

***CENTRAL UNIVERSITY OF SOUTH BIHAR, GAYA***



Course- Agrometeorology  
ATMOSPHERIC PRESSURE  
&  
FACTOR AFFECTING CLIMATE



***DEPARTMENT OF AGRICULTURE***  
***School of Agriculture & Development***

# Introduction

- ❑ Air exerts pressure on everything on the Earth 's surface
- ❑ This happens because the upper layers of the atmosphere rest on the lower layers



Atmospheric pressure can be defined as the force exerted by a column of air due to its weight at a particular place on the earth 's surface .

# Introduction

- The unit in which air pressure is measured is called millibars
- The instrument used to measure atmospheric pressure is called barometer
- There are two types of barometers

Mercury  
barometer

Aneroid  
barometer

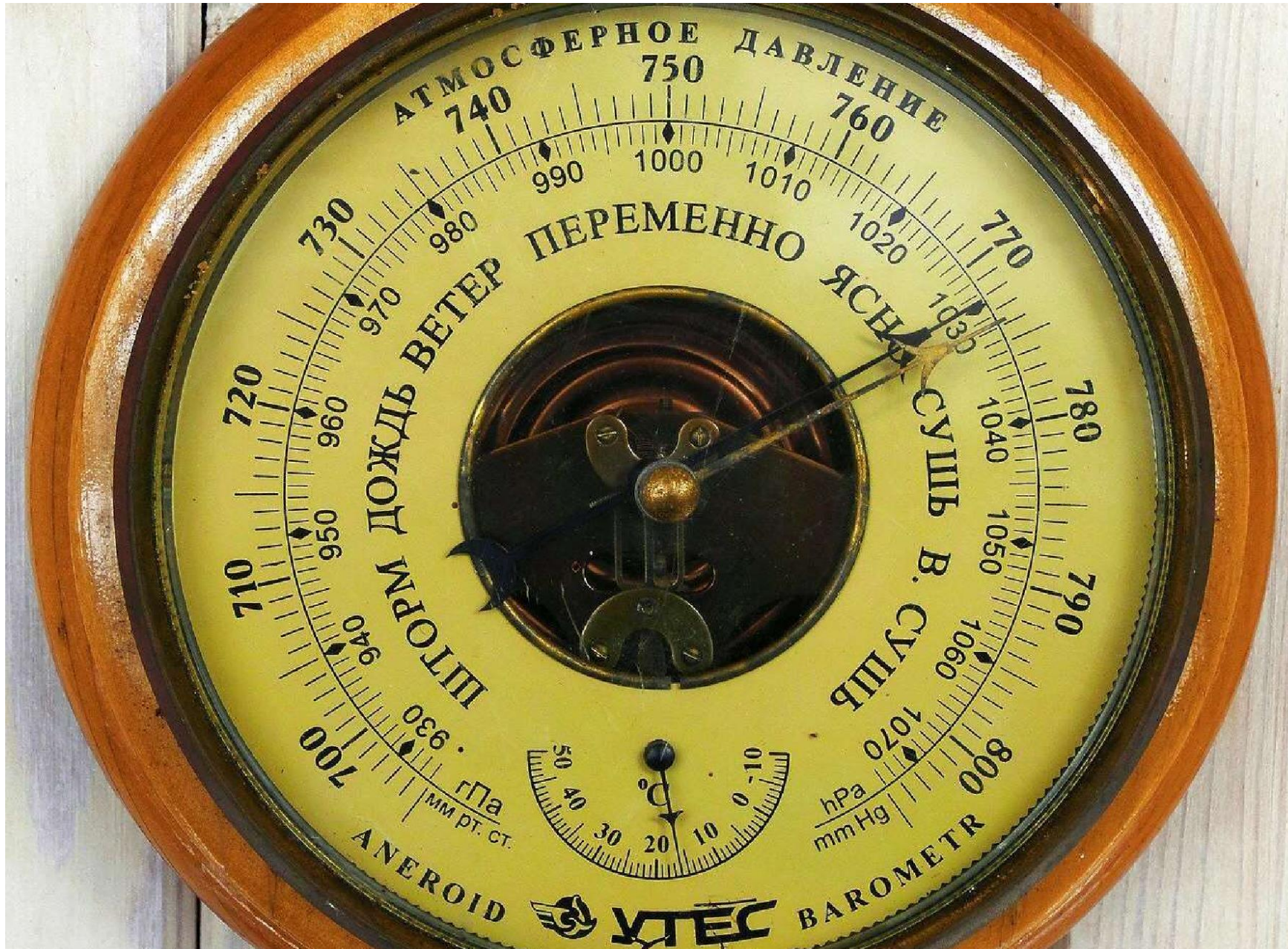
## What is a barometer?

