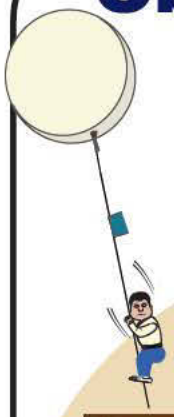
How are Weather Forecasts made?

Observation

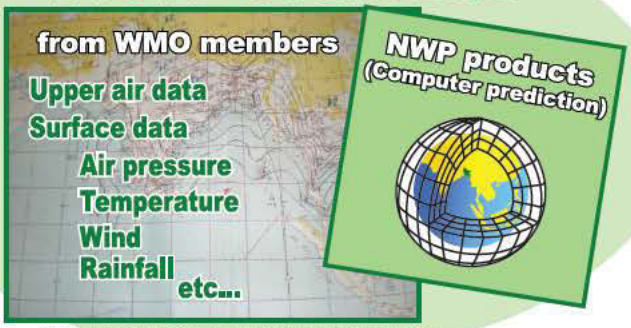


From Sky

From space

Surface

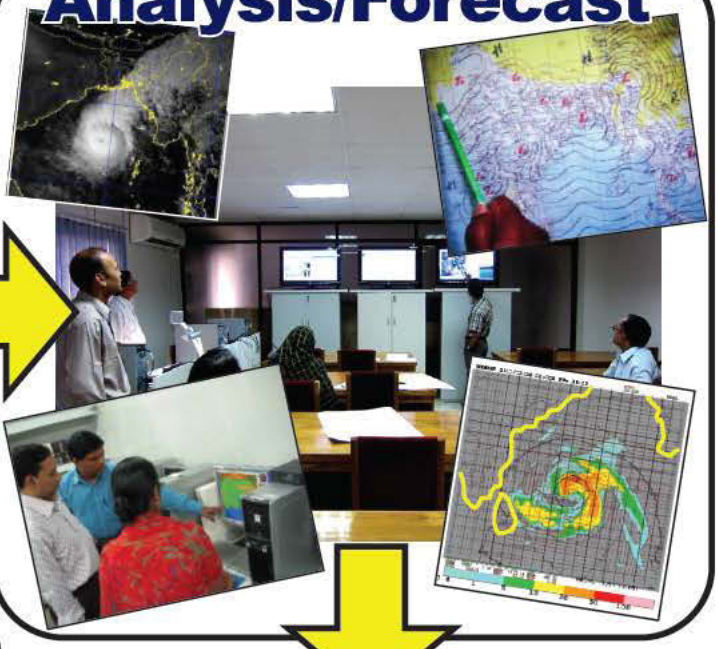
From Overseas



*WMO: World Meteorological Organization

Data Collection

Analysis/Forecast



Bangladesh Meteorological Department (BMD) is mandated to monitor, analyze and predict all climate and meteorological phenomena and also monitor earthquake.

Dissemination

Information/Forecasts issued by BMD

Daily Forecasts

Issuing time

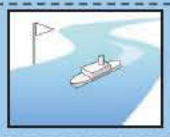
for general public

24-hr forecast and 2-day outlook for whole country

6-hr forecast for Dhaka & Neighborhood

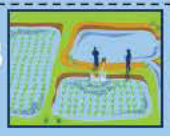
10am, 04pm, 06am, noon, 06pm, midnight

for inland river port



05:30 am, 10am, 04pm, 10pm

for farmers



05:30 am, 04pm

for sea

for sea port only

10:30 am, 10pm

for aviation

for airport & pilot only

frequently

Meaning of Weather Icons

- Sunny
- Partly cloudy
- Cloudy
- Light rain
- Heavy rain
- Thunderstorm
- Squally
- Cyclone

Medium/Long Range Forecasts

Weekly agro-met bulletin & advisories

On request, e-mail service is available.

Issuing date

Monthly forecast

3-month outlook

Warnings/ Advisories

- Tropical cyclone (TC)
- Storm surge induced by TC
- Kalbaishakhi/ Severe thunderstorm
- Tsunami
- Heavy rainfall
- Heat wave
- Cold wave

How to get the weather information/forecast?

