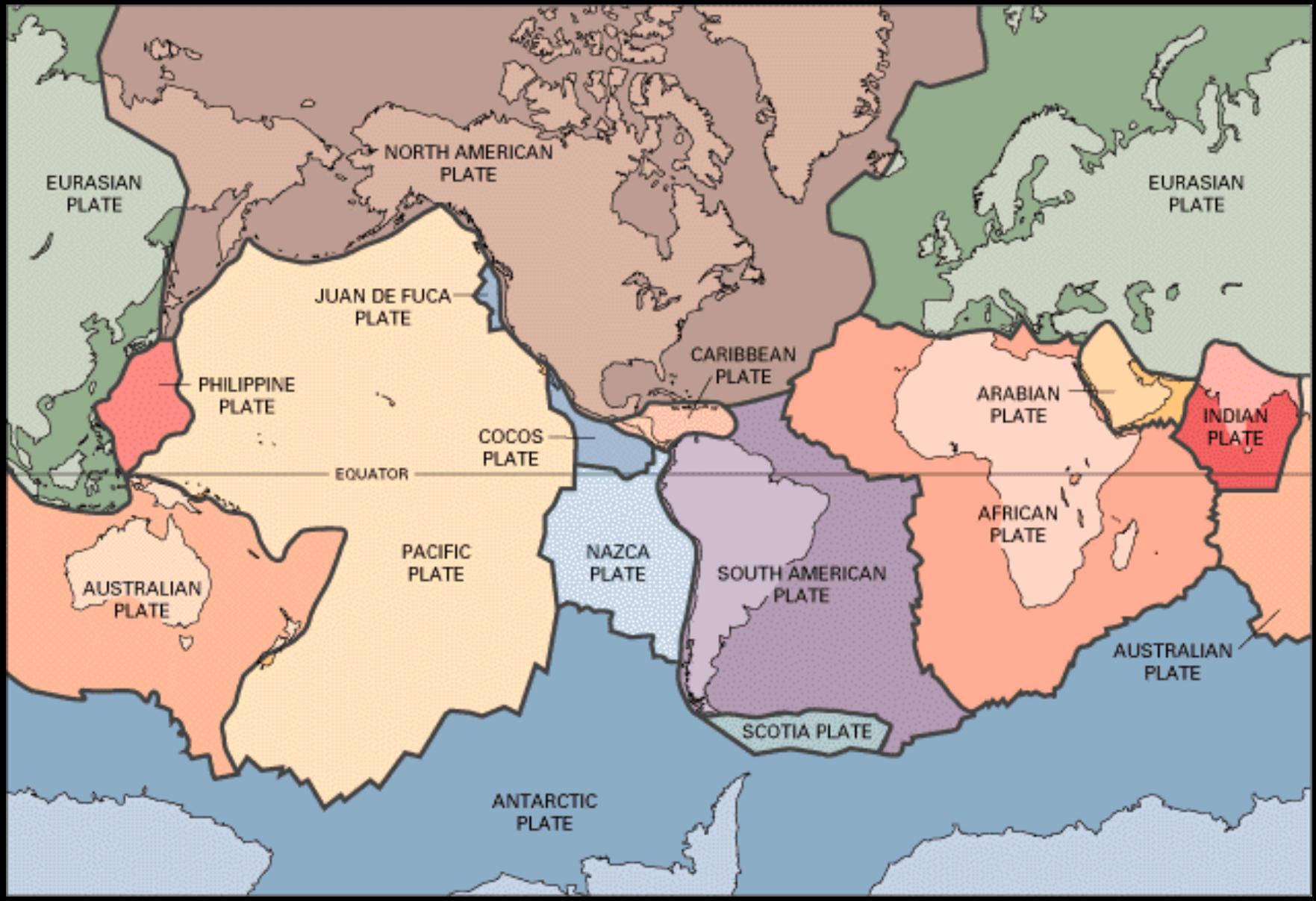

EURASIAN PLATE
NORTH AMERICAN PLATE
EURASIAN PLATE
JUAN DE FUCA PLATE
CARIBBEAN PLATE
PHILIPPINE PLATE
ARABIAN PLATE
INDIAN PLATE
COCOS PLATE
EQUATOR
AFRICAN PLATE
PACIFIC PLATE
NAZCA PLATE
SOUTH AMERICAN PLATE
AUSTRALIAN PLATE
AUSTRALIAN PLATE
SCOTIA PLATE
ANTARCTIC PLATE

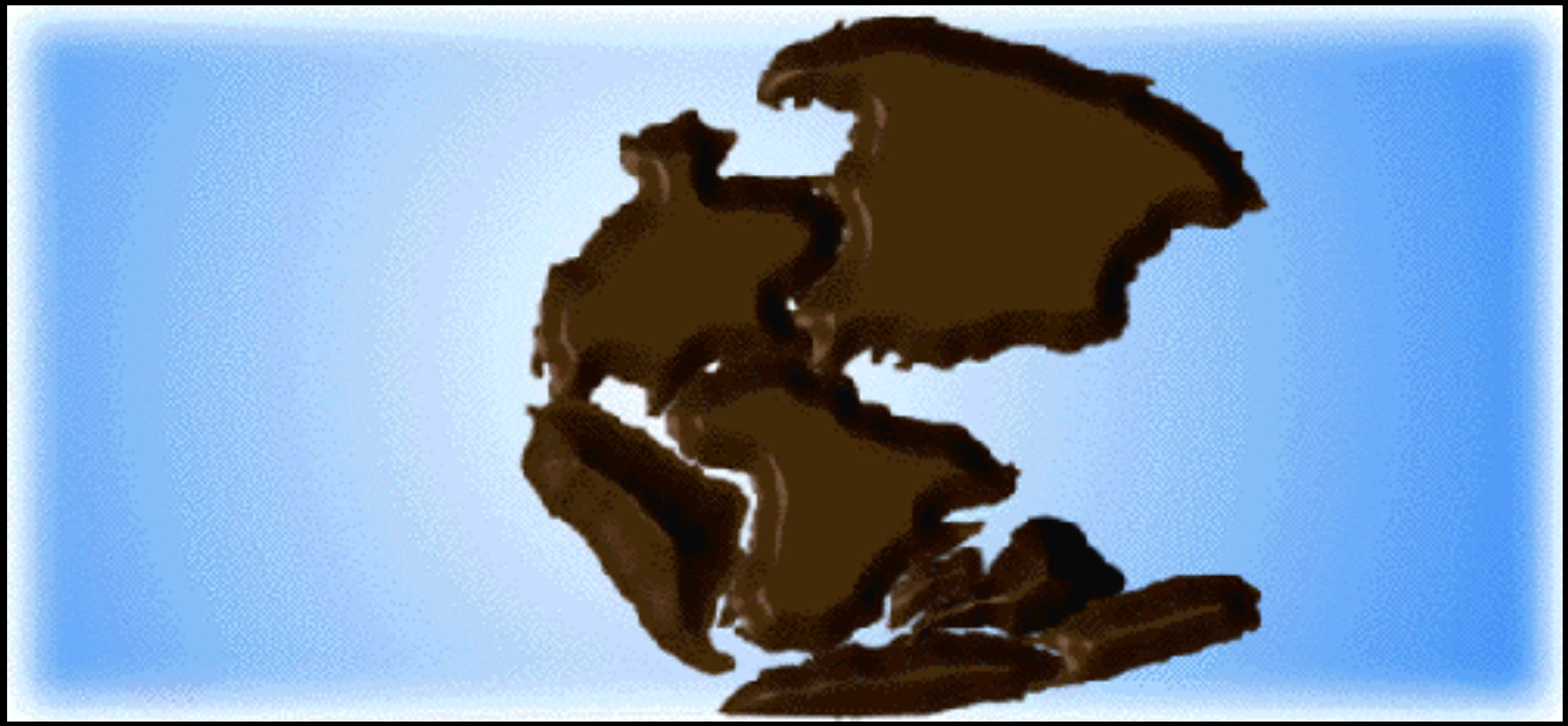
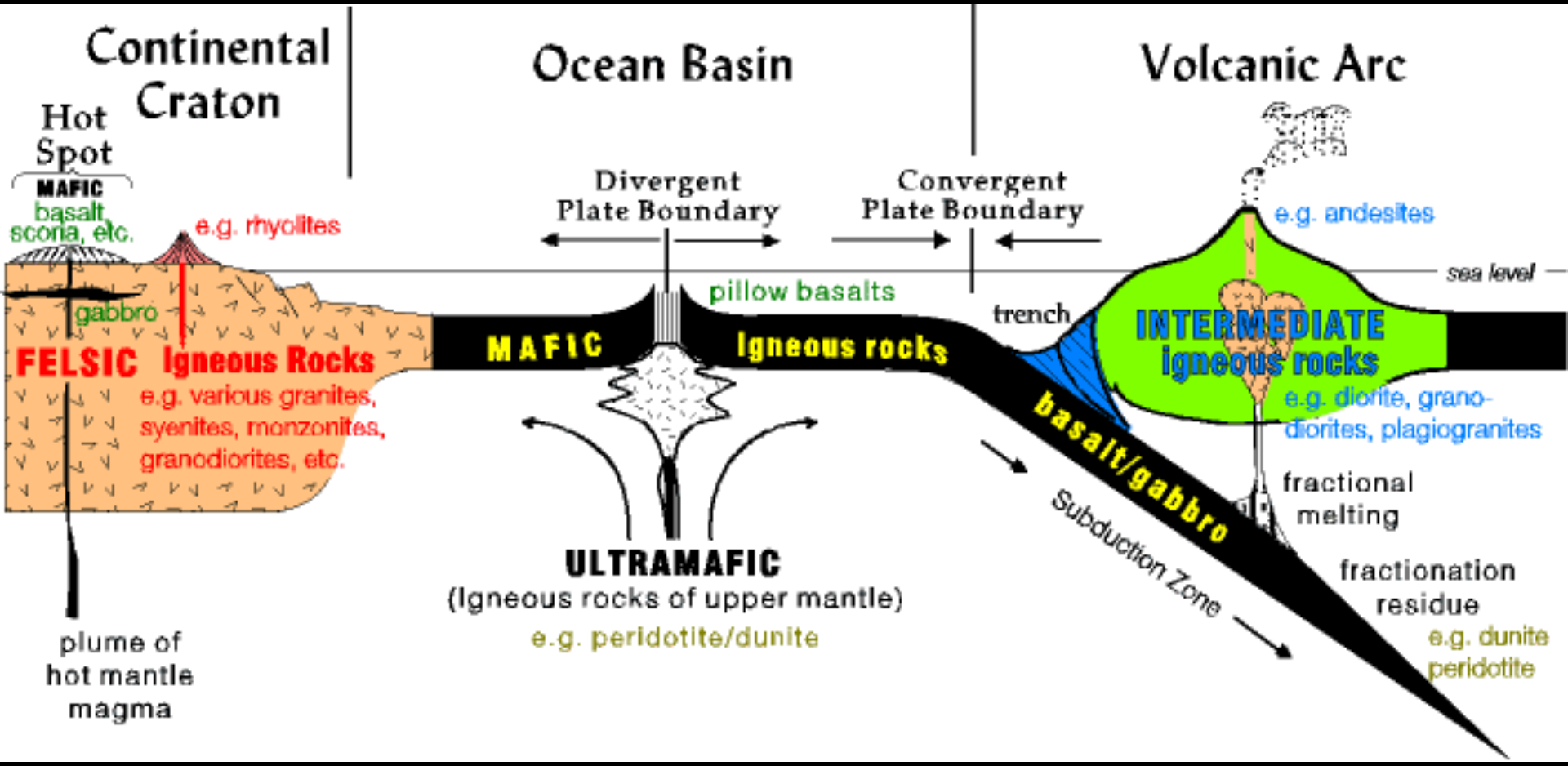
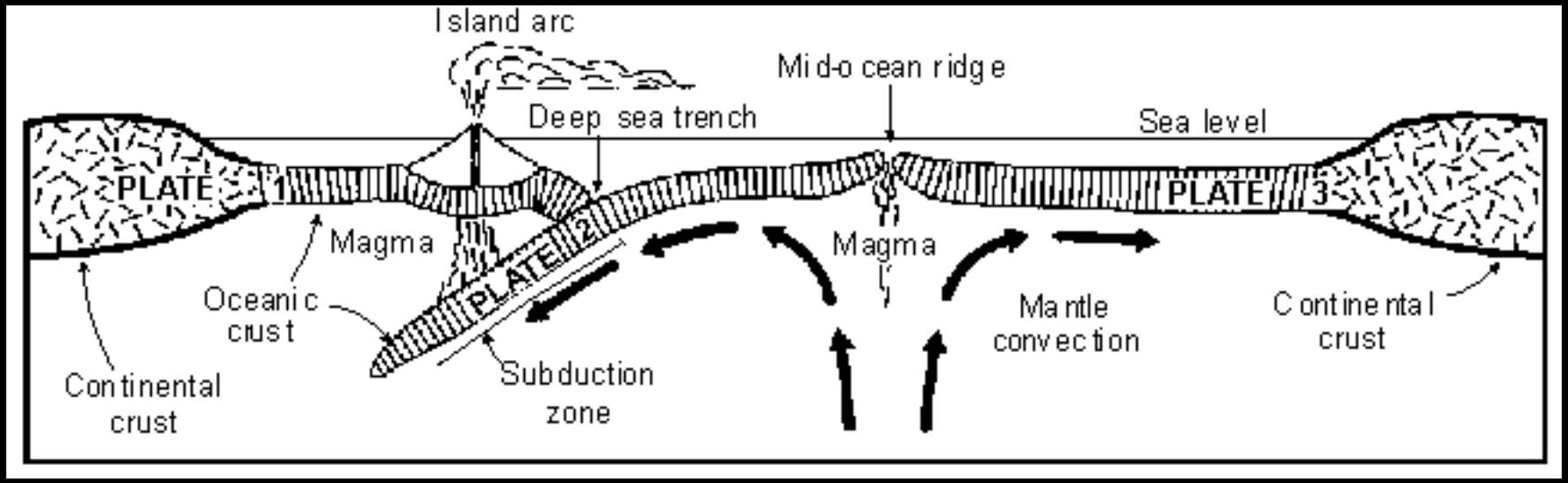


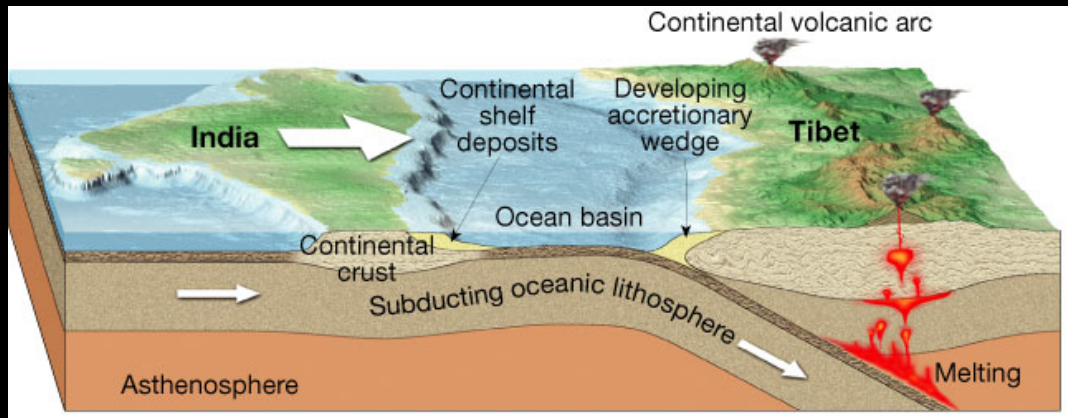
Plate Boundaries

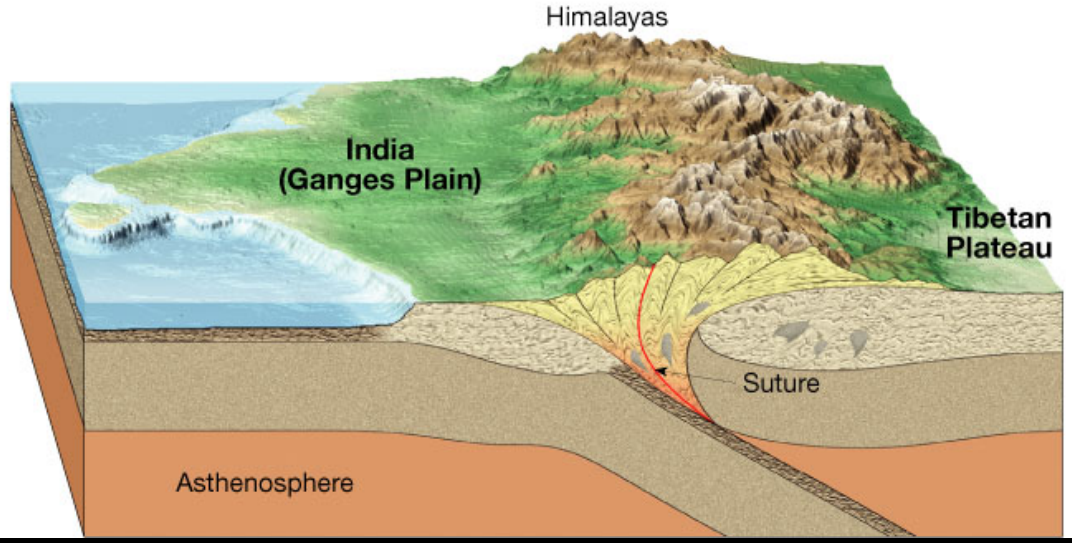
- **Divergent Boundary** – moving apart
- **Convergent Boundary** – moving towards each other
- **Transform Boundary** – moving sideways past each other

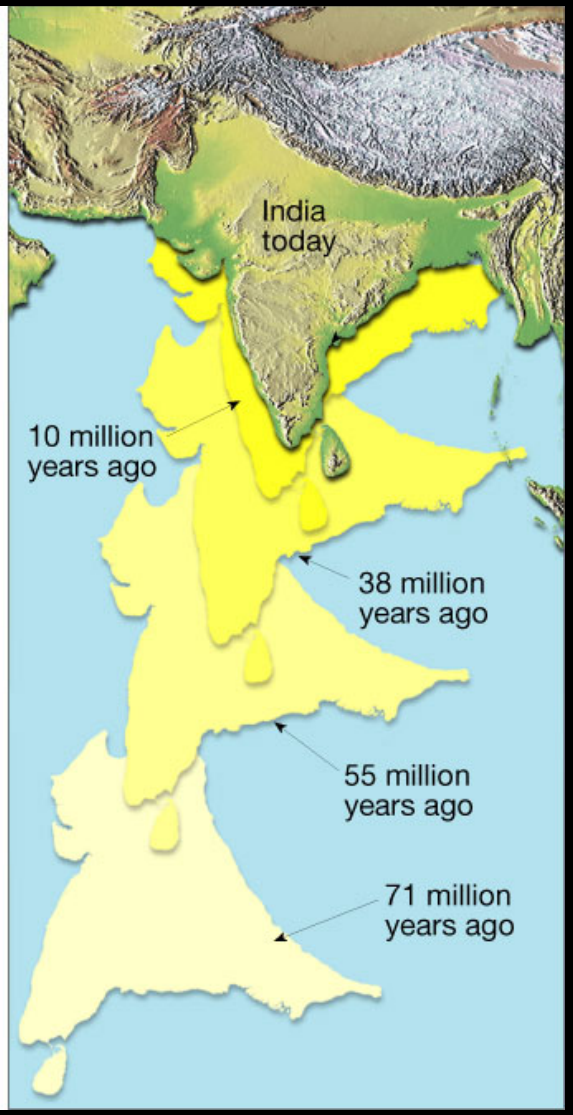

Continental Craton
Ocean Basin
Volcanic Arc
Hot Spot
MAFIC
basalt, scoria, etc.
e.g. rhyolites
Divergent Plate Boundary
Convergent Plate Boundary
e.g. andesites
sea level
pillow basalts
gabbro
trench
FELSIC Igneous Rocks
e.g. various granites, syenites, monzonites, granodiorites, etc.
MAFIC Igneous rocks
INTERMEDIATE igneous rocks
e.g. diorite, grano-diorites, plagiogranites
basalt/gabbro
Subduction Zone
fractional melting
fractionation residue
e.g. dunite peridotite
ULTRAMAFIC
(Igneous rocks of upper mantle)
e.g. peridotite/dunite
plume of hot mantle magma


Island arc
Mid-ocean ridge
Deep sea trench
Sea level
PLATE 1
PLATE 2
PLATE 3
Magma
Magma
Oceanic crust
Continental crust
Subduction zone
Mantle convection
Continental crust

Collision of India and Asia







Oceanic-Continental Convergent Boundary

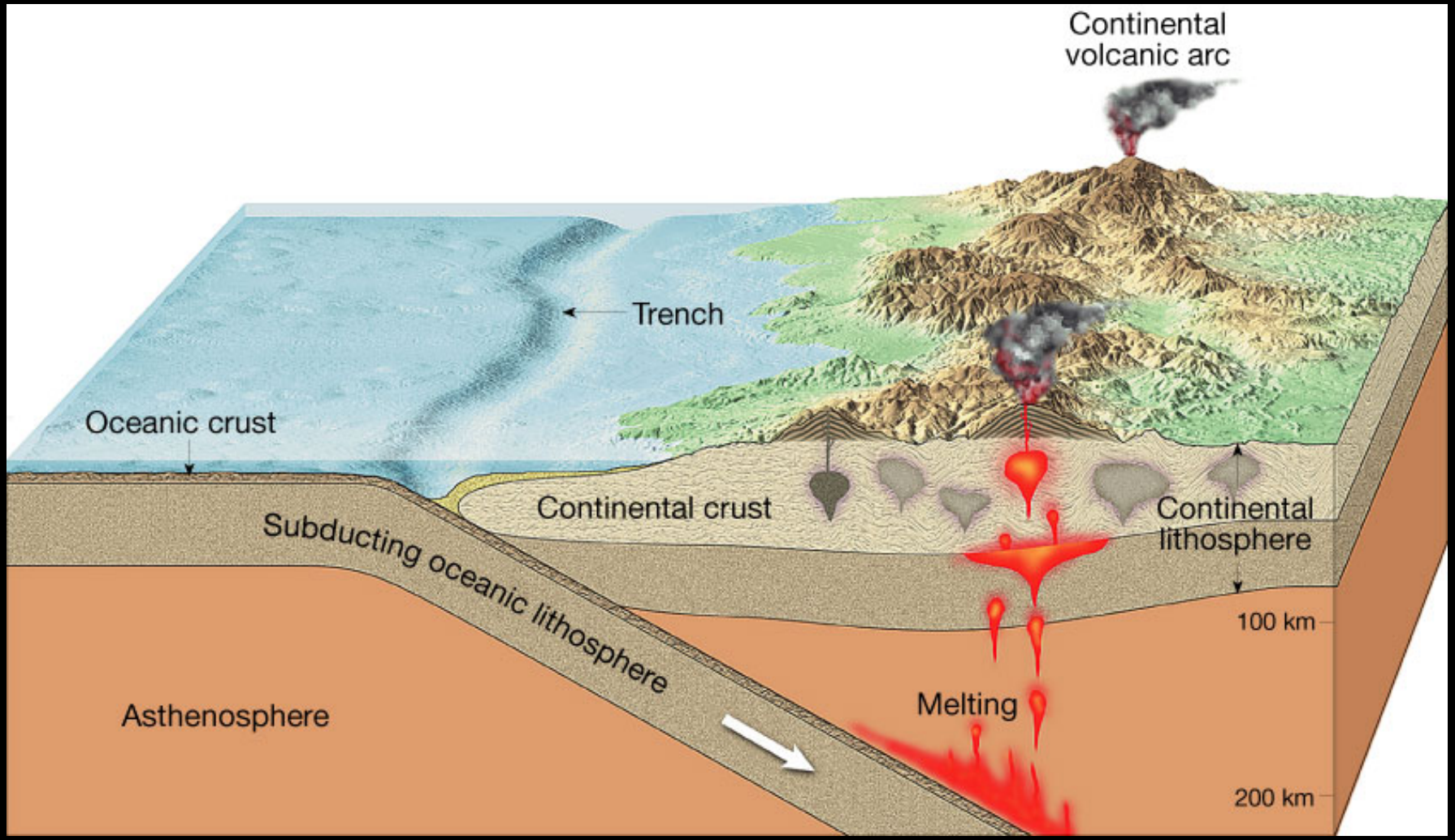
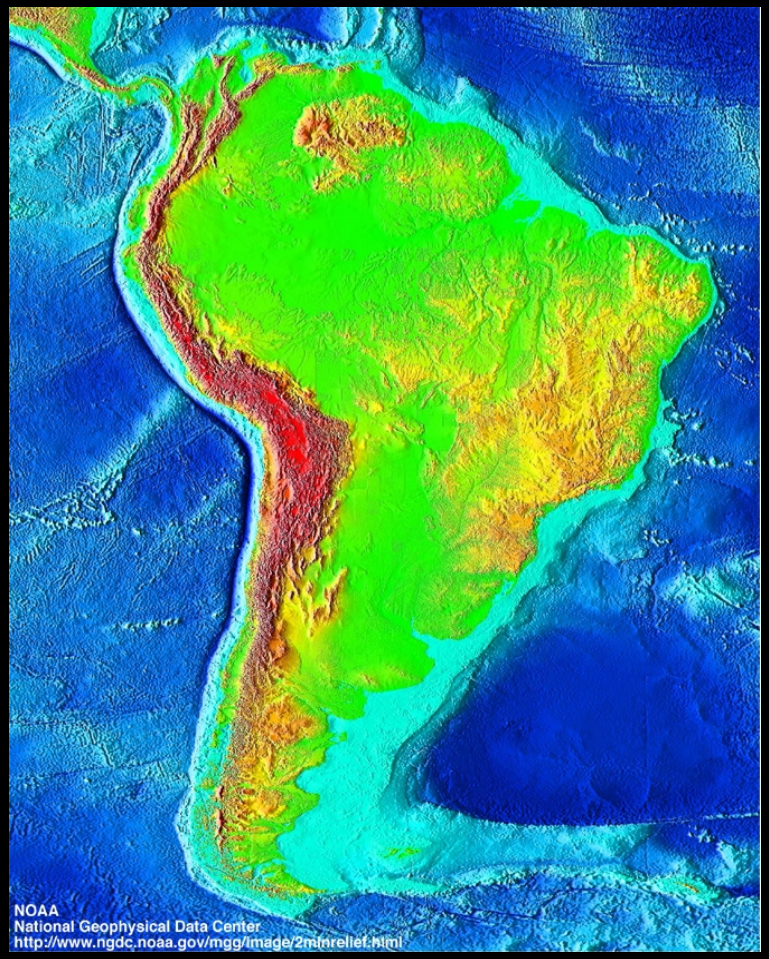


Plate Boundaries

Geologic features at ocean/continent convergent boundaries

- mountains
- trenches
- volcanoes



Oceanic-Oceanic Convergent Boundary

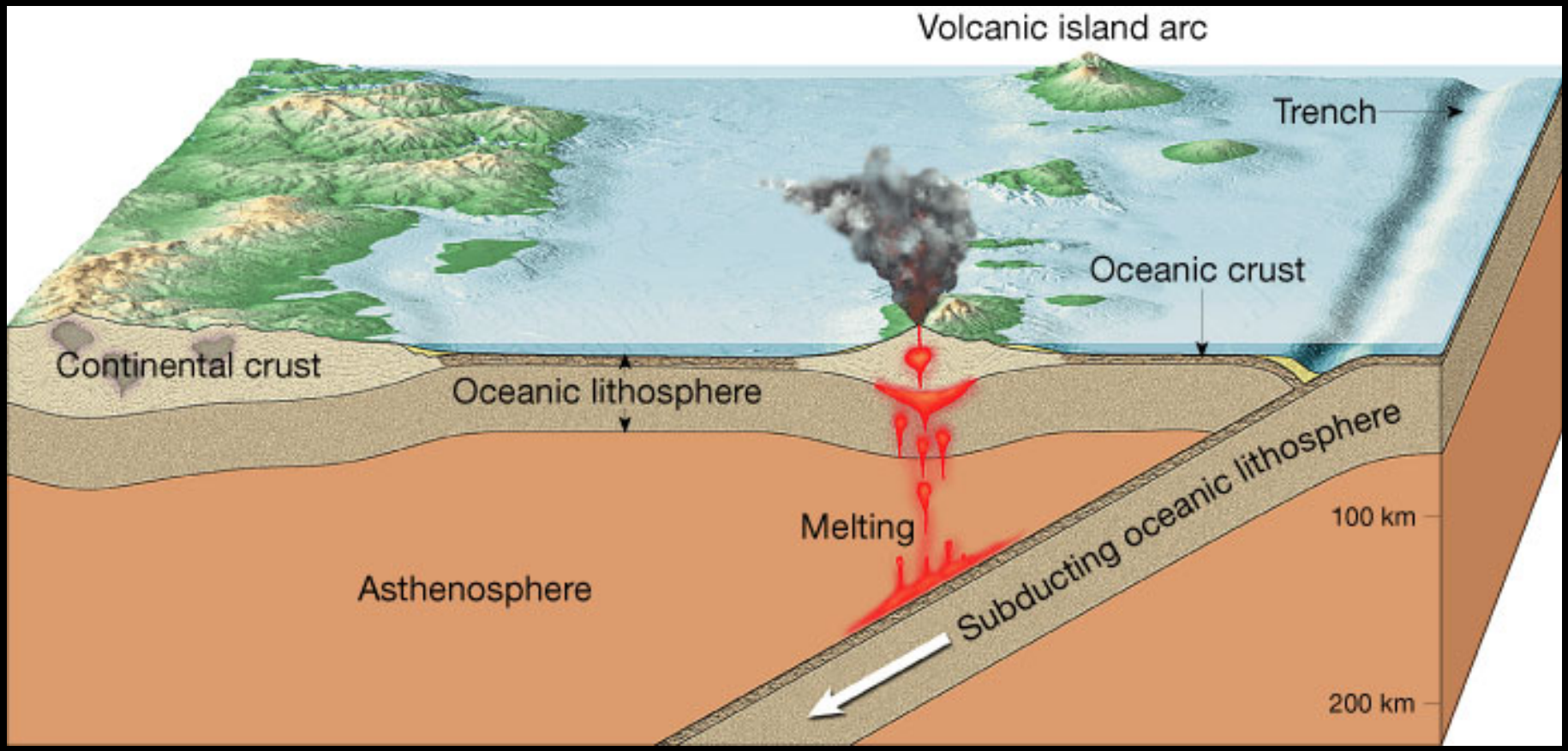
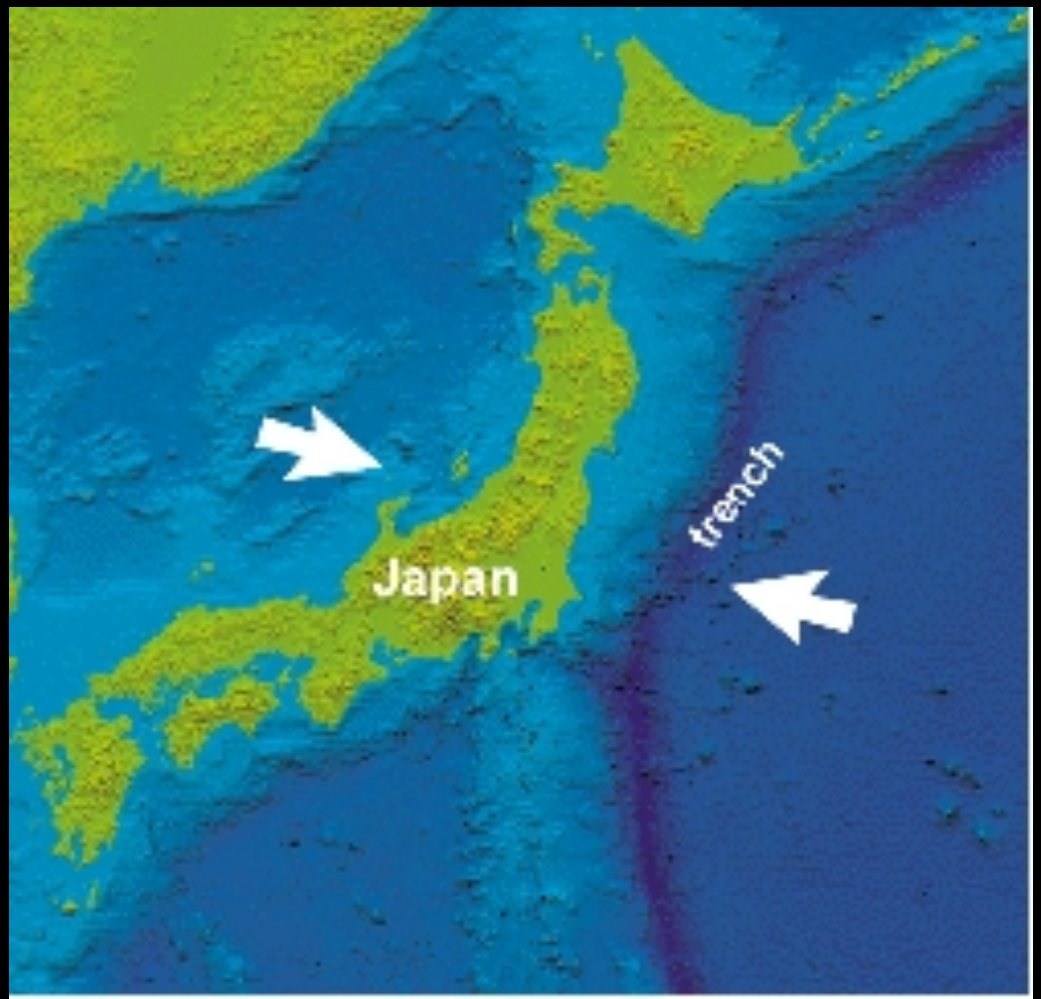
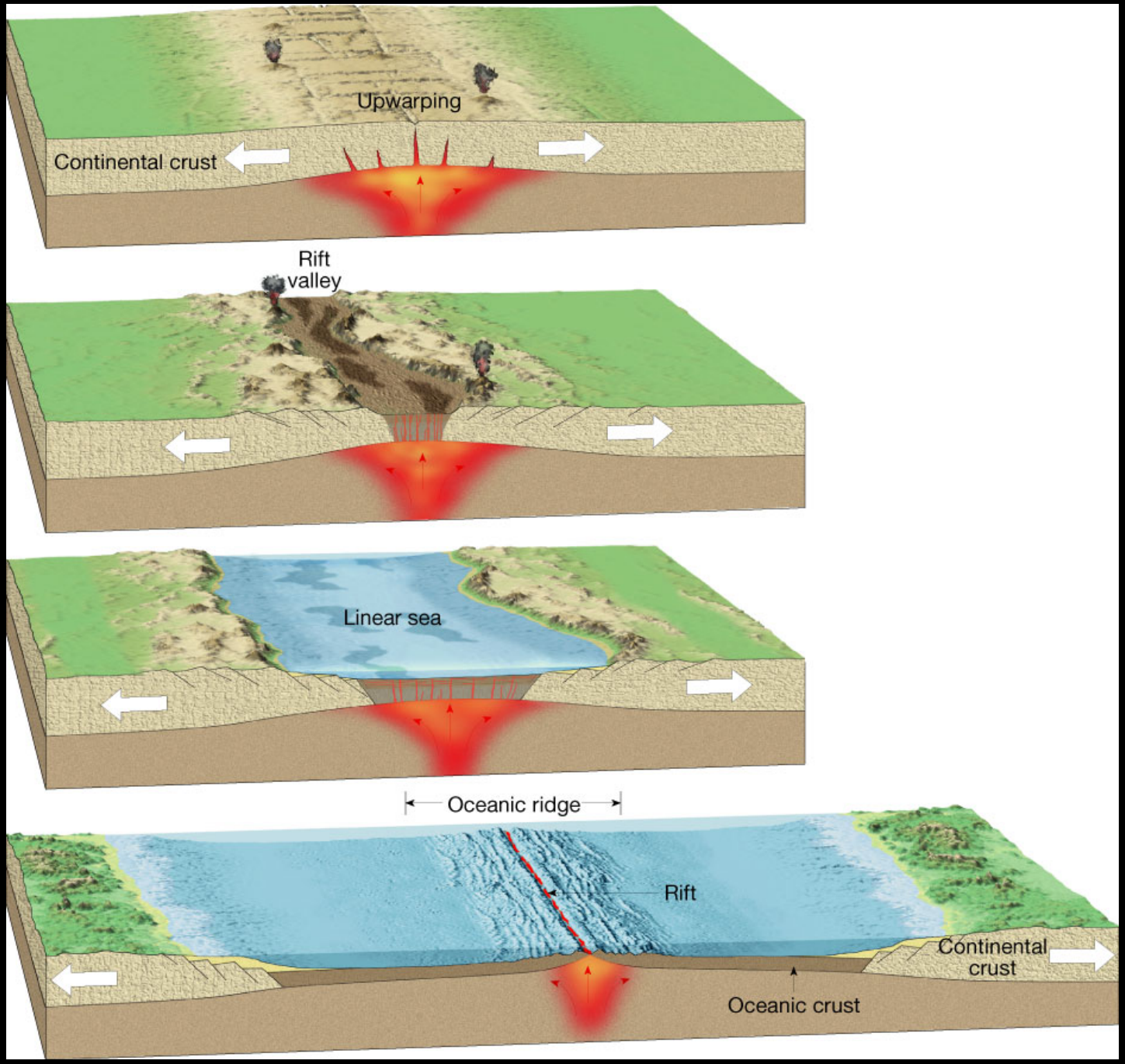


