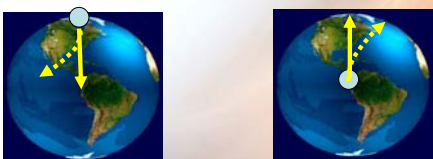


Ocean Currents

The Coriolis Effect

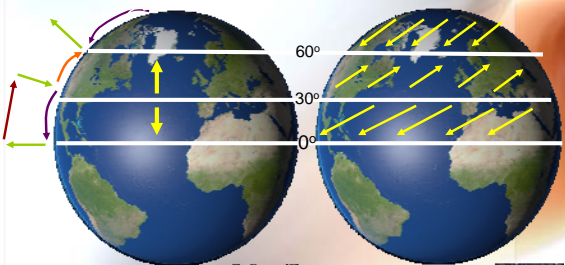
The Coriolis effect deflects objects (wind) moving toward the Equator to the west

The Coriolis effect deflects objects (wind) moving toward the poles to the east.

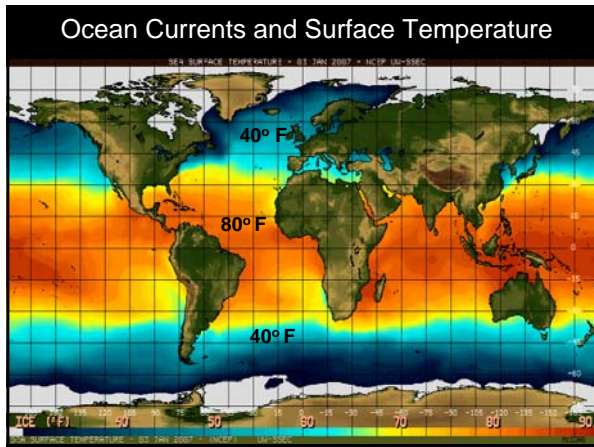


In the northern hemisphere, the Coriolis force deflects objects (wind) to the right in the direction of travel.

In the southern hemisphere, wind is deflected to the left in the direction of travel.



Ocean Currents



Ocean Currents

Surface Currents
The upper 400 meters of the ocean (10%).

Deep Water Currents
Thermal currents (90%)

global currents
the great marine conveyor belt
(after G. Stommel, 1962)

Surface Currents

Forces

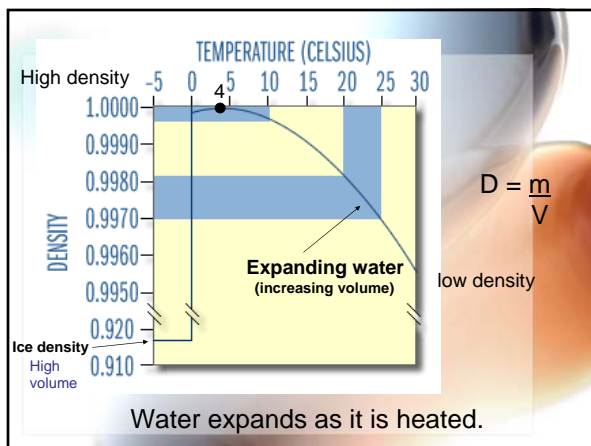
1. Solar Heating (temp, density)
2. Winds
3. Coriolis



Solar Heating and Density

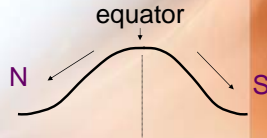
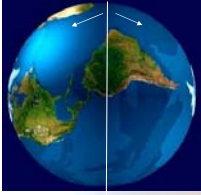
Density

$$\frac{\text{Mass}}{\text{Volume}} \quad \frac{(\text{g})}{(\text{cm}^3)}$$

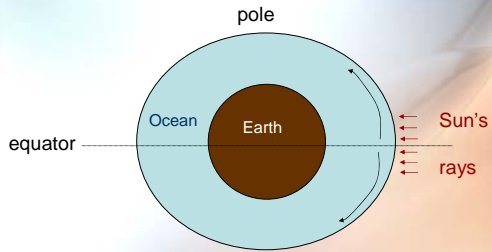


Solar Heating

Heat expands water near the Equator



General Circulation

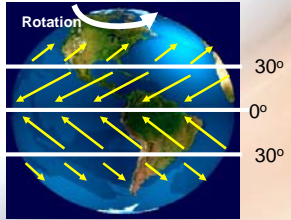


General Circulation (North)



Winds Guide the Direction of Surface Water

Winds blow to the west between 0° and 30° latitude.