Radio

TV

Web: www.bmd.gov.bd

Phone:
9135742
8113071
9111015
Fax: 8118230

Newspaper

DAILY

Weather

Climate of Bangladesh

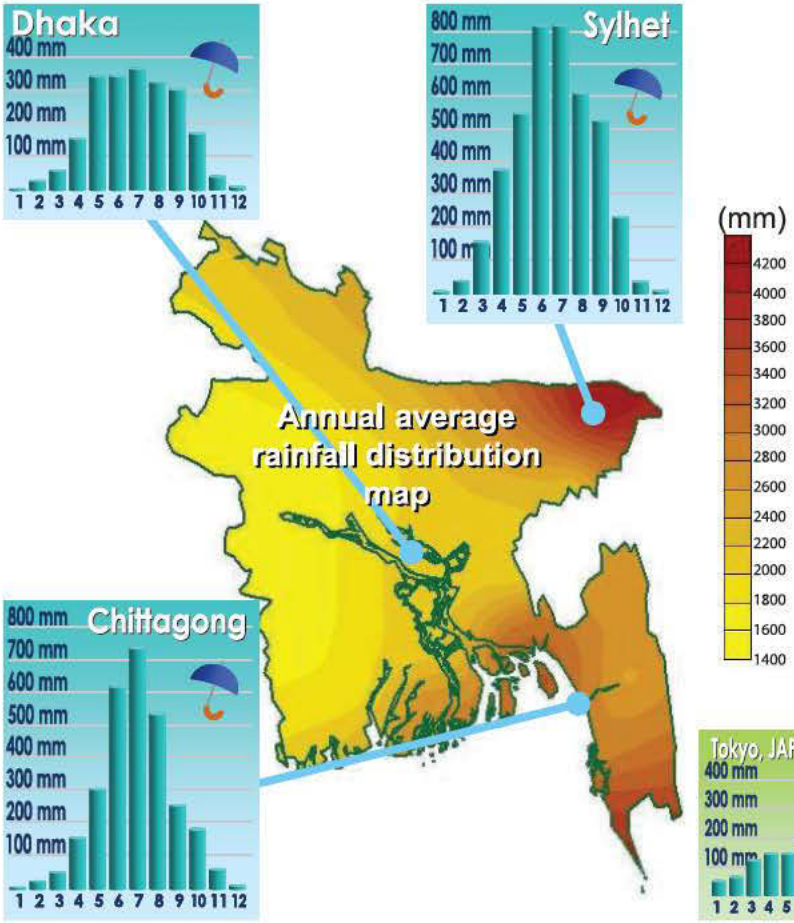
The climate of Bangladesh is tropical monsoon climate characterized by seasonal variation in rainfall and wind pattern. During Southwest monsoon (rainy season) i.e. June - September, Bangladesh receives heavy rain, whereas cool & dry weather prevails during Northeast monsoon (winter season) i.e. December - February.

In between those seasons, which is March to May is severe thunderstorm or locally called Nor'wester season.

Tropical cyclones form over the Bay of Bengal and hit Bangladesh during the pre-monsoon (April-May) and post-monsoon (October-November) season.

How much rain do we receive?

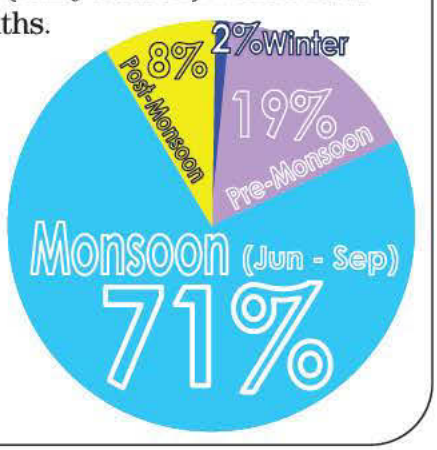
Annual average rainfall for Dhaka is 2150 mm, for Sylhet 4200 mm and country average rainfall is 2430 mm.



April is the hottest month, when maximum temperature of the country records at times more than 40 deg. C.

January is the coldest month, when the minimum temperature is at times below 5 deg. C.

