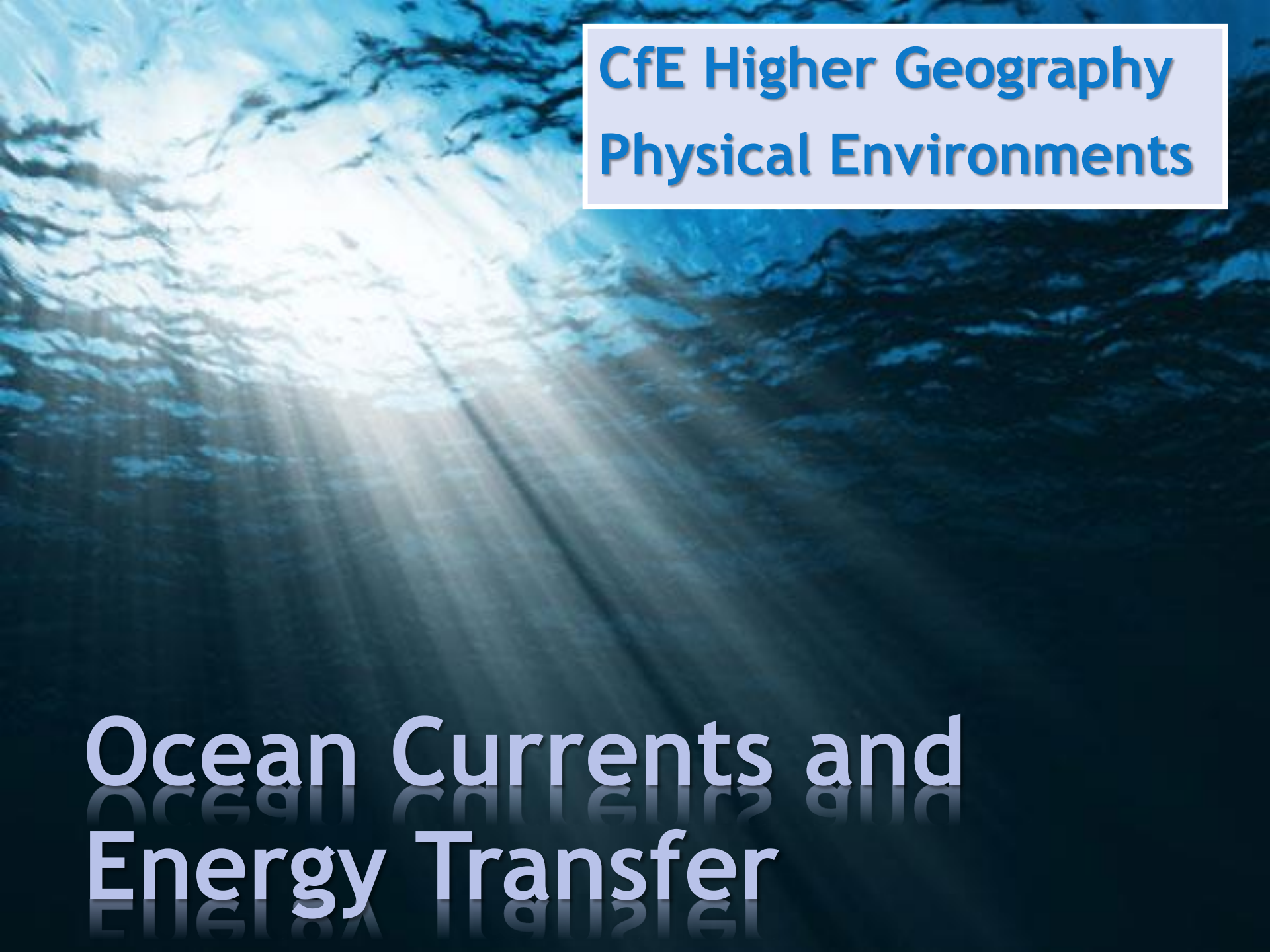
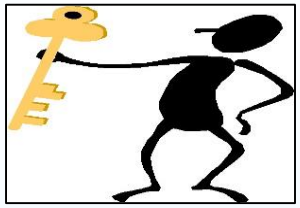


CfE Higher Geography
Physical Environments

Ocean Currents and Energy Transfer

*Key Idea



Just like the atmospheric cells and surface winds, the swirling oceanic currents of the planet also play an important role in the redistributing energy, making sure that the low latitudes tropical regions do not become too hot and the poles do not become too cold.