General Circulation (North)



The Coriolis force deflects objects
To the right of the direction of motion.

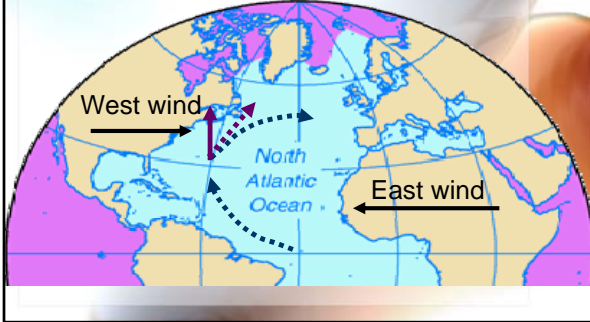


Winds plus Coriolis Force



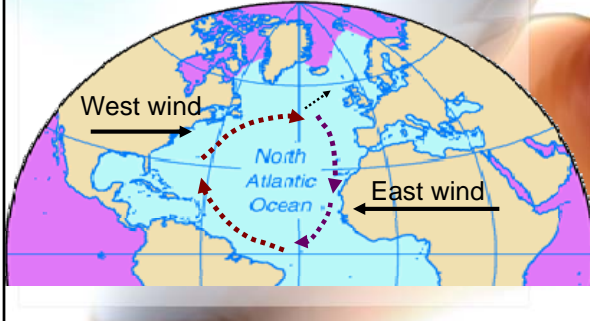
Winds plus Coriolis Force

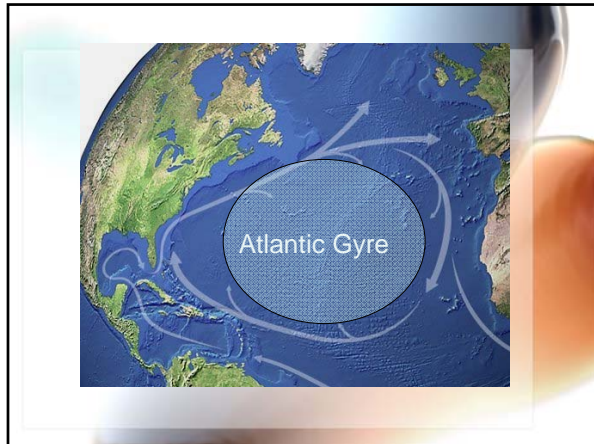
The Coriolis force deflects objects moving toward the poles to the east. Or to the right in the direction of travel.

