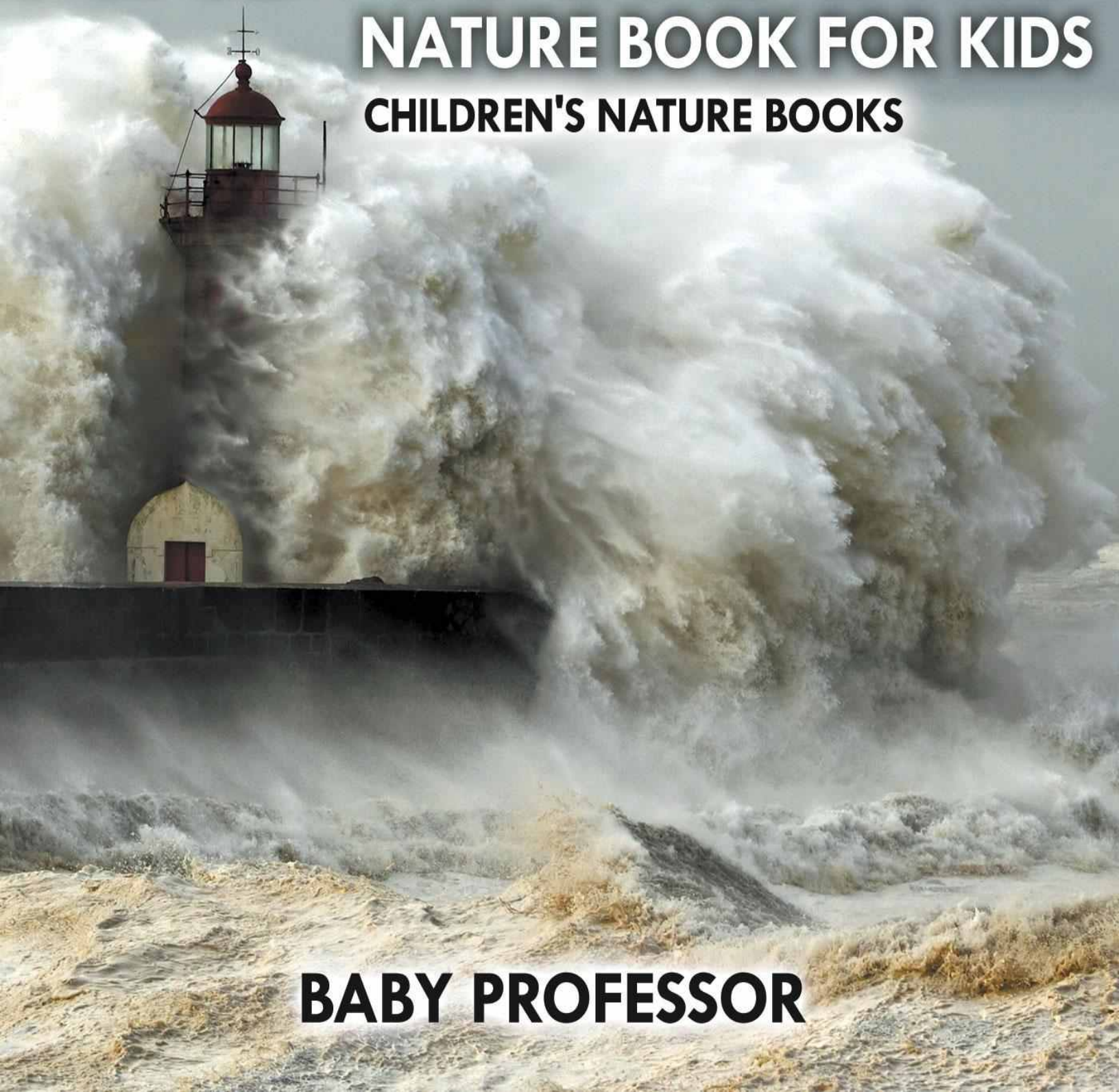


# OCEAN TIDES AND TSUNAMIS

**NATURE BOOK FOR KIDS**  
**CHILDREN'S NATURE BOOKS**



**BABY PROFESSOR**

# OCEAN AND TSU

NATURE BOO

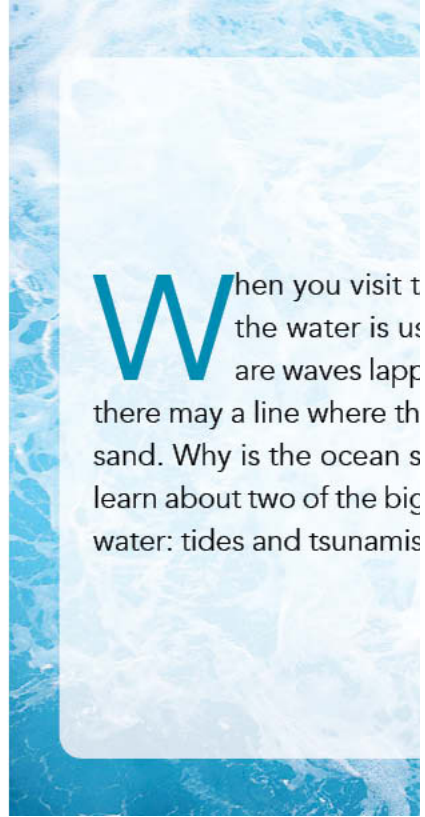
Children's No



Speedy Publishing LLC  
40 E. Main St. #1156  
Newark, DE 19711  
[www.speedypublishing.com](http://www.speedypublishing.com)

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**W**hen you visit t  
