Progress in Real-Time Tsunami Forecasting

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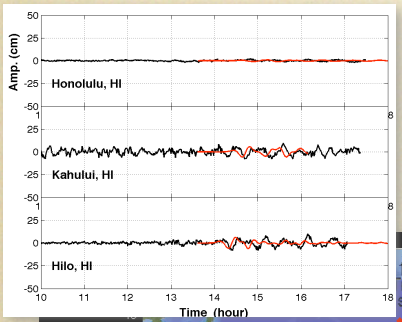
Tsunami Forecast

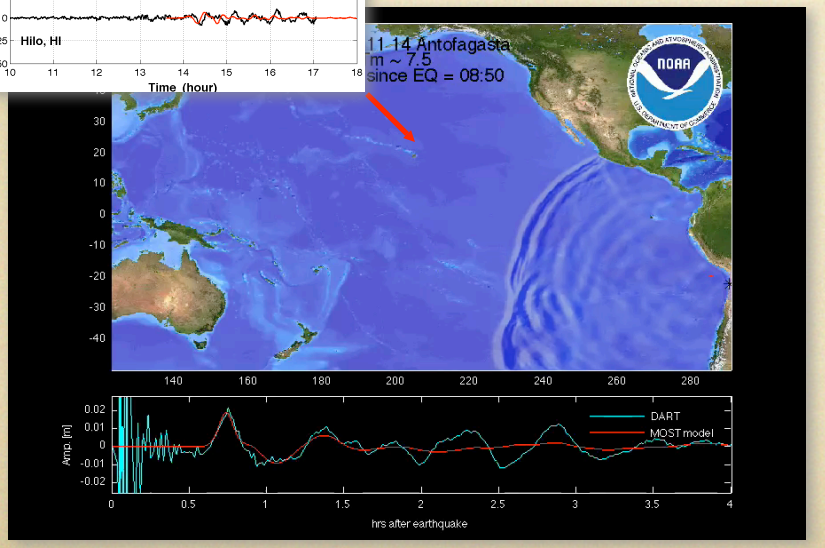
Real-time:

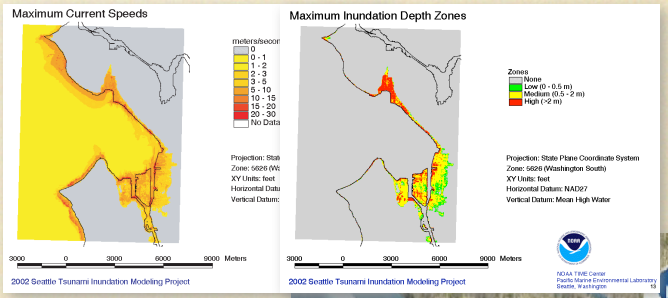
- Event-specific
- Real-time event assessment
- Real-time impact assessment before tsunami arrival

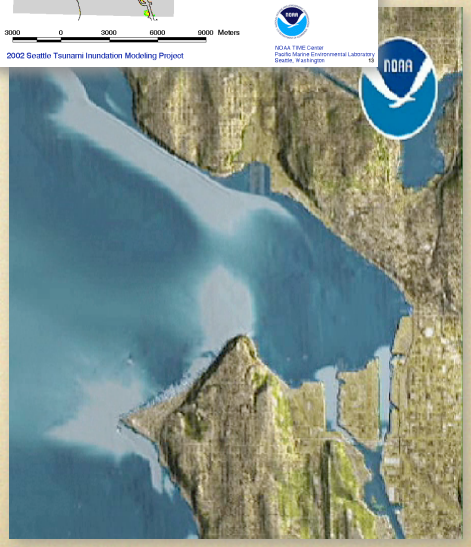
Long-term:

- Site-specific
- Probable Maximum Tsunami
- Multiple scenarios for PTHA
- Comprehensive Hazard Assessment

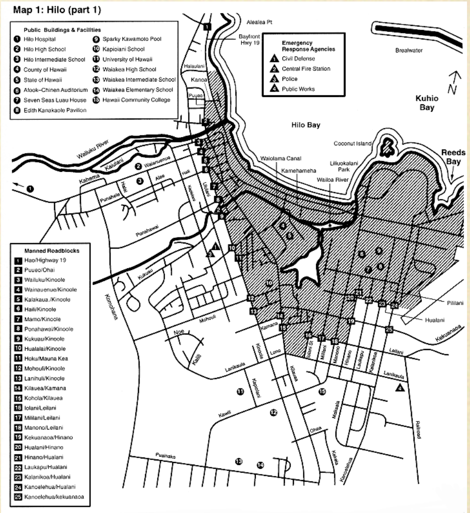


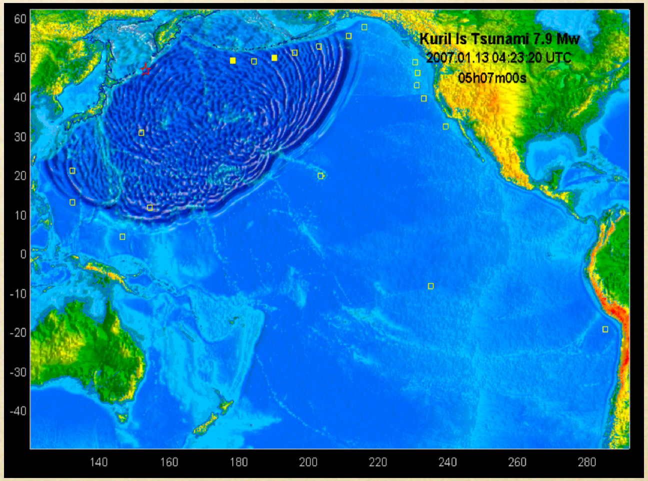






Long-term Forecast for Hilo provides information BEFORE the tsunami is generated





Hypothetical Short-term Forecast for Hilo provides information AFTER the tsunami has been generated

Short- versus Long-term Inundation Forecast at Hilo

Forecast Applications

Time frame	*Applications*
0-24 hours	Real-time Forecast
10-50 years	Inundation & Evacuation maps
50-100 years	Urban Planning (building life span)
100-500 years	FEMA (flood insurance rate map)
up to 10000 years	Nuclear Power Plants (siting and regulations)

