Geography Class 20

REVISION OF THE PREVIOUS CLASS (9:13 AM):

- Different layers as per **chemical composition:** Homosphere and Heterosphere.
- The homosphere will have a uniform composition of gases, unlike the heterosphere.
- Different layers as per **thermal classification:**
- **Troposphere:** The vertical and horizontal winds facilitate the intermixing of the air.
- **Stratosphere:** Temperature in the stratosphere rises with increasing altitude due to the presence of the ozone layer.
- **Mesosphere:** This layer observes a drop in the temperature with the increase in height.
- **Thermosphere:** It is the outermost layer of the atmosphere that exhibits a negative lapse rate and is further divided into the ionosphere and exosphere.
- The layer of mesopause that divides the inner atmosphere from the outer atmosphere is called as **Karman Layer/Karman Line.**
- The amount of insolation received by the earth depends upon the angle of the sun's rays, albedo, length of the day, etc.

Doubts redressal:

- Mesosphere has no ozone layer to trap radiation, hence
- The tilt of the earth and the length of the day affect the amount of insolation and the difference between apogee and perigee is not that significant factor.

HEAT BUDGET (9:35 AM):

- On the global scale, the Earth must re-radiate as much heat back to space as it receives.
- This is necessary to maintain a uniform temperature on the earth.
- The ~~record of the~~ gains and losses in heat by way of incoming solar radiation and outgoing terrestrial radiation is called the heat budget.
- On a long-term basis, the earth neither stores the insolation forever nor releases its own heat forever.
- Hence, the earth has a balanced heat budget.
- That means that the total insolation received is equal to the total heat released from the exosphere to space.
- If the total insolation received by the earth is 100 units.
- 65 units get absorbed by the earth and 35 units get scattered back.
- Out of these 35 units, 27 units will be reflected by clouds, 2 units will be reflected by the earth's surface and 6 units will be scattered in the atmosphere.
- Out of the 65 units absorbed, 51 units will be absorbed by the earth's surface and 14 units will be absorbed by the atmosphere.

Reflection back to the space:

- The 51 units absorbed by the earth are emitted back.
- Out of these 51 units, 17 units will not be absorbed by the atmosphere(greenhouse gases) and will escape directly into space.
- The rest 34 units(51-17) will be absorbed by the greenhouse gases.
- The atmosphere already had 14 units(65-51), and along with the absorbed 34 units, the atmosphere now has 48 units.
- These 48 units will be gradually and slowly released by the atmosphere into space to complete the heat budget.
- The Earth hence stores 65 units of insolation-(51 units for heating the earth’s surface, and 14 units for heating the atmosphere directly).
- Hence terrestrial radiation has more role in heating the atmosphere.

Incoming insolation:

- 100 units.

