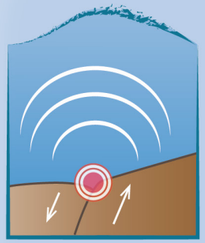
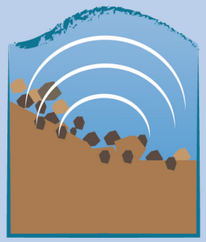
The Science Behind Tsunamis

Tsunamis start because of a sudden displacement of ocean water, usually an earthquake.



81% Earthquakes

Undersea earthquakes cause more than 80 percent of global tsunamis.



10% Landslides

Landslides, typically triggered by earthquakes, generate about 10 percent of global tsunamis.

5% Volcanoes

Volcanic eruptions generate about 5 percent of global tsunamis. Another 4 percent of tsunamis arise from other sources.

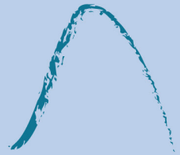
Large Impacts

In extremely rare cases, a meteor of sufficient size could generate a tsunami upon striking the ocean.

Tsunamis consist of a series of waves that can cause dangerous surges of water along shorelines. These surges can last minutes, hours, or even days.

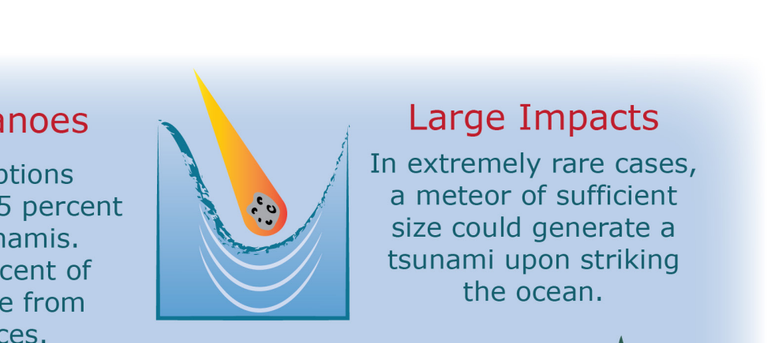
At 16,000 feet deep
Wave Height = < 3 ft
Waves travel 500 mph,
as fast as an airplane.

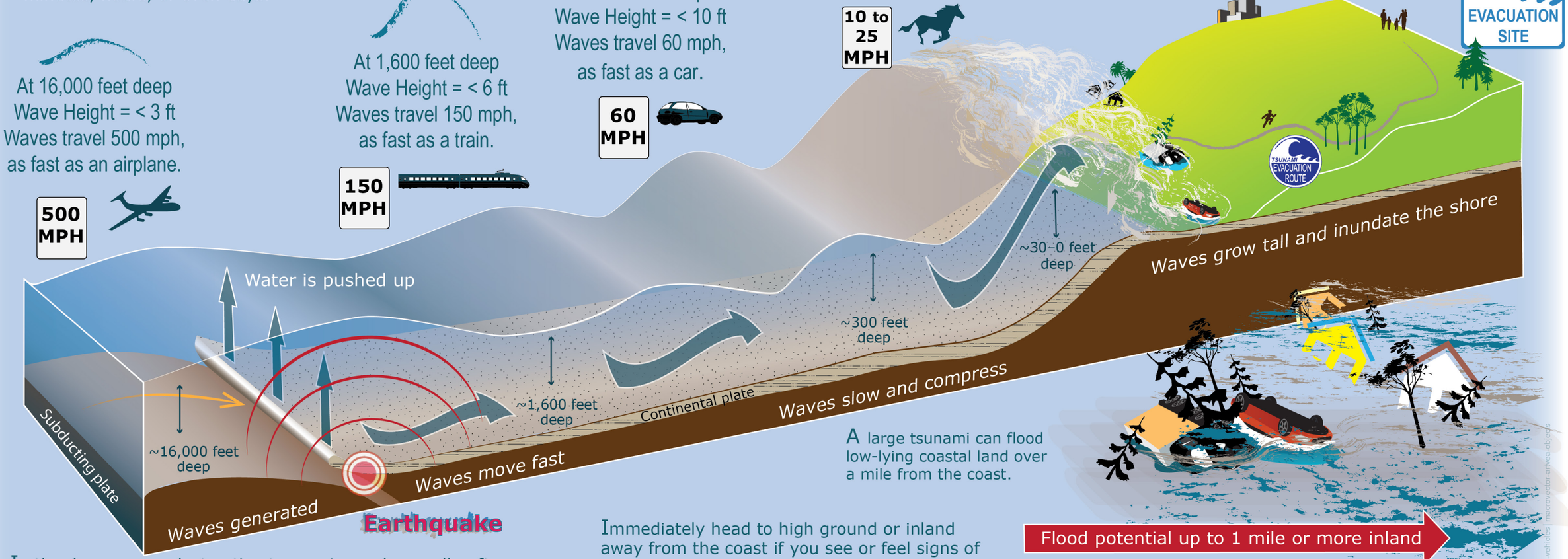
At 1,600 feet deep
Wave Height = < 6 ft
Waves travel 150 mph,
as fast as a train.