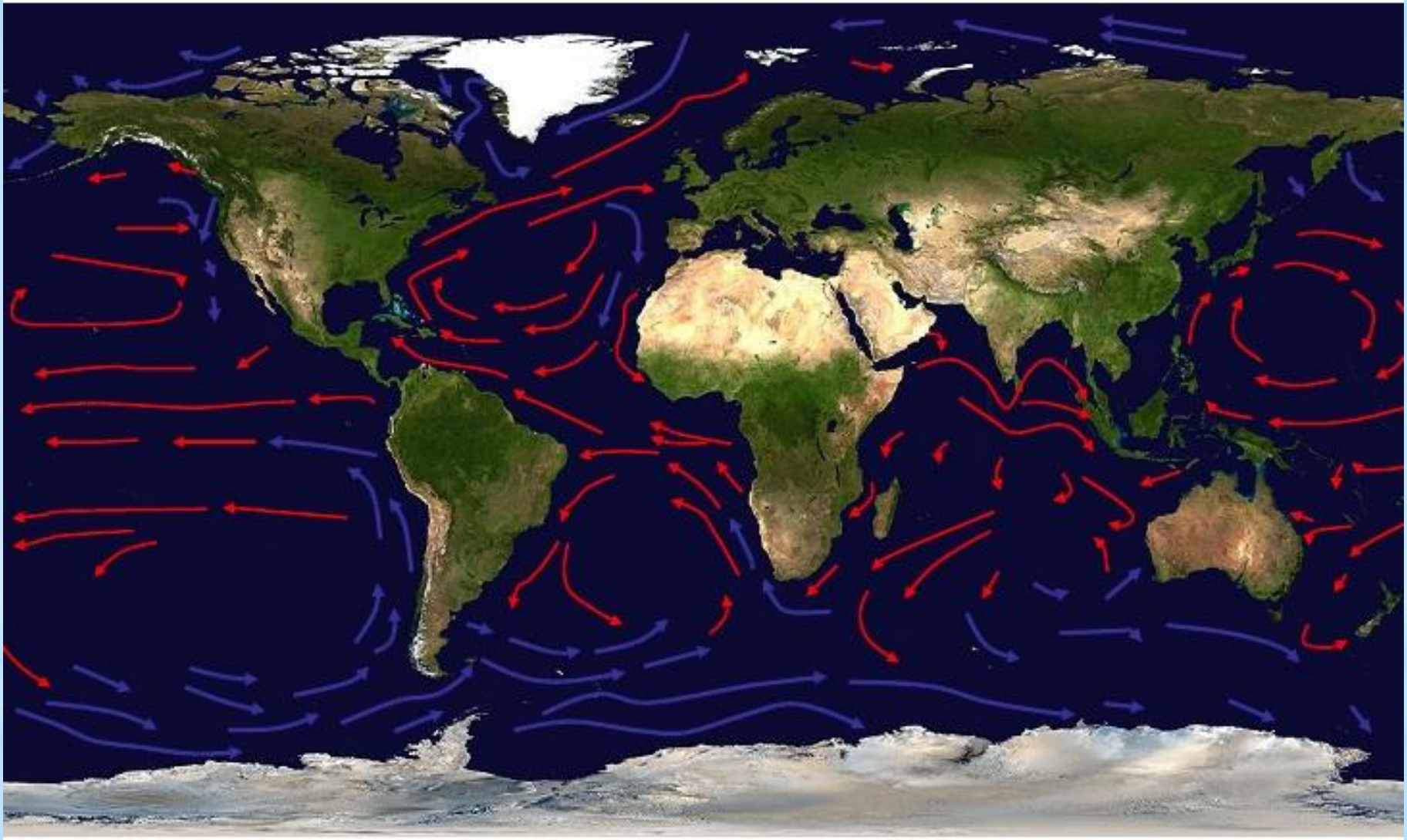
Energy is redistributed in the oceans by ocean currents. This is permanent or continuous movement of ocean water from one place to another. They can flow for thousands of kilometres and can result in **warm** water being transferred to high latitudes (The Poles) and **cool** water being transferred to low latitudes (the Equator and Tropics). Ocean currents can also determine the climates of continents.

