

Learning from the Past to Protect the Future Tsunamis



Lori Dengler, Humboldt State University April 11, 2012

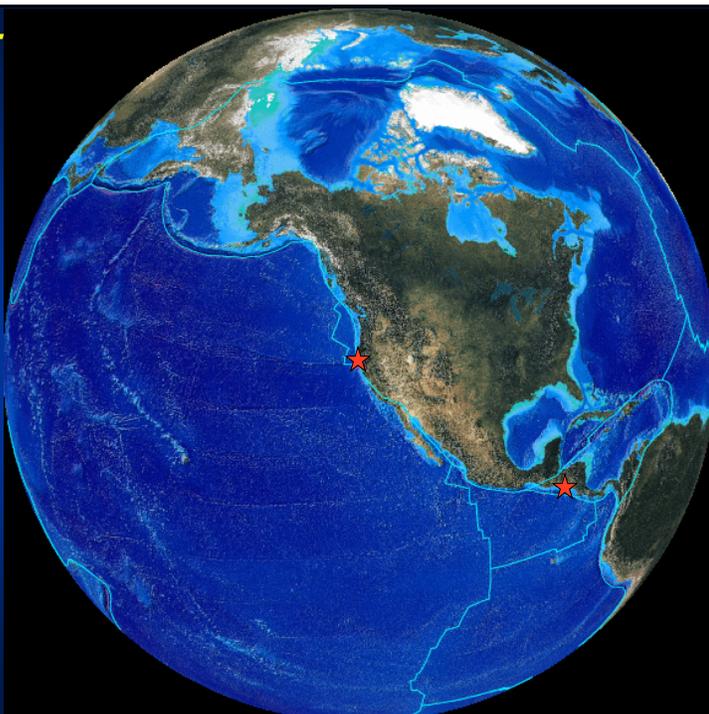


EERI ANNUAL MEETING

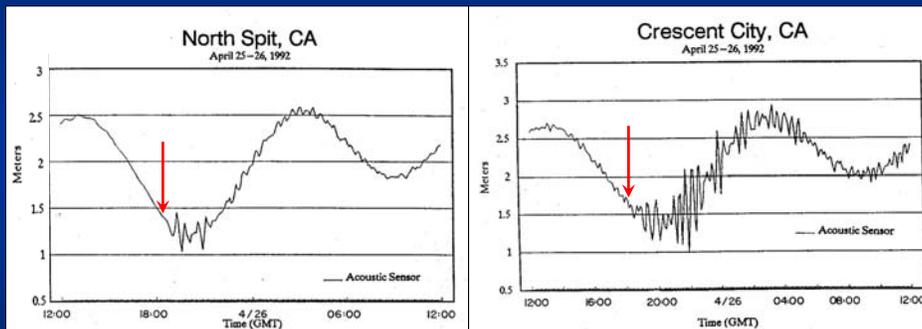
&

NATIONAL EARTHQUAKE CONFERENCE

1992:

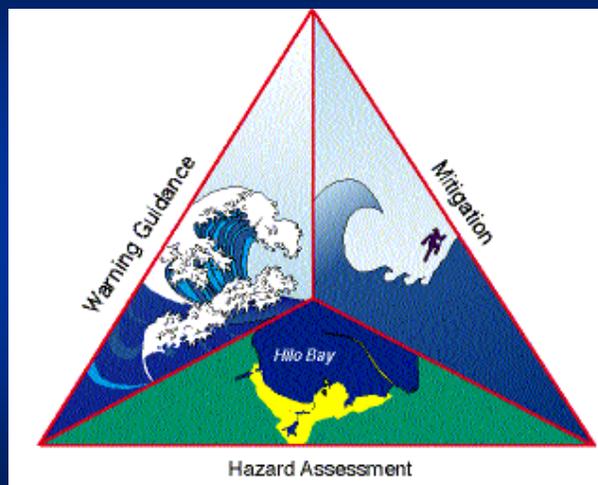


1992 M 7.2 Cape Mendocino Earthquake

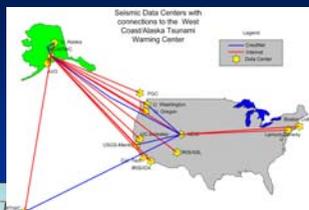


Height - 1meter; Deaths - 0; # Dart buoys - 0 ; # runups measured

1996: National Tsunami Hazard Mitigation Program



Warning Guidance

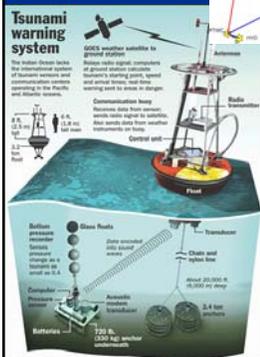


Scientific Data Centers with connections to the West Coast/Norfolk Tsunami Warning Center

Mitigation



Tsunami Evacuation Zone
Humboldt Bay Region



Tsunami warning system

The Indian Ocean lacks an operational system of buoys, pressure sensors, and communication centers operating in the Pacific and Atlantic oceans.

GOES weather satellite to provide data

Radios receive signal components of ground motion, including location of moving ground, speed and arrival timing, local tsunami warning level to issue to mariners and coastal areas.

Communication buoy

Receives data from satellite, transmits data from buoy to shore-based equipment on land.

Radio transmitter

Transmits data from buoy to satellite, then sends data from satellite to shore-based equipment on land.

