

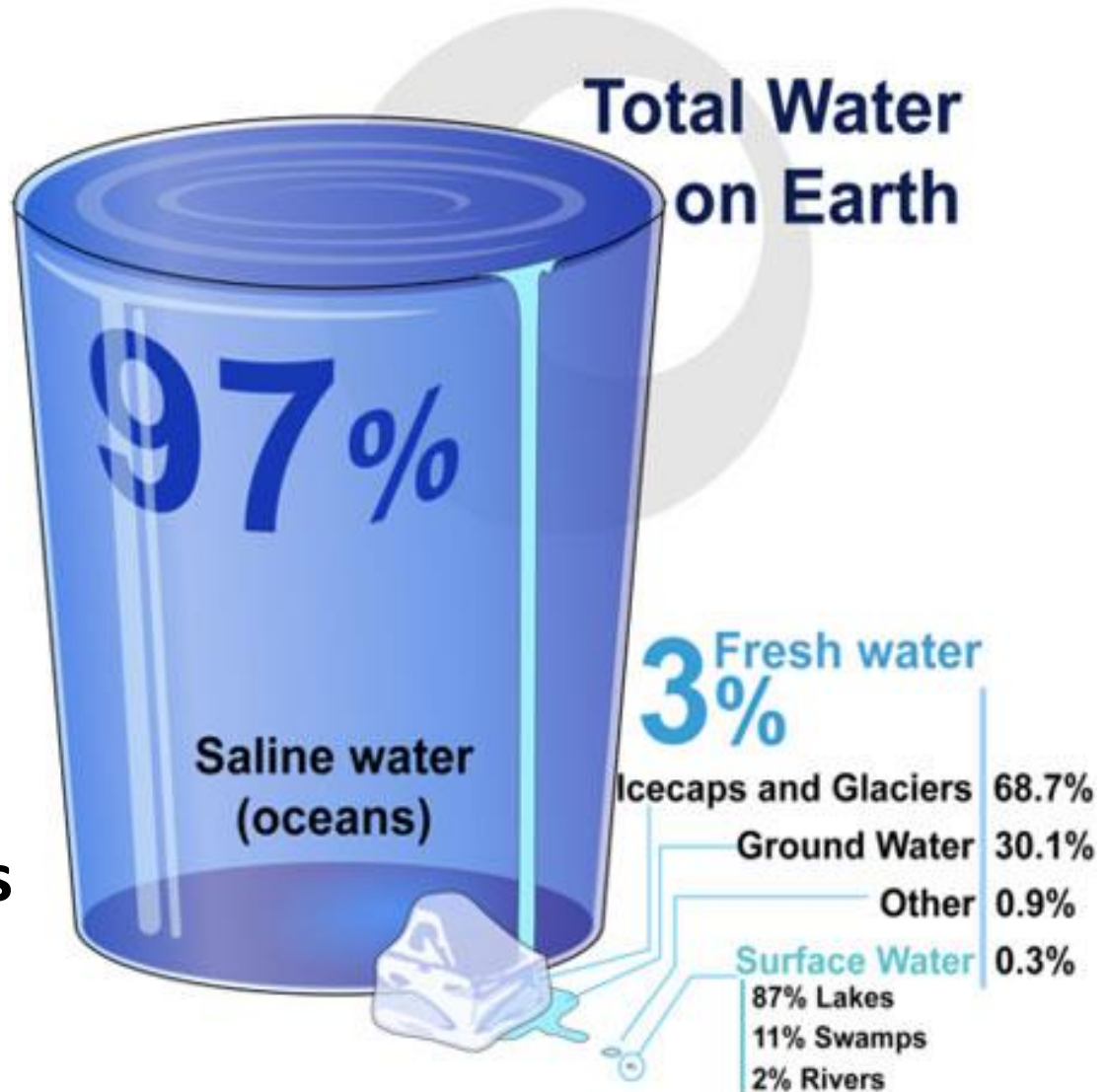
# 111 Seas of the World



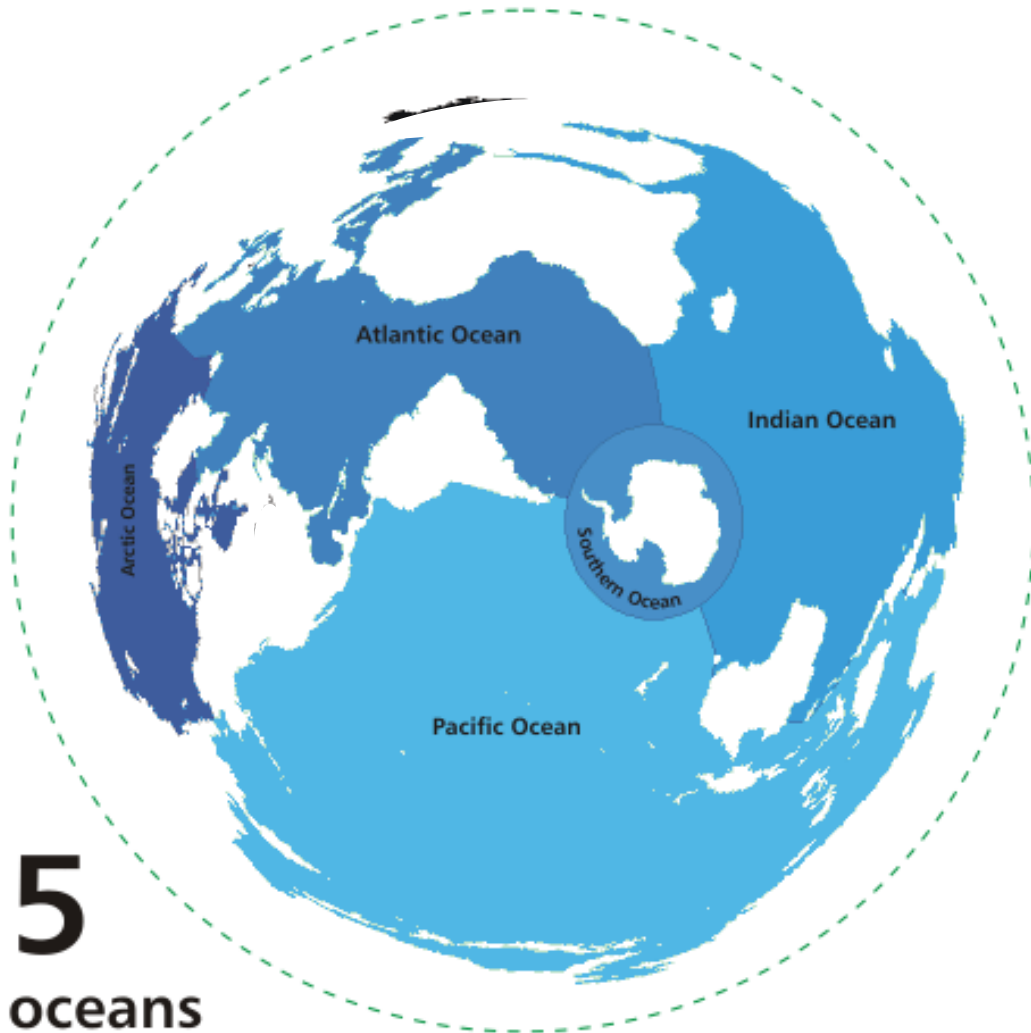
1. Largest sea: **Philippine Sea**, ~2 million sq mi.
2. Smallest sea: **Marmara Sea (Turkey)**, at 4,380 sq mi.
3. Saltiest true (*open*) sea: **Red Sea**, ~4.0%, due to high evaporation, little precipitation, and few (and mostly seasonal) inflowing rivers.
4. Saltiest land-locked sea (*a lake*): **Dead Sea**, ~30%!
5. Lowest salt content: **Baltic Sea**, only 1.0-1.5%, due to low evaporation and many inflowing rivers.
6. Warmest sea: the **Persian Gulf** contains the warmest sea water in the world reaching at 35°C (95°F); Red Sea is the second warmest.
7. Coldest seas are found near the poles.
8. The only sea without a land boundary: **Sargasso Sea**, home to free-floating seaweed called Sargassum and an amazing variety of marine species.

# Saltwater (Saline Water)

- Saltwater is water that contains a **certain amount of salts** with dissolved salt concentration of **more than 1%**.
- **Oceans and seas.**
- Saltwater is also found in some lakes and ponds as well as underground.



**Oceans** are the **largest bodies of water** on Earth (contain salt water only)



**5**  
oceans

- Historically, people first began exploring **shoreline shape**, **ocean depth**, and **tides**.
- **Temperature** and **salinity** are two important factors that influence **ocean circulation** and as a result, the **climate** of the Earth.

