WAVES, TIDES AND CURRENTS

Ocean

Tides

Waves

Currents

The Ocean Floor

Ocean Storms

TIDES

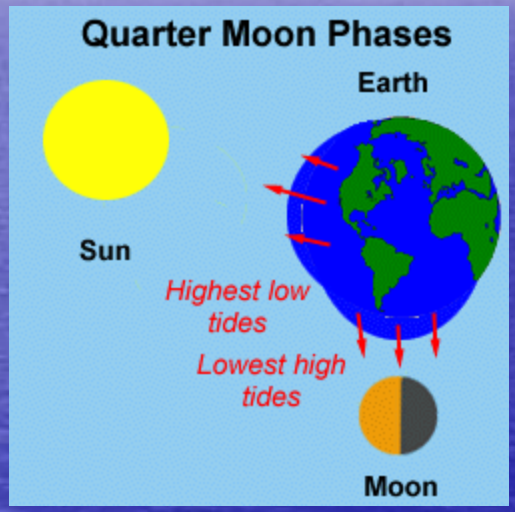
What causes tides?

The gravitational forces of the moon and sun on the water causes the tides..

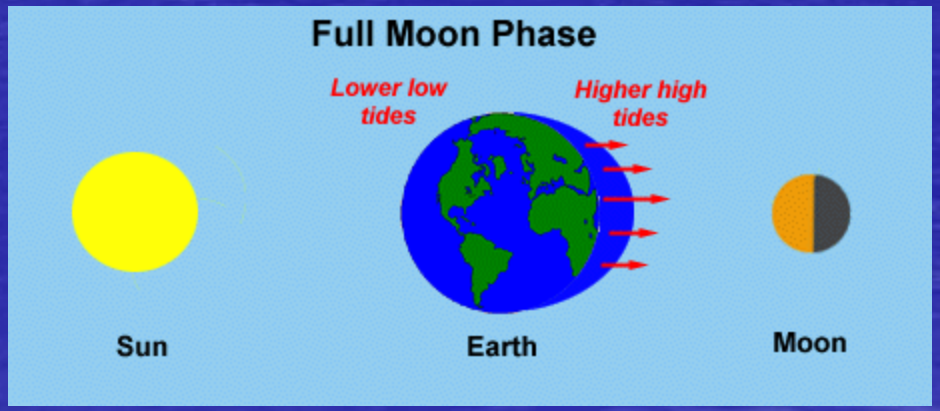
The moon, being nearest, has the greatest effect even though the sun is the larger of the two.

High tides are generated on the sides of the Earth nearest to and farthest from the moon

During new and full moon phases the moon, sun, and Earth are aligned causing a greater gravitational pull on the Earth.



This results in higher high tides and lower low tides.



Spring Tides

- The Moon moves around Earth and Earth moves around the Sun.
- The Moon, Earth, and Sun line up twice a month-when the moon is full and the when it is new.
- The Moon and Sun pull together on Earth's oceans.
- The result is high tides that are very high and low tides that are very low; Spring Tides
- *Spring refers to the "springing up" of the water, not the spring season.*

Neap Tides

- When the Sun and Moon are at a 90 degree angle with Earth, they no longer pull in the same direction.
- The pull of the Sun works against the pull of the Moon.
- High tides are not so high and low tides are not so low; Neap Tides
- Occur twice each month, when the Moon is in its first quarter and its third quarter phases.

CURRENTS

What is a Current?

A current is a continuous flow of water in a given direction

A current is like a river in the ocean

Types of Ocean Currents

There are two types of currents in the ocean:

Surface Currents

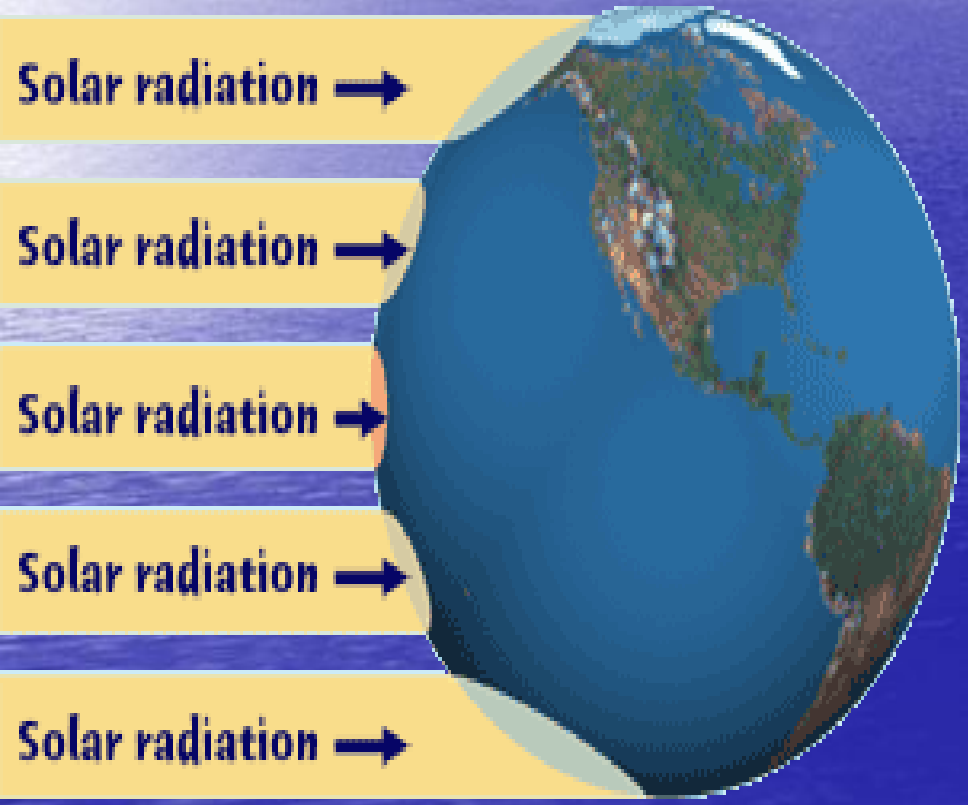
Density Currents

Causes of Surface Currents

Three things cause surface currents:

1. **Wind**
2. **Continents**
3. **Rotation of the Earth, also known as the Coriolis Effect**

Heating of the Earth's Surface



- The sun's rays strike the Earth at different angles
- At the equator, the rays strike the Earth almost perpendicular to its surface, warming up a small area.
- At high latitudes, the curve of the Earth causes the rays to strike a larger surface area-So the same amount of heat is distributed over a larger area.
- The farther from the equator, the cooler the Earth