Chain and cable line

About 20,000 ft, 25,000 ft deep

3.4 km

Pressure sensor

Pressure sensor

Computer

Batteries

700 ft, 200 ft, 100 ft



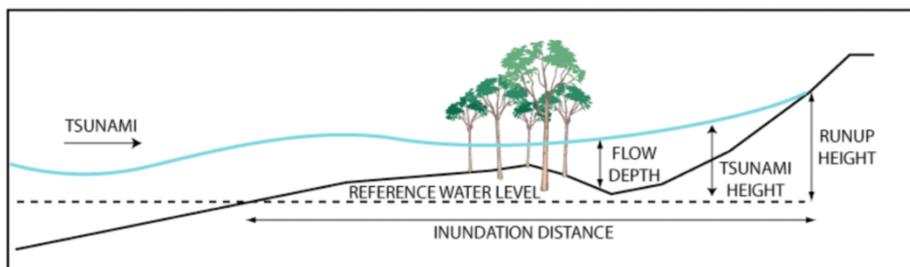
Hazard Assessment

1992 M 7.2 Nicaragua Earthquake

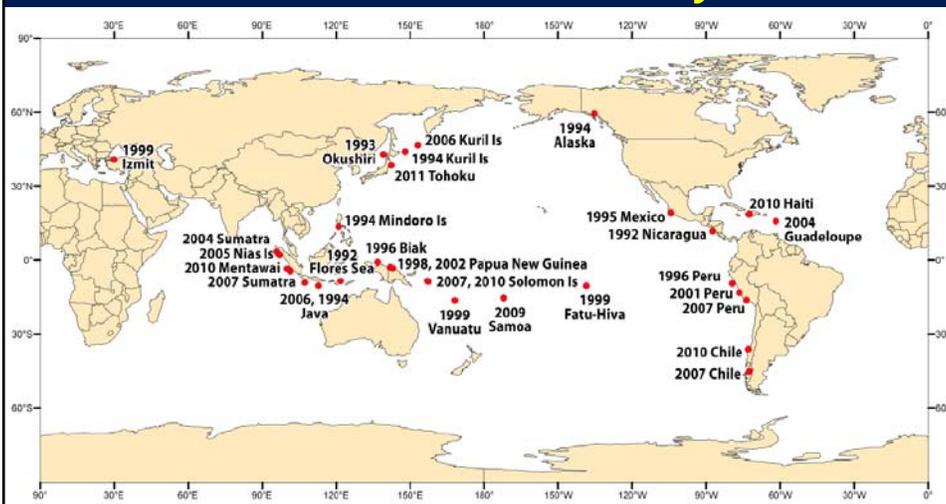


Height – 9.9m; Deaths – 170; # Dart buoys - 0 ; # runups measure

First International Tsunami Survey Team

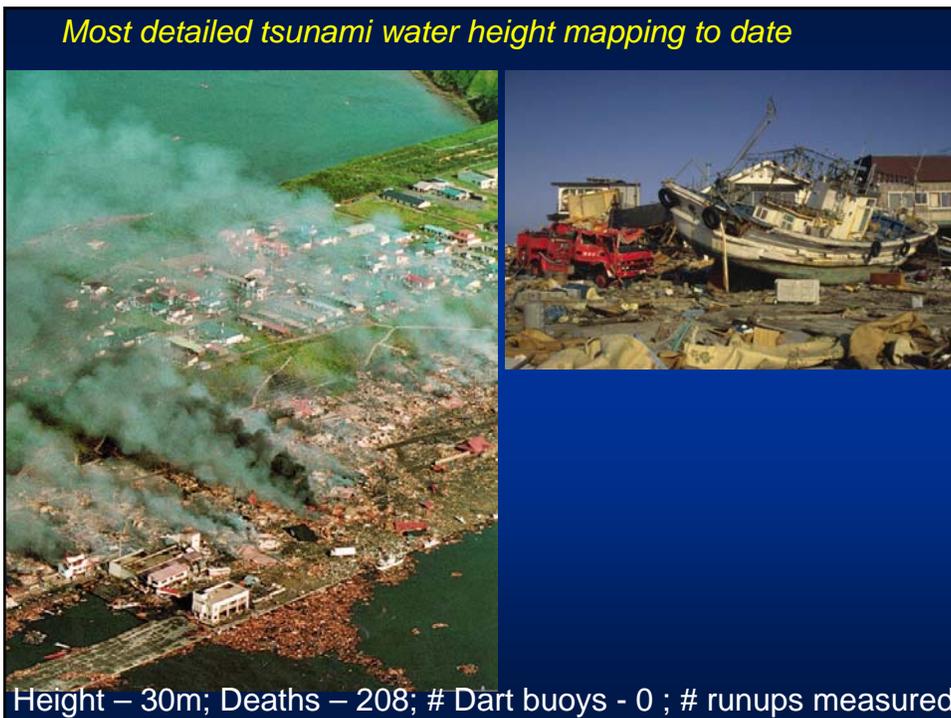
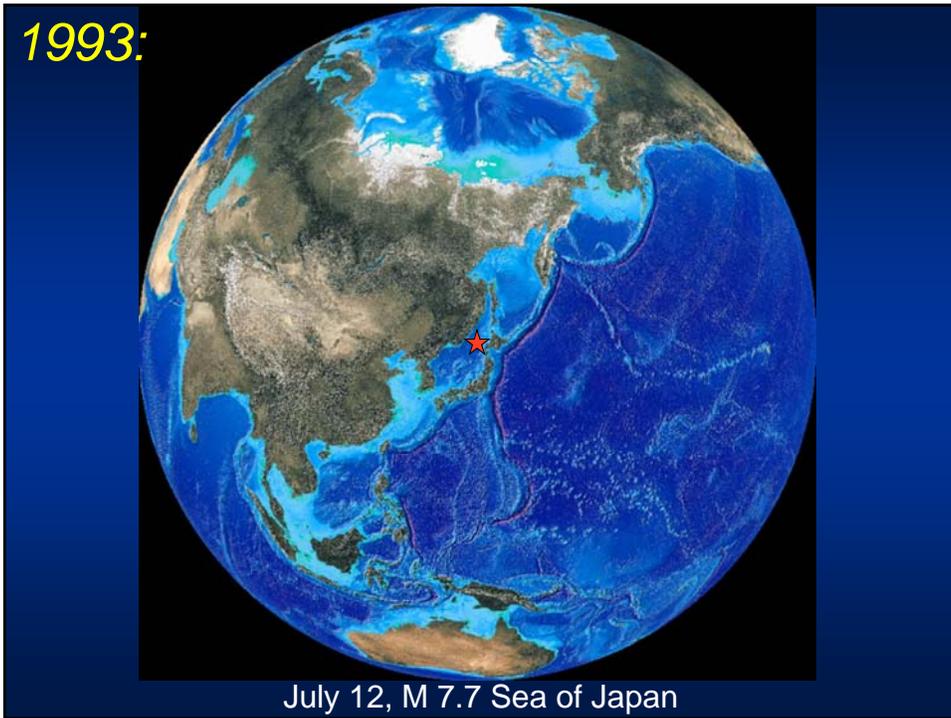


