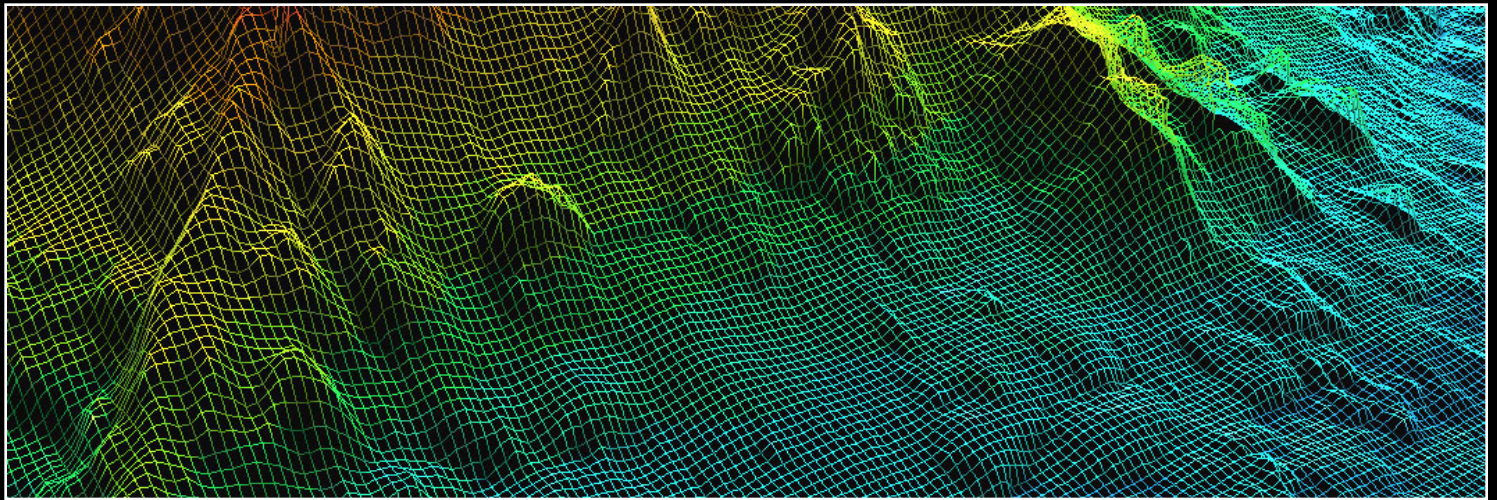
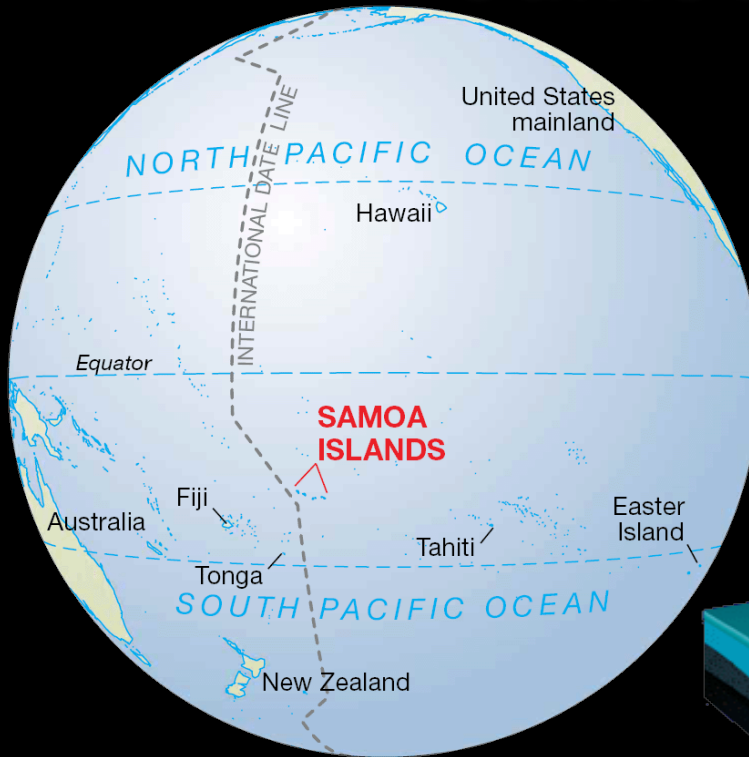


Origin and Impacts of the September 29, 2009 "Samoa Tsunami"