NOAA Tsunami Forecast

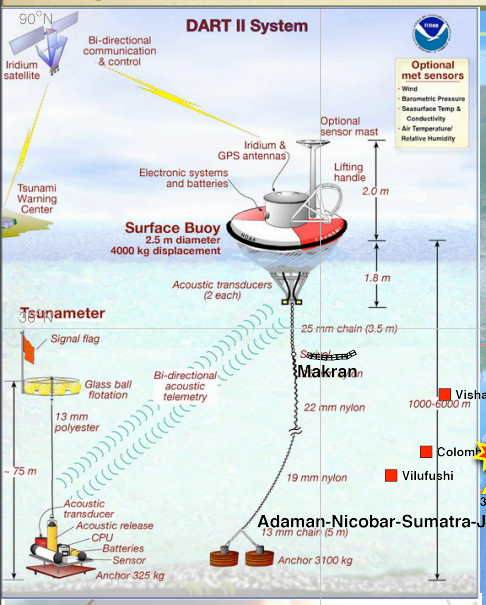
Detection
▲ Tsunameters

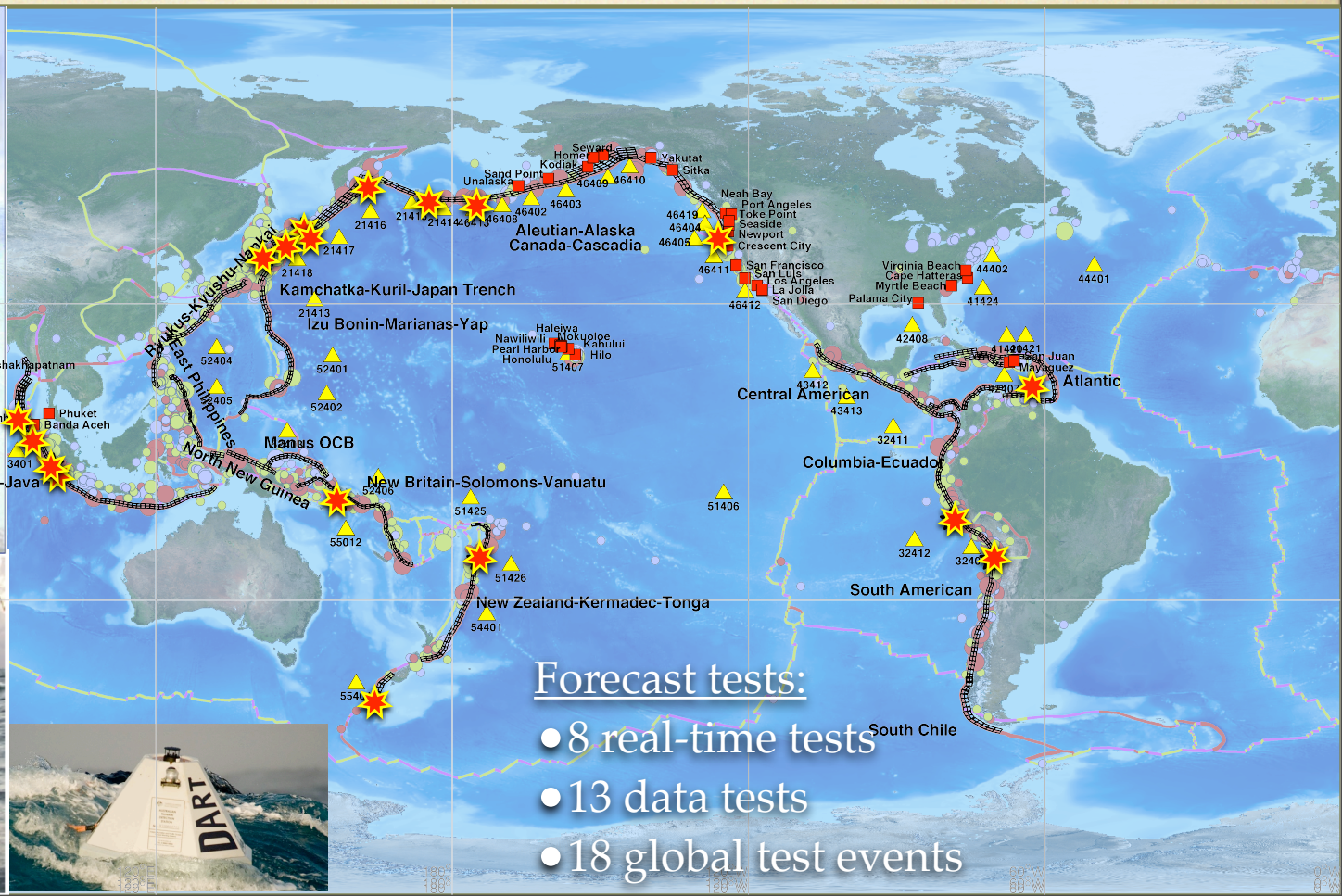
→

Inversion
▭ model database

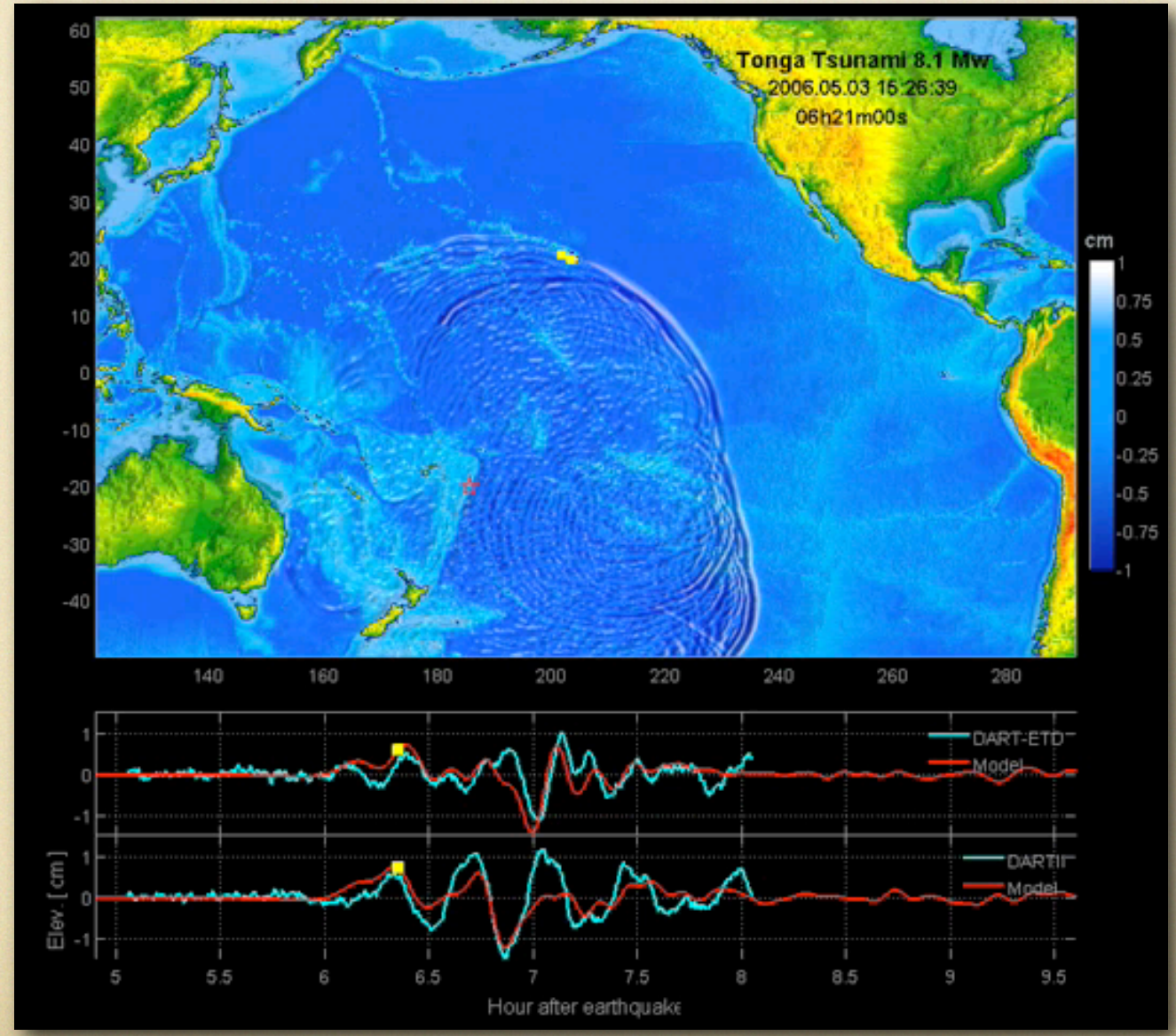
→

Coastal forecast
■ SIM