the water is us  
are waves lapp  
there may a line where th  
sand. Why is the ocean s  
learn about two of the big  
water: tides and tsunamis

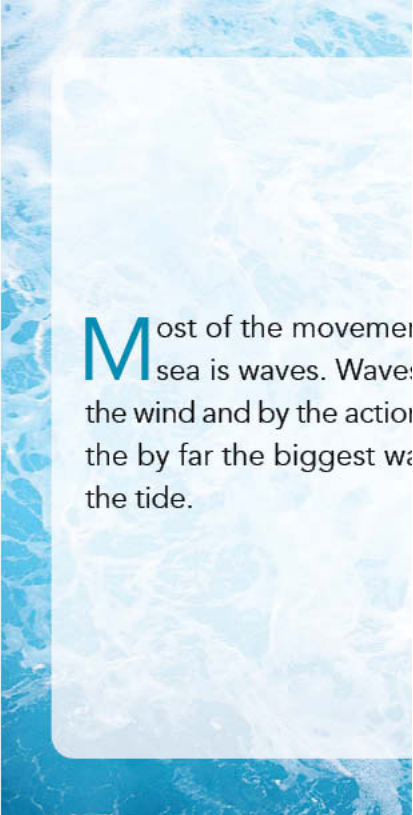


Waves

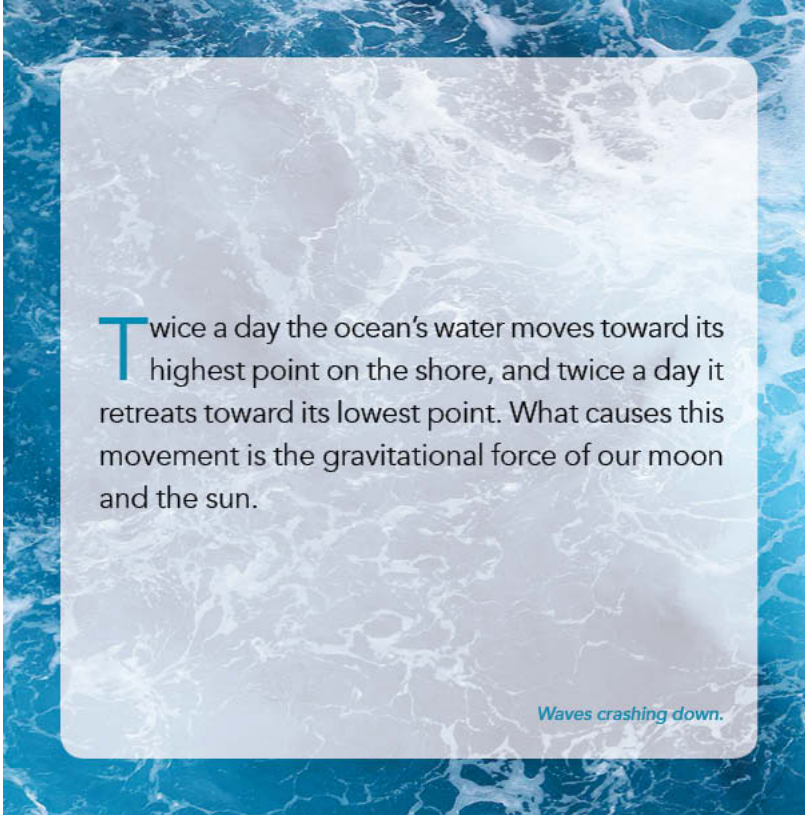




# THE TIDE IS FROM SPACE!



Most of the movement of the sea is waves. Waves are caused by the wind and by the action of the tide. The tide is by far the biggest wave.