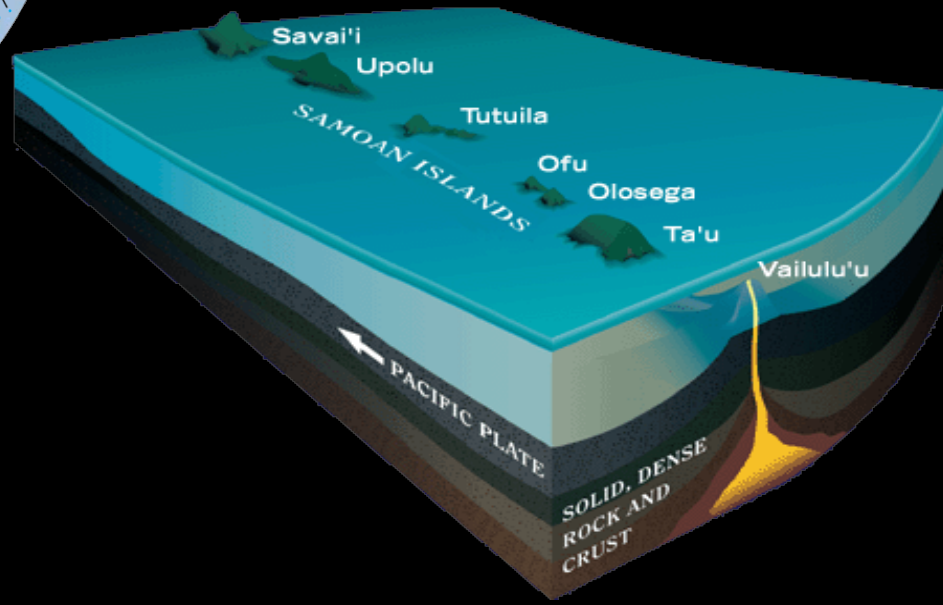


Dawn Wright
OSU Geosciences

Samoa Islands