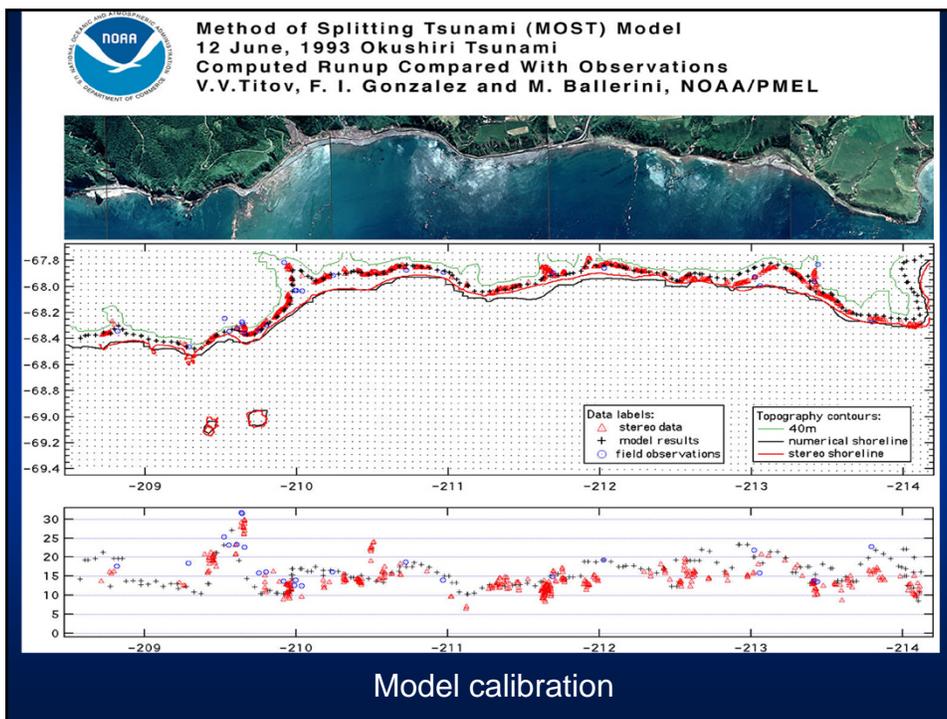
International Tsunami Survey Teams



Number of water level measurements:
 1992 Nicaragua – 36
 2011 Tohoku - ~6000

Figure P. Dunbar, NGDC