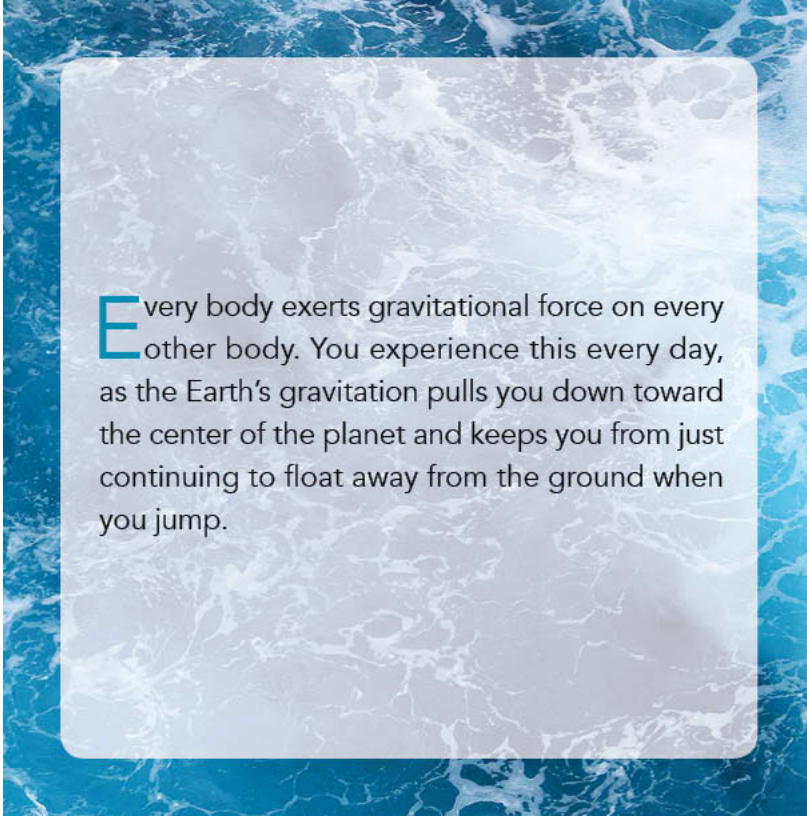
An aerial photograph of the ocean's surface, showing intricate patterns of white foam and deep blue water. A semi-transparent white rectangular box is centered over the image, containing text.

Twice a day the ocean's water moves toward its highest point on the shore, and twice a day it retreats toward its lowest point. What causes this movement is the gravitational force of our moon and the sun.