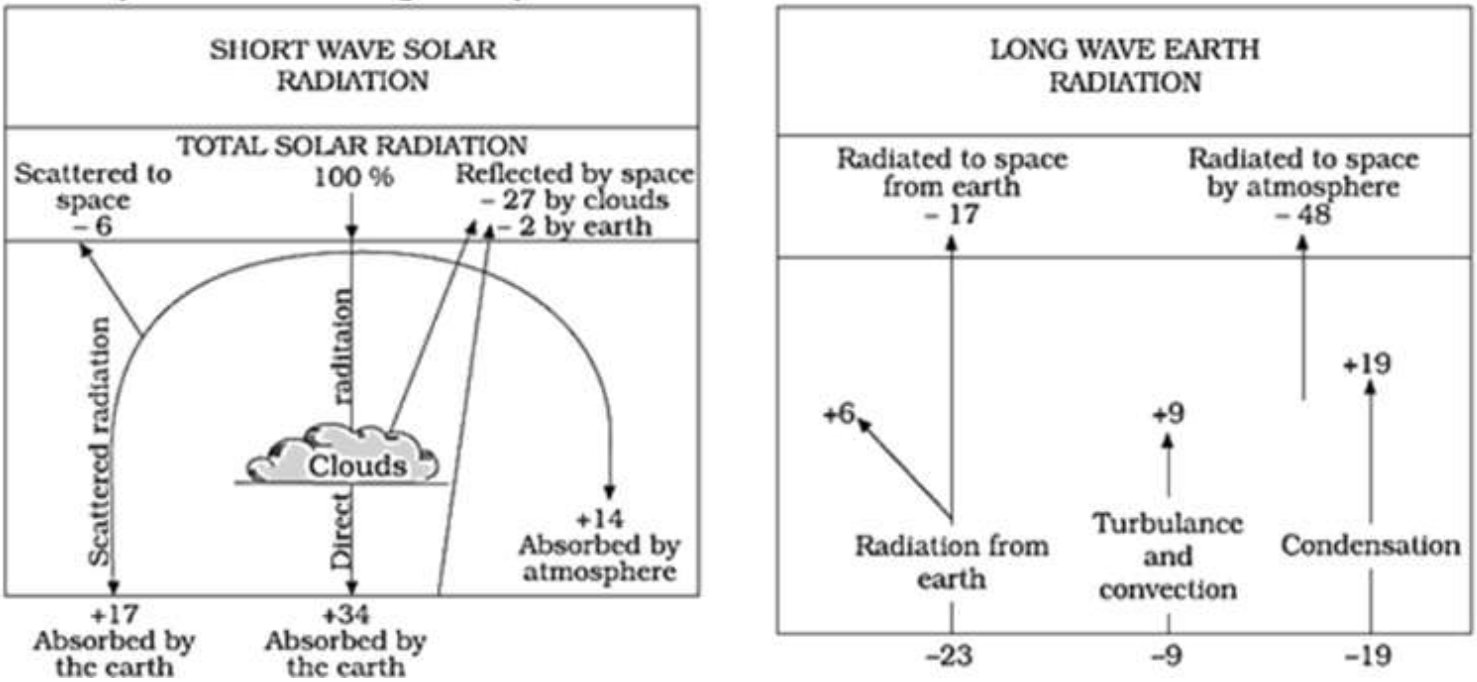
Outgoing insolation:

- I. 27 units are sent back by the clouds by reflection.
- II. 2 units are sent back by the surface through reflection
- III. 6 units are sent back through scattering.
- IV. 17 units are sent back by the surface to the space.
- V. 48 units got gradually released by the atmosphere.
- I + II + III + IV+V= 100 units.

Effect of greenhouse gases:

- Modern human activities increase this time lag of releasing the trapped energy leading to global warming.
- The greenhouse gases in the atmosphere hold the heat in the atmosphere, hence more greenhouse gases will mean more heating of the atmosphere, causing global warming.
- Greenhouse gases are able to absorb only the long-wave terrestrial radiation and not the short-wave radiation from the sun.

Atmospheric heat budget as per NCERT:



Short wave insolation:

- Total insolation of 100 units.
- Scattered to space= 6 units.
- Reflected back to space= 27 units by clouds, 6 units by the earth.
- Scattered radiation absorbed by the earth= 17 units.
- Direct radiation absorbed by the earth= 34 units.
- Absorbed by the atmosphere=14 units.

Long wave radiation from the earth

- Radiated from the earth= 23 units (6 to atmosphere, 17 to space).
- Turbulence and convection= 9 units.
- Condensation= 19 units.
- Radiated to space by atmosphere 48 units.

ALBEDO (10:00 AM):

- It is the ratio between the reflected and incident amount of solar radiation(insolation).
- It is also called the **reflection coefficient.**
- The average albedo of the entire earth is 35 % or 0.35.
- Areas with fresh snow, areas with cloud cover, etc. would have a very high albedo.
- Areas with fresh asphalt will have the lowest albedo.
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Surface	Typical Albedo
Fresh Asphalt	0.04/ 4%
Open Ocean	0.06
Warm Asphalt	0.12
Conifer Forest (in summer)	0.08 to 0.15
Deciduous Trees	0.15 to 0.18
Bare Soil	0.17
Green Grass	0.25
Desert Sand	0.4
New Concrete	0.55
Ocean Ice	0.5-0.7
Fresh Snow	0.8-0.9

No need to remember numbers but need to remember order

- Deciduous trees have a higher albedo than coniferous trees because deciduous trees have larger size leaves.
- Students must focus more on the order of substances with albedo, rather than remembering their albedo numbers.