1) What are ocean currents?

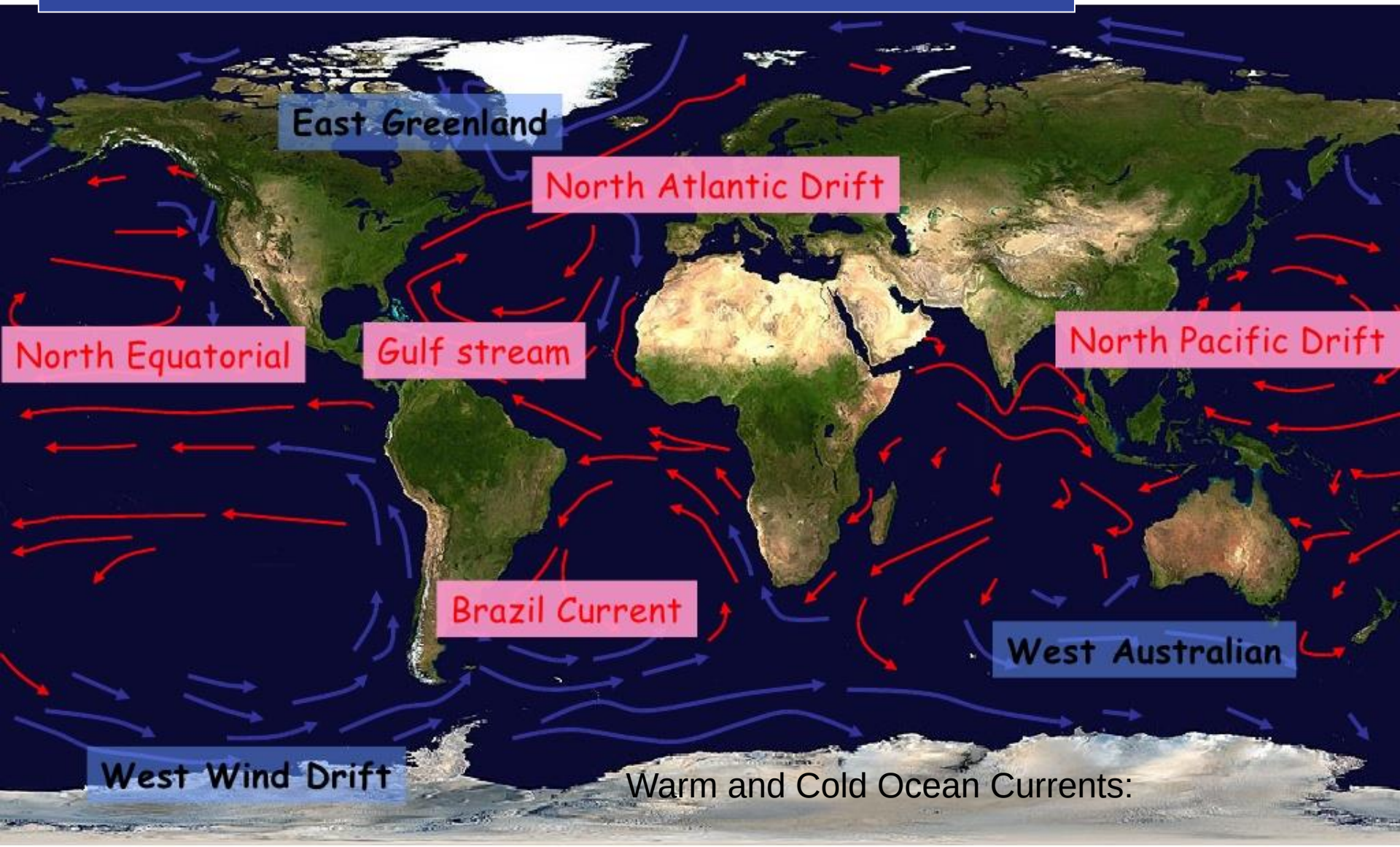
2) Briefly explain how they help to redistribute energy.

