

When I think of tsunamis, I think of...

▪ **Tidal Waves**

Most people assume that there is no difference between a tidal wave and a tsunami, and often use the words interchangeably. This is inaccurate, and while both of the waves carry the power of destruction, the greatest difference is how each is born.

A tidal wave is directly impacted by the atmosphere. The correlating factors between the sun, moon, and Earth cause a disturbance in the sea, and a 'shallow water wave' is formed. Shallow water waves imply that the development of a tidal wave is much closer to the shoreline of a land mass, that will ultimately be in its path. However, because of the depth relating to its origins, it is possible that a tidal wave can 'burn itself out' before it reaches the land.



The origin of the tsunami is much deeper. It is caused by a deep disturbance along the ocean floor. This disturbance usually comes from an underwater earthquake, or even an underwater landslide. The deeper origin of the tsunami creates a more emphatic wave. It will often carry itself across hundreds, or even thousands, of miles of ocean before making landfall.

The tidal wave has what we would call regional preferences. It is unlikely that a tidal wave would make landfall in areas of temperate climates, or northern countries. The various elements which cause its development form, in their precise manner, in lower latitudes, creating a higher possibility for landfall in places like the West Indies, for example. The tidal wave follows the currents, and therefore, is only able to strike areas within the current flow.

The tsunami has the potential to develop anywhere. The placement of the earthquake or landslide, or even the unique event of an underwater eruption, compels the start of the wave. Just like the tidal wave, the tsunami also follows the currents. Yet, since the development of the underwater event can happen within the current flow heading toward the US, Canada, or Great Britain, it could be assumed that a tsunami can hit one of these usually unaffected countries.

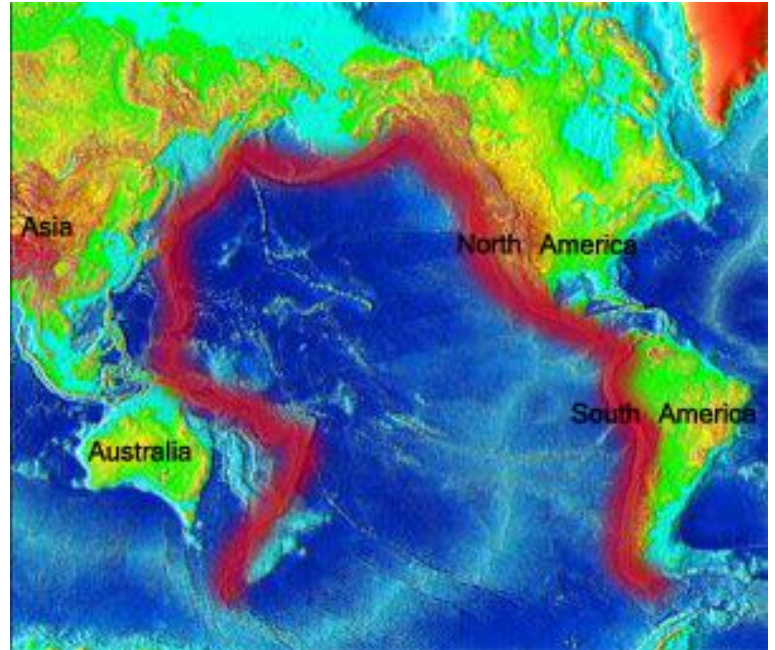
Most people who do understand the difference between the two waves are inclined to believe that the tsunami is more destructive than the tidal wave. While in many cases, this is a correct assumption, a blanket statement is not necessarily true. The size of the waves is determined by many varying factors, including the wind's direction and speed.

▪ **Ring of Fire**

The Pacific Ring of fire is a region of high volcanic and seismic activity that surrounds the majority of the Pacific Ocean Basin. This region is essentially a horseshoe of geologic activity that

includes volcanoes, earthquakes, deep sea trenches, and major fault zones. The Ring of Fire is over 40,000 km long and touches 4 of the world's continents as well as major island chains.

The Pacific Ring of Fire is inherently made up of the plate boundaries that border the Pacific Ocean basin. The eastern side of the Ring of Fire is the result of the Nazca and Coco Plates subducting beneath the South American plate. Subduction is when one plate is forced beneath another. This normally happens when one plate is heavier and thicker than the other. Up near North America part of the Pacific Plate and the Juan de Fuca plate are being subducted under the North American plate. The northern part of the Ring of Fire is the subduction zone of the Pacific plate and the Aleutian Islands. The other areas are the region near Japan and through Oceania. On average the subduction zones see plate movement of up to 10 centimeters per year.



The Ring of Fire is the home of many of the most famous and well known fault zones and volcanoes on the planet. Some of them are probably familiar to you. For example the most recent earthquake that rocked Chile occurred because of the fault zone off the coast of Chile which is a part of the Ring of Fire. The other well known zone is the Cascade volcano chain in North America. The most well known volcano is Mt. St. Helens. On the other side of the Pacific ocean there are even more famous volcanoes like Mount Fuji and Krakatoa.