Arctic Amplification:

- This is a phenomenon under which the rate of increase in temperature in the Arctic region is around 3 degrees Celsius more than that we see in the rest regions.
- This is because the Arctic sees the replacement of the melted ice by ocean water which has lesser albedo(so more absorption).
- This is not seen in the Antarctic because the Antarctic is very large and has a continent below it, so the rate of replacement is slower.
- The Arctic has only water and ice.

Temperature:

- The degree of hotness or coldness of a body is called temperature.

Factors affecting temperature:

I. Insolation: Higher insolation would mean higher temperatures.

- Insolation depends upon latitude, transparency of the atmosphere, and length of the day.
- This is why tropical regions experience higher temperatures than polar regions.
- The Equator does not see the highest temperature because it sees cloud cover and precipitation on a daily basis.
- This is despite the fact that the equator receives vertical sun rays throughout the year.
- So the highest temperature will be seen around sub-tropics.

II. Altitude:

- Temperature decreases with an increase in altitude due to the normal lapse rate.

III. Albedo:

- Higher albedo would mean lower absorption of heat and a lower temperature.

IV. SPECIFIC HEAT/NATURE OF THE SURFACE (10:30 AM):

- Earth's surface behaves differently depending on the specific heat of the material on which insolation falls.
- Land surface with a lower specific heat heats up more rapidly and more intensely than water surface.
- The land also cools more rapidly.
- Water has more specific heat/specific heat capacity than land.
- Specific heat refers to the amount of energy required to raise the temperature of 1 kg of any substance by 1 degree Celsius.
- It is also the heat released when 1 kg of any substance sees its temperature decrease by 1 degree Celsius.

V. Continentality:

- The locations which are in the interior of the continents experience a higher range of temperatures than coastal locations.
- **For Example,** Delhi experiences hotter summers and colder winters than Mumbai.

VI. Distribution of the continents:

- The Northern Hemisphere with more proportion of land than oceans experiences more extreme temperatures than Southern Hemisphere.

VII. Winds:

- They transport the temperatures prevailing in one area to another.
- **For example-** Planetary winds.

VIII. Ocean Currents:

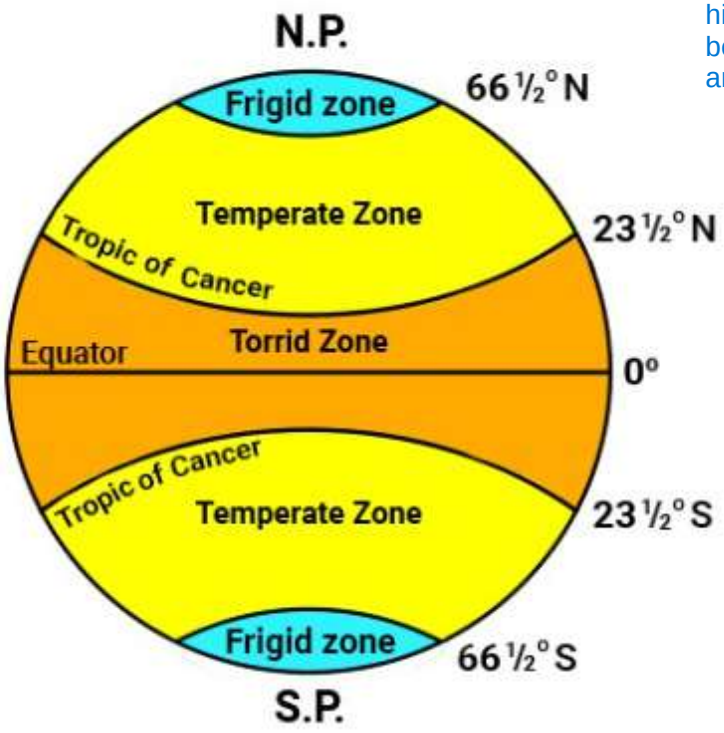
- They transport warm waters from equatorial to polar regions and cold waters from polar to equatorial regions.
- Hence, they help in the global distribution of temperature.