Plate Boundaries

Geologic features at ocean/ocean convergent boundaries

- trenches
- volcanoes
- island arcs




Upwarping
Continental crust
Rift valley
Linear sea
Oceanic ridge
Rift
Continental crust
Oceanic crust

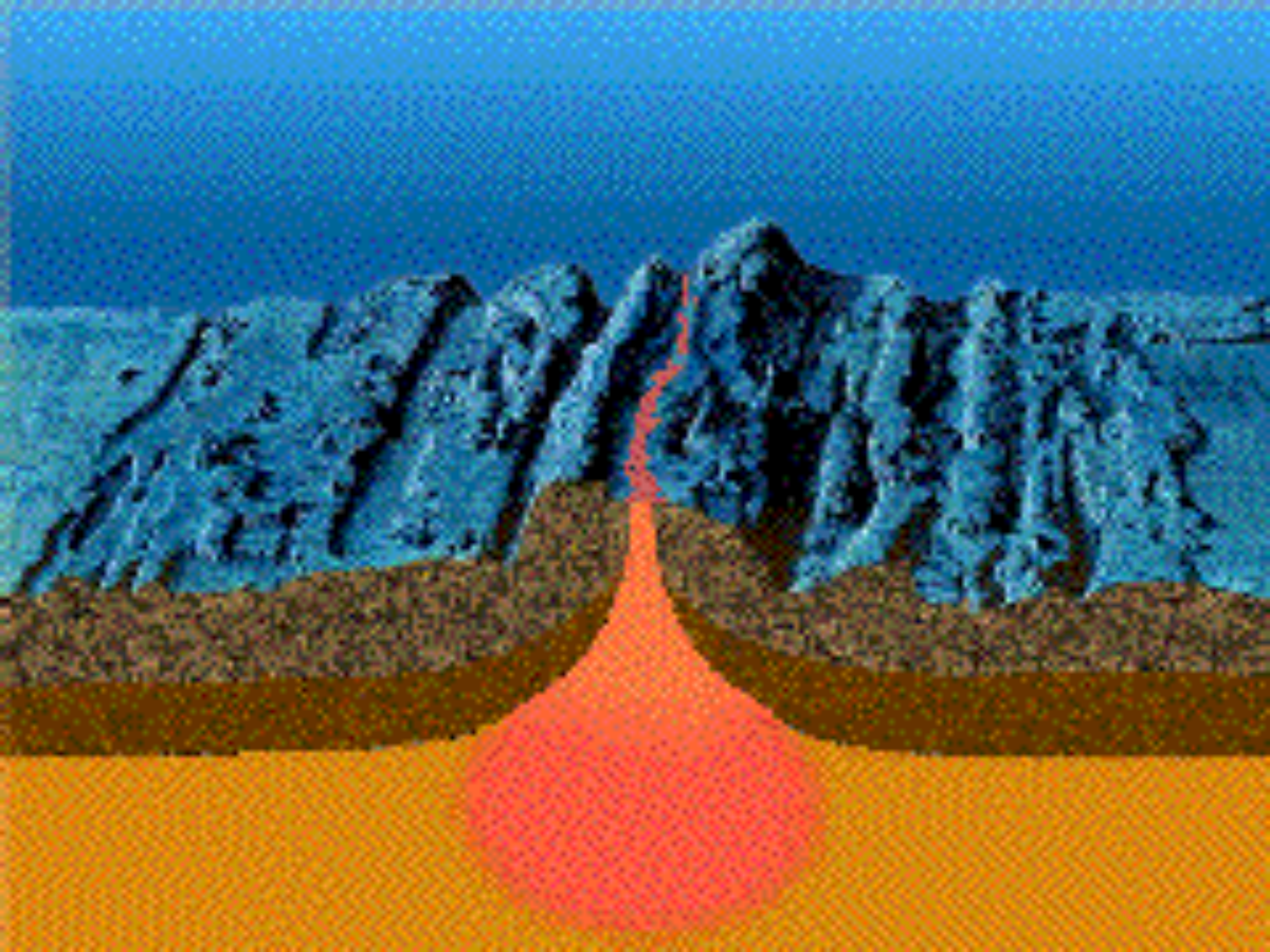


Plate Boundaries

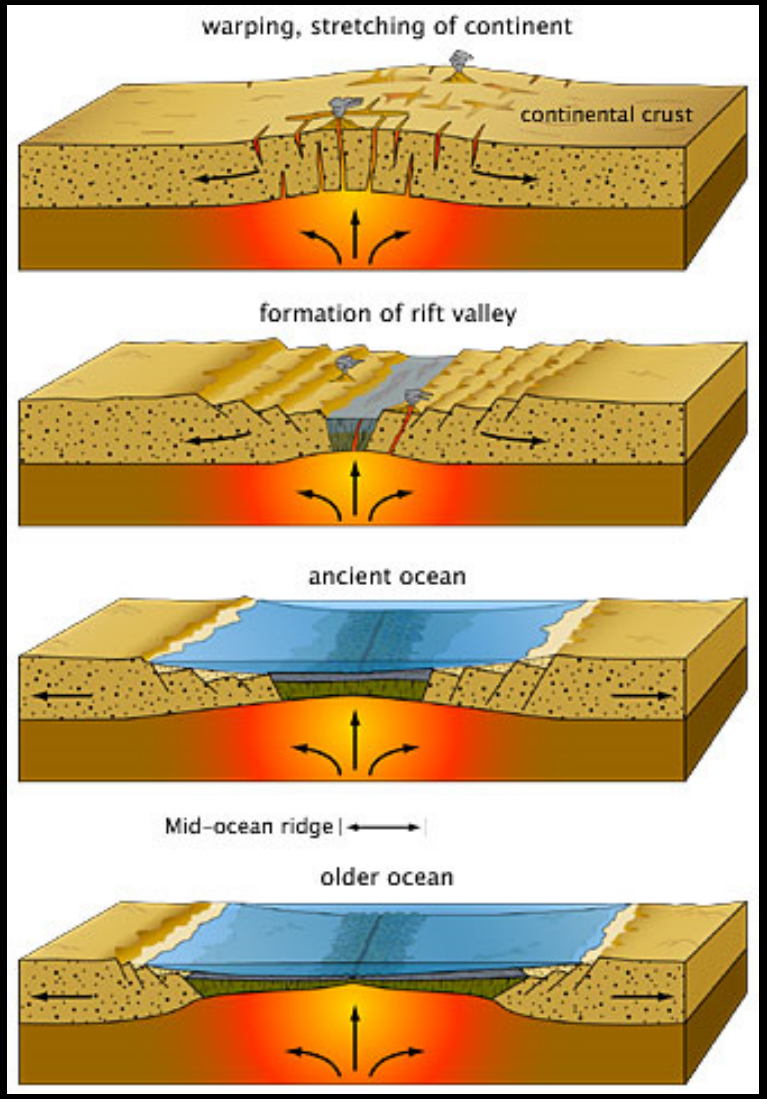


Plate Boundaries

Geologic features at divergent boundaries

- Islands
- Mid-ocean ridges
- Volcanoes
- Rift valley
- Seamounts

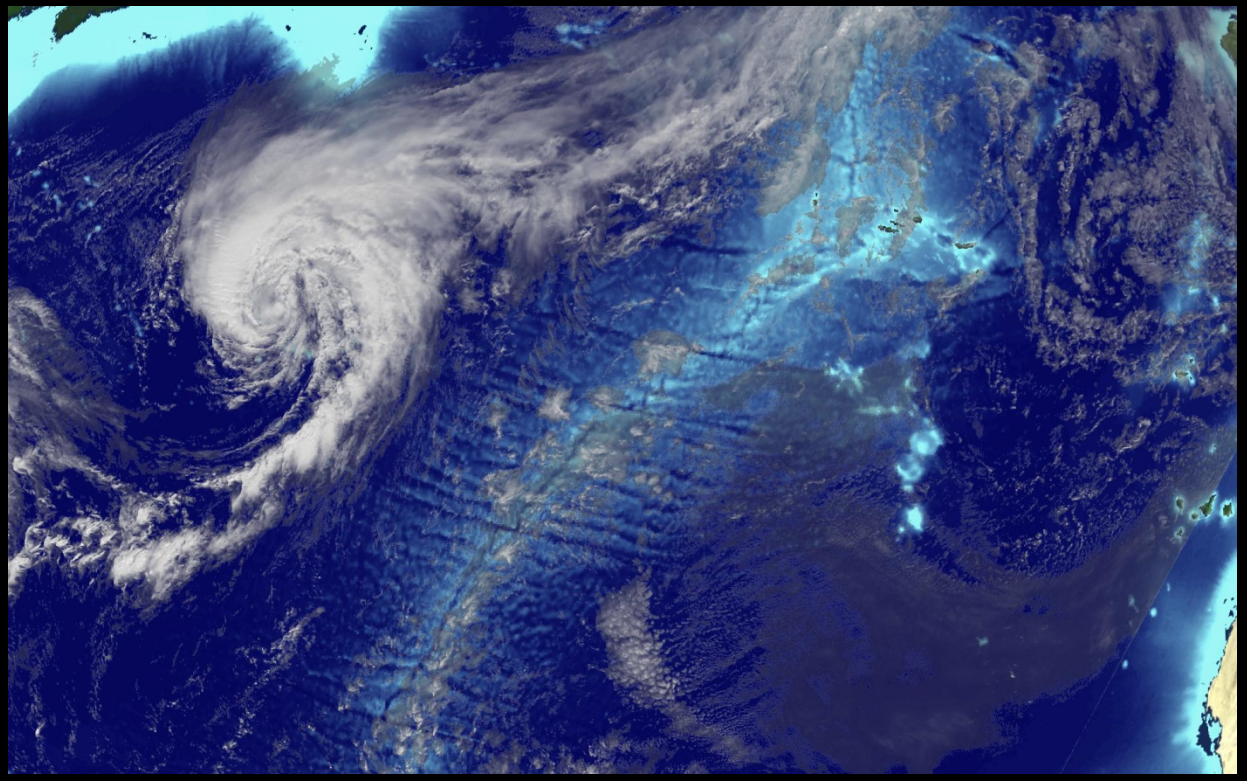


Plate Boundaries

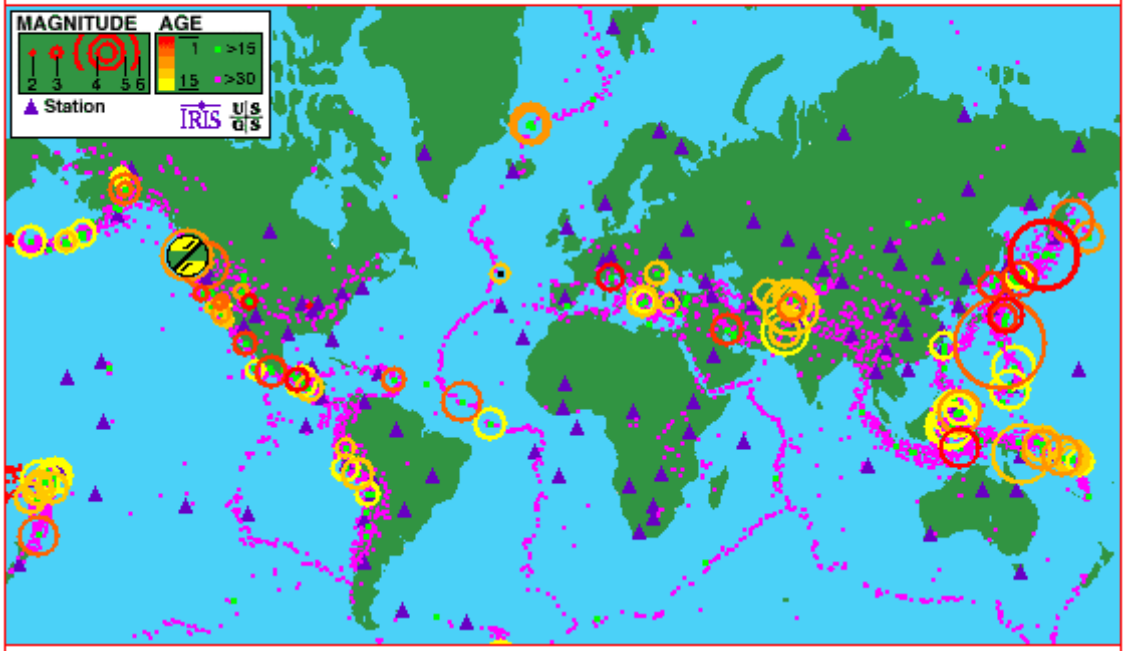
Examples of a divergent boundary

Mid-ocean ridge:
The Mid-Atlantic Ridge

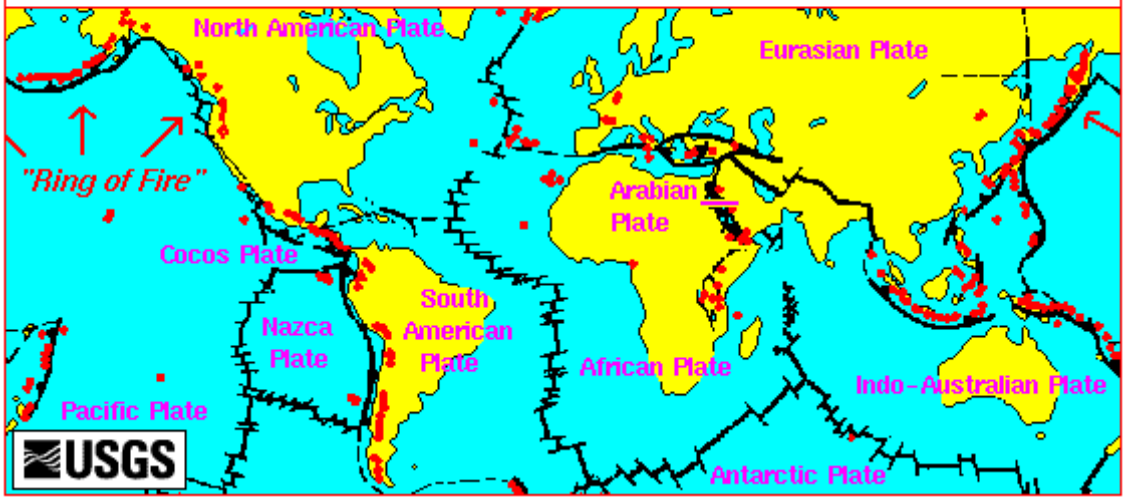
South American Plate & African Plates

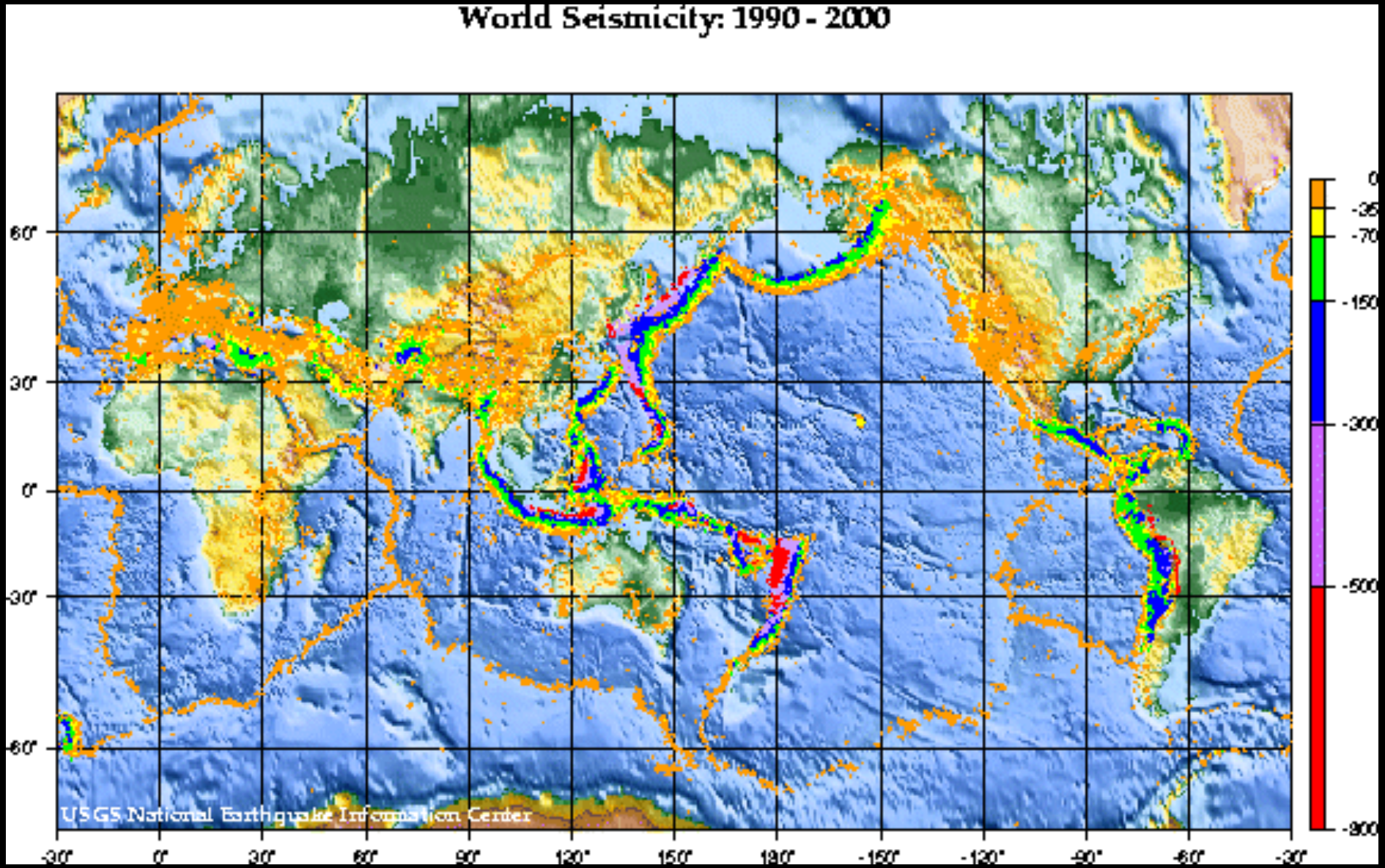

North
Aleutian Trench
"Ring of Fire"
Hawaiian "Hot Spot"
Cocos Plate
East Pacific
Rise
Pacific Plate

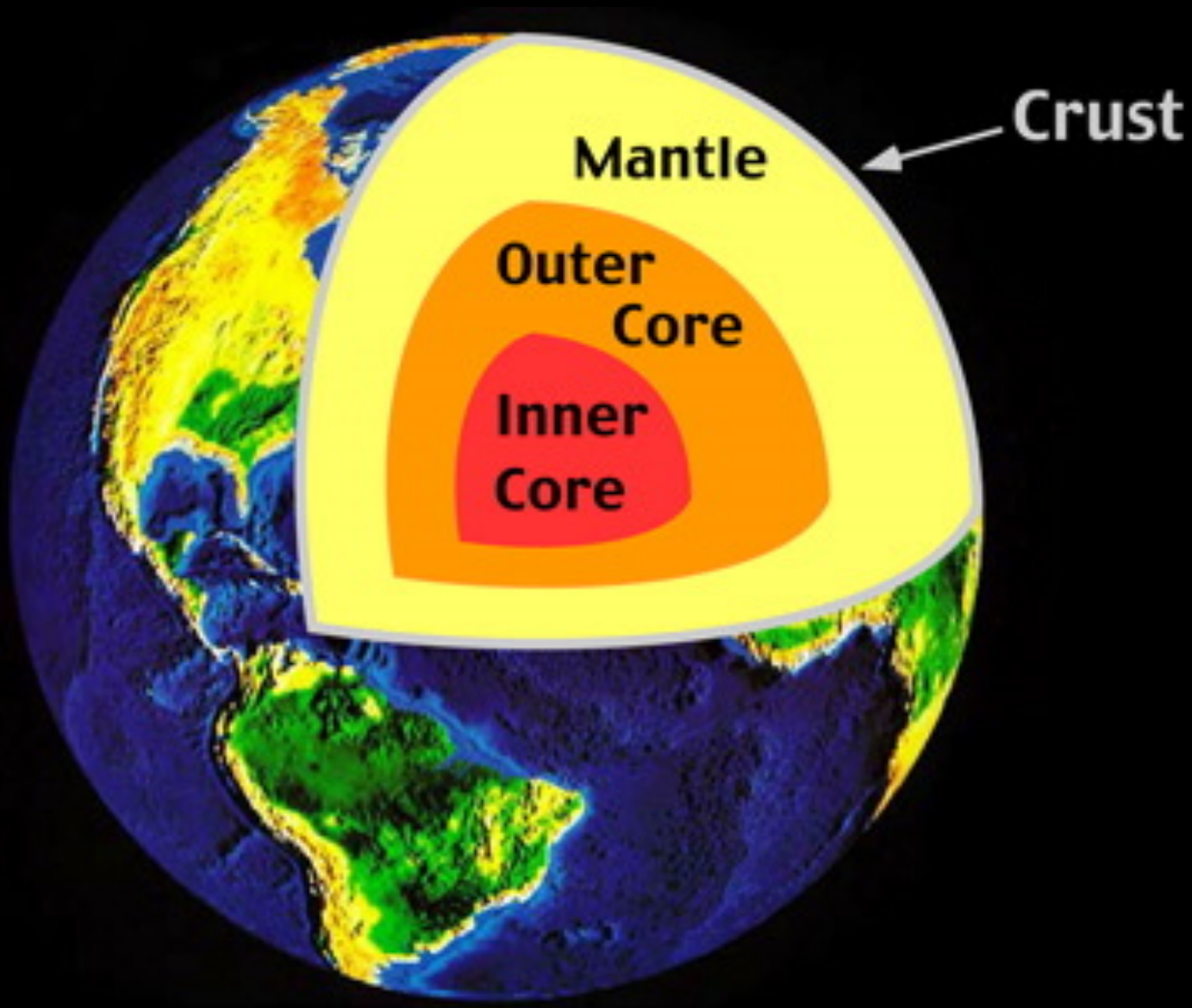
Earthquakes, Active Volcanoes, and Plate Tectonics

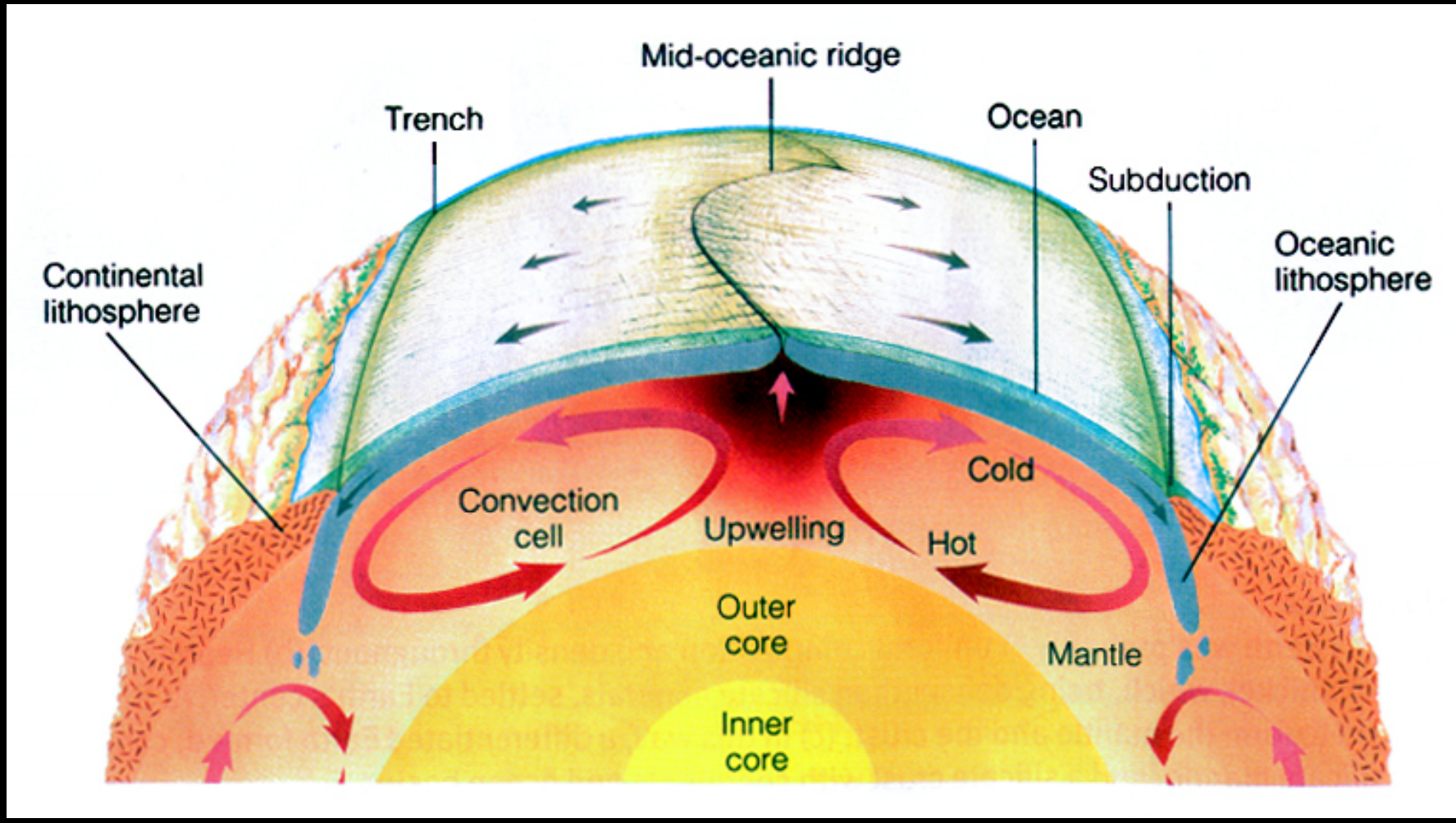


TOP: World-wide earthquakes on July 7, 1999, and past 5 years, demonstrating how earthquakes define boundaries of tectonic plates. Data from NEIC. Chart from IRIS Consortium, USGS, U.Colorado, Reel Illusions, Inc., and U.Washington. Chart modified for web use. Purple triangles are seismic stations, green/yellow "ball" is 5.1 event of July 3, 1999. **BOTTOM:** World-wide active volcanoes (red circles), tectonic plates, and the "Ring of Fire". Chart modified from Tilling, Heliker, and Wright, 1987, and Hamilton, 1976. -- *Topinka, USGS/CVO, 1999*




World Seismicity: 1990 - 2000
60°
30°
0°
-30°
-60°
-30°
0°
30°
60°
90°
120°
150°
180°
-150°
-120°
-90°
-60°
-30°
-35
-70
-150
-300
-500
-900
USGS National Earthquake Information Center

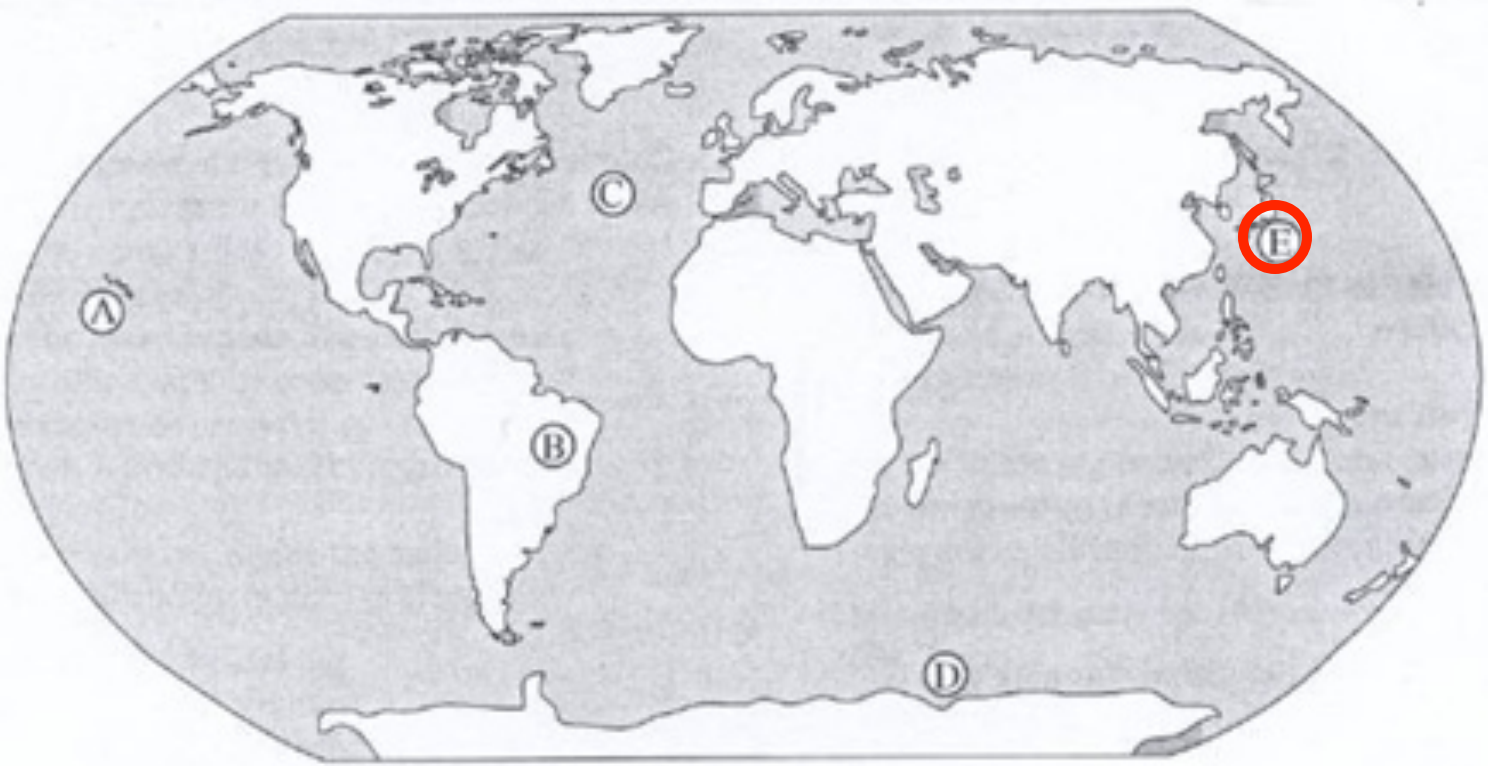

Crust
Mantle
Outer
Core
Inner
Core


Mid-oceanic ridge
Trench
Ocean
Subduction
Continental lithosphere
Oceanic lithosphere
Convection cell
Upwelling
Cold
Hot
Outer core
Mantle
Inner core

Questions 1-3 refer to the locations marked by letters on the world map below.

