Geography Class 21

REVISION OF THE PREVIOUS CLASS (9:16 AM):

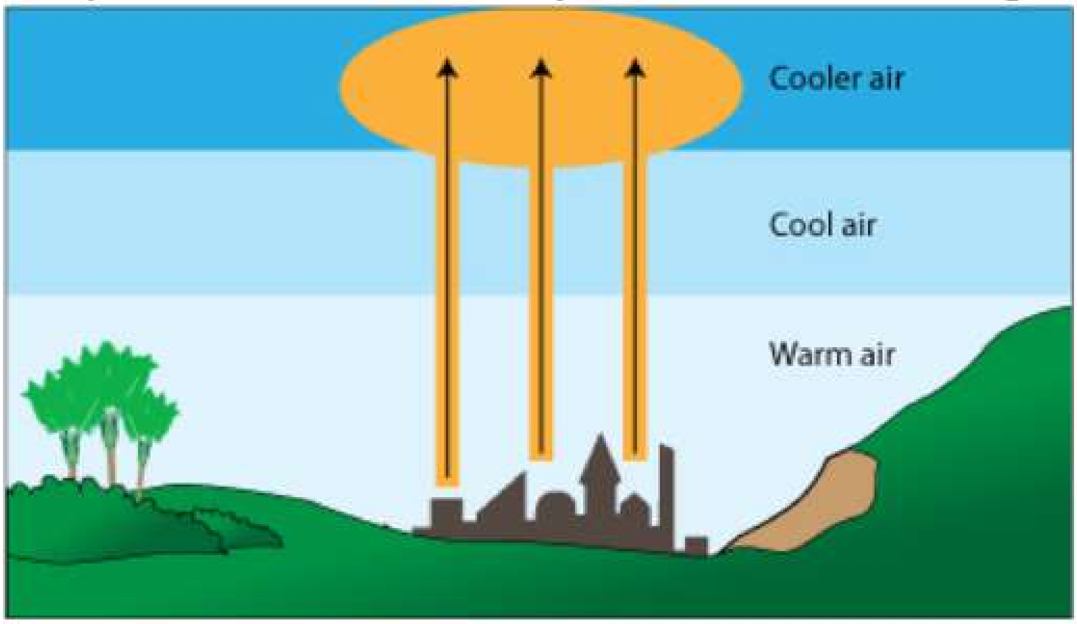
- On the global scale, the Earth must re-radiate as much heat back to space as it receives.
- This is necessary to maintain a uniform temperature on the earth.
- The record of the gains and losses in heat by way of incoming solar radiation and outgoing terrestrial radiation is called the **heat budget.**
- **Albedo** is the ratio between the reflected and incident amount of solar radiation(insolation).
- It is also called the **reflection coefficient.**
- The temperature will be affected by- Insolation, altitude, albedo, specific heat/nature of the surface, continentality, distribution of landmass, winds, and ocean currents.
- **Isotherms** refer to the imaginary line that joins the places with equal temperatures.
- 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

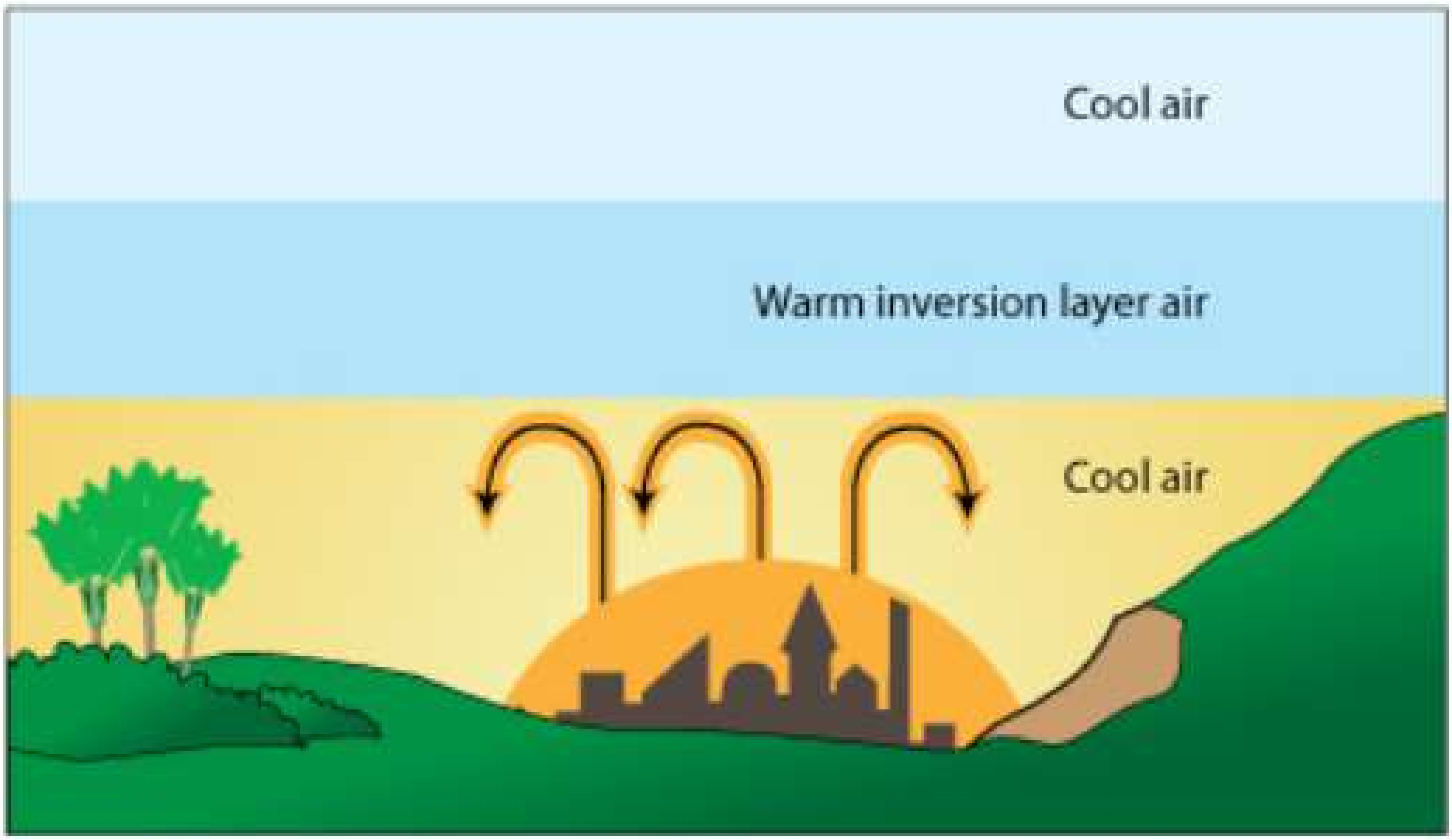
- Isotherms bend equatorward over the oceans in January(Summer).
- Isotherms bend polewardward over the oceans in July(Winter).

