Ocean Motions

I. Currents

A. Ocean water contains **horizontal**, stream-like movements of water called ***ocean currents***.

B. Affected by **weather**, **Earth's rotation**, and the **position** of the **continents**.

C. Importance:

1. moves drifting organisms from place to place – plankton.
2. carries eggs and larvae of organisms that have external fertilization.
3. brings food, oxygen.
4. carries away waste, pollutants.

- **D. Three Main Types:**

1. Surface Currents.

2. Deep Currents.

3. upwelling.

1. Surface Currents

a. Horizontal movements of ocean water caused by wind and occurring at or near the ocean's surface are called **surface currents**.

b. Can reach depths of several hundred meters and lengths of several thousand kilometers.

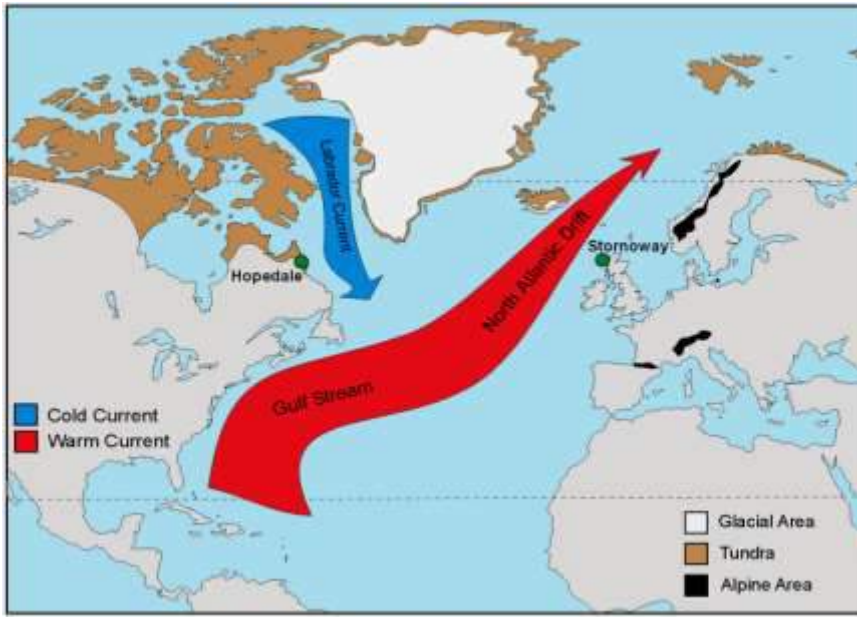
c. The **Gulf Stream** is one of the longest surface currents, transporting 25 times more water than all the rivers in the world combined.