The Ring of Fire is a crucial region for many reasons. It serves as one of the main boundary regions for the tectonic plates of over over half of the globe. It also affects the life of millions if not billions of people who live in these regions. For many of the people who live in the Pacific Ring of Fire, the reality of a volcanic eruption or earthquake is commonplace and a challenge they have come to deal with over time. At the same time the volcanic activity has also provided many valuable resources such as rich farmland.

▪ **2004 Indian Ocean Tsunami**

The earthquake that generated the great Indian Ocean tsunami of 2004 is estimated to have released the energy of 23,000 Hiroshima-type atomic bombs, according to the U.S. Geological Survey (USGS).

Giant forces that had been building up deep in the Earth for hundreds of years were released suddenly on December 26, shaking the ground violently and unleashing a series of killer waves that sped across the Indian Ocean at the speed of a jet airliner.

By the end of the day more than 150,000 people were dead or missing and millions more were homeless in 11 countries, making it perhaps the most destructive tsunami in history.



The epicenter of the 9.0 magnitude quake was under the Indian Ocean near the west coast of the Indonesian island of Sumatra, according to the USGS, which monitors earthquakes worldwide. The violent movement of sections of the Earth's crust,

known as tectonic plates, displaced an enormous amount of water, sending powerful shock waves in every direction.

The earthquake was the result of the sliding of the portion of the Earth's crust known as the India plate under the section called the Burma plate. The process has been going on for millennia, one plate pushing against the other until something has to give. The result on December 26 was a rupture the USGS estimates was more than 600 miles (1,000 kilometers) long, displacing the seafloor above the rupture by perhaps 10 yards (about 10 meters) horizontally and several yards vertically. That doesn't sound like much, but the trillions of tons of rock that were moved along hundreds of miles caused the planet to shudder with the largest magnitude earthquake in 40 years.

Above the disturbed seafloor the great volume of the ocean was displaced along the line of the rupture, creating one of nature's most deadly phenomena: a tsunami. Within hours killer waves radiating from the earthquake zone slammed into the coastline of 11 Indian Ocean countries, snatching people out to sea, drowning others in their homes or on beaches, and demolishing property from Africa to Thailand.

Tsunamis have been relatively rare in the Indian Ocean, at least in human memory. They are most prevalent in the Pacific. But every ocean has generated the scourges. Many countries are at risk. (Read "Tsunami: Facts About Killer Waves" for more about killer waves' causes and warning signs—information that can be a lifesaver in a tsunami zone.)

The Indian Ocean tsunami traveled as much as 3,000 miles (nearly 5,000 kilometers) to Africa, arriving with sufficient force to kill people and destroy property.

A tsunami may be less than a foot (30 centimeters) in height on the surface of the open ocean, which is why they are not noticed by sailors. But the powerful pulse of energy travels rapidly through the ocean at hundreds of miles per hour. Once a tsunami reaches shallow water near

the coast it is slowed down. The top of the wave moves faster than the bottom, causing the sea to rise dramatically.

The Indian Ocean tsunami caused waves as high as 50 feet (15 meters) in some places, according to news reports. But in many other places witnesses described a rapid surging of the ocean, more like an extremely powerful river or a flood than the advance and retreat of giant waves.

11 Facts about the 2004 Tsunami:

- 1.) The December 26, 2004 Indian Ocean tsunami was caused by an earthquake that is thought to have had the energy of 23,000 Hiroshima-type atomic bombs.
- 2.) The epicenter of the 9.0 magnitude quake was under the Indian Ocean near the west coast of the Indonesian island of Sumatra.
- 3.) The violent movement of sections of the Earth's crusts known as tectonic plates displaced an enormous amount of water, sending powerful shock waves in every direction.
- 4.) The tectonic plates in this area had been pushing against each other, building pressure for thousands of years – they continue to do so and will likely cause underwater earthquakes and tsunamis in the future.
- 5.) The shifting of the earth's plates in the Indian Ocean on Dec. 26, 2004 caused a rupture more than 600 miles long, displacing the seafloor above the rupture by perhaps 10 yards horizontally and several yards vertically. As a result, trillions of tons of rock were moved along hundreds of miles and caused the planet to shudder with the largest magnitude earthquake in 40 years.
- 6.) Within hours of the earthquake, killer waves radiating from the epicenter slammed into the coastline of 11 Indian Ocean countries, damaging countries from east Africa to Thailand.
- 7.) A tsunami is a series of waves, and the first wave may not be the most dangerous. A tsunami "wave train" may come as surges five minutes to an hour apart. The cycle may be marked by the repeated retreat and advance of the ocean.
- 8.) Despite a lag of up to several hours between the earthquake and the impact of the tsunami, nearly all of the victims were taken completely by surprise because there were no tsunami warning systems in the Indian Ocean to detect tsunamis or to warn the general populace living around the ocean.
- 9.) The Indian Ocean tsunami traveled as far as 3,000 miles to Africa and still arrived with sufficient force to kill people and destroy property.
- 10.) Many people in Indonesian reported that they saw animals fleeing for high ground minutes before the tsunami arrived – very few animal bodies were found afterward.
- 11.) The earthquake-induced tsunami resulted in at least 155,000 fatalities, 500,000 injuries, and damages that exceeded \$10 billion. Also, it is estimated that 5 million people lost their homes or access to food and water.