3) Name another function of the ocean currents.

Add Red and Blue Arrows to your world map to show the Ocean currents



Now add the names of some of the main ocean currents



Warm and Cold Ocean Currents:

Can you see any patterns to the world's ocean currents?

In simple terms how do ocean currents work?

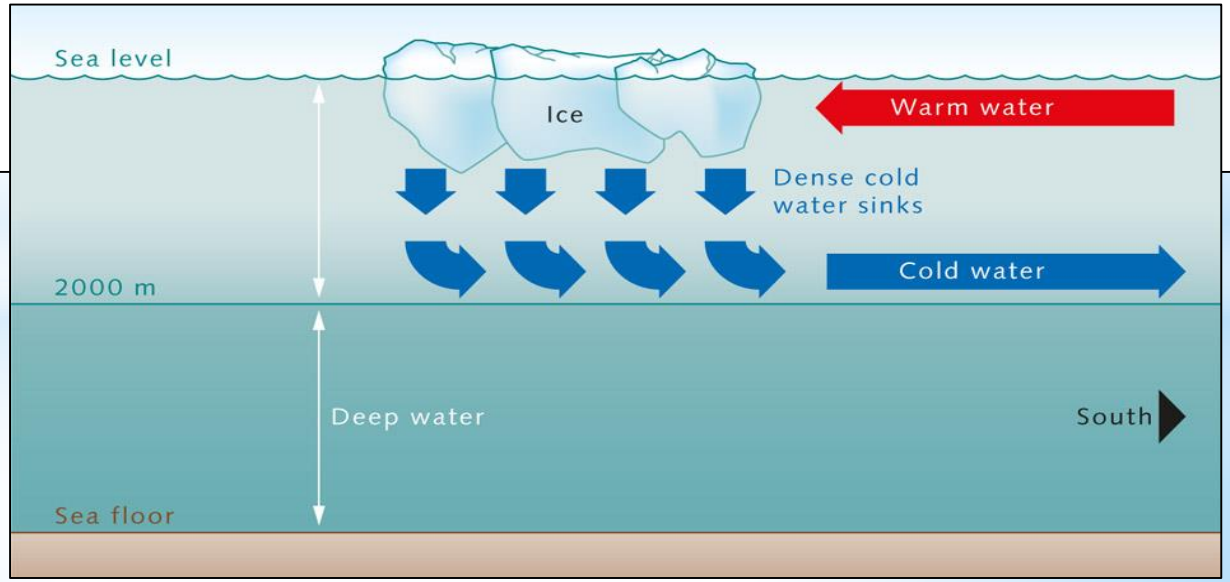
Ocean currents are driven by a phenomenon known as "thermohaline circulation". The thermo refers to the sun's heat and the haline to the salt content. Both of these factors determine the density of ocean water. Colder water, and that with a higher salt content is much denser than warmer water with a lower salt content.

In a bit more depth!