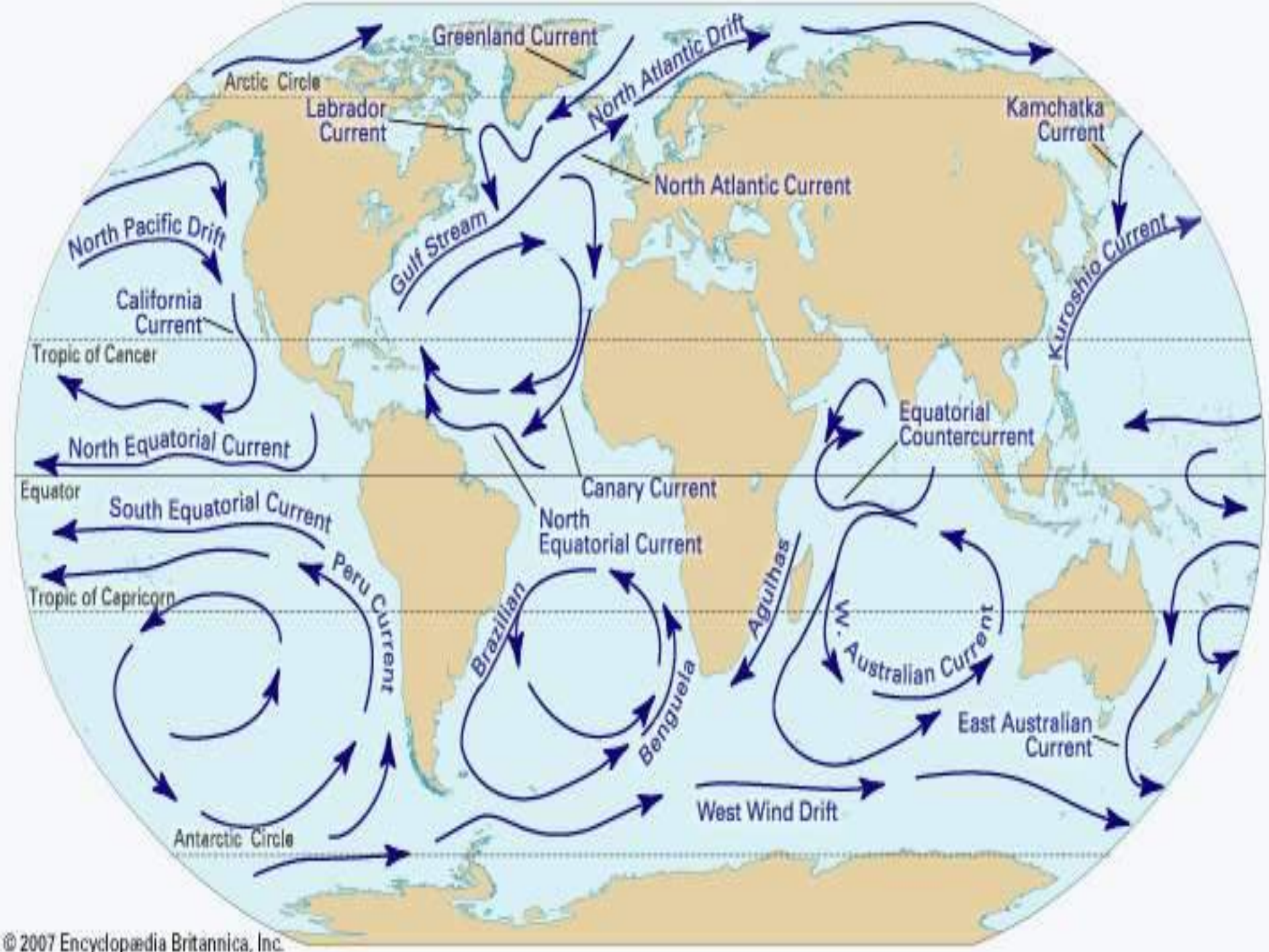
d. Controlled by 3 factors:

» Global winds

» Continental barriers

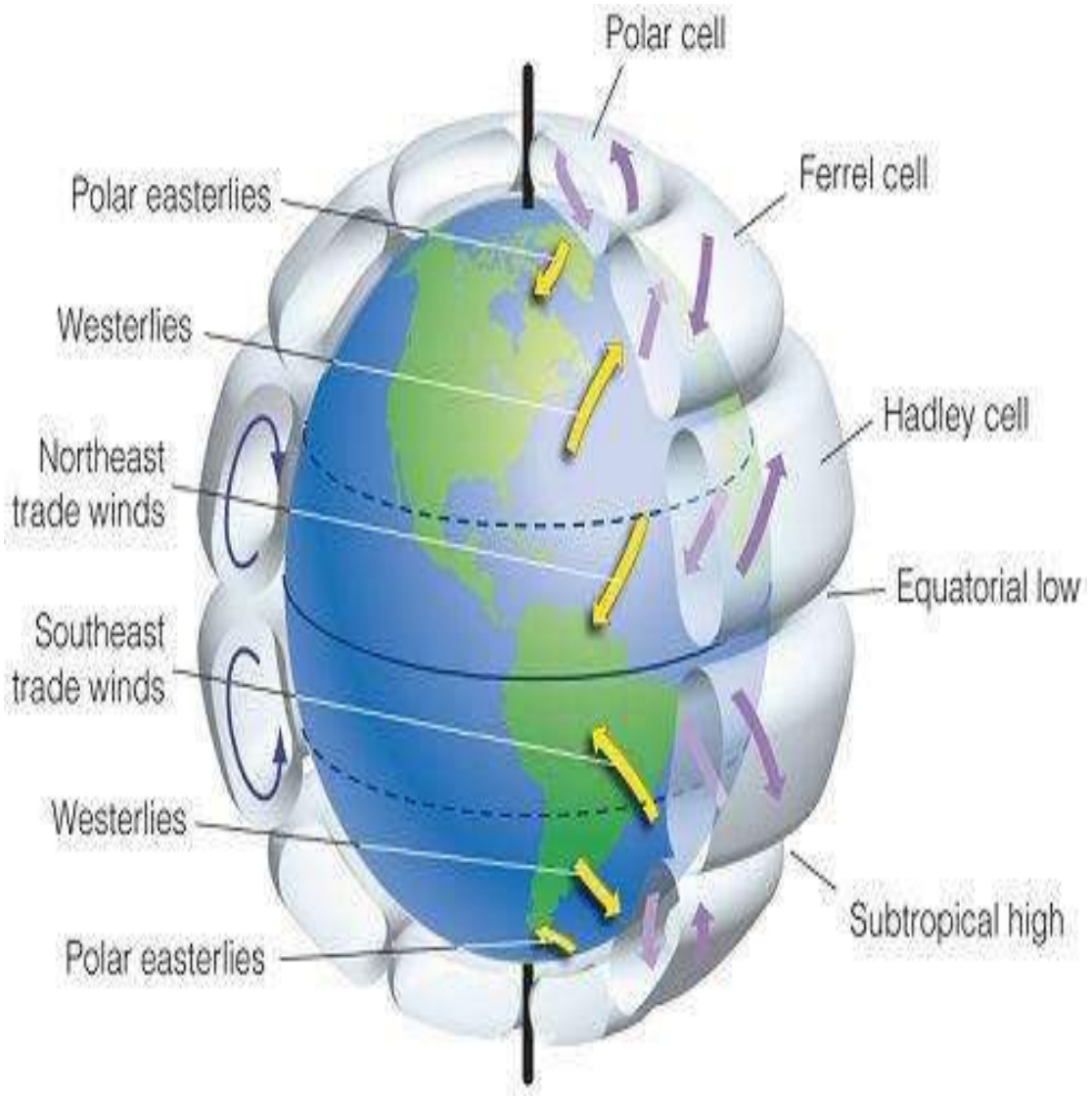
» Coriolis Effect





d1. Global Winds

- **Different winds cause currents to flow in different directions.**
  - **The trade winds are located just north and south of the equator.**
    - **In both hemispheres, they push currents westward across the tropical latitudes.**
  - **The westerlies are located in the middle latitudes.**



d2. Continental Barriers

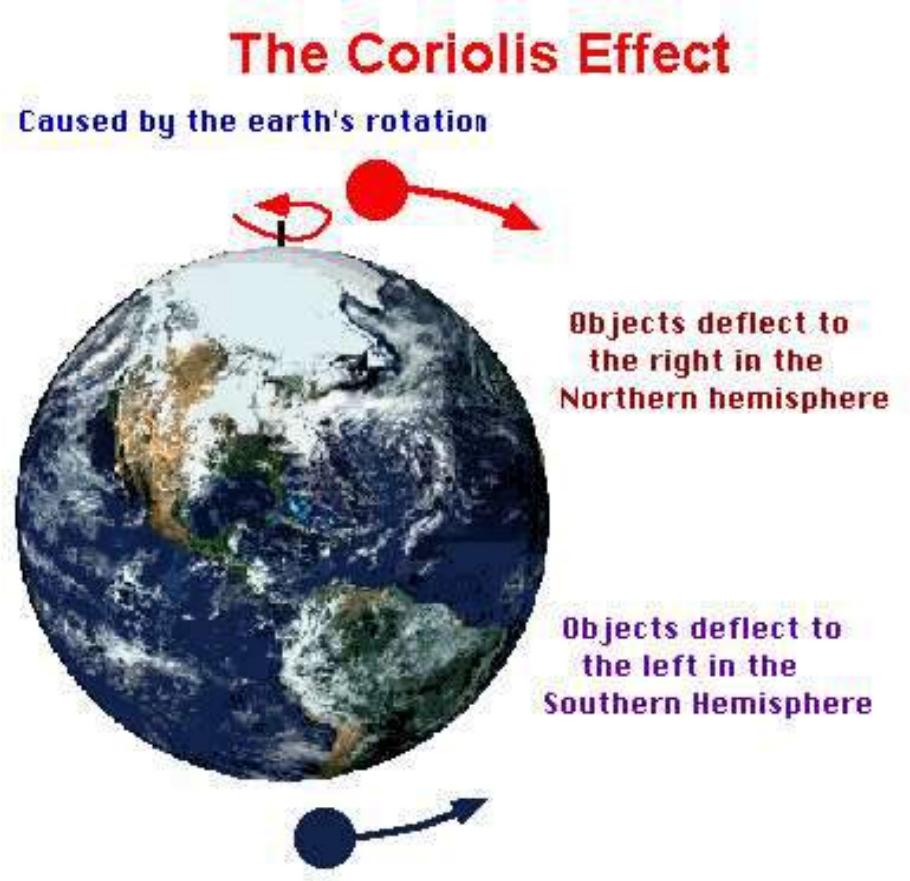
a. The continents are another major influence on surface currents.

b. They act as barriers to these currents.

c. When a surface current flows against a continent, the current is deflected and divided.

d3. Coriolis Effect

- As Earth rotates, ocean currents and wind belts curve.
  - The curving of the paths of ocean currents and winds due to Earth's rotation is called the **Coriolis Effect**.
  - The wind belts and the Coriolis Effect create huge circles of moving water, called **gyres**.