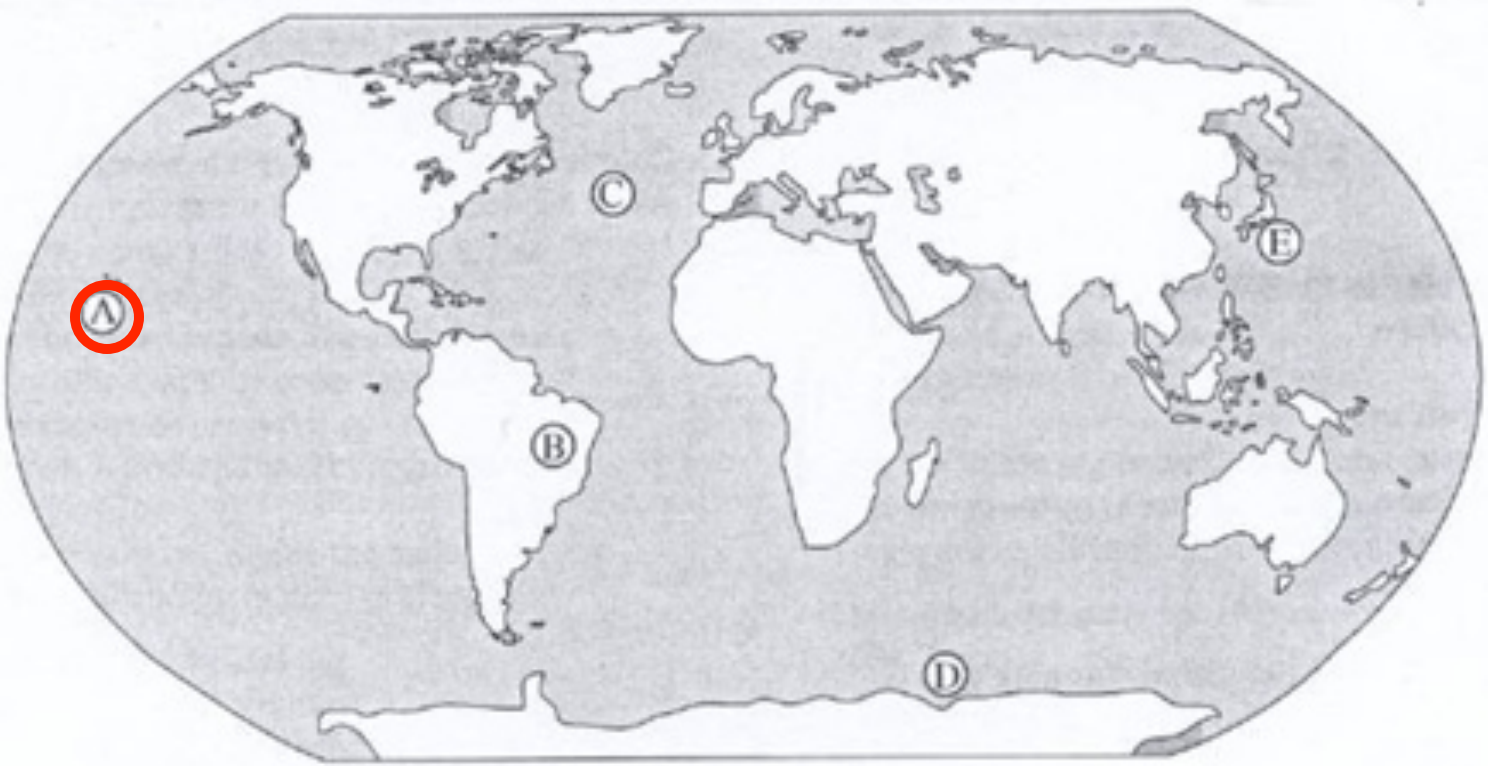
1. The location where new crust is being created at a divergent plate boundary

Questions 1-3 refer to the locations marked by letters on the world map below.



2. The location where one tectonic plate is being forced beneath another, creating a volcanic arc.

Questions 1-3 refer to the locations marked by letters on the world map below.



3. The intraplate location where hot-spot volcanism is occurring

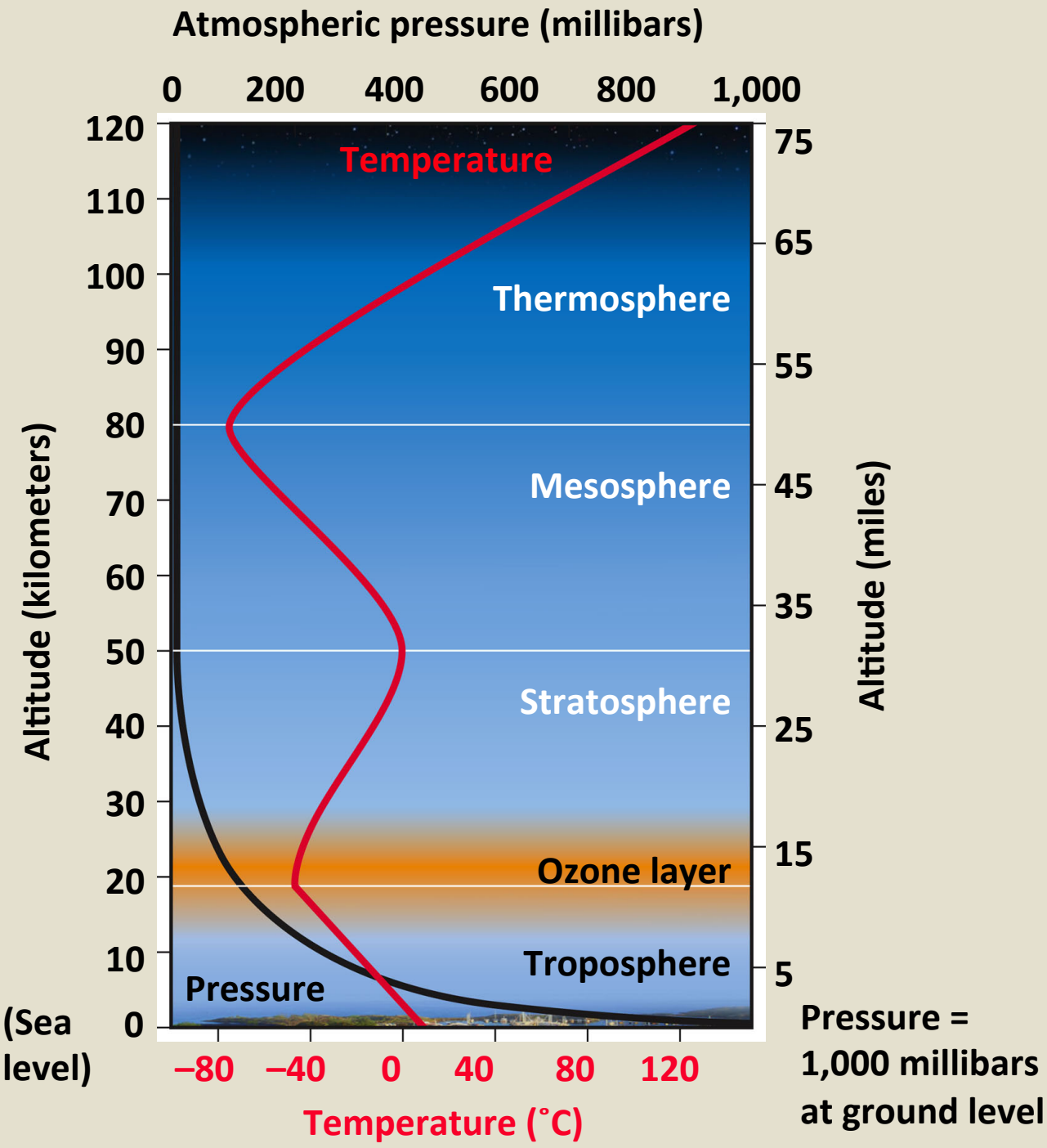
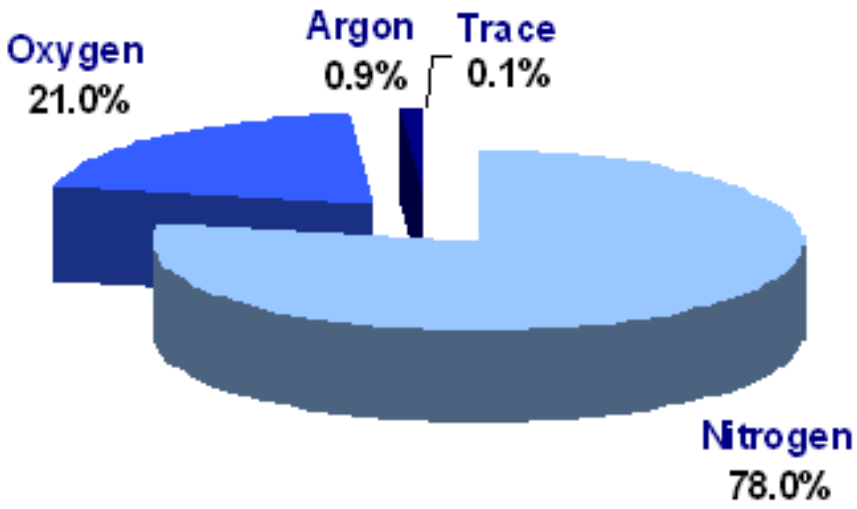
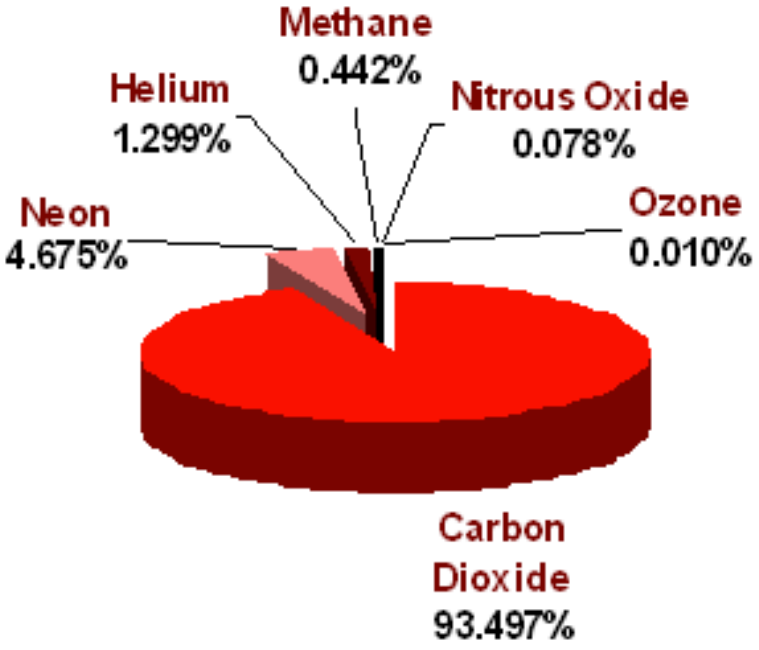

Atmospheric pressure (millibars)
0
200
400
600
800
1,000
120
110
100
90
80
70
60
50
40
30
20
10
0
(Sea level)
Altitude (kilometers)
75
65
55
45
35
25
15
5
Altitude (miles)
Temperature
Thermosphere
Mesosphere
Stratosphere
Ozone layer
Troposphere
Pressure
–80
–40
0
40
80
120
Temperature (˚C)
Pressure = 1,000 millibars at ground level

Fig. 18-3, p. 467

Atmospheric Composition



Trace Gases



28. Which of the following shows the approximate concentration of CO_2, N_2, and O_2 in dry air?

	CO_2	N_2	O_2
(A)	78%	< 1%	21%
(B)	43%	< 1%	56%
(C)	36%	8%	56%
(D)	10%	70%	20%
(E)	< 1%	78%	21%

The Atmosphere Consists of Several Layers

- Density varies
  - Decreases with altitude

- **Atmospheric pressure**
  - Decreases with altitude

Air Movements in the Troposphere Play a Key Role in Earth's Weather and Climate

- **Troposphere**
  - 75–80% of the earth's air mass
  - Closest to the earth's surface
  - Chemical composition of air
  - Rising and falling air currents: weather and climate
  - Involved in chemical cycling

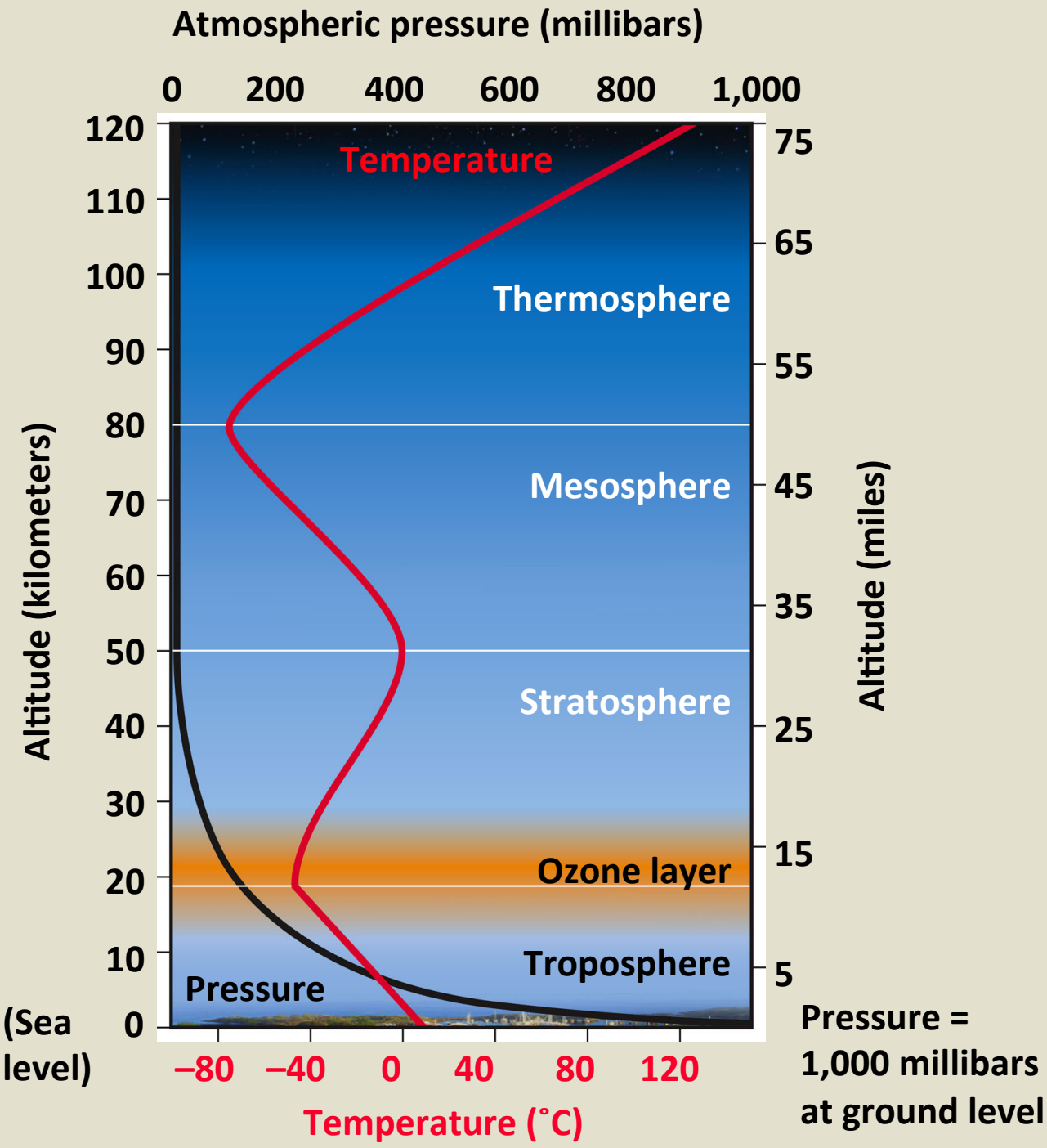

Atmospheric pressure (millibars)
0
200
400
600
800
1,000
120
110
100
90
80
70
60
50
40
30
20
10
0
(Sea level)
Altitude (kilometers)
75
65
55
45
35
25
15
5
Altitude (miles)
Temperature
Thermosphere
Mesosphere
Stratosphere
Ozone layer
Troposphere
Pressure
–80
–40
0
40
80
120
Temperature (˚C)
Pressure = 1,000 millibars at ground level

Fig. 18-3, p. 467

The Stratosphere Is Our Global Sunscreen

- **Stratosphere**
  - Similar composition to the troposphere, with 2 exceptions
    - Much less water
    - O_3, **ozone layer**
  - **Ozone layer**
    - Filters 95% of harmful UV radiation
    - Allows us and other life to exist on land

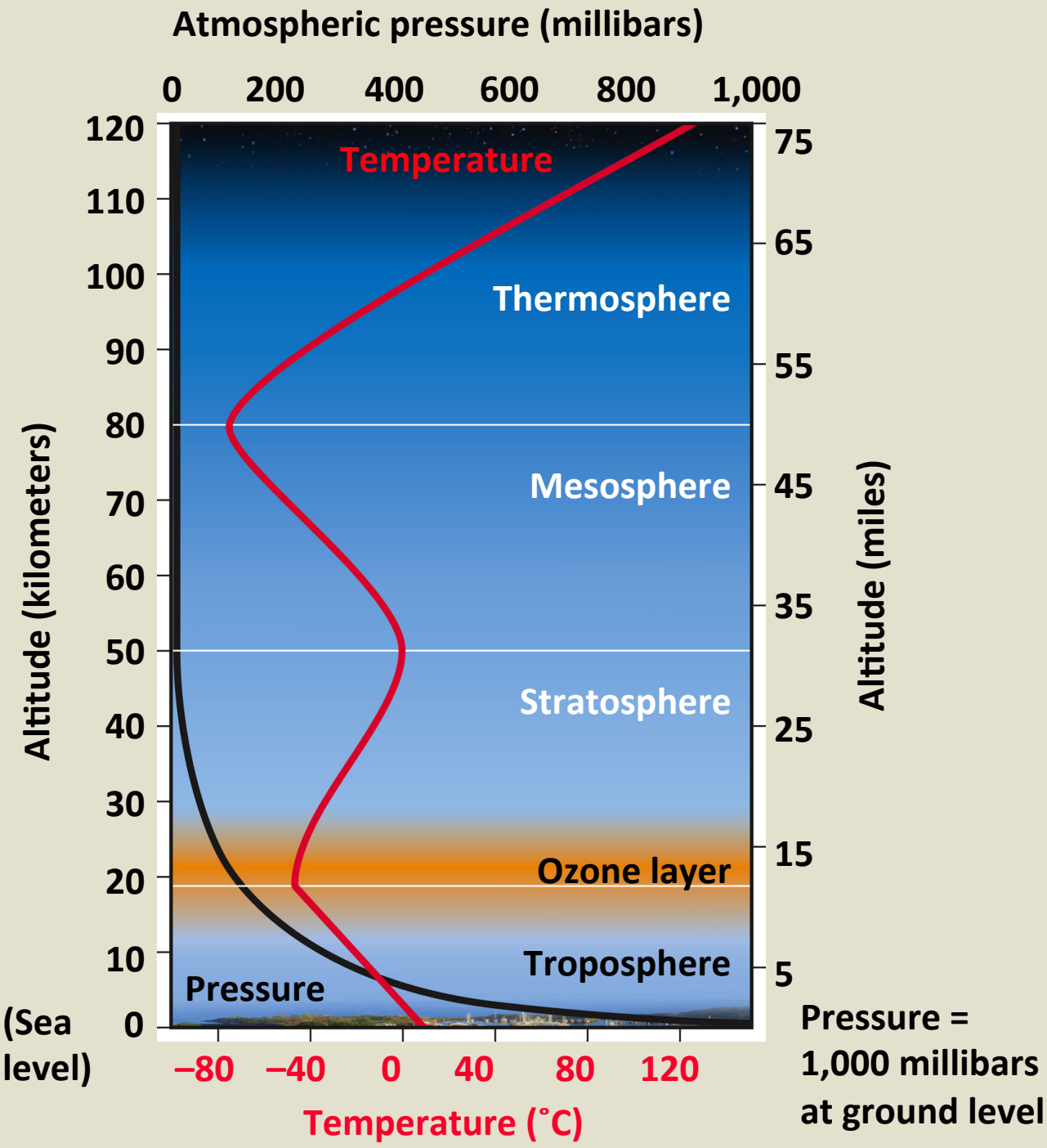
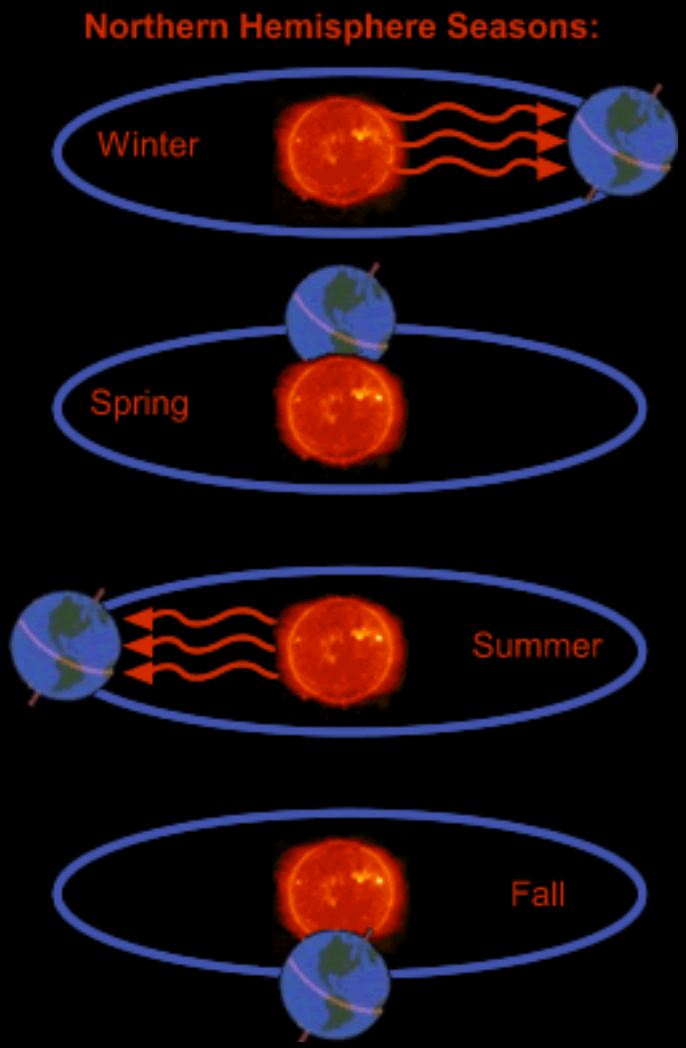

Atmospheric pressure (millibars)
0
200
400
600
800
1,000
120
110
100
90
80
70
60
50
40
30
20
10
0
(Sea level)
Altitude (kilometers)
75
65
55
45
35
25
15
5
Altitude (miles)
Temperature
Thermosphere
Mesosphere
Stratosphere
Ozone layer
Troposphere
Pressure
–80
–40
0
40
80
120
Temperature (˚C)
Pressure = 1,000 millibars at ground level

Fig. 18-3, p. 467

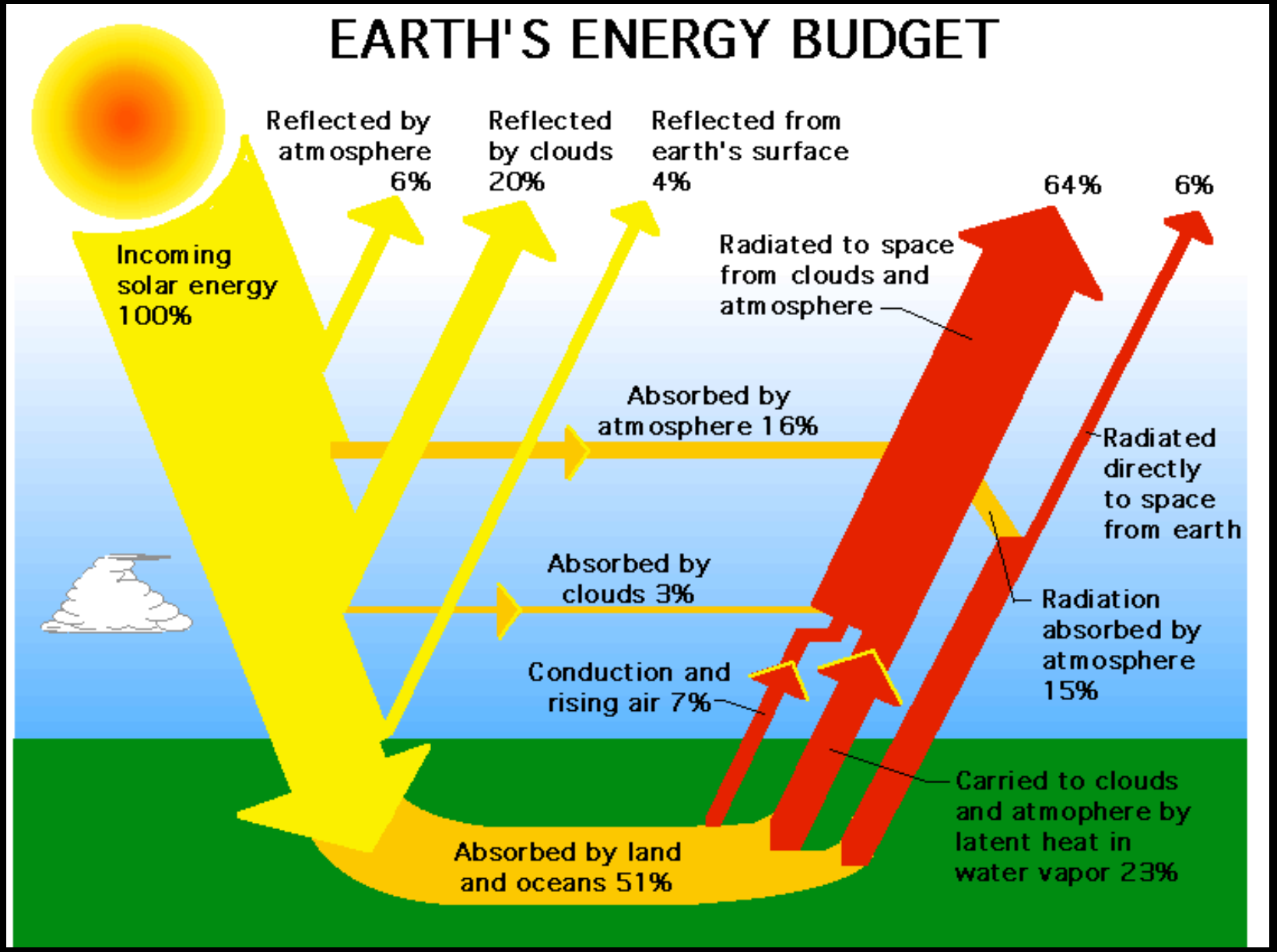
Seasons



The Earth has an axial tilt.

