IOC-USGS MALDIVES TRAINING, 27 AUGUST 2006

TSUNAMI OBSERVATIONS: VARIATIONS IN TSUNAMI ARRIVALS AT COASTAL SEA LEVEL (TIDE) STATIONS

1. WAVE HEIGHT AND PERIOD:

Relevant Points:

a. Tsunami are a series of waves that continue for many hours
b. The 1st wave height may not be the largest.
c. The largest wave may not occur at the station closest to the earthquake's epicenter.
d. Tsunami signals arriving at coastal stations are affected by local conditions, such as the roughness of seafloor, configuration of the coast (bays, headlands), rate of shoaling or shallowing of the seafloor
e. Tsunami wave periods can vary from minutes (5-10) to one hour.

26 September 2003 M8.0 Tokachi-oki earthquake and tsunami.

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A B

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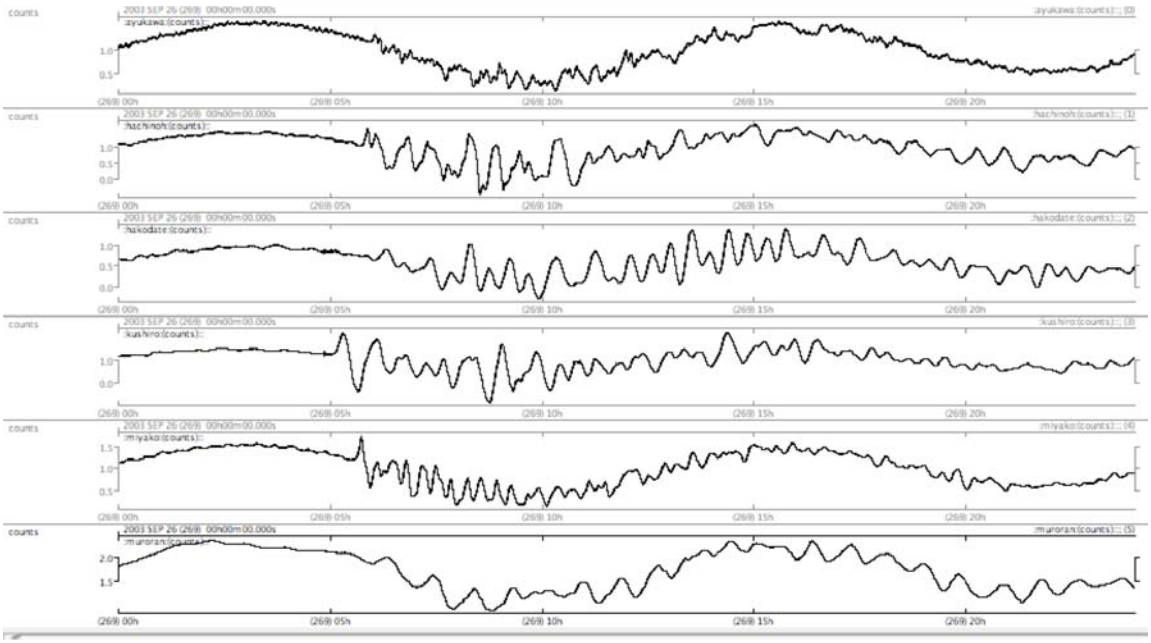

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0 hr 5 hr 10 hr

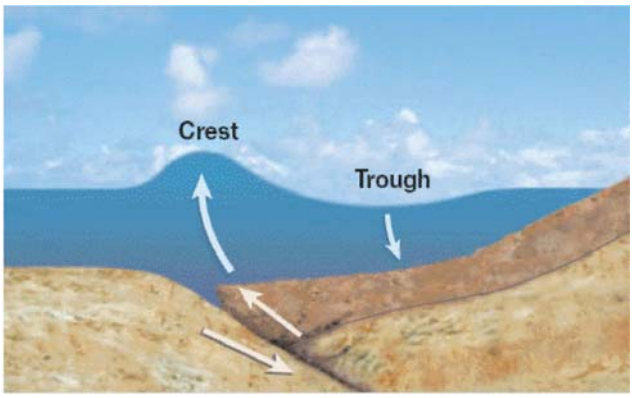
Notes:

1. Record length is about 25 hrs, with tick marks every 5 hours. Amplitude scale of each record varies and normalized. Shown are high-frequency, low-amplitude wind-generated waves (A), tsunami (B), and diurnal tide (C, 1 c12-hr cycle).
2. Showing of the tides is useful because you can determine if the tsunami will arrive at high tides (which would make it more dangerous), or low tide (less dangerous). Removal of tides is useful for showing the tsunami and measuring its arrival time, amplitude and period
3. Tsunami warnings are cancelled when signals become small on many stations. In this example, it would be cancelled after about 12 hrs.