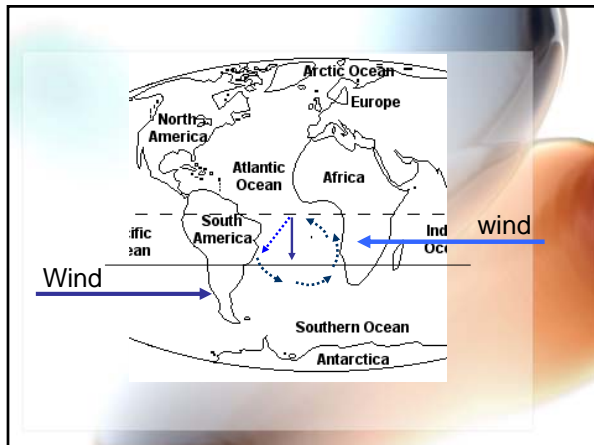


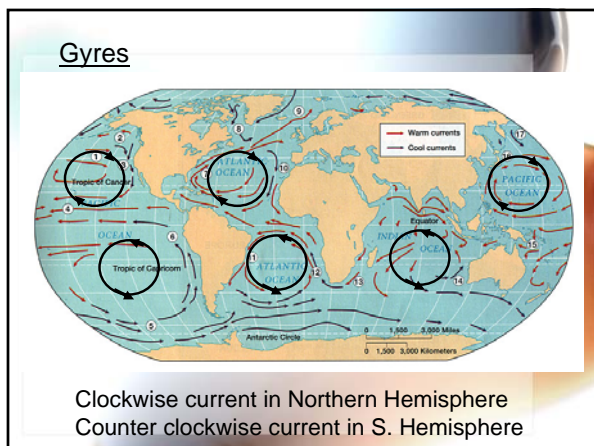
Circulation

The Coriolis force deflects objects (wind) moving toward the Equator to the west or the right in the direction of travel.



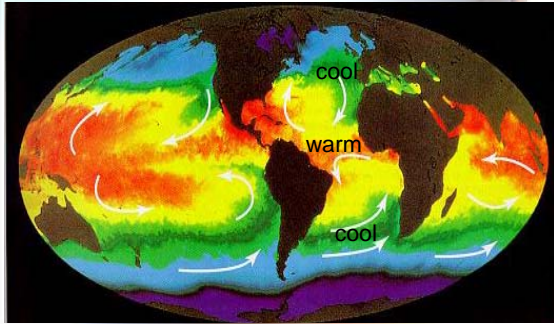




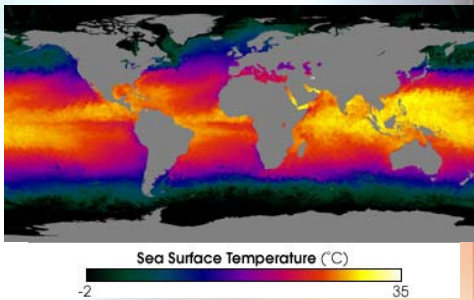


Temperature/Energy Transfer

Heat Capacity



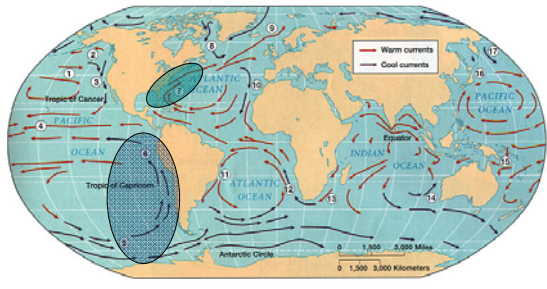
Moderates Ocean Temperatures



Heat Capacity = 1 cal/g°C

Major Surface Currents

Two Major Currents



Gulf Stream

Humbolt Current

The Gulf Stream

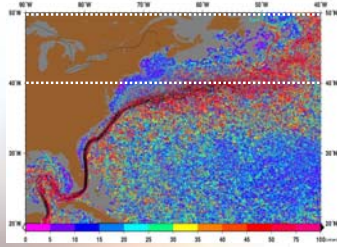
“a river in the ocean”

1000 x more water transported than the Mississippi.