# Tides

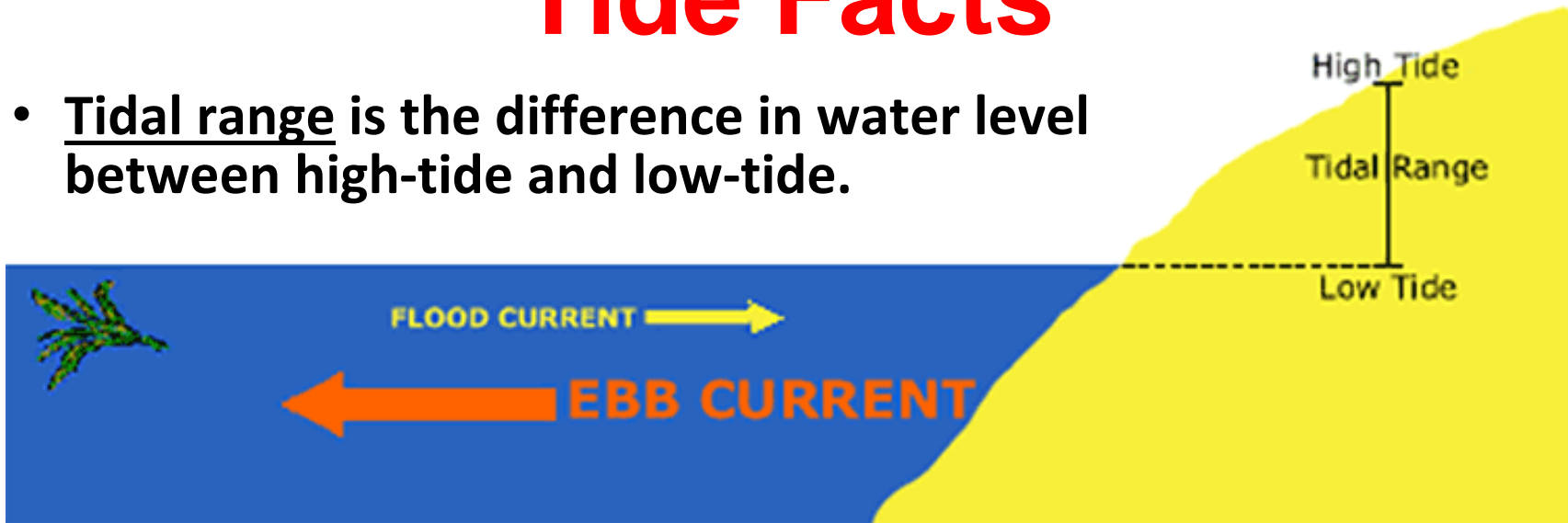
Tides are the slow, periodic **vertical rise and fall of the ocean surface** caused by **gravitational pull of the Moon and Sun** on the rotating Earth.



- Tidal forces affect the entire Earth, but the gravitational pull on LIQUIDS is much more noticeable than on SOLIDS (because liquids move more easily than solids).
- While tidal changes in sea level are easier to observe where land and water meet, they **exist everywhere** - even in the middle of the ocean.

# Tide Facts

- Tidal range is the difference in water level between high-tide and low-tide.



- Tides produce oscillating currents known as tidal streams.