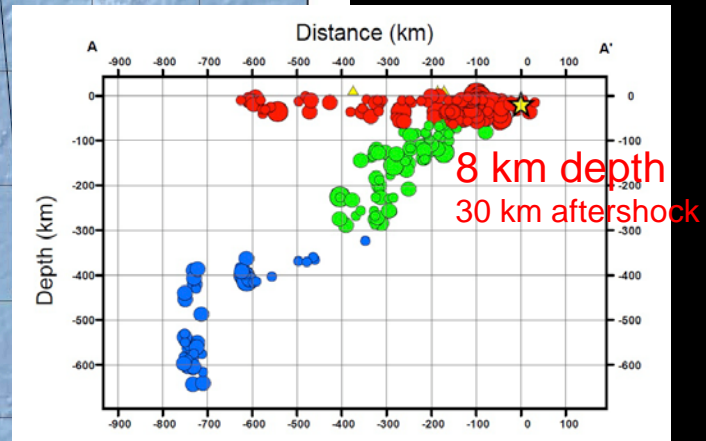
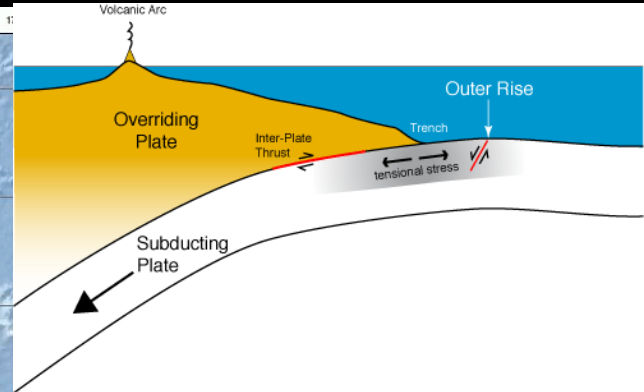
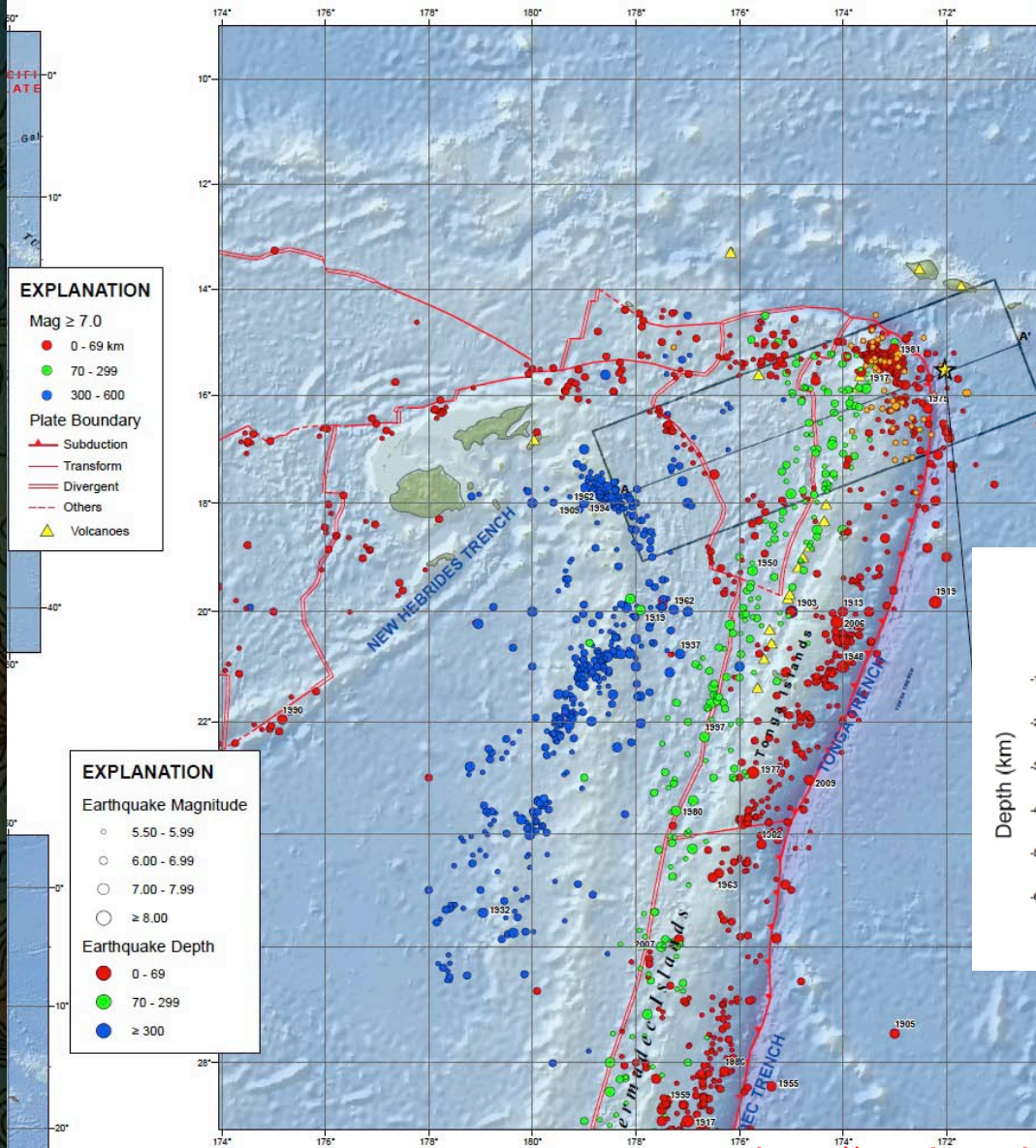