- ❖ An instrument measuring atmospheric pressure (Means- The weight of the air in the atmosphere)

### Remember -

- ❖ 50 % of the total mass of the air is found below 5 km and average density decreases from about  $1.3 \text{ kg m}^{-3}$  at the surface to  $0.7 \text{ kg m}^{-3}$  at 5000 m.
- ❖ Air pressure always decreases with an increase in altitude, but it does not decrease constantly.
- ❖ Actual density depends upon temperature, amount of water vapour in the air and gravity.
- ❖ Pressure is measured as force per unit area.
- ❖ The units used in Meteorology are millibars (mb)
- ❖ Pascal (Pa) is the SI unit of pressure.
- ❖ Fluctuation of wind action is known as turbulence.





## Mercury barometer

A mercury barometer is used to calibrate and check aneroid barometers



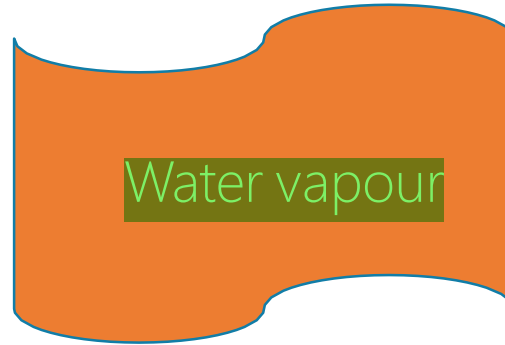
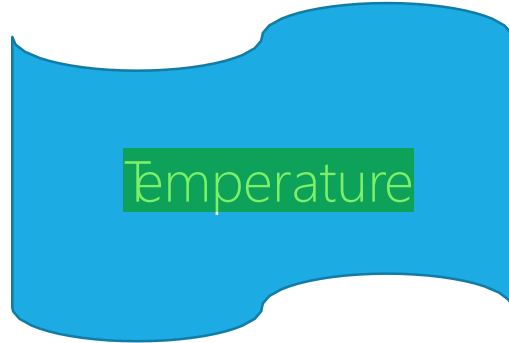