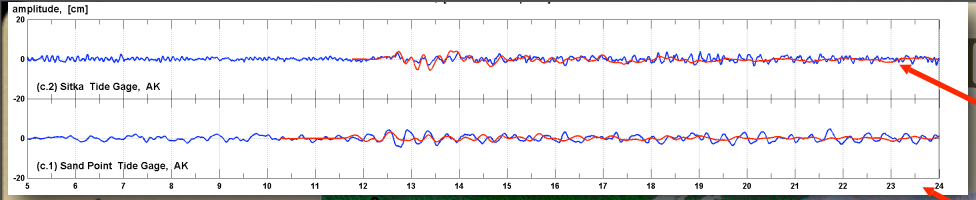


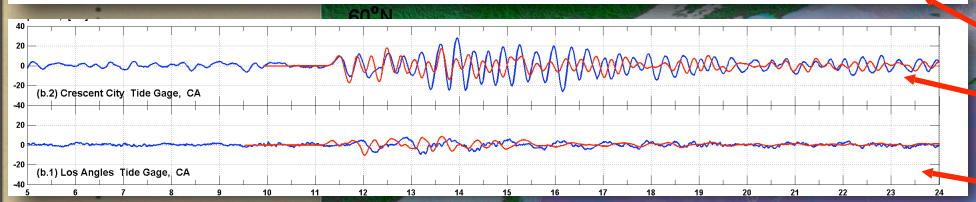


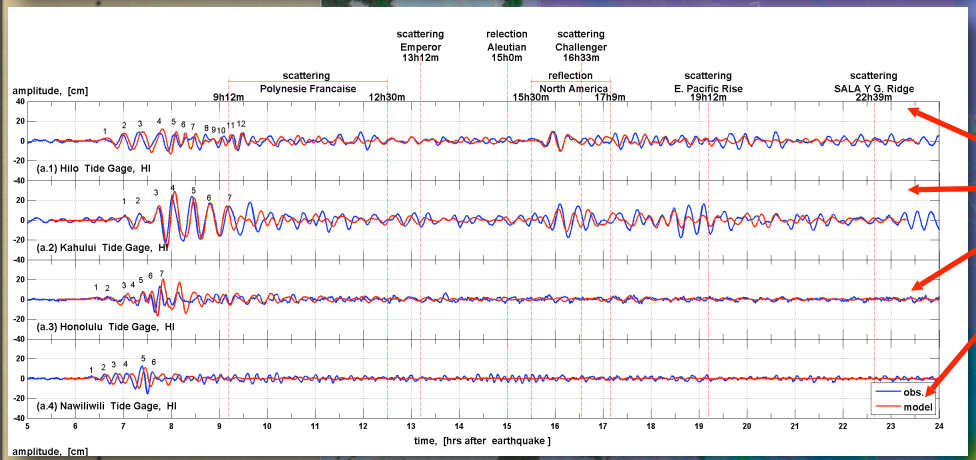
May 3, 2006 Tonga tsunami



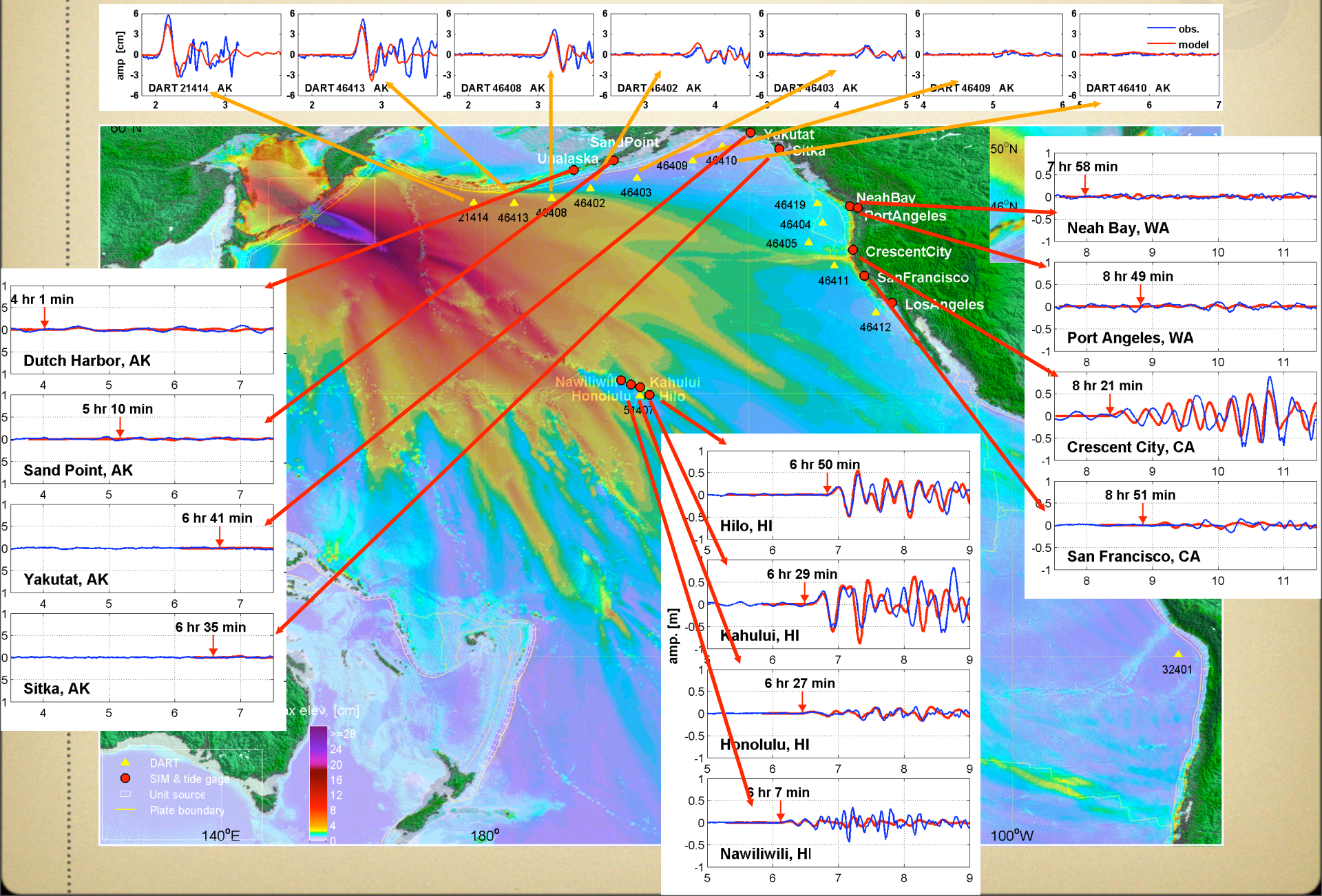
Tonga tsunami



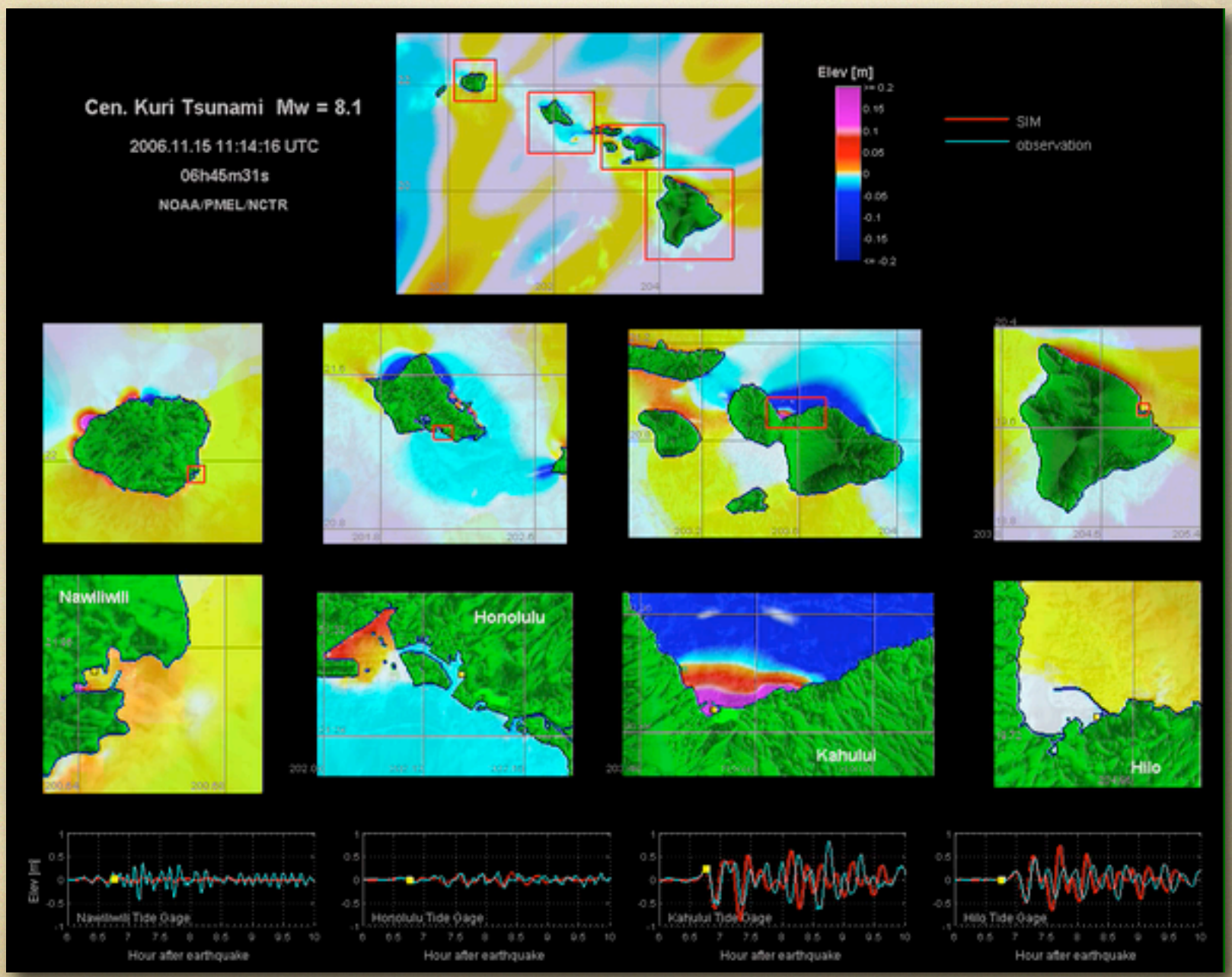