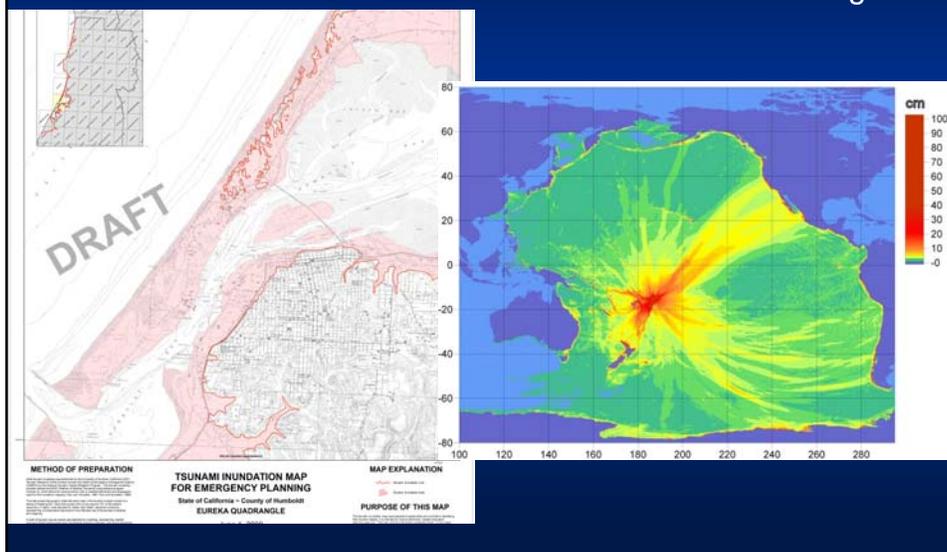




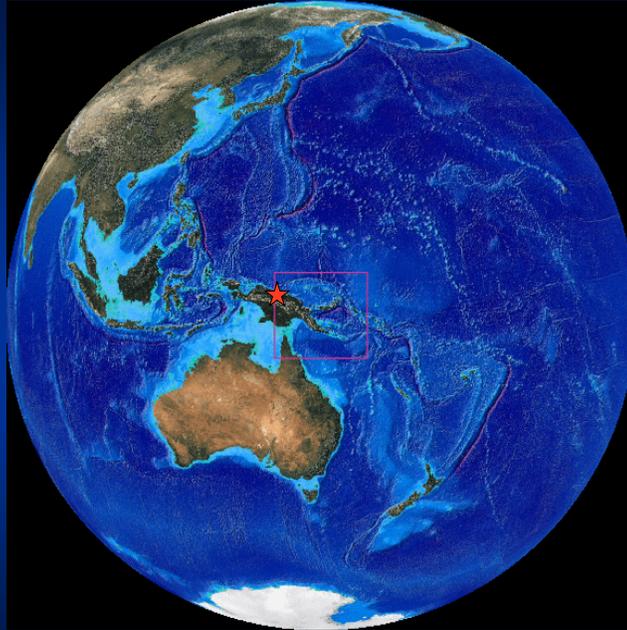
Model Confidence:

Hazard mapping

Forecast modeling



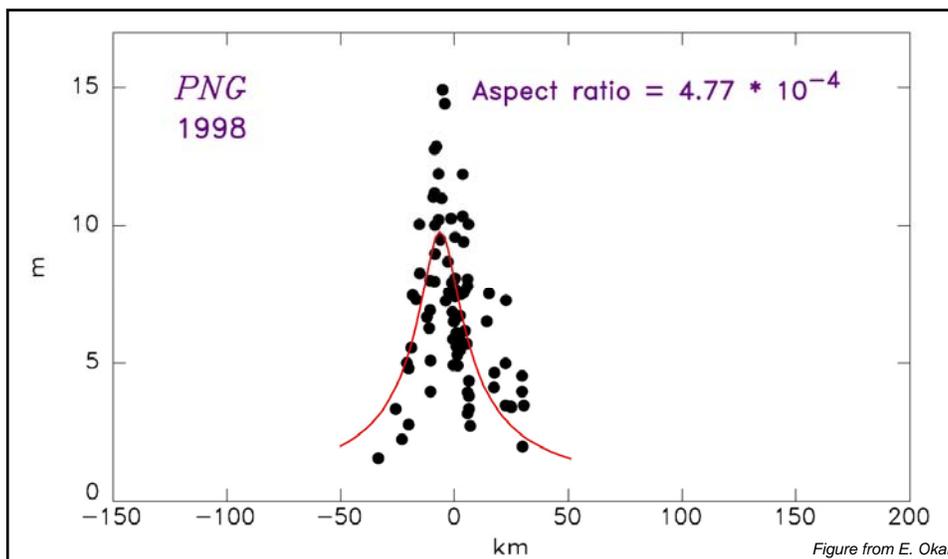
1998:



