

5 Atmospheric Disturbances

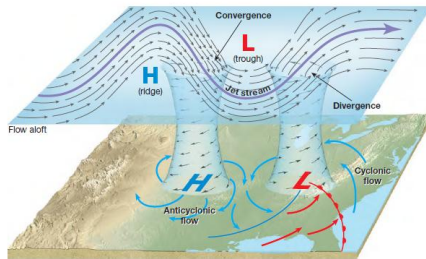
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1. Cyclones-

- tropical and temperate and associated weather conditions.

2. Anticyclones and associated weather conditions.

- atmospheric disturbances (weather systems) that are often accompanied by variable cloudiness and winds that bring air having contrasting temperatures.
- Under these circumstances, the maximum and minimum temperatures may occur at any time of the day or night.

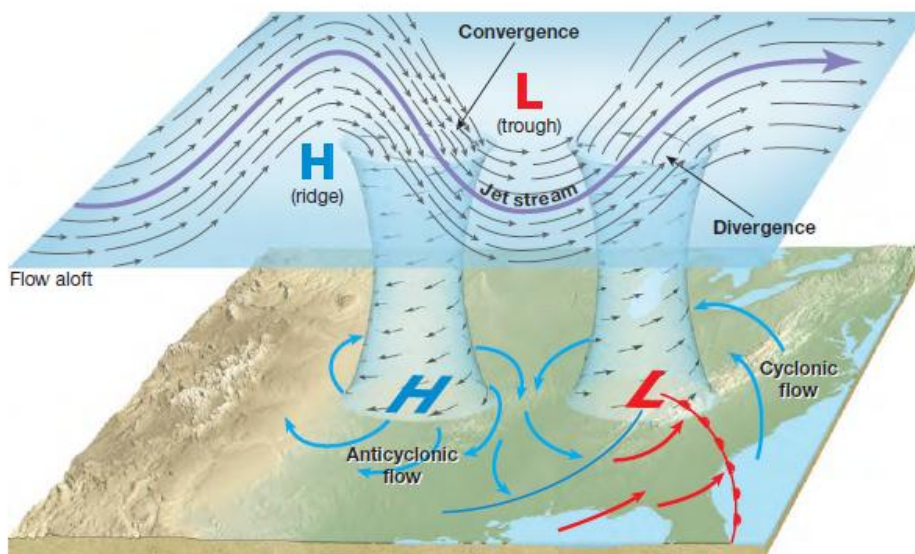


➤ Introduction:

- the term atmospheric disturbance is more general than storm
 - Atmospheric disturbances are any disturbance in the atmosphere.
 - They are short lived, and transient.
 - This means they generally only last a few days, and do not stay in one place for a prolonged period of time.
 - During their short lives, the atmospheric disturbances have a dramatic effect on the atmosphere and surrounding areas.
 - They are important because they tend to lead to harsh weather conditions and storms.
- Some of the most common disturbances are
 - Extra tropical cyclones
 - tropical cyclones
 - mid-latitude cyclones,
 - Anticyclone
 - hurricanes, and
 - tornadoes.
 - The atmospheric disturbances include such variations in the secondary circulation of the atmosphere that cannot be placed in the category of storms

- ❑ Embedded within the wind belts of the general atmospheric circulation are secondary circulations, which are made up of storms and other atmospheric disturbances
- ❑ Atmospheric disturbance is a broader and more general term than storms – includes variations in secondary circulation ...
- ❑ Such Disturbances include:
 - ❑ a) Middle Latitude Cyclones
 - ❑ b) Cyclones and Anticyclones, and
 - ❑ c) Weak Tropical Disturbances
 - ❑ (e.g., Easterly Waves, Polar Outbreaks)
 - ❑ Well-defined Storms include: Hurricanes, Tornadoes, Thunderstorms, Snowstorms and Blizzards