At 300 feet deep
Wave Height = < 10 ft
Waves travel 60 mph,
as fast as a car.

At 30 feet deep
Wave Height = ~ 30 ft
Waves travel 10–25 mph,
as fast as a horse.





A large tsunami can flood low-lying coastal land over a mile from the coast.

Flood potential up to 1 mile or more inland

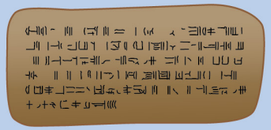
In the deep ocean, destructive tsunamis can be small—often only a few inches or less in height—and cannot be seen nor felt on ships at sea. Tsunami wave energy extends from the surface to the bottom in even the deepest waters. Tsunami speed slows in shallow water as wave height increases rapidly.

Immediately head to high ground or inland away from the coast if you see or feel signs of a tsunami. Signs include ground shaking or coastal waters rapidly drawn out into the ocean. The force of some tsunamis is enormous. Large rocks weighing several tons along with boats and other debris can be moved inland hundreds of feet by tsunami wave activity, destroying homes and buildings. Debris and water move with great force and can kill or injure people, pets, and livestock.

Historical Tsunami Database

Understanding tsunamis begins with information. NOAA's National Centers for Environmental Information (NCEI) collects critical data about the impacts of tsunamis into our Historical Tsunami Database for public use. Our database compiles wave heights, fatalities, and damage information from more than 2,000 tsunami events. In pictures, wave observations, and eyewitness surveys, NCEI keeps unique data that help communities prepare for the future.

Eyewitnesses and field reconnaissance surveys

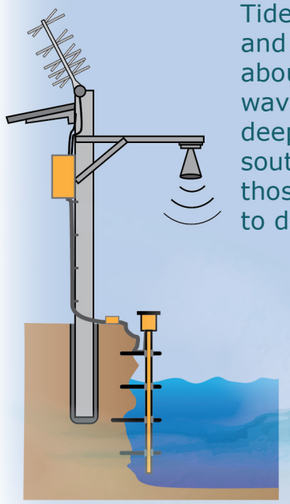


How do scientists learn about tsunamis, especially if they happened long ago? Primarily, from eyewitness accounts. A description of the earliest known tsunami from 4,000 years ago survives on a Syrian cuneiform tablet, which is a wedge-shaped clay tablet permanently marked by a stylus tool. Today, teams of researchers routinely conduct eyewitness and field reconnaissance surveys as the primary means to collect records for the Historical Tsunami Database.