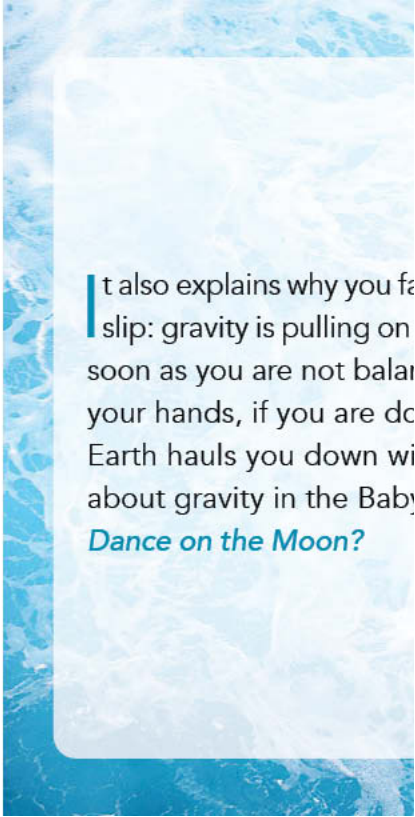
*Waves crashing down.*



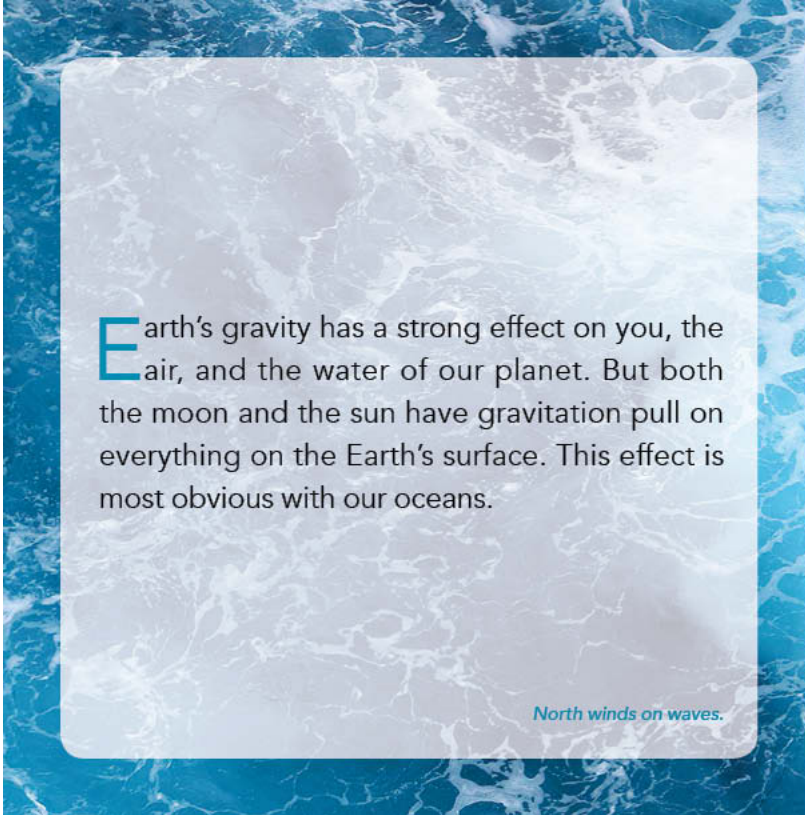




Every body exerts gravitational force on every other body. You experience this every day, as the Earth's gravitation pulls you down toward the center of the planet and keeps you from just continuing to float away from the ground when you jump.



It also explains why you fall when you slip: gravity is pulling on you. So, as soon as you are not balanced on your hands, if you are doing a handstand, Earth hauls you down with its gravity. About gravity in the Baby *Dance on the Moon?*

An aerial photograph of the ocean's surface, showing a complex pattern of white foam and blue water. A semi-transparent white rectangular box is overlaid on the center of the image, containing text.

Earth's gravity has a strong effect on you, the air, and the water of our planet. But both the moon and the sun have gravitation pull on everything on the Earth's surface. This effect is most obvious with our oceans.

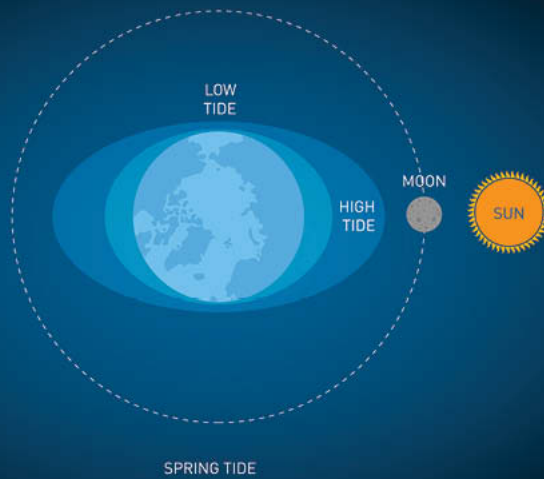
*North winds on waves.*





# SPRING TIDE

## TIDE TYPES OF EARTH



Since the moon is closer to the Earth, its gravitational effect is greater than that of the Sun. On the side of the Earth facing the moon, the water bulges up slightly in response to the moon's pull and the water comes in to make "High Tide". On the opposite side of the Earth, the water is pulled away from the shore to make "Low Tide". This happens twice a day.

