

MODULE 35 - CYCLONE

OBJECTIVES

At the end of this article we would be able to answer the following questions:-

1. Meaning of cyclones and its causes
2. Different types of cyclones
3. Learn how to recognize areas which are more prone to cyclones
4. Mitigation measures to reduce the effects of cyclones
5. Management practices

SUMMARY

'Cyclone' is the term used globally to cover tropical weather systems in which winds equal or exceed 'gale force' (minimum of 34 knot, i.e., 62 kmph). These are intense low pressure areas of the earth atmosphere coupled system and are extreme weather events of the tropics.

Cyclones are characterized by their devastating potential to damage structures, viz. houses; lifeline infrastructure-power and communication towers; hospitals; food storage facilities; roads, bridges and culverts; crops etc. The most fatalities come from storm surges and the torrential rain flooding the lowland areas of the coastal territories. Based on the lessons learnt from the cyclones around the world and the advances made in various related sciences and disciplines on the subject a cyclone risk mitigation and preparedness framework is a very important part of its management. Every country and community has to decide its own mitigation strategy according to its own risks, resources and capabilities. Early warning of cyclones and its dissemination to the coastal habitations is an important preparatory measure to reduce the losses of life and property during cyclones.

TRANSCRIPTION

CYCLONES

A simply cyclone mean coil of a snake. It is just like rotation of the earth, its structure is in shape of a coil motion or in a circular motion. It is have a just like a human being, it has a centre eyes.

- In meteorology, a cyclone is an area of closed, circular fluid motion rotating in the same direction as the Earth.

- The word cyclone is derived from the Greek word 'Cyclos' meaning the coils of a snake. It was coined by Henry Paddington because the tropical storms in the Bay of Bengal and in the Arabian Sea appeared like the coiled serpents of the sea.
- This is usually characterized by inward spiraling winds that rotate counter clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere of the Earth.
- Most large-scale cyclonic circulations are centered on areas of pressure. The largest low-pressure systems are cold-core polar cyclones and extra tropical cyclones which lie on the synoptic scale.
- Warm-core cyclones such as tropical cyclones, mesocyclones, and polar lows lie within the smaller mesoscale.
- Cyclones have also been seen on other planets outside of the Earth, such as Mars and Neptune.

TYPES OF CYCLONES

There are six main types of cyclones:

1. Polar cyclone
2. Polar low
3. Extratropical
4. Subtropical
5. Tropical and
6. Mesocyclone

Polar cyclone

- A **polar, sub-polar, or Arctic cyclone** (also known as a polar vortex) is a vast area of low pressure which strengthens in the winter and weakens in the summer.
- A polar cyclone is a low pressure weather system, usually spanning 1,000 kilometers (620 mi) to 2,000 kilometers (1,200 mi), in which the air circulates in a counterclockwise direction in the northern hemisphere, and a clockwise direction in the southern hemisphere.
- In the Northern Hemisphere, the polar cyclone has two centers on average. One center lies near Baffin Island and the other over northeast Siberia.
- In the southern hemisphere, it tends to be located near the edge of the Ross Ice Shelf near 160 west longitude.
- When the polar vortex is strong, westerly flow descends to the Earth's surface. When the polar cyclone is weak, significant cold outbreaks occur.

Polar low

- A **polar low** is a small-scale, short-lived atmospheric low pressure system (depression) that is found over the ocean areas pole ward of the main polar front in both the Northern and Southern Hemispheres.

- During winter, when cold-core lows with temperatures in the mid-levels of the troposphere reach -45°C (-49°F) move over open waters, deep convection forms which allows polar low development to become possible.
- The systems usually have a horizontal length scale of less than 1,000 kilometers (620 mi) and exist for no more than a couple of days. They are part of the larger class of mesoscale weather systems.

Extratropical/ Temperate

- An **extra tropical cyclone** is a synoptic scale low pressure weather system that has neither tropical nor polar characteristics, being connected with fronts and horizontal gradients in temperature and dew point otherwise known as "baroclinic zones".

Subtropical

- A **subtropical cyclone** is a weather system that has some characteristics of a tropical cyclone and extra tropical cyclone.
- Since they form from initially extra tropical cyclones which have colder temperatures aloft than normally found in the tropics, the sea surface temperatures required for their formation are lower than the tropical cyclone threshold by three degrees Celsius, or five degrees Fahrenheit, lying around 23 degrees Celsius.

Tropical

- A **tropical cyclone** is a storm system characterized by a low pressure center and numerous thunderstorms that produce strong winds and flooding rain.
- A tropical cyclone feeds on heat released when moist air rises, resulting in condensation of water vapour contained in the moist air.