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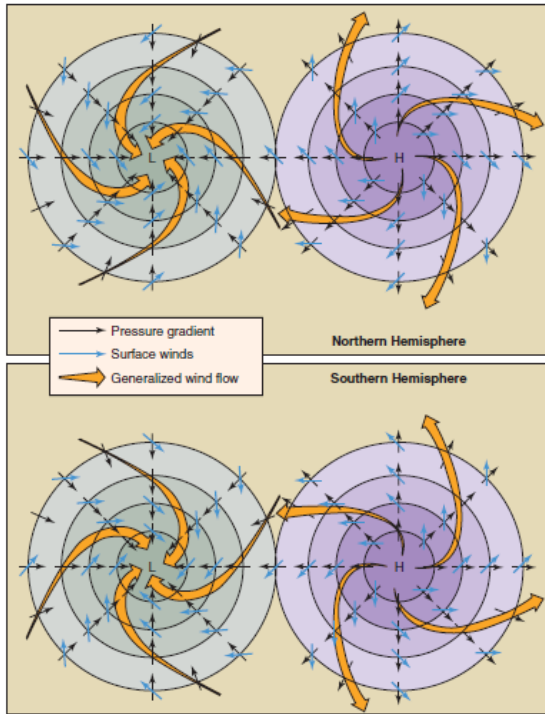


1. Cyclones-

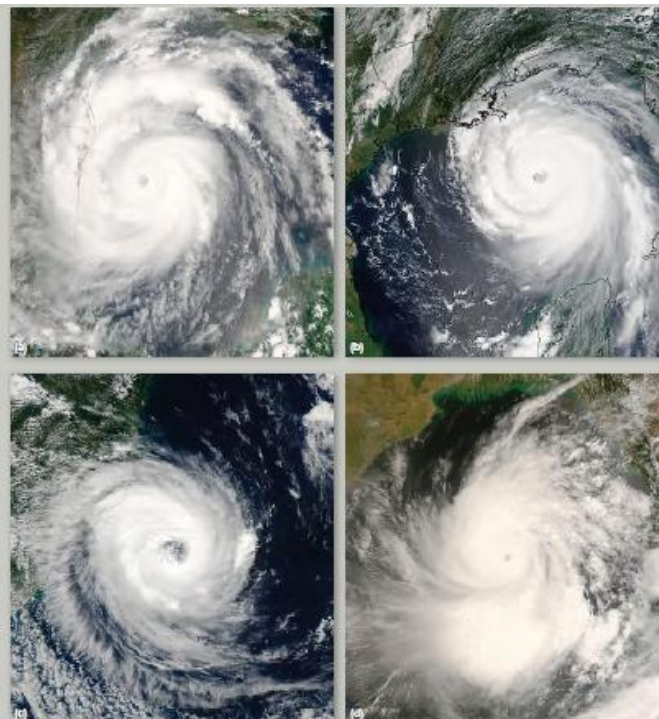
- tropical and temperate and associated weather conditions.
- The wind circulation around a low is called *cyclonic circulation*.
- Around a high it is called *anti cyclonic circulation*.
- The direction of winds around such systems changes according to their location in different hemispheres

Pattern of Wind Direction in Cyclones and Anticyclones

Pressure System	Pressure Condition at the Centre	Pattern of Wind Direction	
		Northern Hemisphere	Southern Hemisphere
Cyclone	Low	Anticlockwise	Clockwise
Anticyclone	High	Clockwise	Anticlockwise



• **FIGURE 5.9** Movement of surface winds associated with low pressure centers (cyclones) and high pressure centers (anticyclones) in the Northern and Southern Hemispheres. Note that the surface winds are to the right of the pressure gradient in the Northern Hemisphere and to the left of the pressure gradient in the Southern Hemisphere.

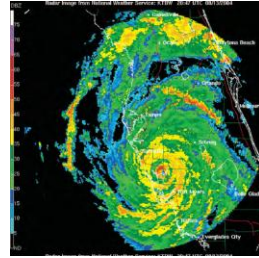
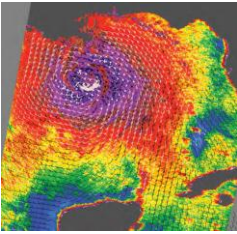


What is a Cyclone?

- Cyclone is a region of low atmospheric pressure surrounded by high atmospheric pressure resulting in swirling atmospheric disturbance accompanied by powerful winds blowing in anticlockwise direction in the Northern Hemisphere and in the clockwise direction in the Southern Hemisphere.
- They occur mainly in the tropical and temperate regions of the world.
- Cyclones are called by various names in different parts of the world as mentioned in box on the next page.

