Pop Goes the Wave: Tsunami Inundation Modeling

Material adapted from "Simulation of an Impact Tsunami" http://users.tpg.com.au/users/aoaug/tsuballn.html

Introduction:

Knowing the extent to which a tsunami could inundate a coastal area is key to helping a community prepare for such an emergency. Tsunami warning systems are designed to alert the public of such risks, but unless the public are knowledgeable about what to do and where to go if a tsunami is approaching, a warning system can have limits. Tsunami wave modeling, such as that which takes place at the O.H. Hinsdale Wave Laboratory at Oregon State University, researches various scenarios in which a tsunami can inundate a stretch of coastline. Coastal communities such as Seaside, Oregon can use this information to prepare for possible tsunamis.

Materials:

(Materials in **bold** are provided by SMILE)

Flipchart Paper
Turkey Trays
Modeling Clay
Sand
Coffee Grinds
Lego
Water
Balloons
Push Pins

Materials provided are enough to support **4** student teams

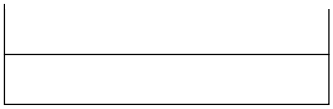
Handouts/Overheads:

Tsunami Inundation Overhead

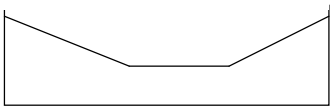
Activity

1. Review how tsunamis occur and how they are related to subduction zones. Divide the class into groups and distribute the materials. Inform the students they are to create a model of tsunami inundation at the coast.

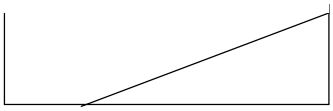
2. Assign each team a shoreline type:
   A. Low lying coast (no slope, flat beach)



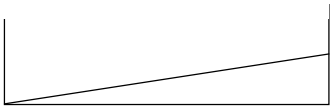
   B. Estuary/River Mouth (Flat inlet in a valley)



   C. Steep beach slope



   C. Gentle beach slope (gradual gradient from beach to highland)



Ask the students to create a model of their shoreline type by using the modeling clay for the shape of the land the sand for a beach area in one end of the turkey tray. Lego can be added to represent buildings/populated areas and toothpicks for trees, students can be as creative as they like with how they design their type of shoreline.

Students should fill the model with water to the level of the sand in the tray (water should not initially submerge any 'land').

3. Now the groups can begin investigating the effects of tsunamis on their modeled shoreline. Ask the students to keep their models steady and mark the 'high tide mark' (where the water meets the sand) by sprinkling coffee grinds on the water line.

Next, the groups should blow up a balloon as full as possible, tie the end off and place the balloon in the water at the opposite end to the modeled shoreline (the 'ocean'), holding it as far down into the water

as possible. As the balloon is being held, another student should take the pin and pop the balloon. This will create a displacement of water and waves to wash onto their shoreline.

As this is a very scaled down model, the waves will happen very quickly so the students will have to observe closely.

Questions to ask the students:

- How far is the shoreline inundated? (This is indicated by the deposition of the coffee grinds)
- Were any of the "buildings" affected?
- What parts (if any) of the shoreline were not affected? Why?

Students can run this test a few times to make clear observations and answer these questions by brainstorming their ideas on flipchart paper.

4. Now ask the groups to switch models and work with a different shoreline type. They should reset the model (i.e. add more coffee grinds and blow up another balloon), and repeat the inundation tests again.

What differences are there between this model and the one they created? If time allows, students may swap more times to view all the other shoreline types.

5. Finally, students should review their observations.

Questions to ask the students:

- What do the models show in terms of tsunamis and people?
- Are there any characteristics or structures on the model that appear to lessen the extent of the inundation?

Class Extensions:

- Students can compare the inundation of their mini-tsunamis with a model of wind waves by blowing through a straw across the water surface in the direction of the beach area. Can these waves inundate the shoreline as much as the displaced waves?

- Students could take a look at the work carried out at the O.H Hinsdale Wave Laboratory at Oregon State University (http://wave.oregonstate.edu/). What type of research does this center carry out?