Temperature inversion:

- The average rate of decrease in temperature with an increase in altitude is called the **Normal Lapse Rate.**
- According to the Normal Lapse Rate, temperature decreases with the increase in altitude i.e. 6.5 degrees Celsius fall with every km.
- Under certain conditions in the atmosphere, the normal lapse rate may get reversed, so that the temperature increases with the altitude.
- This phenomenon is called **Temperature Inversion** or **Negative Lapse Rate.**



Normal pattern



Thermal inversion

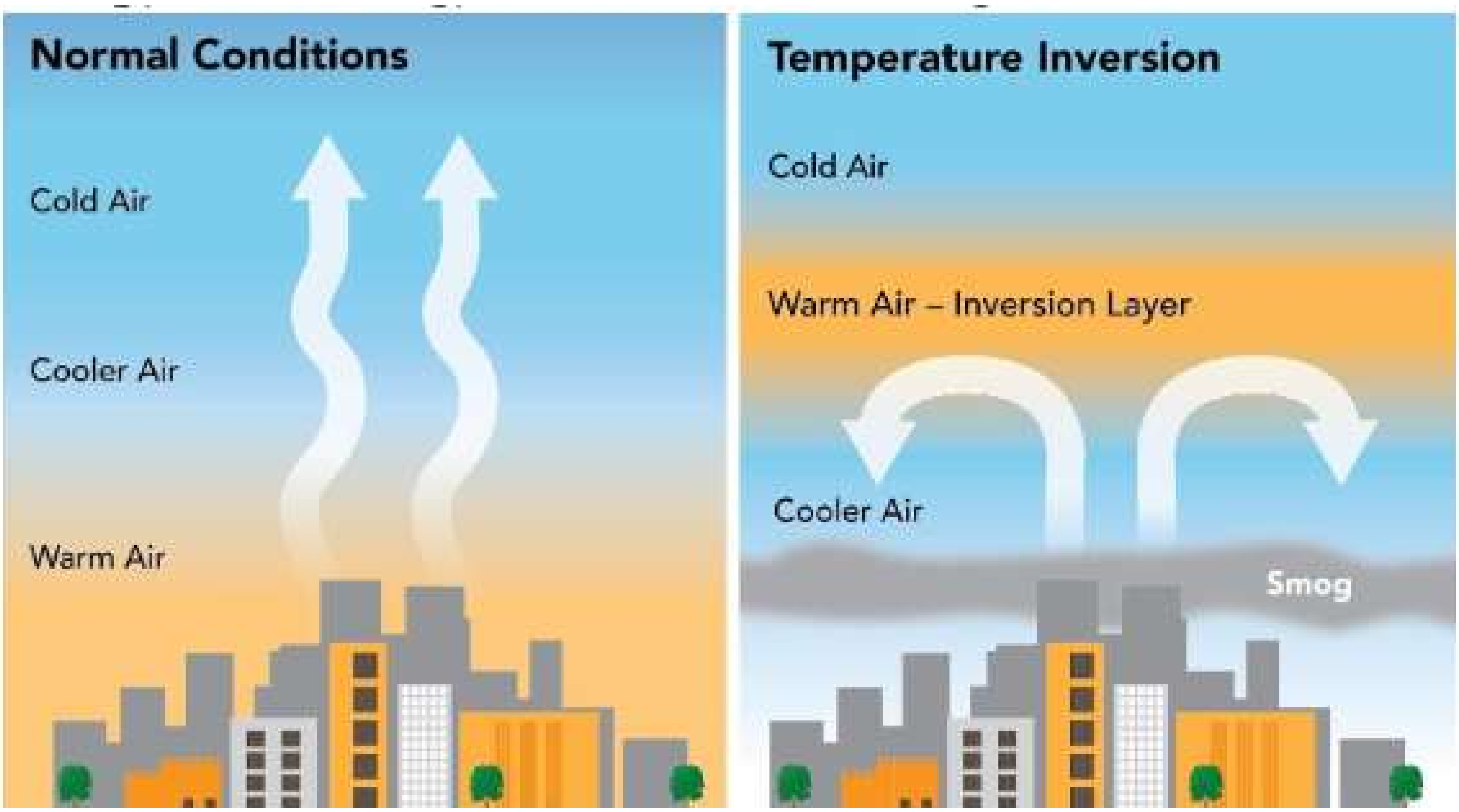
Types of temperature inversion:

I. Radiational Inversion

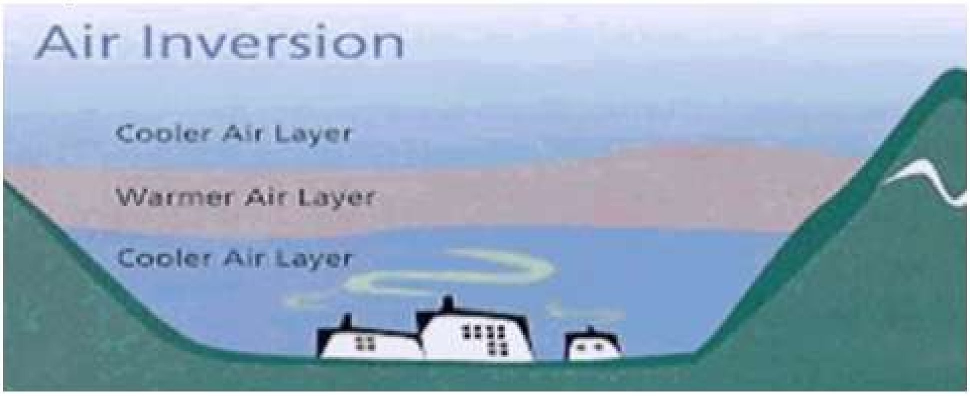
- This is also called **Ground Inversion** or **Non-Advection Inversion.**
- During the long winter nights, the coldness of the ground surface results in the cooling of the air parcel that comes in contact with it.
- The land surface radiated heat more rapidly during the night.
- During this cooling of the layer closer to the ground surface, it becomes heavier and settles down, also that the layer above it remains warmer than this layer.
- It is more common over northern plains during winters.

