

# Ocean Circulations

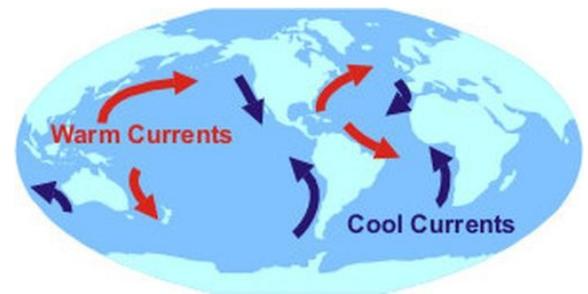
This text is from the U.S. National Oceanic and Atmospheric Administration.

In January 1992, a container ship near the International Date Line, headed to Tacoma, Washington, from Hong Kong, lost 12 containers during severe storm conditions. One of these containers held a shipment of 29,000 bathtub toys. Ten months later, the first of these plastic toys began to wash up onto the coast of Alaska. Driven by the wind and ocean currents, these toys [continued] to wash ashore during the next several years, and some even drifted into the Atlantic Ocean.

The ultimate reason for the world's surface ocean currents is the sun. The heating of the earth by the sun has produced semi-permanent pressure centers near the surface. When wind blows over the ocean around these pressure centers, surface waves are generated by transferring some of the wind's energy, in the form of momentum, from the air to the water. This constant push on the surface of the ocean is the force that forms the surface currents.

Around the world, there are some similarities in the currents. For example, along the **west** coasts of the continents, the currents flow toward the equator in both hemispheres.

These are called cold currents as they bring cool water from the polar regions into the tropical regions. The cold current off the west coast of the United States is called the California Current.



*Basic currents off the coasts of the continents.*

Likewise, the opposite is true as well. Along the **east** coasts of the continents, the currents flow from the equator toward the poles. [These] are called warm [currents] as they bring the warm tropical water north. The Gulf Stream, off the southeast United States coast, is one of the strongest currents known anywhere in the world, with water speeds up to 3 mph (5 kph).

These currents have a huge impact on the long-term weather a location experiences. The overall climate of Norway and the British Isle is about 18°F (10°C) warmer in the winter than other [sites] located at the same latitude due to the Gulf Stream.

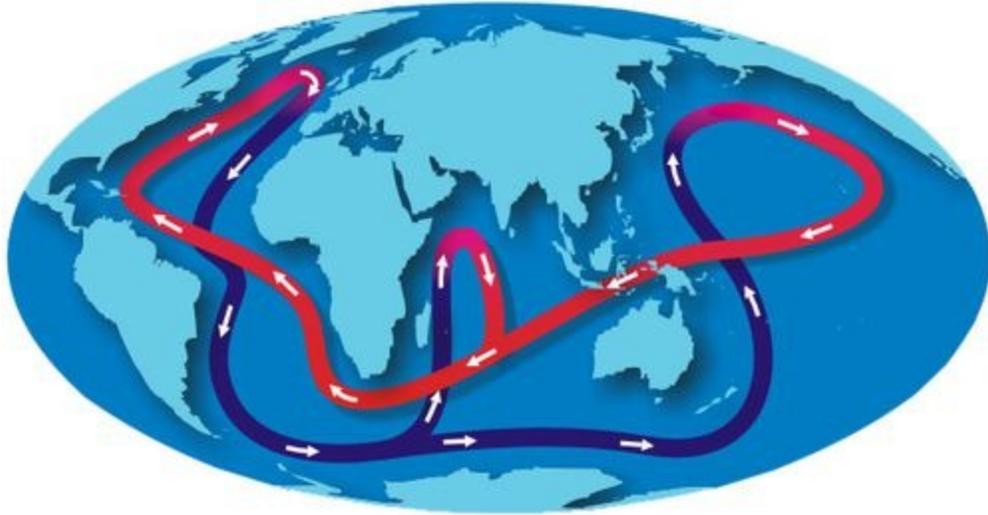
While ocean currents are shallow level circulations, there is global circulation, which extends to the depths of the sea called the **Great Ocean Conveyor**. Also called the thermohaline circulation, it is driven by differences in the density of the sea water, which is controlled by temperature (thermal) and salinity (haline).

In the northern Atlantic Ocean, as water flows north it cools considerably increasing its density. As it cools to the freezing point, sea ice forms with the "salts" extracted from the frozen water making the water below more dense. The very salty water sinks to the ocean floor.

It is not static, but a slowly southward flowing current. The route of the deep water flow is through the Atlantic Basin around South Africa and into the Indian Ocean and on past Australia into the Pacific Ocean Basin.

If the water is sinking in the North Atlantic Ocean, then it must rise somewhere else. This upwelling is relatively widespread. However, water samples taken around the world indicate that most of the upwelling takes place in the North Pacific Ocean.

It is estimated that once the water sinks in the North Atlantic Ocean, [it would take] 1,000-1,200 years before that deep, salty bottom water rises back to the upper levels of the ocean again.



*The Great Ocean Conveyor Belt - The blue color represents the deep cold and saltier water current with the red color indication shallower and warmer current.*

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. According to the text, what are cold currents?

- A. currents flowing toward the equator along the east coasts of continents
- B. currents flowing toward the equator along the west coasts of continents
- C. currents flowing from the equator along the east coasts of continents
- D. currents flowing from the equator along the west coasts of continents

2. How does the text compare cold currents and warm currents?

- A. They are shallow, and cold currents flow toward the equator while warm currents flow away from the equator.
- B. Cold currents and warm currents are shallow, and they both flow toward the equator.
- C. They are deep, and cold currents flow toward the equator while warm currents flow away from the equator.
- D. Cold currents are deep, but warm currents are shallow; they both flow away from the equator.

**3.** Read these sentences from the text.

While ocean currents are shallow level circulations, there is global circulation, which extends to the depths of the sea called the Great Ocean Conveyor. Also called the thermohaline circulation, it is driven by differences in the density of the sea water, which is controlled by temperature (thermal) and salinity (haline).

In the northern Atlantic Ocean, as water flows north it cools considerably increasing its density. As it cools to the freezing point, sea ice forms with the "salts" extracted from the frozen water making the water below more dense. The very salty water sinks to the ocean floor.

Based on the text, what conclusion can you make about the water in the Great Ocean Conveyor?

- A. the warmer the water, the denser it is
- B. the warmer the water, the saltier it is
- C. the colder the water, the denser it is
- D. the colder the water, the less dense it is

**4.** Read these sentences from the text.

. . . surface waves are generated by transferring some of the wind's energy, in the form of momentum, from the air to the water. This constant push on the surface of the ocean is the force that forms the surface currents.

[. . .]

While ocean currents are shallow level circulations, there is global circulation, which extends to the depths of the sea called the Great Ocean Conveyor.

What can you infer about the water in the ocean based on the text?

- A. The surface water of the ocean is always moving, but the deep water stays still.
- B. The deep water of the ocean is always moving, but the surface water stays still.
- C. The surface water and deep water of the ocean are always still.
- D. The surface water and deep water of the ocean are always moving.

**5.** What is the main idea of the text?

- A. Circulations in the ocean move water of different temperature and salt levels in the world.
- B. Surface ocean currents are shallow and move toward or away from the equator.
- C. Water sinks in the North Atlantic ocean, and it takes 1,000 to 1,200 years for it to rise to the ocean's upper levels.
- D. Twelve containers holding 29,000 bathtub toys were lost at sea in 1992, and the toys washed ashore over several years.