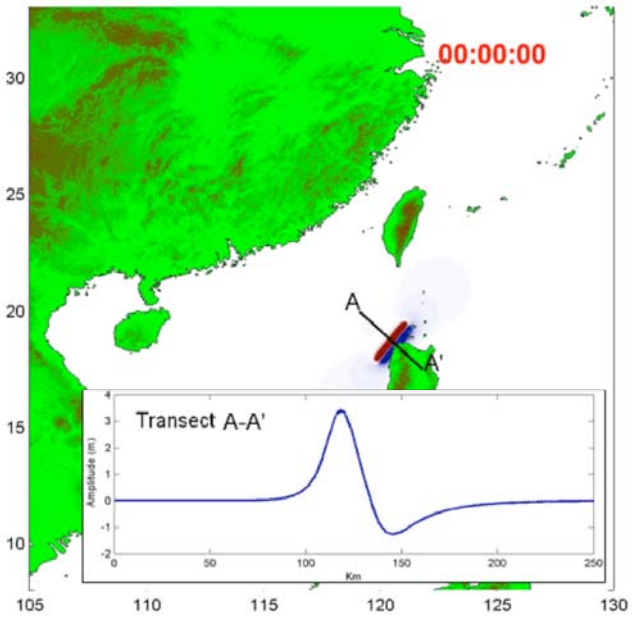
2. CHARACTER OF LEADING WAVES – WHEN IS THE 1st WAVE A RECEDING WAVE? PREDICTIONS BASED ON THEORY VS ACTUAL

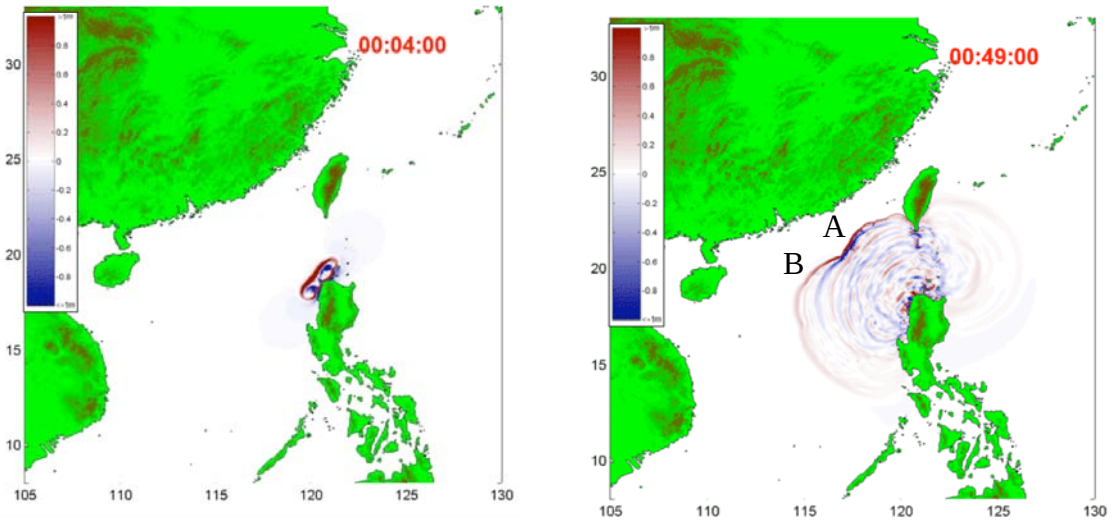
Relevant Points:

a. The earthquake rupture determines the initial character of the tsunami wave.
b. In theory, for a subduction zone thrust earthquake, the thrusting plate moves the ocean column upward creating a wave crest above and a trough behind. An advancing wave is created in the direction of the thrust, and a receding wave in the direction of plate subduction.
c. In reality, seafloor topography between the tsunami source and affected coast will modify and may complicate the character of the leading wave (so that the prediction from theory may be wrong).



Instantaneous push of ocean column upwards during thrust earthquake. Initial water displacement is advancing crest (red) and trough (blue).





Left: The 1st tsunami wave arrival will be an advancing wave (wall of water) toward China, and a receding wave at Luzon, Philippines.
Right: With time, the wave character is changed by seafloor topography. The trailing trough catches up to crest in the north (A), but not in the south (B).

Tsunami Source Propagation model: Dr. Philip Liu, Cornell University