Tropical Cyclones

- Tropical cyclones are violent storms that originate over oceans in tropical areas and move over to the coastal areas bringing about large scale destruction caused by violent winds, very heavy rainfall and storm surges.
- This is one of the most devastating natural calamities.
- They are known as
 - *Cyclones* in the Indian Ocean,
 - *Hurricanes* in the Atlantic,
 - *Typhoons* in the Western Pacific and South China Sea, and
 - *Willy-willies* in the Western Australia.



➤ The name of the Cyclone which means “*coils of snake*” in *Greek* was given to the revolving storms in the North Indian Ocean By **Henry Piddington** who was the president of the Marine court in Calcutta (Kolkatta) from 1839 to 1856 in the mid –19th century, and he was first to coin this word.

General Characteristics:

Cyclones in India are moderate in nature.

Some of the general characteristics of a cyclone are:

1. Strong winds
2. Exceptional rain
3. Storm surge

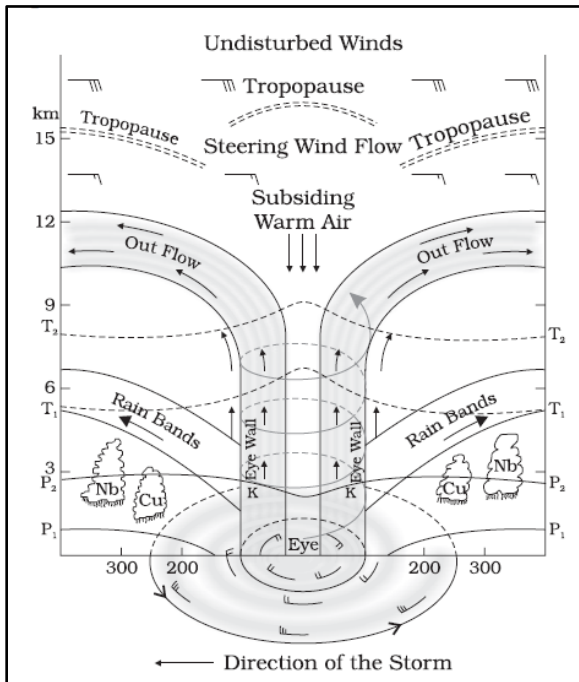
Cyclones are known by different names in different parts of the world:

- **Typhoons** in the Northwest Pacific Ocean west of the dateline South China Sea
- **Hurricanes** in the North Atlantic Ocean, the Northeast Pacific Ocean east of the dateline, or the South Pacific Ocean.
- **Tropical cyclones** - the Southwest Pacific Ocean and Southeast Indian Ocean.
- **Severe cyclonic storm** (the North Indian Ocean)
- **Tropical cyclone** (the Southwest Indian Ocean)
- **Willie-Willie** in Australia
- **Tornado** in South America

Tropical cyclones : associated weather conditions

Tropical cyclones originate and intensify over warm tropical oceans. The conditions favourable for the formation and intensification of tropical storms are:

- (i) Large sea surface with temperature higher than 27° C;
 - (ii) Presence of the Coriolis force;
 - (iii) Small variations in the vertical wind speed;
 - (iv) A pre-existing weak low- pressure area or low-level-cyclonic circulation;
 - (v) Upper divergence above the sea level system.
- The energy that intensifies the storm, comes from the condensation process in the towering cumulonimbus clouds, surrounding the centre of the storm.
 - On reaching the land the moisture supply is cut off and the storm dissipates.
 - The place where a tropical cyclone crosses the coast is called the landfall of the cyclone.
 - The cyclones, which cross 20° N latitude generally, recurve and they are more destructive.



- A schematic representation of the vertical structure of a mature tropical cyclonic
- A mature tropical cyclone is characterised by the strong spirally circulating wind around the centre, called the eye.
- The diameter of the circulating system can vary between 150 and 250 km.