The November 15, 2006 Central Kuril Tsunami



High-resolution forecast models



Offshore vs. Inundation

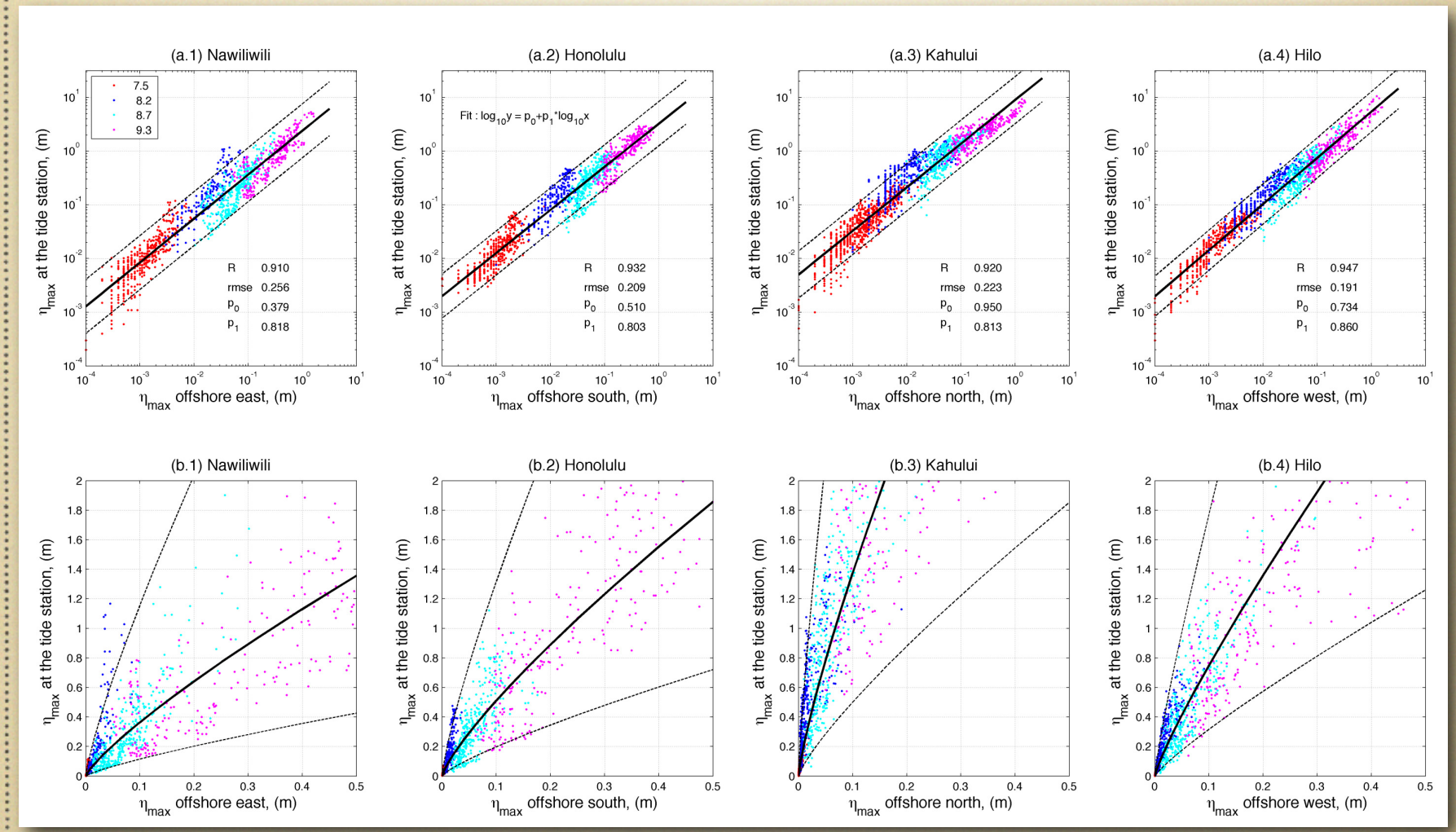
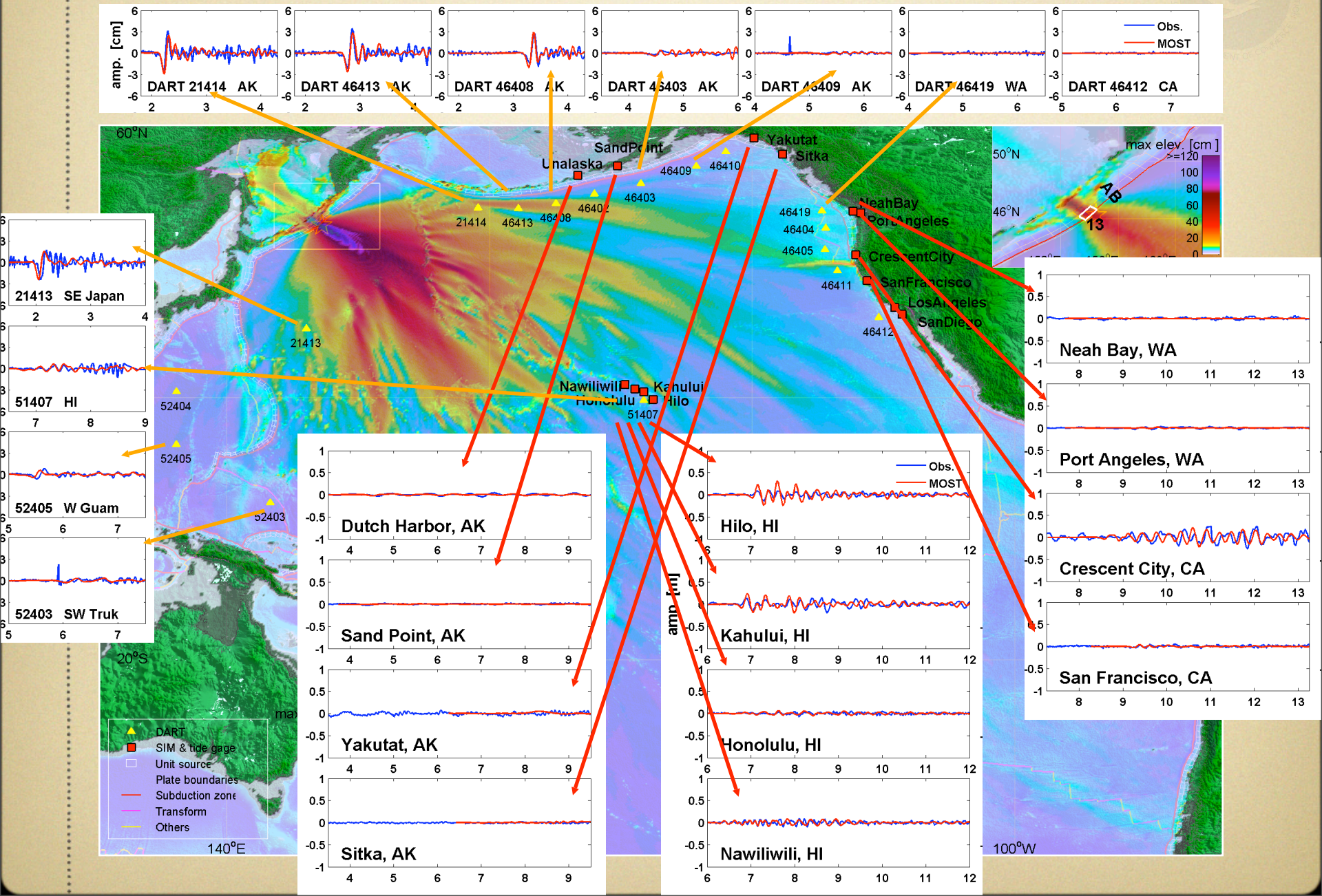
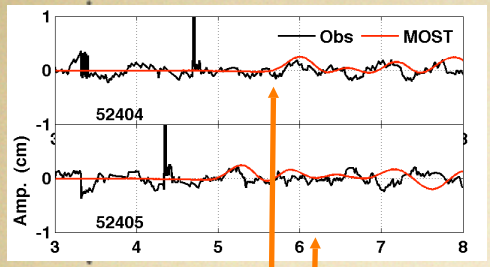