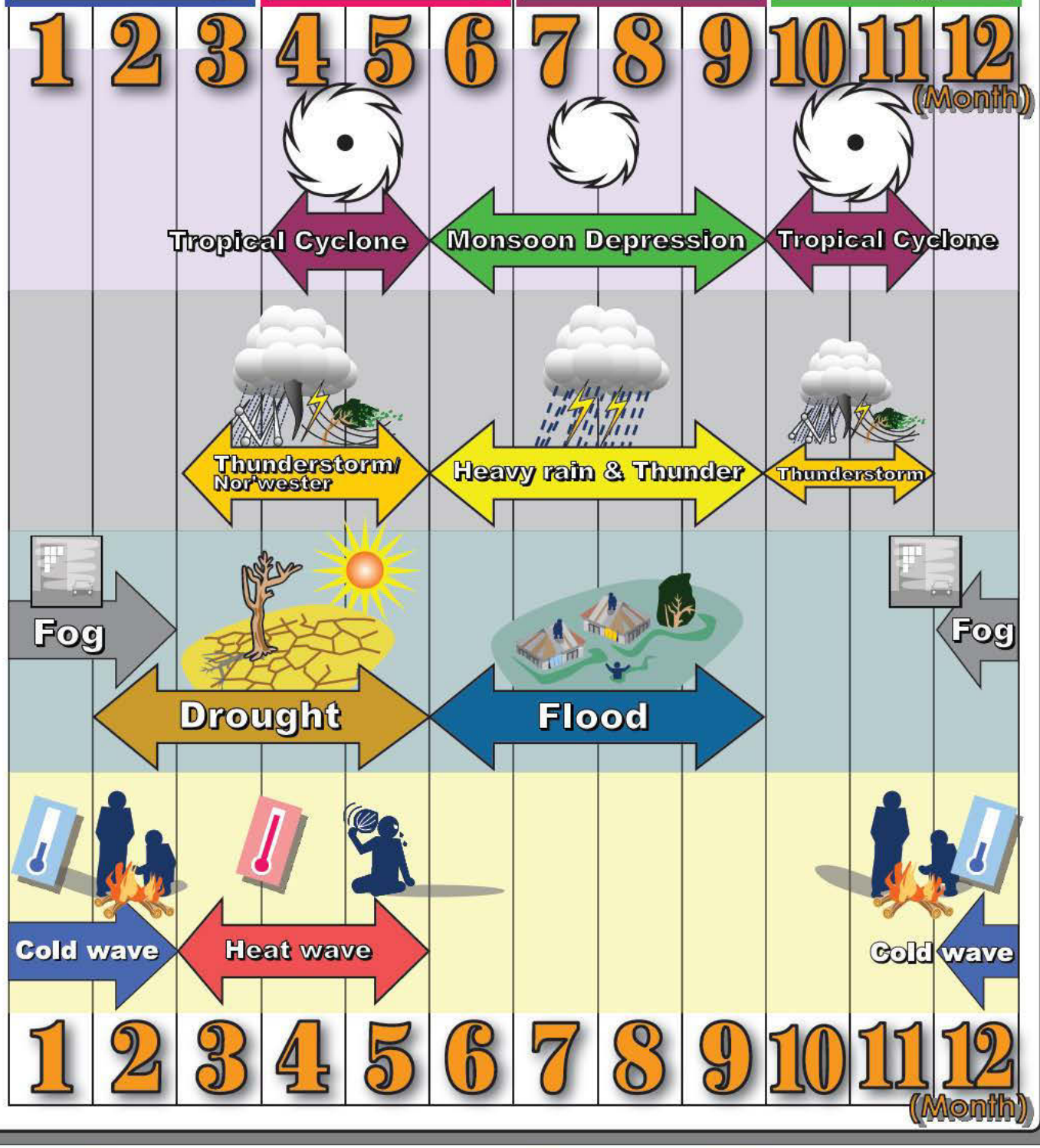
Bangladesh receives 71 % of the total annual rainfall during Southwest monsoon (rainy season) which lasts for 4 months.



