

What causes the tides?



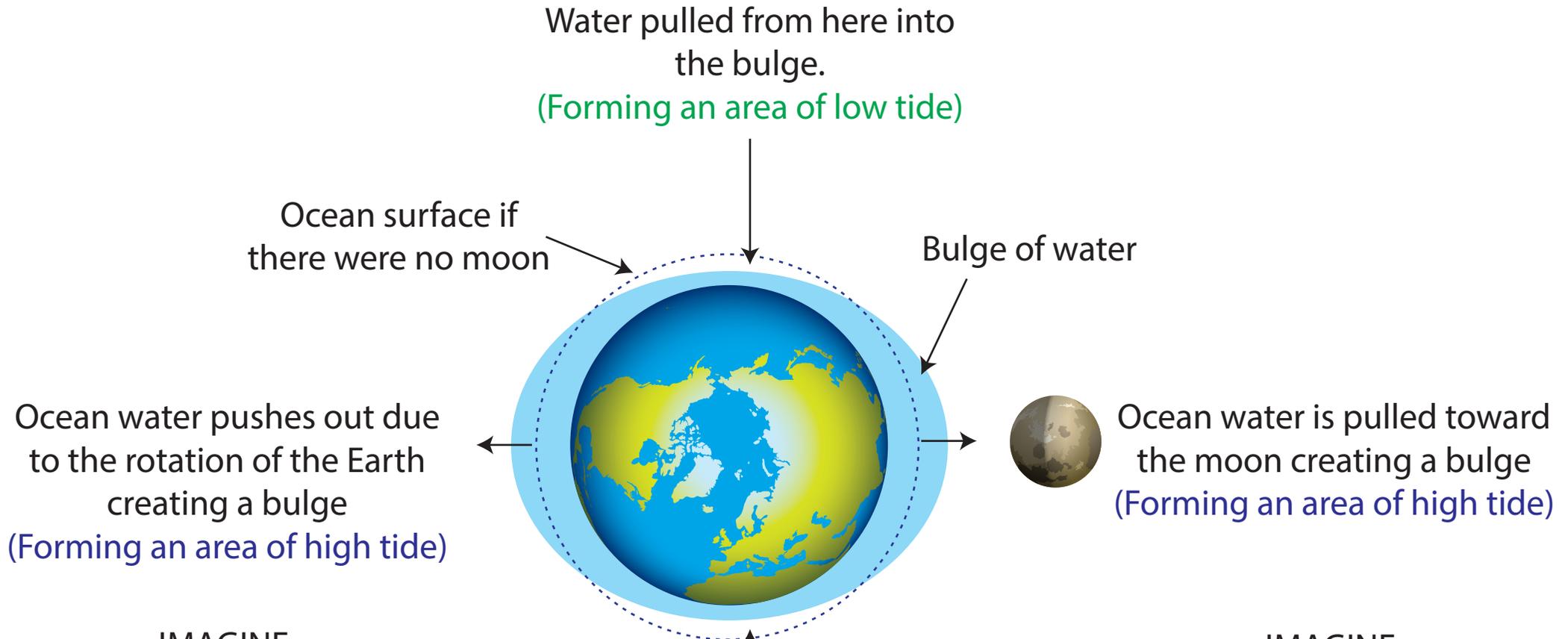
The movement of tidal water on our planet is driven by the gravitational forces of the Moon and the Sun.

Bodies in the solar system are attracted to each other. Larger bodies have a stronger pull than smaller bodies. But that pull is lessened with distance.



The Sun and the Moon both exert a gravitational pull on the Earth. Even though the Moon is much smaller than the Sun, the Moon's gravitational pull on the Earth has a stronger effect on the tides. This is because the Moon is so close to the Earth.