Pre-requisites of ground inversion

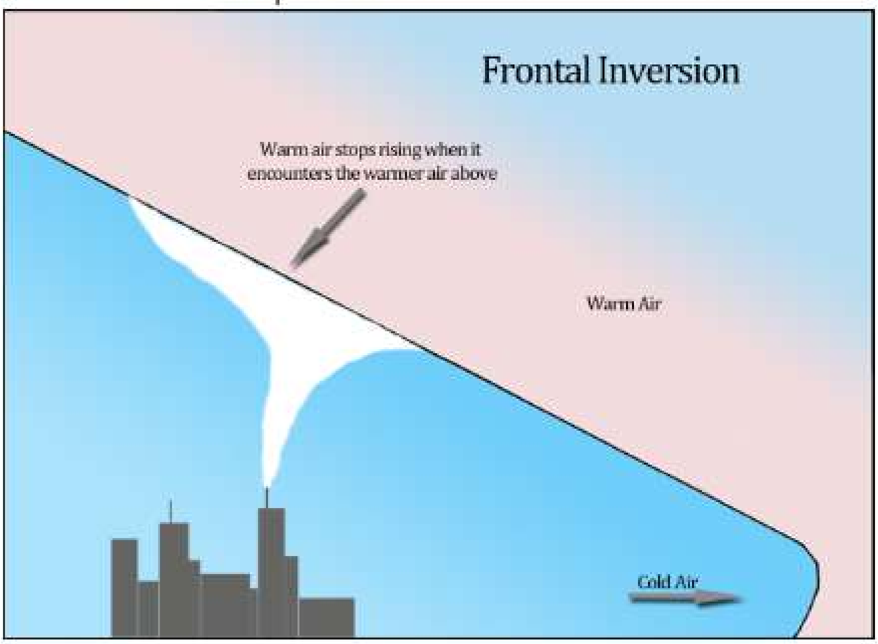
- **Cold ground surface -** During the long winter nights, the excessive release of long waves of terrestrial radiation makes the possibility of a cold ground surface.
- **Long winter nights:**
- Winters shall have longer nights facilitating the loss of heat through the ground surface through terrestrial longwave radiation.
- **Cloudless clear sky -** The presence of clouds shall reflect the terrestrial radiation to the ground surface retaining the heat.
- **Dry air -** The absence of water vapor is necessary as it is a greenhouse gas with the potential to trap heat.
- **Effect of Radiation Inversion:**
- It can cause pollutants to remain in the air for a longer time.
- **Smog**(Smoke + Fog) can be formed or strengthened.


Normal Conditions
Cold Air
Cooler Air
Warm Air
Temperature Inversion
Cold Air
Warm Air – Inversion Layer
Cooler Air
Smog

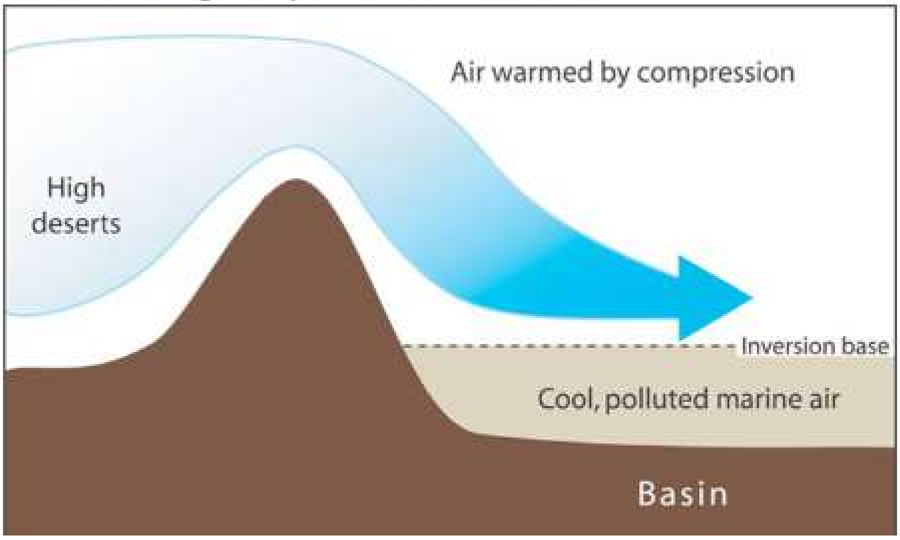
II. AIR-DRAINAGE INVERSION (9:45 AM):

- In the hilly areas, the mountain slopes and the hills experience a rapid fall in the temperature during the night.
- However, the valley sides and floor remain warmer due to radiation exchange.
- The cooler and denser air of the hills start to sink to the valley floor due to gravity.
- The upper slopes of the mountains cool faster because it loses heat by emitting longwave terrestrial radiation at a faster pace than the valleys.
- This results in a cold dense layer of air formed at the mountain surface to be pulled down to the valleys under the influence of gravity.
- The warmer air in the valley gets displaced by the colder air producing temperature inversion.
- 

Frontal inversion:

- It is caused due to frontal convergence of air masses.
- An air mass is a large volume of air that usually has uniform temperature and moisture.
- An air front can be understood as a boundary between two air masses of different temperatures.
- The warmer air is forced from the ground by undercutting the cold air.
- This causes temperature inversion where the warm air is lying above the cold air.
- 