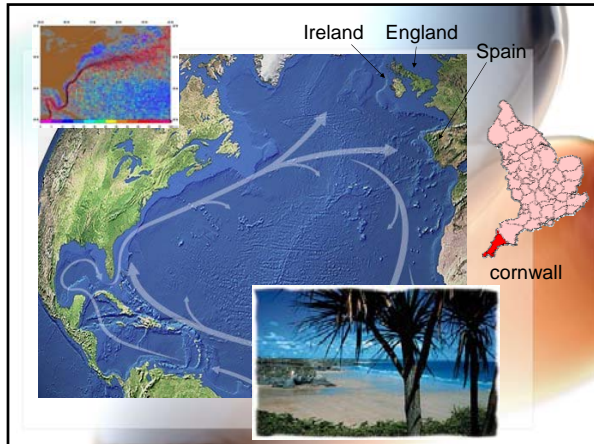
20 – 40 miles wide

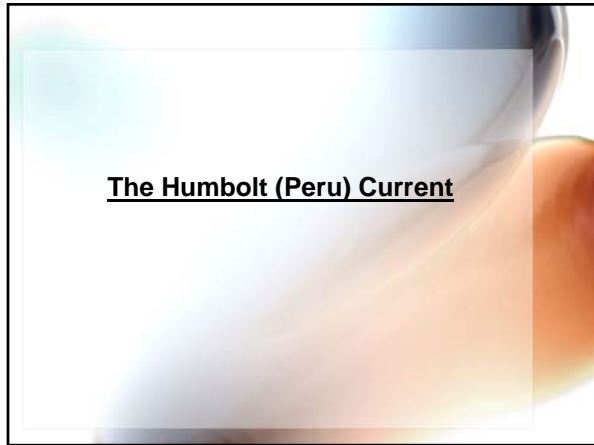
½ mile deep

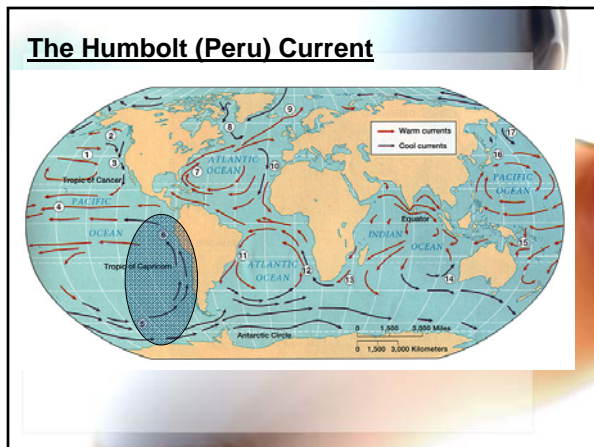
4 miles per hour











Easterlies

THE PERU OR HUMBOLDT CURRENT

Westerlies

South Equatorial Current

PERU

Peru Current

Cool water
Cool air

desert

7-8 C° cooler than the ocean at similar latitudes

Dry conditions near the coast.

Upwelling

Wind

Water pulled away from shore

productive Coastal Range

Upwelling

nutrients

Nutrient Source for Food Web

Basis for a rich fishing industry off Peru.

Surge of Nutrients: Food Chain

Phytoplankton constitute the food base of all marine animals, are microscopic organisms that inhabit only the sunlit uppermost oceanic layer, using sunlight to photosynthetically combine carbon dioxide and dissolved nutrient salts.

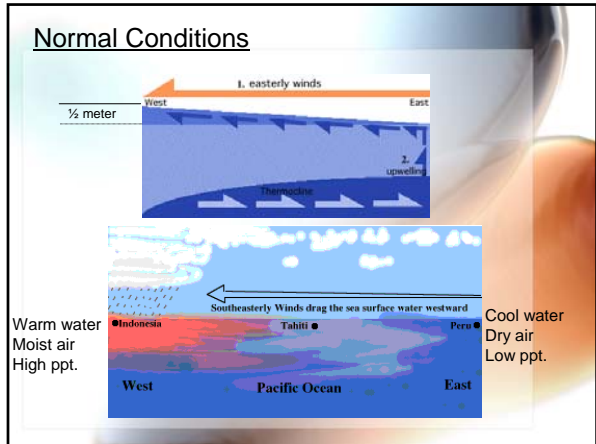
Zooplankton marine animals that rely mainly upon water motion for transport. Zooplankton subsist on phytoplankton and smaller zooplankton.

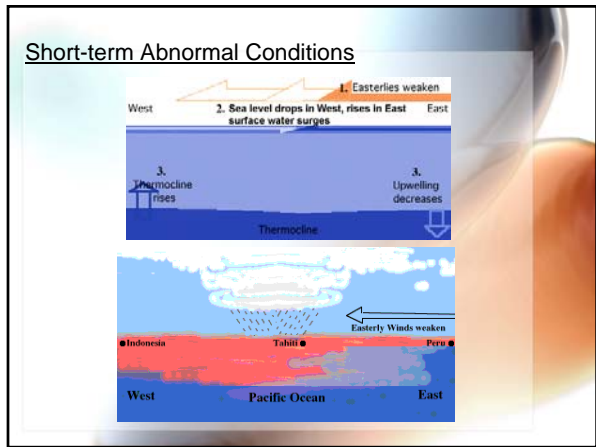
Nekton free swimmers, are dominated by the bony and cartilaginous fishes, molluscans, and decapods, with rarer mammals and reptiles.