## Bay of Fundy Tidal Streams

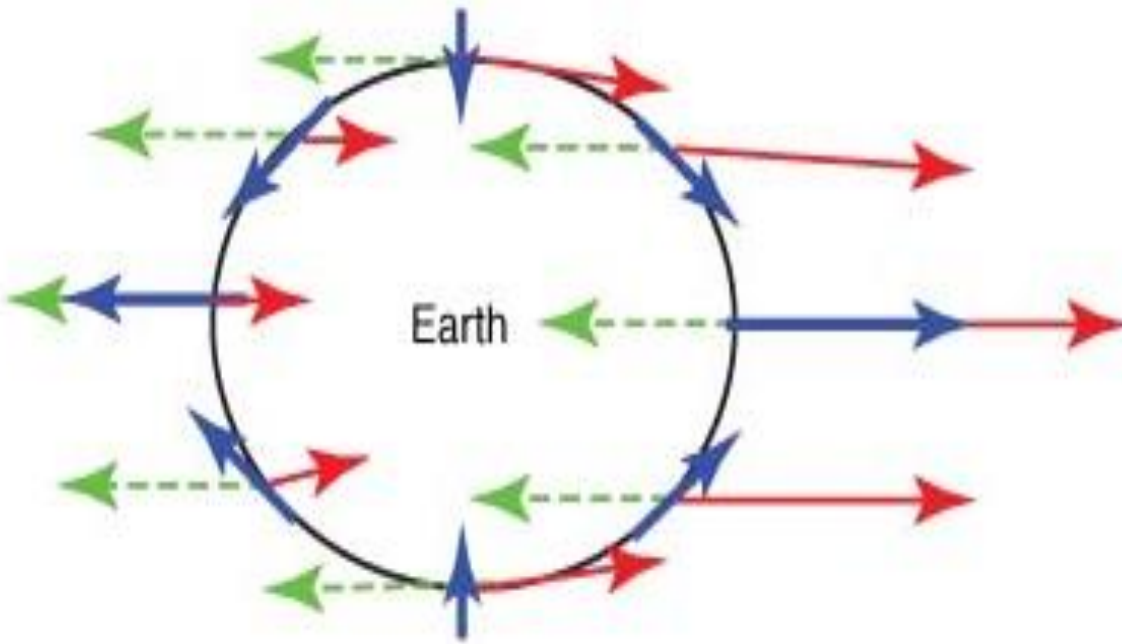


- One low-tide/high-tide cycle takes about **12 hours and 25 minutes** (the *lunar day* is equal to about 24.8 hours).

# Tide-Generating Force

For any two massive bodies rotating around the common center, let's consider the following two forces:

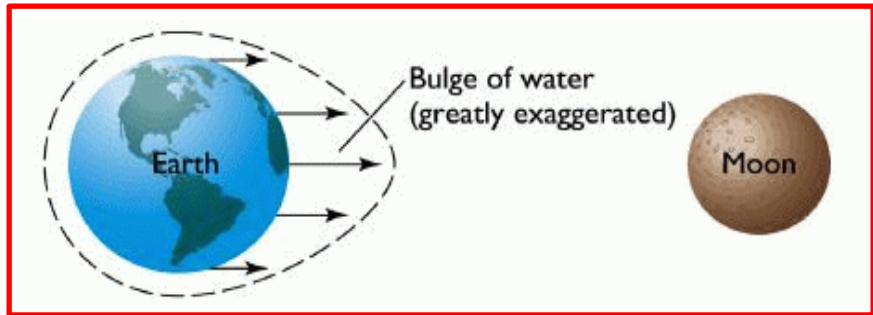
1. **Gravitational pull** (varies with distance)
2. Apparent **centrifugal force** (same everywhere)



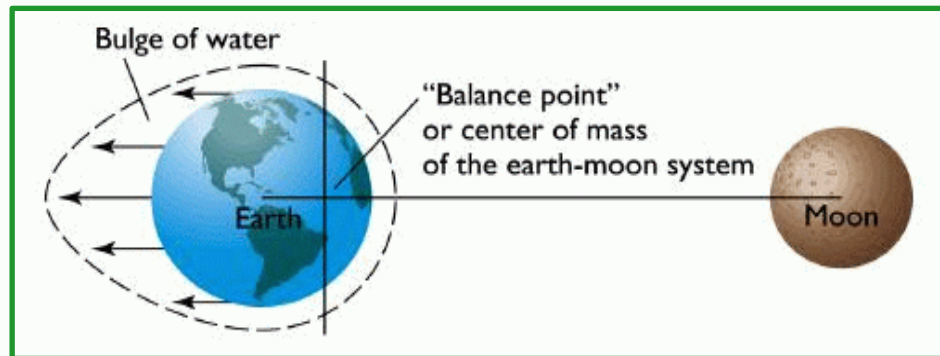
**Tide-  
generating  
force results  
from their  
difference  
(and is called a  
*differential force*)**



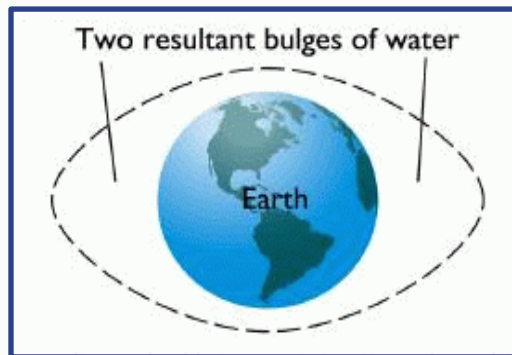
# Tidal “Bulges”