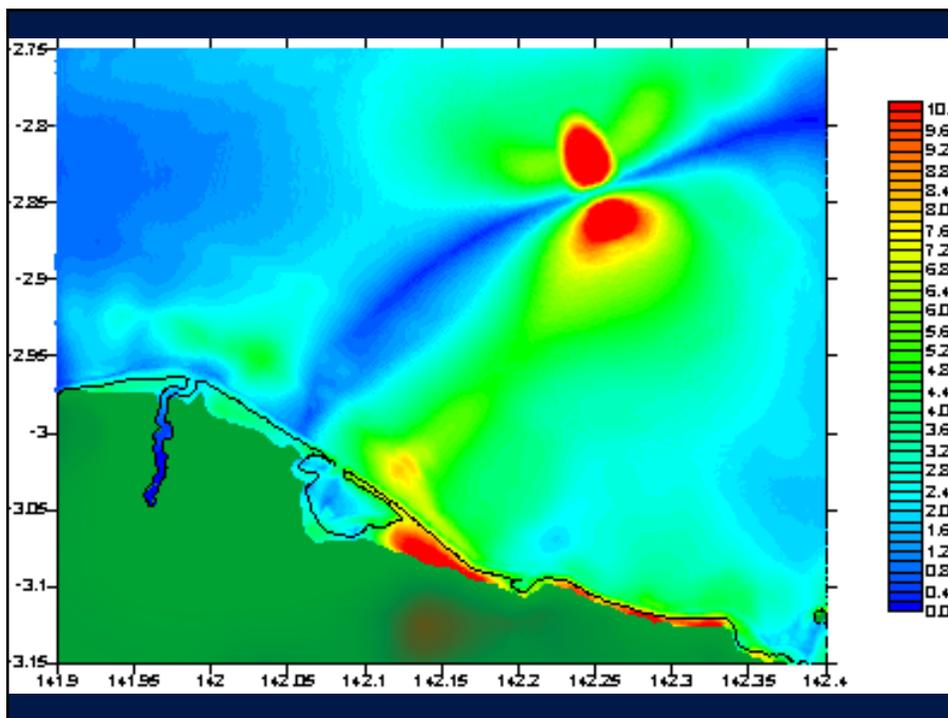
July 17, M 7.1 Sissano, Papua New Guinea

