

Tsunamis are often no taller than normal wind waves, but they are much more dangerous.

Wind waves come and go without flooding higher areas.
Water flows in a circle.

Tsunamis run quickly over the land as a wall of water.
Water flows straight.

Even a tsunami that looks small can be dangerous!
Any time you feel a large earthquake, or see a disturbance in the ocean that might be a tsunami, head to high ground or inland.

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Occurance

- Sudden displacement over a broad area creates a wave
- Tsunami waves have a ~50cm amplitude
- Wavelengths of 100's km 1 ($\lambda=150$ for the tsunami of Vanuatu 1999)
- Contact with land squishes these wavelengths and amplitudes rise.
- [Tsunami Movie 3](#)

Detecting Tsunami 4.5

- NOAA's DART system
- Deep-ocean Assessment and Reporting of Tsunami
- Acquisition of data – Seismic waves
- Review of inundation map
- Making the call

Location, Location, Location

7

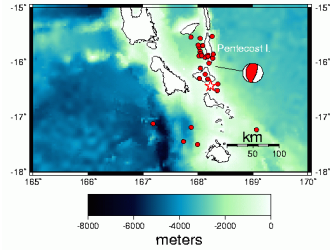
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Squeezing out the Fun

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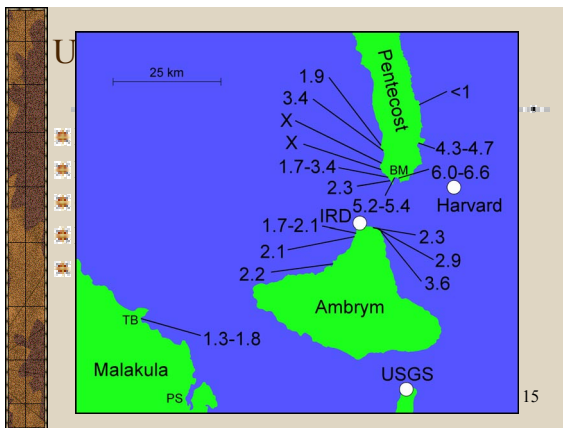
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November 26, 1999



- 1:21 local, 7.3 magnitude off the coast SE of Pentecost
- 2m slip – 50km long fault – 1km focus depth – N05E 32SE₆

usgs case1 movie 8



Tsunami related Loss

☒ Destruction of Waves

- Wave One – Mud buildings destroyed
- Two – Mud buildings carried out to sea with two citizens, foundations of cement buildings compromised
- Three – No comparable effect

☒ Death toll: Five

- Two elders, two from pulse two, one drunk on Kava

☒ Landslides

- Destroyed houses, roads, water storage units

Response

- Vanuatu Govt. Dispatches aid
 - ◆ Engineers and hazard specialists to assess damage
 - ◆ Supply base set up on E. Pentecost
 - Citizens of Baie Martelli relocated to base while new town is constructed
- \$101780 in support from U.K., France, U.N, New Zealand 14
 - ◆ Including water tanks, clothing, food, helicopters, and house-hold items.
Well, glad I got that spatula now.

Model Assumptions

- The Linear wave equation (An equation without the goodies)
 - ◆ Ignores the non-linear components essential to shallow water behavior
 - ◆ Non-linear components matter greatly at depths
 - ◆ Addressing the bi-model behavior requires too much work/time 9
- Initial condition – the cause of water displacement
 - ◆ Landslides (submarine and terrestrial) can also be the initial condition for large tsunamis. (Papua New Guinea 1998) 10
- Basins are frictionless
 - ◆ Data on bathymetry that could be used as a friction factor is poor
 - ◆ Friction changes with time, depth, and when running upland
- Conditions. Paper or plastic? Reflective or Radiative?
 - ◆ Radiative allows for radiating waves but not their impact on solids
 - ◆ Reflective allows for impact but assumes 100% reflectance



Improvements

- Education is good . . . but people are people
 - ◆ Education is needed but so is faith in the warning horn
- Bathymetrical Data
 - ◆ Are Geologists on the late side for school?
 - ◆ Are modelers asking too much
- Multiple scenarios with multiple equations
 - ◆ Scenarios for every scenario
 - ◆ How affective do these match against models “on-the-fly”?
- InSar
 - ◆ Synthetic Aperture Radar Interferometry (no crystal ball) 11

References

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- 2.) <http://www.ess.washington.edu/tsunami/images/tsunami.pdf>
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- 5.) <http://www.ndbc.noaa.gov/Dart/dart.shtml>
- 6.) <http://www.tsunami.civil.tohoku.ac.jp/hokusai2/topics/tsuna mi-news/99Vanuatu/linear/linear.html>
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References (cont.)

- 8) http://www.tsunami.civil.tohoku.ac.jp/hokusai2/topics/tsuna mi-news/99Vanuatu/movies/usgs_movie1.html
- 9) Conversation with the man
- 10) <http://pr.caltech.edu/periodicals/EandS/articles/Tsunami%20 Feature.pdf>
- 11) http://nasadaacs.eos.nasa.gov/articles/2005_tsunami.html
- 12) <http://www.red-efl.net/placepages/vanuatu.htm>
- 13) <http://www.usc.edu/dept/tsunamis/VANUATU/photos/>
- 14) <http://www.cidi.org/disaster/99b/0226.html>
- 15) Caminade, P.; Charlie, D.; Kangolu, U.; Koshimura, S.; Matsutomi, H.; Moore, A.; Ruscher, C.; Synolakis, C.; Takahashi, T., Vanuatu Earthquake and Tsunami Cause Much Damage, Few Casualties. 81(52), 641,646-647, Dec. 26, 2000.

Making your own Kava Juice

- ✘ Harvest only the roots of a Kava plant >3 yrs.
 - The natives usually wait 5-8 yrs for potency
- ✘ Chew them and spit them into a container of 10oz of coconut milk and 2oz water.
- ✘ Let ferment in the ground for two weeks.
(any cool place will do)
- ✘ Strain out the Kava Juice.
- ✘ Drink.

<http://www.kundalini-tantra.com/kavanl.html>