## Aneroid barometer

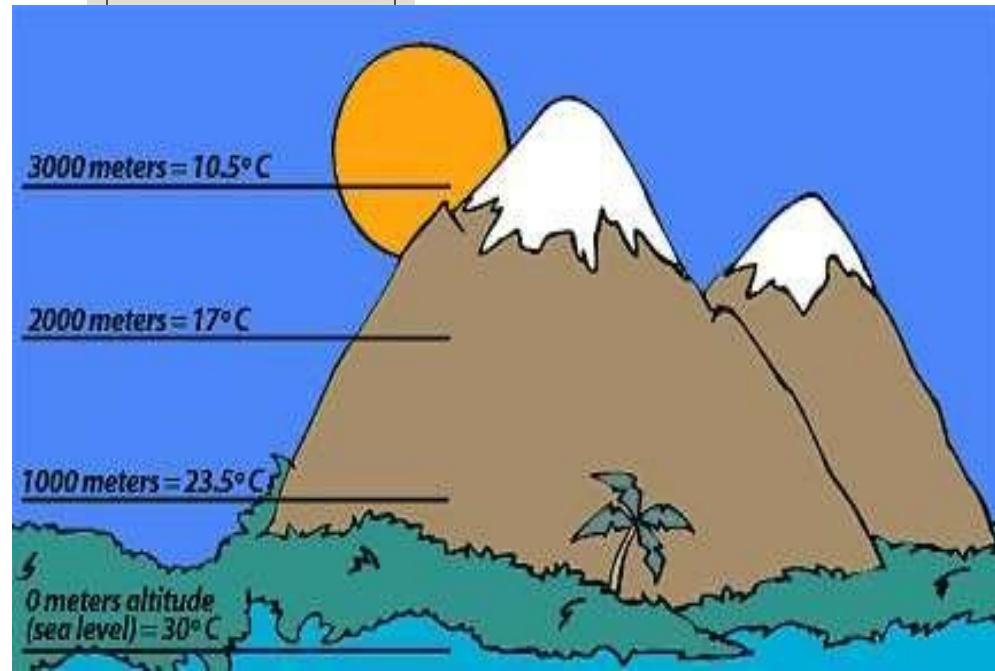
A non-liquid  
barometer called the  
aneroid barometer is  
widely used in  
portable instruments  
and in aircraft  
altimeters because of  
its smaller size and  
convenience.

# FACTOR AFFECTING ATMOSPHERIC PRESSURE

- Atmospheric pressure on the earth's surface it is not uniform
- It varies from place to place and time to time.
- There are three main factors –

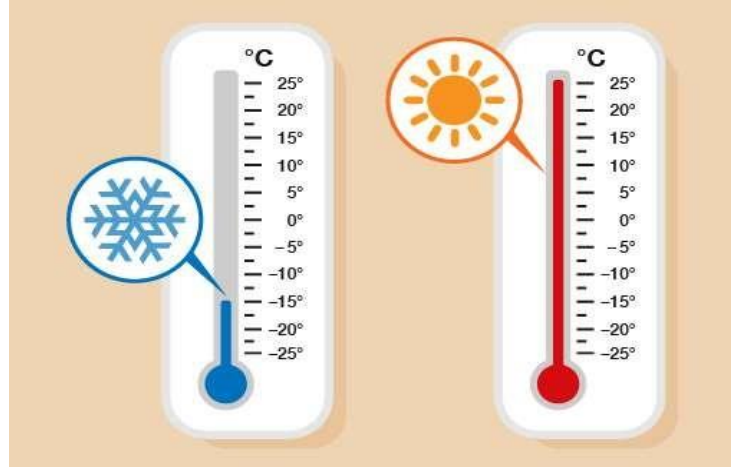


# ALTITUDE



- Altitude: at sea level, the air column exerts its full pressure, but when we stand on a hill or when we go in the upper layers of the atmosphere, level a portion of air which cannot exert its full pressure.
- In the sky above the density of air decreases and so does the pressure exerted by it .

# TEMPERATURE



- When Temperature increases the air expands and its density decreases as a result air becomes lighter and exerts less pressure.
- Hot air expands and exerts low pressure.
- Cold air contracts and exerts high pressure.
- The equator has a low pressure due to the prevalence of high temperatures but poles have a high temperature.