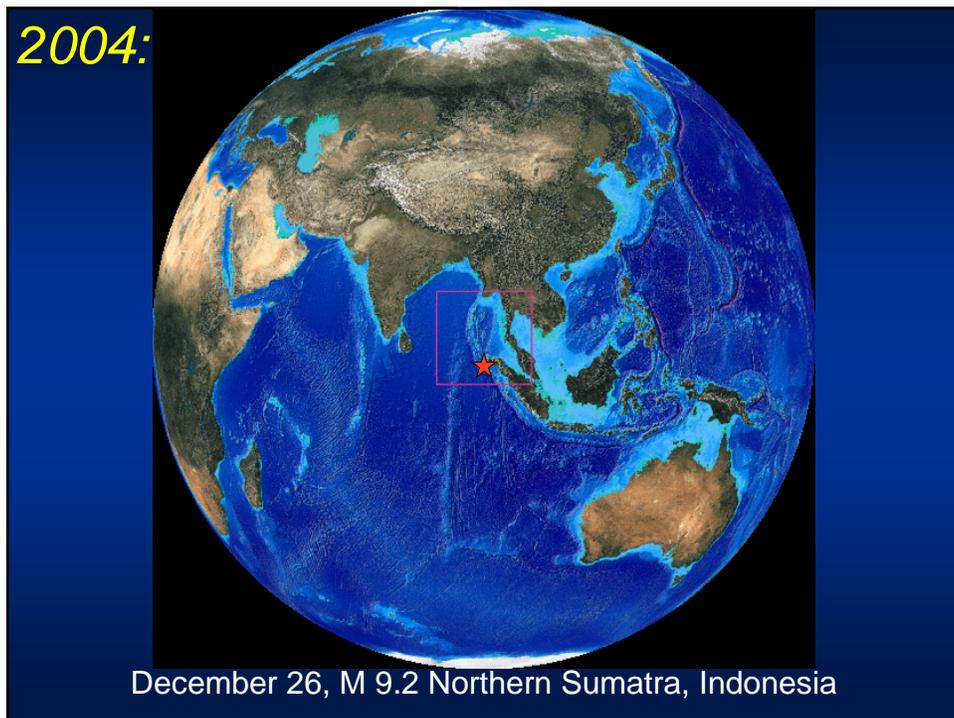
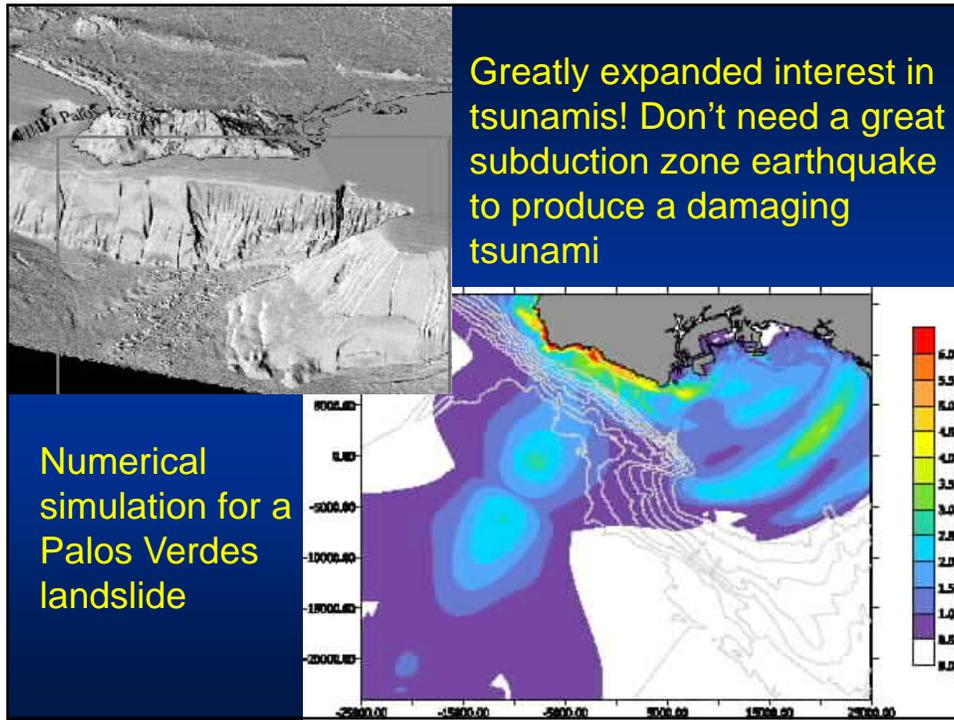


Height – 15m; Deaths – 2205; # Dart buoys - 2 ; # runups measure

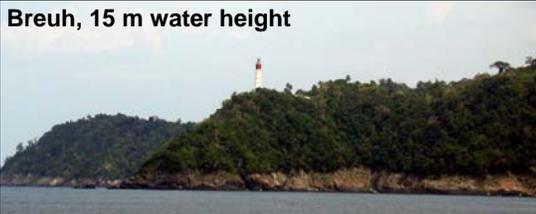


Very high waves that affected only 70 km of coast - the signature of a landslide-caused tsunami