The sun has a similar, smaller effect. When the moon and the sun are on opposite sides of the Earth, the gravitation forces partly cancel each other out, and both high and low tides are less extreme. This is called a **Neap Tide**. And when the moon is on the same side of the Earth as the sun, the tides can get to their greatest highs and lows.



*Hopewell Rock in the Bay of Fundy at low tide*





## HIGH TIDES IN THE BAY OF FUNDY

The shape of the shoreline and how shallow part of the ocean is also affect the size of the tides. The highest tidal range in the world is in the Bay of Fundy, between New Brunswick and Nova Scotia in eastern Canada. The Bay is much more shallow than the open ocean, and is shaped like a narrow, long bottle. This exaggerates the tidal effect, so at its most extreme the difference between high and low tide can reach over fifty feet!

*St. Martins Sea Caves High Tide.*





The extreme tide change speeds erosion, creating a landscape that releases lots of nutrients into the water. This attracts fish, whales, and other marine life. Scientists are under way to try to harness the power of Fundy tides to create energy without hurting the Bay's ecosystem.

The high tides often provide a challenge for sailors. You may anchor your boat in the water, row to shore for supplies, and when you return, that your boat is stuck on a mud flat!

*High tide in the Bay of Fundy.*

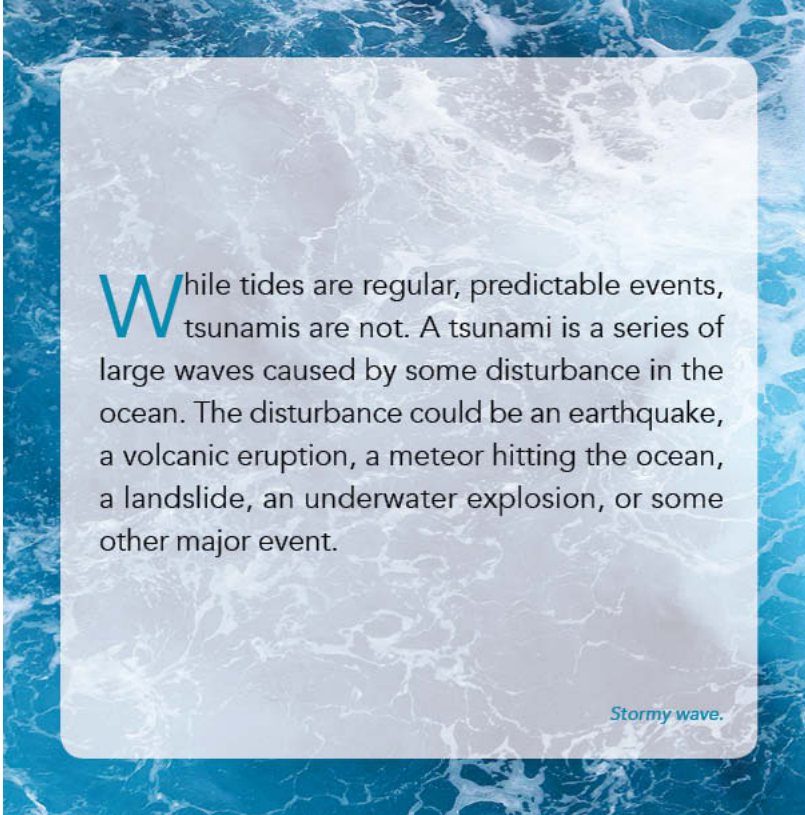






# A TSUNAMI FOLLOWS A HUGE EVENT

“**T**sunami” is Japanese. It is the general term for a wave that affects harbors. It probably arose from the sea, would not pass under them, as they get to shallow water. As fishermen got home, they found their village mysteriously destroyed.

An aerial photograph of the ocean showing a complex pattern of white-capped waves and blue water. A semi-transparent white box is overlaid on the center of the image, containing text.

While tides are regular, predictable events, tsunamis are not. A tsunami is a series of large waves caused by some disturbance in the ocean. The disturbance could be an earthquake, a volcanic eruption, a meteor hitting the ocean, a landslide, an underwater explosion, or some other major event.