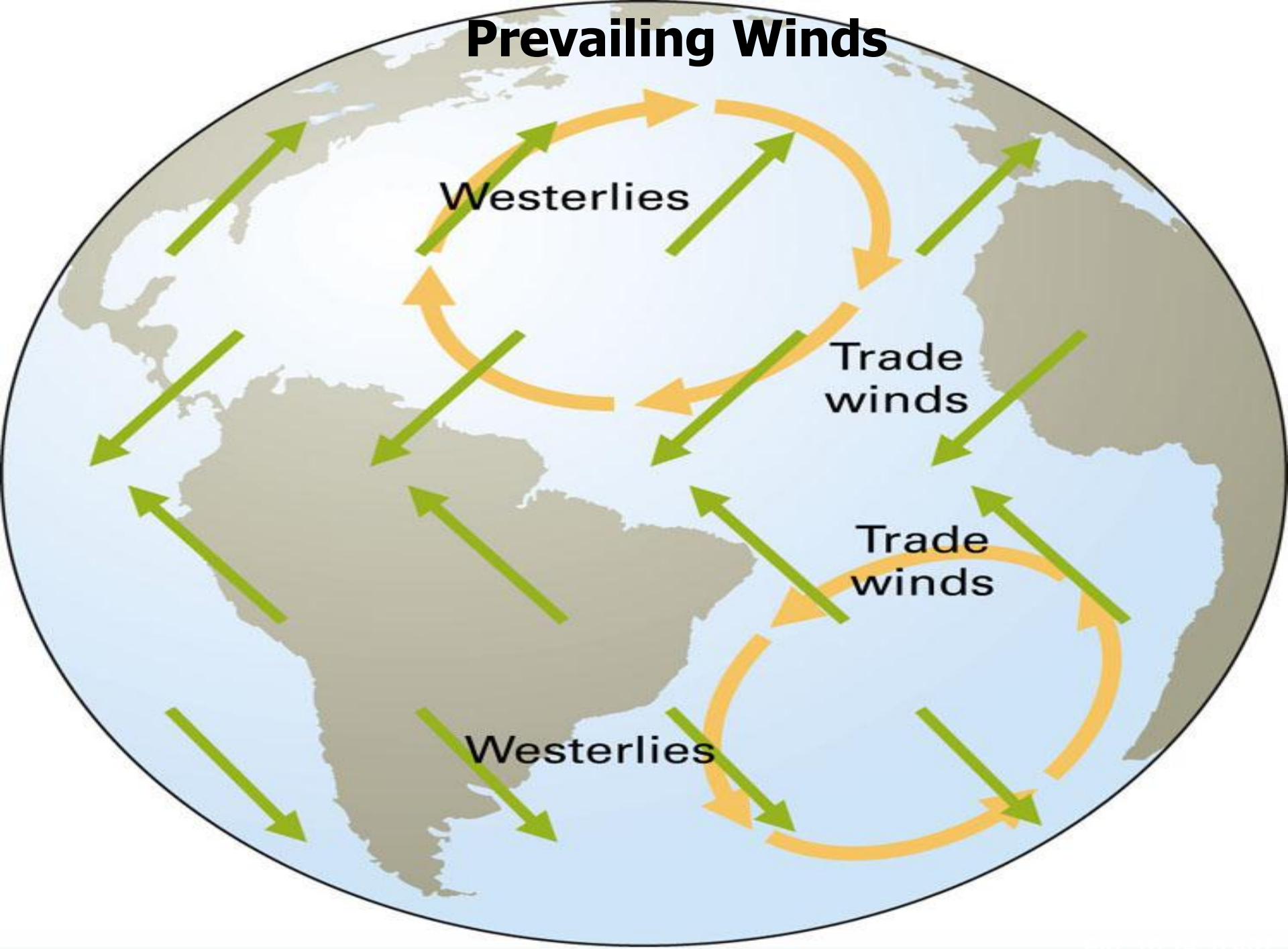
What Causes the Wind?

- This difference in temperature between the equator and the poles causes our atmosphere and ocean to circulate.

- What does warm air do?
- What does cooler air do?