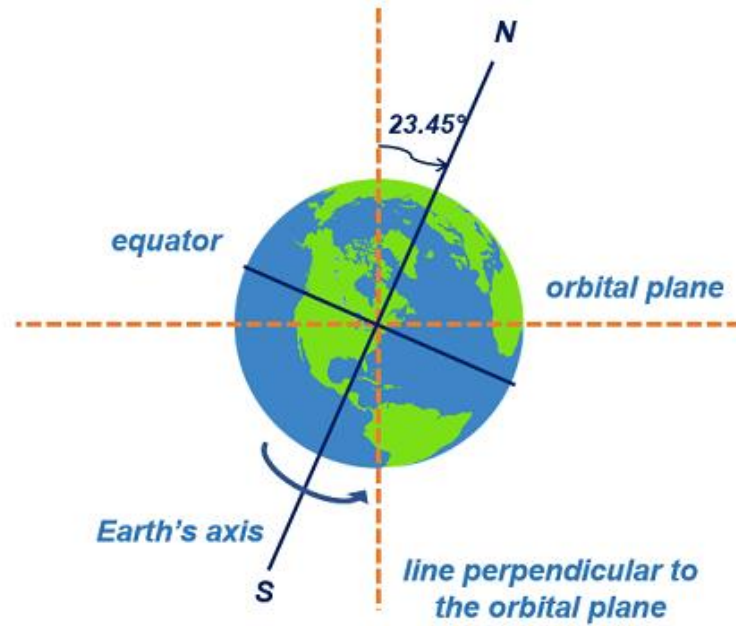


## WATER VAPOUR



- Air containing more water vapour is lighter than air which has little or no water vapour, and thus the air pressure decreases.
- Water vapour content is lighter in cold areas than in air which is dry with the result that moist air of a high temperature exerts a less pressure when compared to cold air.

# ROTATION OF THE EARTH



- The pressure at  $60-70^{\circ}\text{N}$  and  $S$  becomes low. The rotation of the earth near sub-polar belts, makes the air to escape from these belts which move towards the horse latitude ( $30-35^{\circ}\text{N}$  and  $30-35^{\circ}\text{S}$ ).
- These latitudes absorb the air from sub-polar belts making the pressure high.
- G.D. Coriolis (1844) a French Mathematician indicated that air is deflected towards right in the Northern Hemisphere and Left in the Southern hemisphere due to rotation of earth and this was termed after him as Coriolis force.
- Coriolis force is not actually a force but it is effect created by rotation of earth.

# Types of air

## Hot air

- When the temperature increases the air expands
- Density decrease
- The air becomes lighter