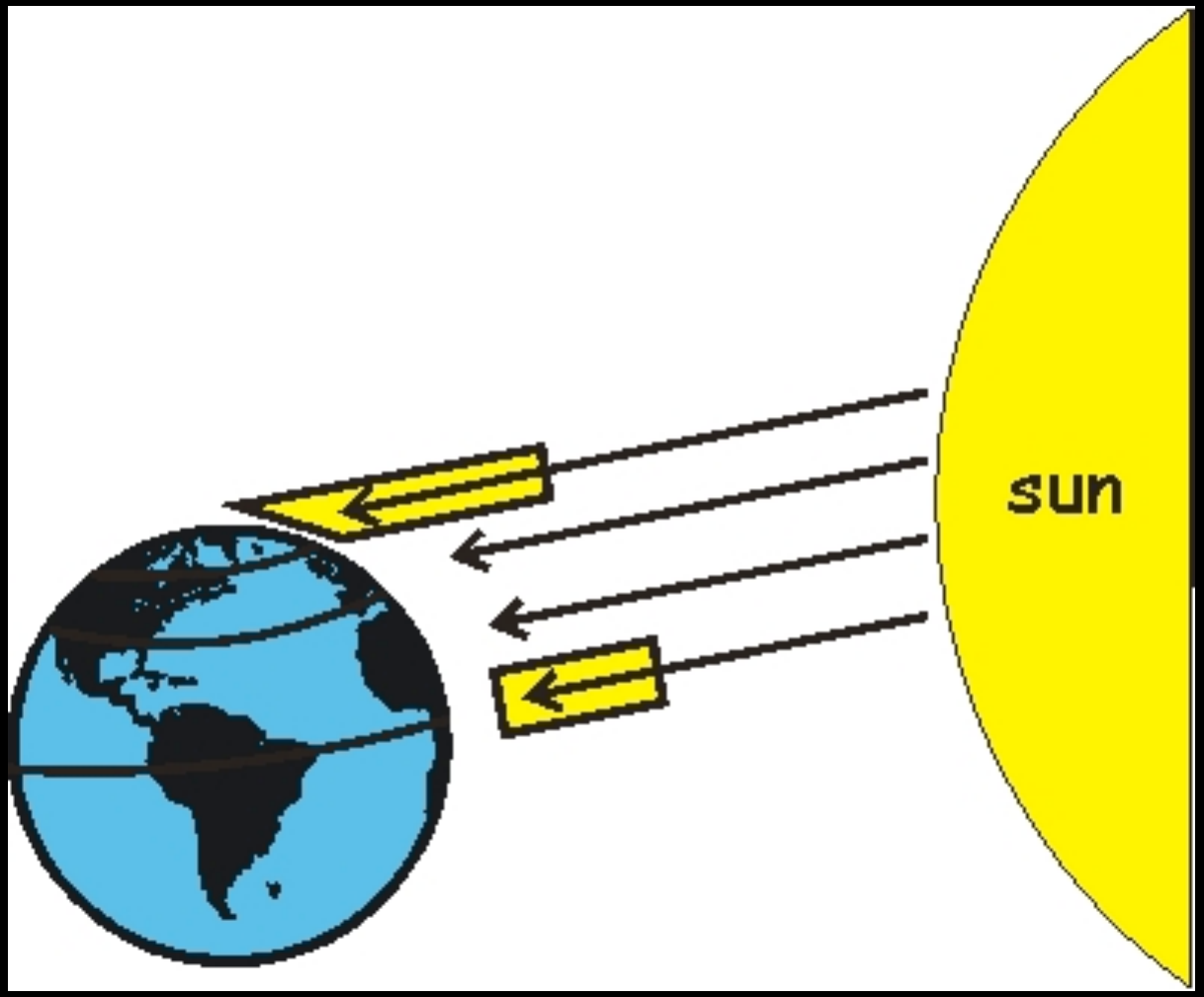
The Earth's axis of rotation is tilted at an angle of 23.5 degrees to the plane of the Earth's orbit around the Sun.

Earth's Tilt Is the Reason for the Seasons!

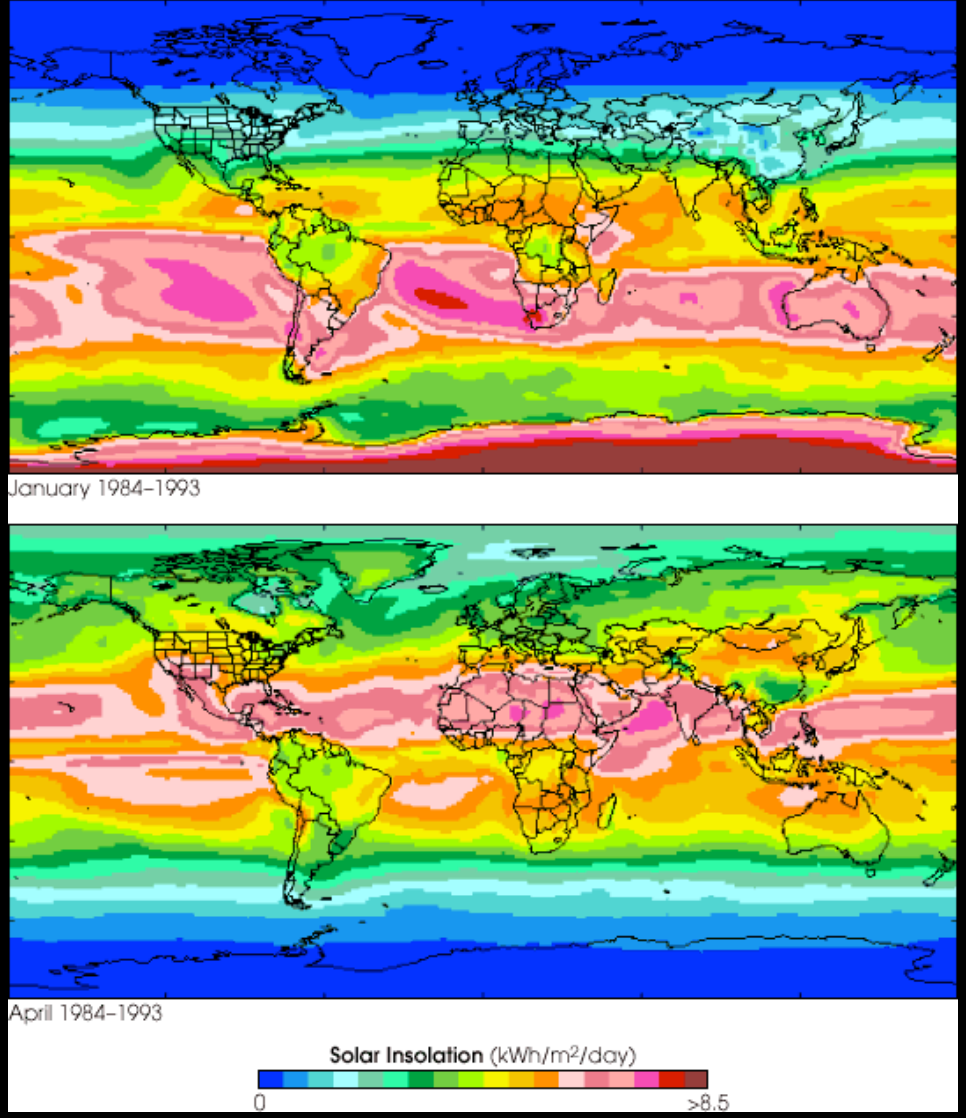


Practically all of the energy that reaches the earth comes from the sun.

Transfer of Energy- Unequal Distribution

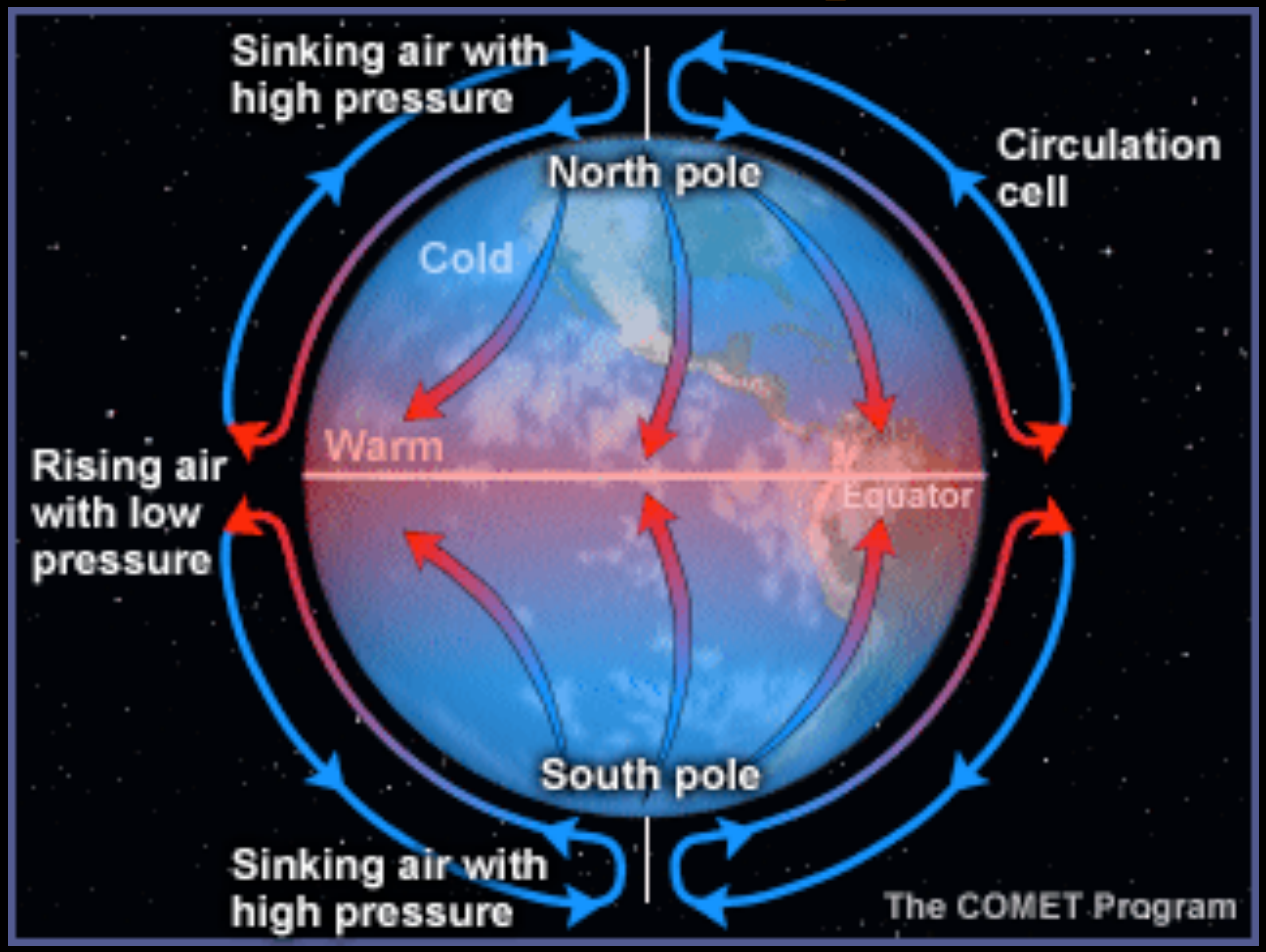


Temperature differences at Earth's Surface are caused by Earth's tilt in it's orbit around the Sun.



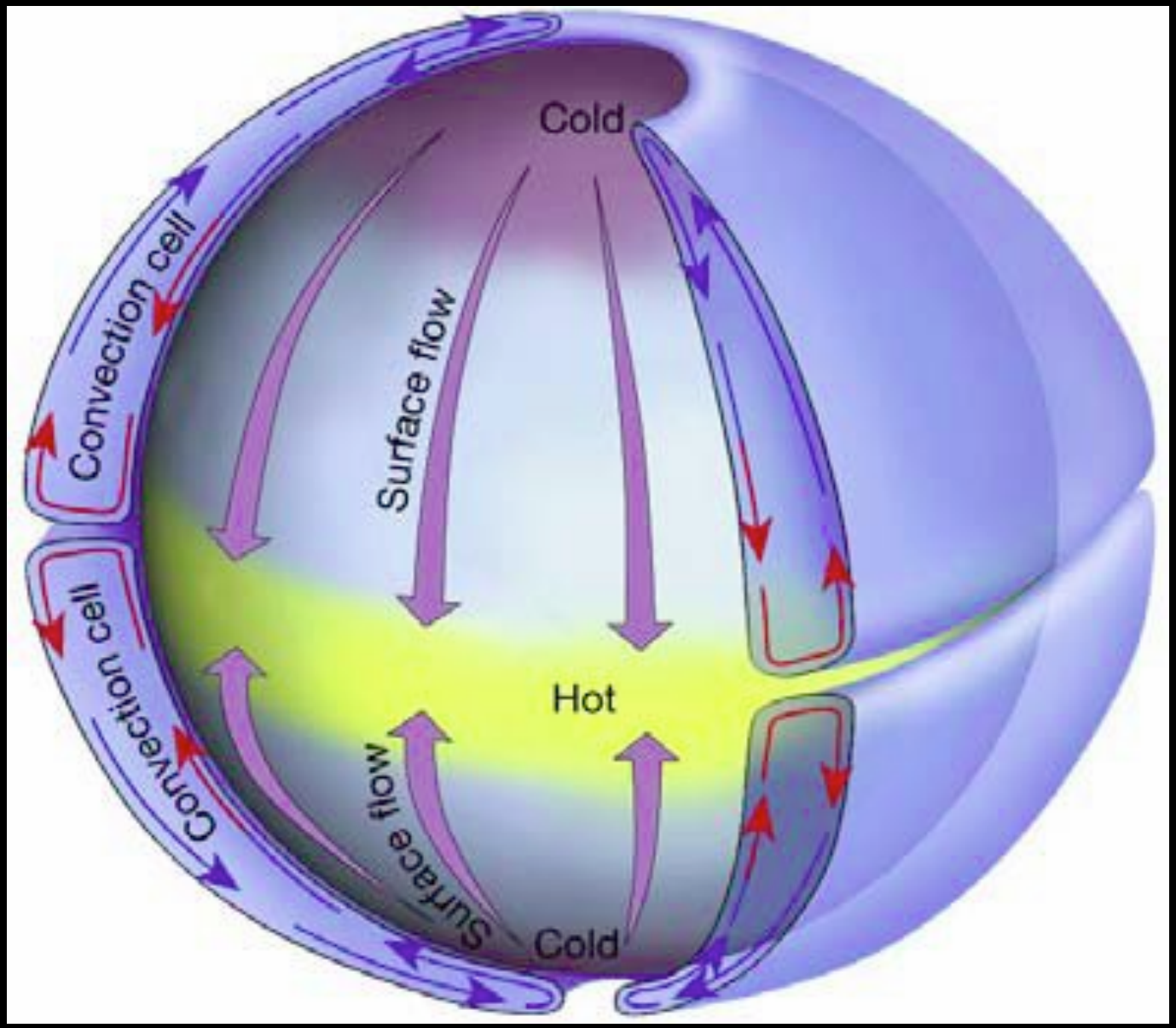
The primary source of energy to drive our global climate system is the heat we receive from the Sun, termed solar insolation. The picture shows the distribution of solar insolation throughout the Earth.

Convection Cells in the Atmosphere

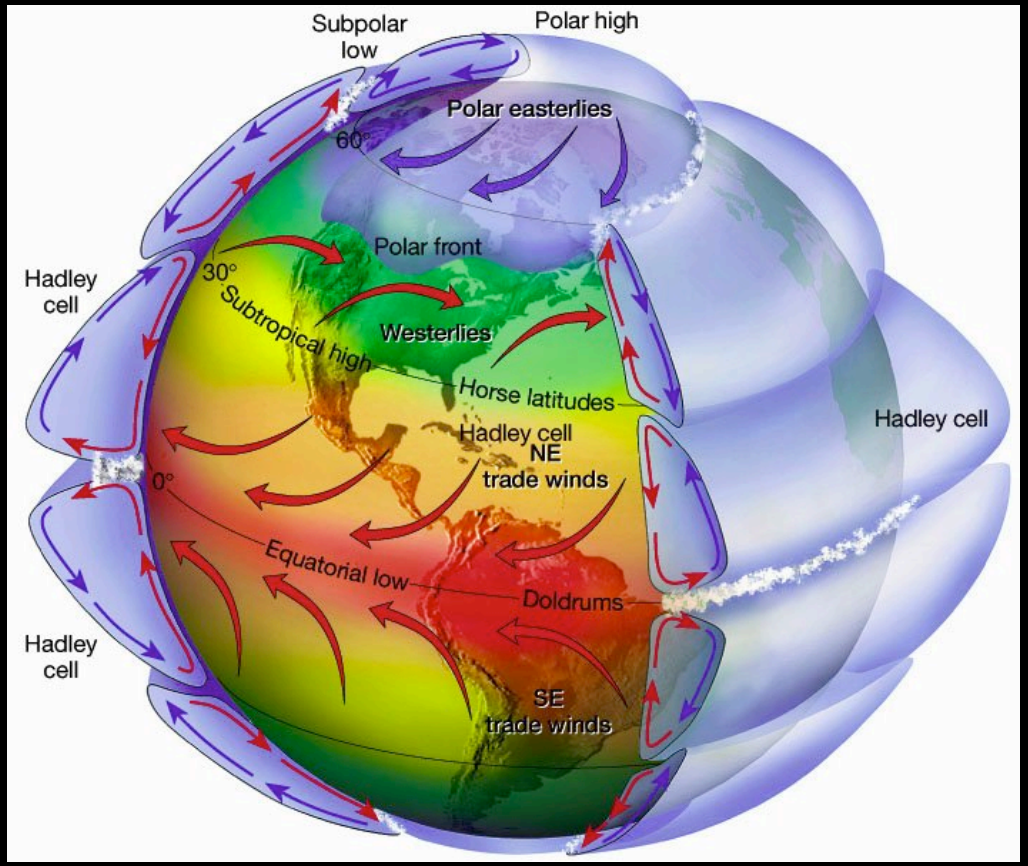


UNEQUAL HEATING CAUSES CONVECTION CELLS
WARM, MOIST (LESS DENSE) AIR RISES, THEN COOLS AND SINKS---THE RETURN, SURFACE FLOW ARE THE SURFACE WINDS.

Convection Cells in the Atmosphere

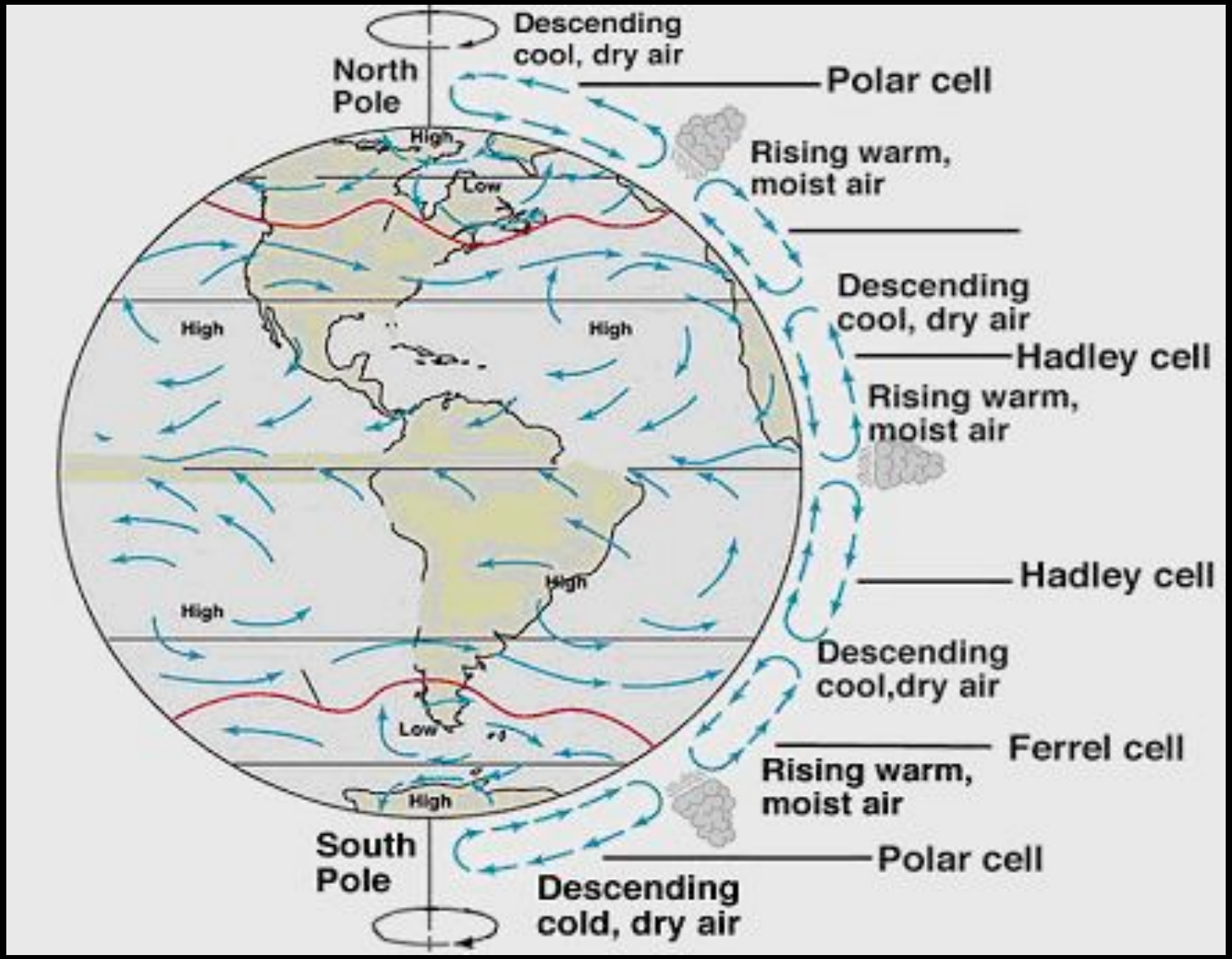


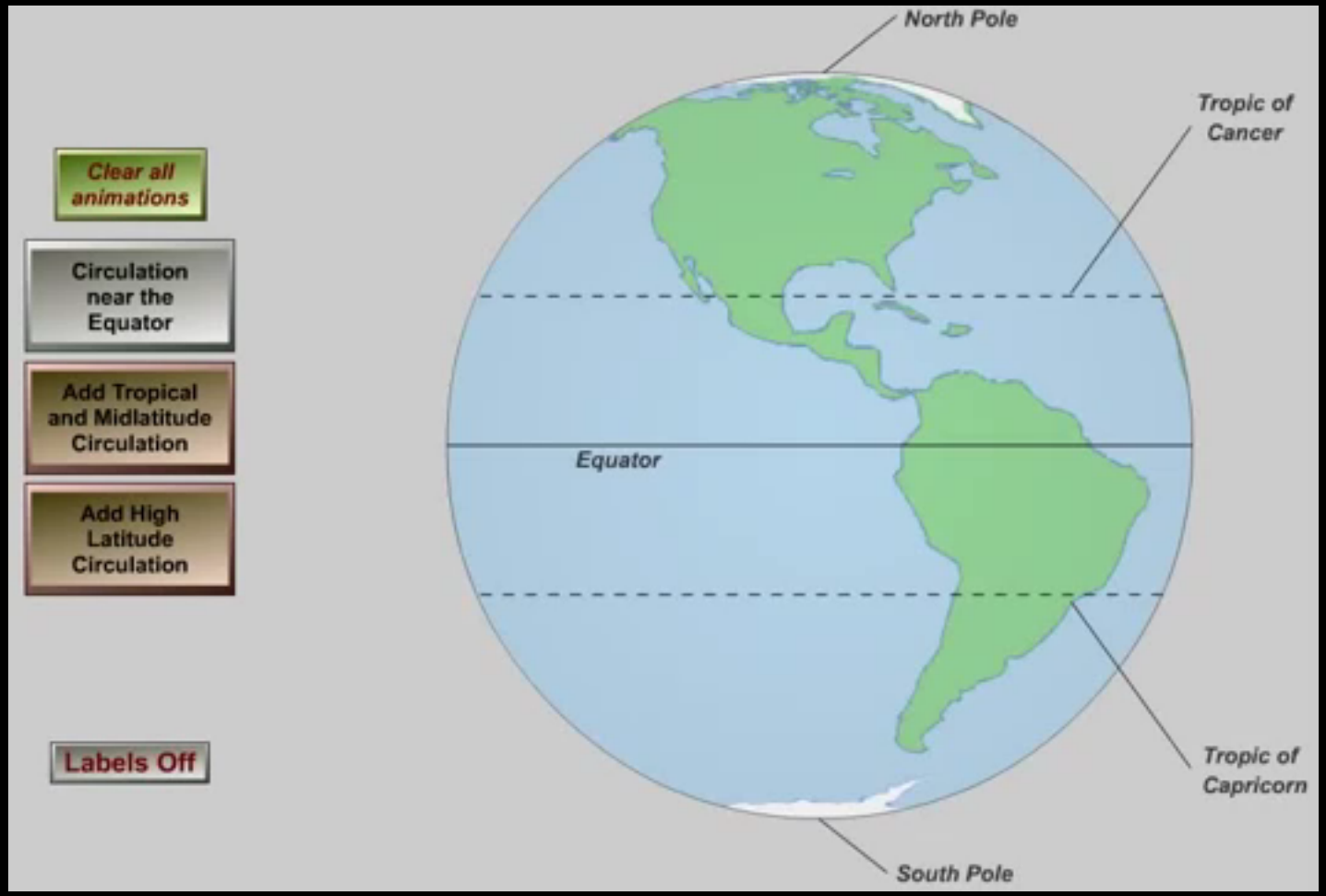
Development of Global Surface Winds



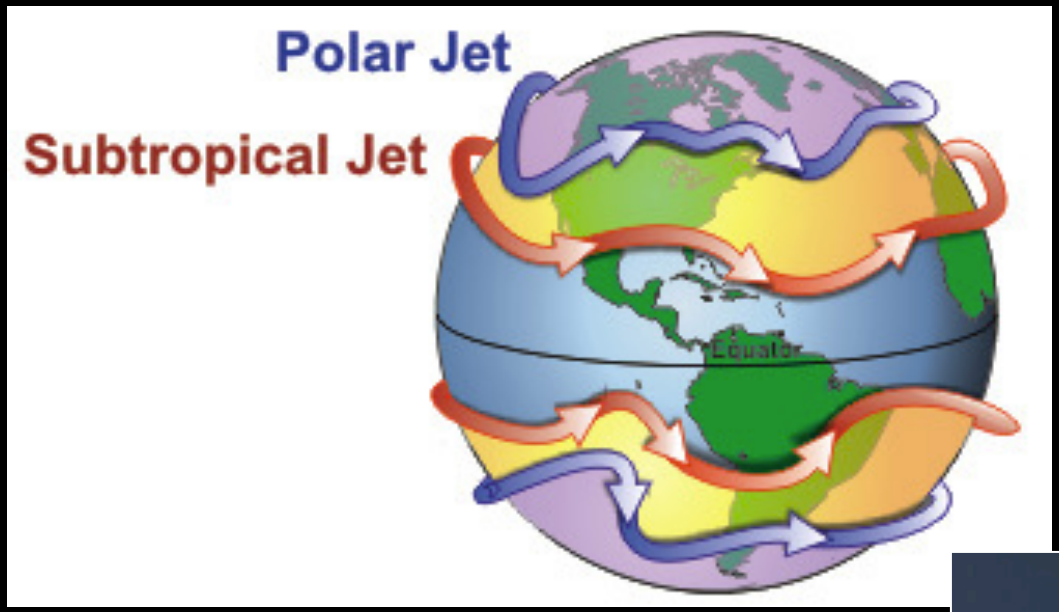
This is complicated by the Earth's rotation, which gives rise to a force called the CORIOLIS EFFECT.

This causes moving objects to be deflected: to the right, in the northern hemisphere to the left, in the southern hemisphere.

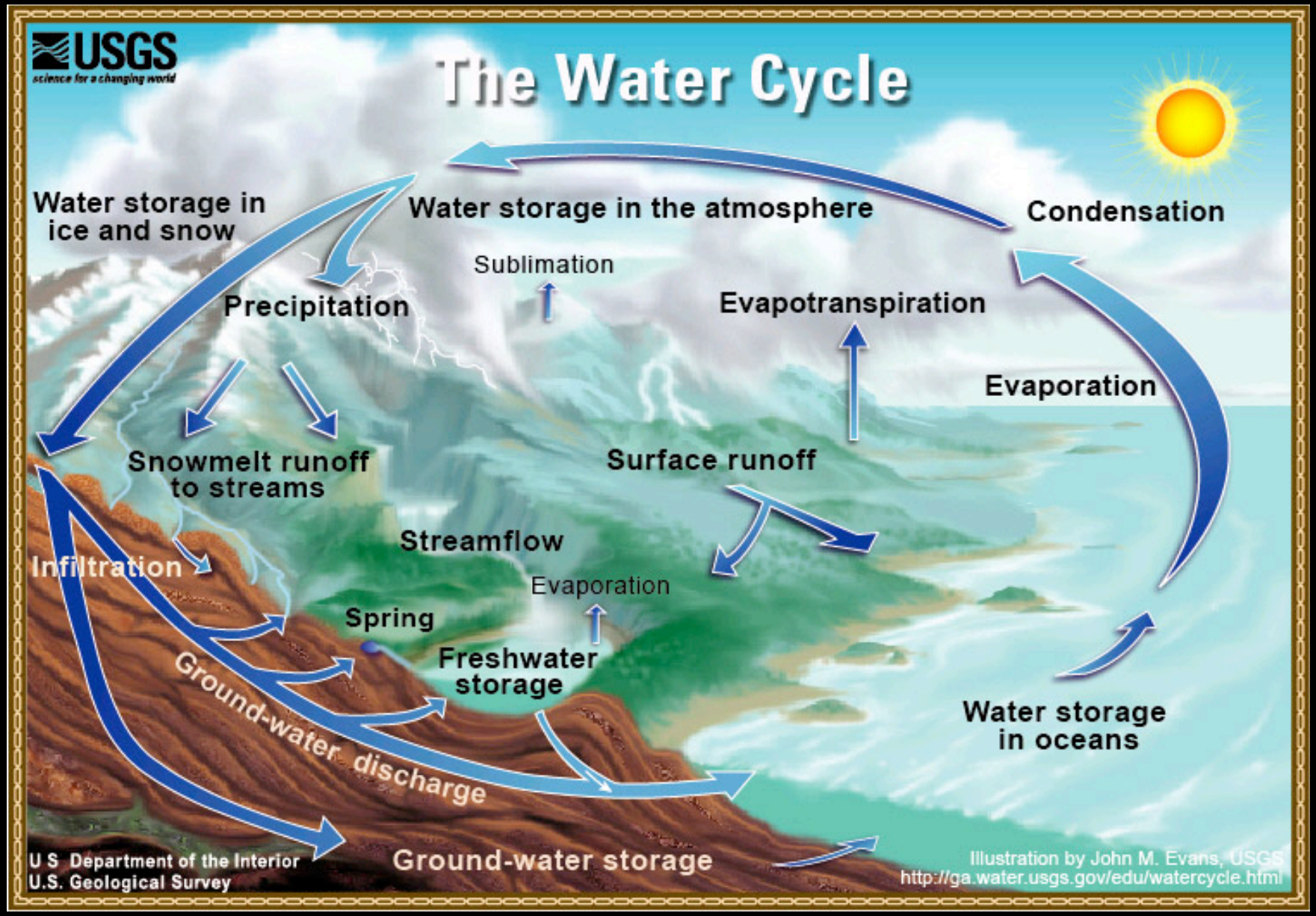

Descending
cool, dry air
North
Pole
Polar cell
High
Low
Rising warm,
moist air
Descending
cool, dry air
High
High
Hadley cell
Rising warm,
moist air
High
High
Hadley cell
Descending
cool,dry air
Low
Ferrel cell
Rising warm,
moist air
High
South
Pole
Polar cell
Descending
cold, dry air

