

# OCEANS

**WATER, WATER EVERYWHERE...  
BUT ONLY ON THE EARTH!**

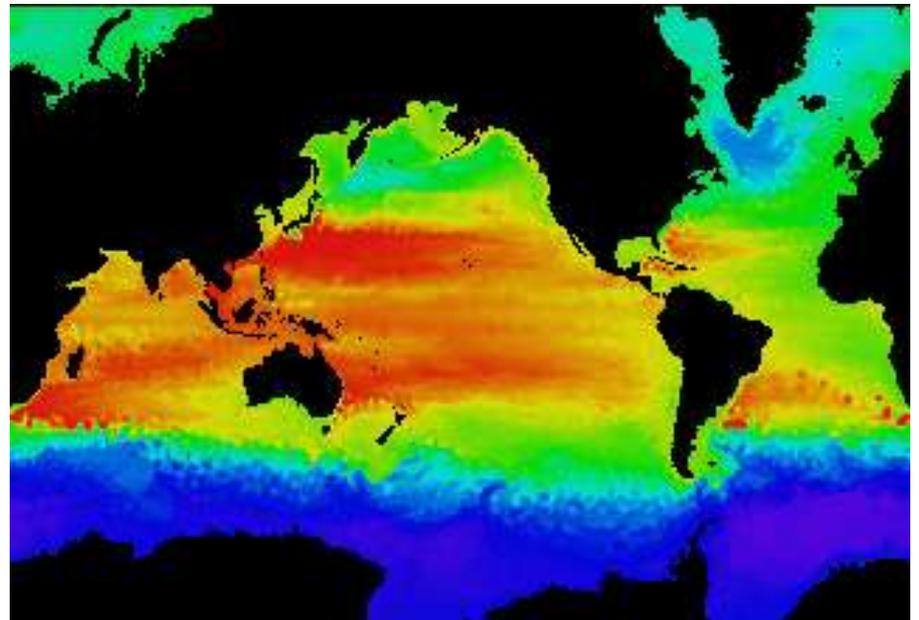
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# Oceans

- ▶ Over **70%** of the Earth's surface is covered by water
- ▶ Of that, 95% is salt water – only 5% is fresh water – and part of that is ice



# Ocean names



- ▶ All the oceans are really just one body of water
- ▶ This is divided into the four named oceans:
  - Pacific
  - Atlantic
  - Indian
  - Arctic



# Tides

- ▶ The oceans are always in motion
- ▶ Tides happen twice daily
- ▶ Tides are caused by the pull of gravity by the moon, and to a lesser degree by the sun
- ▶ Why do you think the sun would pull less than the moon?

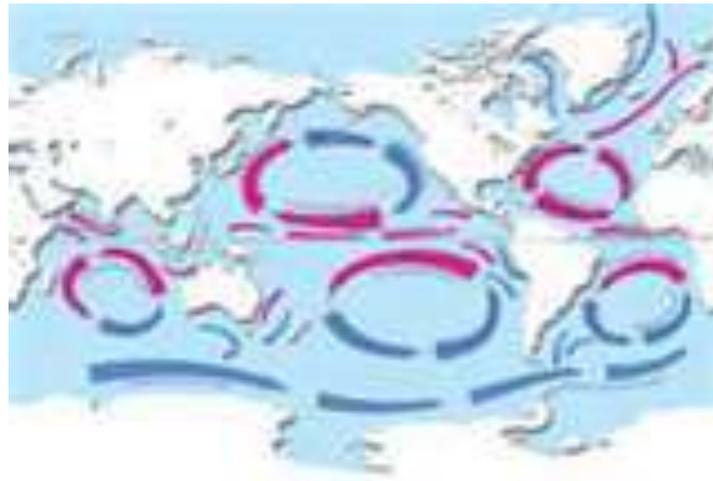


# Currents

- ▶ There are two type of Ocean Currents:

## **Surface Currents**–Surface Circulation

- ▶ These waters make up about 10% of all the water in the ocean.
- ▶ These waters are the upper 400 meters of the ocean.