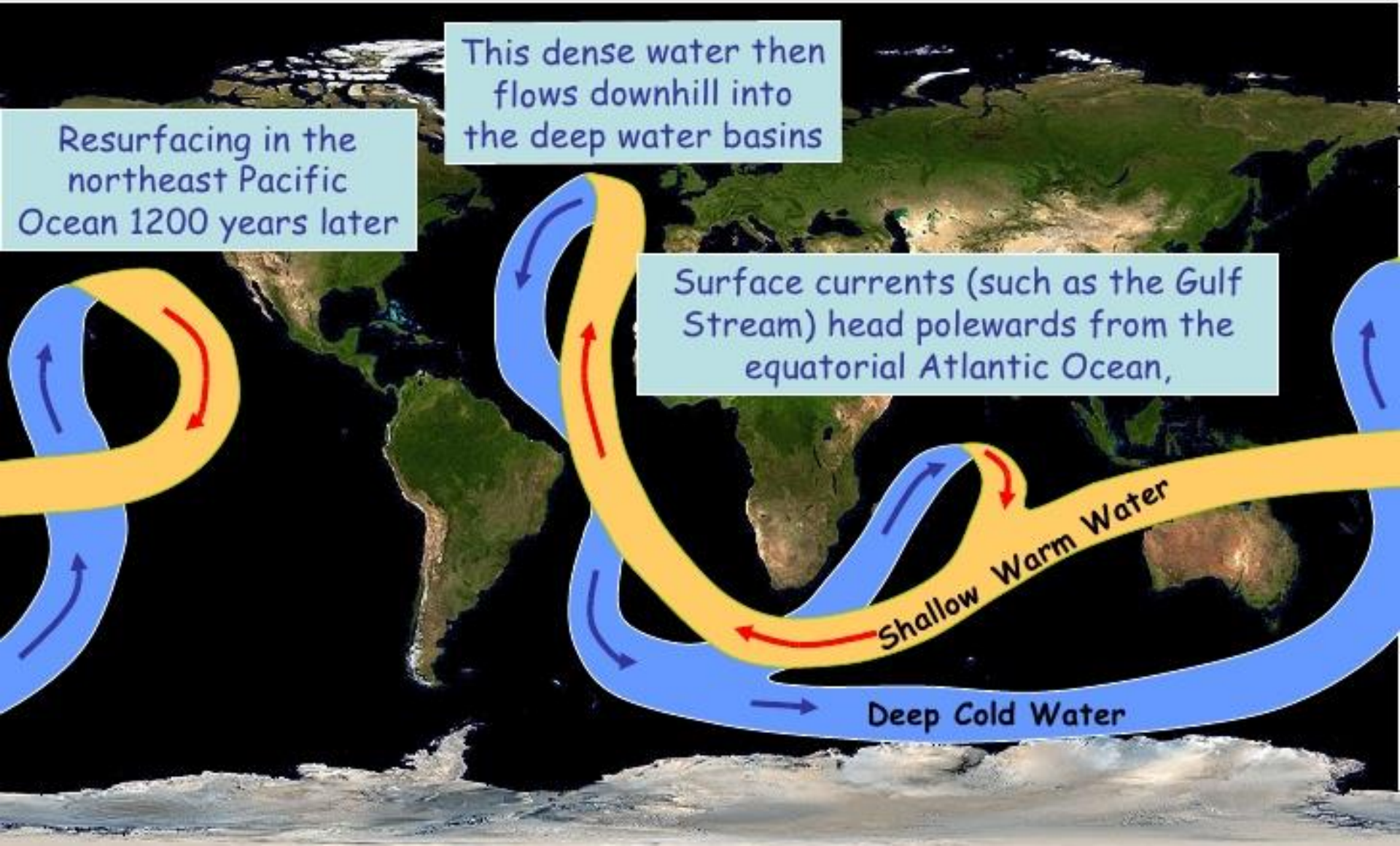
- **Uneven heating** of surface water in **high** and **low** latitudes sets up convection currents which transfer energy.
- The direct heat from the sun makes Equatorial water warm. Water here also has a lower salt content than that at the Poles. This warm water is less dense so moves along the ocean surface from the Equator to the Poles. A good example of such an ocean current would be the North Atlantic Drift.

In simple terms how do ocean currents work?

- In contrast, due to less insolation the water at the Poles is much colder and also contains more salt making it far denser than Equatorial water. The cold, dense water from the Poles flows along the ocean bed towards warmer equatorial regions . A good example is the Labrador current or the East Greenland current.
- The end result is a circulatory system of currents, which is disrupted and distorted by the effects of the earth's rotation and the distribution of land masses.