2. Deep Currents

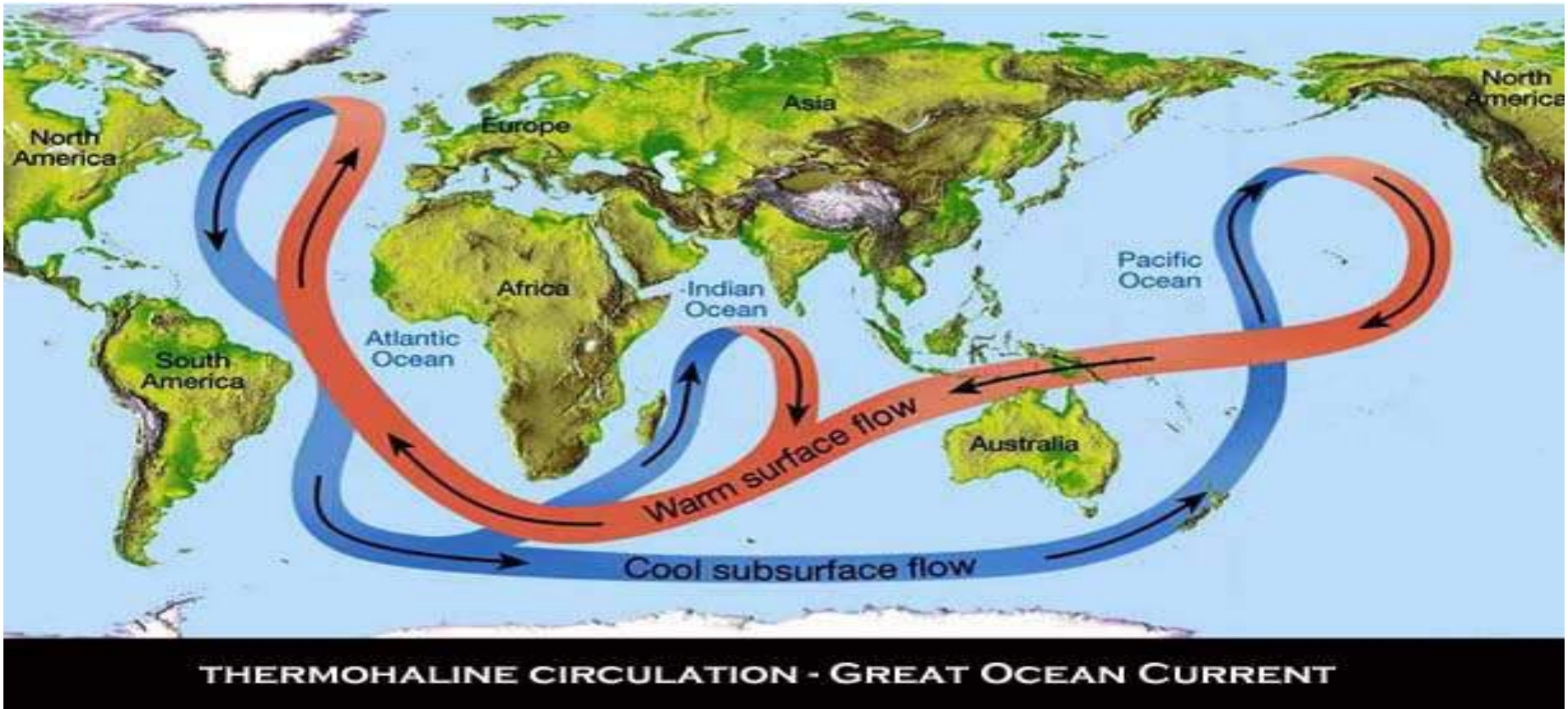
a. Stream-like movements of ocean water located far below the surface are called deep currents.

