In Search of the Source of Wind SS2- 2

Atmospheric pressure
- Atmospheric pressure is the weight of atmospheric air at the surface of the Earth.
- Winds are caused by atmospheric pressure fluctuations.

Variations in atmospheric pressure
- The average weight that air exerts on the earth's surface is 1034 mg per cm^2.
- The atmospheric pressure is measured using an instrument called Mercury Barometer.
- It is recorded in units like millibar (mb) and hectopascal (hPa).
- The level of mercury at normal atmospheric pressure will be 76 cm.
- The atmospheric pressure at that point will be 1013.2 mb or 1013.2 hPa.

Factors affecting Atmospheric pressure
-Altitude
-Temperature
-Humidity

Atmospheric pressure and altitude
-The atmospheric pressure decreases with altitude.
-The pressure decreases at the rate of 1 millibar (mb) per an altitude of 10 meters.
- There is a decrease in atmospheric pressure in high altitudes, due to decrease in the density of air with altitude.
-The atmospheric pressure and the altitude are inversely proportional.

Temperature and atmospheric pressure
- When the air warms up, it expands and goes up.
- This causes a decrease in atmospheric pressure
- Heat and atmospheric pressure are inversely proportional.
- During the day the atmospheric pressure decreases as the result of the heat the Sun.
- However, because of the lack of sunlight at night, atmospheric pressure increases.

Humidity and atmospheric pressure
- Humidity is the amount of water (vapour) in atmospheric air.
- Vapour is lighter than air.

- If the quantity of water vapour is more in a unit volume of air, then naturally the atmospheric pressure will be less.
- On the seashore, which receives plenty of sunlight, the humidity is high and the pressure is low.
- In areas far from the sea, humidity is low and atmospheric pressure is high.
- Humidity and atmospheric pressure are inversely proportional.
-Altitude, temperature and humidity experienced in a region influence the atmospheric pressure.
- If the atmospheric pressure of an area is higher than that of the surrounding regions, it can be designated as high pressure(High - H).
- And if the atmospheric pressure of an area is lower than that of the surrounding regions, it can be designated as low pressure (Low – L)

Isobars

- isobars are the imaginary lines joining places having the same atmospheric pressure.
- We can easily understand the distribution of the atmospheric pressure of any region by observing the isobars.

Global pressure belts

- At certain latitudes the atmospheric pressure is almost the same.
- Based on this, the earth's surface is divided into different pressure belts.
- Equatorial low pressure belt 0°
- Sub tropical high pressure belt 30°N, 30°S
- Sub polar low pressure belt 60°N, 60°S
- Polar high pressure belt 90°N, 90°S

These are known as the global pressure belts.

Equatorial low pressure belt 0°

- The area where the sun rays are perpendicular throughout the year.
- The air expands due to sun's heat and rises up on a massive scale in this area.
- This is the reason for the low pressure experienced throughout this zone.
- The equatorial low pressure belt is situated between 5° North and South latitudes.
- As the air in this zone ascends on a large scale, winds are very feeble here.
- This pressure belt is also known as 'doldrum', meaning 'the zone with no winds'.
- The region was a nightmare for the ancient mariners.

Sub tropical high pressure belt-(30 °N & 30 °S)

- This pressure belt is located at 30 ° latitude in both hemispheres.
- The warm air rising from the equatorial low pressure belt (0°) gradually cools and drops to 30° latitudes under the influence of the Earth's rotation.
- And there it becomes high pressure belt.

Sub polar low pressure belt (60°N & 60°S latitudes)
- As this zone is close to the Pole, the air is colder here.
- The air in this zone thrown away due to the rotation of the earth.
- As a result, low pressure is experienced all along the sub polar region.

Polar high pressure belt (90°N & 90°S)
- This zone experiences severe cold throughout the year.
- As a result, the air remains chilled under the extreme cold that prevails over the Poles, and this contributes to the steady high pressure experienced here.

Shift of the pressure belts
- Variations in the amount of solar energy received and the rotation of the earth contribute to the formation of different pressure belts.
- The pressure belts shift according to the apparent movement of the Sun.
- The pressure belts shift 5º northward during the period of Sun's northward progression and towards the south 5º during the period of its southward progression.