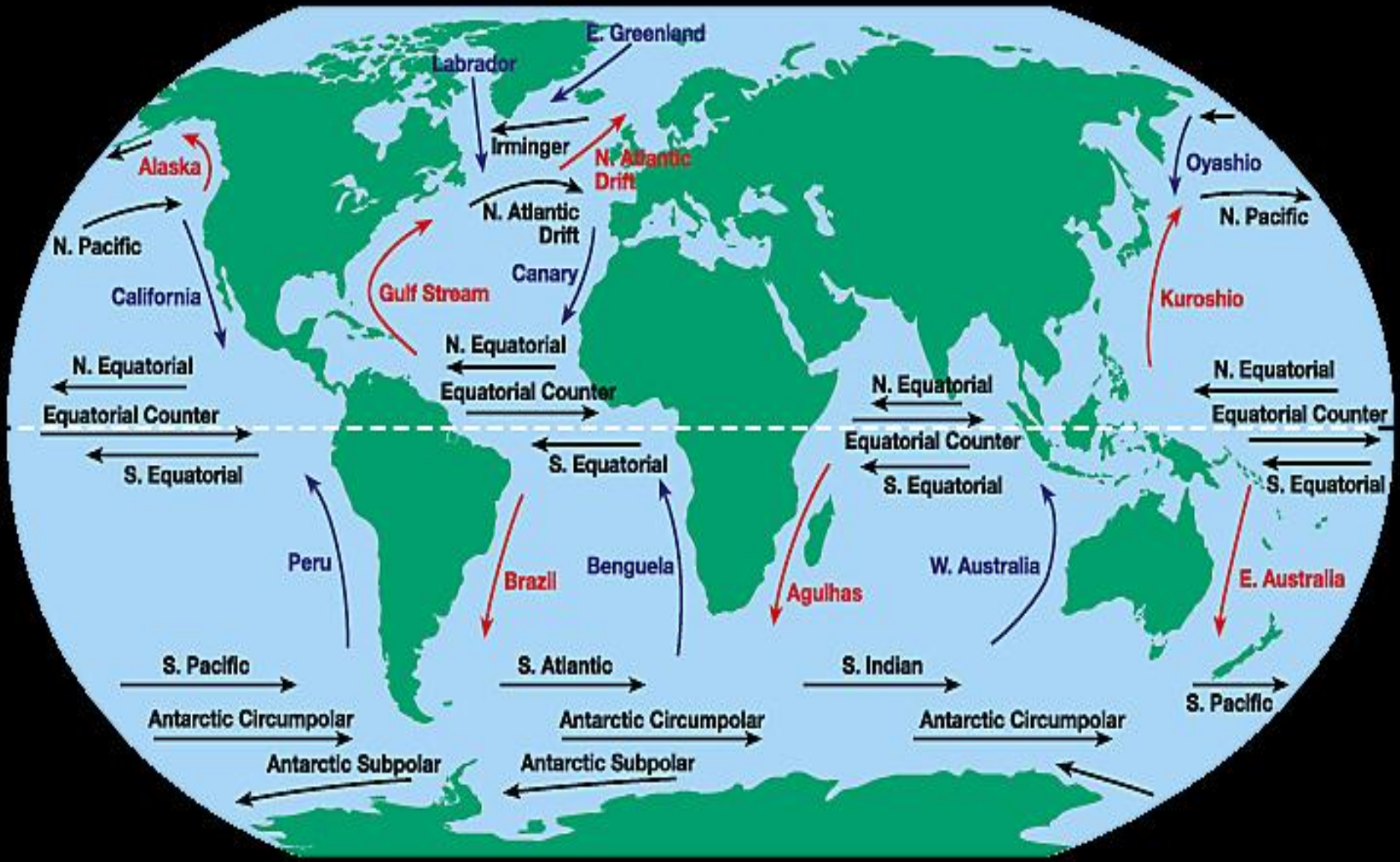
- This exchange of warm air and cool air causes the winds that prevail over the Earth.