*Stormy wave.*

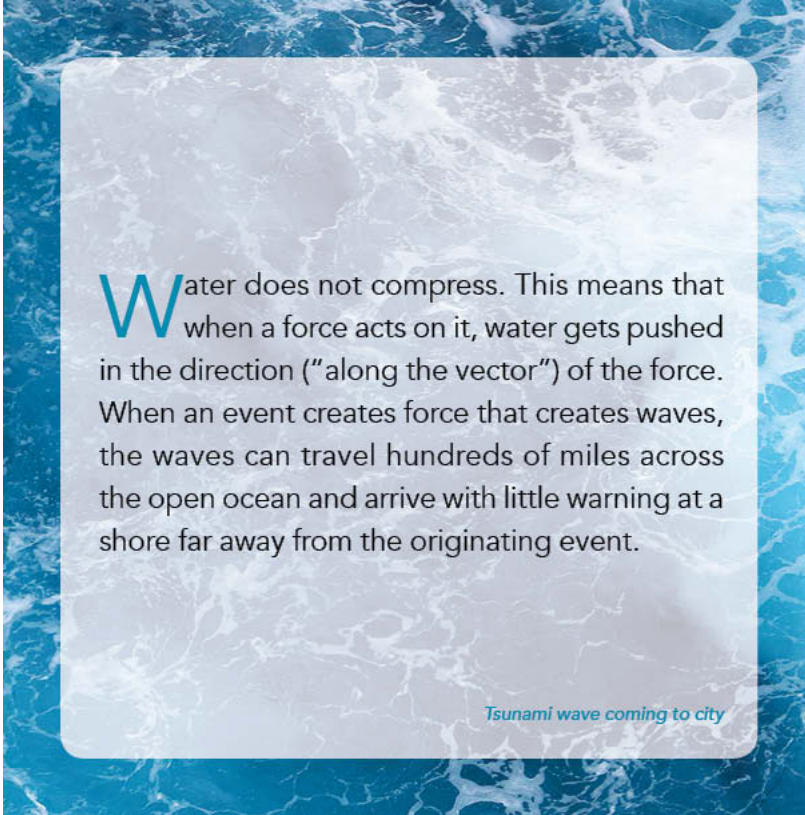




**G**reek scientists first suggested that tsunamis were caused by undersea earthquakes. This theory was not widely accepted until the 1950s, when scientists discovered that earthquakes can create tsunamis.

*Giant blue waves crested with foam.*

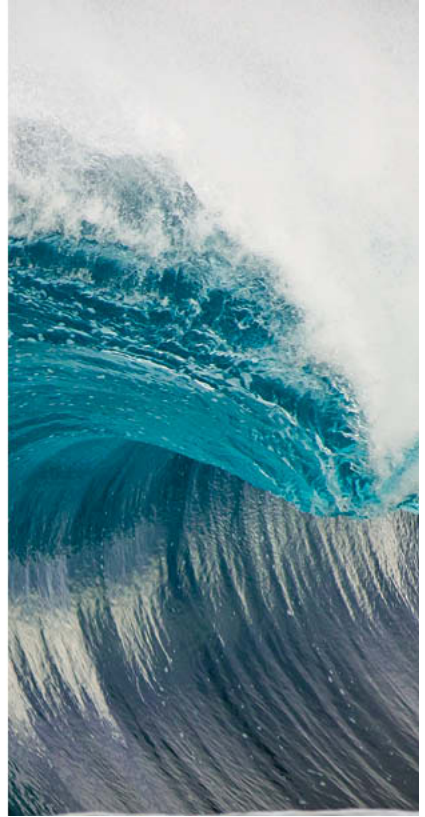




Water does not compress. This means that when a force acts on it, water gets pushed in the direction (“along the vector”) of the force. When an event creates force that creates waves, the waves can travel hundreds of miles across the open ocean and arrive with little warning at a shore far away from the originating event.