Atmospheric pressure and winds
-The horizontal movement of air from a high pressure zone to a low pressure zone is called wind.
- Global variations in the atmospheric pressure lead to the formation of winds.
- There are different types of winds on the earth's surface.
-They are wind like Light breeze that makes the leaves flutter and cyclones that cause widespread damage.
- Winds are named on the basis of the direction from which they blow.
- For example the south wind, Westerlies,sea breeze, Mountain breeze
- The peculiarities of the source regions influence the nature of the wind.
- Winds blowing from the sea will be saturated with moisture whereas the moisture content will be less in winds blowing from drier regions.

Factors that control speed and direction of the winds.

- Pressure gradient
- Coriolis force
- Friction

Pressure gradient

-The change in pressure with horizontal distance is termed as pressure gradient.
-The pressure gradient is said to be steeper when the pressure difference is more.
-The wind speed will be higher there.

Coriolis Force

-Freely moving bodies get deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere.
-This is due to the force generated as a result of Earth's rotation which is known as the Coriolis force.
-This force increases as it moves towards the Poles from the Equator.

Ferrel's law.

-Admiral Ferrel found out that the winds in the Northern Hemisphere deflect towards their right and those in the Southern Hemisphere deflect towards their left due to the Coriolis Effect.
-The law put forward by him on the basis of this is known as Ferrel's law.

Friction

-Wind obstructions cause friction in the wind.
-The speed of wind will be high over ocean surfaces and plains as the friction is less.
-On the other hand, the friction being more along difficult terrains and places with dense forest cover, the speed of wind will be less in those places.

Pressure belts and winds (The different planetary winds)

-There were differences in pressure over different latitudinal zones at the global level.
-These pressure differences lead to the formation of winds.
-Winds blow from high pressure regions to low pressure regions.
-The winds developed between the global pressure belts is called as planetary winds.

Which are the Planetary Winds

- Trade winds

- Westerlies
- Polar easterlies

Trade winds

-The winds are constantly blowing from the sub tropical high pressure belt of both hemispheres towards the equatorial low pressure belt is known as Trade winds.
-The Trade winds blows From 30°N & 30°S latitude to 0° latitude.
-As these winds blow from the north east in the Northern Hemisphere, they are known as north east trade winds..
-This wind is blowing from the south east in the Southern Hemisphere, so it is known as the South east trade winds
-The equatorial low pressure zone where the trade winds from both the hemispheres converge is known as the Inter Tropical Convergence Zone (ITCZ).

What could be the reason for the trade winds blowing from the south east and the north east directions?

-Winds change direction due to the Earth's rotation (through the Coriolis force).
-In the northern hemisphere,trade winds are blowing in the north-east direction as they move to the right.
-In the southern hemisphere, trade winds are blowing in the south-east direction as they move to the left.

Westerlies

-The Westerlies are blow continuously from the sub tropical high pressure zones (30 ° latitudes) into Sub polar low pressure zones (60 ° latitudes) In both hemispheres.
-As the direction of these winds is mostly from the west, they are known as the westerlies.
- Due to the vast expanse of oceans in the Southern Hemisphere the westerlies are stronger in the Southern Hemisphere than in the Northern Hemisphere.
- The ancient mariners had given different names to the rough westerlies in the Southern Hemisphere, such as 'Roaring Forties' (along 40° latitudes), 'Furious Fifties' (along 50° latitudes) and 'Shrieking Sixties' (60° latitudes).

Polar Easterlies

-The cold polar regions are centres of high pressure.
-The polar winds are the cold winds that blow from these high pressure areas towards the sub polar low pressure belts.
-These winds blow from the East in both the hemispheres due to the Coriolis Force.

-Hence these are known as polar easterlies.
-These winds play a significant role in determining the climate of North America, the eastern European countries, and Russia.

Periodic winds
-Periodic winds are winds that repeat at regular intervals of time and can be seasonal or diurnal.
- Monsoon winds
- Land and sea breeze
- Mountain and valley breeze are the main periodic winds.

Monsoon winds
-The term 'monsoon' is derived from the Arab word 'mousom'.
-It means 'winds that change direction in accordance with season'.
-Monsoon is the seasonal reversal of wind in a year.