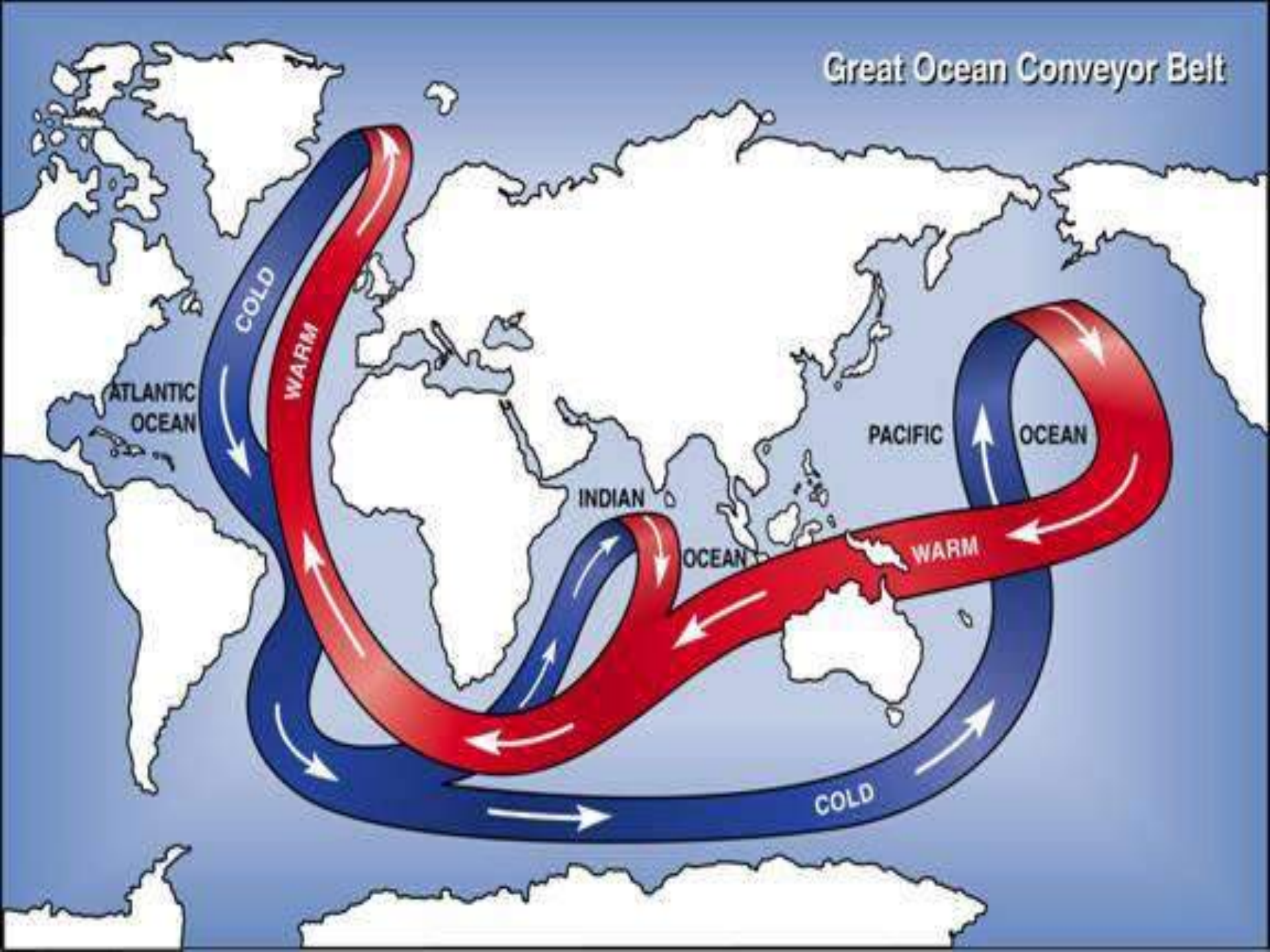
b. Move much *slower* than surface currents.