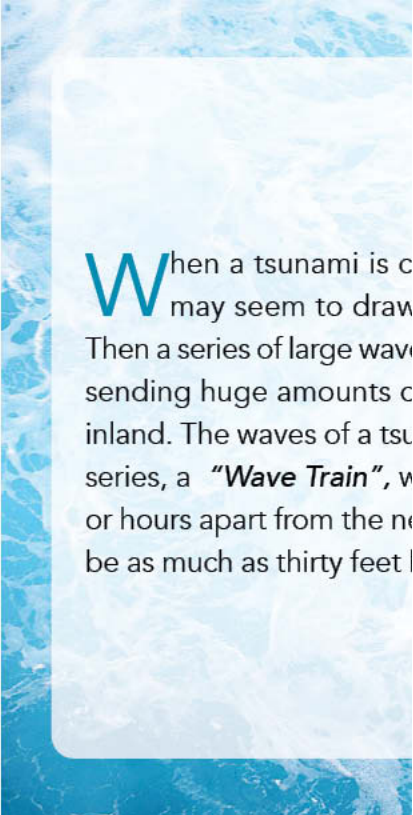
*Tsunami wave coming to city*





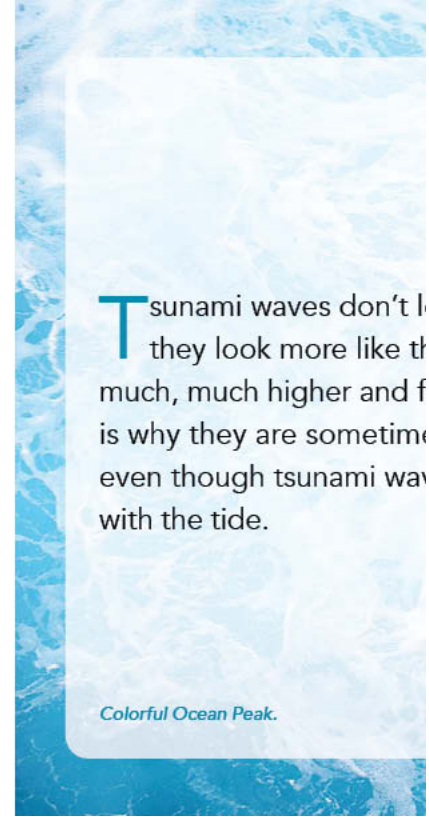


# TSUNAMI WAVES



When a tsunami is caused, it may seem to draw water away from the shore. Then a series of large waves come, sending huge amounts of water inland. The waves of a tsunami are a series, a *“Wave Train”*, with waves that are minutes or hours apart from the next. The waves can be as much as thirty feet high.





**T**sunami waves don't look like regular waves. They look more like the ocean's giant hand, much, much higher and faster. This is why they are sometimes called "tidal waves" even though tsunamis have nothing to do with the tide.

*Colorful Ocean Peak.*

## LANDSLIDES

Underwater landslides can create huge tsunamis as they displace large volumes of water very quickly. In 1958, a landslide in Alaska generated the highest wave ever recorded: 1700 feet high! Fortunately, the landslide and wave were in a bay, which contained its destructive force.

A similar event in the waters of the Vajont Dam in Italy caused a wave surge over 800 feet high that killed over two thousand people.

*Longarone (BL) after Vajont disaster dam, 1963.*









# TSUNAMI DISASTERS

Tsunamis can cause destruction. Since people have died because

Tsunamis have two types of damage. The first is when they are travelling at high speeds, they can destroy buildings, and forests. When the water drains back in, it carries wreckage with it. Small boats and pieces of buildings can cause injuries. People who were down to the sea to struggle to survive the waves as they



*Here are some tsunami disasters  
past and from long ago.*

## **INDONESIA**

**A** giant earthquake near  
a huge tsunami that killed  
in countries around the Indian

*A village near the coast of Sumatra lays  
the Tsunami that struck South East Asia*

## FUKUSHIMA, 2011

Japan's nuclear reactors at Fukushima were protected by high sea walls along 15 miles of shoreline. When the tsunami waves rolled in, they were 50% higher than the walls, and just spilled over them and knocked many of the walls down. This was a disaster all along the coast, but particularly in that it caused a massive spill of radioactive material at the reactor.

*Damage scenery of the East Japan great earthquake disaster.*







## ALEXANDRIA, 365

A tsunami heavily damaged Alexandria in Egypt in 365. Historian Ammianus Marcellinus is the first to have recorded the pattern of an earthquake, the sea drawing back from the shore, and then the huge waves rolling in and damaging the shore and the city.