The Thermohaline Conveyor



* Other factors influencing Ocean Currents

1) Winds:

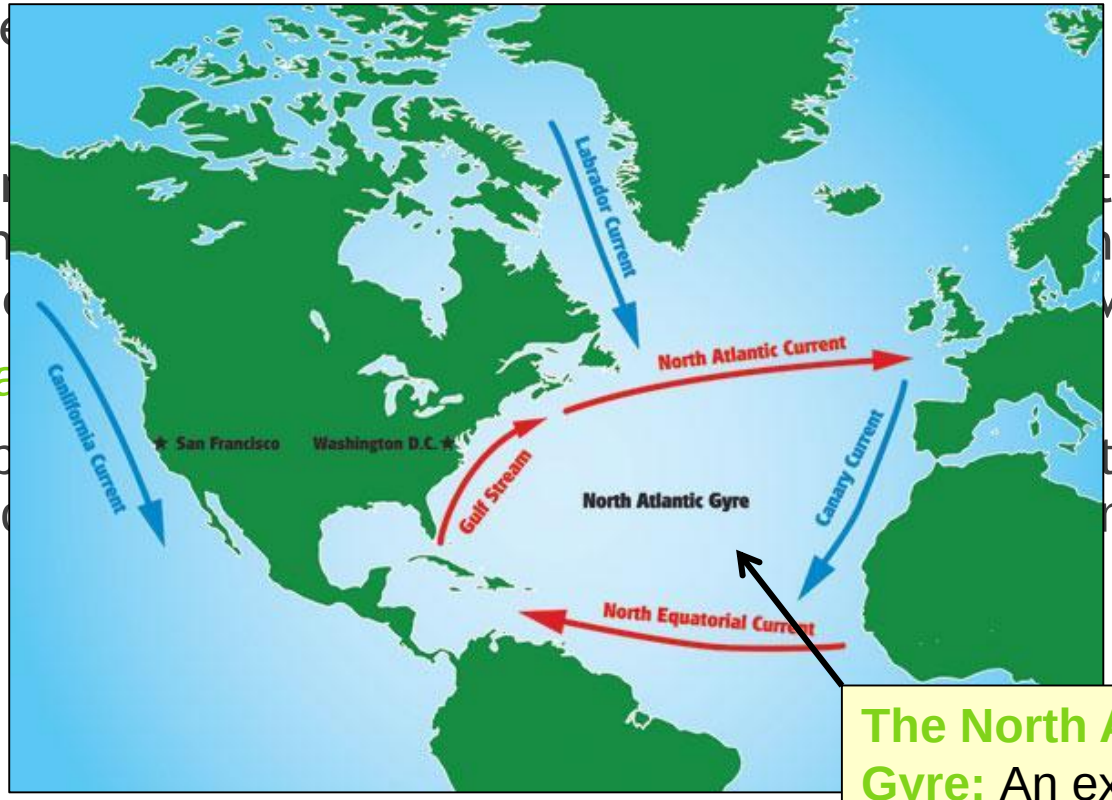
These create a frictional drag as they blow over the water surface. Therefore wind direction.

2) Coriolis

The spin to the right in the north t, and to the left in th wise movement.