Map courtesy of National Park of American Samoa



Tectonic Setting

Convergence Rate Near Epicenter = 86 mm/yr (3.4 in)

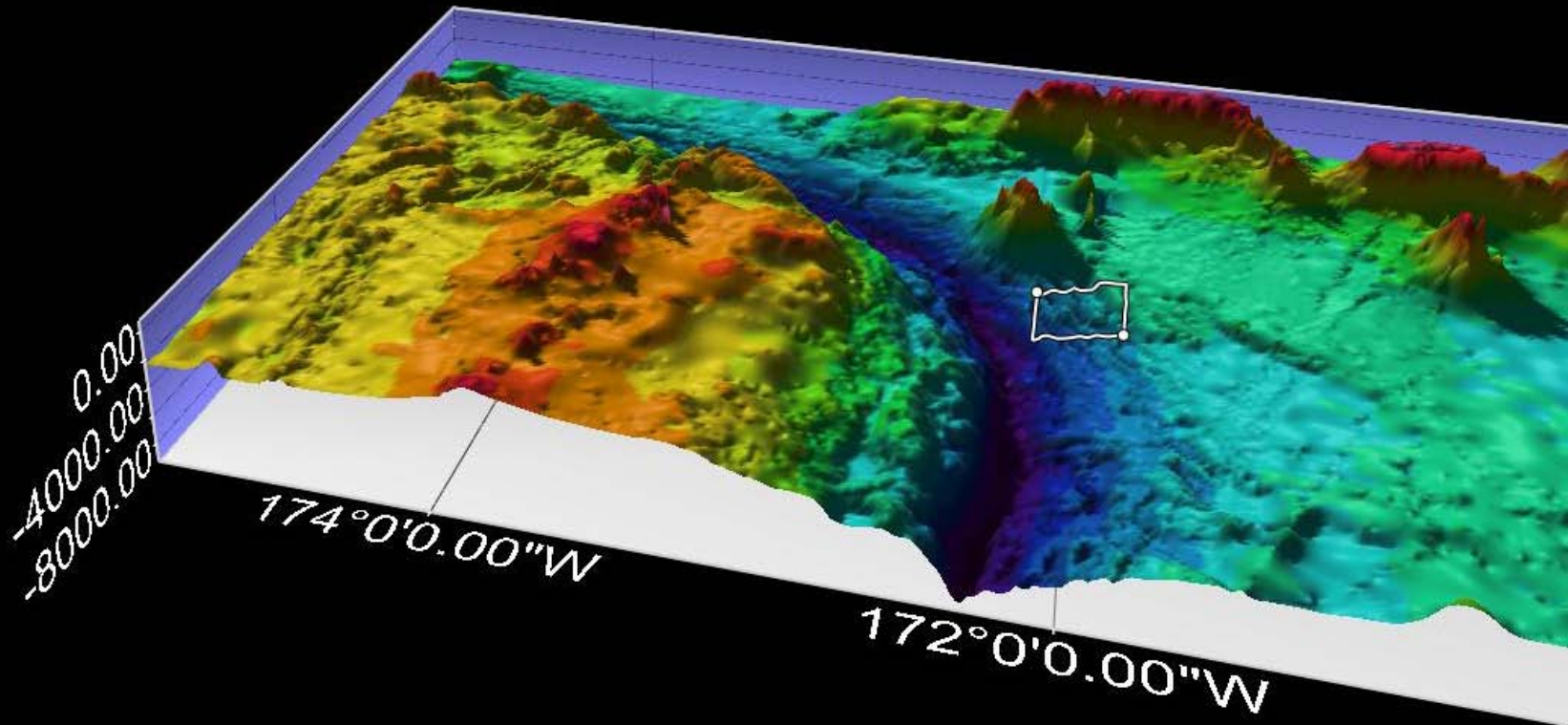


Lay et al., 2009, AGU

September 29, 2009

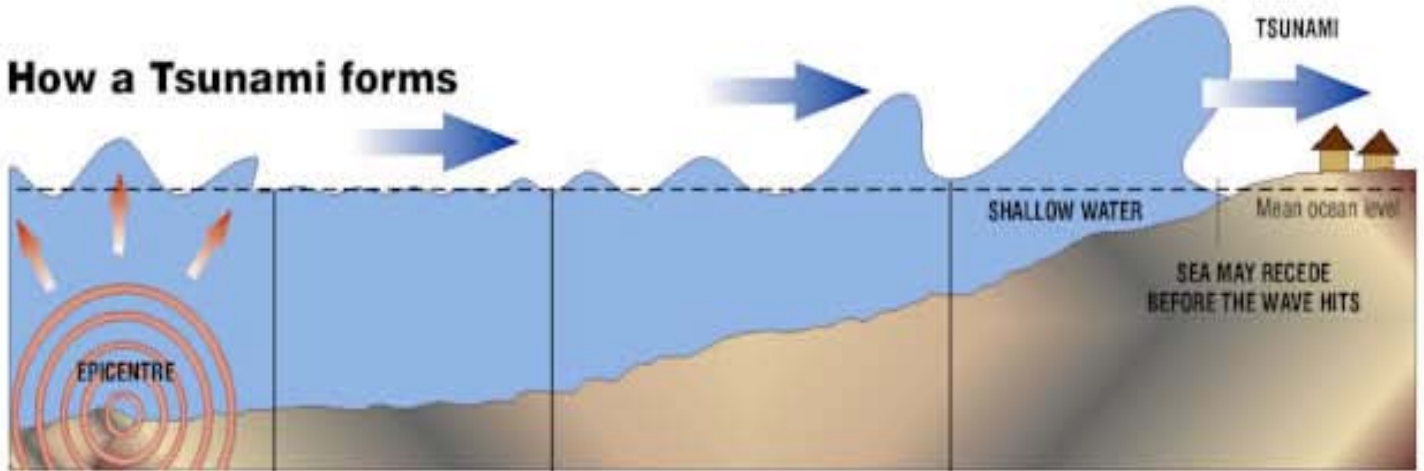
6:48 a.m. local time, M8.1

**9 deaths in Tonga, 149 in Samoa, 39 in American Samoa
Deadliest in history, \$150 million damage**



