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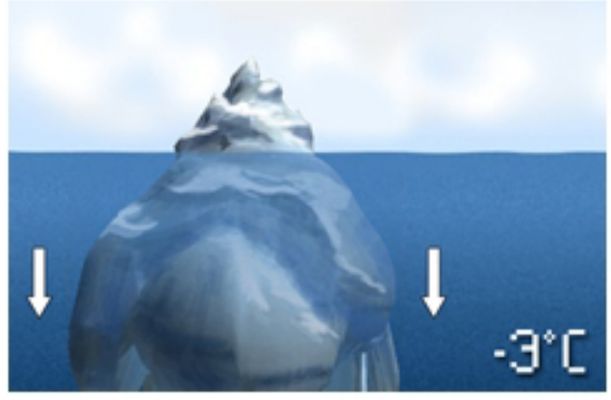
Winds drive ocean currents in the upper 100 meters of the ocean's surface. However, ocean currents also flow thousands of meters below the surface. These deep-ocean currents are driven by differences in the water's density, which is controlled by temperature (*thermo*) and salinity (*haline*). This process is known as thermohaline circulation.



Thermohaline circulation begins in the Earth's polar regions. When ocean water in these areas gets very cold, sea ice forms. The surrounding seawater gets saltier, increases in density and sinks.

In the Earth's polar regions ocean water gets very cold, forming sea ice. As a consequence the surrounding seawater gets saltier, because when sea ice forms, the salt is left behind. As the seawater gets saltier, its density increases, and it starts to sink. Surface water is pulled in to replace the sinking water, which in turn eventually becomes cold and salty enough to sink. This initiates the deep-ocean currents driving the global conveyer belt.

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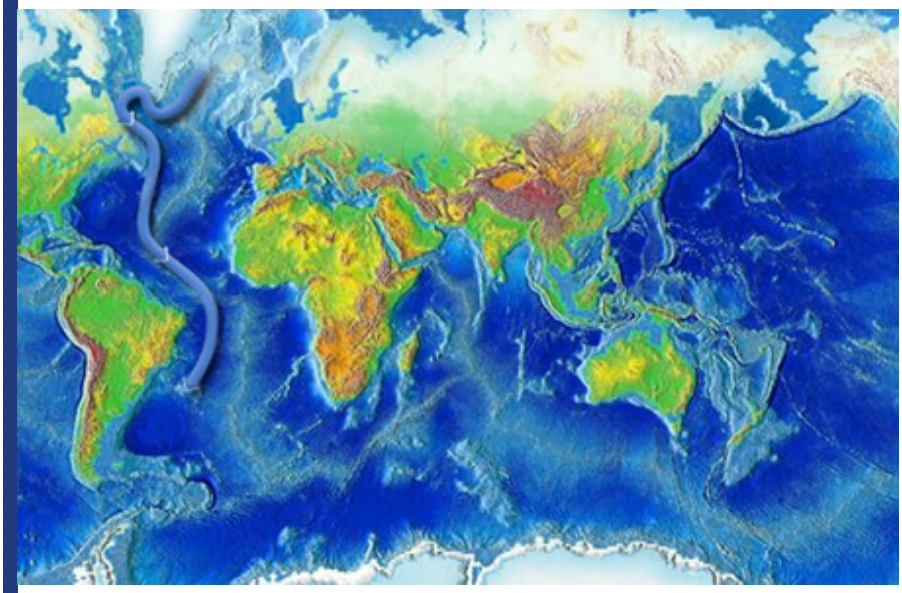
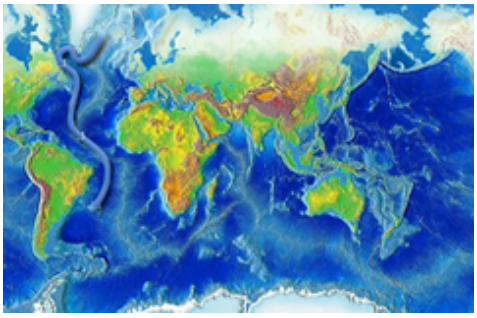


This animation shows the path of the global conveyer belt. The blue arrows indicate the path of deep, cold, dense water currents. The red arrows indicate the path of warmer, less dense surface waters. It is estimated that it can take 1,000 years for a "parcel" of water to complete the journey along the global conveyor belt.