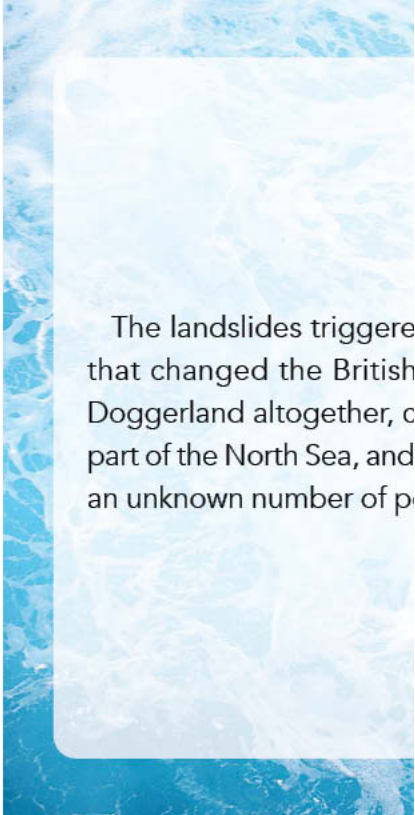
## MESSINA

This earthquake and related events resulted in the death of more than 100,000 people, making it one of the worst natural disasters in history.



## THE STOREGGA SLIDE, 6,000 BCE

In the North Sea between England and Denmark there was once a large, low territory that historians call Doggerland. It was inhabited, and the southern part of it linked Britain to what is now France. About eight thousand years ago there were three huge landslides in Norway involving almost 200 miles of cliffs.



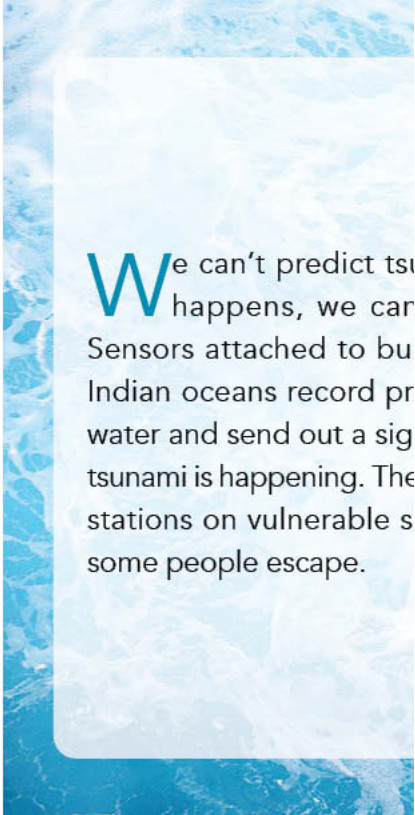
The landslides triggered a sea level rise that changed the British Isles and Doggerland altogether, cutting off part of the North Sea, and an unknown number of people.







# TSUNAMI WARNINGS



**W**e can't predict tsunamis. When a tsunami happens, we can't see it coming. Sensors attached to buoys in the Indian oceans record pressure changes in the water and send out a signal when a tsunami is happening. The sensors are on vulnerable shores, so some people escape.



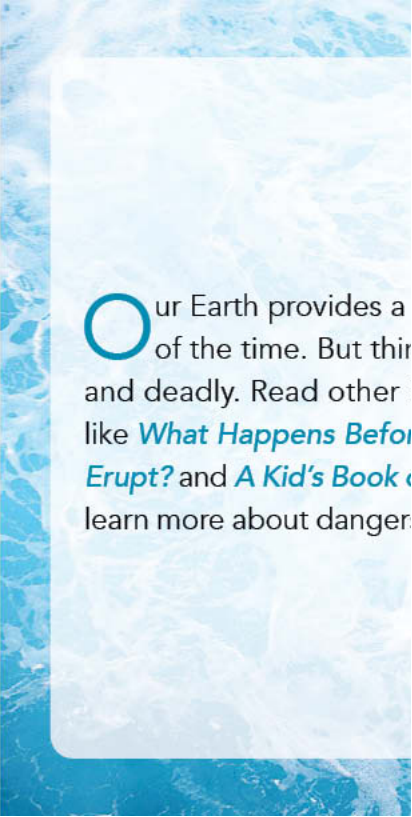
It may be too late to get away if you see a tsunami coming at more than 400 miles per hour.

In 2004 Tilly Smith, aged 11, was in Thailand with her parents. She was drawing back very quickly when she had learned in school what she had learned in school from her parents. Her family and classmate managed to escape the tsunami immediately.

*Tsunami evacuation route sign.*



**LEARN MORE  
ABOUT THE  
EARTH**



Our Earth provides a  
of the time. But this  
and deadly. Read other  
like *What Happens Before  
Erupt?* and *A Kid's Book*  
learn more about danger