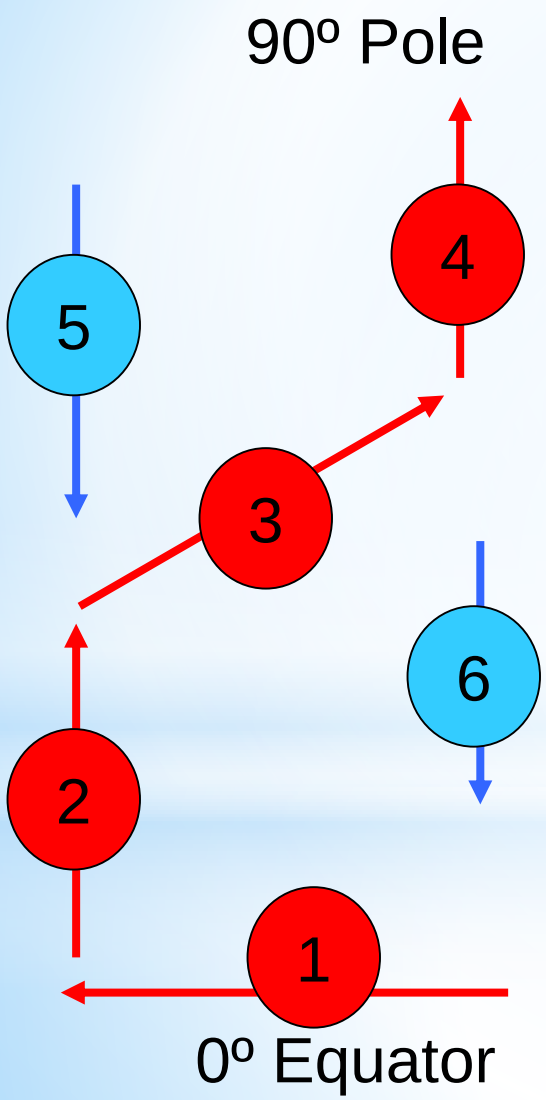
3) Land ma

These ob t most of the world's oc nown as Gyres.



The North Atlantic Gyre: An example of how land masses obstruct and divert ocean currents