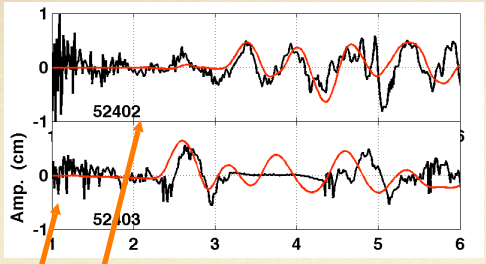
Figure 14 Maximum computed water elevation at offshore and nearshore in (a) logarithmic and (b) Cartesian coordinates. Colors represent tsunami moment magnitudes. The solid black lines are the fits by regression analysis in logarithmic scale. The dashed black lines are the prediction bonds based on 95% confident level. R, square of the correlation; rmse: root mean squared error; p_0 and p_1, parameters.

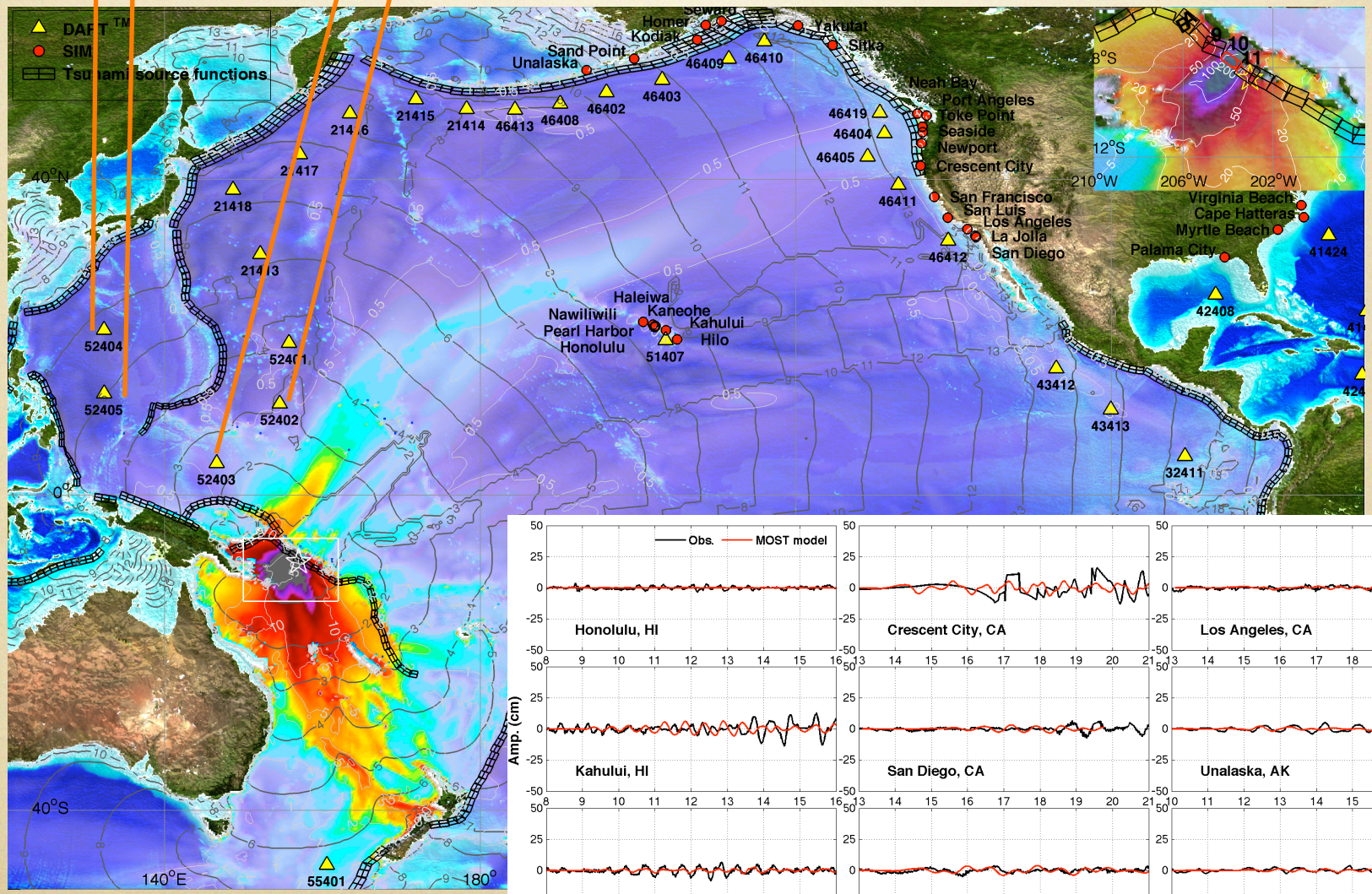
The Jan. 13, 2007 Kuril Is. Tsunami Mw 7.9