Disaster Calendar
& Extreme Meteorological Events

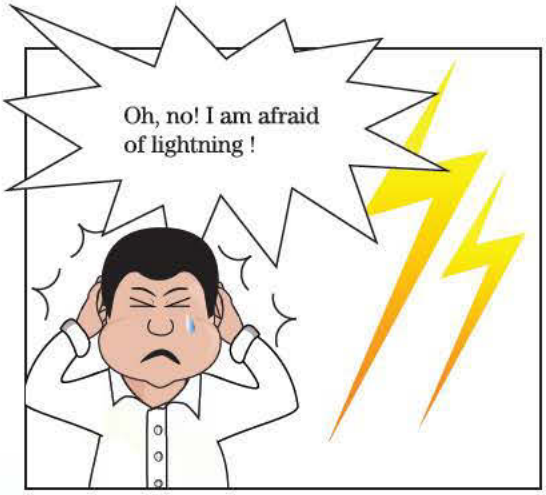
~ Bangladesh is one of the most disaster prone countries in the world. ~

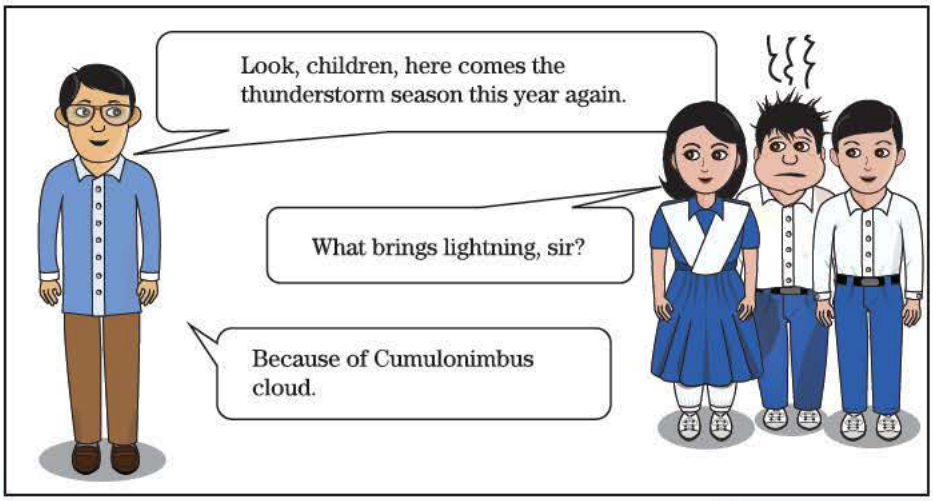
Lowest Temp.	Highest Temp.	Strongest Wind	Highest Rainfall
2.8 deg Celsius	45.1 deg Celsius	225 km/h	590 mm/day
04 Feb 1968	18 Mar 1972	29 Apr 1991(Cyclone)	15 Jun 2001
Srimongal	Rajshahi	Sandwip	Sandwip