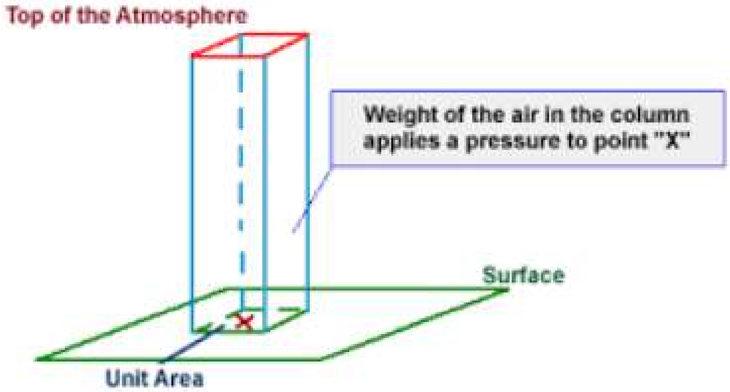
Advection Inversion:

- It is produced when a thick layer of warm air passes over cold water surface or land creating temperature inversion.
- 

Significance of temperature inversion:

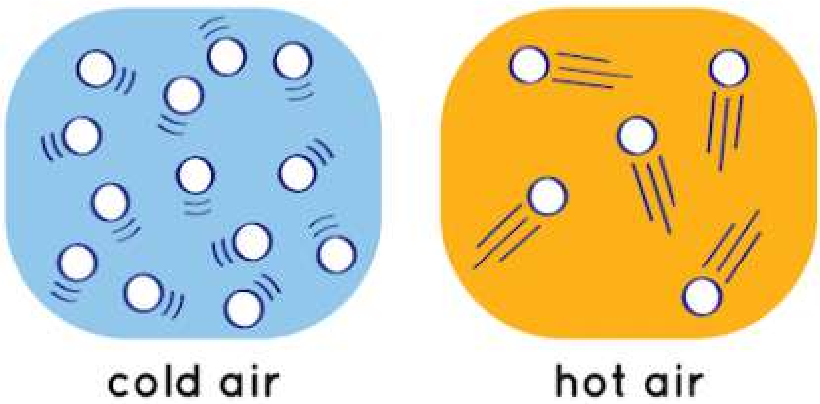
- Temperature inversion prevents convection and creates stability in the atmosphere.
- This prevents cloud formation and precipitation.
- The temperature inversion results in stable and calm conditions near the surface.
- Because of lower temperatures near the surface, the conditions are favorable for the creation of **fog.** cold air condensed and formation of fog happens which will not go up due to temp. inversion.
- Stable air conditions reduce wind activity.
- This prevents the distribution of air pollutants in urban areas-as we see in winter in Delhi due to Diwali + Stubble burning.
- Smoke and other air pollutants react with fog and cause the formation of **Smog** which is very hazardous and prevents sunlight from reaching the surface.
- Smog also prolongs the temperature inversion conditions.
- The cold air that reaches down the mountain valley is very cold and has the potential to cause dew, fog, and frost.
- This can destroy crops and is harmful to any human settlement.
- This is why we see human settlements and plantations on slopes and not on valley floors.
- **For example-** the apple orchards of Uttarakhand & Himachal, Coffee Plantations of Brazil, etc.

AIR PRESSURE (10:15 AM):

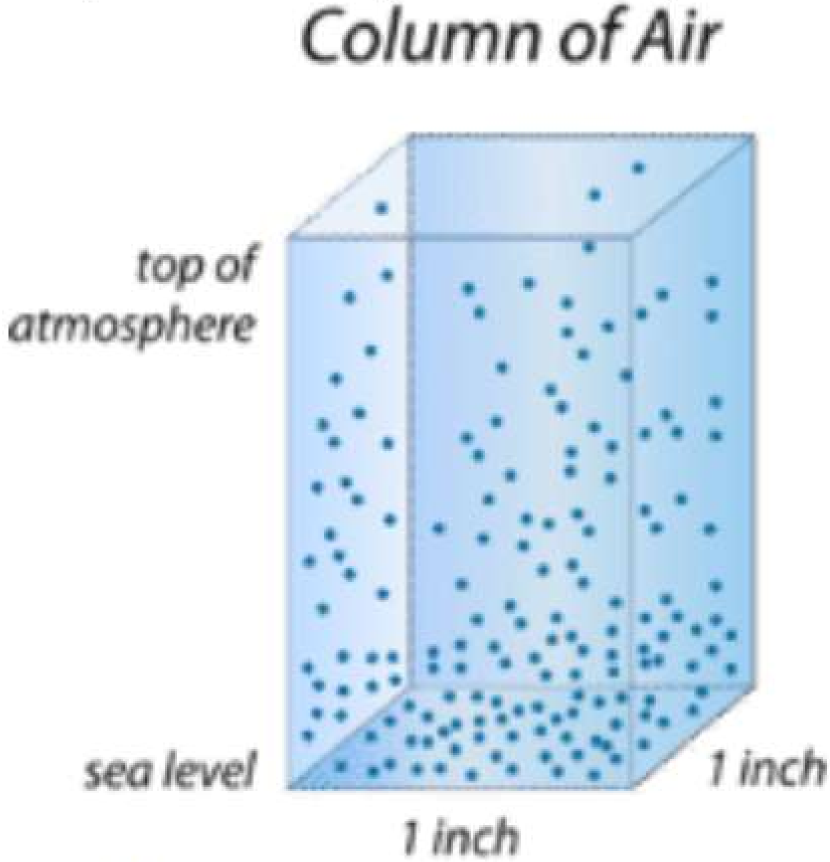
- Pressure is the force experienced per unit area.
- Atmospheric pressure is the pressure exerted by the earth's atmosphere on the surface.
- 

- The average atmospheric pressure near sea level is near 1013 millibars.
- Pressure is measured by a **barometer.**
- **Isobar** is a line that connects places with uniform pressure.

