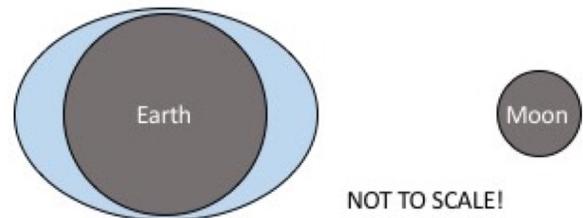


Why Does the Earth's Oceans Have Tides?

Tides cause daily changes in water level in the oceans and along coastlines. The primary reason for tides on Earth is gravitational interaction with the Moon and Sun. The entire Earth experiences tides – both on the continents and oceans. The effect is most pronounced in the oceans because, as a liquid, it is more easily deformed by tidal forces when compared to the solid Earth.

Although the Moon and Sun both affect tides on Earth, the affect of the Moon on Earth's tides is twice as strong as for the Sun. This may seem strange since the Moon is so much smaller than the Sun and the Sun has much greater gravity. However, the formation of tides is strongly affected by the distance between objects. Since the Moon is much closer to the Earth, it has a greater effect than the Sun.

There are two tidal bulges that form in the Earth's oceans – one on the side of the Earth facing the Moon and the second bulge is on the opposite side of the Earth. The explanation for the formation of two tidal bulges is very complex but it is due to the gravitational interaction between the Earth and Moon resulting in tidal forces. The tidal force causes the shape of the Earth to elongate forming two tidal bulges aligned with the Moon.



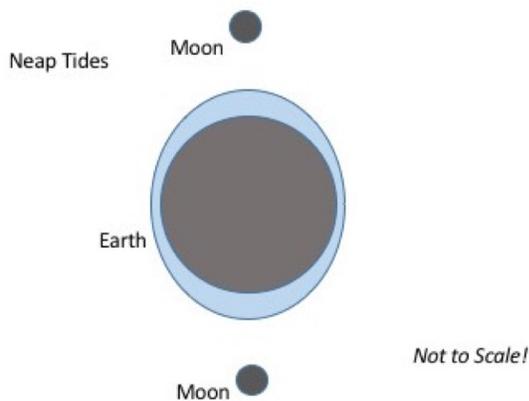
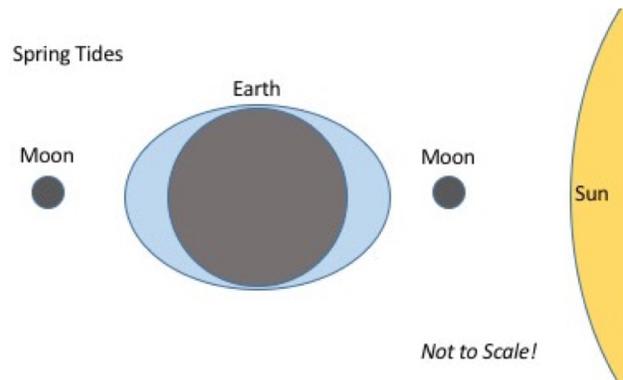
The Earth rotates on its axis through the two water bulges that are aligned with the Moon. When the part of the Earth that is within a tidal bulge, the coastline there experiences high tide. Low tide occurs when that part of the Earth is between the two bulges.

You might think that tides would occur exactly every 12 hours since the Earth rotates on its axis in 24 hours. However, as the Earth is rotating on its axis, the Moon is also orbiting the Earth in the same direction as the Earth is rotating. A spot on Earth has to rotate an additional 50 minutes to catch up and be in the same position with the Moon. Thus, a complete tide cycle with two high tides and two low tides takes 24 hours and 50 minutes. That means that every day, the time of the high tides and low tides occurs 50 minutes later than on the previous day. For most coastlines, high tides occur every 12 hours and 25 minutes (half of 24 hours and 25 minutes). It is the same for low tides and they occur every 12 hours and 25 minutes.

Gravity from the Sun also influences tides on the Earth. There are small tidal bulges on Earth due to the Sun - one on the side of the Earth facing the Sun and the second bulge is on the opposite side of the Earth. However, they are only about half the size of those caused by the Moon. Thus, the Moon has the greatest affect on the tides that we experience.

As the Moon orbits the Earth, the orientation between the Earth, Moon and Sun constantly changes. The phases of the Moon that we experience every month are evidence of these changes. Since both the Moon and Sun affect tides on Earth, the orientation between all of them affects tides.

When the Sun and Moon are aligned with the Earth, the largest high tides and lowest low tides occur and are known as Spring tides. The reason for this is that the gravitational forces of the Moon and Sun add together to produce an extra high tidal range. Spring tides occur about twice a month during full Moon (when the Moon is on the opposite side of the Earth from the Sun) and the new Moon when the Sun and the Moon are on the same side of the Earth.



When the Sun and Moon are at right angles to one another, their gravitational force compete. In this orientation, the high tides are not as high as during Spring tides. In addition, the low tides are not as low as during Spring tides. Another way of saying this is that the tidal range is small. This type of tide is known as a Neap tide. Neap tides occur about twice a month when the Moon is in its first and third quarter phases.

There are other factors than can affect sea level and tides such as the shape of the coastline, the shape of the seafloor, and weather.