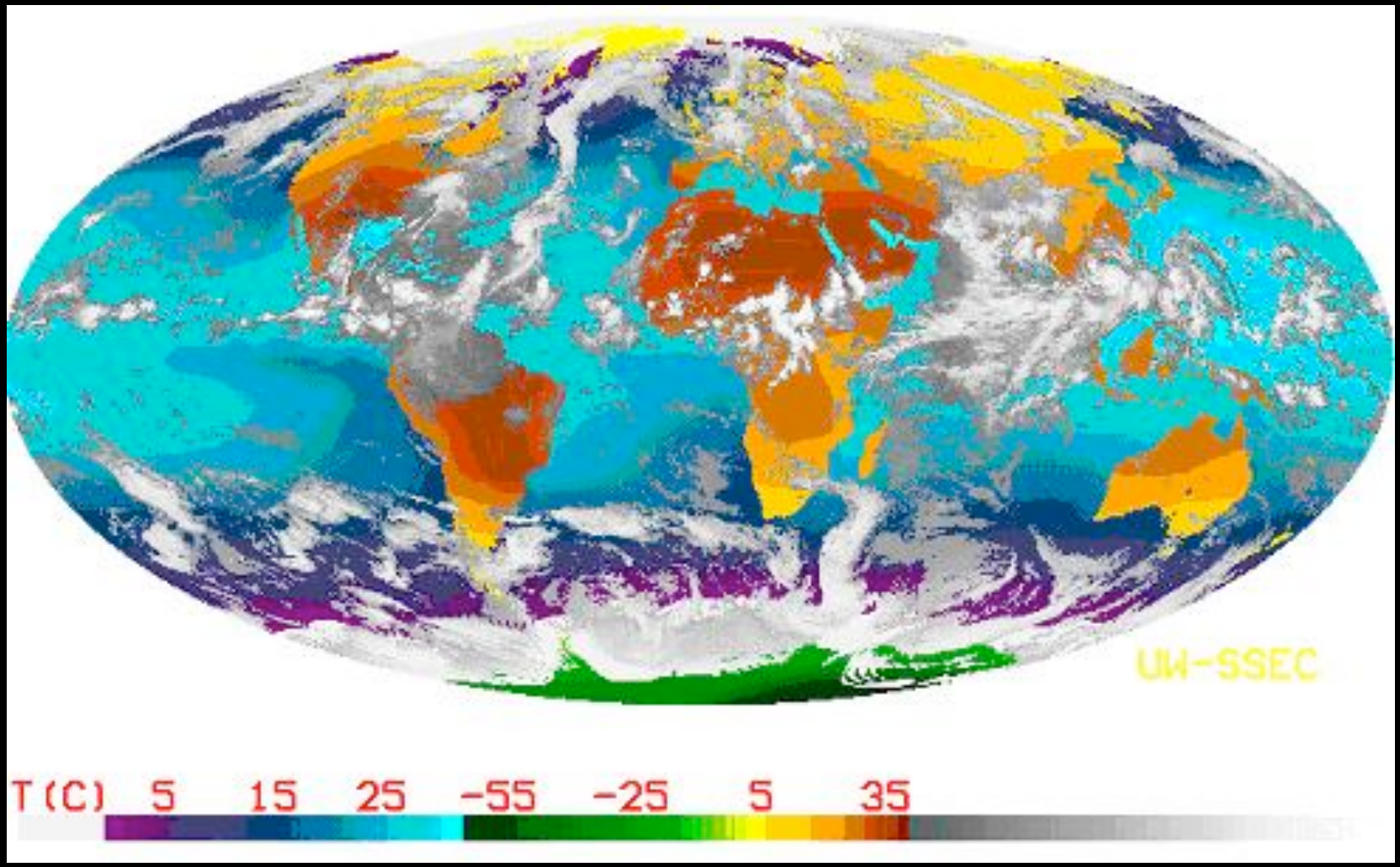

Clear all animations
Circulation near the Equator
Add Tropical and Midlatitude Circulation
Add High Latitude Circulation
Labels Off
North Pole
Tropic of Cancer
Equator
Tropic of Capricorn
South Pole

Jet streams are fast flowing, narrow air currents found in the upper atmosphere or in troposphere

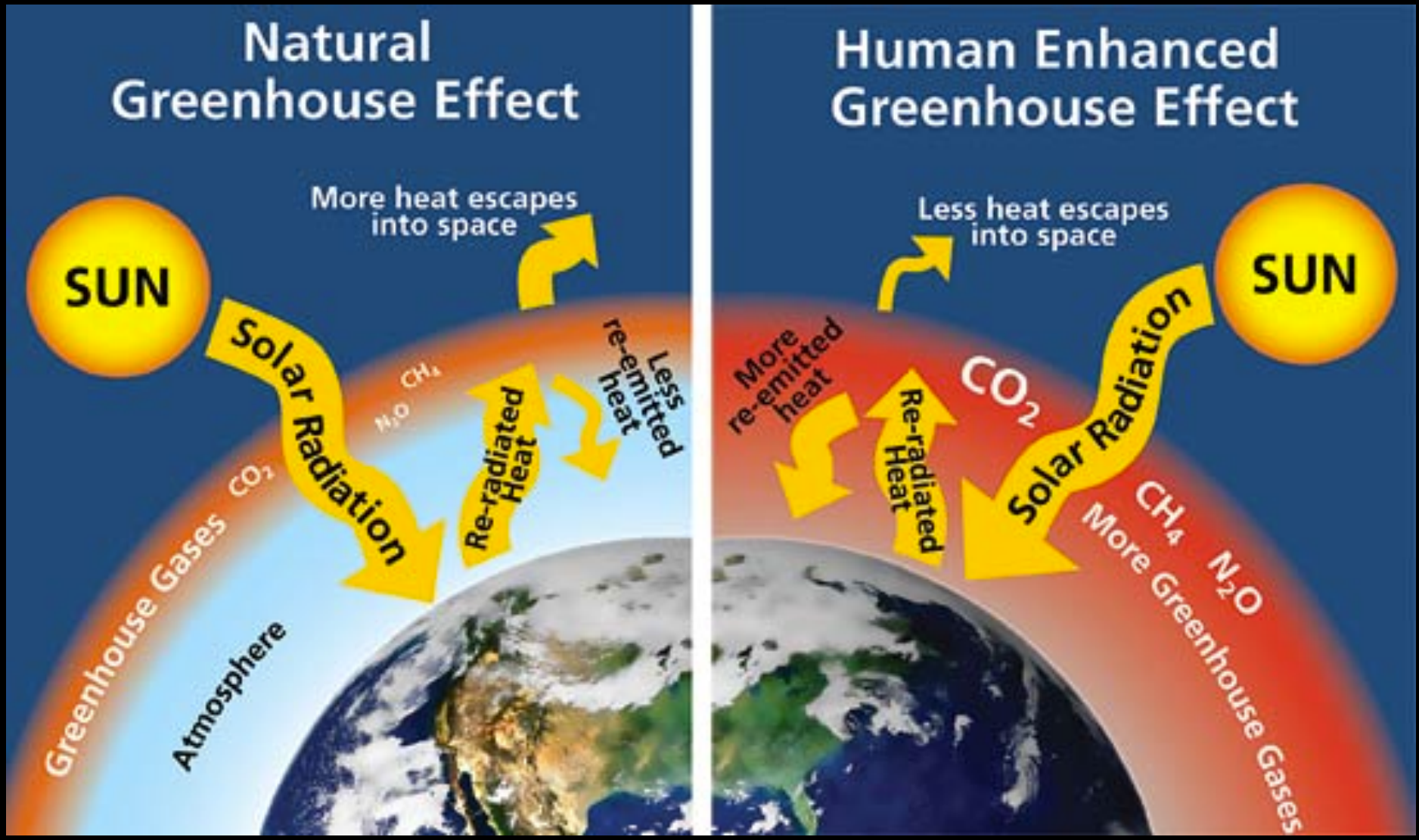


Jet streams are caused by a combination of a planet's rotation on its axis and atmospheric heating (by solar radiation and, on some planets other than Earth, internal heat). Jet streams form near boundaries of adjacent air masses with significant differences in temperature, such as the polar region and the warmer air towards the equator.


USGS
science for a changing world
The Water Cycle
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Sublimation
Precipitation
Evapotranspiration
Evaporation
Snowmelt runoff to streams
Surface runoff
Streamflow
Infiltration
Evaporation
Spring
Freshwater storage
Ground-water discharge
Water storage in oceans
Ground-water storage
U S Department of the Interior
U.S. Geological Survey
Illustration by John M. Evans, USGS
http://ga.water.usgs.gov/edu/watercycle.html



The picture above illustrates nicely the global circulation patterns at work.


Natural
Greenhouse Effect
More heat escapes
into space
SUN
Solar Radiation
Re-radiated
Heat
Less
re-emitted
heat
CH_4
N_2O
CO_2
Greenhouse Gases
Atmosphere
Human Enhanced
Greenhouse Effect
Less heat escapes
into space
SUN
More
re-emitted
heat
Re-radiated
Heat
CO_2
Solar Radiation
CH_4 N_2O
More Greenhouse Gases

Questions 7-9 refer to the following regions of Earth's atmosphere.

(A) Thermosphere
(B) Exosphere
(C) Troposphere
(D) Mesosphere
(E) Stratosphere

7. The phenomenon causing global warming occurs primarily in this region of the atmosphere.

Questions 7-9 refer to the following regions of Earth's atmosphere.

(A) Thermosphere
(B) Exosphere
(C) Troposphere
(D) Mesosphere
(E) Stratosphere

8. The beneficial ozone layer is in this region of the atmosphere.

Questions 7-9 refer to the following regions of Earth's atmosphere.

(A) Thermosphere
(B) Exosphere
(C) Troposphere
(D) Mesosphere
(E) Stratosphere

9. Most oxygen is found in this layer of the atmosphere.

54. If Earth had no atmosphere, the mean surface temperature would be approximately −15°C. With our present atmosphere, Earth's mean surface temperature is approximately +15°C. Which of the following is the best explanation for this difference?

(A) Reflection of incident solar radiation by clouds
(B) Scattering of visible radiation by aerosols
(C) Absorption of ultraviolet radiation by the ozone layer
(D) Absorption of infrared radiation by atmospheric gases
(E) The breakdown of oxygen molecules in the thermosphere

Questions 4-6 refer to the gases listed below.

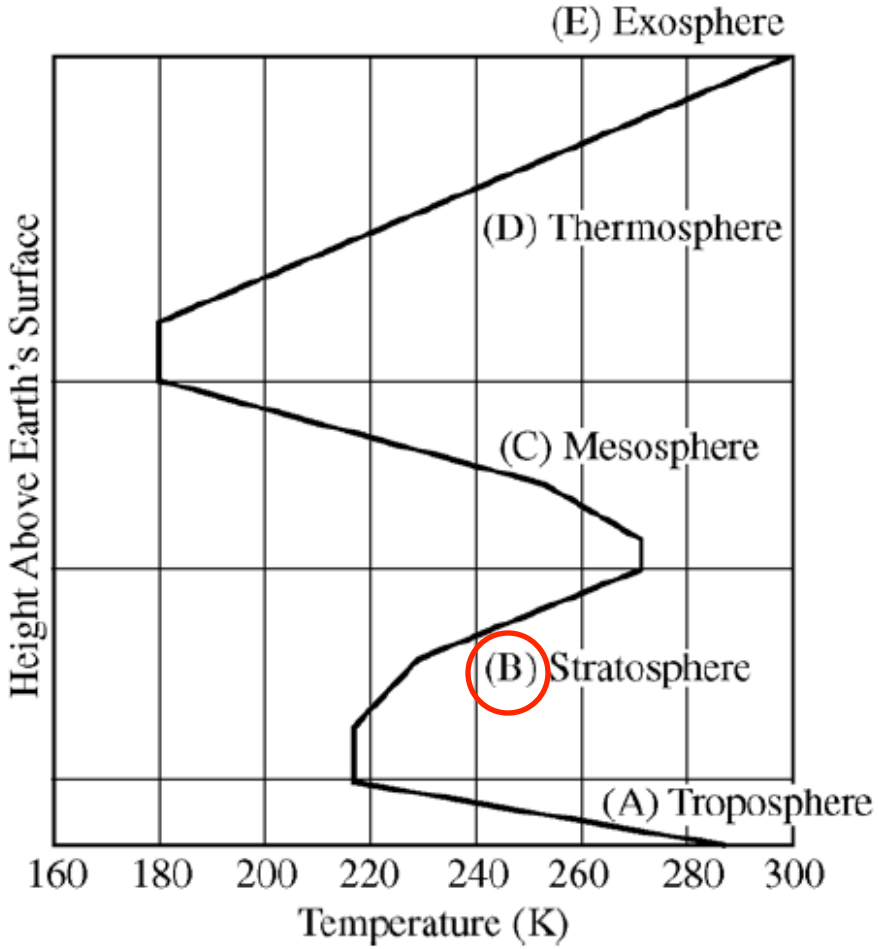
(A) H_2O
(B) CO_2
(C) CH_4
(D) O_3
(E) CCl_2F_2

4. The most abundant nonanthropogenic greenhouse gas

5. A greenhouse gas that is exclusively anthropogenic

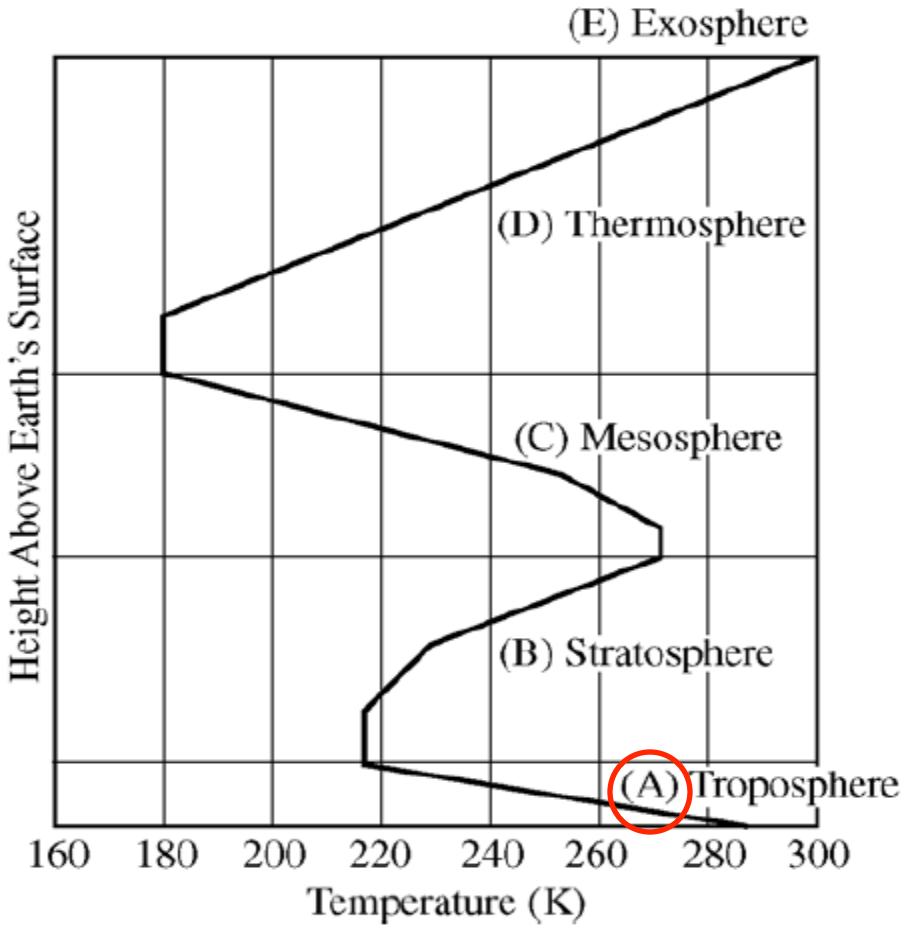
6. A greenhouse gas that, in the lower troposphere, is formed by photochemical reactions

Questions 11-14 refer to the layers of Earth's atmosphere in the temperature profile shown below.



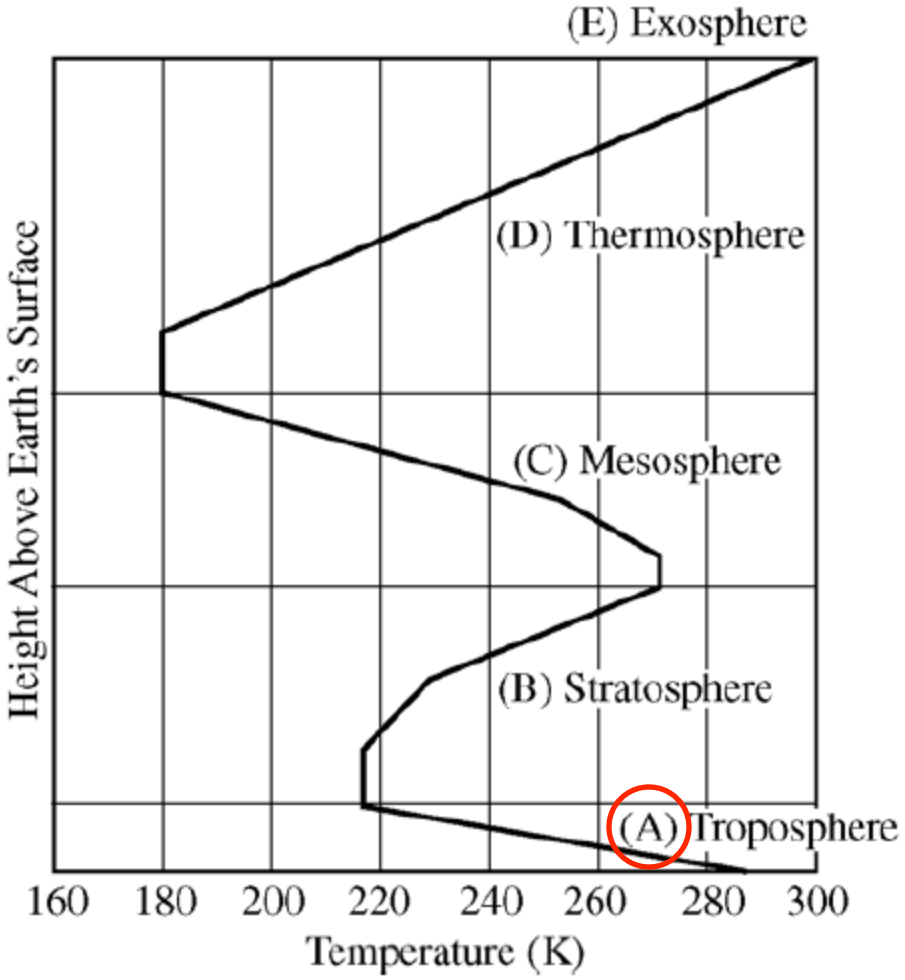
11. Region where the protective ozone layer is located

Questions 11-14 refer to the layers of Earth's atmosphere in the temperature profile shown below.



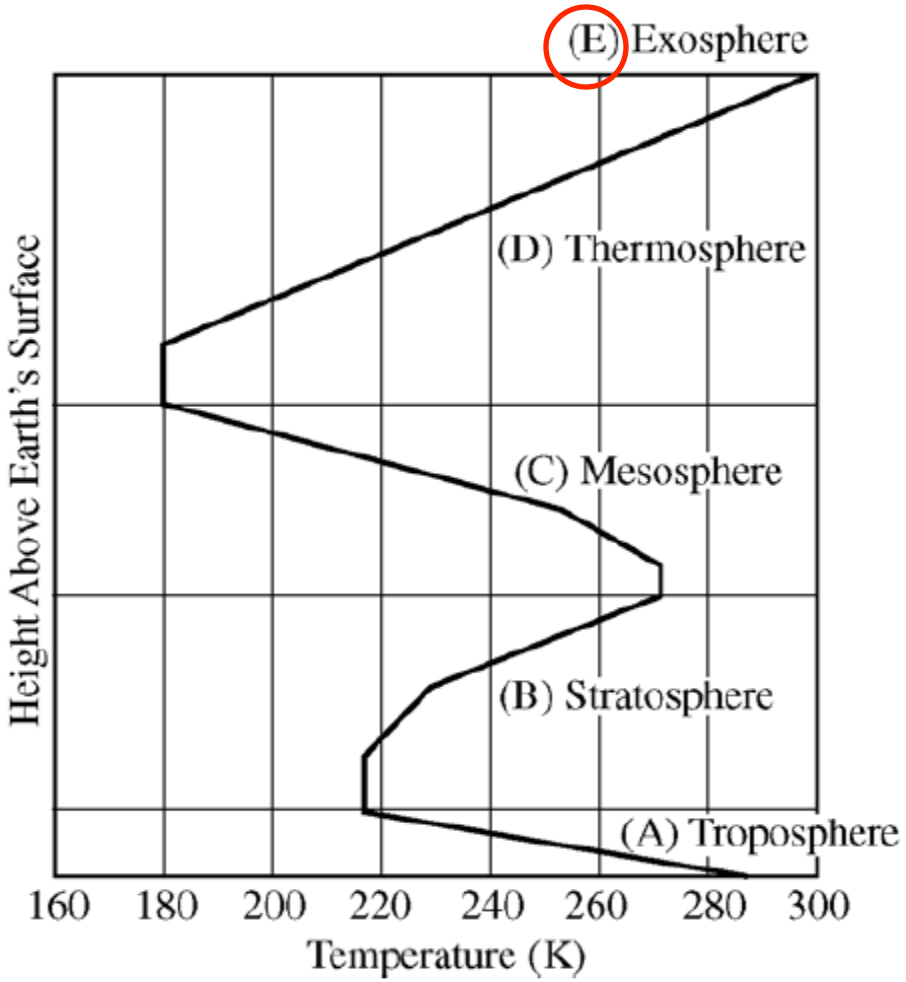
12. Region that contains the majority of molecules in the atmosphere

Questions 11-14 refer to the layers of Earth's atmosphere in the temperature profile shown below.



13. Region largely responsible for the weather experienced at the Earth's surface

Questions 11-14 refer to the layers of Earth's atmosphere in the temperature profile shown below.



14. Region with the lowest atmospheric pressure

39. Global climate change occurs because increasing concentrations of greenhouse gases in

(A) the troposphere absorb outgoing IR radiation
(B) the stratosphere absorb outgoing IR radiation
(C) the troposphere absorb incoming UV radiation
(D) the stratosphere absorb incoming UV radiation
(E) neither the troposphere nor the stratosphere absorb incoming UV radiation

The most abundant gas in Earth's atmosphere is

(A) nitrogen
(B) oxygen
(C) water vapor
(D) carbon dioxide
(E) hydrogen

The primary cause of Earth's seasons is the

(A) constant tilt of Earth's rotational axis with respect to the plane of its orbit around the Sun
(B) changing distance of Earth from the Sun at different times of the year
(C) periodic wobbling of Earth on its axis of rotation
(D) changing relative positions of Earth, its Moon, and the Sun
(E) periodic changes in solar energy output

Which of the following best describes the mechanism of the greenhouse effect in Earth's atmosphere?

(A) Ultraviolet radiation from the Sun is absorbed by ozone gas in the stratosphere.

(B) Gamma radiation from the Sun is absorbed at ground level by dust particles in the atmosphere.

(C) Infrared radiation from Earth's surface is absorbed by gases in the atmosphere.

(D) Cosmic radiation from deep space is absorbed by gases in the atmosphere.

(E) Alpha radiation from the Sun is absorbed by water vapor in the atmosphere.

El Niño

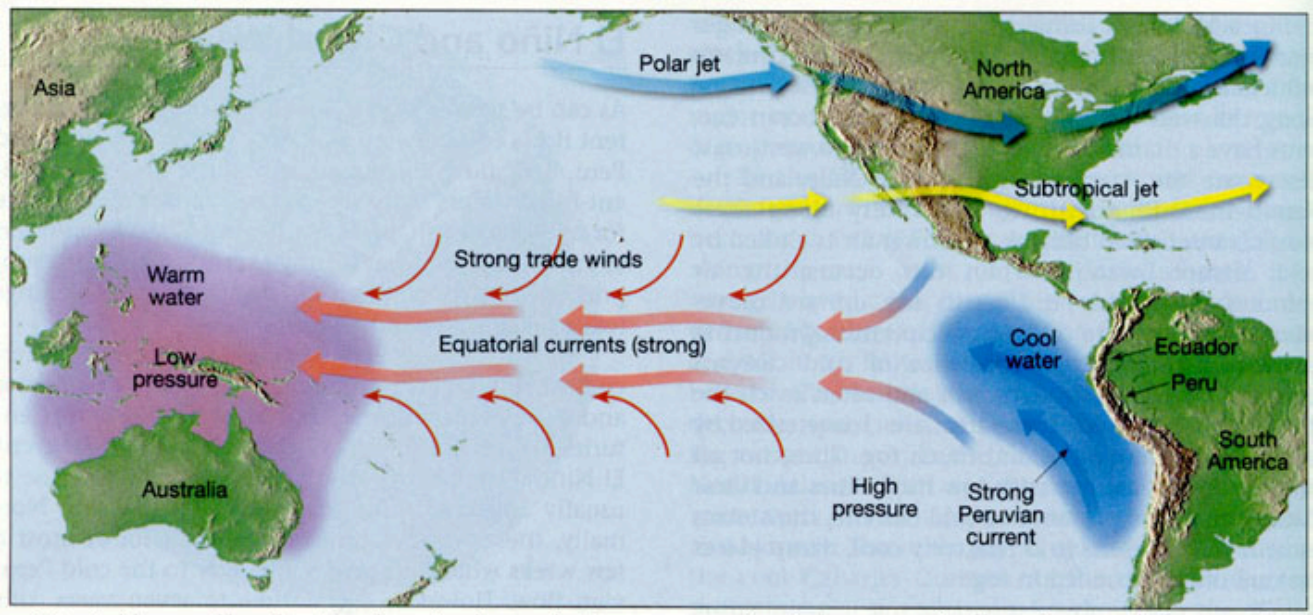


Fig.6 Normally, the trade winds and strong equatorial currents flow toward the west. At the same time, an intense Peruvian current causes upwelling of cold water along the west coast of South America.

Normal Conditions:

The humboldt current brings relatively cold water northward along the west coast of South America, an effect increased by upwelling of cold water along the Peruvian coast.

El Niño

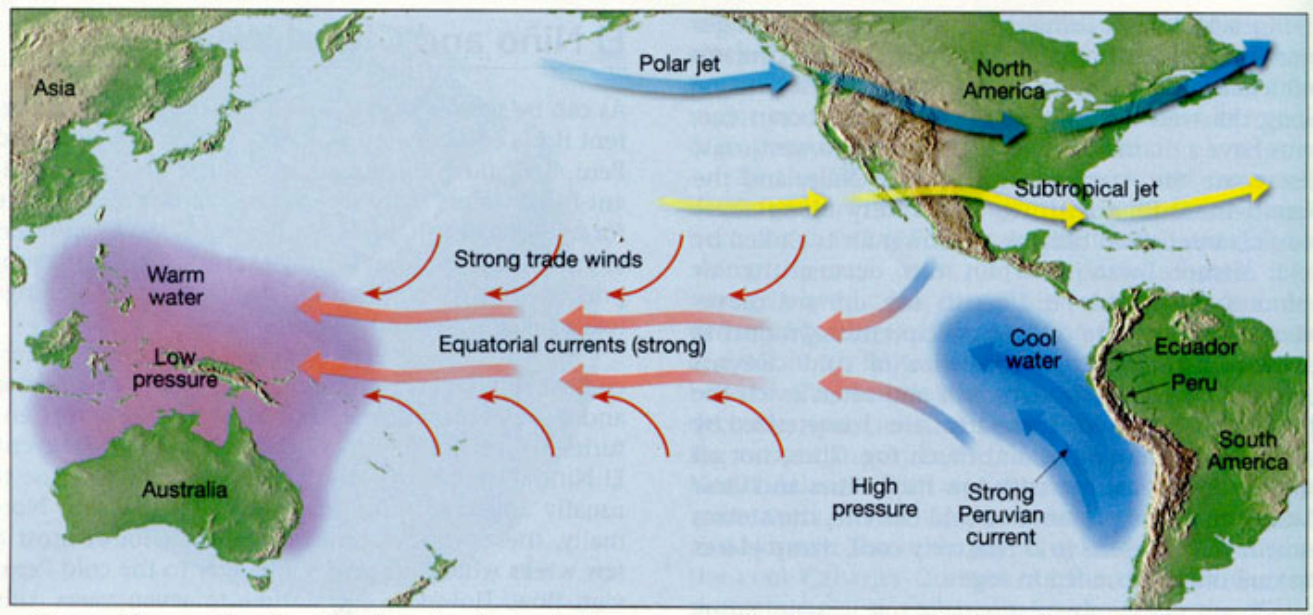


Fig.6 Normally, the trade winds and strong equatorial currents flow toward the west. At the same time, an intense Peruvian current causes upwelling of cold water along the west coast of South America.

Normal Conditions:

-Cold water then flows westward along the equator and is heated by the tropical sun.

-Normal conditions make the western Pacific about 3°C to 8°C warmer than the eastern Pacific.

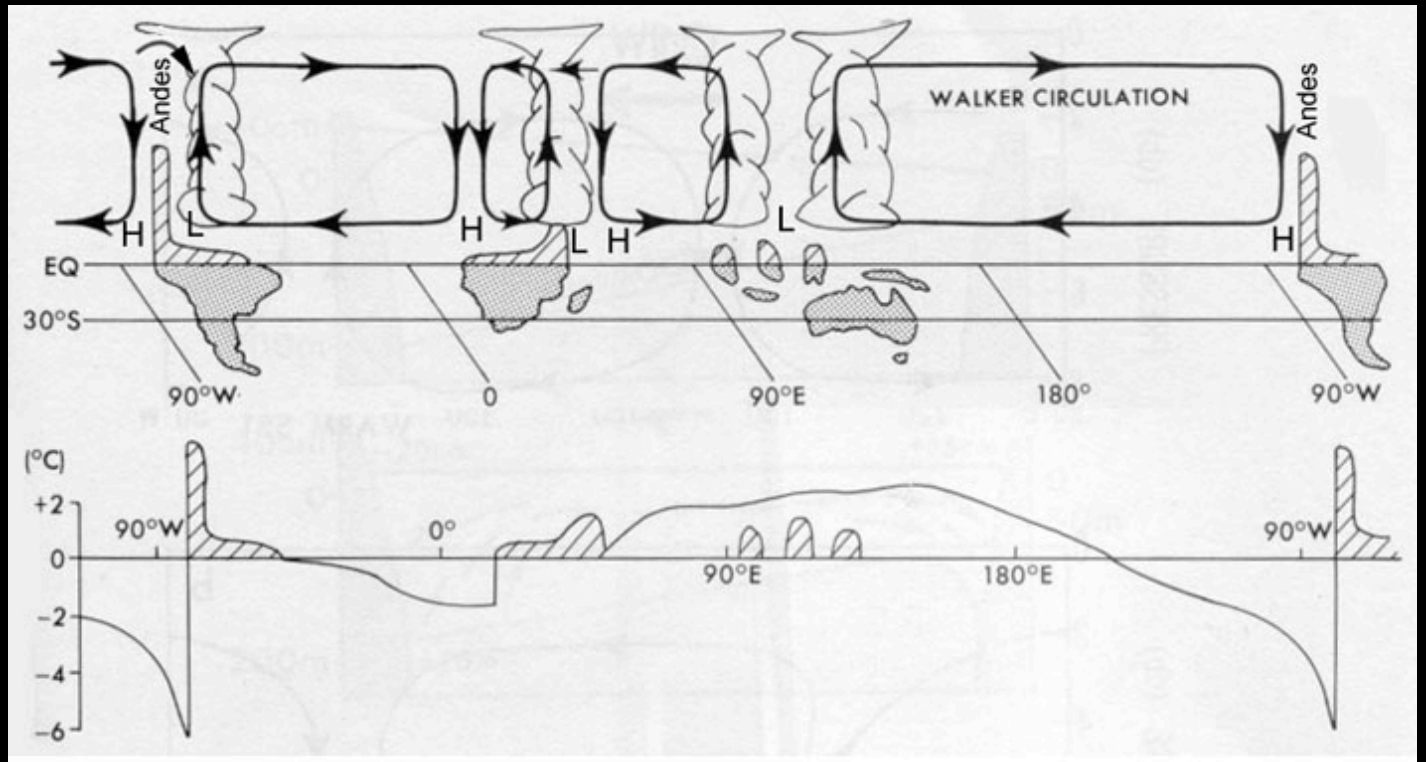
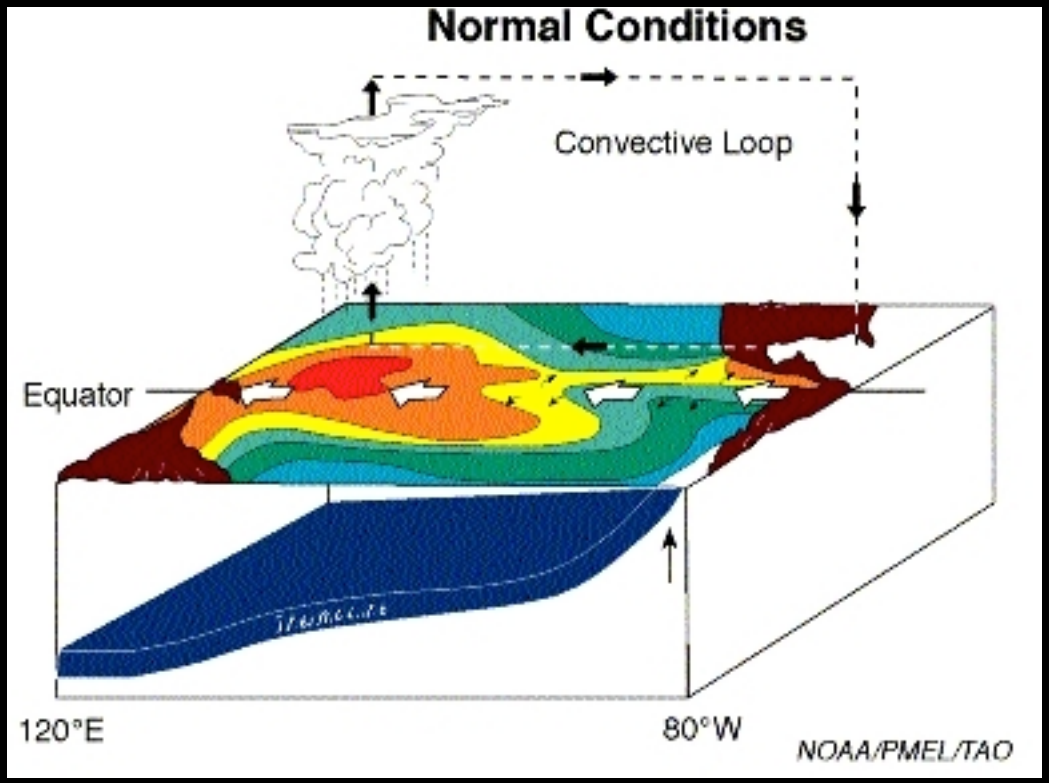


Fig.9 Schematic diagram of the normal Southern Oscillation along the equator during non-ENSO-conditions. Rising air and heavy rains tend to occur over Indonesia and the western Pacific, southeast Africa, and Amazonia, while sinking air and desert conditions prevail over the eastern equatorial Pacific and southwest Africa.