Factors affecting air pressure:

- **Temperature:**
- An increase in the ~~air~~ temp. causes the air to get heated and it expands as the outward pressure of the molecules is spread over a larger area.
- Therefore, the pressure of air decreases.
- When the air is cooled, it contracts which causes an increase in pressure.
- 

ALTITUDE (10:45 AM):

- The pressure of air at ground level is higher than that of the air at a higher altitude.
- 

- When the air rises through **convection,** its volume increases and pressure decreases.
- When the air sinks through subsidence, its volume decreases, and pressure increases.

Rotation:

- The rotation of the earth causes air at the poles to be thrown away towards the equator.
- This air expands and the pressure drops.
- The air from both poles piles up along the equator, which increases the pressure.
- This effect is observed if we consider only the impact of rotation.

PRESSURE BELTS (11:15 AM):

- Air rising at the equator due to high temperature causes expansion, resulting in the development of a **low-pressure belt at the equator.**
- Rising air at the equator spreads out as it reaches the top of the troposphere and moves toward the poles.
- As this air converges towards the polar region, its density increases and it begins to sink- subsidence.
- This subsidence causes a high-pressure belt at **30 Degrees North and South of the equator.**
- Some of the high-pressure air moves toward the equator and some toward the poles.
- The air moving toward the equator replaces the air rising there.
- This causes the completion of a cell.
- Low temperatures at the **poles** result in the contraction of air and the development of **high pressure.**
- The air blowing away from the poles as a result of rotation spreads out to greater space and the pressure falls, leading to a **low-pressure belt along 60 degrees North & South of the equator.**
- Some of the air from a sub-tropical high-pressure belt reaches 60 degrees north & south and converges with the air from the poles leading to convection along 60 degrees North and South.

Thermally-induced pressure belts:

- They are formed due to incoming solar radiation.
- They are- the Equatorial low-pressure belt and the Polar high-pressure belt.

Dynamically-induced pressure belts:

- They are formed due to the rotation of the earth.
- They are- Subtropical high-pressure belts and Sub-polar low-pressure belts.
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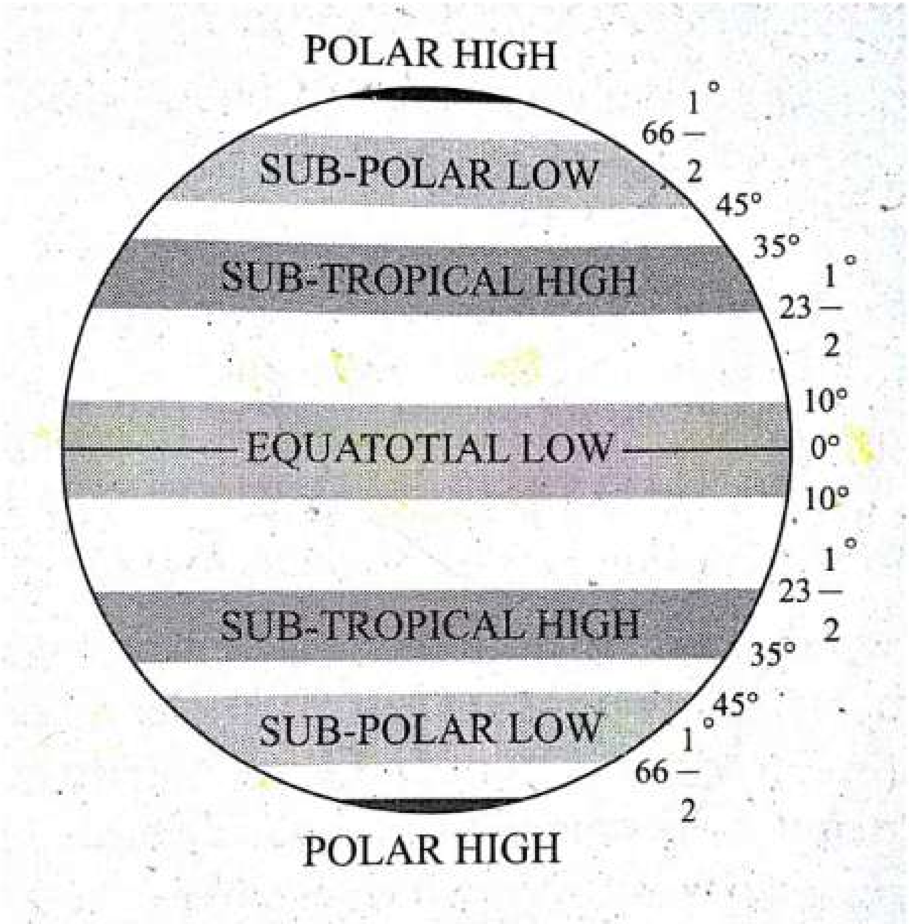
- 

Pressure Belts

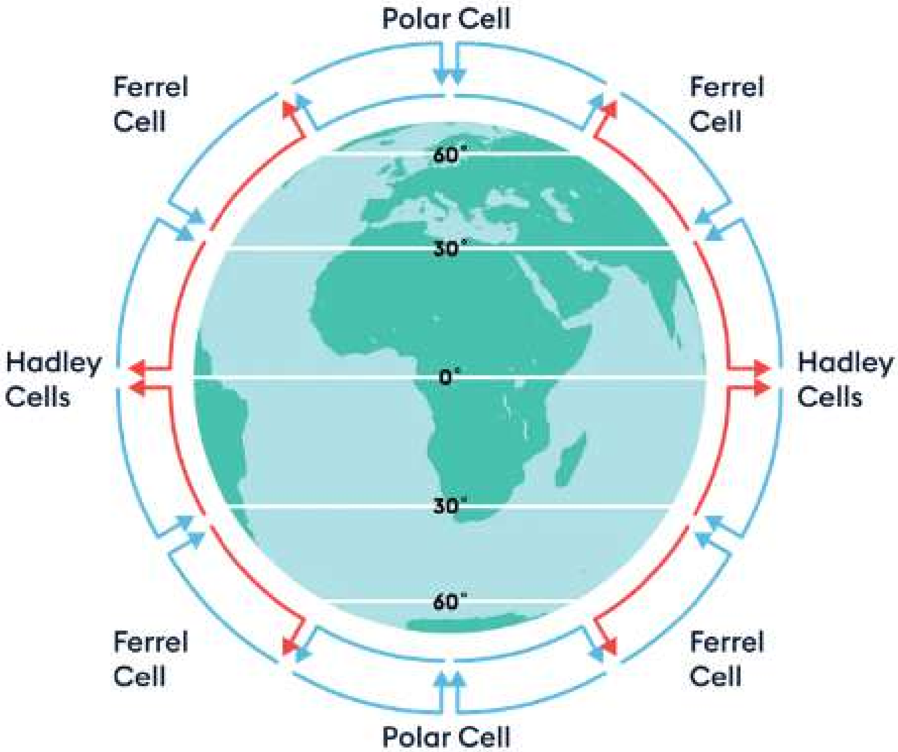
Hadley Cell:

- The cell is formed in the region of the belt of trade winds located between the **subtropical high-pressure belt and the equatorial low-pressure belt.**
- In the equatorial belt, low pressure is created as a result of insolation.
- Air rises and diverges to poles at the top of the atmosphere.
- In the subtropics region, the wind cools and sinks, and creates dynamic subtropical highs.

Ferrel cell/Mid-latitude cell:

- Surface winds blow from the **subtropical high-pressure area to the subpolar low-pressure area.**
- The rising air moves horizontally and settles on the surface near latitudes 25 to 35 degrees.
- From here it starts flowing again in the form of westerly wind towards the subpolar region.

Polar cells:

- Polar easterlies blow from polar high-pressure areas to sub-polar or mid-latitude low-pressure belts.
- Hadley cell is the largest, then Ferrel and Polar is the smallest cell.
- 

Distribution of pressure:

- The apparent movement of the sun between the tropics causes different pressure belts to shift north & south of the equator.
- The difference in heating between land and ocean causes disturbance in different pressure belts.

Pressure in January (11:45 AM):

- The Equatorial low-pressure belt extends well into the southern hemisphere.
- Sub-tropical high-pressure belt of the southern hemisphere is found only over the oceans.
- The low temperature in the northern hemisphere produces a continuous high-pressure system, linking it with the high-pressure cells of Siberia and North America.

Pressure in July:

- The Equatorial Low-pressure belt extends too much into the northern hemisphere linking with the low-pressure systems of India and Tibet.
- The subtropical high-pressure belt in the northern hemisphere is not continuous and exists only over the oceans.
- Sub-tropical high-pressure belts in Southern Hemisphere form a continuous belt of high pressure.

Mapping Exercise:

- **Christopher Columbus** of Italy reached the continent earlier in ~~1498~~ 1492, but he felt that he had reached India.
- North America & South America were named after **Americo Vespucci,** the Italian merchant who reached South America in 1502.
- The **Isthmus of Panama** connects North & South America.
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- Panama is the southernmost country in North America.

Bering Sea

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RUSSIA
Bering Strait
Alaska
(U.S.)
Bering
Sea
W
N
S
E
Aleutian Islands
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Gulf of Alaska, Gulf of Mexico, Caribbean Sea, Hudson Bay.

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Important Mountain ranges:

- Rockies Mountain towards the west.
- Appalachian towards the east.
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Great Plains:

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- The highest point of North America is in the Alaska range- **Mount McKinley or Denali.**
- The lowest point in North America is at **Death Valley** in the **Rockies**, which measured the highest recorded temperature on the earth at 56.7 degrees Celsius in 1913.

The topics for the next class are types and mechanisms of winds and South American mapping.

