Types of Winds
[UPSC Notes]

What is Wind?

The wind is the movement of air that has both direction and speed to it. It comprises gusts and eddies. An eddy is a whirl of air when wind encounters a solid object and forms moves to the leeward side of the object. A gust can be described as a strong but sudden flow of wind.

Unlike natural phenomena like snowfall or rain, wind can only be felt and not seen. We feel its presence when it makes other things like trees, leaves, and dust move. The wind is measured using instruments such as a weathercock/weather vane.

Geographical Factors Affecting Wind

There are a few factors that affect the wind's flow and direction. They have been listed and explained below;

1. **Pressure Gradient Force:** This force is responsible for the initial direction and flow of the wind. The flow makes the air move from a high-pressure area to a low-pressure area. The direction is perpendicular to isobars. The relationship between wind velocity and pressure gradient force is directly proportional, which means that with the increase in wind velocity, there will also be an increase in its pressure gradient force and vice versa.

2. **Coriolis force/Deflection Force:** This force is responsible for the deflection in the wind's direction and hence is also called 'deflection force'.the deflection is towards the right in the northern hemisphere and towards the left in the southern hemisphere.
3. **Friction Force generated by surface:** This force acts as a restraining force to the wind's flow. This friction is caused due to the irregularities in the orientation of landforms. Friction is the most of terrains and the least on the surface of oceans. It is to be noted that the effect of this force is only effective for a few thousand kilometres from the surface of the earth.

Mechanism of the Wind System

Sun radiation affects th formation of the wind system. The earth's surface absorbs the Sun's radiation differently in different parts. This variation comes because of the different landscapes on the earth's surface. Valleys, sea surface, mountains, etc., absorb the solar radiation on varying levels. This makes the air of some areas hotter than others and creates low atmospheric pressure. The colder air from other surfaces comes from the higher atmospheric pressure zone to the warmer and lower atmospheric pressure zone.

The varying terrains and the different atmospheric pressure zones are responsible for the difference in temperatures. And it is due to this difference that the wind occurs. There is a directly proportional relationship between the pressure difference and the air flow. The more the pressure difference, the faster the wind will flow. Winds balance out the unevenness between the distribution of pressure everywhere.

What are the Types of Wind?

There are primarily three types of wind, namely

1. Permanent Wind
2. Local Wind
3. Seasonal Wind

These have a further classification, which has been discussed below;

Permanent Wind

These winds blow throughout the year and hence, called permanent winds. They follow a specific direction while blowing. Permanent wind can also be classified into three categories;

- **Trade Winds**: These permanent winds blow from east to west throughout the year in the equatorial region of the earth. The equatorial region is located between the 30°N and 30°S latitudes.
- **Easterlies:** True to their name, these are permanent winds that flow from the east. These are trade winds from the tropical areas and the prevailing winds from the polar areas.
- **Westerlies:** These are permanent winds that blow from the west to the east in the earth's middle latitudes. The middle latitudes are latitudes between 30° and 60°. Westerlies are also called anti-trades as they originate from higher-pressure areas (horse latitudes) and move toward the poles. They also bring the extratropical cyclones.

Local Wind

- Local wind is the type of wind that blows only in a specific time frame of a day or a year in a particular area. These winds can be classified into four sub-categories. They are as follows;
- **Land Breeze:** The type of wind that blows from the land toward the sea is called a land breeze. It blows usually at night.
- **Sea Breeze:** The type of wind that blows from a large water body toward the land is called a sea breeze. It occurs due to variation in the pressure of air which occurs due to variation in the heat capacity of water and dry land.
- **Anabatic Winds:** The type of wind that is sloped upwards and is driven by a warm surface temperature on a mountain slope are called Anabatic winds.
- **Katabatic Winds:** The type of wind that is down-sloped because of colder temperatures of the mountain surface are called Katabatic winds.

Seasonal Wind

True to their name, seasonal winds are winds that change their direction with the onset of differing seasons. A monsoon wind is the perfect example of a seasonal wind. The

monsoon winds are the seasonally changing winds that change direction between summer and winter in the low-latitude regions of India.

Local Winds of the World

There are several local winds across the world. The name of local winds have been provided to you in the table below:

Name of the Local Winds of the World	Region
Alisio	Caribbean
Alize	Central Africa and the Caribbean
Abrolhos	Brazil
Berg	South Africa
Barguzin wind	Russia
Chinook	Rocky Mountains
Föhn or foehn	Alps, North Italy
Harmattan	Central Africa
Loo	India, Pakistan
Ghibli	Libya
Pampero	Argentina, Uruguay

Roaring Forties	Southern Hemisphere
Southerly Buster	Sydney

Local Winds in India

India's weather and climate can be described as temperate to tropical. The country gets a decent amount of rainfall and has warm summer. Monsoon is a proper season in India. The months vary from state to state, governed by the seasonal winds of monsoon and demographical factors. The Indian summer monsoon usually lasts between the months of June to September. In these months, almost all parts of the country receive the most of their annual precipitation percentage. The monthly average totals up to 200-300 mm of rainfall across the country.

- One of the prominent local winds that flow through India is Loo. The Loo is a strong, gusty, dusty wind that brings about the hot and dry summers that we often associate the country with. Loo blows from the west, over the Indo-Gangetic Plain, towards the parts of Northern India and Pakistan. It blows quite strongly within the months of May and June.

Loo is responsible for causing very low humidity in the atmosphere and higher temperatures. It has an extremely drying effect on crops that may brown in the areas that are worst hit by Loo.

- Kali Andhi is another such local wind in India. A violent dust storm happens before the monsoon in the northwestern parts of the Indo-Gangetic Plain region.