# Currents

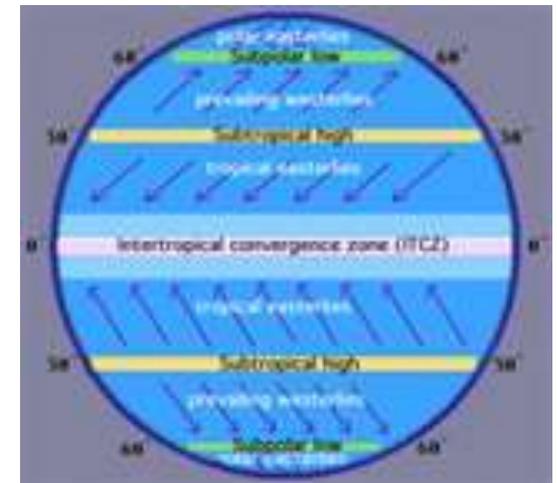
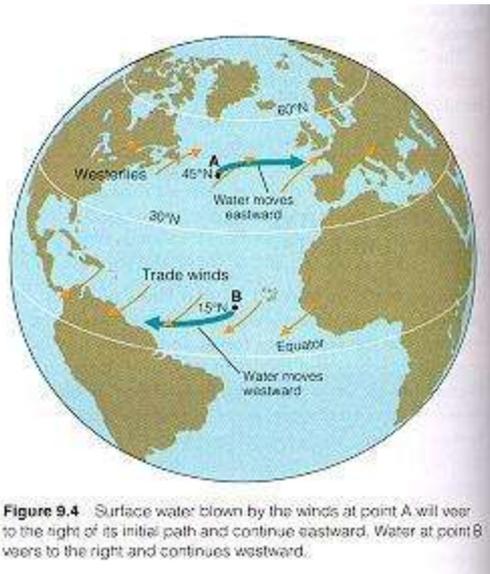
## Deep Water Currents–Thermohaline Circulation

- ▶ These waters make up the other 90% of the ocean
- ▶ These waters move around the ocean basins by density driven forces and gravity
- ▶ The density difference is caused by different temperatures and salinity
- ▶ These deep waters sink into the deep ocean basins at high latitudes where the temperatures are cold enough to cause the density to increase.



# Forces

- ▶ Ocean Currents are influenced by two types of forces
- ▶ **1. Primary Forces--start the water moving**
- ▶ The primary forces are:
  - Solar Heating
  - Winds
  - Gravity
  - Coriolis effect

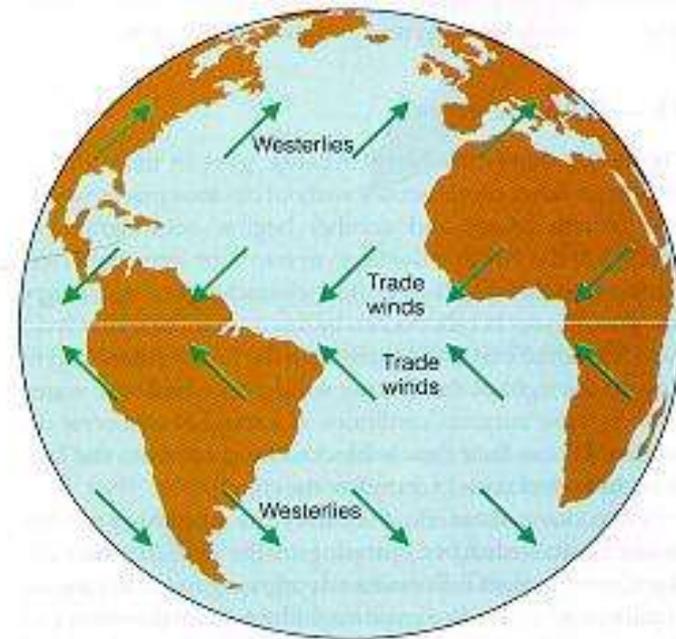


# Forces

- ▶ **2. Secondary Forces--influence where the currents flow**
- ▶ **Surface Circulation**
  - Solar heating cause water to expand. Near the equator the water is about 8 centimeters high than in middle latitudes. This cause a very slight slope and water wants to flow down the slope.
  - Winds blowing on the surface of the ocean push the water. Friction occurs between the wind and the water's surface.