The Walker Circulation:

-The trade winds are part of the low-level component of the Walker circulation.

-Trades winds bring warm moist air towards the Indonesian region. (causing abundant rainfall)



The Walker Circulation:

-In the Indonesian region moist air rises to high levels of the atmosphere after moving over normally very warm seas.

-Air then travels eastward before sinking over the eastern Pacific Ocean.

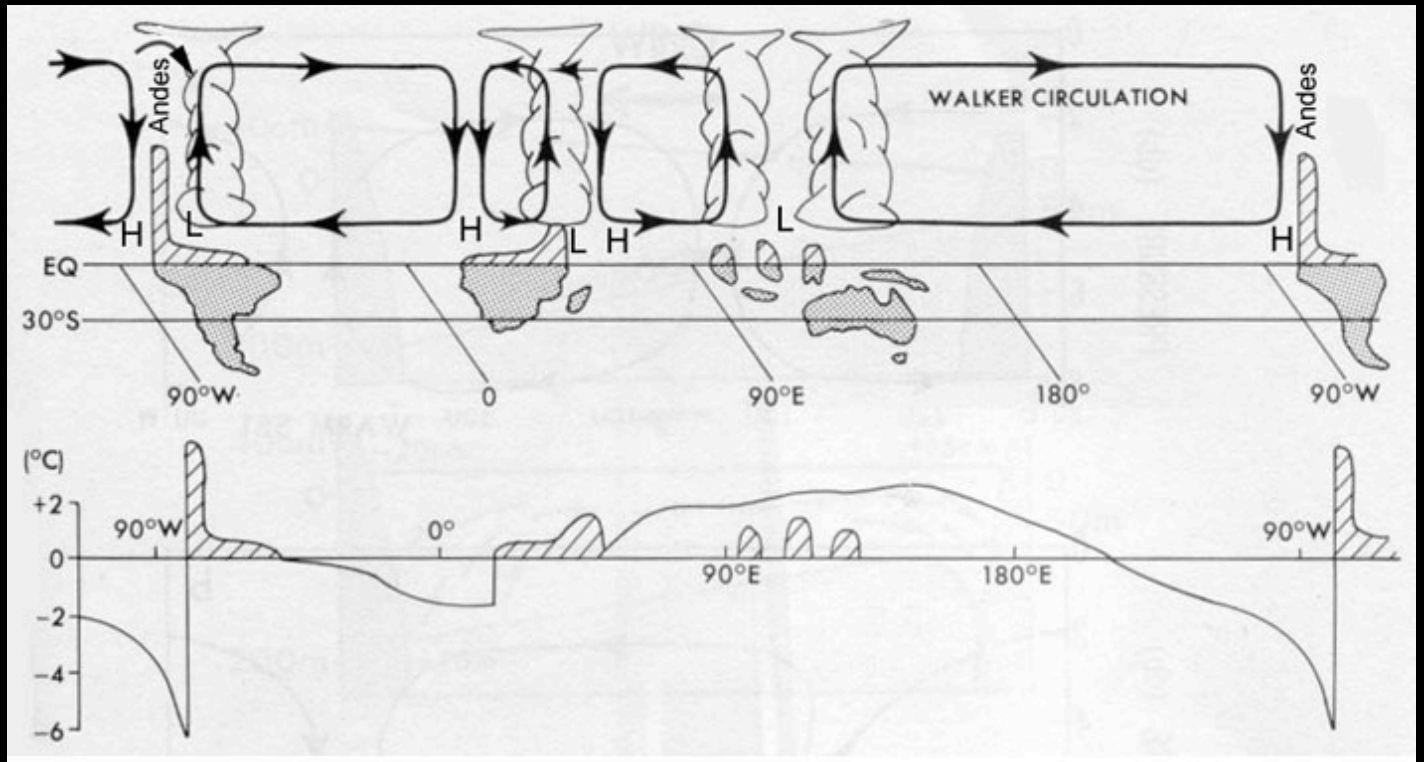


Fig.9 Schematic diagram of the normal Southern Oscillation along the equator during non-ENSO-conditions. Rising air and heavy rains tend to occur over Indonesia and the western Pacific, southeast Africa, and Amazonia, while sinking air and desert conditions prevail over the eastern equatorial Pacific and southwest Africa.

The Southern Oscillation:

Rising air is associated with a region of low air pressure, towering cumulonimbus clouds and rain. High pressure and dry conditions accompany the sinking air.

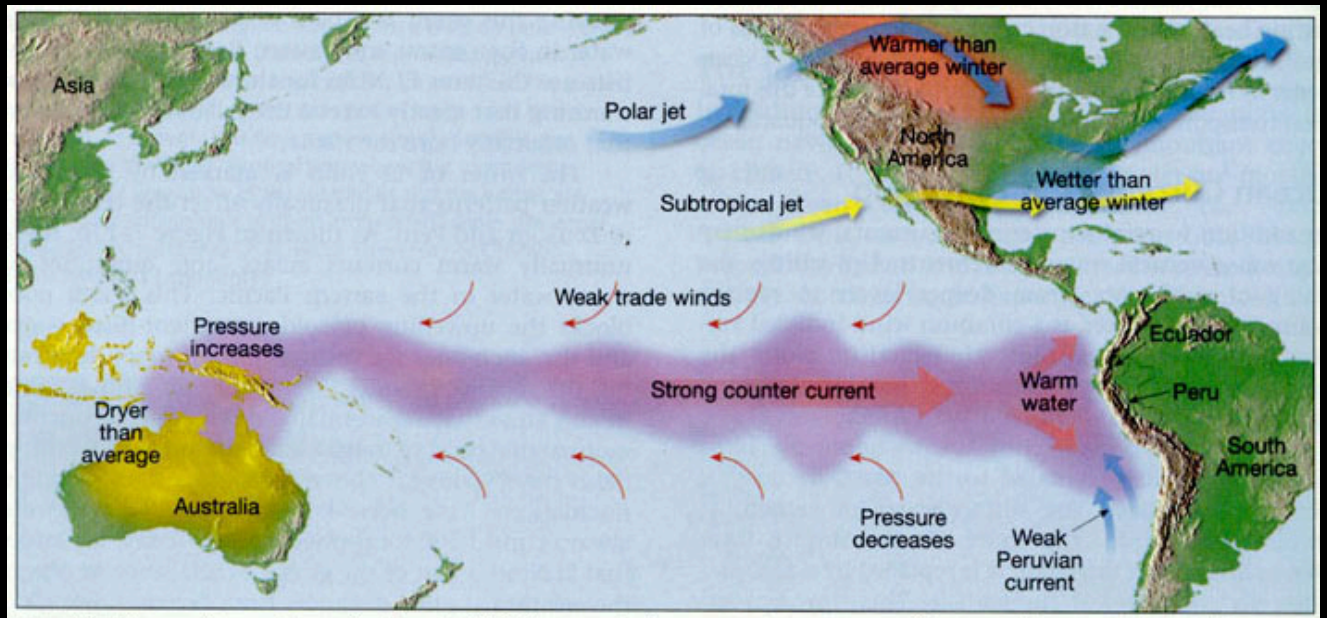


Fig.14 Upon the advent of an ENSO event, the pressure over the eastern and western Pacific flip-flops. This causes the trade winds to diminish, leading to an eastward movement of warm water along the equator. As a result, the surface waters of the central and eastern Pacific warm, with far-reaching consequences to weather patterns.

El Niño Conditions:

-Weakened trade winds allow warm water to move eastward.

-Thick upper ocean layer keeps nutrient rich water from upwelling along the coast of the Americas.

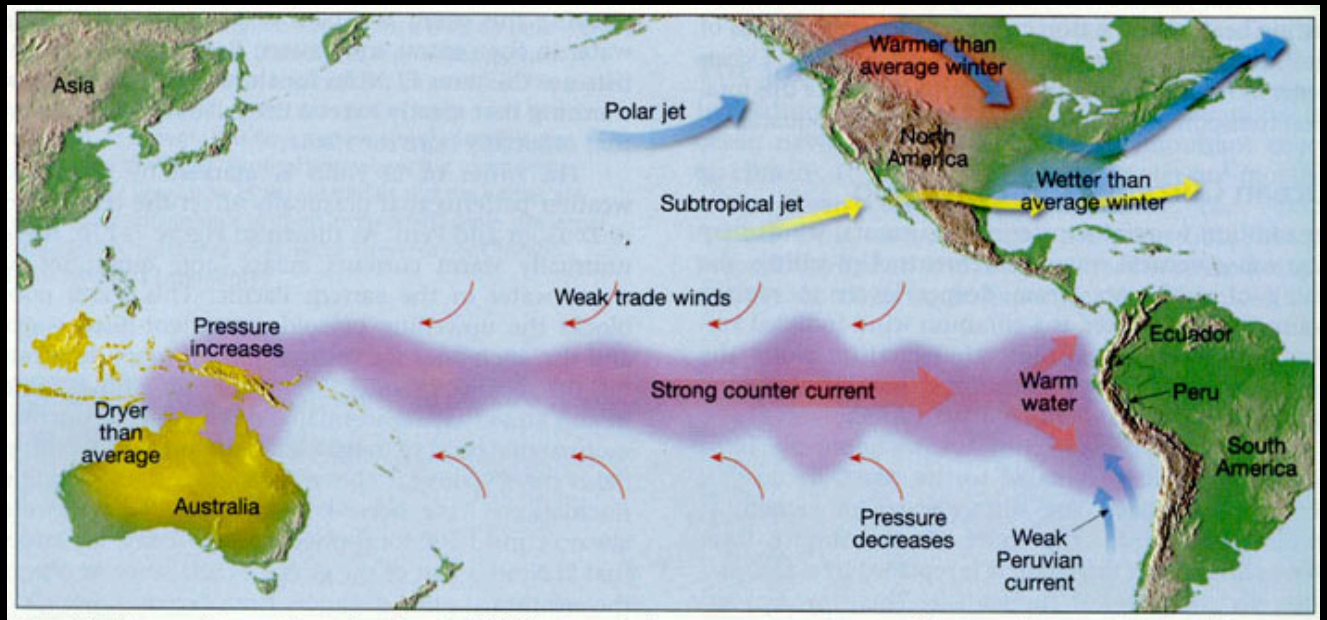


Fig.14 Upon the advent of an ENSO event, the pressure over the eastern and western Pacific flip-flops. This causes the trade winds to diminish, leading to an eastward movement of warm water along the equator. As a result, the surface waters of the central and eastern Pacific warm, with far-reaching consequences to weather patterns.

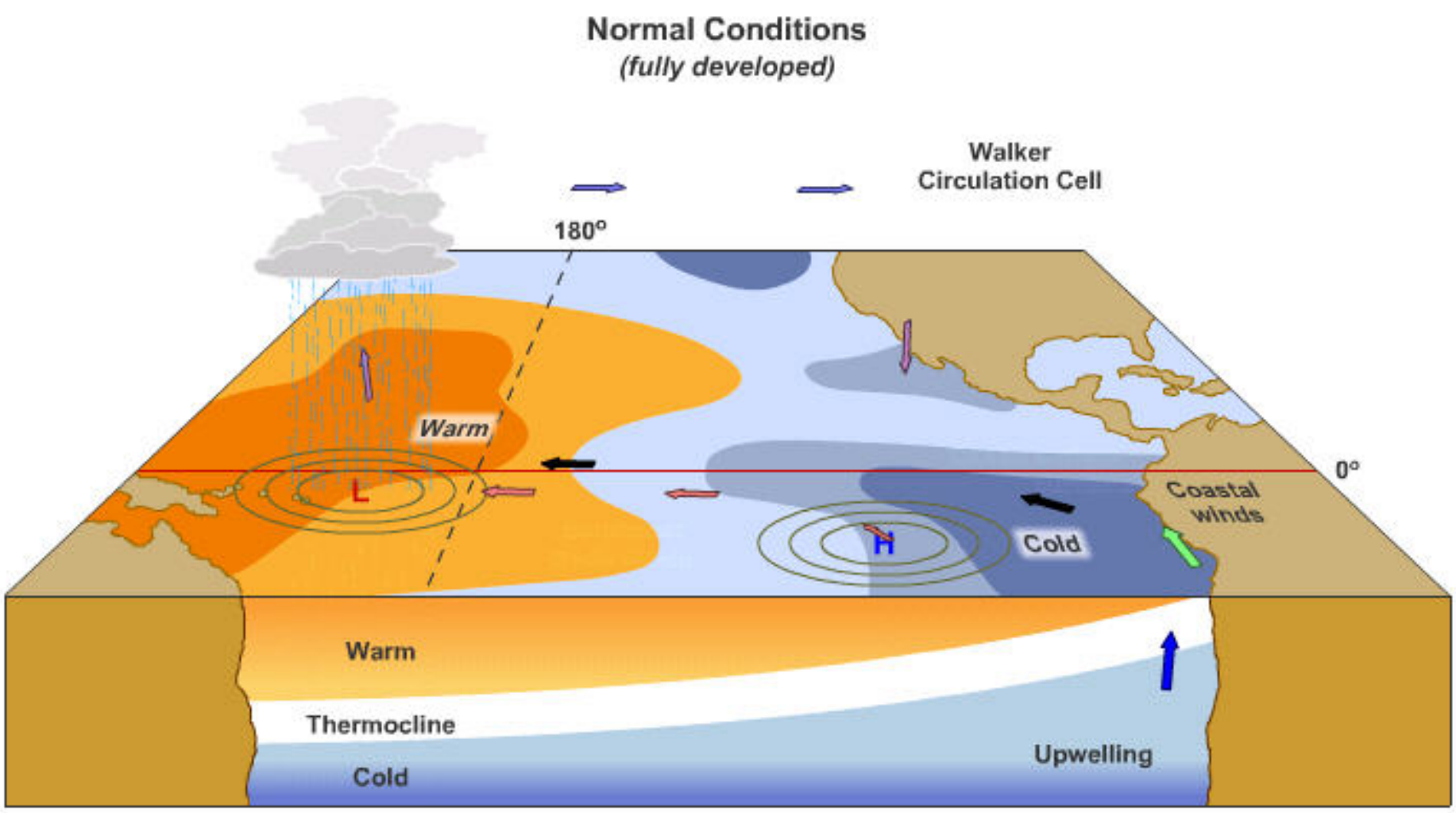
El Niño Conditions:

-The normally cold waters on the South American coast warm by 2°C to 8°C.

-Ocean heat released into the atmosphere increases cloud formation and alters path of jet stream.

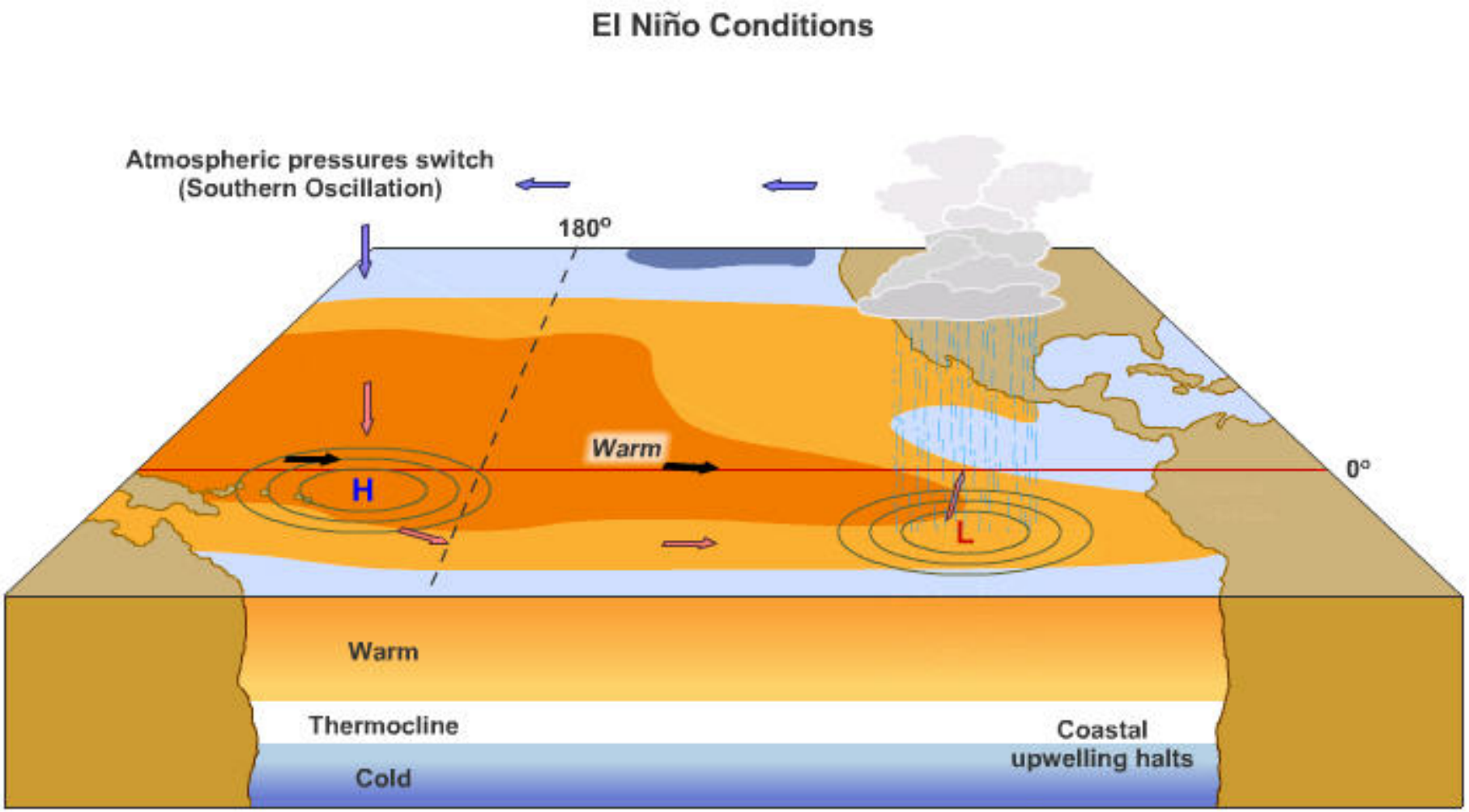
El Niño: Normal Conditions

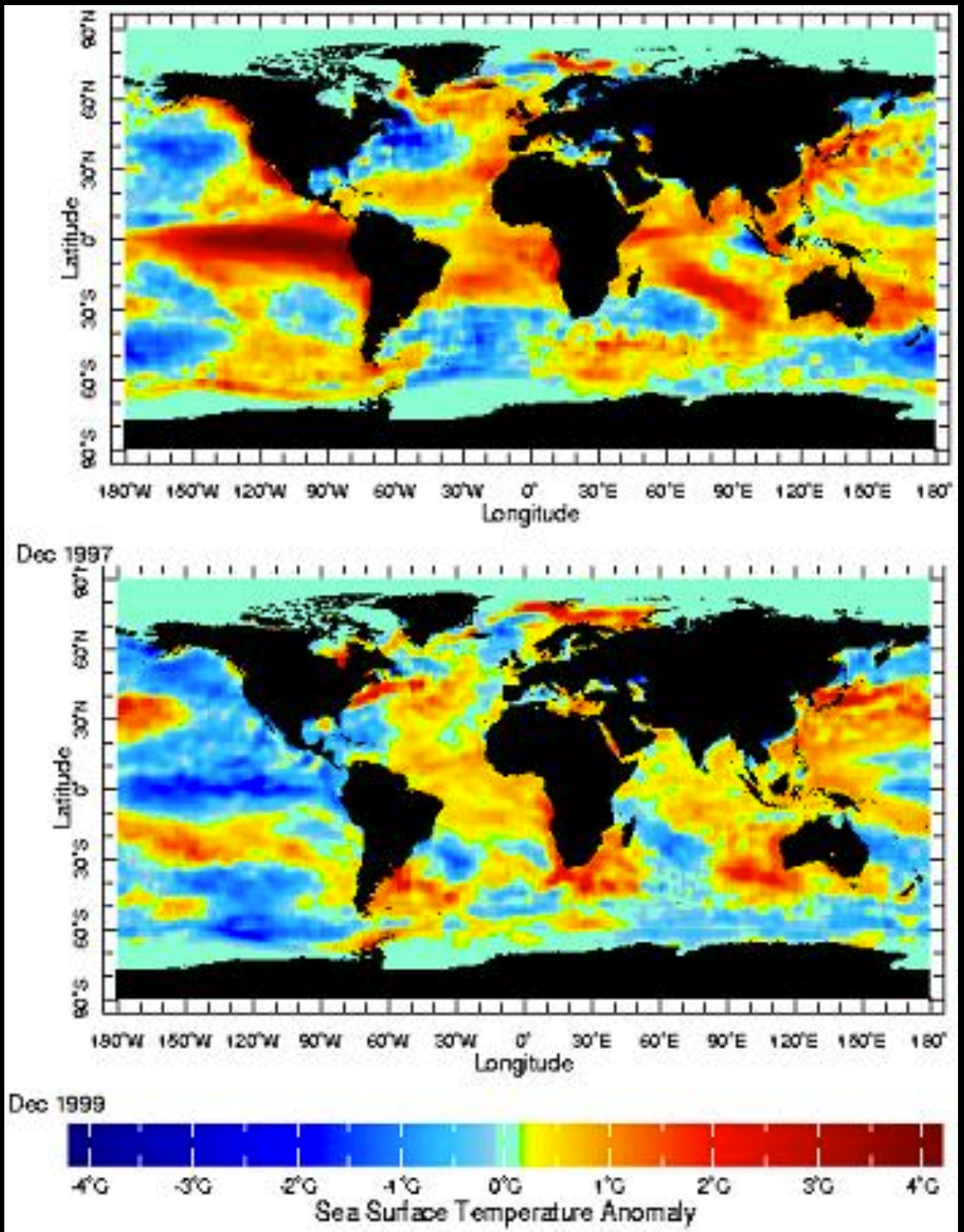
Prentice Hall Textbook animation link

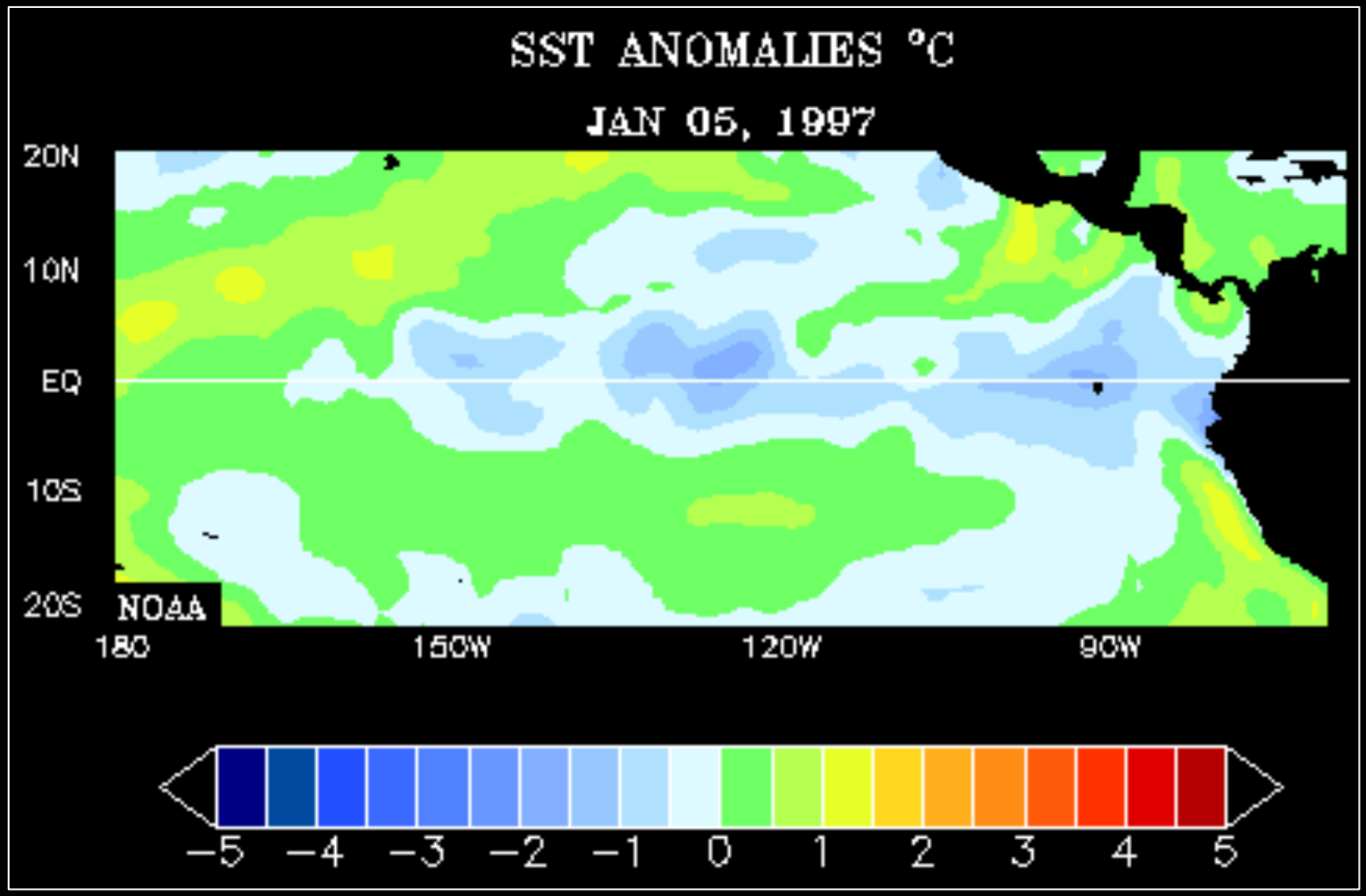


El Niño: El Nino Development

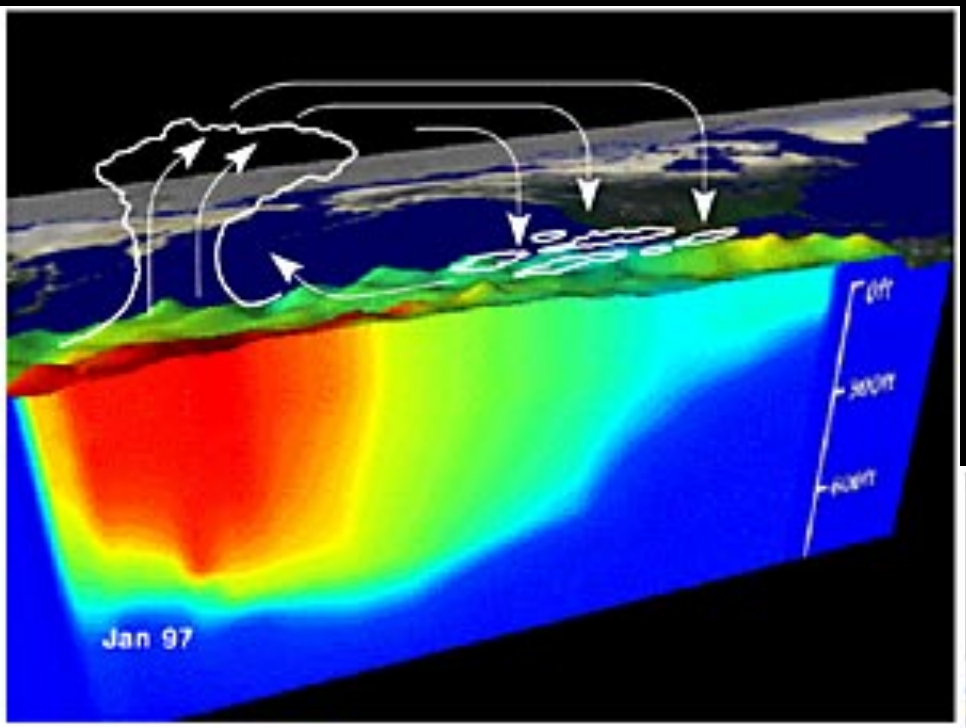
Prentice Hall Textbook animation link

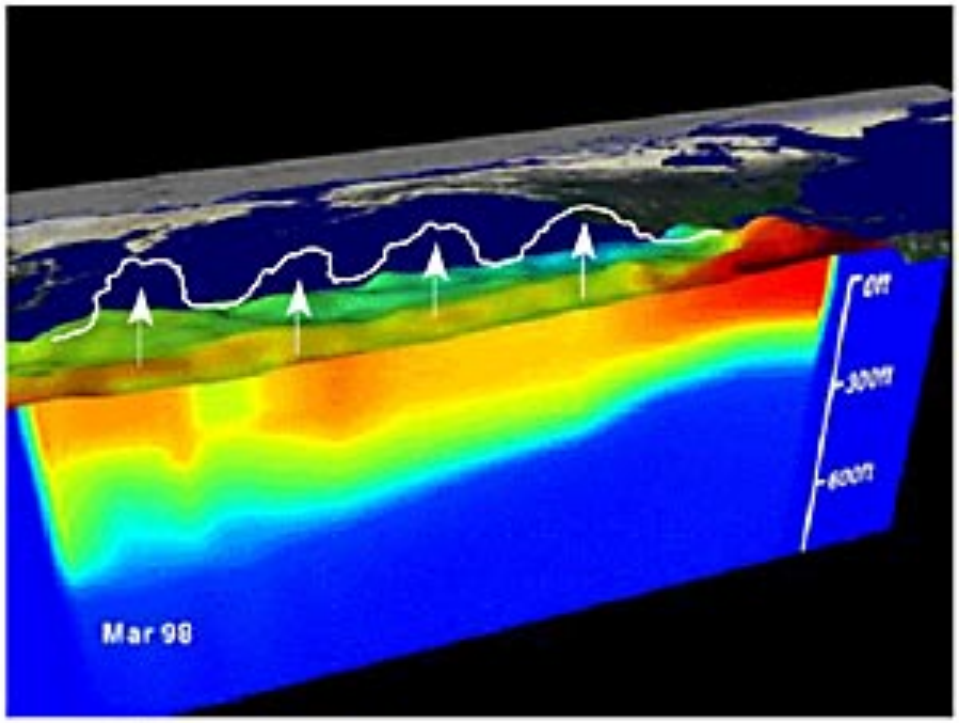


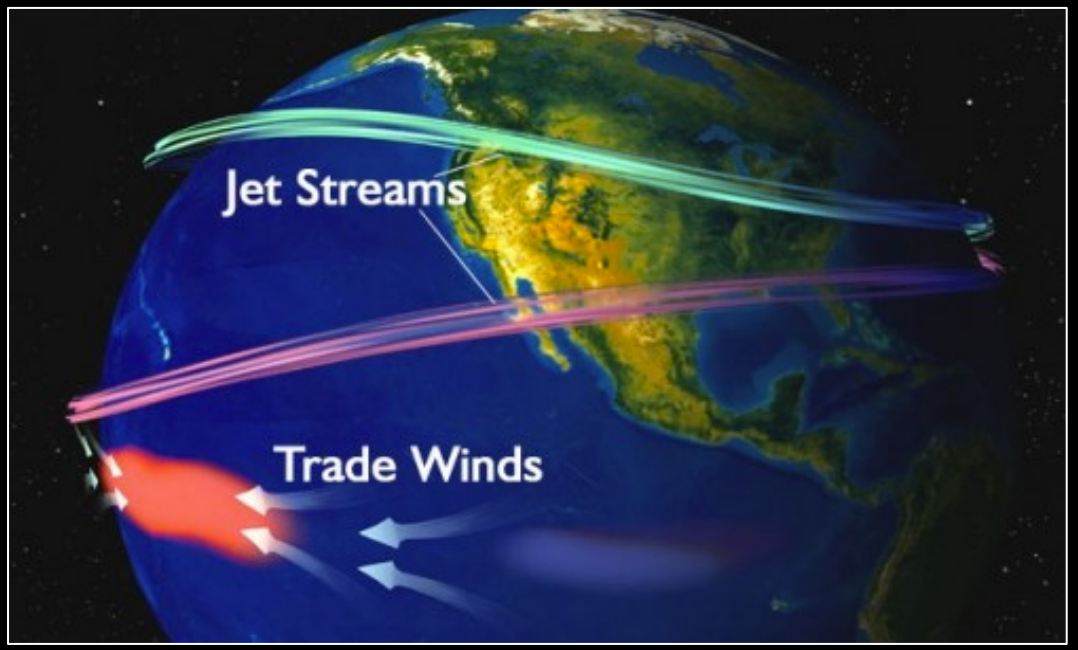

Dec 1997
Dec 1999
Latitude
Longitude
90°N
60°N
30°N
0°
30°S
60°S
90°S
180°W 150°W 120°W 90°W 60°W 30°W 0° 30°E 60°E 90°E 120°E 150°E 180°
-4°C -3°C -2°C -1°C 0°C 1°C 2°C 3°C 4°C
Sea Surface Temperature Anomaly