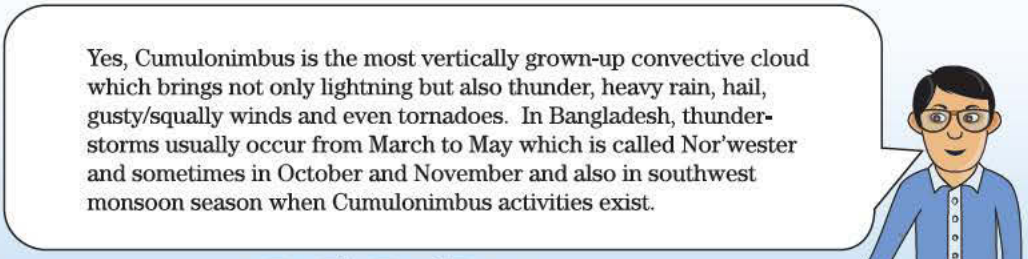


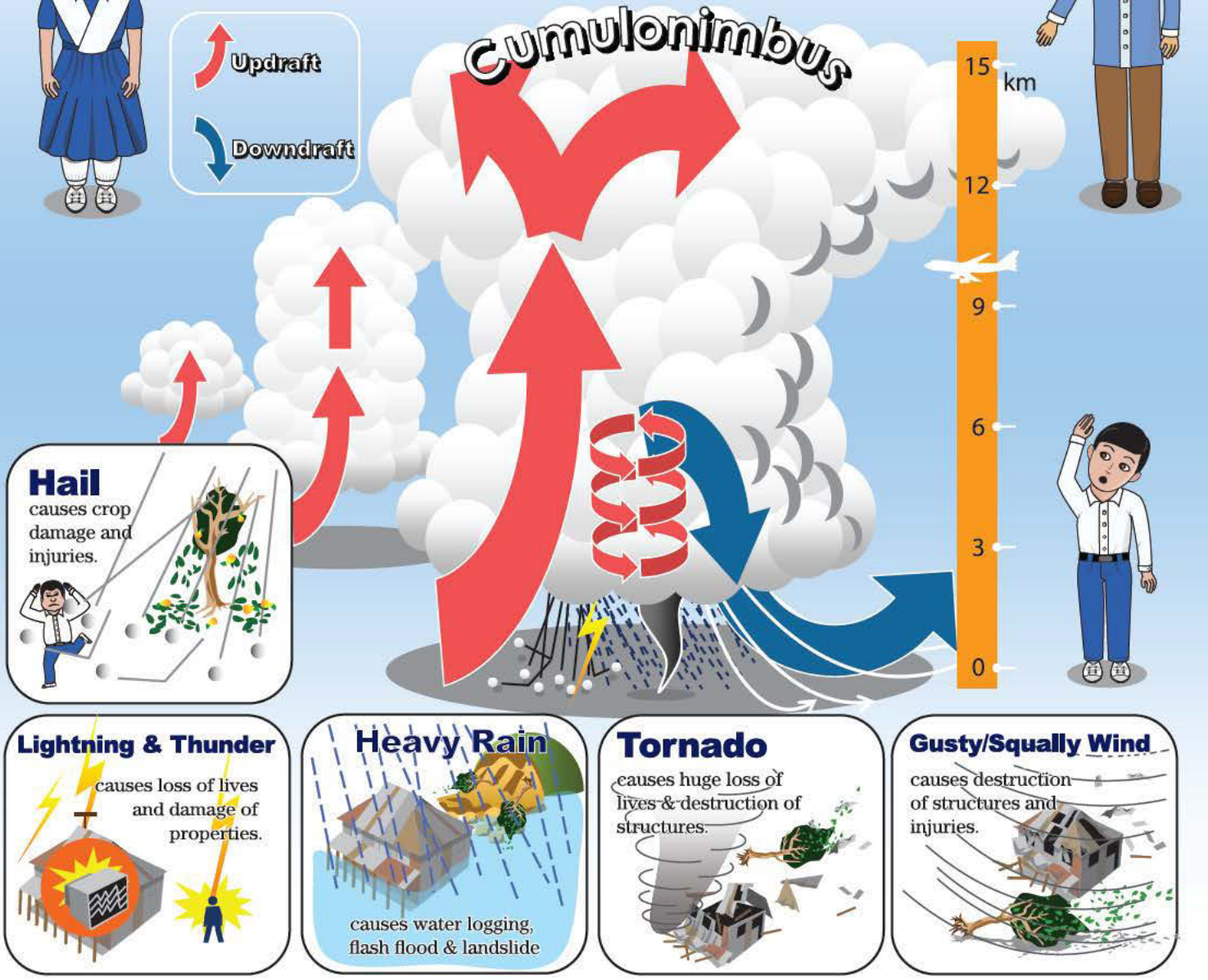
* Duration of each phenomenon may change a little bit every year.