Tsunami Generation

How a Tsunami forms



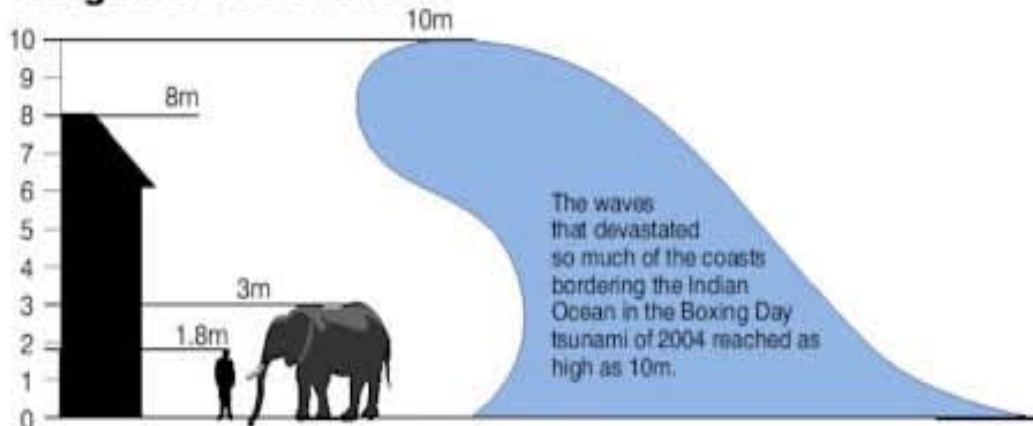
During a quake the sea floor either rises or subsides along a fault line and a mass of water is displaced

Waves rush away at high speeds. In deep oceans tsunamis can be as little as 60cm high but can travel more than 700km/h.