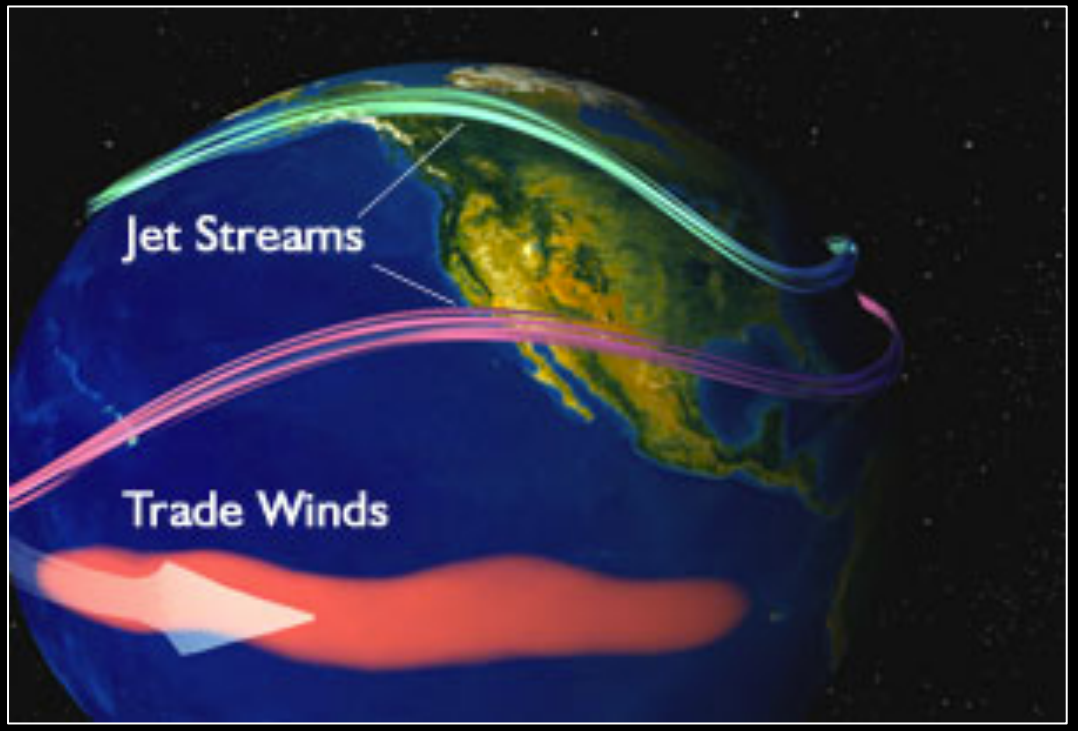

SST ANOMALIES °C
JAN 05, 1997
20N
10N
EQ
10S
20S
NOAA
180
150W
120W
90W
−5
−4
−3
−2
−1
0
1
2
3
4
5

Walker Cells El Niño: 1998 Event






Jet Streams
Trade Winds


Jet Streams
Trade Winds

El Niño: Duration & Effects

Duration:

-Non-El Niño - 5 to 10 years

-El Niño - 1 to 3 years

-Equatorial Pacific in El Niño 20% of the time!

Effects:

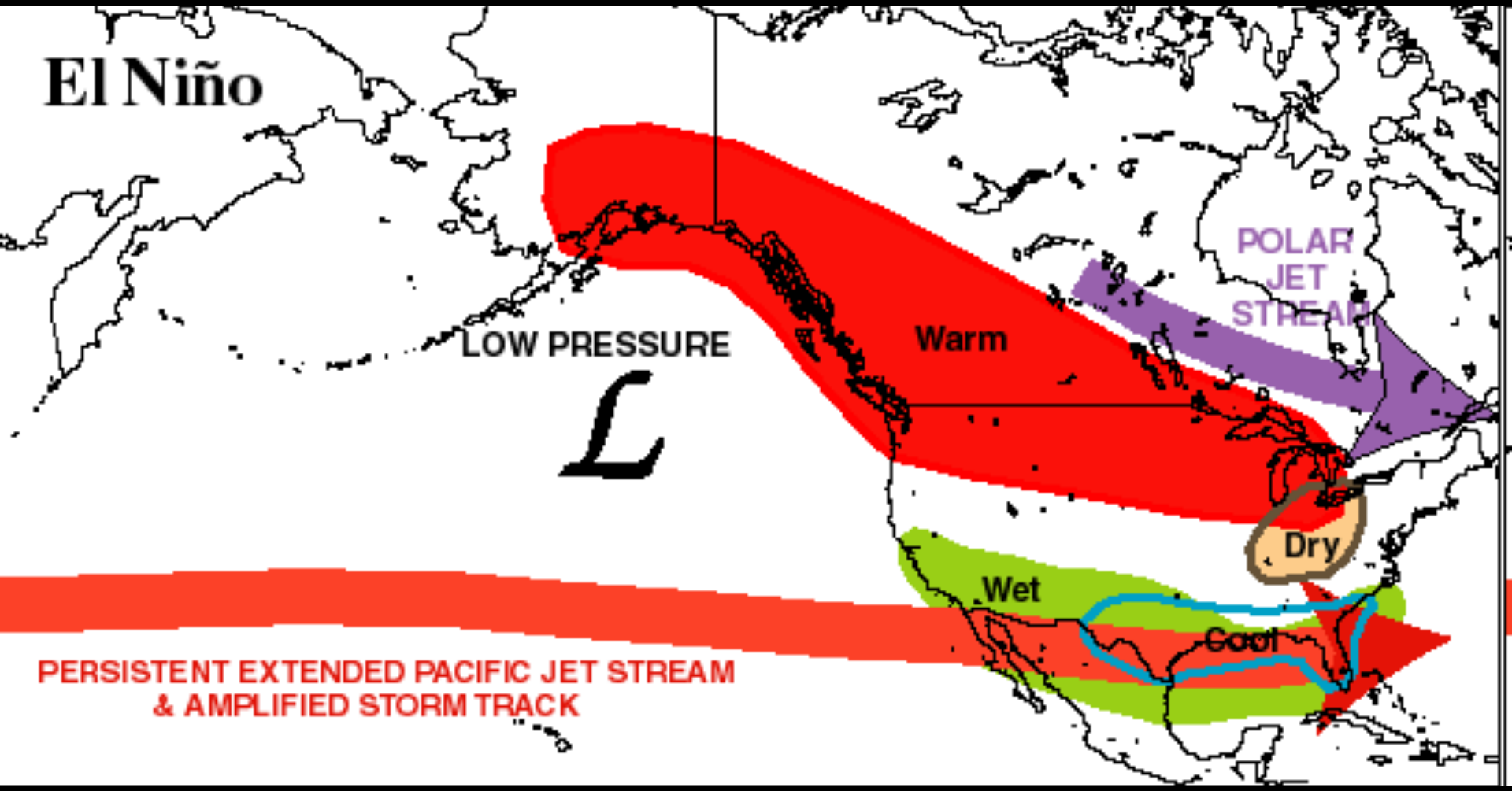
The area of humid, rising air and abundant rainfall shifts eastward, to the central, and eastern Pacific.

-This shift causes torrential rains and flooding in the normally arid areas along the west coast of South America.

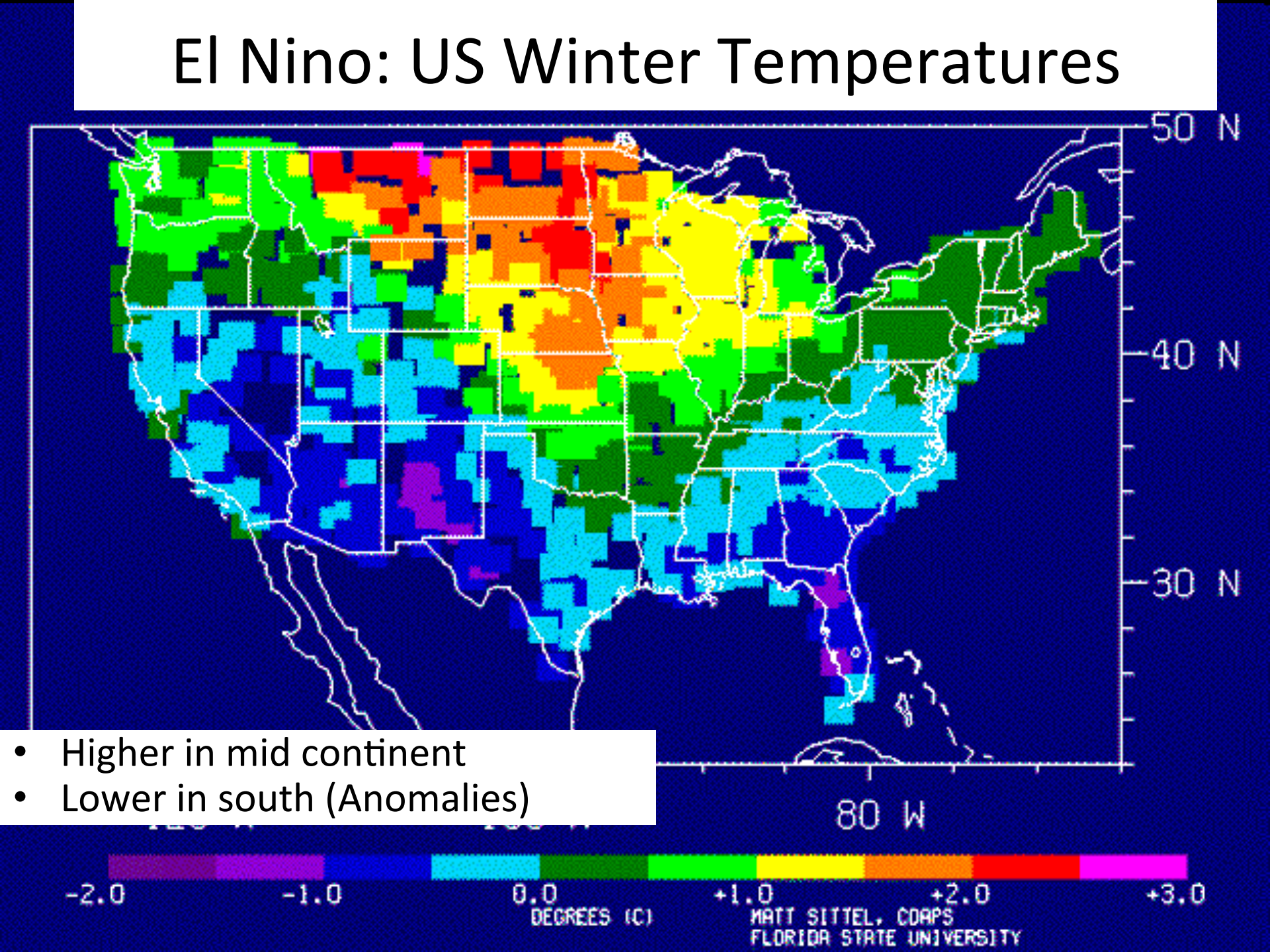
-The absence of coastal upwelling affects the marine (ocean) food chain and the local economy.

- Altered path of the jet stream: global effects.

El Nino

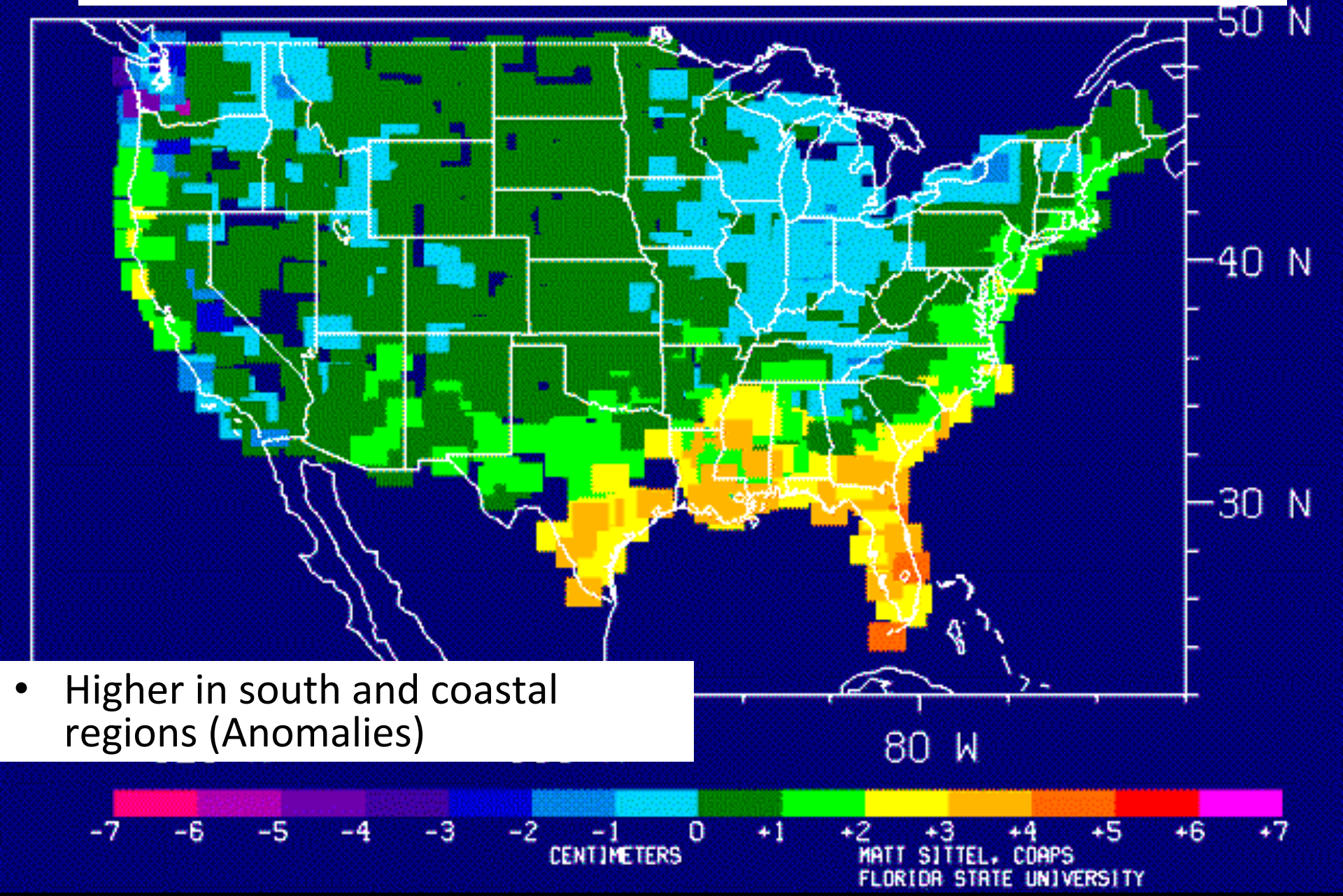

El Niño
LOW PRESSURE
L
Warm
POLAR
JET
STREAM
Dry
Wet
Cool
PERSISTENT EXTENDED PACIFIC JET STREAM
& AMPLIFIED STORM TRACK

El Nino: US Winter Temperatures



- Higher in mid continent
- Lower in south (Anomalies)

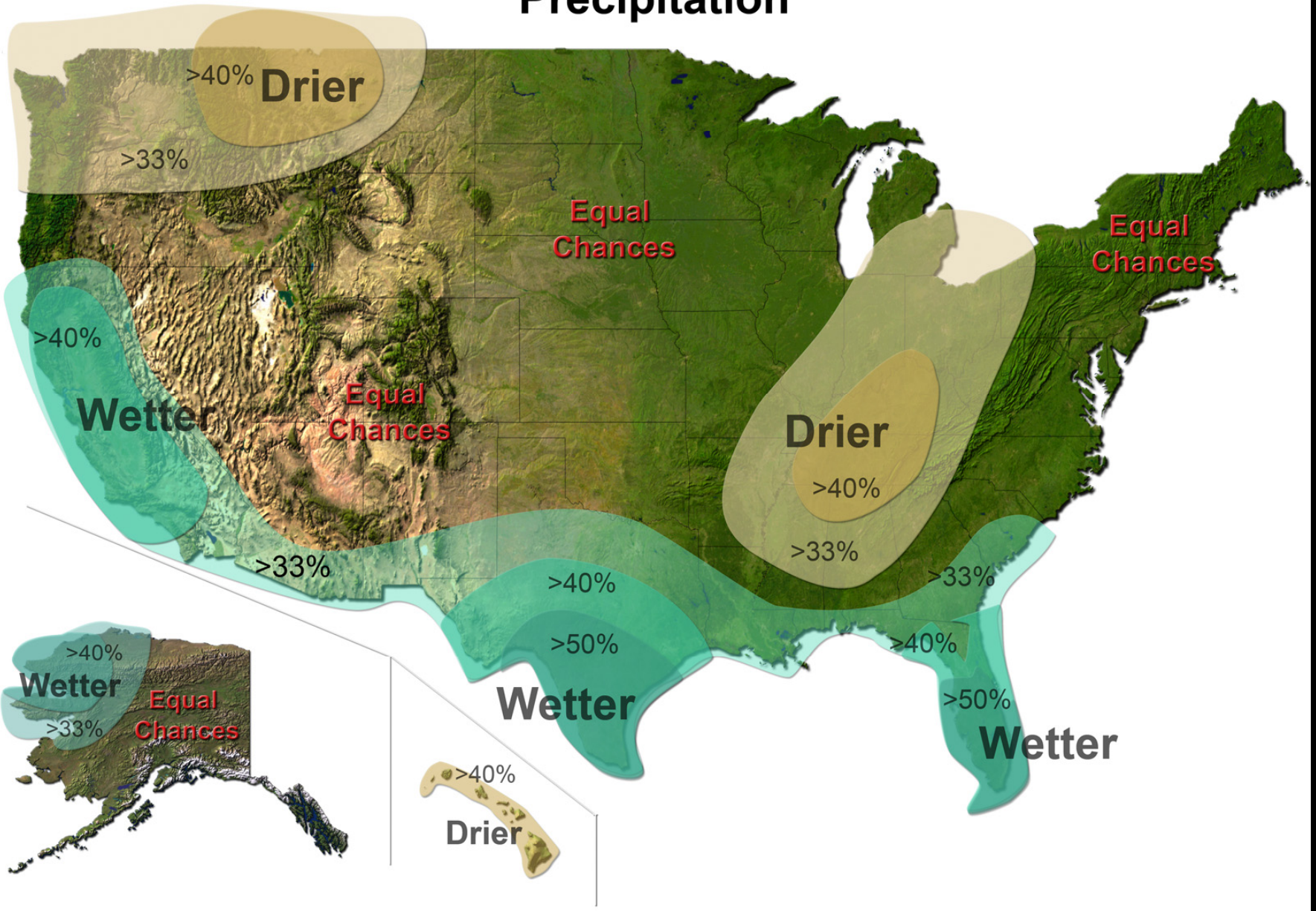
El Nino: US Winter Precipitation



- Higher in south and coastal regions (Anomalies)

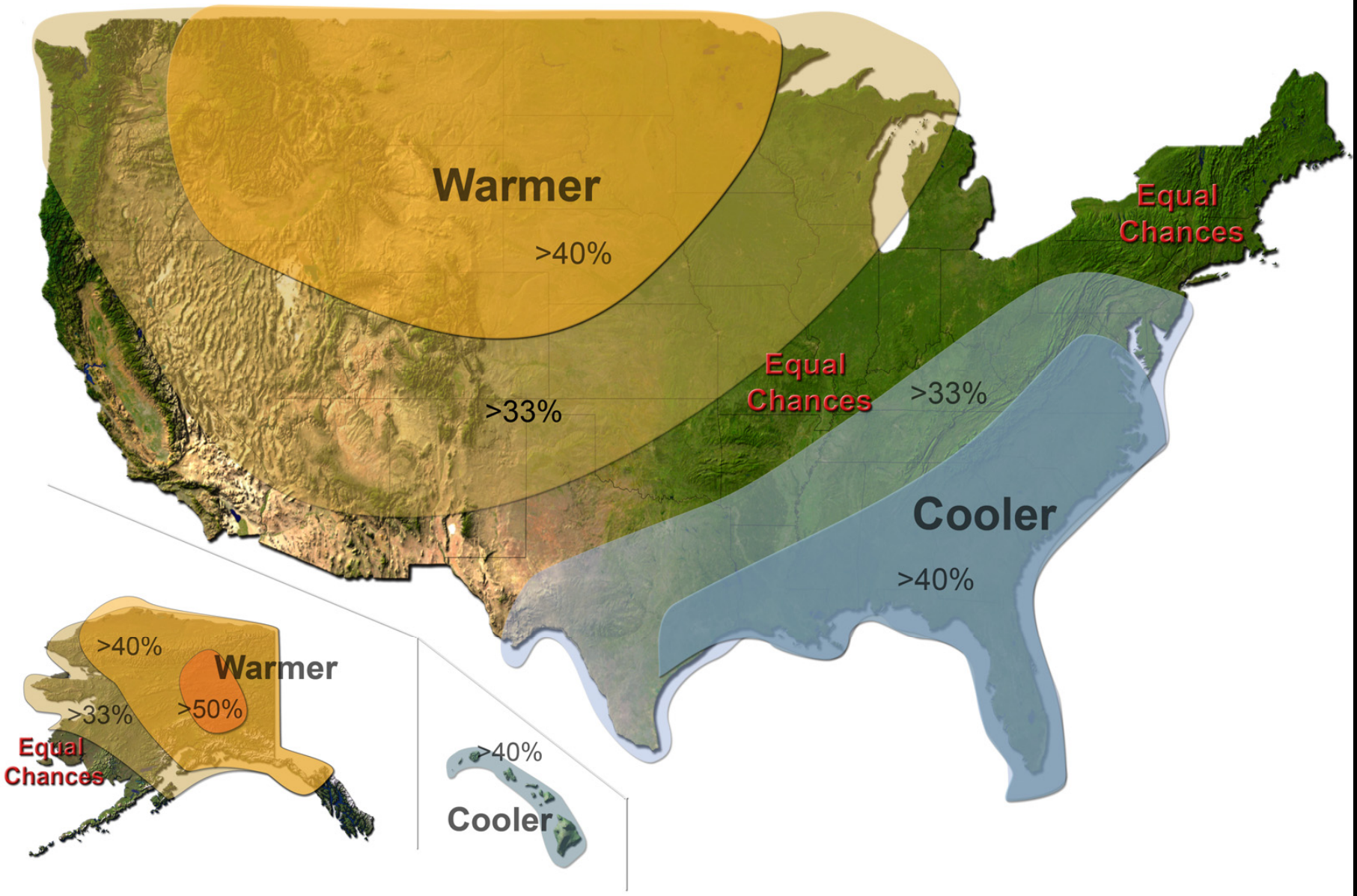
U.S. Winter Outlook

Precipitation



U.S. Winter Outlook

Temperature



GLOBAL EFFECTS OF EL NIÑO

Other parts of the world, such as Africa, India, and Australia, experience severe droughts. These droughts cause:

-Fresh water shortages,

-devastating brush fires,

-agricultural crop failure,

-leading to malnutrition, disease, starvation, and death.

GLOBAL EFFECTS OF EL NIÑO

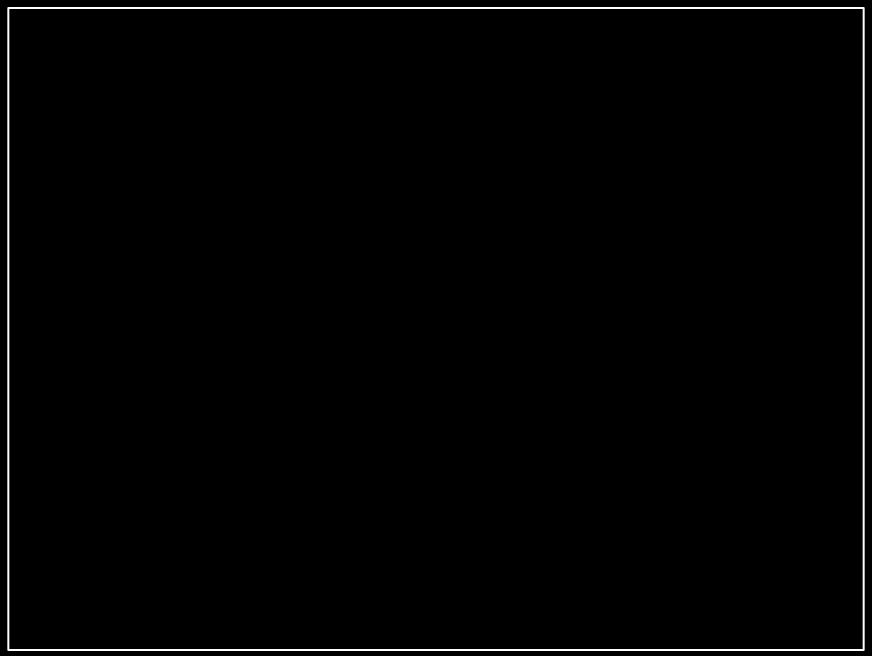
Economic effects of EL Niño Events:

-Crop prices increase (ex. wheat, rice and cotton)

-Farming and Fishing Industries have experienced huge economic hardships due to El Niño Events (causing food price increases).

-Severe weather causes hundreds of millions of dollars in property damage in the U.S. alone.

GLOBAL EFFECTS OF EL NIÑO



El Niño, a periodic warming of the ocean surface waters, occurs in which of the following region?

a) Tropical East Pacific
b) Gulf of Mexico
c) Arctic North Pacific
d) Temperate West Atlantic
e) Tropical Indian Ocean

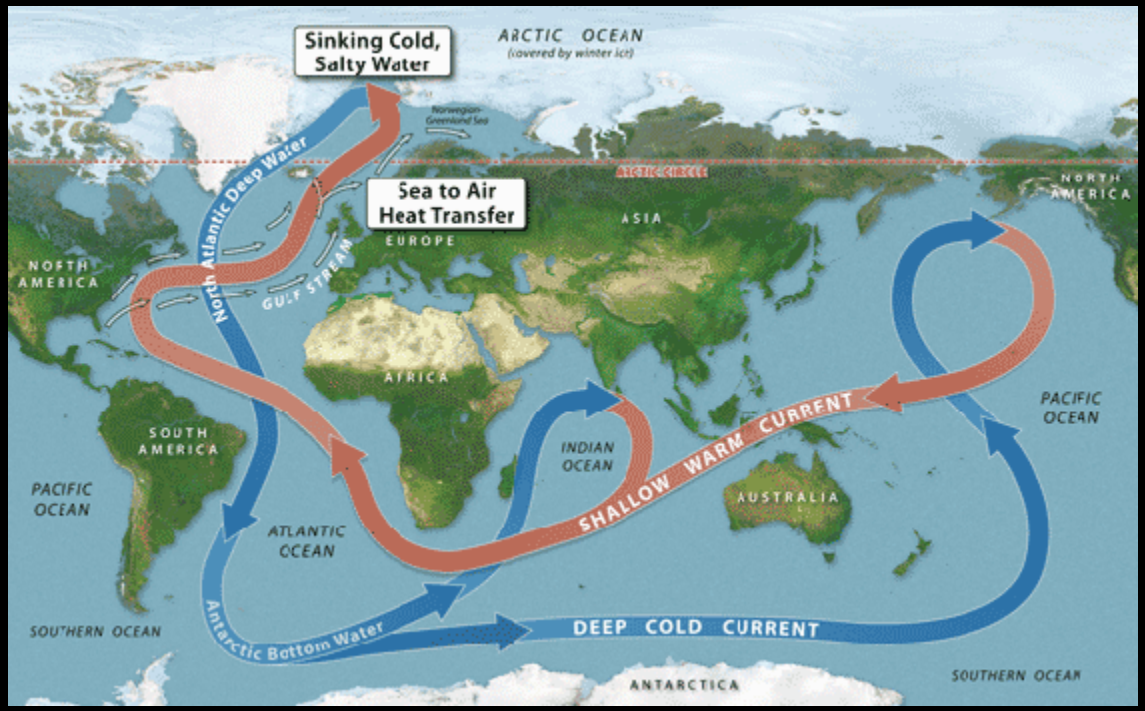
99. During an El Niño–Southern Oscillation event, which of the following best describes conditions in the eastern part of the tropical Pacific Ocean (e.g., near Peru and Ecuador) ?

	Sea Surface Temperature	Rainfall
(A)	Low	Low
(B)	Low	High
(C)	High	Low
(D)	High	High
(E)	High	Normal

DEEP CIRCULATION

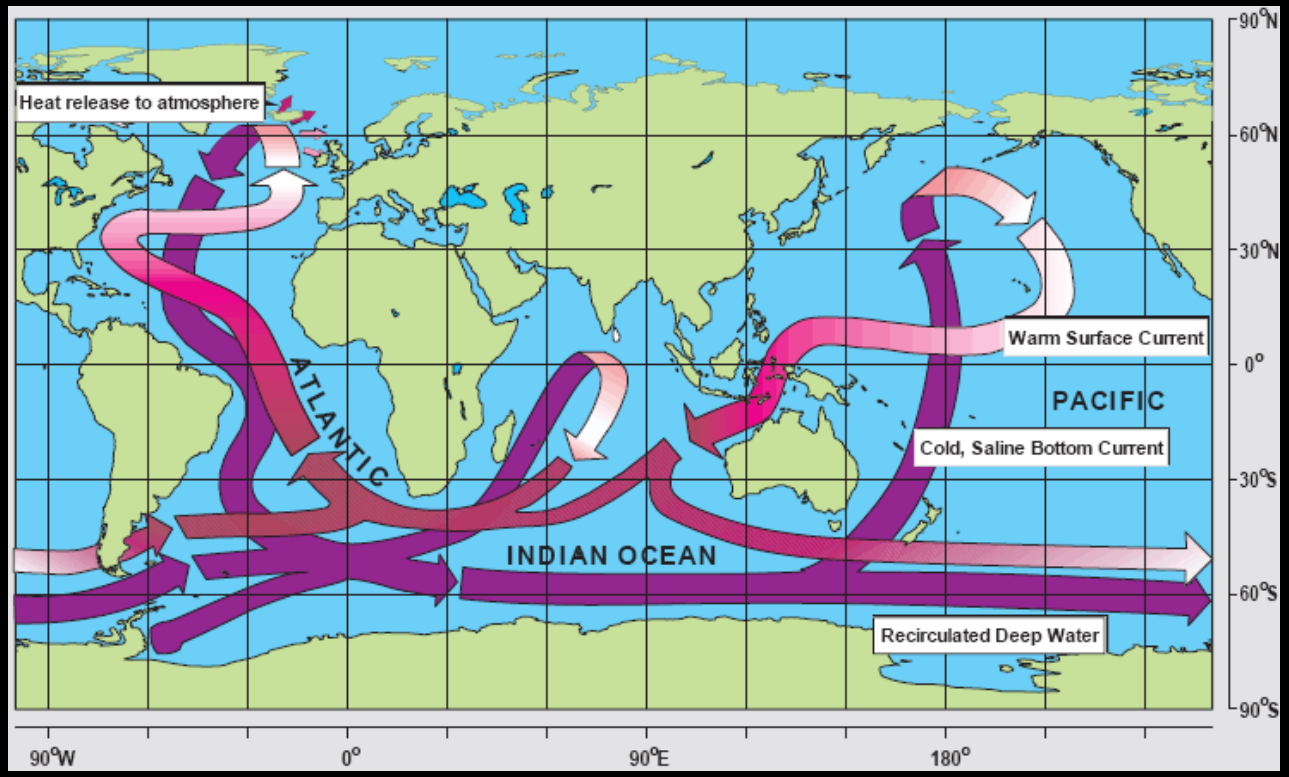
The Global Conveyer Belt is driven by density variations in the ocean.