The Bulge Theory Of The Tides



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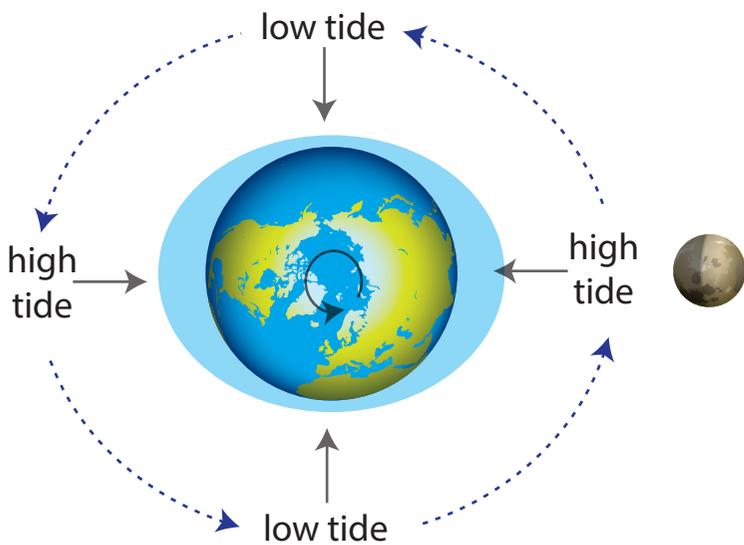
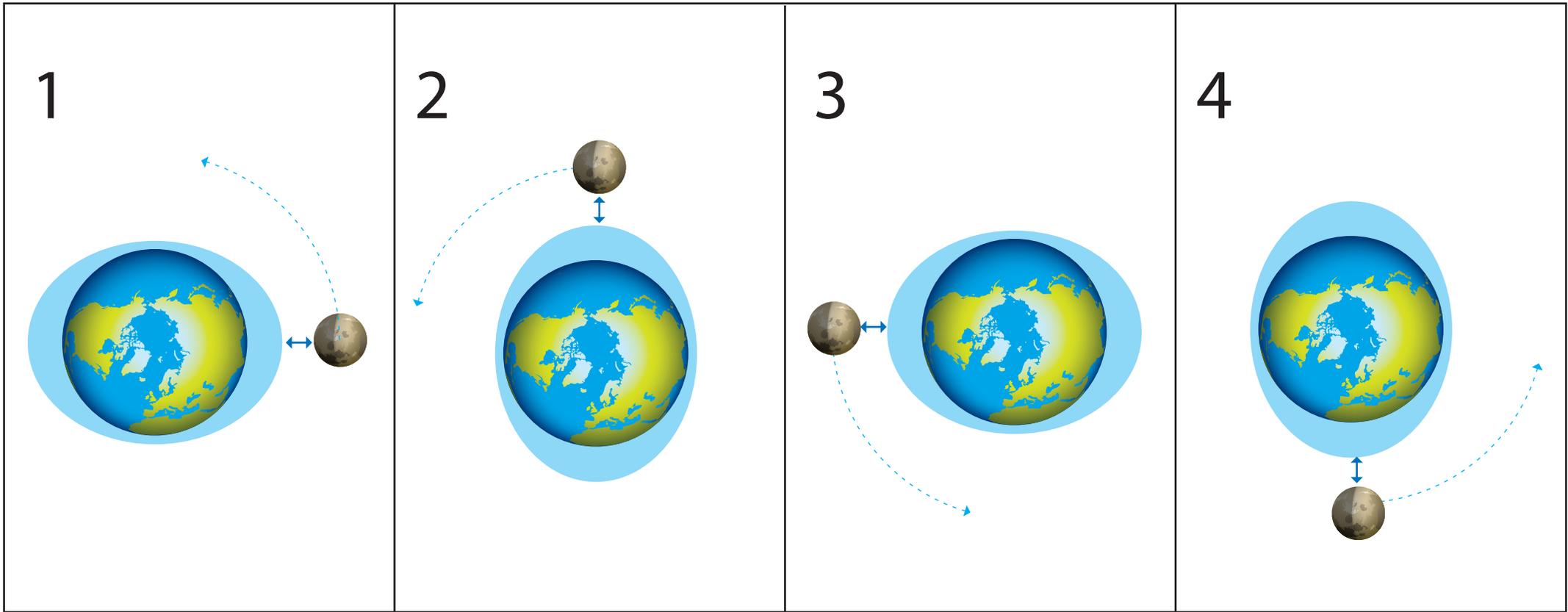


Water pulled from here into the bulge.
(Forming an area of low tide)

This diagram is not to scale.

IMAGINE:



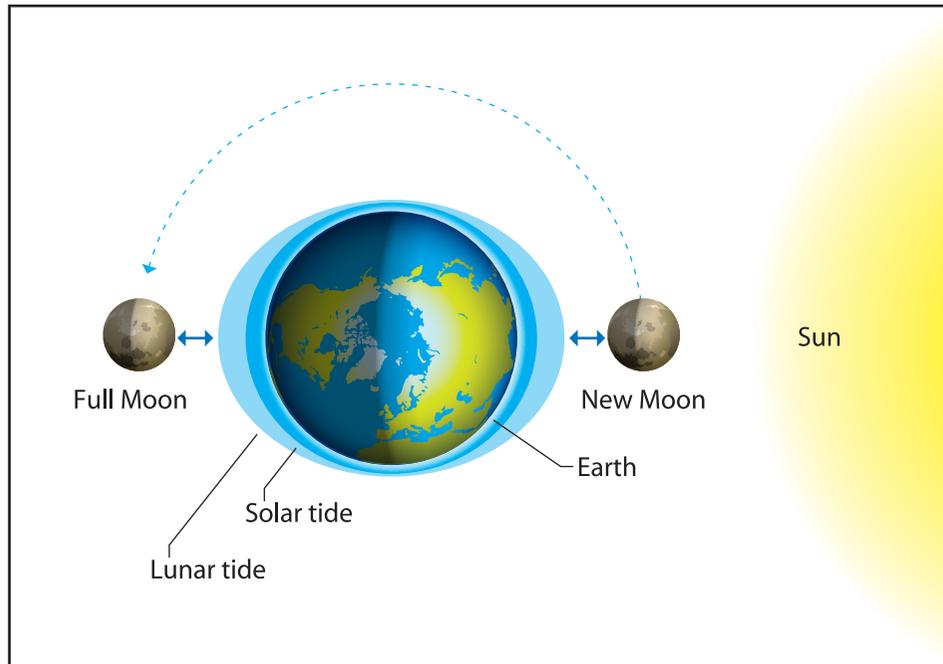


- The bulge of water stays aligned with the Moon as it orbits the Earth.
- There are two areas of low tide and two areas of high tide.

As the Earth rotates, a surface location will experience a high tide when it is in the region that is most affected by the gravitational pull of the Moon. This will be followed by an area of low tides. Then high tide followed by low tide once again. It takes 24 hours and 50 minutes for the Moon to return to its starting point. This is why the tide times are almost an hour later each day.

Why does the strength of tides change?

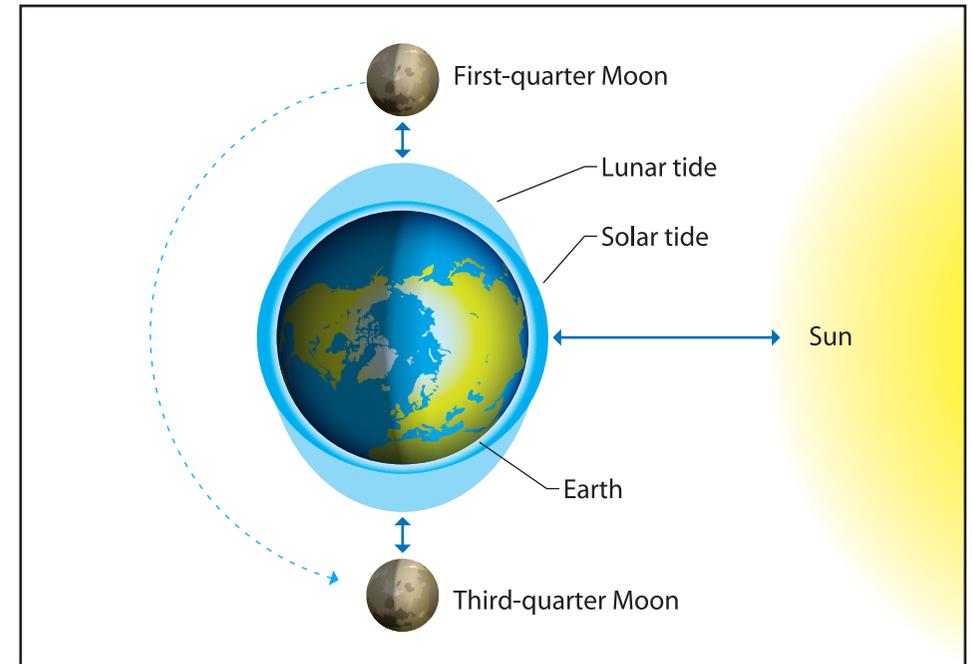
- The gravity of the Sun and the Moon BOTH act on the Earth.
- The Moon's gravity has a greater effect on the Earth because it is closer.



Spring Tides

Imagine you are above the North Pole, looking down at the Earth (as in the diagram above.) When the Earth and the Moon line up with the Sun the gravitational forces on the Earth are at their greatest strength. This happens when the Moon is at its 'full moon' and 'new moon' phases.

At these times the tides will be stronger and there will be a greater difference in water levels. Measurements will be higher during high tide and lower during low tide.