**gravitational attraction of the Moon dominates on the near side**



**centrifugal force due to Earth-Moon rotation dominates on the opposite side**



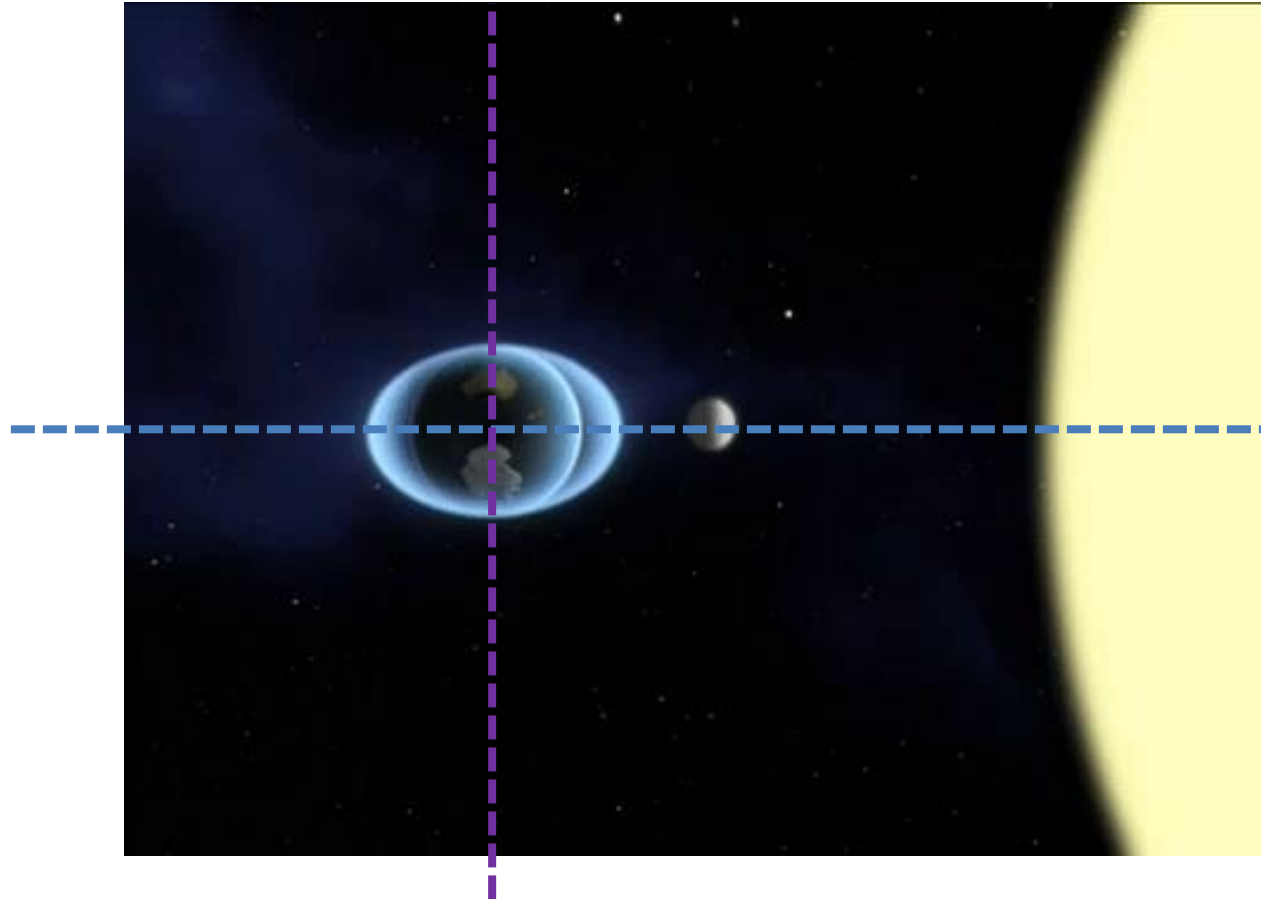
**two tidal bulges of water**

**The Sun has a similar effect, however ~2 times smaller.**

# Combined effect of the Moon and the Sun

(water bulges shown are greatly exaggerated!)

When tidal forces are aligned, tidal bulges add up.



When tidal forces act at right angle, tidal bulges are at right angle (larger one pointing towards the Moon, smaller one pointing towards the Sun)



# The Bay of Fundy, Canada: world's largest tidal range

- Tidal energy is focused by shape and shallowness of bay.
- Maximum spring tidal range in Minas Basin = 17 meters (**56 feet!**).

Alma harbor at **High Tide** and **Low Tide**