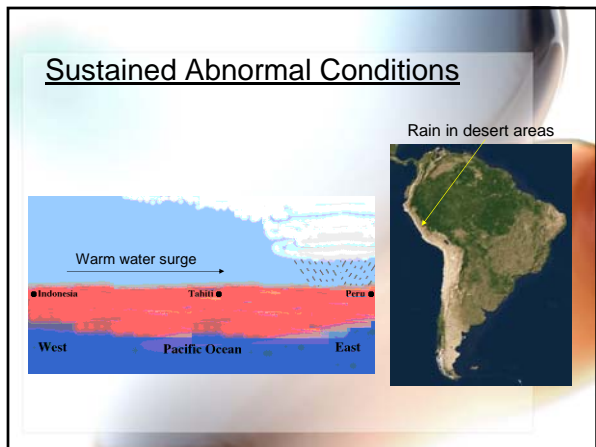
easterly winds

mixed layer

Thermocline



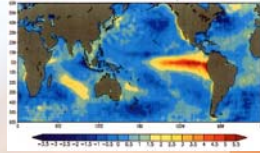




Abnormal Conditions

El Niño: Spanish name for the male child

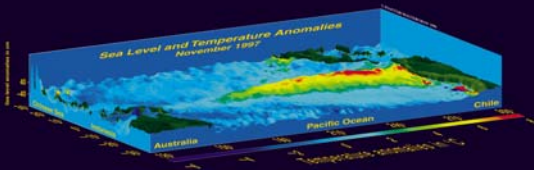
Sustained sea surface temperature anomalies across the central tropical Pacific Ocean.



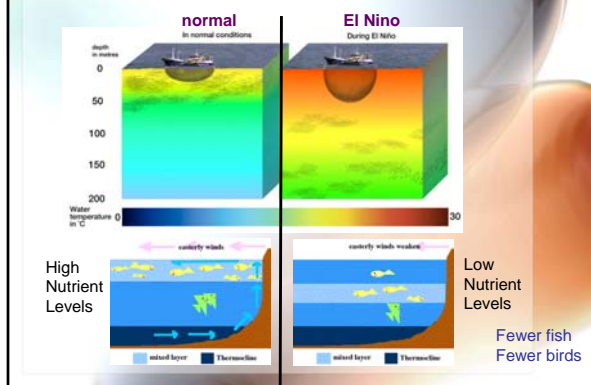
Initially referred to a weak, warm current appearing annually around Christmas time along the coast of Ecuador and Peru and lasting only a few weeks to a month or more.

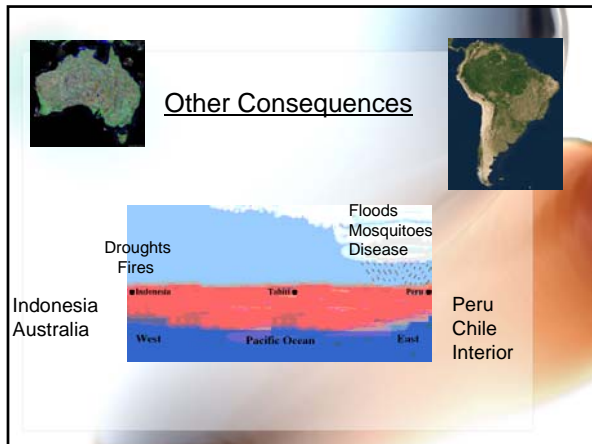
Every three to seven years, an El Niño event may last for many months

El Niño



The coast of Peru is one of five major fishing grounds in the world





El Niño is driven by slackening of easterly winds off the coast of Peru.

This results in less upwelling of cool nutrient-rich water.

Persistent El Niño allows warm moist air to persist near Peru leading to high rainfall in an area that typically receives little rain.

Conversely, Australia and Indonesia experience drought.