AACDIOSW is code for remembering factors affecting temperature

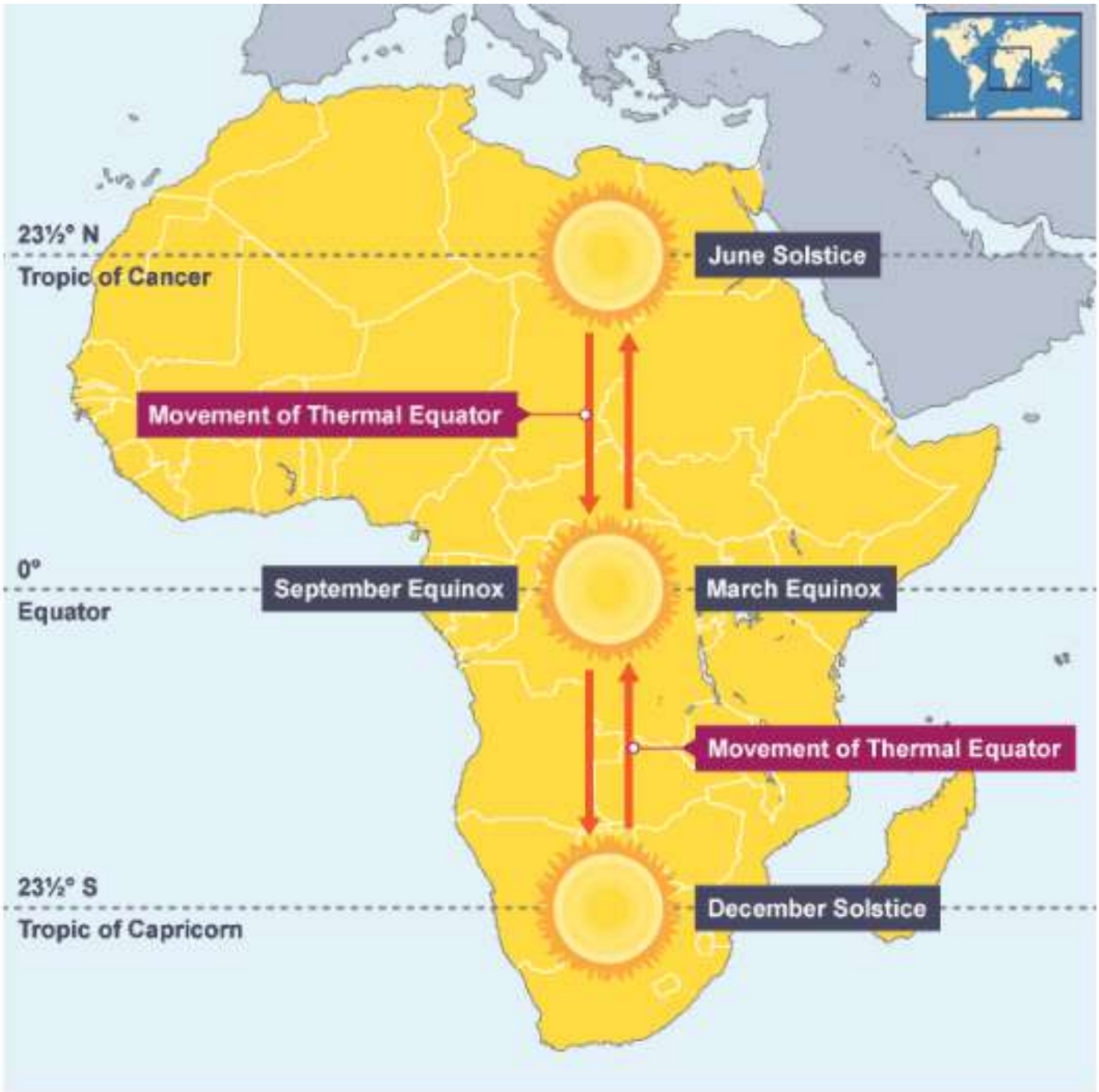
DISTRIBUTION OF TEMPERATURE (11:10 AM):

- The earth is divided into:
- **Torrid zone**-high temperatures
- **Temperate Zones-** moderate temperature
- **Frigid Zone**- Low temperature

23.5 to 40 is sub tropic region where high temperature can be seen because in Torrid zone clouds exist and rainfall happens oftenly.