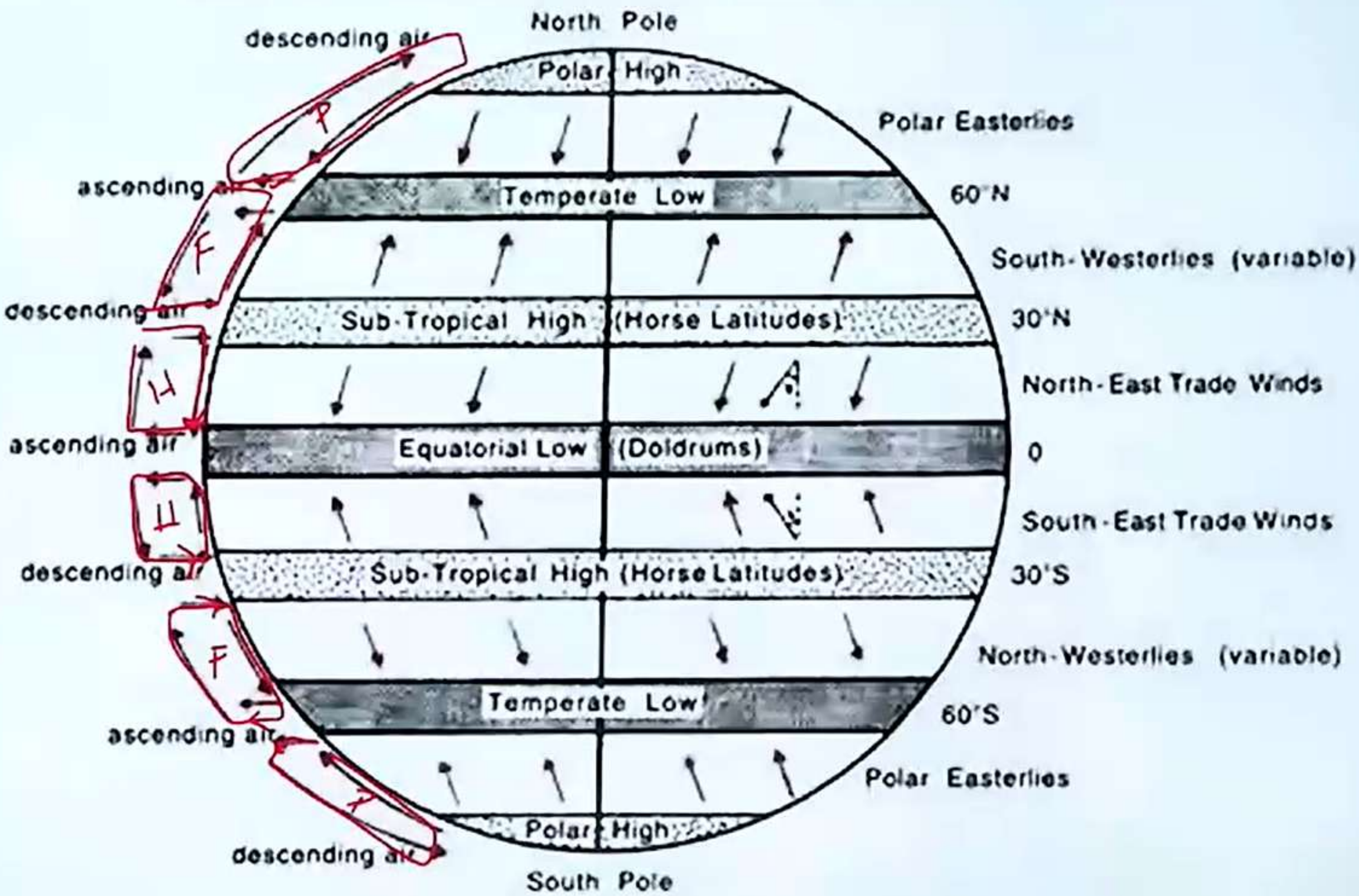


Fig. 115 The distribution of world pressure belts and planetary winds

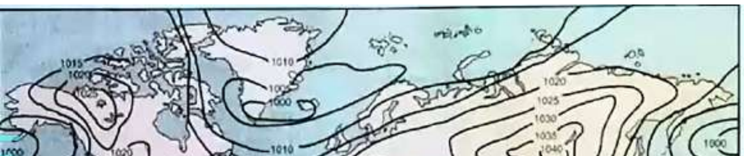
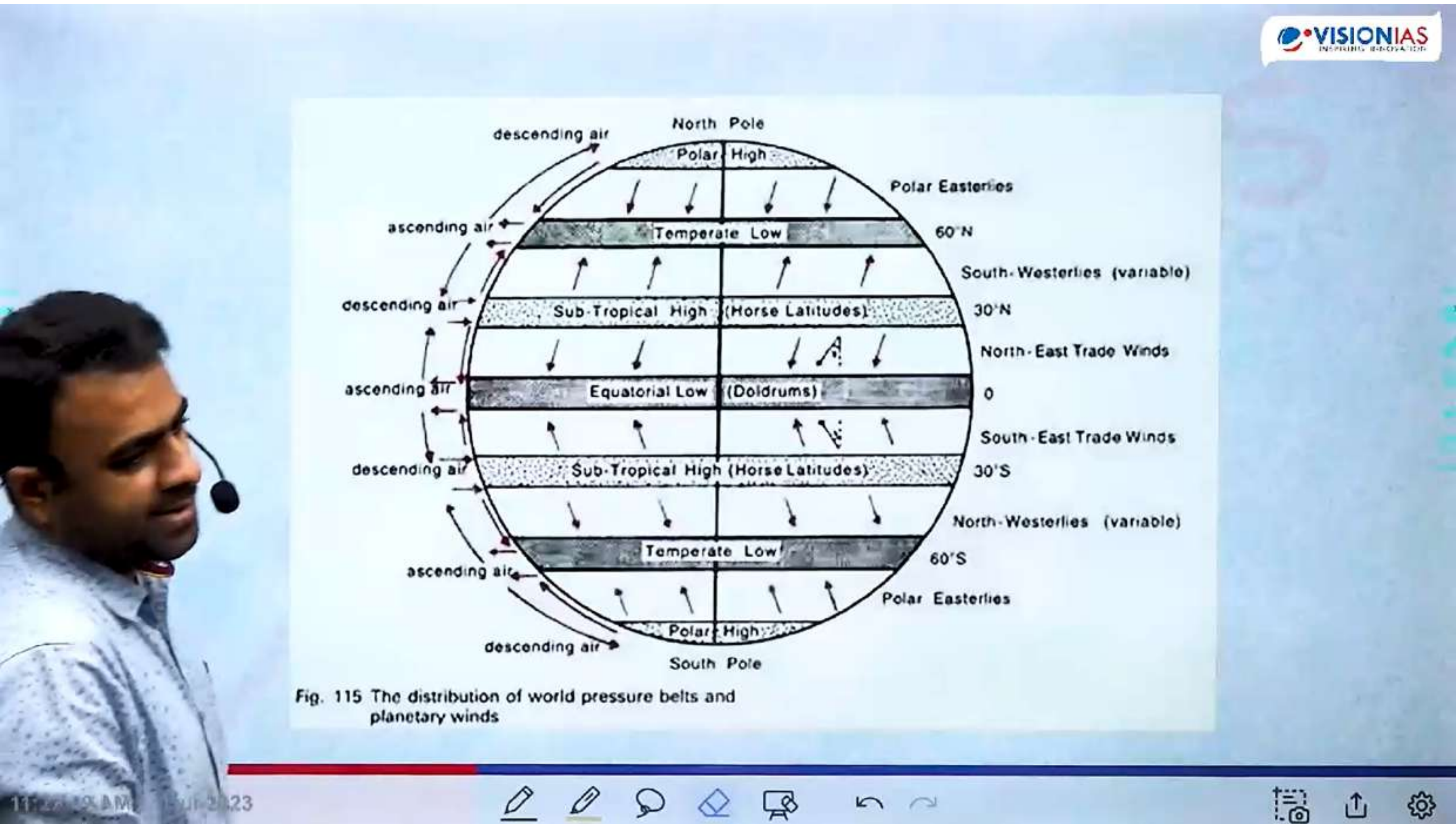


Fig. 16.5. World distribution of pressure in January (Figures are in millibars)

Fig. 16.6 World distribution of pressure in July (Figures are in millibars)