The waves grow higher and slow down as they reach the shallower water near coastal areas

The tsunami hits the coast devastating all in its path. People die not only from drowning, but also from being crushed by buildings and debris.

Height of the wave



Satellite Imagery

Can be useful in assessing tsunami inundation

Pre-tsunami

Post-tsunami

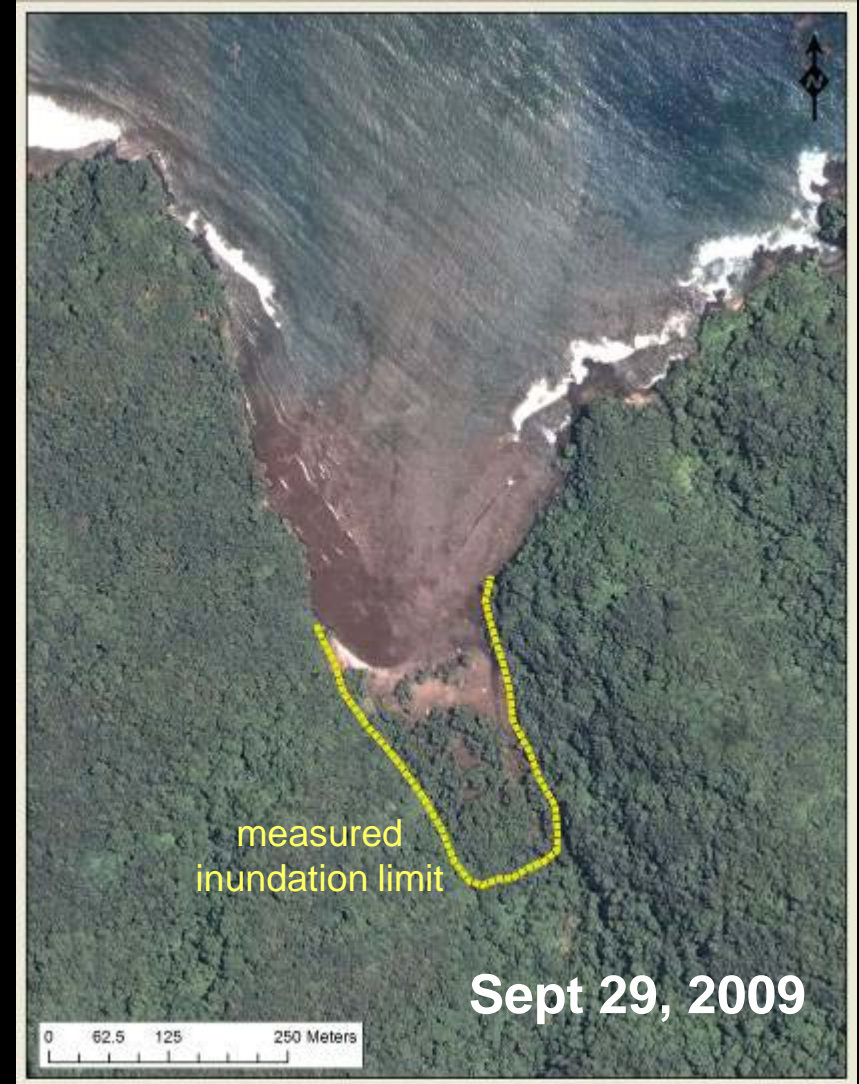


Satellite Imagery

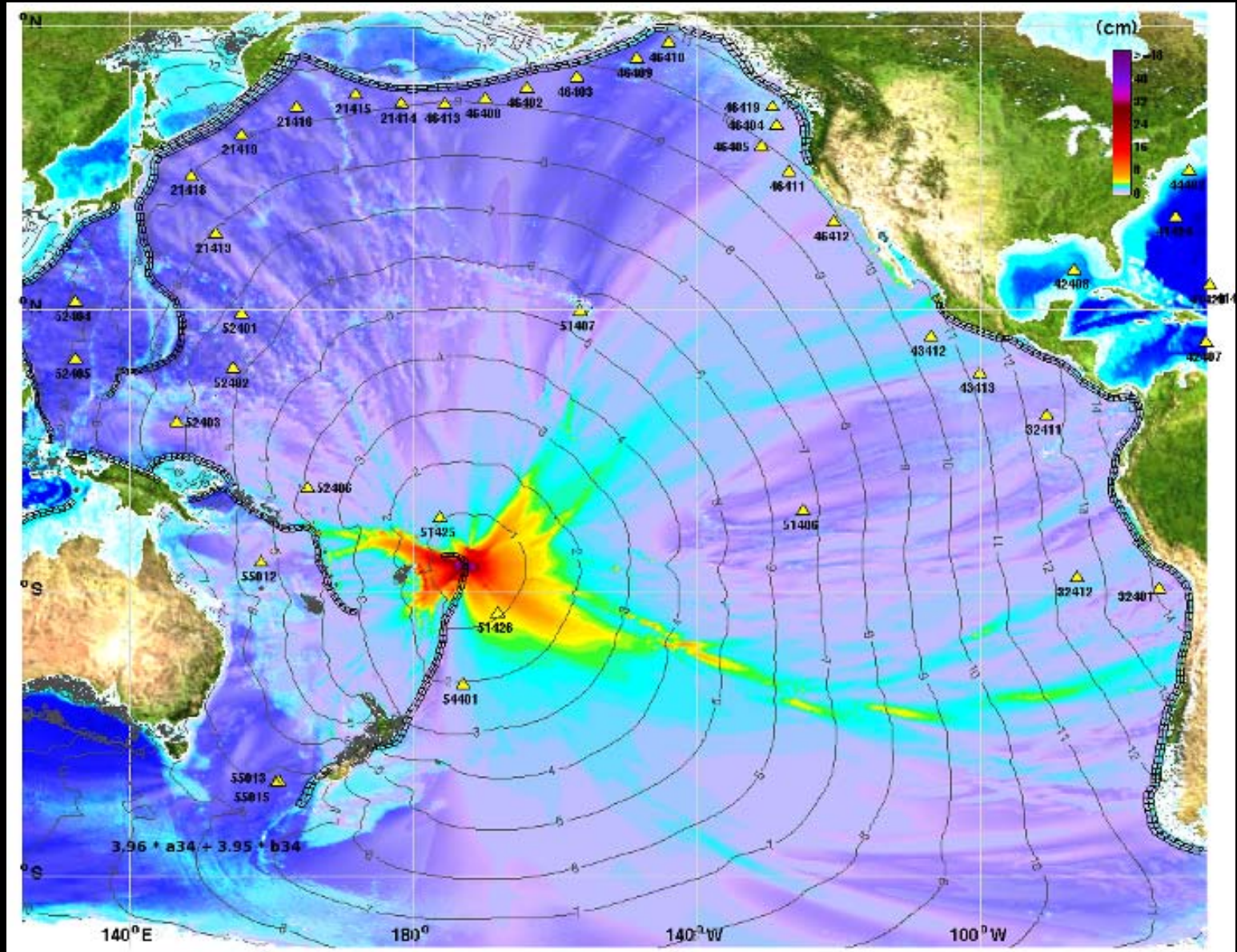
But can be inaccurate if tree canopy remains after tsunami

Pre-tsunami

Post-tsunami



Tsunami Propagation



Damage at Pago Pago Harbor

First major wave....



Damage at Pago Pago Harbor

First major wave....