- 

- **Isotherms** refer to the imaginary line that joins the places with equal temperatures.
- Isotherms are used to study temperature distribution along the earth.
- The positions of isotherms over the earth's surface can be analyzed to conclude about the seasonal variation of temperature.
- Isotherms move Northwards between January to July.
- Isotherms move Southwards between July to January.
- The **Thermal Equator** shifts north or south of the equator with the apparent movement of the sun.


23½° N
Tropic of Cancer
June Solstice
Movement of Thermal Equator
0°
Equator
September Equinox
March Equinox
Movement of Thermal Equator
23½° S
Tropic of Capricorn
December Solstice

ISOTHERM MOVEMENT DUE TO OCEAN-LAND DIFFERENCE (11:30 AM):

- We see different behavior of isotherms over adjacent land and ocean because of differences in specific heat capacity.
- **For the Northern Hemisphere:**
- Isotherms bend poleward over the oceans in January(Winter).
- Isotherms bend equatorward over the oceans in July(Summer).

For the Southern Hemisphere

- Isotherms bend equatorward over the oceans in January(Summer).
- Isotherms bend polewardward over the oceans in July(Winter).

Temperature:

- Temperature simply refers to the hotness/coldness of any substance.

Related terminologies:

- It is usually measured in degree Celsius or Fahrenheit, but the standard unit is Kelvin.
- It is measured with a thermometer.
- The highest temperature is experienced around 1 PM or 2 PM, but not just at 12 PM because the ground does not start releasing the trapped heat immediately.
- The lowest temperature of the day will be experienced just before sunrise.
- This is because as soon as the sun sets, the earth starts releasing the trapped heat, which causes the atmosphere to cool down eventually
- This release of heat would have been at maximum level late at night, just before sunrise when insolation will start again.
- **Mean Daily Temperature:** (Sum of the 24 hours temperatures)/ 24. added for every hour
- **Mean Monthly Temperature:** (Sum of Mean Daily Temperatures of 30 days)/30.
- **Diurnal Temperature:** Difference between the highest temperature of the day and the lowest temperature of the day.
- **Annual Range of Temperature:** It is obtained by subtracting the lowest mean monthly temperature from the highest mean monthly temperature of the year.
- It is not obtained by subtracting the highest and lowest temperatures achieved in a year.

- **Al Aziziya of Libya** claimed to have recorded the highest temperature on the Earth at 58 degrees Celsius; not verified by the **World Meteorological Organization**.
- **Death Valley** USA recorded the highest temperature at 56.7 degrees Celsius.
- The lowest temperature on the earth was measured at the **Vostok Station of Antarctica** at -88 degrees Celsius.

Range of temperature:

- The range of temperature increases from the equator to the poles.
- Near the equator, the temperature range is low, because the length of the day remains the same.
- As we move towards the poles, the differences between summer and winter temperatures are high.
- **For example-** Siberia has an average summer of 25 degrees Celsius and an average winter temperatures of -40 degrees Celsius.
- Seasons are less marked in Southern Hemisphere than in the Northern Hemisphere due to the higher expanse of oceans.

i.e. temperature variation is less here

MAPPING EXERCISE AFRICA (12:00 PM):

- The oceans surrounding Africa are the Atlantic Ocean and the Indian Ocean.
- The Southern Ocean does not surround Africa because it starts at 66 degrees South latitude and Africa lies well above it. eliminates at around 35 degree south latitude
- Africa is connected with Asia through land at the **Sinai Peninsula:**

