

Deep Ocean Currents

Currents and Climate

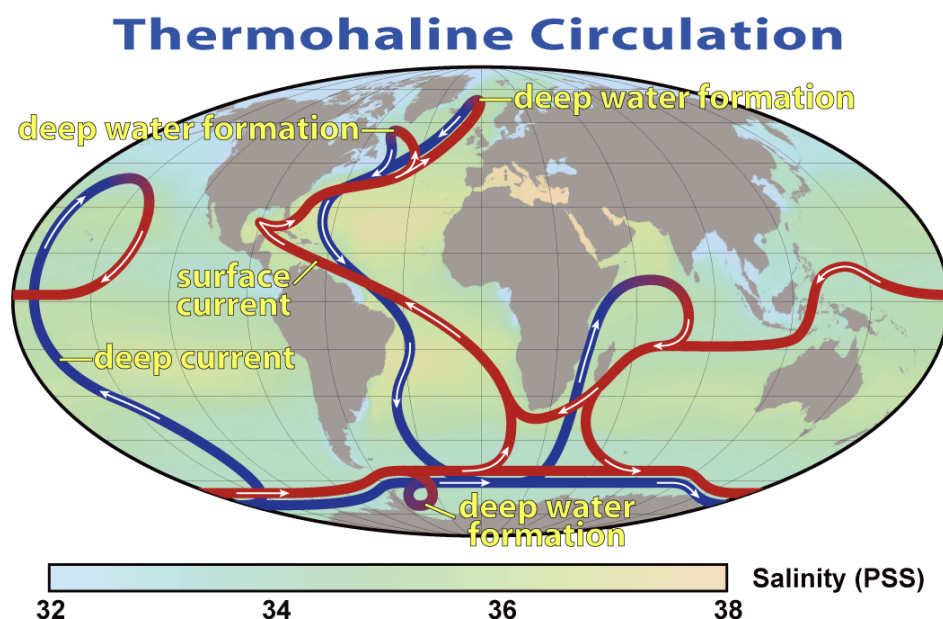
- The Earth's climate is greatly affected by **surface currents** that transfer heat from near the equator to regions with higher latitudes.
 - For example, the Gulf Stream, a river of warm water in the Atlantic, has a current that travels past the equator and brings warm water to North America and Europe. The warm waters from the Gulf Stream that make it to the North Sea raise the air temperatures in that region by about 3 to 6°C.

Connections

Due to water's high specific heat, water transports a large amount of energy. In fact, the Gulf Stream alone transports more than 100 times the world's energy demand.

Density and Circulation

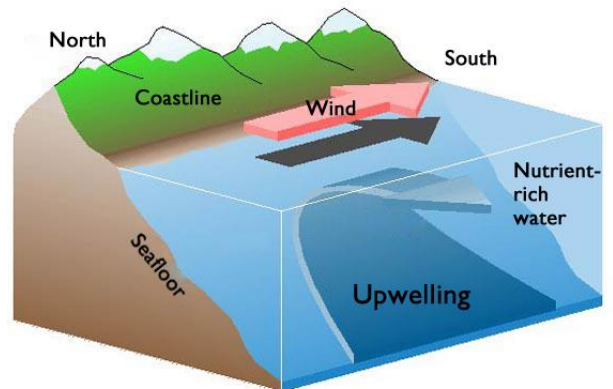
- **Thermohaline circulation**, or circulation due to density, drives deep ocean circulation
- The density differences results from the differences in salinity and temperature in the water.
 - High density water has a low temperature and a high salinity. When the temperature goes down, the particles in the water vibrate less, so the same number of molecules take up less space and make the water denser.
 - Water also becomes denser when you add salt because there are more molecules in a given volume.



Thermohaline Circulation transports water throughout the planet.

Density and Circulation

- Changes in temperature and salinity of seawater take place at the surface. In cold regions like near the poles, water becomes denser because the cold air lowers the water's temperature.
- This causes the freshwater to freeze out of the seawater and become sea ice, increasing the salinity of the surrounding water. The cold and dense water sinks in a process called **downswelling**.
 - The dense water sinks, pushing deeper water out of its way as it moves along the bottom of the ocean.
 - Surface currents move warmer water into the space that the dense water used to be in.
- **Upwelling** is when cold, nutrient-rich water rises from oceanic depths to balance the dense water sinking to the bottom of the ocean.
 - It occurs mostly near the shore when wind blows water away from the coast, leaving a vacated space for deep, denser water to rise up and fill.
 - Cold, deep water collects nutrients that fall to the bottom of the seafloor, and these nutrients are brought to the surface when the water rises.



The process of upwelling involves the movement of water.

Concept Check

- What is the difference between upwelling and downswelling? What occurs in each process?
- How does thermohaline circulation work?
- What is a surface current?