Mesocyclone

- A **mesocyclone** is a vortex of air, 2.0 kilometers (1.2 mi) to 10 kilometers (6.2 mi) in diameter within a convective storm.
- Air rises and rotates around a vertical axis, usually in the same direction as low pressure systems in both northern and southern hemisphere.
- They are most often cyclonic, that is, associated with a localized low-pressure region within a severe thunderstorm. Such storms can feature strong surface winds and severe hail.
- Mesocyclones often occur together with updrafts in super cells, where tornadoes may form.

CAUSES OF CYCLONES

Cyclones are caused by atmospheric disturbances around a low-pressure area distinguished by swift and often destructive air circulation. They are usually accompanied by violent storms and bad weather. The air circulates inward in an anticlockwise direction in the northern hemisphere and clockwise in the southern hemisphere.

In India, cyclones are classified due to the:

Strength of the associated winds,

Storm surge and

Exceptional rainfall occurrences.

Cyclones are classified into five different levels on the basis of wind speed. They are further divided into the following categories according to their damage capacity.

Cyclone Category	Wind Speed in Km/h	Damage Capacity
01	120-150	Minimal
02	150-180	Moderate
03	180-210	Extensive
04	210-250	Extreme
05	250 and above	Catastrophic

CYCLONE FACTORS

The formation of tropical cyclones is the topic of extensive ongoing research and is still not fully understood, while six factors appear to be generally necessary, tropical cyclones may occasionally form without meeting all of the following conditions.

- In most situations, water temperatures of at least 26.5 °C (79.7 °F) are needed down to a depth of at least 50 m (160 ft); waters of this temperature cause the overlying atmosphere to be unstable enough to sustain convection and thunderstorms.
- Another factor is rapid cooling with height, which allows the release of the heat of condensation that powers a tropical cyclone.
- High humidity is needed, especially in the lower-to-mid troposphere; when there is a great deal of moisture in the atmosphere, conditions are more favourable for disturbances to develop.
- Low amounts of wind shear are needed, as high shear is disruptive to the storm's circulation.

EFFECTS OF CYCLONES

Effects of tropical cyclones

The main effects of tropical cyclones include:-

- Heavy rain, strong wind, large storm surges storm at landfall, and tornado.
- The destruction from a tropical cyclone depends mainly on intensity, size, and location.
- Tropical cyclones act to remove forest canopy as well as change the landscape near coastal areas, by moving and reshaping sand dunes and causing extensive erosion along the coast.
- Even well inland, heavy rainfall can lead to mudslides and landslides in mountainous areas.

How does a cyclone affect us?

1. A cyclone causes heavy floods.
2. It uproots electricity supply and telecommunication lines.
3. Road and rail movements come to halt because floods damage rail tracks and breach roads.
4. Seaports stop work due to high winds, heavy rains and poor visibility. Sometimes ships overturn or are washed ashore. The high speed winds bends and plucks out trees and plants.
5. A cyclone tears away wall sidings and blows off roofs of houses.
6. Houses collapse and people are rendered homeless. In villages kachha houses get blown away. The speeding winds cause loose metal and wooden sheets to fly turning them to potential killers. Broken glass pieces can cause serious injuries.
7. The floodwaters can turn the fields salty.
8. Bridges, dams and embankments suffer serious damages.
9. Floods wash away human beings and animals and make water unfit for drinking. There can be outbreak of diseases like Cholera, Jaundice or Viral fever due to intake of impure water.

CYCLONES MITIGATION

Based on the lessons learnt from the cyclones around the world and the advances made in various related sciences and disciplines on the subject a cyclone risk mitigation and preparedness framework can be presented in the shape of the following diagram:

Risk Mapping, Assessment and Analysis

- The first and probably the most complex task of cyclone mitigation is to map the hazard, risks and vulnerabilities of cyclone at all levels, analyze and assess the levels of risks and monitor it continuously.
- Atmospheric and remote sensing sciences have made a huge progress in the understanding of the phenomenon of cyclones.
- Satellite images can spot the development of low pressure zones, doppler radars can track them down and instrumented aircrafts can reach the cyclone eye, eye walls and spiral bands to transmit data on wind velocity, pressure and moisture contents of the low pressure zones.
- Such maps are now available at a regional, district and even sub district levels in most of the countries.

Structural and Non Structural Mitigation

Every country and community has to decide its own mitigation strategy according to its own risks, resources and capabilities. Broadly such strategies would be two folds: structural and non-structural.