Prevailing Winds



Surface Ocean Currents

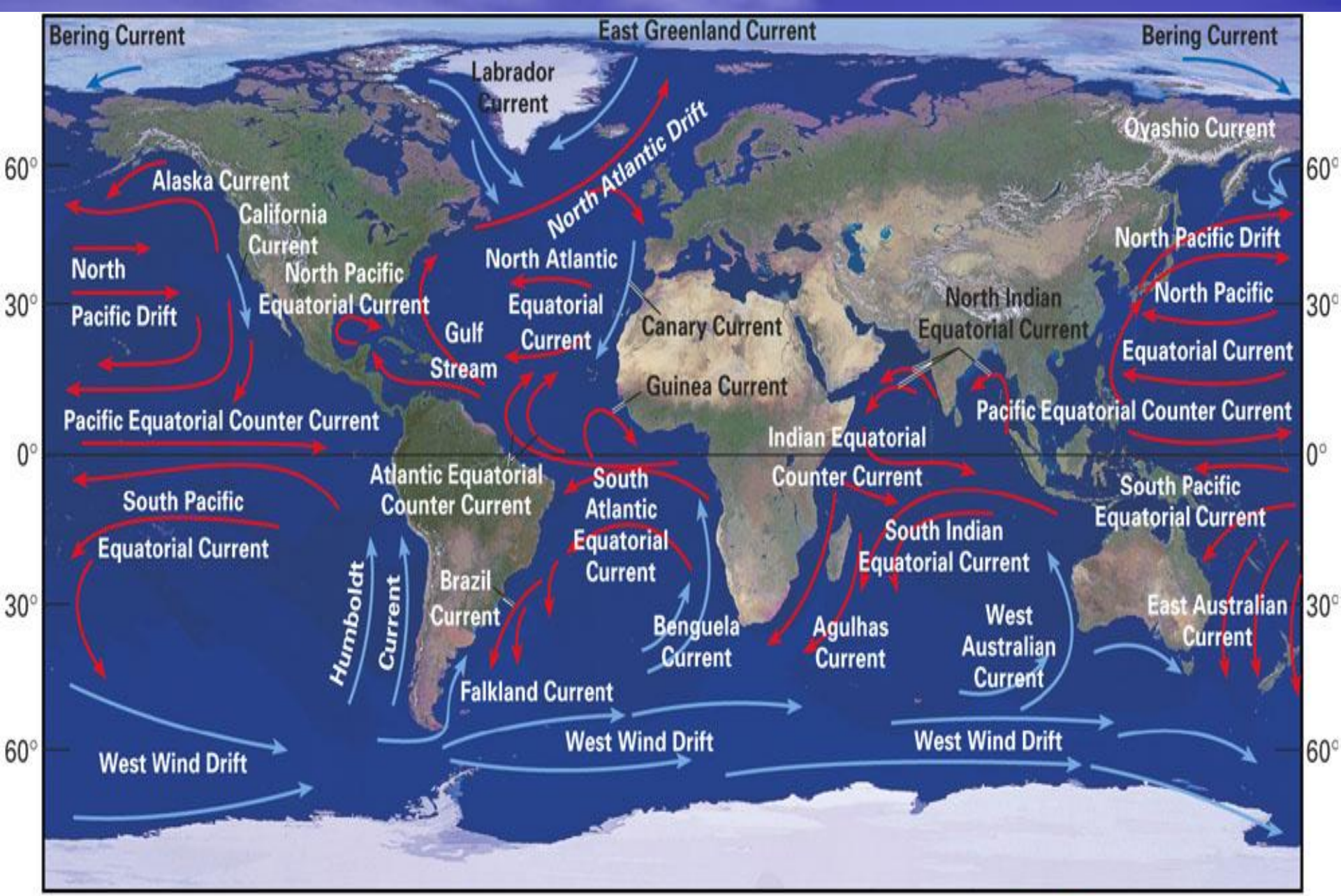
- Surface currents are caused by the transfer of energy from winds.
- Surface currents occur in the top 100 – 300 m of water.
  - Example: Gulf Stream – 80km wide, 5km velocity (at fastest)
- Gyre – circuit of currents around the periphery of an ocean basin (e.g. Gulf Stream is part of the North Atlantic Gyre)



The water of the ocean surface moves in a regular pattern called surface ocean currents. The currents are named. In this map, warm currents are shown in red and cold currents are shown in blue.

Surface-Ocean Currents

- Most are part of the gyres that circulate in the ocean basins
- Gyres circulate *clockwise* in the northern hemisphere
- Gyres circulate *counterclockwise* in the southern hemisphere
- Why?



Observe direction of circulation of gyres

Warm water current

Cool water current

The Coriolis Effect

- The Coriolis Effect is caused by the Earth's rotation.
- Because the Earth is spinning objects do not move above it in a straight line.
- Objects are deflected in a curved path.
- This is what causes clouds in a hurricane to swirl.
- This is also why winds and currents move in circular paths

Coriolis Effect

- Why don't we notice the Coriolis Effect?
- Something has to move a very long way before the Coriolis effect is noticeable - at least several hundred miles.
- For example, if you throw a football the path only curves a tiny bit due to the Coriolis effect - far too small for you to ever notice.