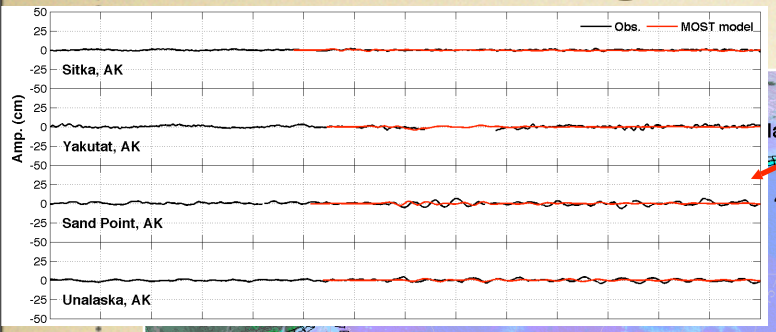
The 1 April 2007 Solomon Tsunami Mw 8.2

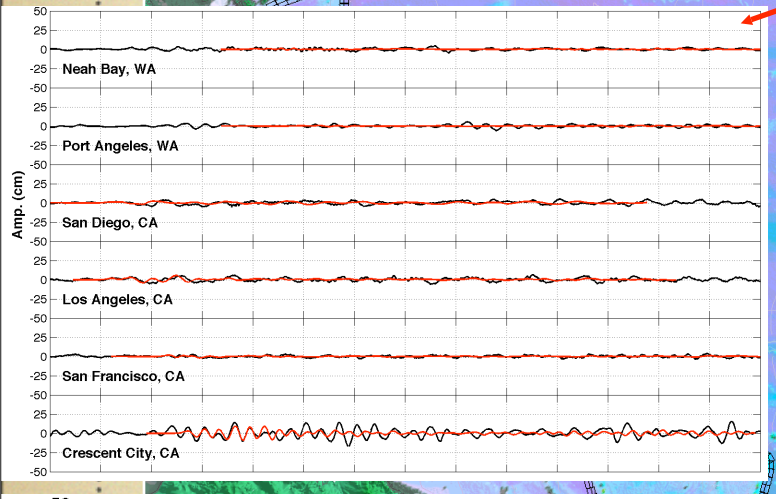


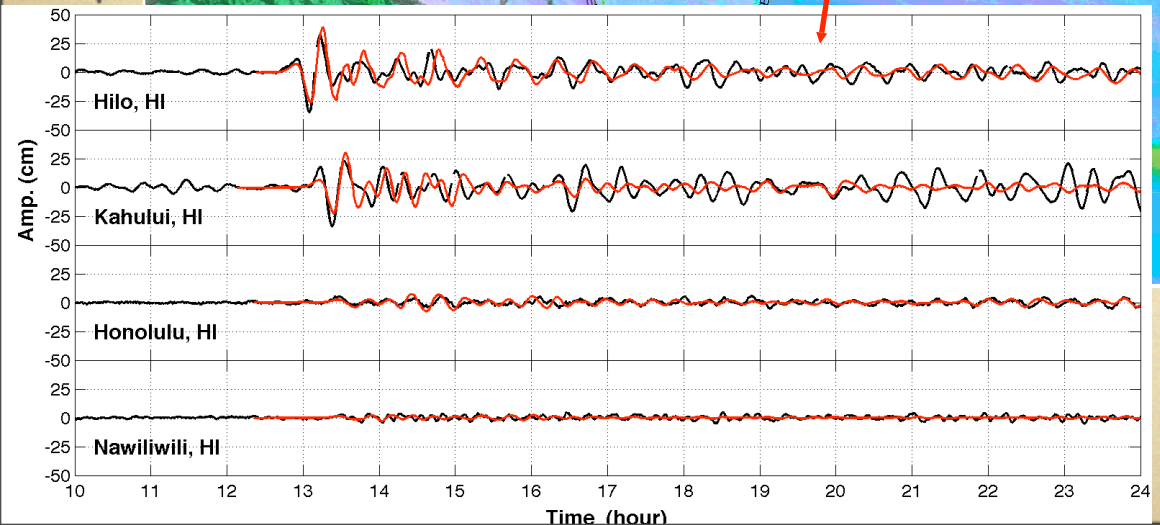


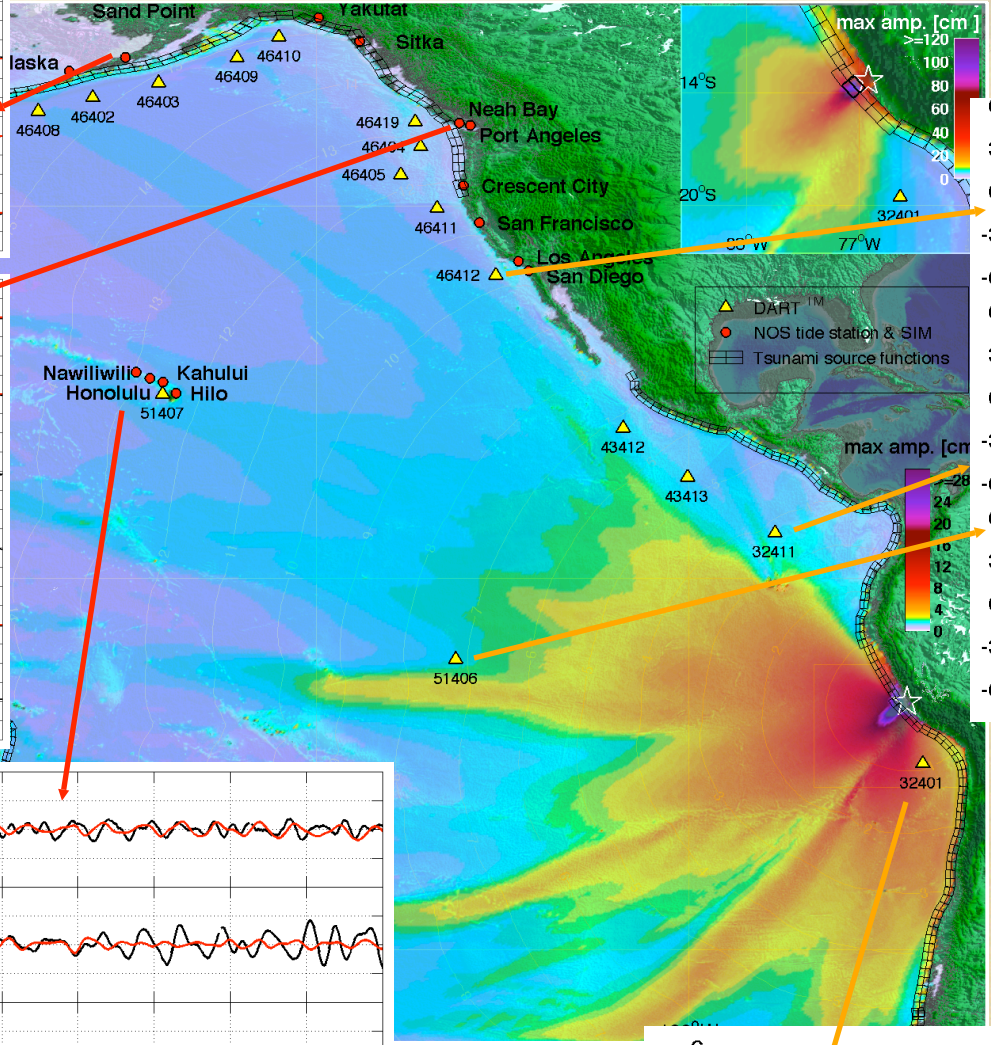


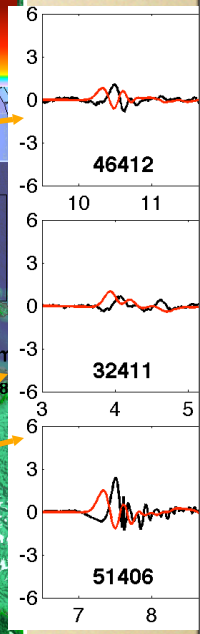
The August 15, 2007 Peru Tsunami

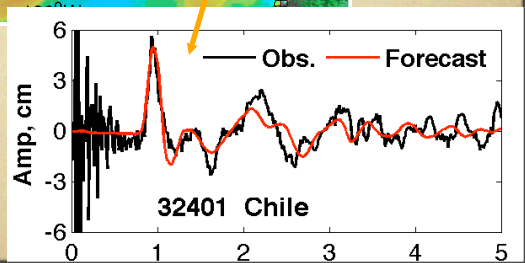




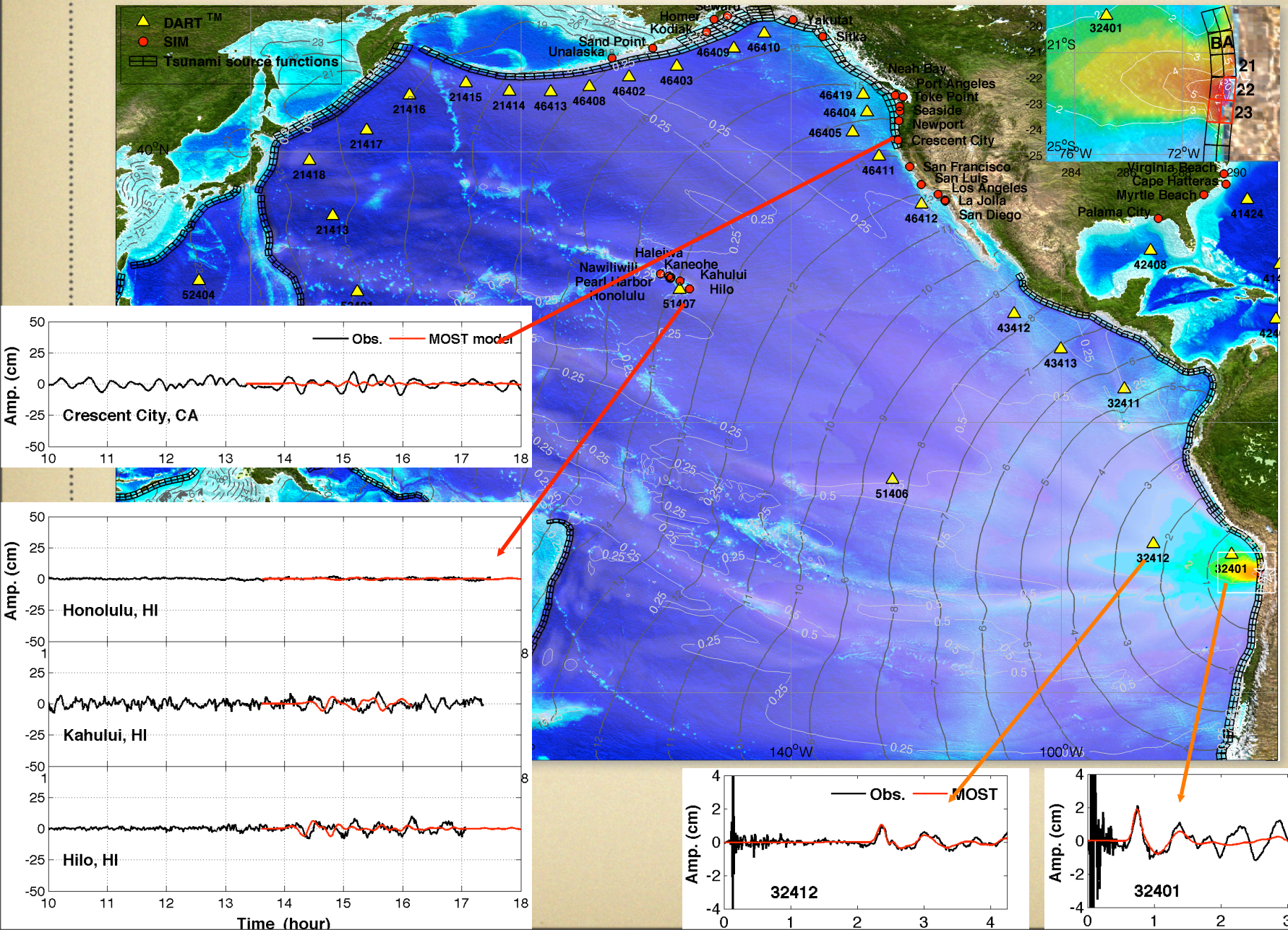




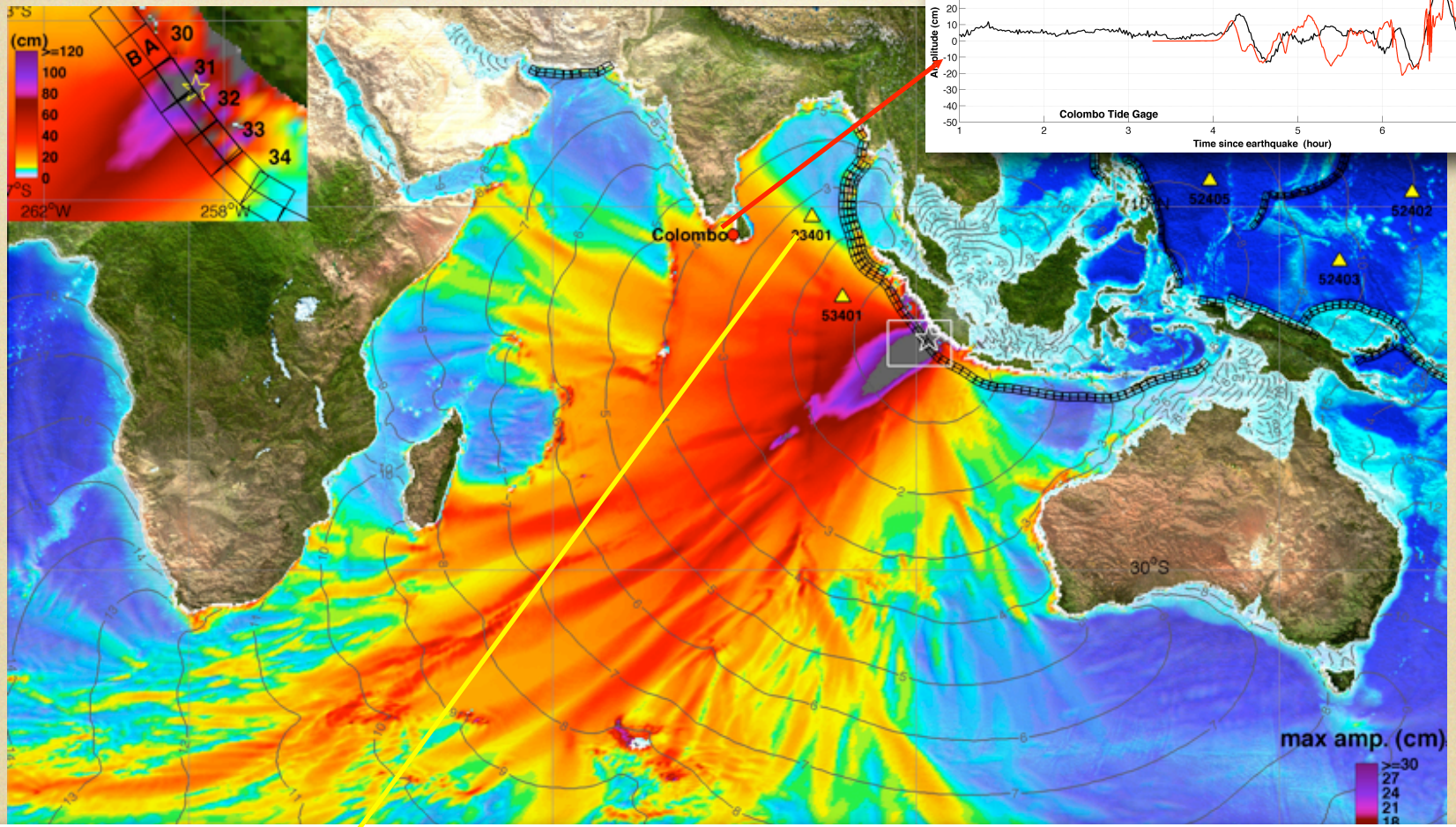


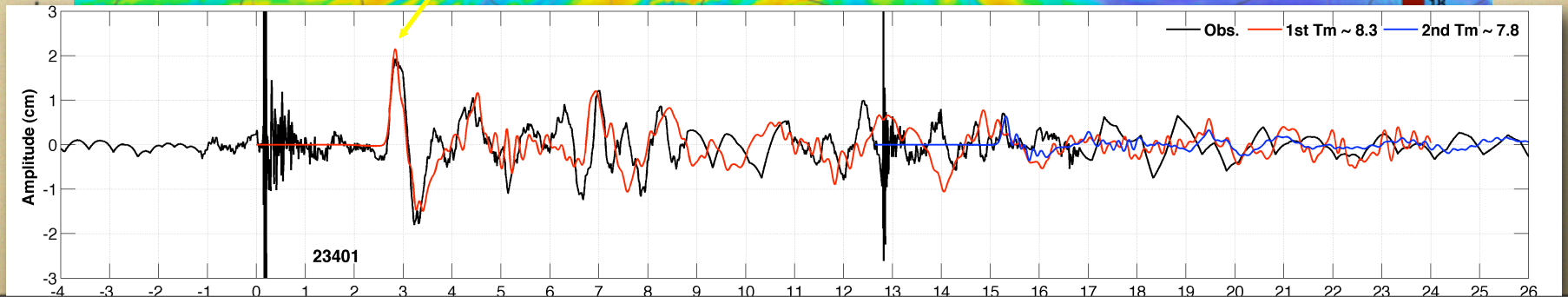


The 14 November 2007 Chile Tsunami (Mw 7.6)