- Structural mitigation measures generally refer to capital investment on physical constructions or other development works, which include engineering measures and construction of hazard resistant and protective structures and other protective infrastructure.
- Among the structural mitigation measures sea walls and saline water embankments are probably the most effective and capital intensive investment to mitigate the risks of cyclones.
- Bio shields usually consist of mangroves, palms, bamboo and other tree species and halophytes and other shrub species that inhabit lower tidal zones.
- Early warning of cyclones and its dissemination to the coastal habitations is an important preparatory measure to reduce the losses of life and property during cyclones.
- Non-structural measures refer to awareness and education, policies techno-legal systems and practices, training, capacity development etc.

MANAGEMENT PRACTICES

What to do before and during a cyclone.

1. Have your dwellings checked before a cyclone season starts and carry out whatever repairs that are needed.
2. Create storm awareness by discussing effects of a cyclonic storm with family members so that everyone knows what one can and should do in an emergency. This helps to remove fear and anxiety and prepares everyone to respond to emergencies quickly.
3. Keep your valuables and documents in containers, which cannot be damaged by water.
4. Keep information about your blood group.
5. Store up at least seven-day stock of essential food articles, medicines and water supply.
6. Keep blankets & clothes ready for making beds. Also keep cotton bandages and several copies of photographs of family members in case they are needed for identification purposes after the storm.
7. Store some wooden boards so that they can be used to cover windows.
8. Keep trees and shrubs trimmed. Remove damaged and decayed parts of trees to make them resist wind and reduce the potential for damage. Cut weak branches and make winds blow through.
9. All doors, windows and openings should be secured.
10. Continue to listen to warning bulletins and keep in touch with local officials. Keep radio sets in working condition. Battery powered radio sets are desirable.
11. Evacuate people to places of safety when advised.
12. Store extra drinking water in covered vessels.

What one should not do during a Cyclone attack?

1. During the storm do not venture out unless advised to evacuate.
Keep monitoring the warnings. This will help you to prepare for a cyclone emergency.
 - a. Pass on the information to others.
 - b. Remember that a cyclone alert means that the danger is within 24 hours. Stay alert.
 - c. When your area is under cyclone warning get away from low-lying beaches or other low-lying areas close to the coast
 - d. If your house is securely built on high ground take shelter in the safer part of the house. However, if asked to evacuate do not hesitate to leave the place.
 - e. Small and loose things, which can fly in strong winds, should be stored safely in a room.

- f. Be sure that a window and door can be opened only on the side opposite to the one facing the wind.
- g. Make provision for children and adults requiring special diets.
- h. Switch off electrical mains in your house.
2. Fishermen are advised not to venture out into the sea. They should keep boats and rafts tied up in a safe place.
3. Avoid taking shelters near old and damaged buildings or near trees.
4. Do not touch power lines.

What to do after the storm.

- You should remain in the shelter until informed that you can return to your home.
- You must get inoculated against diseases immediately.
- 1. It is advisable to wait for the "all clear message" on radio and TV networks.
- 2. Wait for emergency relief teams to arrive. It may take a little time before relief becomes effective.
- 3. Stay away from flooded areas.
 - o Donating blood
 - o Locating places where dead bodies can be kept until they are disposed off
 - o Organizing clearing-up so that normalcy returns as soon as possible

AREAS THAT ARE GENERALLY PRONE TO CYCLONES

- The Indian subcontinent is one of the worst affected regions in the world.
- The disaster potential is particularly high at the time of landfall in the north Indian Ocean (Bay of Bengal and the Arabian Sea) due to the accompanying destructive wind, storm surges and torrential rainfall.

Cyclones prone areas in India –

- Gujarat
- Orissa
- A few part of South India

Cyclones prone area in World –

Cyclone is the term that covers cyclones, hurricanes and typhoons. Therefore, some areas of the world that are cyclone-prone include:

- Australia's northern coastline, from north west to northeast (the Indian Ocean to the Coral Sea)
- The Solomon Islands
- Fiji

- Philippines
- India
- Burma
- Bangladesh
- Gulf of Mexico
- Myanmar (Burma)
- Taiwan

CONCLUSION

- 'Cyclone' is the term used globally to cover tropical weather systems in which winds equal or exceed 'gale force' (minimum of 34 knot, i.e., 62 kmph). These are intense low pressure areas of the earth atmosphere coupled system and are extreme weather events of the tropics.
- Cyclones are characterized by their devastating potential to damage structures, viz. houses; lifeline infrastructure-power and communication towers; hospitals; food storage facilities; roads, bridges and culverts; crops etc. The most fatalities come from storm surges and the torrential rain flooding the lowland areas of the coastal territories. Based on the lessons learnt from the cyclones around the world and the advances made in various related sciences and disciplines on the subject a cyclone risk mitigation and preparedness framework is a very important part of its management. Every country and community has to decide its own mitigation strategy according to its own risks, resources and capabilities. Early warning of cyclones and its dissemination to the coastal habitations is an important preparatory measure to reduce the losses of life and property during cyclones.