Case Study 1: The North Atlantic



1 NORTH EQUATORIAL CURRENT

2 GULF STREAM

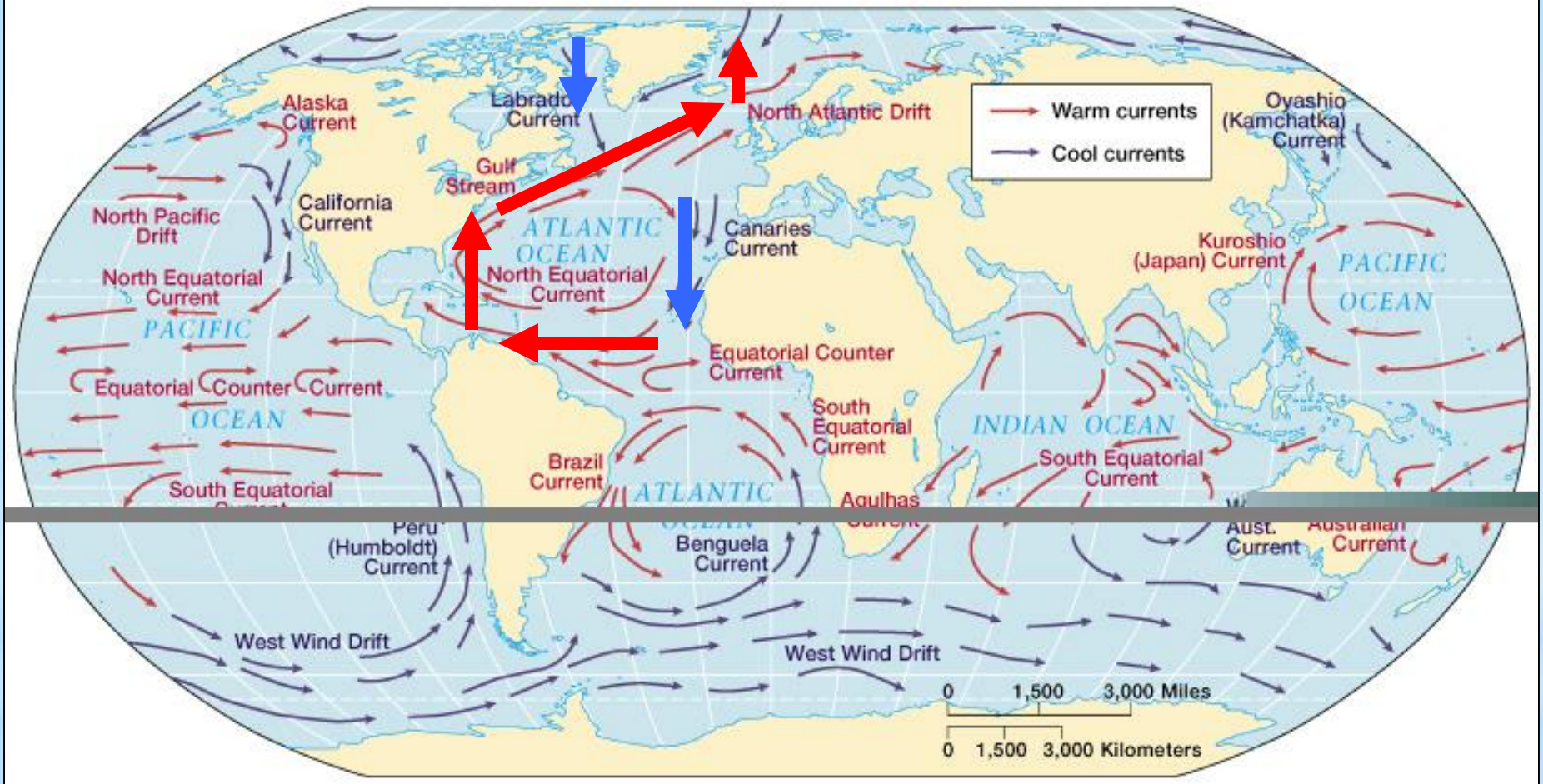
3 NORTH ATLANTIC DRIFT

4 NORTH ATLANTIC DRIFT

5 LABRADOR CURRENT

6 CANARIES CURRENT

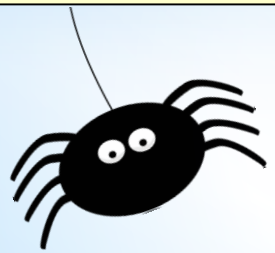
Case Study: The North Atlantic



*The North Atlantic Drift

Read the information on the North Atlantic Drift on page 6 of "Higher Geography".

In your notes, draw a spider diagram that summarises the main features of this current and its effects on Europe.



*Test Your Understanding!

Exam Type Question 1

For either the Pacific or the Atlantic Ocean, explain how the ocean currents operate to maintain the energy balance (5)

Exam Type Question 2

Study the map of selected ocean currents.

DESCRIBE and ACCOUNT FOR the pattern of ocean currents in either the Atlantic or Pacific oceans (4)

Quick Check: Are these questions asking for the same response or different?

* Model Answer: Exam Question 1

Due to uneven heating by the sun, water in Equatorial regions is warm, while that in Polar regions is much colder. The currents in the Atlantic Ocean operate to reduce this energy imbalance and redistribute the energy. In the Atlantic Ocean in the Northern Hemisphere currents are set up in clockwise loops called gyres. These transfer warm Equatorial water across the ocean surface of the Atlantic northwards (e.g. like the Gulf Stream or North Atlantic Drift) and take colder Polar water southwards (e.g. the Canaries current or the Labrador current.

This movement of cold and warm water ensures that energy balance is maintained by transferring energy so that the tropical latitudes do not become too hot and polar latitudes too cold.

* Model Answer: Exam Question 2

Atlantic Ocean

Description

•Currents are set up in clockwise loops called gyres.

•Warm water from equatorial regions moves across Atlantic (e.g the North Atlantic Drift which brings warm tropical waters to the west of Scotland).

•Colder waters are transferred southwards towards tropical latitudes e.g in the Canaries Current.

Explanation

•Currents are driven by surface winds which create a frictional drag on the water surface. The prevailing winds determine current direction.

•The coriolis force deflects currents clockwise in the North Atlantic

•Uneven heating and differences in salt content creates differences in water density, resulting in the ocean water moving in convection currents, with warm, less dense water moving across the ocean surface and cold denser water moving across the ocean bed.

•Land masses obstruct and divert the currents, causing gyres between the major land masses.