

The Boxing Day Tsunami

The Boxing Day Tsunami occurred in the Indian Ocean on December 26, 2004. In this exercise, you will explore the causes and effects of this event.

In order to answer the following questions, you will need to open the [Boxing Day Tsunami KMZ file](#) in Google Earth. Be sure to specify the units for all distances, velocities, and times.

1. What were the latitude, longitude, magnitude, and depth of the source event for the tsunami?
2. What was the closest country to the source event? Use the data in the *Countries where Deaths Occurred* folder to find out. Expand the folder. How many deaths occurred in that country as a result of the tsunami?
3. What country in which deaths occurred was farthest from the source event? About how far was it? How many deaths occurred there?
4. Make the *Earth's Tectonic Plates* folder visible. This data is from the United States Geological Survey. What types of plate boundaries are represented by this data? Describe the interaction that occurs between the plates along the first three of the types of boundaries listed in the legend. What two types of plate boundaries are closest to the location of the source event?
5. Make the folder that is entitled *Seismic Events, Dec 25 to 31, 2004* visible. Where did most of the seismic events represented in this folder occur? How do these events relate to the source event?
6. What types of plate boundaries are associated with the clusters of seismic events that occurred near Alaska and along the western coast of South America during the period December 25 to December 31, 2004?
7. According the Tectonic Summary in the USGS report on the event, [Magnitude 9.1 - OFF THE WEST COAST OF NORTHERN SUMATRA](#), what was the cause of the seismic event that triggered the tsunami?

8. Watch the visualization from Kenji Satake at the Active Fault Research Center in Tsukuba, Japan, that is linked from the Carleton College Science Education Resource Center's [Tsunami Visualizations](#) page. Also watch the NOAA visualization that tracks the tsunami waves until they reach the East African coast of Somalia and the NOAA and the rerun of the model that generated a world-wide picture of the wave's propagation.. What happens to the waves as they reach islands and as they enter straits that are narrower and shallower than the open ocean?
9. Open the [NGDC Wave Travel Time Overlay](#) in Google Earth. This overlay documents the travel time of the waves from the location of the source event. Each line represents an hour of travel time. Bold lines mark 5-hour intervals.
 - a) How long did it take the waves to reach Mozambique? What was their average velocity along the route that they took?
 - b) How long did it take the waves to reach Cambodia? How did the velocity of the waves change as they proceeded from the source location to Cambodia? Why did this happen?
10. Make the *Runups, Distances, and Times* folder visible and highlight it. If the time slider appears in the upper right corner of the Google Earth 3D Viewer, expand it to its full range. What were the tsunami runup heights and travel times for each of the following places?
 - Beach labeled "South of Sibolga, Indonesia"
 - The Eva Hotel, which is northeast of Tangalla, Sri Lanka
 - Cape May, New Jersey
11. Link to the Pacific Northwest Seismic Network's January, 1700 [Cascadia Subduction Zone earthquake and tsunami](#) page. Please follow the links on that page, and describe the evidence for the "Great Quake of 1700"?

12. Look at the before and after photos for the tsunami that are linked from the Carleton College Science Education Resource Center's [Tsunami Visualizations](#) page. Why do people live and work along the shoreline even though it subjects them to the danger of tsunami waves? What adaptations to this threat would it be practical to implement?