Thunderstorm / Nor'wester

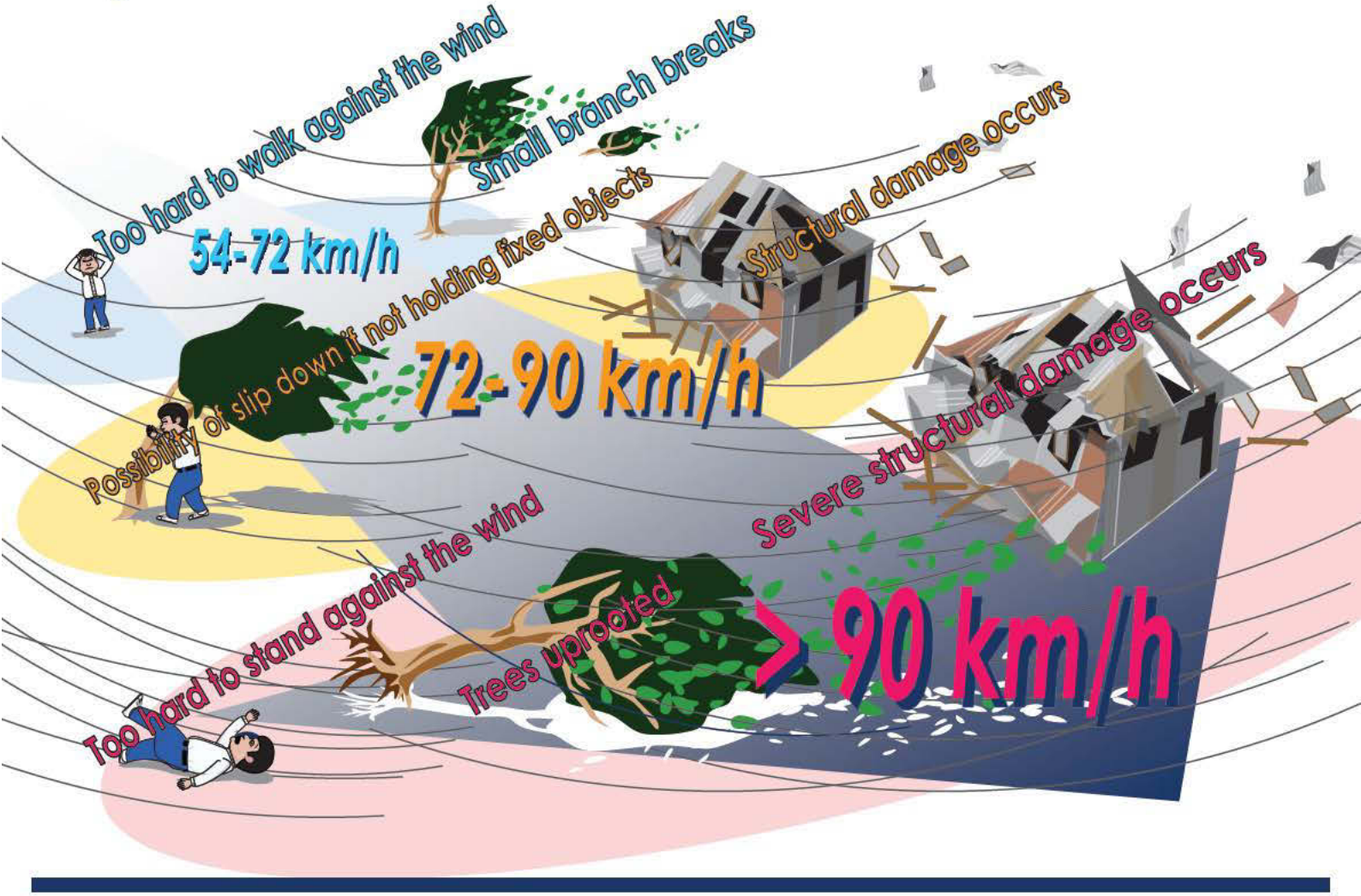