Current: continuous flow of water in a given direction

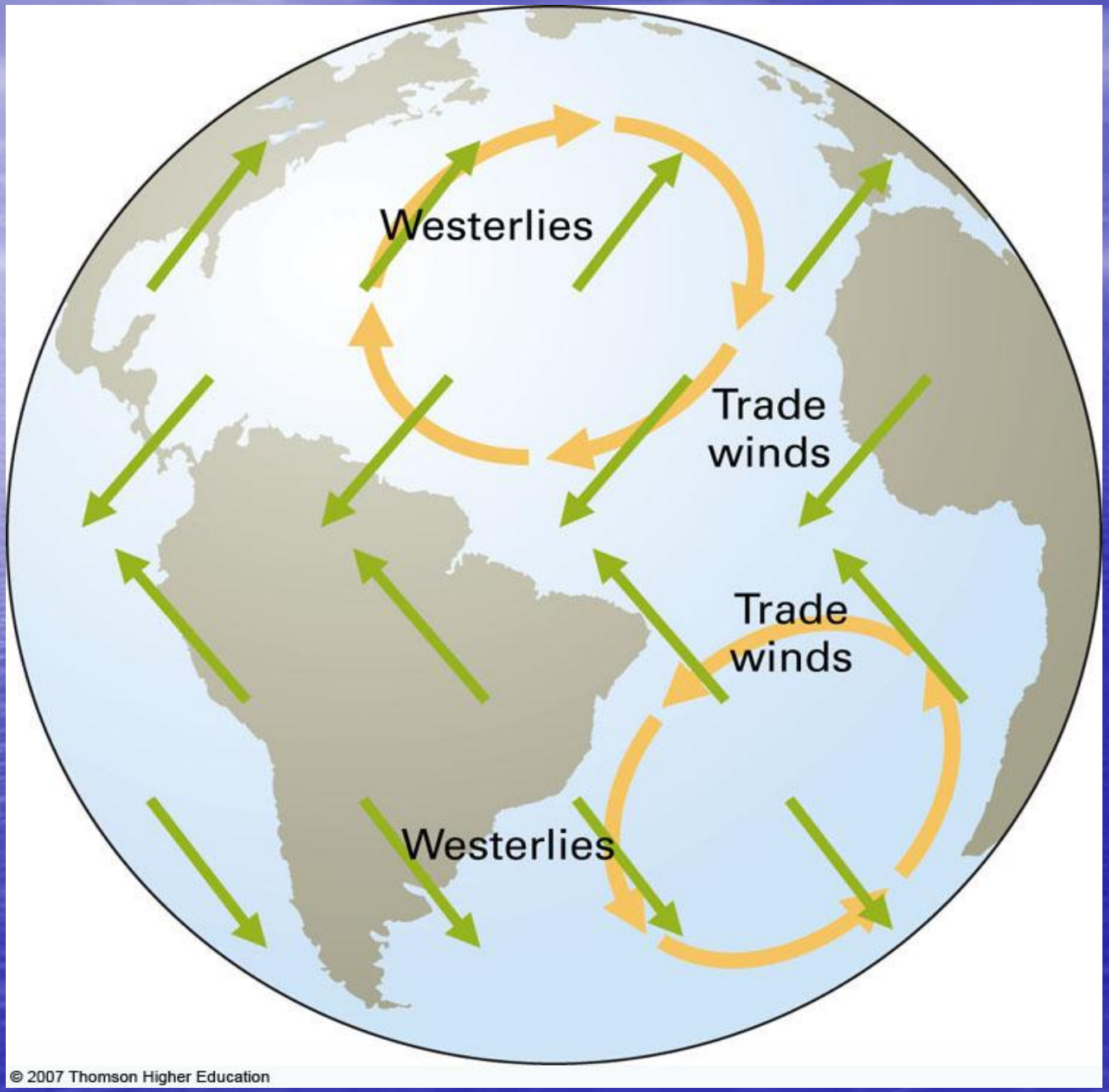
Surface currents – wind-driven flow in the top 400m of seas

- Example: Gulf Stream – 80km wide by 650m deep, 5km velocity (at fastest)

- Winds blow in particular directions due to differential heating of the earth's surface
- Gyre – circuit of currents around the periphery of an ocean basin (e.g. Gulf Stream is part of the North Atlantic Gyre)
- Westerlies and trade winds produce gyres

Westerlies and trade winds produce gyres

- Trade winds blow from east to west toward the equator. As the move over the oceans, they push surface currents from east to west.
- Westerly winds (westerlies) blow from west to east, pushing surface currents along with them.


Westerlies
Trade winds
Trade winds
Westerlies
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