## Moist air

- Air which contain more water vapour
- Lighter

## Cool air

- When the temperature decreases
- Density increase
- The air is more heavier

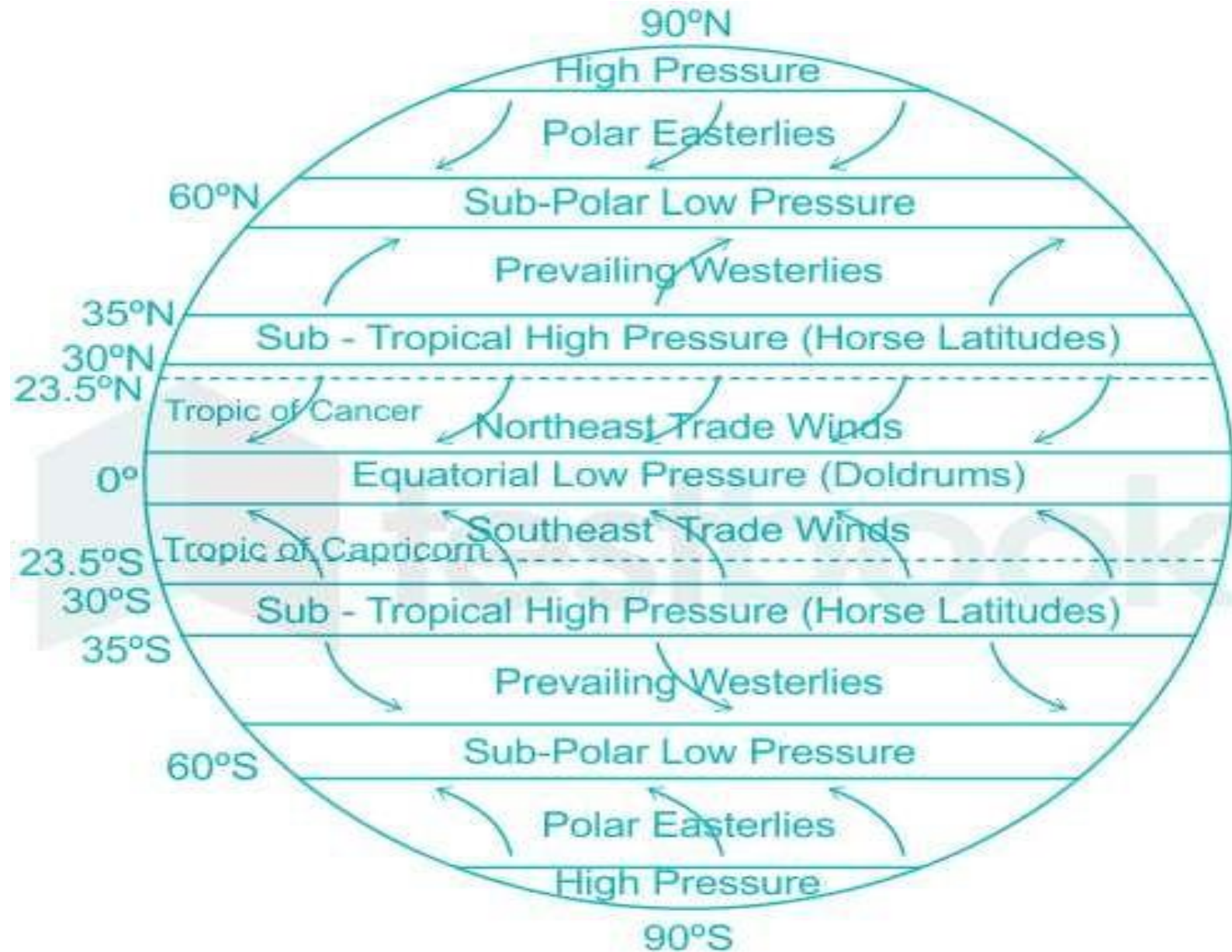
## Dry air

- Air which contain lessor no water vapour
- Heaviercontains



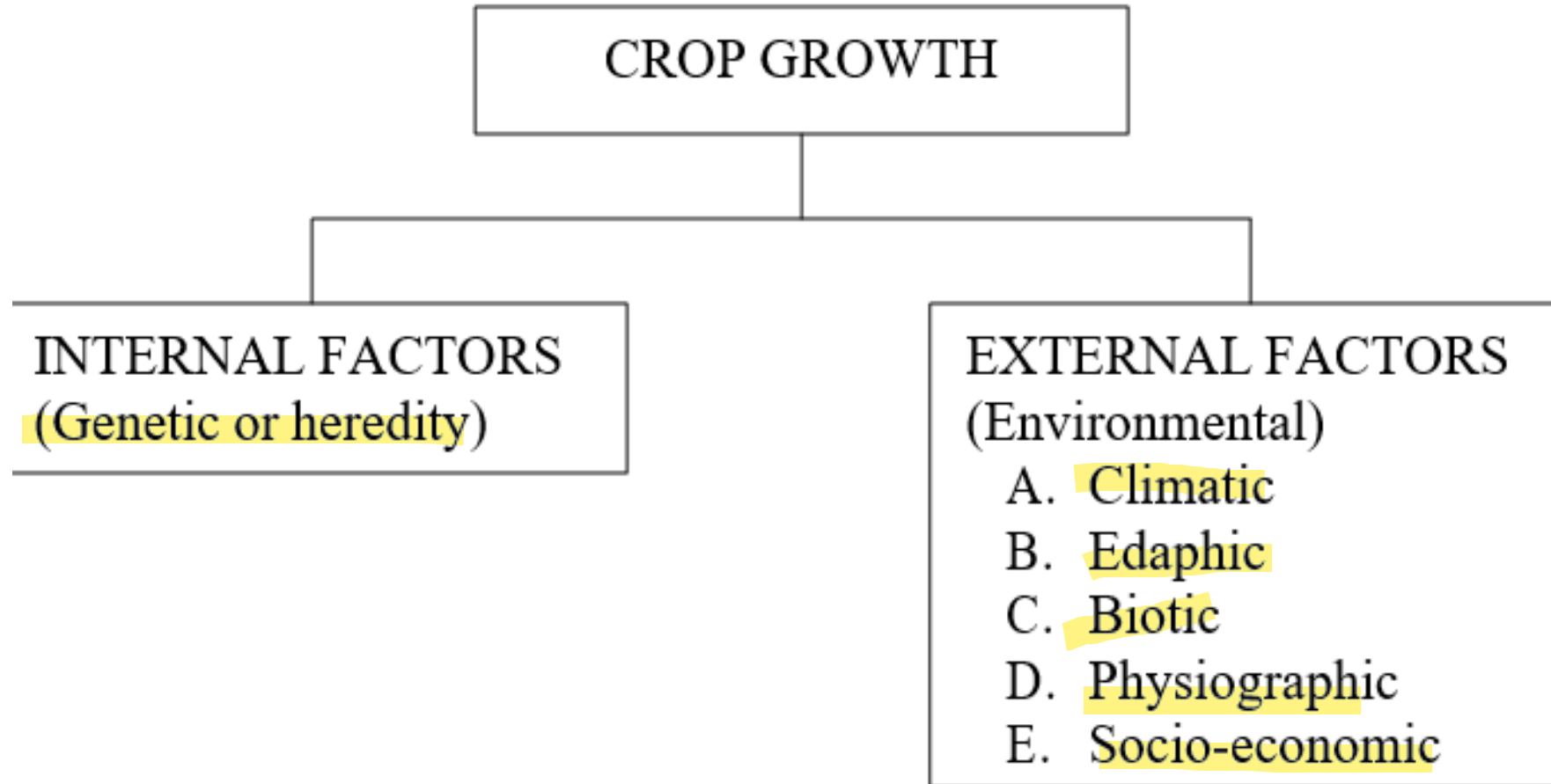
# PRESSURE BELTS

- The horizontal distribution of atmospheric pressure is **not uniform all over the globe**
- It **varies from place to place**
- It is also **affected by temperature**
- But **majorly it varies due to the rotation of the earth**
- There are four important pressure belts.
- **Equator lies a low-pressure belt known as the equatorial low or doldrums.**
- **Polar latitude with persistent high-pressure areas is called polar high.**



Major Pressure Belts and Wind System

# Factor affecting Climate



# CLIMATIC FACTORS

Nearly 50 % of yield is attributed to the influence of climatic factors. The following are the atmospheric weather variables which influences the crop production.

1. Precipitation
2. Temperature
3. Atmospheric humidity
4. Solar radiation
5. Wind velocity
6. Atmospheric gases



## Precipitation

- Precipitation includes all water which falls from atmosphere such as rainfall, snow, hail, fog and dew.
- Rainfall one of the most important factor influences the vegetation of a place.
- Total precipitation in amount and distribution greatly affects the choice of a cultivated species in a place.
- Low and uneven distribution of rainfall is common in dryland farming where drought resistance crops like pearl millet, sorghum and minor millets are grown.
- In desert areas grasses and shrubs are common where hot desert climate exists
- Though the rainfall has major influence on yield of crops, yields are not always directly proportional to the amount of Precipitation as excess above optimum reduces the yields
- Distribution of rainfall is more important than total rainfall to have longer growing period especially in drylands

## Temperature

- Temperature is a measure of the intensity of heat energy. The range of temperature for maximum growth of most of the agricultural plants is between 15 and 40°C.
- The temperature of a place is largely determined by its distance from the equator (latitude) and altitude.
- It influences the distribution of crop plants and vegetation.
- Germination, growth and development of crops are highly influenced by temperature.
- Affects leaf production, expansion and flowering.
- Physical and chemical processes within the plants are governed by air temperature.
- Diffusion rates of gases and liquids changes with temperature.
- Solubility of different substances in plant is dependent on temperature.
- The minimum, maximum (above which crop growth ceases) and optimum temperature of an individual's plant is called as cardinal temperature.