GLOSSARY

1. Thunderstorm – electrical storm and lightening storm
2. Windstorm– a storm marked by high wind with or no precipitation
3. Hail – is a form of solid precipitation which consists of balls or irregular lumps of ice
4. Clockwise – in parallel direction
5. Anti clockwise – in opposite direction
6. Forest canopy – upper covering of forest

7. Erosion – removal of upper surface
8. Meteorological – weather forecasting
9. Hail – is a form of solid precipitation which consists of balls or irregular lumps of ice
10. Mudslides – are moving rivers of rock, soil, and water
11. Landslides – a wide range of ground movement, such as rock falls, deep failure of slopes and shallow
12. Estuaries – is a partly enclosed coastal body of water with one or more rivers or streams flowing into it

FAQs

Q.1 - Define the term cyclones?

A- A cyclone is an area of closed, circular fluid motion rotating in the same direction as the Earth . This is usually characterized by inward spiraling winds that rotate counter clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere of the Earth.

Q.2 – Name how many type of cyclones are there?

A– Polar cyclones, polar low, Extratropical, Subtropical, Tropical, and Mesotropical cyclones.

Q.3 – Mention the names of prone areas of world?

A– They are –

- Australia's northern coastline, from north west to northeast (the Indian Ocean to the Coral Sea)
- The Solomon Islands
- Fiji
- the Philippines
- India
- Burma
- the Caribbean
- Bangladesh
- Gulf of Mexico
- Southeastern United States
- Myanmar (Burma)

•Taiwan

Q.4 - Define the term Tropical Cyclones?

A- A tropical cyclone is a storm system characterized by a low pressure center and numerous thunderstorms that produce strong winds and flooding rain. A tropical cyclone feeds on heat released when moist air rises, resulting in condensation of water vapour contained in the moist air. They are fueled by a different heat mechanism than other cyclonic windstorms such as nor'easters, European windstorms, and polar lows, leading to their classification as "warm core" storm systems.

Q.5- What are the effects of tropical Cyclones?

A- The main effects of tropical cyclones include:-

- Heavy rain, strong wind, large storm surges storm at landfall, and tornado.
- The destruction from a tropical cyclone depends mainly on its intensity, its size, and its location.
- Tropical cyclones act to remove forest canopy as well as change the landscape near coastal areas, by moving and reshaping sand dunes and causing extensive erosion along the coast.
- Even well inland, heavy rainfall can lead to mudslides and landslides in mountainous areas.

Q.6 - Define Polar Cyclones.

A - A polar, sub-polar, or Arctic cyclone (also known as a polar vortex) is a vast area of low pressure which strengthens in the winter and weakens in the summer. A polar cyclone is a low pressure weather system, usually spanning 1,000 kilometres (620 mi) to 2,000 kilometres (1,200 mi), in which the air circulates in a counterclockwise direction in the northern hemisphere, and a clockwise direction in the southern hemisphere. In the Northern Hemisphere, the polar cyclone has two centers on average. One center lies near Baffin Island and the other over northeast Siberia. In the southern hemisphere, it tends to be located near the edge of the Ross ice shelf near 160 west longitude.

Q.7 – Define TORNADOES.

A - Tornadoes are tropical cyclone spawned which are to expected for about half of the storms of tropical storm intensity. These are heavily concentrated in the right front quadrant of the storm (relative to the track) in regions where the air has had a relatively short trajectory over land. These form in conjunction with strong convection.

Q.8 – Define STORM SURGE.

A - The storm surge is an abnormal rise of water due to a tropical cyclone and it is an oceanic event responding to meteorological driving forces. Potentially disastrous surges

occur along coasts with low-lying terrain that allows inland inundation, or across inland water bodies such as bays, estuaries, lakes and rivers. For a typical storm, the surge affects about 160 km of coastline for a period of several hours. Larger storms that are moving slowly may impact considerably longer stretches of coastline.

Q.9 – Explain Extratropical Cyclones.

A - The descriptor "extratropical" refers to the fact that this type of cyclone generally occurs outside of the tropics, in the middle latitudes of the planet. These systems may also be described as "mid-latitude cyclones" due to their area of formation, or "post-tropical cyclones" where extratropical transition has occurred, and are often described as "depressions" or "lows" by weather forecasters and the general public. These are the everyday phenomena which along with anti-cyclones, drive the weather over much of the Earth.

Q.10 – Differentiate between structural and non structural mitigation measure.

A - Structural mitigation measures generally refer to capital investment on physical constructions or other development works, which include engineering measures and construction of hazard resistant and protective structures and other protective infrastructure while Non-structural measures refer to awareness and education, policies techno-legal systems and practices, training, capacity development etc.