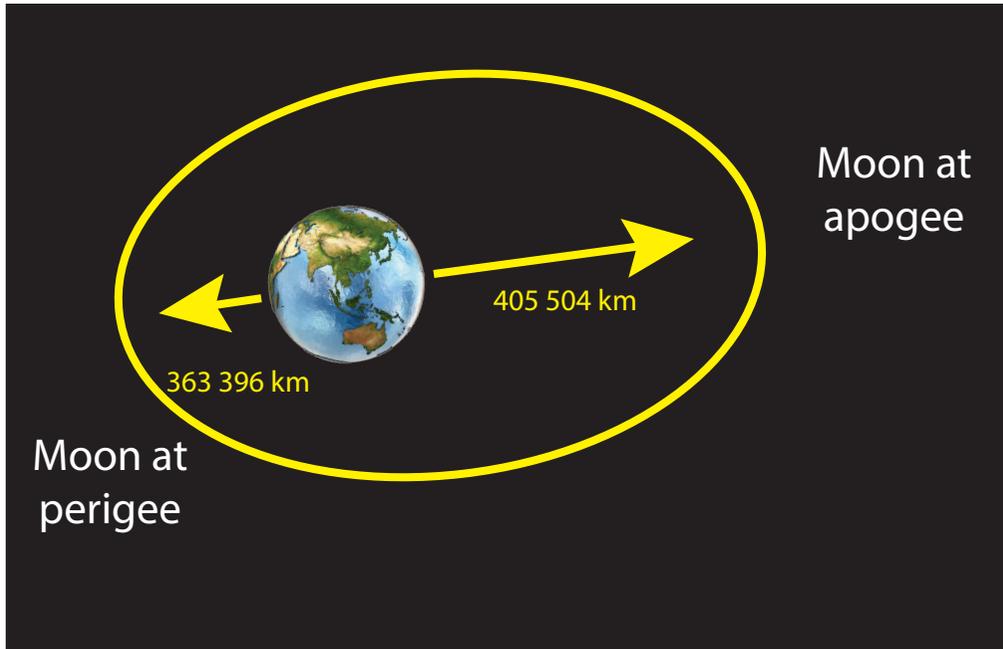


Neap Tides

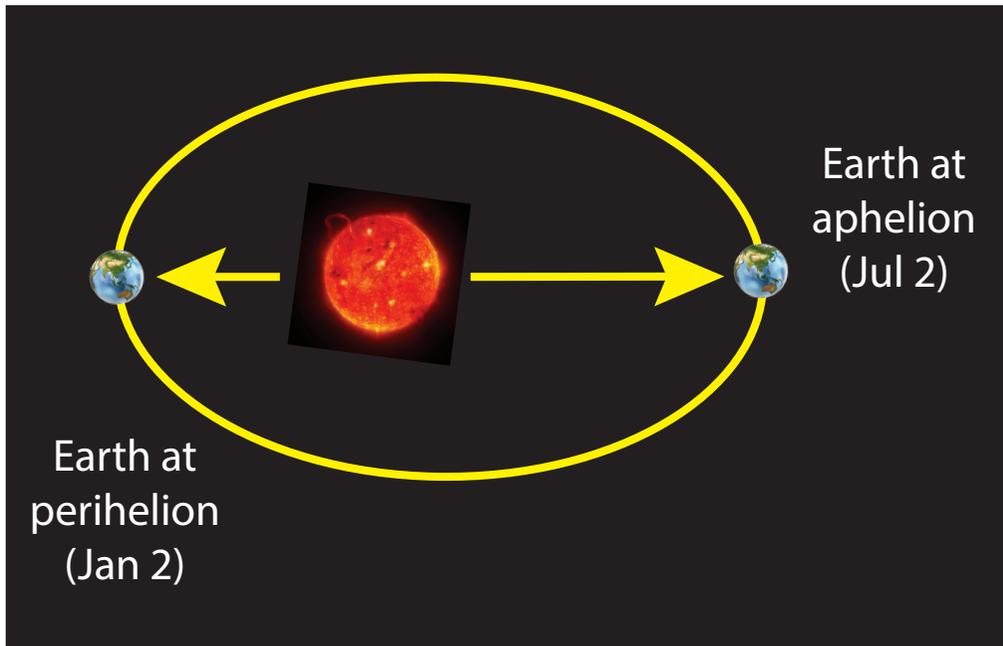
Neap tides are smaller tides. There is less variation between water levels at high and low tide. Neap tides occur when the Moon is at its first quarter and third quarter phases.