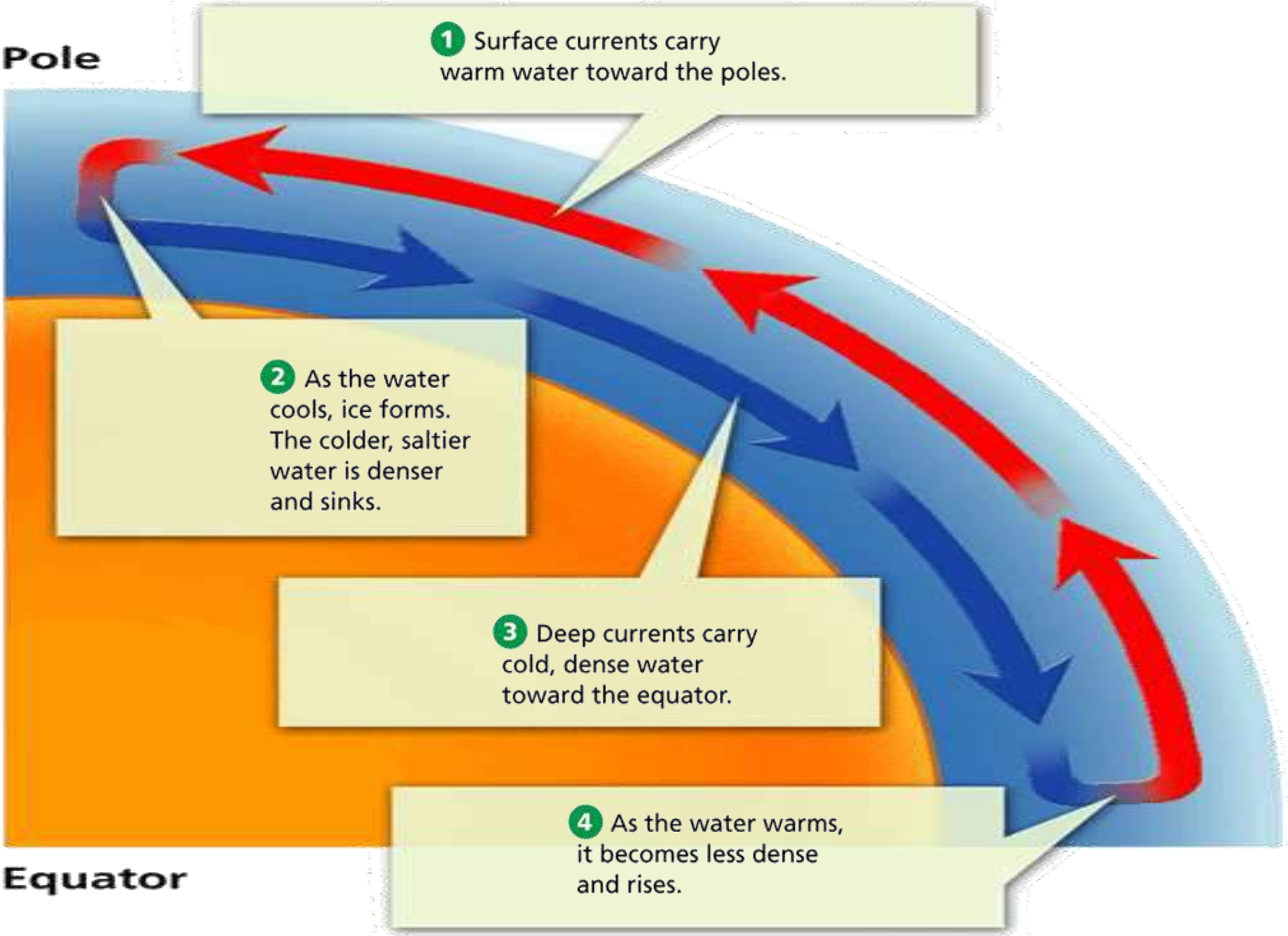
c. Form as cold, dense water of the polar regions sinks and flows beneath warmer ocean water.

- **The density of ocean water if affected by temperature and salinity.**
  - **Decreasing temperature and increasing salinity will increase the water's density.**
    - » **Cold water is more dense than warm water!**

d. when combined with surface currents, results in conveyor belt movement of water around globe



