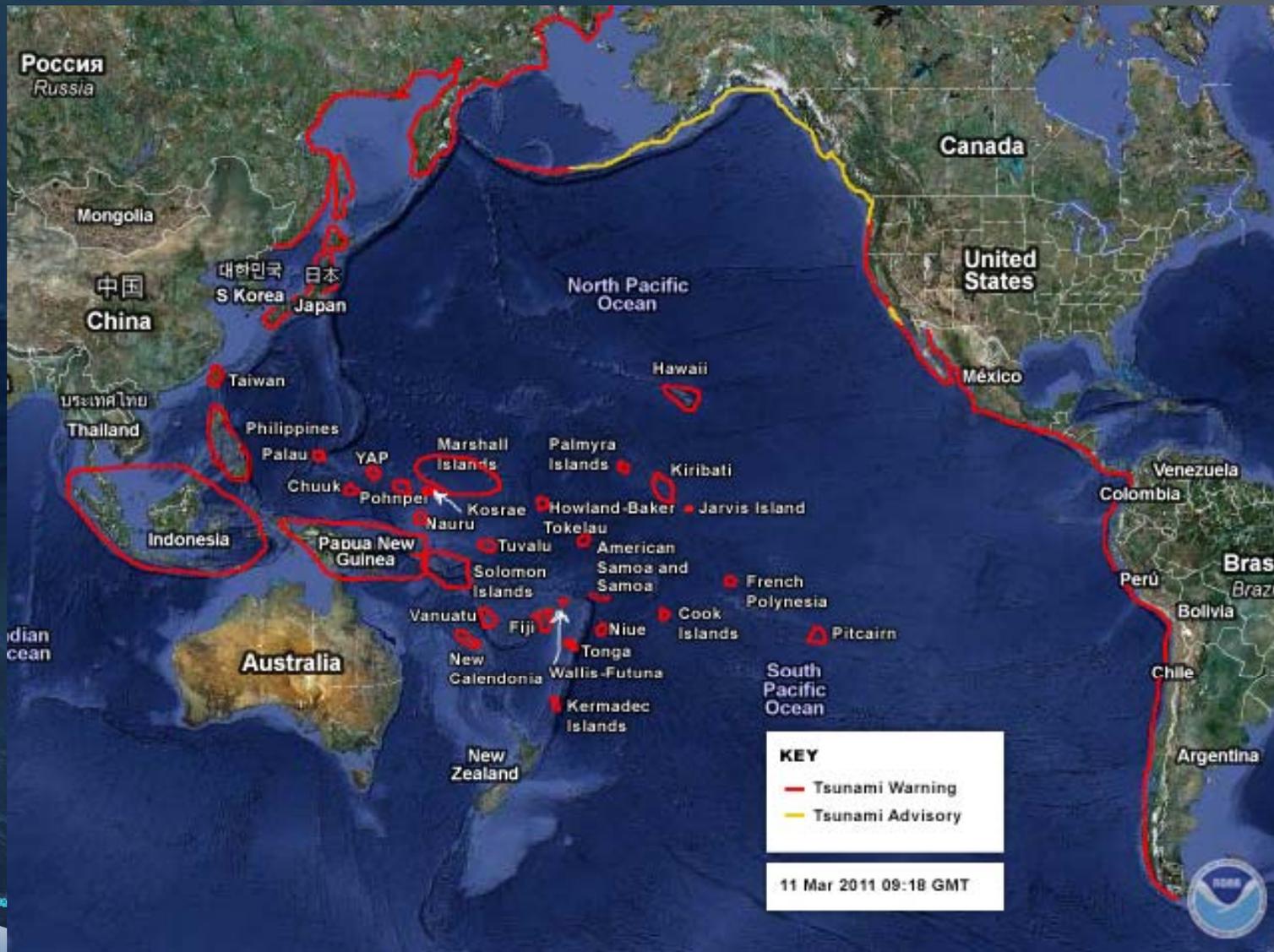


# Japan Tsunami Travel Times



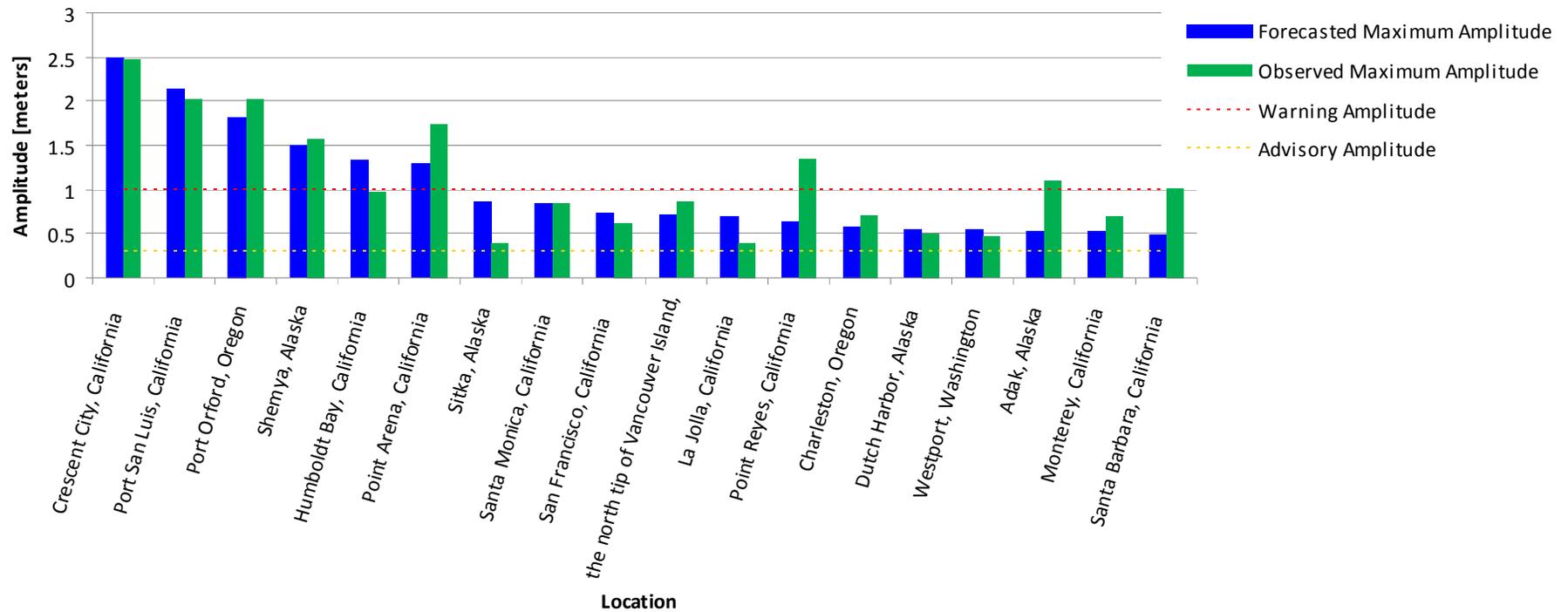
# NOAA's Tsunami Warning and Advisory Areas for Japan Tsunami

03/11/2011 - 04:18am EST



# Japan Tsunami Forecast and Observed Wave Heights

**Maximum Tsunami Amplitudes  
March 11, 2011 - Honshu, Japan**



A photograph of a boat named 'TSUNAMI' on a dark, stormy sea. The boat is a small, dark-colored vessel with a complex superstructure, possibly a research or survey boat. The sea is dark blue with white-capped waves. The sky is dark and cloudy. The text 'THANK YOU!' is overlaid in a light blue, serif font in the center of the image.