- Spring tides are not named after the season. They can occur at any time of the year. The word comes from the Old English word 'springan' which means to burst forth.
- Neap times are named from the Old English word 'nep' meaning to become lower.

Unusually High Tides



The orbit of the Moon around the Earth.



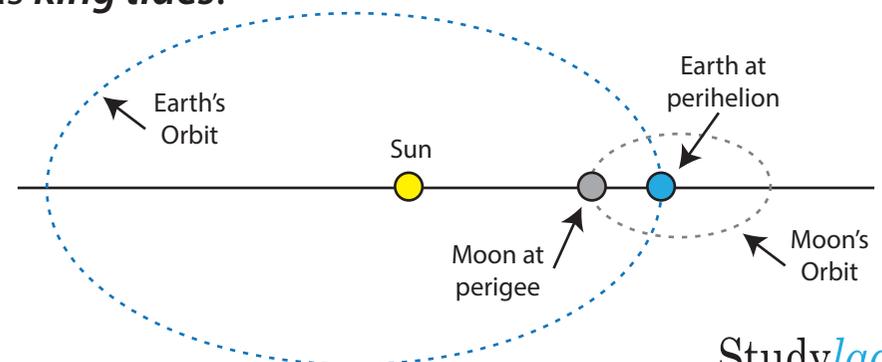
The orbit of the Earth around the Sun.

Sometimes high tides will be unusually high. This happens when the Moon and Earth are aligned with the Sun at certain points in their orbits.

The Moon's orbit around the Earth is elliptical so there are times when the Moon is closer to the Earth (at perigee.) At these times the Moon's gravity will have a stronger effect on the Earth, producing a higher than usual spring tide. These are sometimes referred to as *perigean tides*.

The Earth also follows an elliptical path around the Sun. It is closest to the Sun at perihelion and this occurs on January 2nd each year. Tides are higher around this time of the year because the closer proximity of the Earth makes the Sun's gravitational force stronger.

Much higher spring tides than usual occur when the Earth is at perihelion and aligns with the the Moon at perigee during a new or full moon. Pacific countries such as Australia and New Zealand refer to particularly high tides as *king tides*.

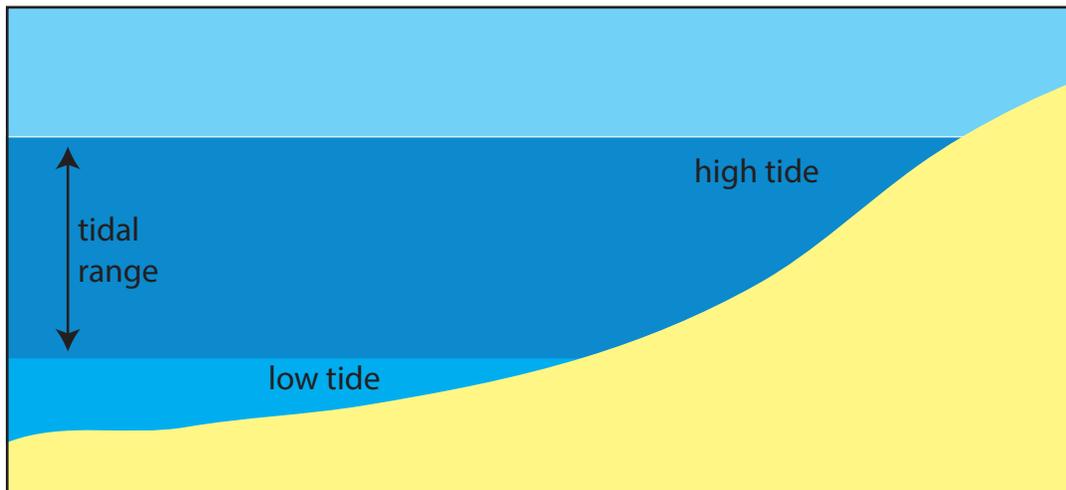


Real Tides

The tides throughout the world do not all behave the same way. Some places in the world may only get one high tide and one low tide. Some places might experience a very large difference in water levels between high and low tide (tidal range.) Other places might not see much change in water levels at all.

Why does this happen?

The Earth has a rocky surface. There are deep ravines and mountains, as well as large areas of flat land all over the surface of the planet. Seventy percent of this rocky terrain is covered by water. So there are a lot of obstacles that get in the way. This changes the way water moves on the planet.



The Bay of Fundy, in New Brunswick, Canada is known for having the highest tidal range in the world.



Seas that are protected by surrounded by land often have a smaller tidal range. The Mediterranean Sea Between Europe and Africa is a good example.