- The eye is a region of calm with subsiding air.
- Around the eye is the eye wall, where there is a strong spiralling ascent of air to greater height reaching the tropopause.
- The wind reaches maximum velocity in this region, reaching as high as 250 km per hour.
- Torrential rain occurs here.
- From the eye wall rain bands may radiate and trains of cumulus and cumulonimbus clouds may drift into the outer region.
- The diameter of the storm over the Bay of Bengal, Arabian sea and Indian ocean is between 600 - 1200 km.
- The system moves slowly about 300 - 500 km per day.
- The cyclone creates storm surges and they inundate the coastal low lands.
- The storm peters out on the land.

Extra Tropical or Midlatitude cyclones Cyclones

- The systems developing in the mid and high latitude, beyond the tropics are called the *middle latitude or extra tropical cyclones*.
- The passage of front causes abrupt changes in the weather conditions over the area in the middle and high latitudes.

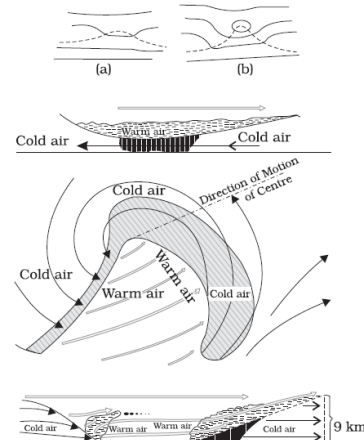
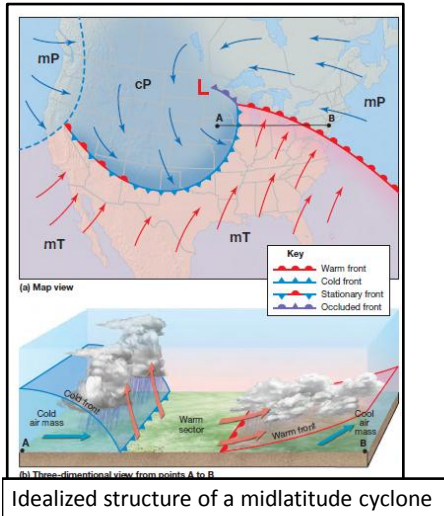


Figure 10.9 : Extra tropical cyclones

- ***Midlatitude cyclones*** are low-pressure systems with diameters that often exceed 1000 kilometers (600 miles) and travel from west to east across the middle latitudes in both hemispheres.
- Lasting from a few days to more than a week, a mid-latitude cyclone in the Northern Hemisphere has a ***counter clockwise*** circulation pattern with airflow directed inward toward its center.
- Most mid-latitude cyclones have a cold front and a warm front extending from the central area of low pressure.
- Surface convergence and ascending air initiate cloud development that frequently produces precipitation.

Where Do Midlatitude Cyclones Form?

- ❑ The development of midlatitude cyclones does not occur uniformly over Earth's surface but tends to favor certain locations, such as the leeward (eastern) sides of mountains and along coastal areas.
- ❑ In general, midlatitude cyclones form in areas where significant temperature contrasts occur in the lower troposphere.

Anticyclonic: Weather and Atmospheric

- ❑ anticyclones generally produce clear skies and calm conditions.
- ❑ high-pressure systems are not associated with stormy weather,
- ❑ both their development and movement have not been studied as extensively as those of midlatitude cyclones.
- ❑ However, anticyclones do not always bring desirable weather.
- ❑ Large anticyclones often develop over the Arctic during the winter.
- ❑ These cold high-pressure centers are known to migrate as far south as the Gulf Coast, where they can impact the weather over as much as two-thirds of the United States (Figure 9–19).
- ❑ This dense frigid air often brings record-breaking cold temperatures.



Anticyclonic weather:

(a) A cold anticyclone associated with an outbreak of frigid arctic air impacts the eastern two-thirds of North America. Temperatures are shown in degrees Fahrenheit.

(b) Outbreak of arctic air invades New England, bringing subzero temperatures and mostly clear skies.

- ❑ large anticyclones persist over a region for several days or even weeks.
- ❑ Once in place, these stagnant anticyclones block or redirect the migration of midlatitude cyclones. Thus, they are sometimes called *blocking highs*.
- ❑ During these events, one section of the nation is kept dry for a week or more while another region remains continually under the influence of cyclonic storms.