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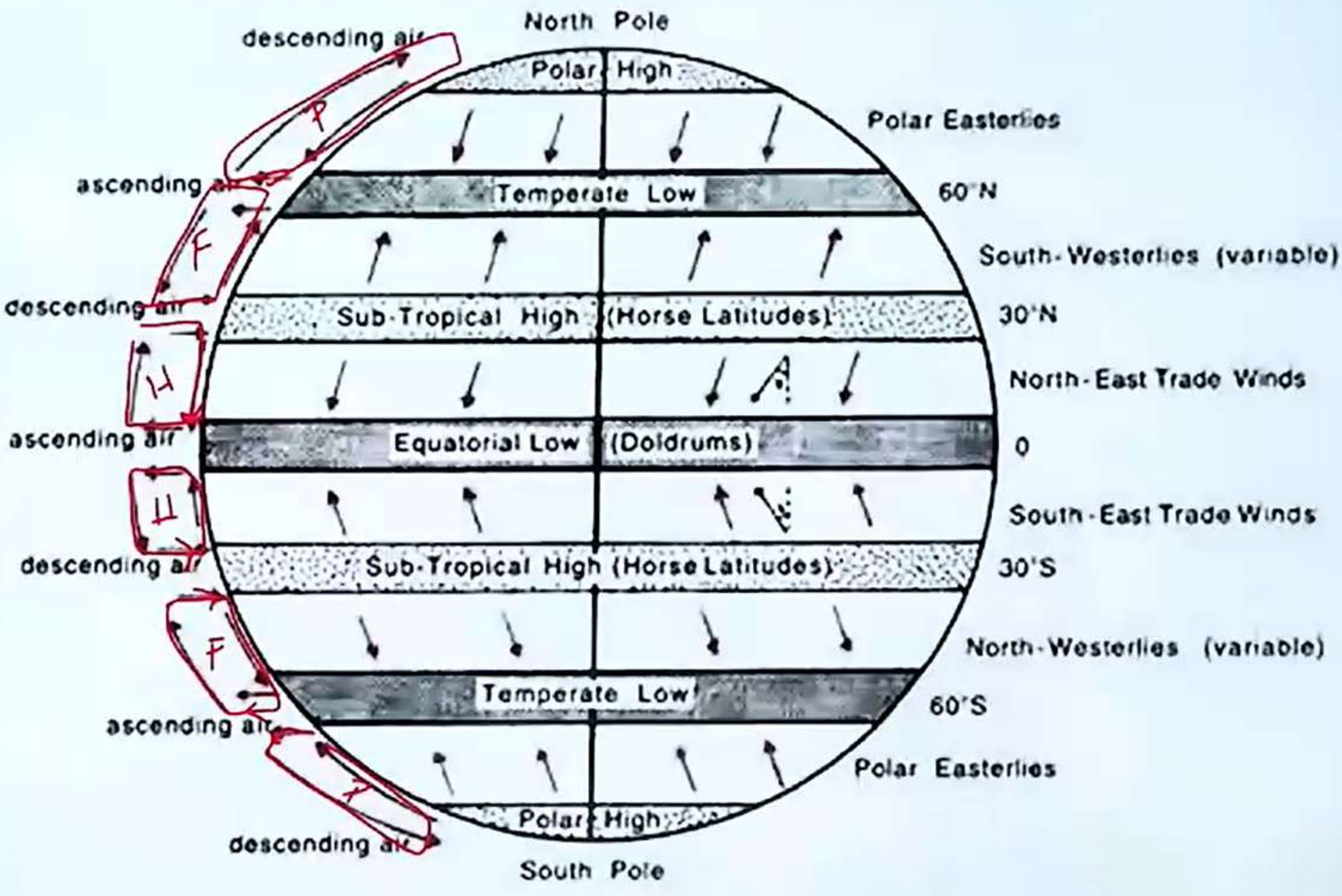

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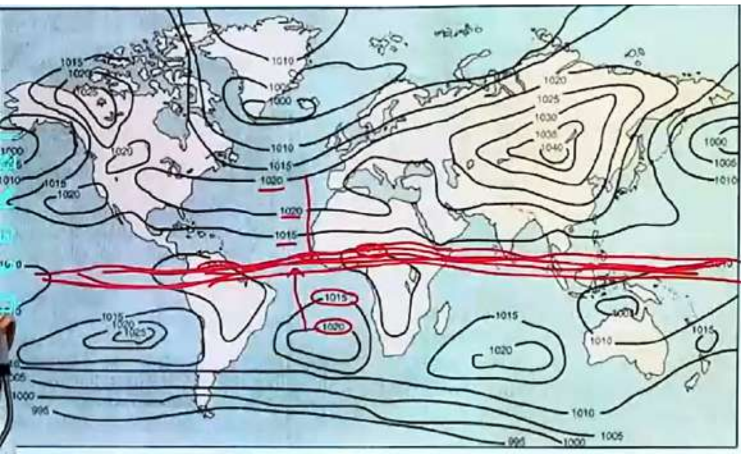

Fig. 16.5. World distribution of pressure in January (Figures are in millibars)

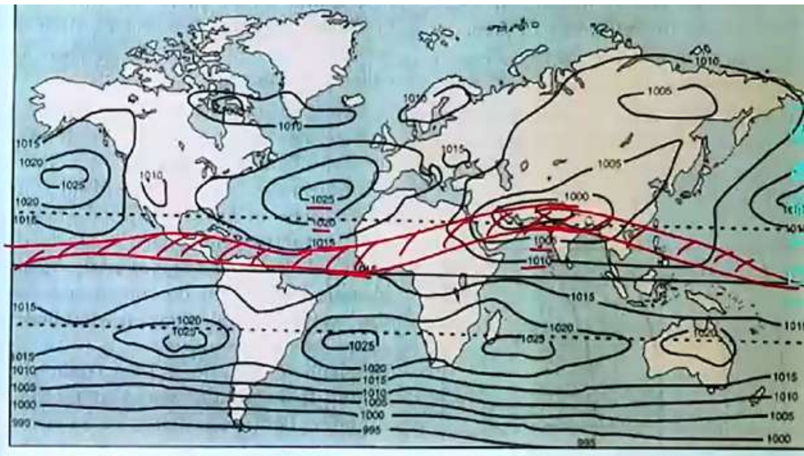

Fig. 16.6 World distribution of pressure in July (Figures are in millibars)