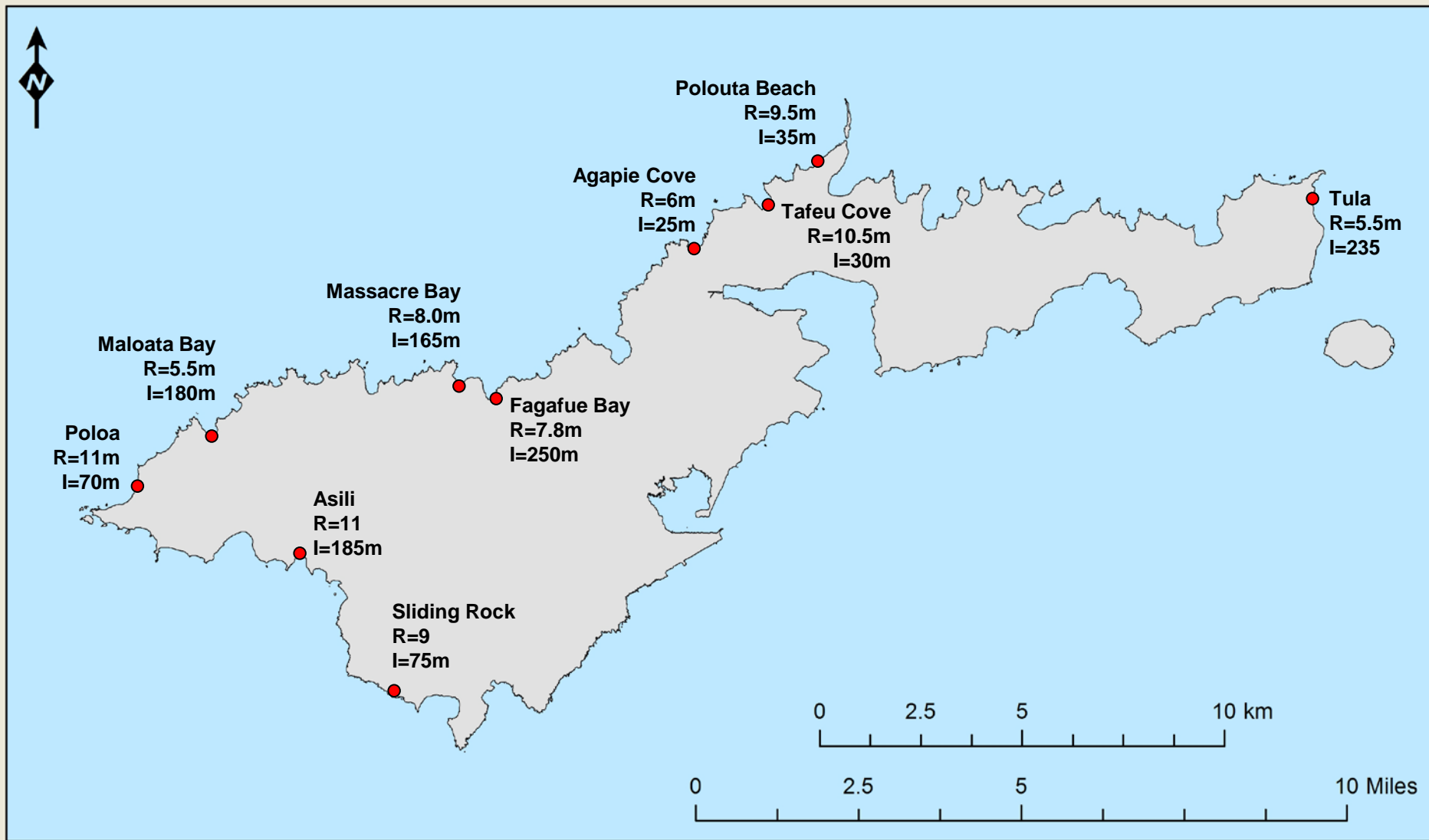
Damage at Pago Pago Harbor

That second wave!

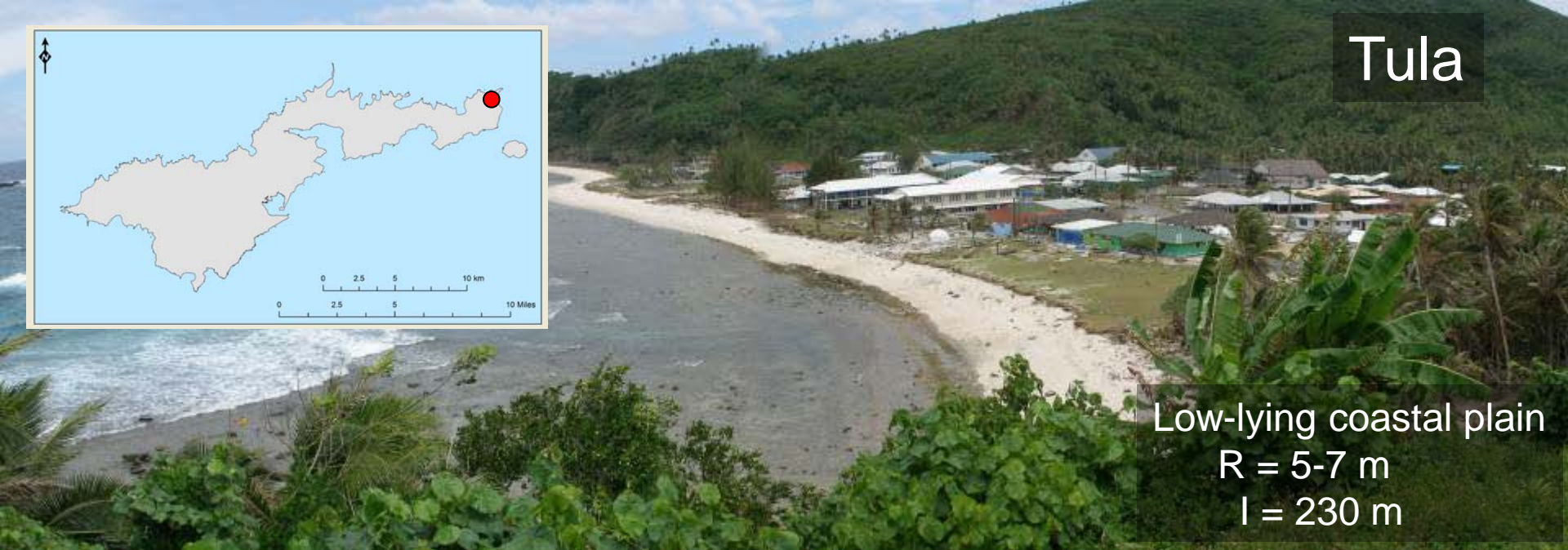
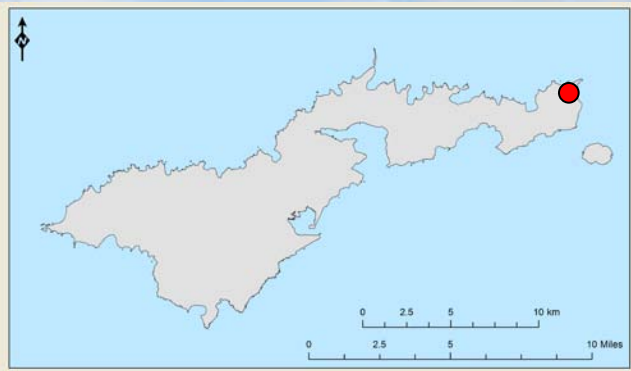