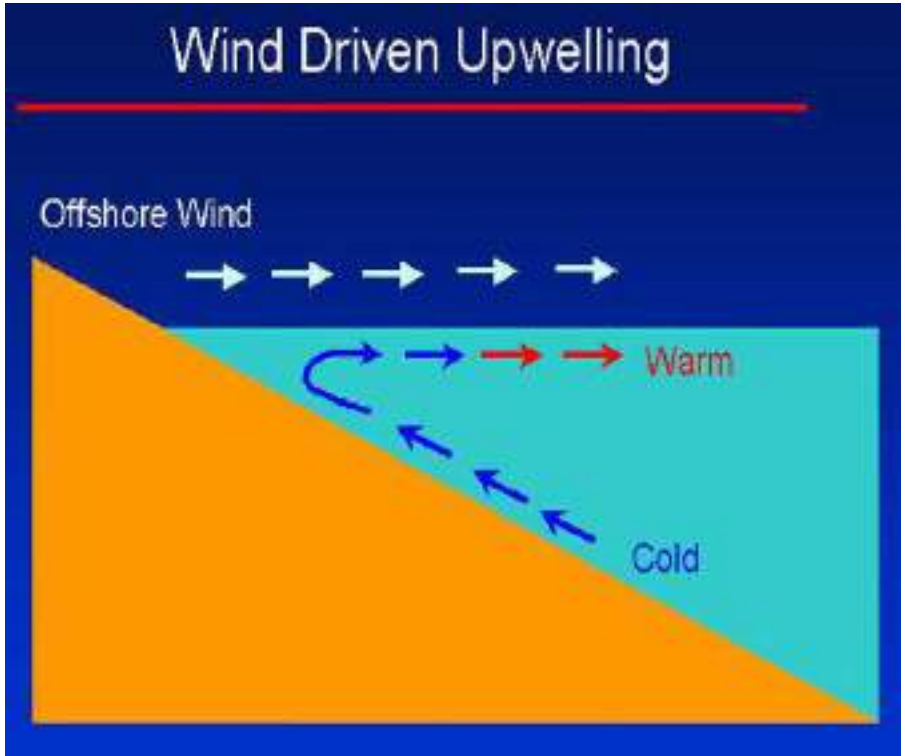

Great Ocean Conveyor Belt
COLD
WARM
ATLANTIC
OCEAN
INDIAN
OCEAN
PACIFIC
OCEAN
WARM
COLD

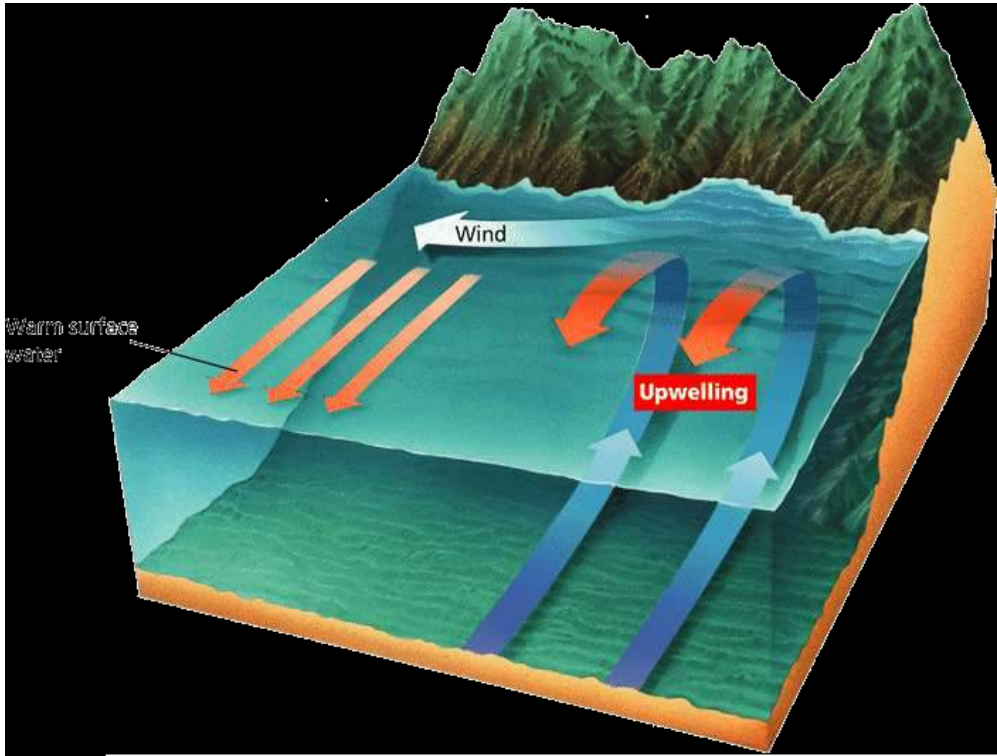

Pole
1 Surface currents carry warm water toward the poles.
2 As the water cools, ice forms. The colder, saltier water is denser and sinks.
3 Deep currents carry cold, dense water toward the equator.
4 As the water warms, it becomes less dense and rises.
Equator

3. upwelling

a. wind blows, moves water away, causes new water to rise up to replace it.

b. brings up tiny ocean organisms, minerals, and other nutrients from the deeper layers of the water.