# Wind direction



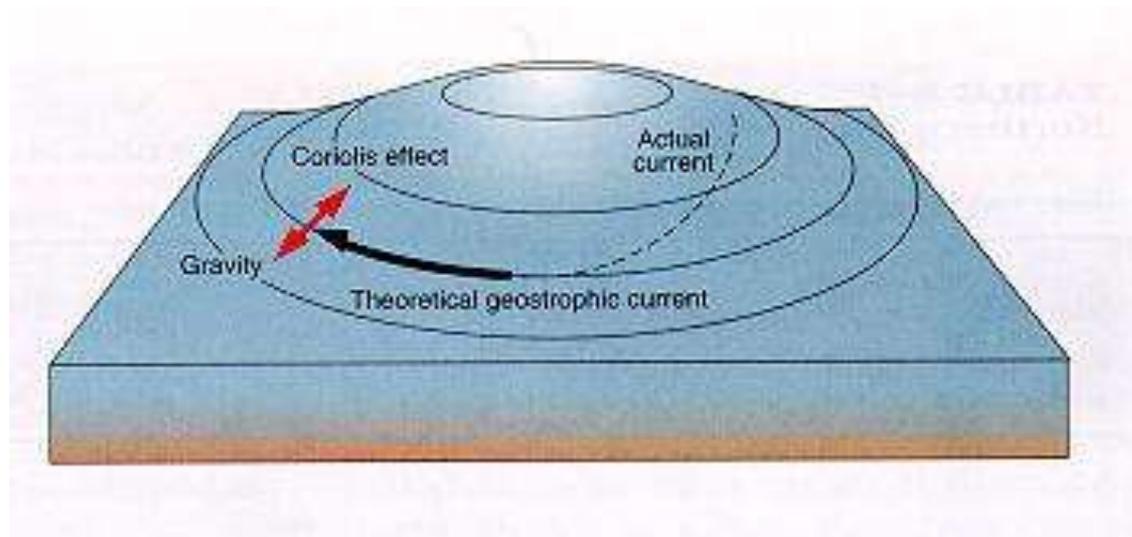
**Figure 9.1** Winds, driven by uneven solar heating and Earth's spin, drive the movement of the ocean's surface currents. The prime movers are the powerful westerlies and the persistent trade winds (easterlies).

# Wind

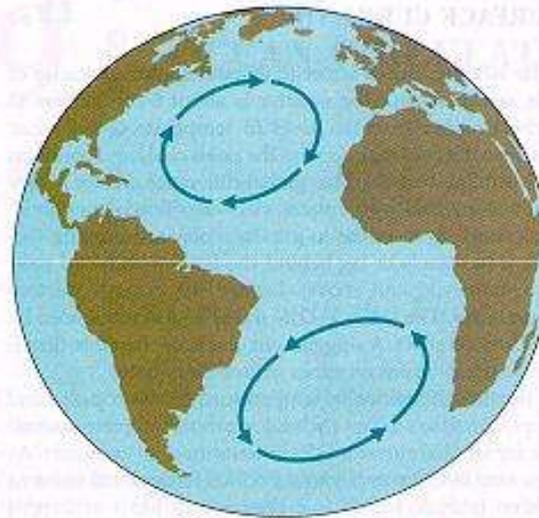
- ▶ A wind blowing for 10 hours across the ocean will cause the surface waters to flow at about 2% of the wind speed.
  - Water will pile up in the direction the wind is blowing.
  - Gravity will pull the water down the "hill" or pile of water.
  - But the Coriolis Force causes the water to move to the right (in the northern hemisphere) around the mound of water.



# Mounding

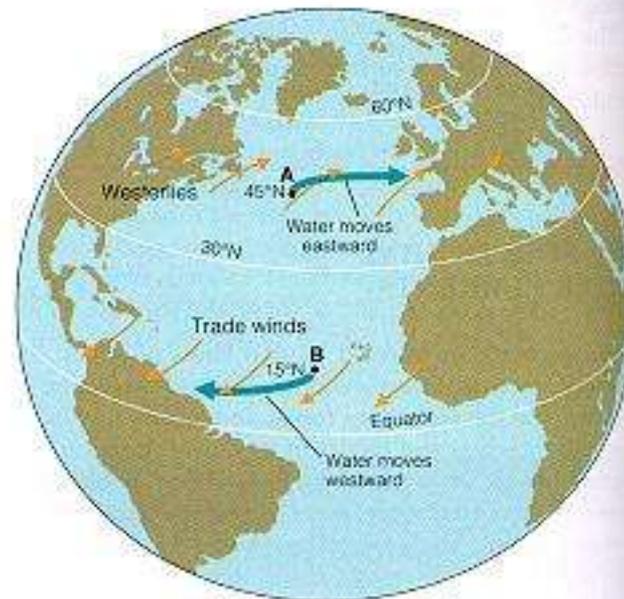


- ▶ These large mounds of water and the flow around them are called **Gyres**. They produce large circular currents in all the ocean basins.
  - Gyres



**Figure 9.2** A combination of four forces—surface winds, the sun's heat, the Coriolis effect, and gravity—circulates the ocean surface clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere, forming gyres.

- ▶ Remember the Coriolis Force move objects to the right in the northern hemisphere, and to the left in the southern hemisphere



**Figure 9.4** Surface water blown by the winds at point A will veer to the right of its initial path and continue eastward. Water at point B veers to the right and continues westward.