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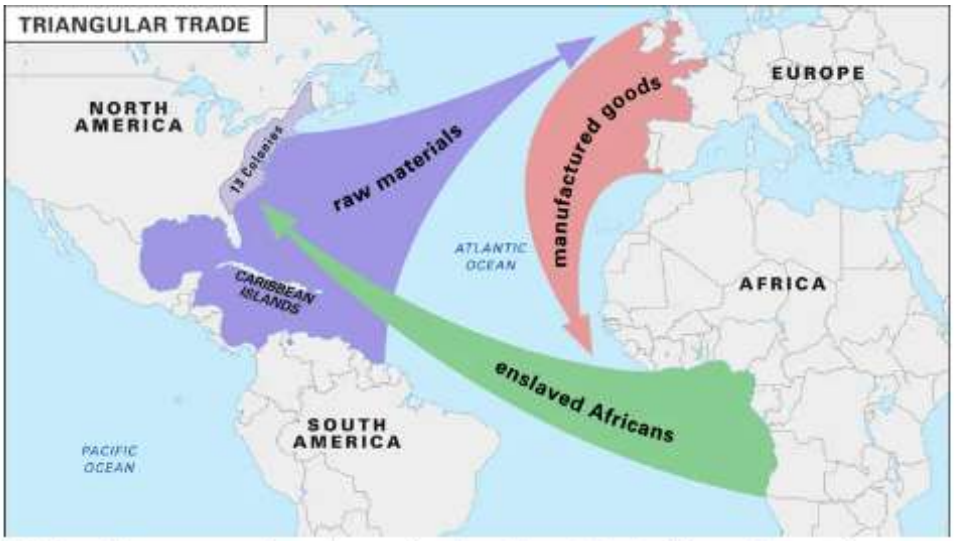
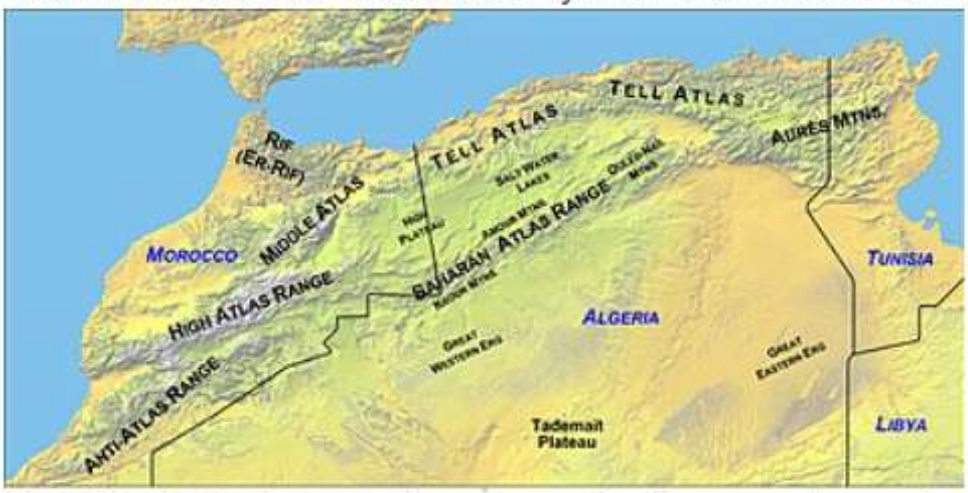
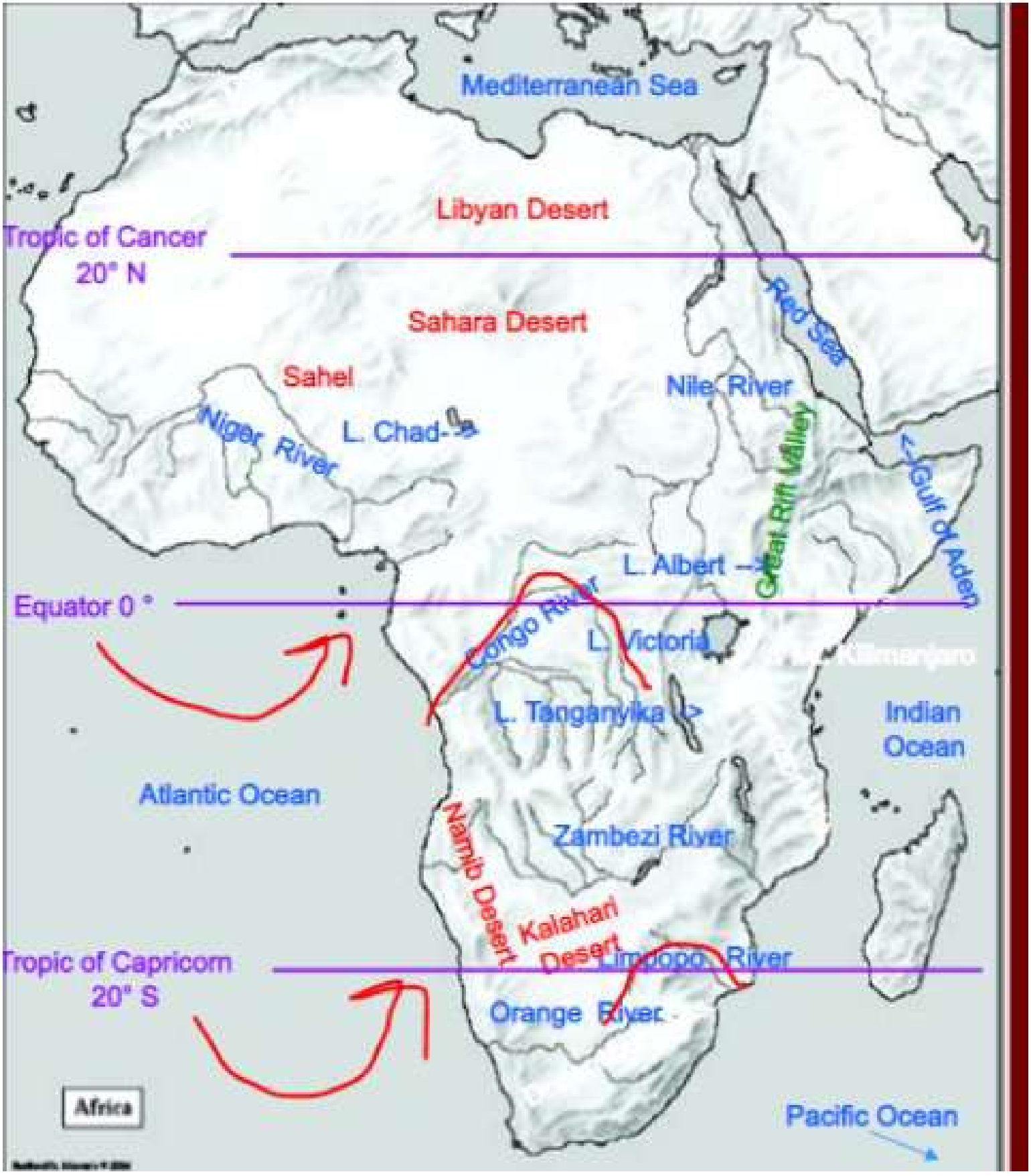
- Africa was referred to as the **Dark Continent** because of its unexplored nature.
- Much of Africa has very difficult terrain, and most colonial demands were met through the ports only like the slave trade.

- 

- Africa has remained geologically stable for a long time.
- **The Atlas Mountains** are the only fold mountains of Africa.
- 

- **The Nile** is the longest river on earth with more than twice as long as the **Brahmaputra,** at ~~6500 km.~~ 6650km
- It crosses both equator and the Tropic of Cancer, before ending in the Mediterranean Sea.


Mediterranean Sea
Libyan Desert
Tropic of Cancer
20° N
Sahara Desert
Red Sea
Sahel
Nile River
Niger River
L. Chad
Great Rift Valley
Gulf of Aden
L. Albert
Equator 0 °
Congo River
L. Victoria
Mt. Kilimanjaro
L. Tanganyika
Indian
Ocean
Atlantic Ocean
Zambezi River
Namib Desert
Kalahari
Desert
Limpopo River
Tropic of Capricorn
20° S
Orange River
Africa
Pacific Ocean

- Africa also has the largest desert in the world- the Sahara desert.
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- The highest point in Africa is Mount Kilimanjaro in Tanzania.

- The lowest point in Africa is at the **Lake Assal of Djibouti.**
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The topics for the next class are Temperature Inversion, Pressure, and Winds.