-Technically called Thermohaline Circulation



DEEP CIRCULATION

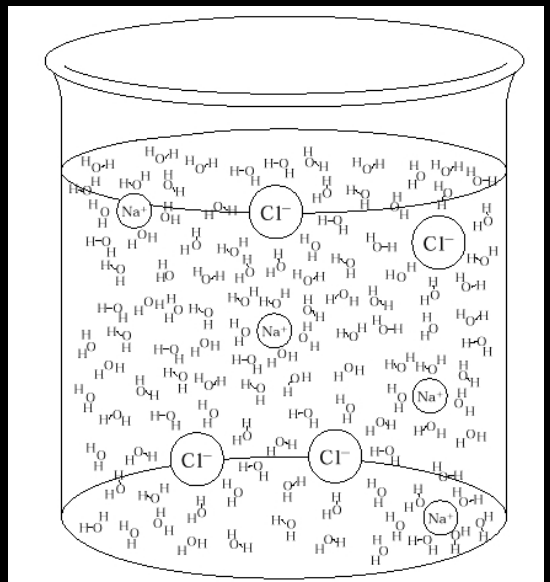
The density of sea water is controlled by two factors: **temperature** and **salinity**.

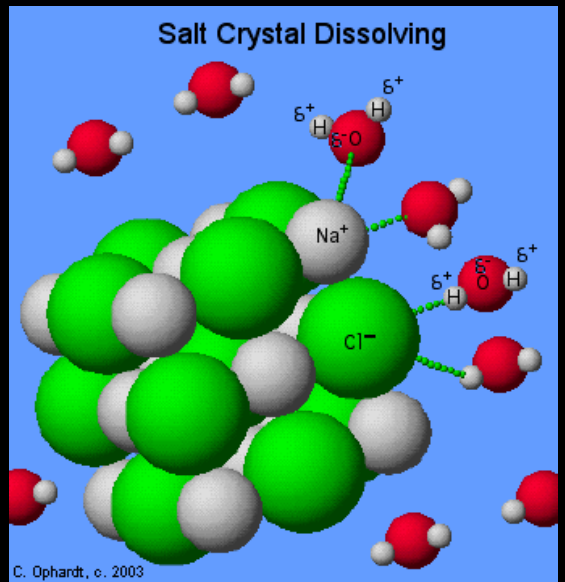


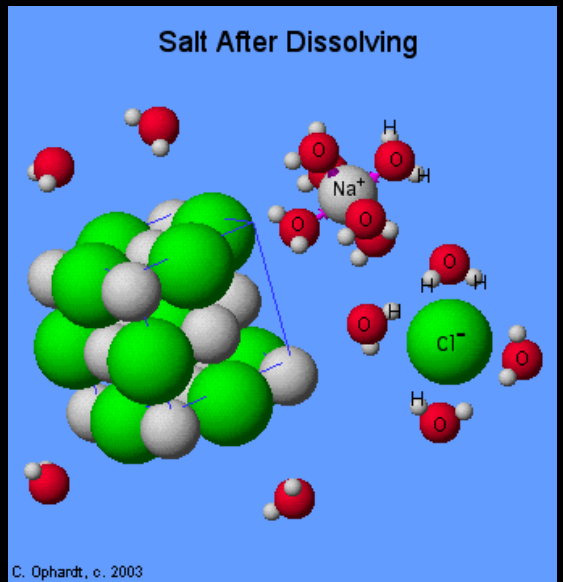
DEEP CIRCULATION

Salinity-

-Amount of salts and minerals dissolved in water.
-Salinity varies throughout the oceans.
-Average = 35 ppt (Parts Per Thousandth)
or 3.5%







DEEP CIRCULATION

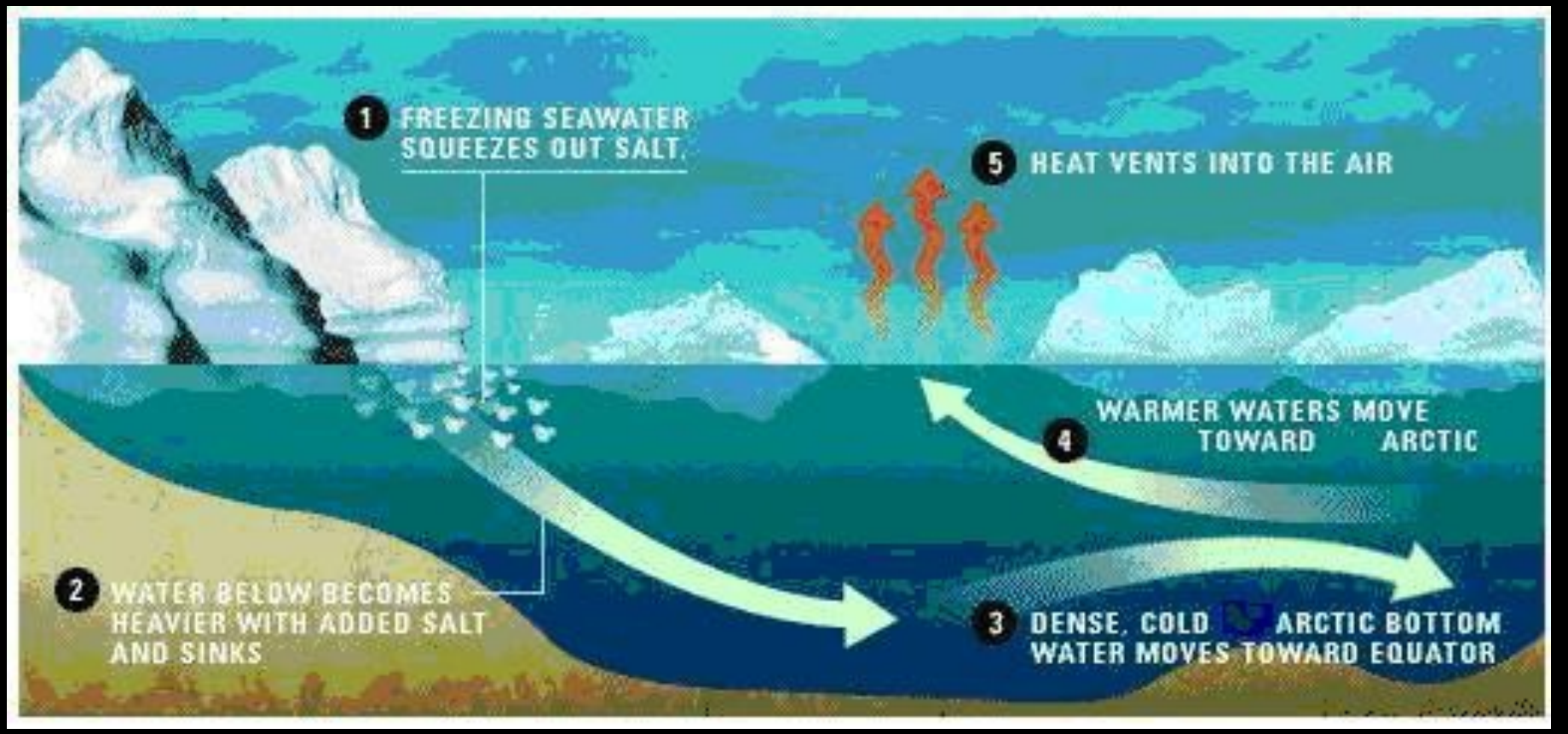
Temperature & Salinity-

Salt is left out of freezing water.

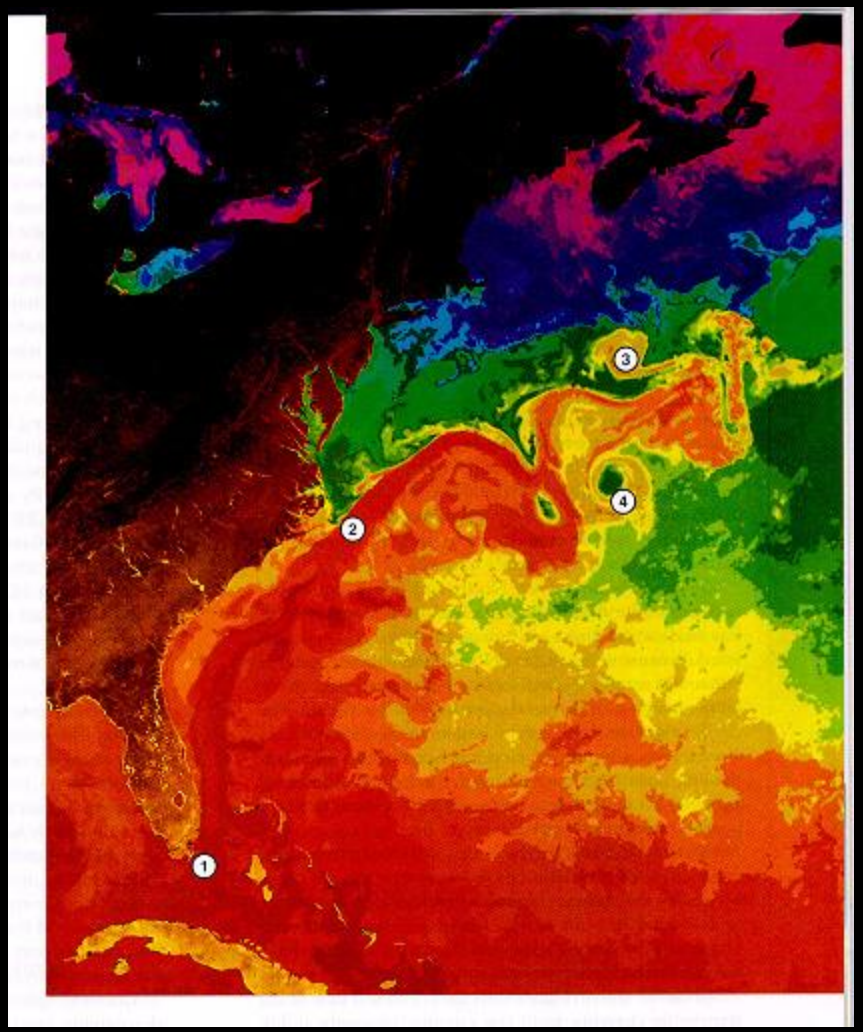
As seawater gets colder and saltier, its density increases, and it starts to sink toward the bottom.

Surface water is pulled in to replace the sinking water …the current begins.

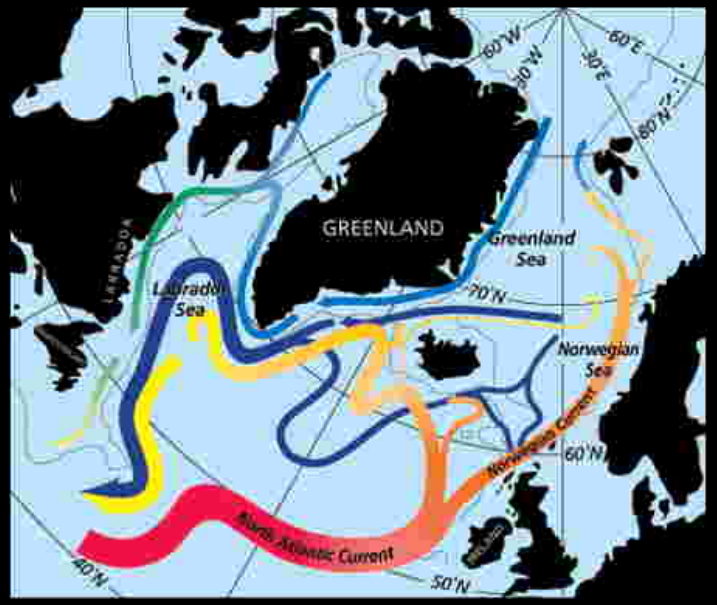
DEEP CIRCULATION



DEEP CIRCULATION



The Gulf Stream carries warm salt water into the high latitude North Atlantic where the water cools.



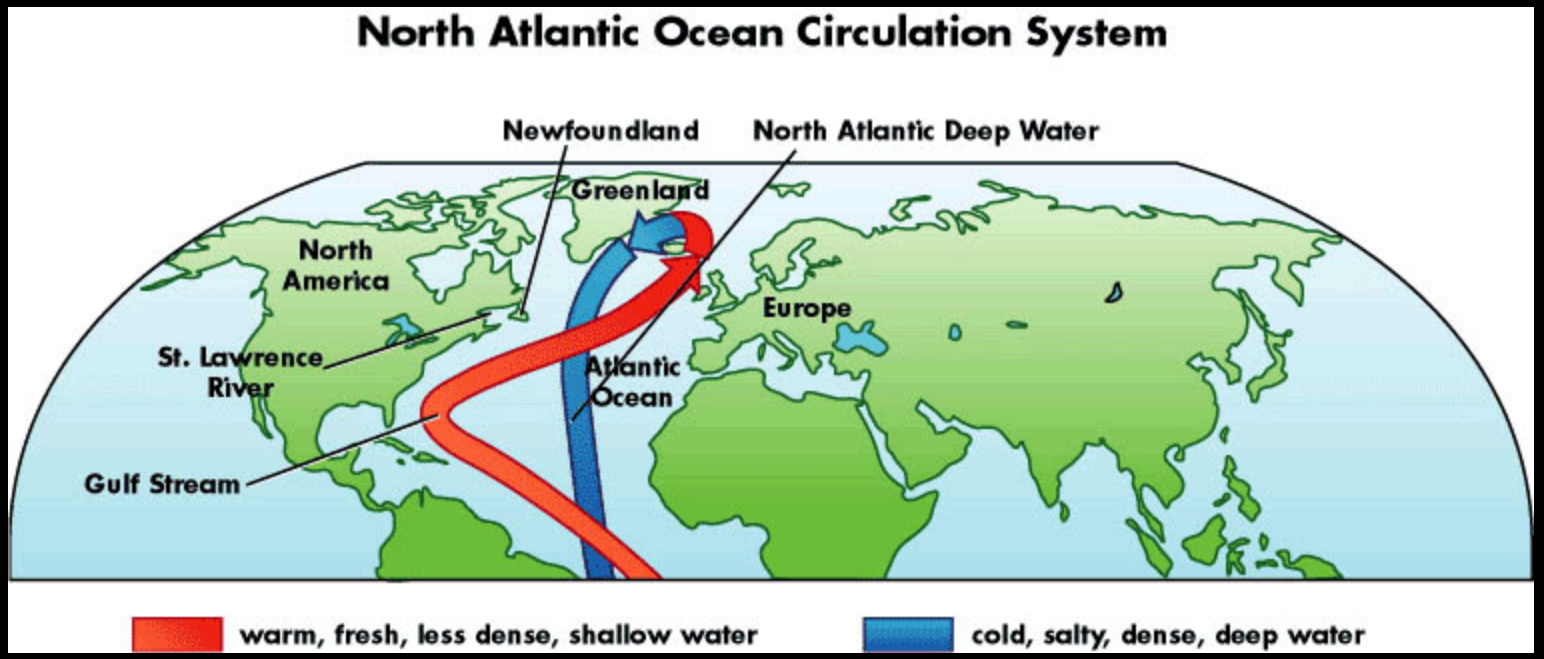
DEEP CIRCULATION

Deep waters are **"formed" where the air temperatures are cold** and where the **salinity of the surface waters are relatively high.**

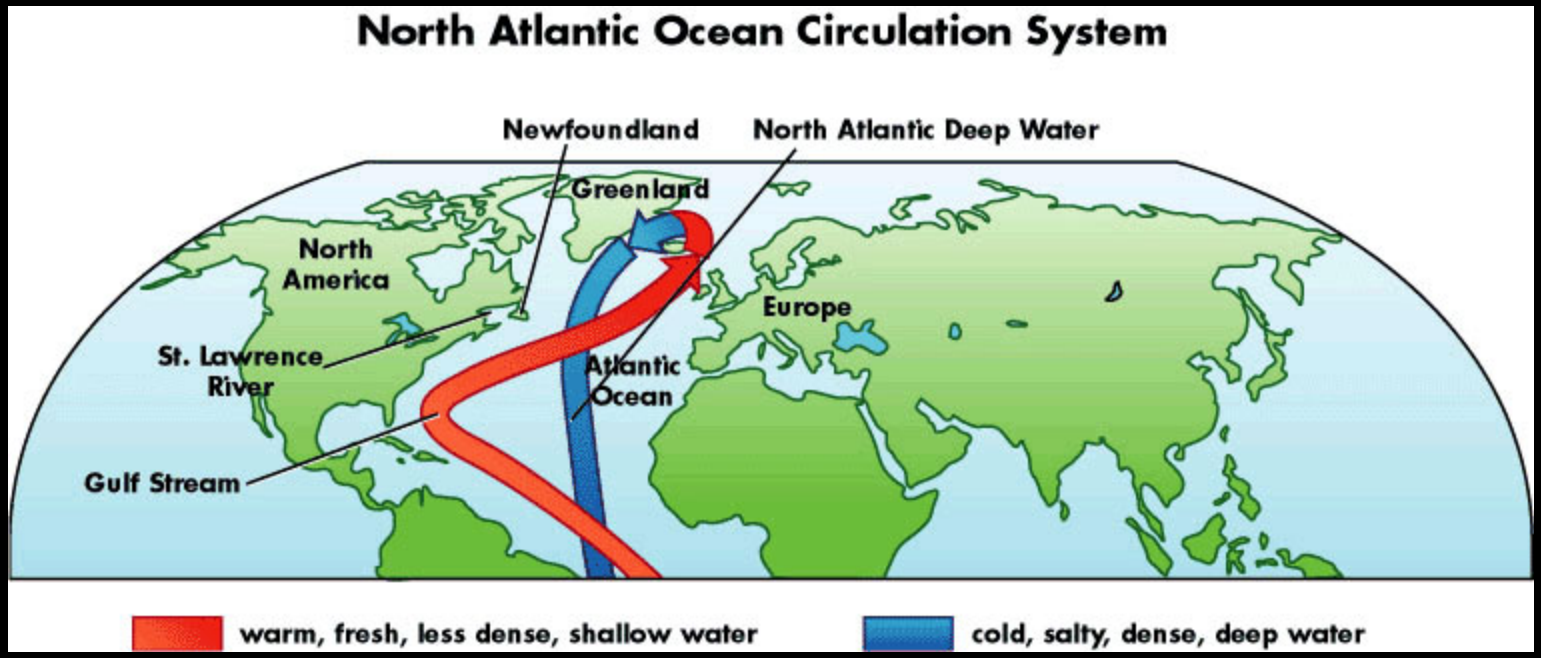
DEEP CIRCULATION

The cooling and the added salt cause the waters to sink in the Norwegian Sea (Off the coast of Greenland).

This is the formation of Atlantic Deep Water.



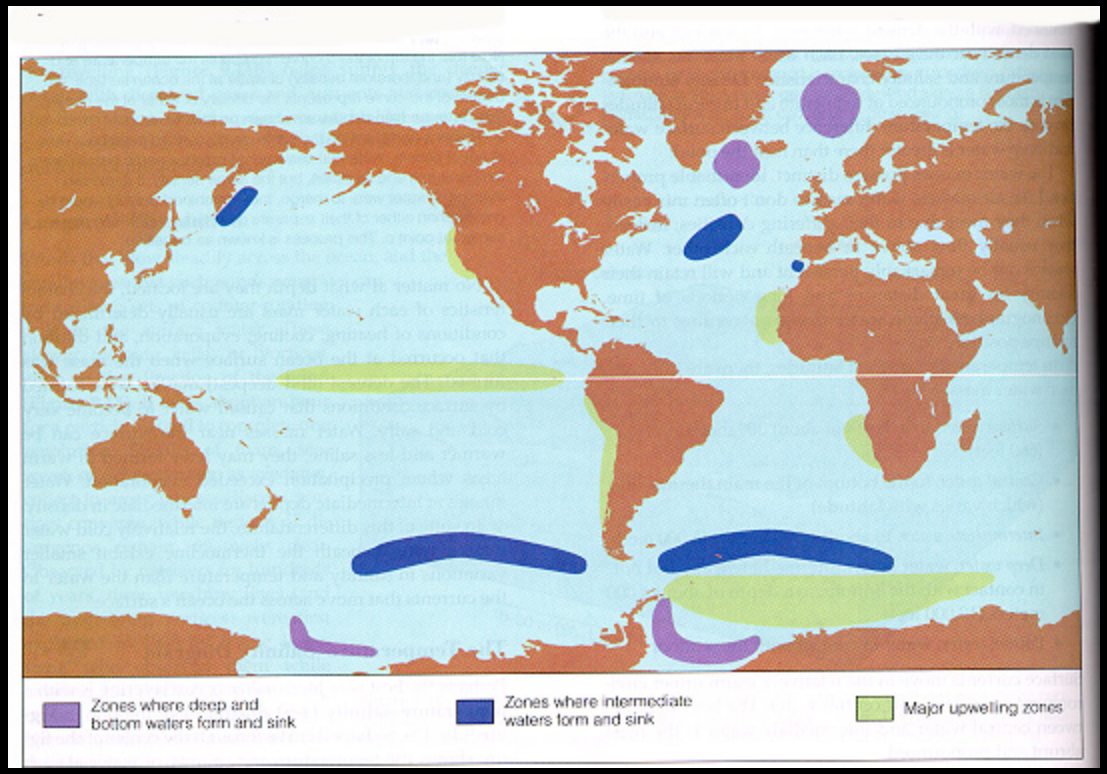
DEEP CIRCULATION



This new deep water can only flow south because it is surrounded by continents.

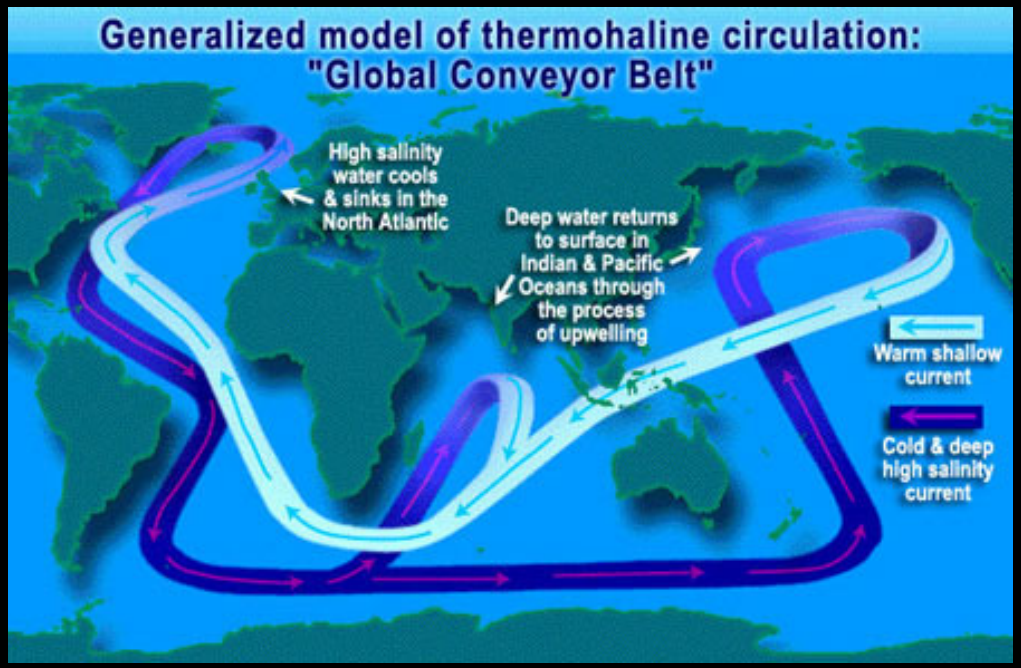
-The water flows past the equator, all the way to the far ends of Africa and South America.

DEEP CIRCULATION



As the current travels around the edge of Antarctica, fresh streams of cold water sink into and recharge the conveyer belt.

DEEP CIRCULATION



Two sections split off and turn northward, on into the Indian Ocean, the other into the Pacific.

Both of these currents warm up and become less dense as they travel…
-eventually rising back to the surface

Surface Circulation

Wind is the most important cause of surface currents.

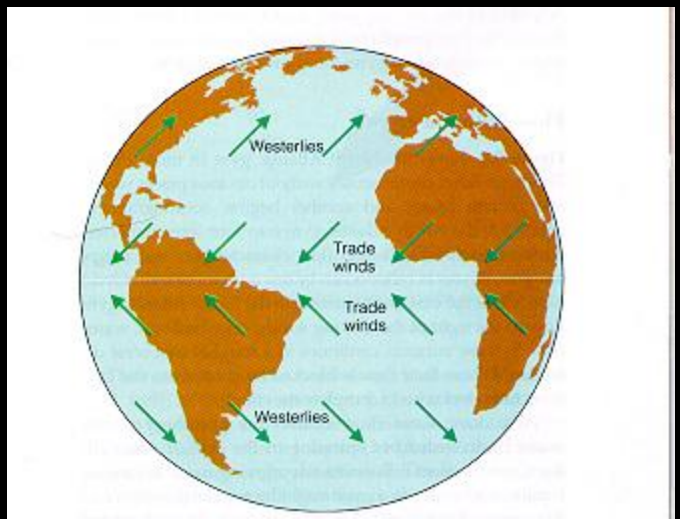
Wind Belts:

-Trade-winds on either side of the equator

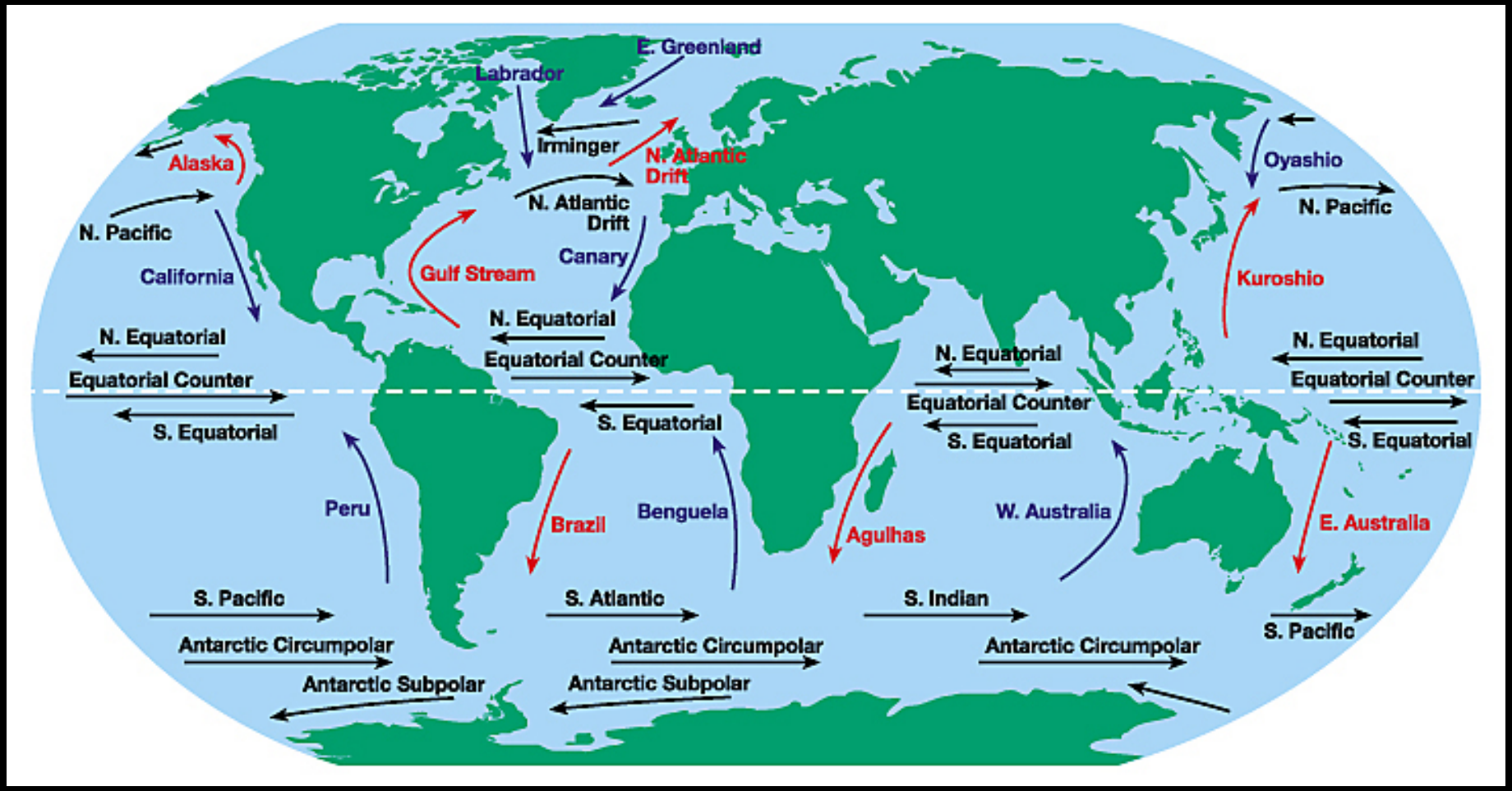
  -blow from the east

-Westerlies in the mid-latitudes

  -blow from the west



Surface Circulation



The worlds largest oil reserves are found in:

a) The Peru Current
b) The California Current
c) The Brazil Current
d) The Gulf Stream
e) The East Australia Current

Which of the following statements about ocean water is correct?

a) As salinity of ocean water decreases density increases.

b) As salinity of ocean water increases density decreases.

c) As salinity of ocean water increases density increases.

The rainshadow effect: the process

The rain shadow effect is a result of orthographic lift. In orthographic lift, mountains act as a barrier to clouds' movement and precipitation is lifted over the mountains. The windward side of the mountain receives plenty of rain, while the leeward side is much drier, resulting in a desert.

1. Water evaporates into the air.
2. Wind pushes clouds toward the mountains. The clouds rise, the air cools and the water vapor condenses.
3. The windward side of the mountains get rainfall.
4. As the clouds come over the mountains, they lose their water, then fall and heat up again, leaving little rain for the leeward side of the mountain.

Where can you find it?

- Sonoran Desert
- Mojave Desert
- Chihuahuan Desert
- Great Basin Desert

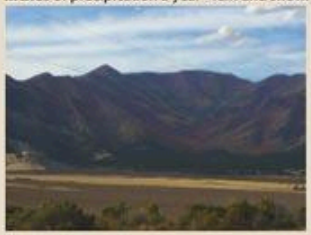
NOTE: This effect can also be seen to a lesser extent in other places in the U.S.

The deserts that are left behind...

Due to irrigation, the **Sonoran Desert** has many fertile agricultural areas. It is the hottest of the North American deserts, with the most biological diversity. Parts of the desert receive **10-12 inches** of rain a year.

The **Chihuahuan Desert** is the largest desert in North America and most of it lies south of international borders. It has cool summers and extermely hot summers, receiving less than **10 inches** of rainfall a year.

The **Great Basin** is the largest desert in the United States. It is usually cold due to high latitude and elevation. It gets about **7-12 inches** of precipication a year - rain and snow.



The **Mojave Desert** recieves less than **6 inches** of rain a year due to the rain shadow effect created by the Sierra Nevada and other mountain ranges within the desert.

Infographic by: Lindsay Dubois Sources: Wikipedia, Desert USA