Estimated Run-Up Elevations, Inundation Distances North and West Coasts

Inundation Distance = distance tsunami travels inland

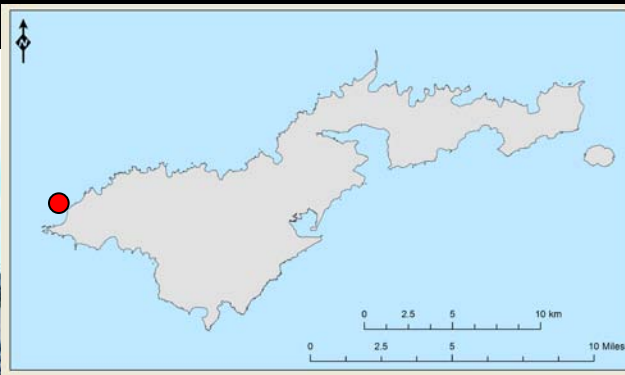


Tula



Low-lying coastal plain
 $R = 5-7 \text{ m}$
 $I = 230 \text{ m}$





Entire village destroyed; no fatalities



Steep coast
 $R = 11-12 \text{ m}$
 $l = 70 \text{ m}$



Figure 5. Near Lepa, Samoa. The high water line was measured at 13.6 meters above sea level here.



Figure 6. Debris piled up at more than 12 m elevation at Poloa, American Samoa.

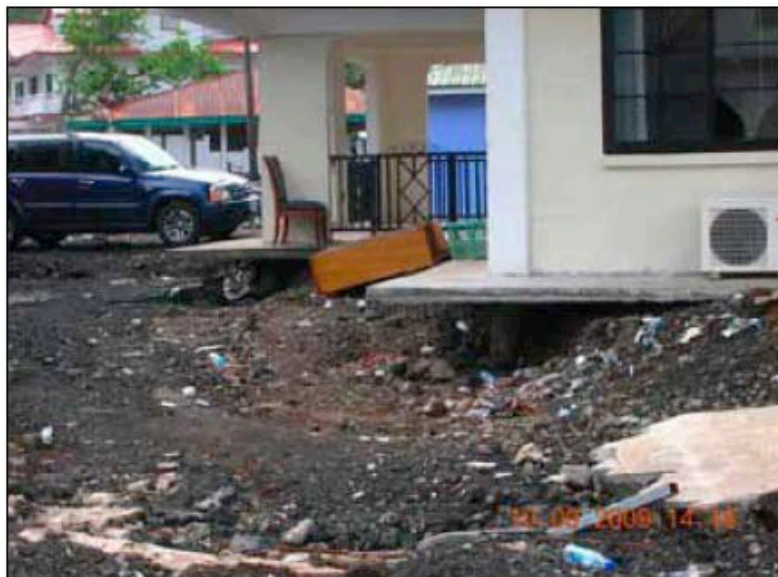


Figure 7. Scouring to a depth of 0.65 m underneath a large multi-family dwelling in Leone, American Samoa.



Figure 8. In Lepa, Samoa, scour caused the collapse of part of a village meetinghouse.



Figure 10 (a) ▲ On Niuatoputapu Island's north tip: the entire forest was overwhelmed by the tsunami, with stripped and uprooted trees as well as coral boulders.

Earthquake Emergency Research Institute

(b) ▼ The scars on the bark of the tree — at the far right in (a) — indicate 9.4 m flow depth above terrain, 6 m above sea level and 200 m from the beach, with scour of more than 2 m at the roots.

(c) ▼ Tafahi Island looking north from the maximum 22 m runup, with broken branches in the foreground and the destroyed forest along the beach.

