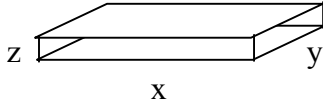


Tsunami energy: a workshop for Energy Systems, 2004-05 (EJZ 3 Jan 05)

Consider the Christmas Tsunami that just devastated Indonesia and the surrounding islands and coasts. The newspaper reported that it involved the sudden drop by about $z=100$ m of a segment of the Earth's crust underwater, about $x=1000$ km long and $y=10$ km wide.



Use these dimensions to estimate the volume of water displaced by the underwater earthquake. $V =$

Recall how density is related to volume and mass, by definition: Density $\rho =$

Then look up the density of water, $\rho_{\text{water}} =$ _____ and find out the mass of water displaced: $M_{\text{water}} =$

If this much water falls a distance z , how much gravitational potential energy is released?

$U =$

Compare this to the energy output of a typical power plant, for example, Bonneville Dam. How many days or weeks would the Dam have to run to produce the energy equivalent of this tsunami?

Think about it: Your learning in this program prepares you to think in some more depth about questions many people are asking about this disaster, with a little research, common sense, and skills at making order-of-magnitude estimates. For example:

Warning system: How fast do these waves travel? How much warning could sirens provide for a future tsunami like this one?

Moving to safety: How high can tsunami waves be expected to reach in this century? (It will get worse, with global warming.) What percent of the land in Indonesia is above this height? How long would it take people to get that high? How effective could a warning system be?

Infrastructure: in addition to short-term emergency relief, many tsunami victims will need to have water, sewer, and transportation infrastructures rebuilt from the ground up. This could be accomplished more quickly using conventional technologies. Name some alternative or advanced technologies you could envision being used in the rebuilding effort. What are the benefits of using these technologies? What are the costs? Is it worth it?

What other relevant questions might you investigate, based on what we have learned so far, and your developing skills for investigating complex new questions?