Factors responsible for the formation of the monsoon winds?
-The apparent movement of the sun
-Coriolis force
-Differences in heating

South west monsoon winds
-Sun's rays fall vertically to the North of the Equator during certain months due to the tilt of the Earth's axis.
-The pressure belts also shift slightly northwards in accordance with this.
-The south east trade winds also cross the equator and moves towards the north as the Inter Tropical Convergence Zone (ITCZ) moves northwards during the summer in the northern hemisphere.
-As the trade winds cross the Equator they get eflected and are transformed into south west
monsoon winds due to the Coriolis Effect.
-The low pressure formed over the land due to the intense day temperature attracts these sea winds and further contributes to the formation of the South west monsoon winds.

North east monsoon winds

-As a result of the formation of high pressure zones over the Asian landmass and low pressure zones over the Indian Ocean during winter, the north east trade winds get strengthened.
-These are the North East monsoon winds.

Sea breeze
-The air in contact with the land gets heated up and ascends as the land heats up quickly during the daytime.
-This leads to the formation of low pressure over the land.
-which causes the comparatively cooler air blow from the sea to land.
-This is known as sea breeze.

Land breeze.
-As the land cools faster than the sea during the night it would be high pressure over the land and low pressure over the sea.
-This results in the movement of air from the land to sea.
-This is the land breeze.
-The land breeze which starts blowing at night becomes active early in the morning and ceases by sunrise.

Mountain and valley breeze

Valley breeze
-During the day time the air above the mountains gets heated and rises up.
-As a result, the wind blows up slope from the valley with relatively lower temperature.
-This is known as valley breeze.

Mountain breeze
-During night the air in the mountainous regions cools due to the intense cold conditions in that region.
-As cool air is dense, it blows towards the valley.
-This is known as mountain breeze.

Local winds
-Local winds are winds whose effects are limited to a relatively smaller area.
-Formed as a result of the local pressure= differences, these winds are weak.

-Such winds exist in different parts of the world in different names.
-Loo, Mangoshowers, Kalbaisakhi, Chinook, Harmattan and Foehn are some of the local winds in the world.

Chinook
-Chinook is a hot local wind that blows down the eastern slope of the Rocky Mountains in North America.
-As a result of this wind, the ice on the eastern slope of the Rocky Mountains has been melts down.
-Therefore, it is called Chinook, which means 'Who Eats Snow'.
-Since this wind reduces the severity of the cold, it is helpful for wheat cultivation in the Canadian lowlands.

Foehn
-Foehn is the wind that blows down the northern slopes of the Alps mountain.
-As the air heats up due to pressure from the descent, it helps in reducing the severity of cold in that region.

Harmattan
-Harmattan is a dry wind which blows from the Sahara desert towards West Africa.
-On the arrival of these winds, the humid and sultry conditions of West Africa improve significantly.
-Hence, people call these winds as the doctor.

Loo
-Loo is a hot wind blowing in the North Indian plain.
-These winds blowing from the Rajasthan desert raise the summer temperature of the North Indian plains.

Mango showers
-The winds that blow in South India during summer season are called Mango showers.
-These wind cause the ripening and fall of mangoes and hence the name.

Variable winds
-Variable winds are winds with entirely different characteristics formed during certain atmospheric situations.

-Cyclones and Anticyclones are variable winds.

Cyclones

-Cyclones are caused by the formation of low atmospheric pressure at the centre surrounded by high pressure regions.
-Strong whirl winds blow towards such low pressure centres from the surrounding high pressure areas.
-Due to Coriolis effect cyclones are flow in the anti-Clock wise direction in the Northern Hemisphere.
-in the southern Hemisphere direction of cyclones are clock wise.
-Based on the climatic region of their formation, cyclones can be classified as tropical cyclones and temperate cyclone.
-The Ockhi - cyloninc winds that struck the coastlines of Kerala and Lakshdweep during November 2017 was a tropical cyclone
-Tropical cylones are caused due to local pressure differences in the tropical oceans, especially the Indian ocean.

Anti cyclones

-Anti cyclones are phenomenon where strong whirl winds blow from the high pressure centres to the surrounding low pressure areas.
-Due to Coriolis effect the pattern of winds in anti cyclones is clock wise in the Northern Hemisphere and anti clockwise in the Southern Hemisphere.