The 12 September 2007 Sumatra Tsunami (Mw 8.3)

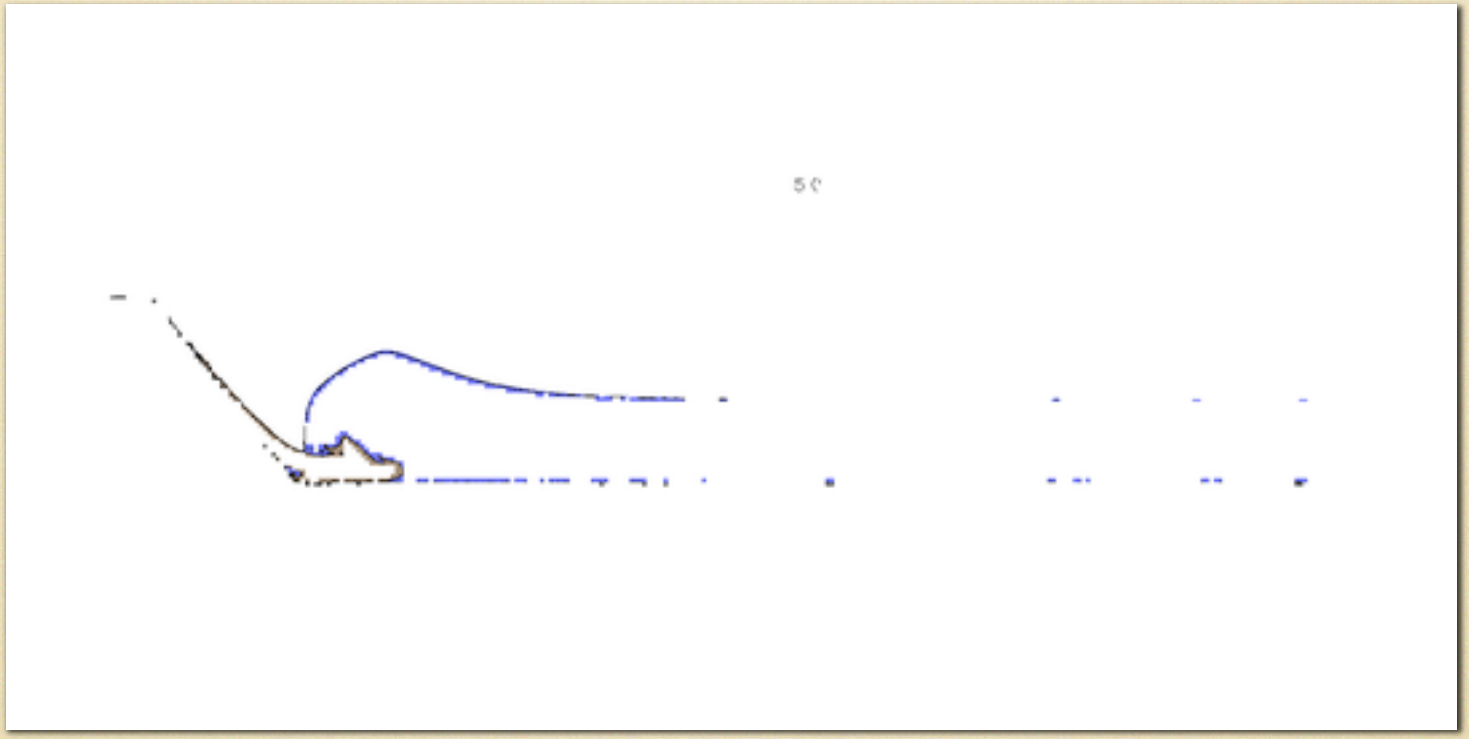




Future Plans and Challenges

- Tsunami Forecast System development (accuracy, speed, robustness, extended coverage -- global)
  - Optimize DART network
  - New tsunami data inversion techniques
  - Local tsunami forecast
- International coordination toward Global Forecast System (Australia, Indonesia, Chile, China, Russia)
- Next generation models
  - Tsunami inundation impact
  - Landslide and other sources

Next-generation models



Large-scale landslide-generated tsunami model

(studies for Nuclear Regulatory Commission)

Summary

- Real-time tsunami forecast method has been developed that combines tsunami measurement and modeling into real-time capability to forecast tsunami dynamics at specific coastal locations
- Real-time experimental forecasts show up to 90% amplitude accuracy and high efficiency of the method
- Tsunami Forecast System is being transfered into operations of the U.S. Tsunami Warning System