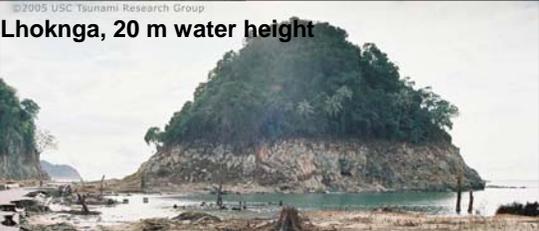
Breuh, 15 m water height



Coastal soil and vegetation stripped for 100 miles

©2005 USC Tsunami Research Group

Lhoknga, 20 m water height

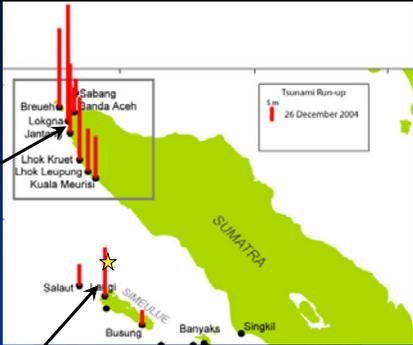


Jantang, 20 m water height



Ht – 50m; Deaths – 227K; # Dart buoys - 6 ; # runups measured - 1

Comparing the Aceh coast and Simeuleu Island

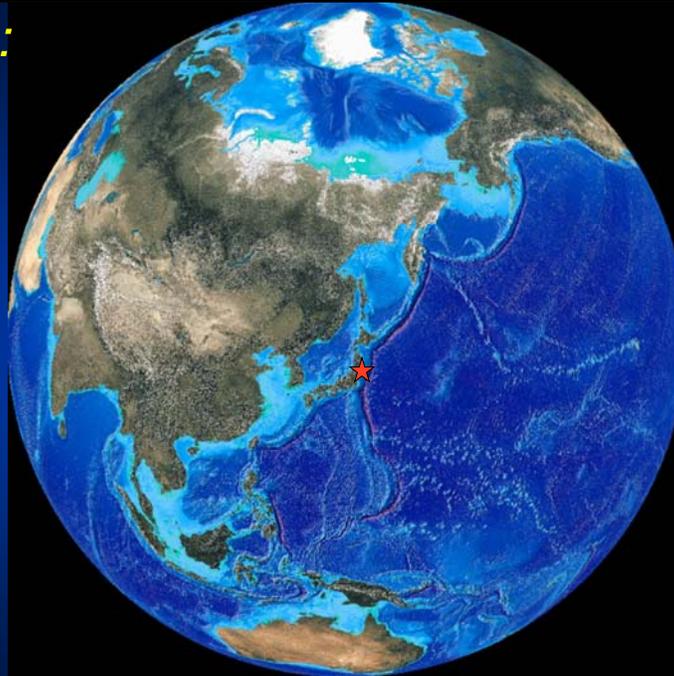


Jantang



Langi

2011:



March 11, M 9.0 Tohoku

Tohoku-oki



Ht – 39m; Deaths ~ 20K; # Dart buoys - 39 ; # runups measured - 5



86% residents outside inundation hazard area died in Unosumai town. (419 death<Blue shaded area> / Total death 485) source:Mainichi news paper

Kamaishi Junior High School



Evacuation: Town was attacked by tsunami at 15:17



Professor Katada's Principles of Tsunami Survival

- Don't be caught by assumption
 - Do as much as you can
- Take the lead in evacuation



Junior High and Elementary School Students drill together, June 20.

The Okawa Elementary School Tragedy



74 students and 10 teachers died – Principal apologized:
"I should have prepared an adequate disaster manual and raised awareness among teachers about the level of danger,"