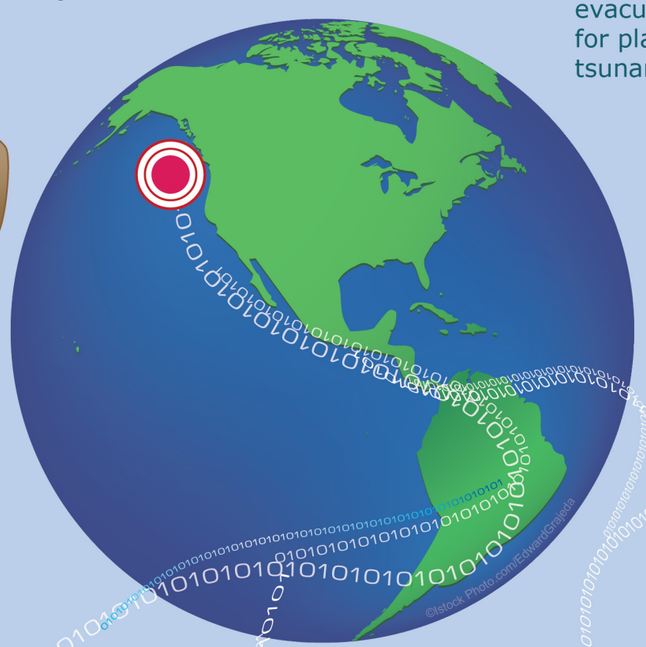
Warning centers

Our Historical Tsunami Database serves many people who watch ocean conditions that may indicate a tsunami could develop—such as earthquakes or undersea volcanic eruptions. U.S. Tsunami Warning Centers and other observation agencies consult NCEI's database to review past events to determine areas at risk of danger.

Tide gauges and deep-ocean sensors



Tide gauges—wave sensors positioned on or near coasts—in California and Oregon recorded the December 23, 1854, tsunami from Japan about twelve hours after generation, resulting in the first tsunami waves recorded on tide gauges. Much later in February 1980, the first deep-ocean recordings of a small tsunami were taken near the southern Kuril Islands. Both types of records help those consulting the Historical Tsunami Database to develop warnings and models for forecasting.



Responders

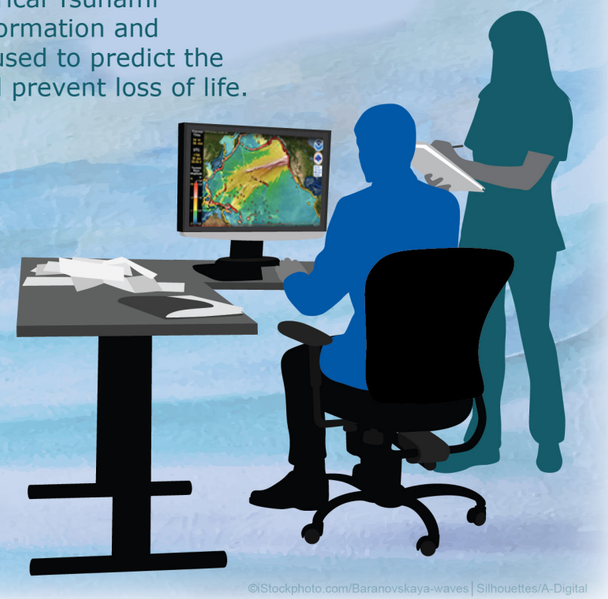
Emergency responders use the Historical Tsunami Database to make evacuation decisions, plans, and maps for places most likely to be at risk for tsunami waves.

General public

The general public can easily access information about past events from the Historical Tsunami Database. Access is free at: **www.ngdc.noaa.gov/hazard/tsu.shtml**. This quality-controlled information offers residents and citizens on many coastlines a better understanding of tsunami hazards.

Researchers

Researchers search the Historical Tsunami Database to discover new information and validate models. Models are used to predict the behavior of future events and prevent loss of life.



*Stay alert! Tsunamis tend to occur after strong or long earthquakes. If you feel the earth shake intensely or for a long time in or near a coastal area, immediately move inland or to higher ground as quickly as possible. Also, check **tsunami.gov** for warnings.*

www.ngdc.noaa.gov/hazard/tsu.shtml