Crops	Minimum temperature °C	Optimum temperature °C	Maximum temperature °C
Rice	10	32	36-38
wheat	4.5	20	30-32
Maize	8-10	20	40-43
Sorghum	12-13	25	40
Tobacco	12-14	29	35

### Atmospheric Humidity (Relative Humidity - RH)

- Water is present in the atmosphere in the form of invisible water vapour, normally known as humidity. Relative humidity is ratio between the amount of moisture present in the air to the saturation capacity of the air at a particular temperature.
- If relative humidity is 100% it means that the entire space is filled with water and there is no soil evaporation and plant transpiration.
- Relative humidity influences the water requirement of crops
- Relative humidity of 40-60% is suitable for most of the crop plants.
- Very few crops can perform well when relative humidity is 80% and above.
- When relative humidity is high there is chance for the outbreak of pest and disease.



## Solar radiation (without which life will not exist)

- From germination to harvest and even post harvest crops are affected by solar radiation.
- Biomass production by photosynthetic processes requires light.
- All physical process taking place in the soil, plant and environment are dependent on light
- Solar radiation controls distribution of temperature and there by distribution of crops in a region.
- Visible radiation is very important in photosynthetic mechanism of plants. Photosynthetically Active

Radiation (PAR -  $0.4 - 0.7\mu$ ) is essential for production of carbohydrates and ultimately biomass.

- Photoperiodism is a response of plant to day length

**Short day – Day length is <12 hours (Rice, Sunflower and cotton), long day – Day length is > 12 hours (Barley, oat, carrot and cabbage), day neutral – There is no or less influence on day length (Tomato and maize).**

- Phototropism — Response of plants to light direction. Eg. Sunflower
- Photosensitive – Season bound varieties depends on the quantity of light received

## Wind velocity

- The basic function of wind is to carry moisture (precipitation) and heat.
- The moving wind not only supplies moisture and heat, also supplies fresh CO<sub>2</sub> for the photosynthesis.
- Wind movement for 4 – 6 km/hour is suitable for more crops.
- When wind speed is enormous then there is mechanical damage of the crops (i.e.) it removes leaves and twigs and damages crops like banana, sugarcane
- Wind dispersal of pollen and seeds is natural and necessary for certain crops.
- Causes soil erosion.
- Helps in cleaning produce to farmers.
- Increases evaporation.
- Spread of pest and diseases.

## Atmospheric gases on plant growth

- $\text{CO}_2$  – 0.03%,  $\text{O}_2$  - 20.95%,  $\text{N}_2$  - 78.09%, Argon - 0.93%, Others - 0.02%.
- $\text{CO}_2$  is important for Photosynthesis,  $\text{CO}_2$  taken by the plants by diffusion process from leaves through stomata
- $\text{CO}_2$  is returned to atmosphere during decomposition of organic materials, all farm wastes and by respiration
- $\text{O}_2$  is important for respiration of both plants and animals while it is released by plants during Photosynthesis
- Nitrogen is one of the important major plant nutrient, Atmospheric N is fixed in the soil by lightning, rainfall and N fixing microbes in pulses crops and available to plants
- Certain gases like  $\text{SO}_2$ , CO,  $\text{CH}_4$ , HF released to atmosphere are toxic to plants



A large, blue speech bubble with a black outline is centered on a light beige background. The bubble has a tail pointing towards the bottom-left corner. Inside the bubble, the words "Thank you" are written in a white, sans-serif font.

Thank you