Currents and Climate

1. **Currents can greatly affect the climate in many parts of the world.**

- **Warm-water currents:**
  - **The Gulf Stream carries warm water from the Tropics to the North Atlantic Ocean.**

- **Cold-water currents:**
  - **For example: The California current carries cold water from the North Pacific Ocean toward Mexico along the western coast of the USA → therefore, cooler climate year-round than inland states.**


Winter sea-ice cover
CANADA
North Atlantic circulation
EUROPE
Deep southerly return flow
USA
Atlantic Ocean
Gulf Stream
25° N section
Subtropical recirculation
AFRICA
SOUTH AMERICA
Sinking regions


Washington
Oregon
UNITED STATES
California
MEXICO
California Current LME
Pacific Ocean

2. **The South Pacific trade winds move warm water to the western Pacific .**

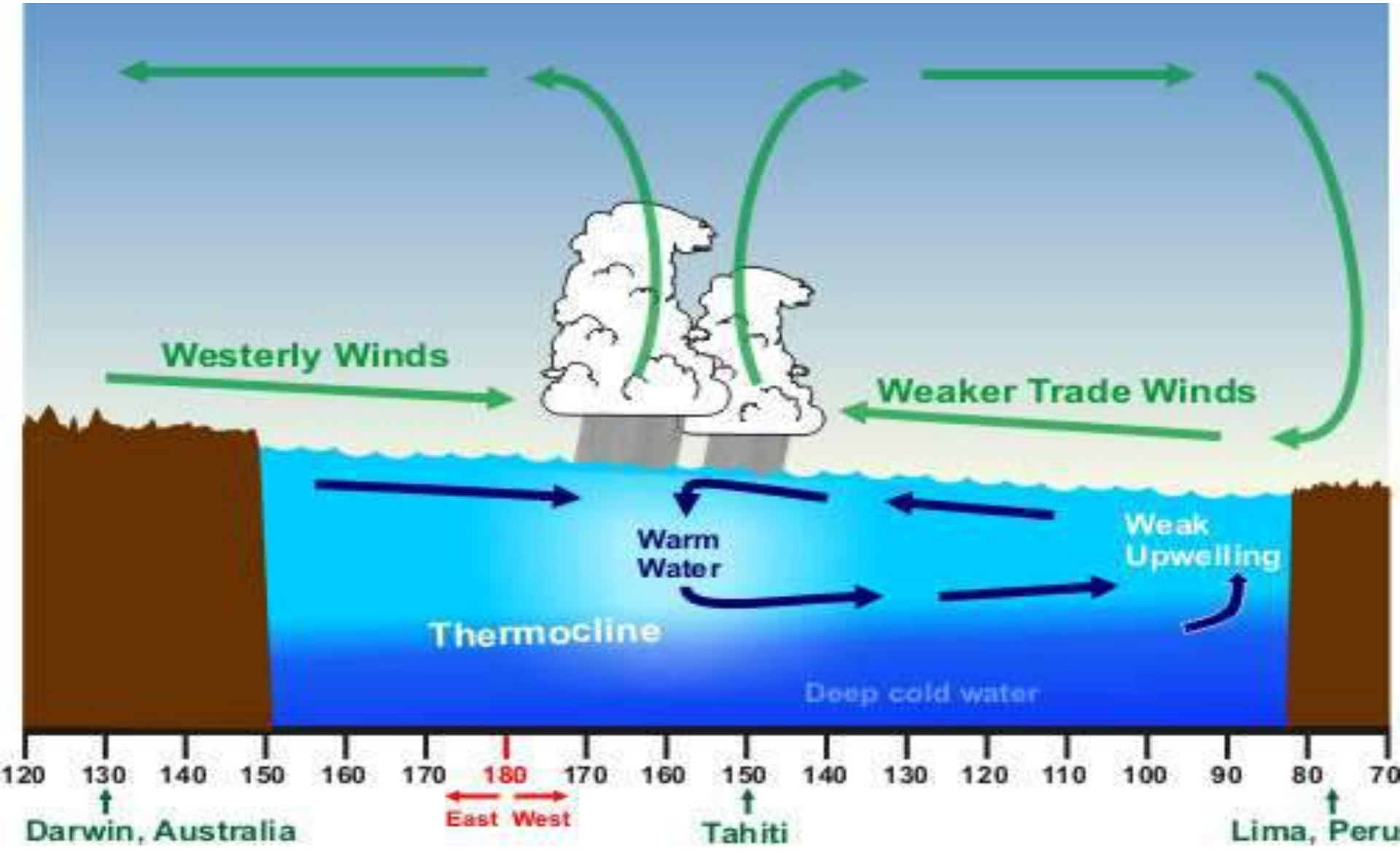
a. El Niño-

Pacific Ocean trade winds slow and almost stop which brings warmer conditions and weak upwelling currents to the eastern Pacific.

b. La Niña-

winds blow stronger than normal pushing warm water out and allowing cold water in. A stronger upwelling occurs.

El Niño Conditions



La Niña Conditions