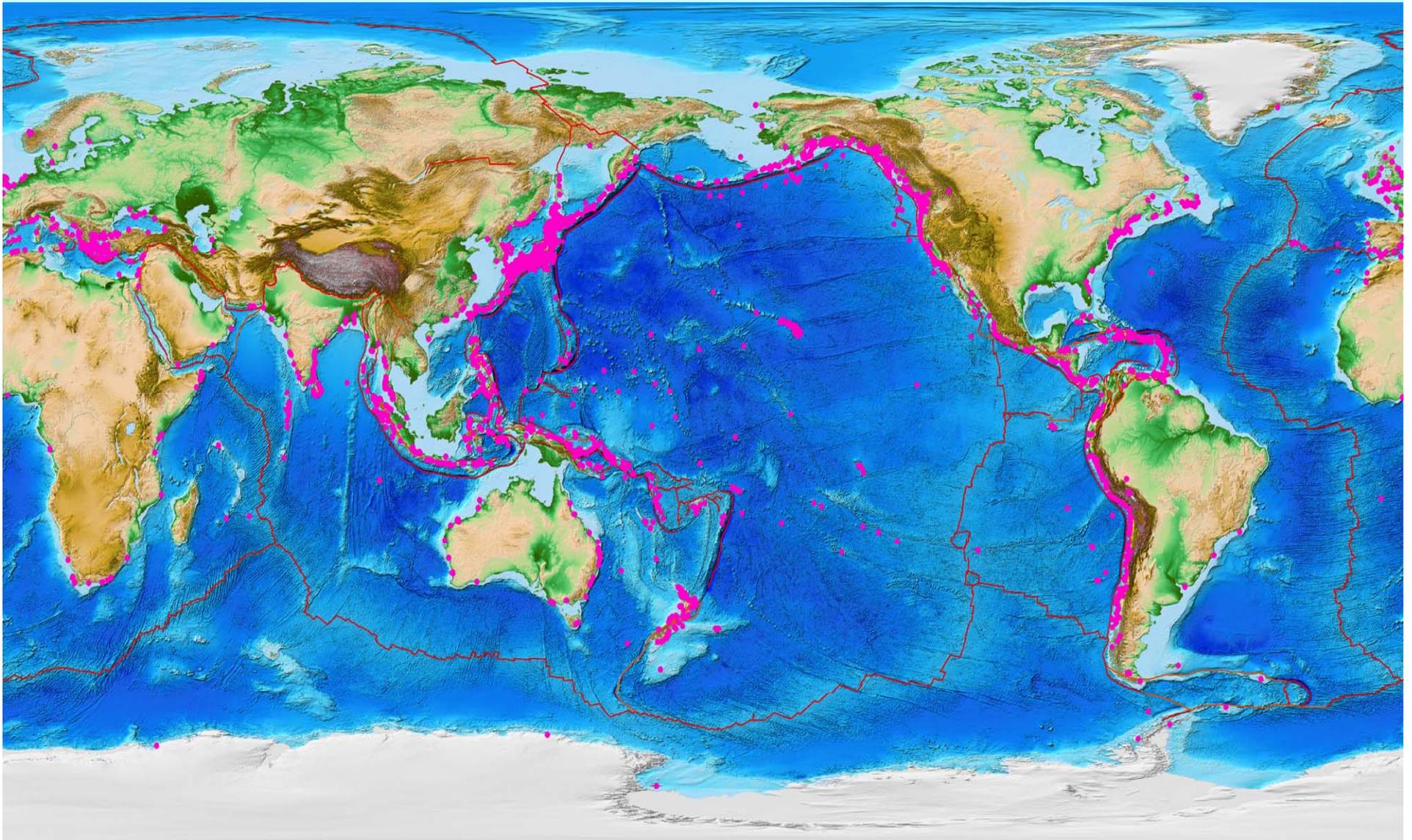
THANK YOU!

# Japan Tsunami Time Line

TIME (Eastern)	Japan Earthquake and Tsunami
12:46am 03/11/2011	9.0 Magnitude Earthquake just off the coast of Japan
12:55 am	NOAA Pacific Tsunami Warning Center (PTWC) issues Tsunami Warning for Japan, Russia Marcus Island, and Northern Marianas Islands and a Tsunami Watch for Hawaii, Guam, Wake Island, Midway Island, the Marshall Islands, Taiwan, the Philippines, and other countries in the far western Pacific Ocean north of Australia.
12:58am	NOAA West Coast/Alaska Tsunami Warning Center (WC/ATWC) issues Tsunami Information Statement (assessing potential tsunami threat) for Alaska, British Columbia, Washington, Oregon and California.
1:46 am	NOAA WC/ATWC issues Tsunami Advisory issues for Aleutian Islands and a Tsunami Watch for the rest of Alaska, British Columbia, Washington, Oregon and California.
2:30 am	NOAA PTWC expands the Tsunami Warning to include Hawaii and most other Pacific Nations.
4:18 am	NOAA WC/ATWC Tsunami Watch to a Warning for California north of Pt. Concepcion, and the Western Aleutian Islands. The rest of Alaska, Washington, Alaska and BC were placed in an Advisory.
8:14 am	First wave arrives in Honolulu, HI
10:37 am	First wave arrives in Crescent City, CA
11:10 am 03/12/2011	Final Advisory was canceled.

# Global Tsunami Threat

**NOAA Focus Areas: Alaska, Hawaii, U.S. West Coast and the Caribbean**



The most common causes of tsunamis are underwater landslides and earthquakes. Here's how an underwater earthquake can cause a tsunami:

- 1 An underwater earthquake occurs when a plate shifts abruptly and pushes water upward with tremendous force.
- 2 Low and fast waves are generated in all directions across the ocean, some speeding as fast as 600 m.p.h.
- 3 As waves enter shallower water, they are compressed, their speed slows, and they build in height.
- 4 The wave height increases and associated currents intensify becoming a threat to life and property.