Thermohaline circulation drives a global-scale system of currents called the “global conveyor belt.” The conveyor belt begins on the surface of the ocean near the pole in the North Atlantic. Here, the water is chilled by arctic temperatures. It also gets saltier because when sea ice forms, the salt does not freeze and is left behind in the surrounding water. The cold water is now more dense, due to the added salts, and sinks toward the ocean bottom. Surface water moves in to replace the sinking water, thus creating a current.

This deep water moves south, between the continents, past the equator, and down to the ends of Africa and South America. The current travels around the edge of Antarctica, where the water cools and sinks again, as it does in the North Atlantic. Thus, the conveyor belt gets "recharged." As it moves around Antarctica, two sections split off the conveyor and turn northward. One section moves into the Indian Ocean, the other into the Pacific Ocean.



Cold, salty, dense water sinks at the Earth's northern polar region and heads south along the western Atlantic basin.

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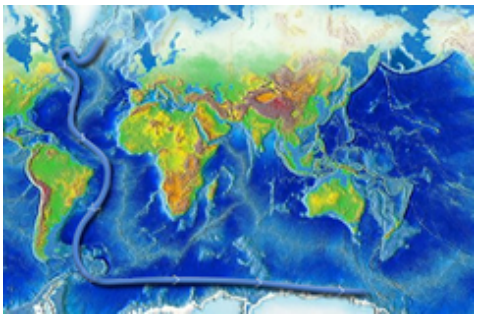
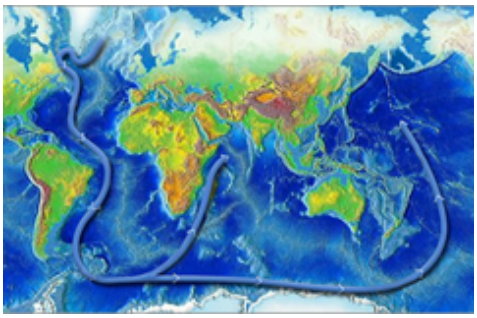
These two sections that split off warm up and become less dense as they travel northward toward the equator, so that they rise to the surface (upwelling). They then loop back southward and westward to the South Atlantic, eventually returning to the North Atlantic, where the cycle begins again.

The conveyor belt moves at much slower speeds (a few centimeters per second) than wind-driven or tidal currents (tens to hundreds of centimeters per second). It is estimated that any given cubic meter of water takes about 1,000 years to complete the journey along the global conveyor belt. In addition, the conveyor moves an immense volume of water—more than 100 times the flow of the Amazon River (Ross, 1995).

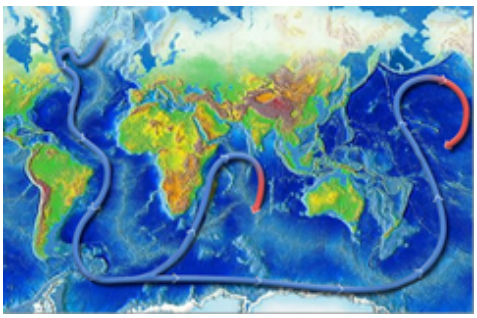
The conveyor belt is also a vital component of the global ocean nutrient and carbon dioxide cycles. Warm surface waters are depleted of nutrients and carbon dioxide, but they are enriched again as they travel through the conveyor belt as deep or bottom layers. The base of the world's food chain depends on the cool, nutrient-rich waters that support the growth of algae and seaweed.



The current is "recharged" as it travels along the coast of Antarctica and picks up more cold, salty, dense water.



The main current splits into two sections, one traveling northward into the Indian Ocean, while the other heads up into the western Pacific.



The two branches of the current warm and rise as they travel northward, then loop back around southward and westward.

The now-warmed surface waters continue circulating around the globe. They eventually return to the North Atlantic where the cycle begins again.