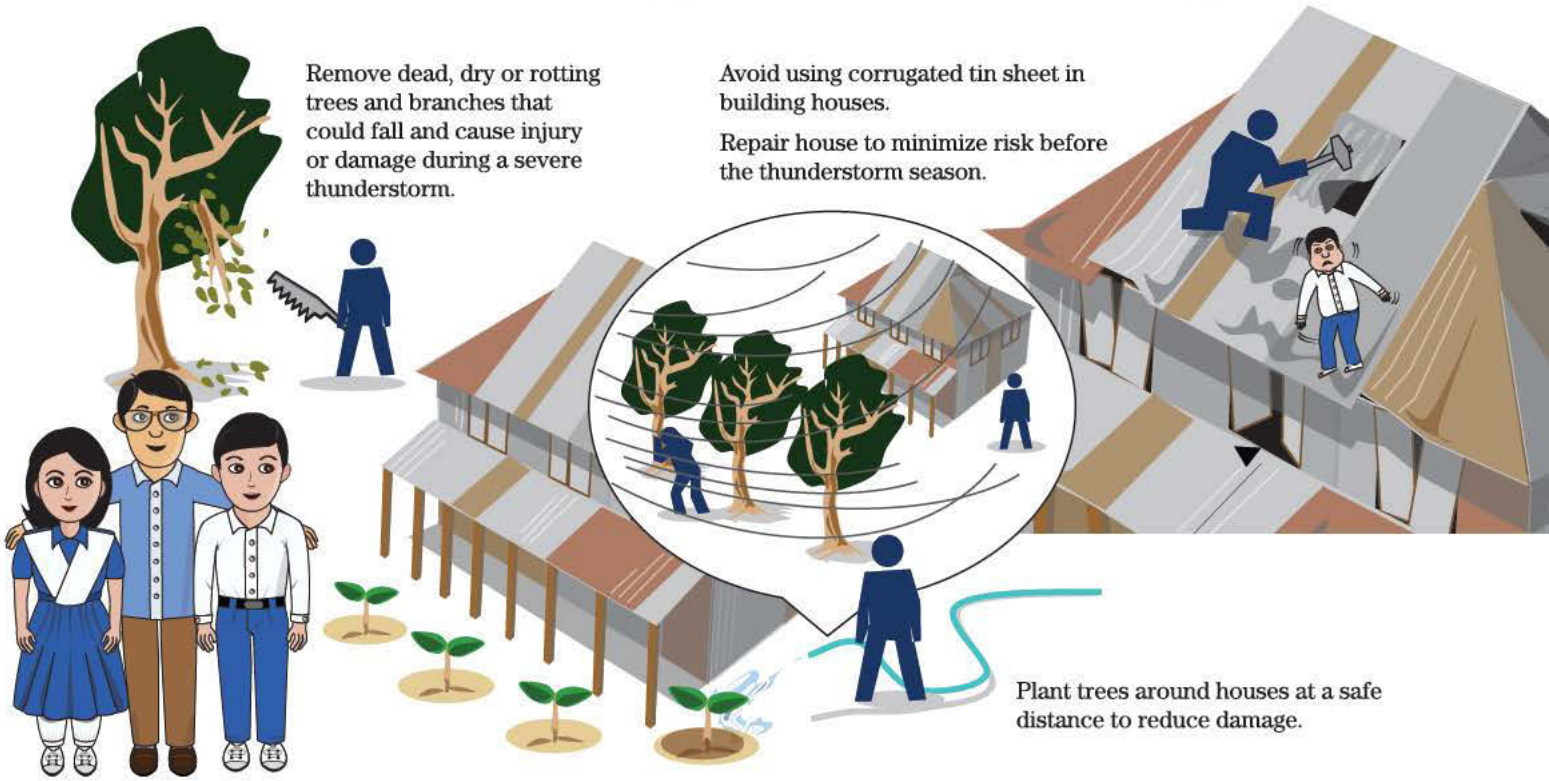




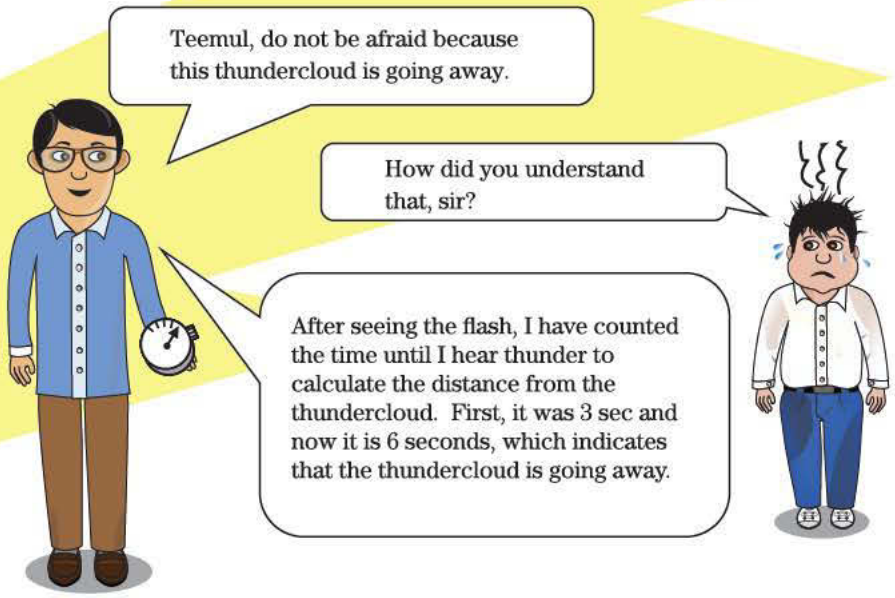
Damage induced by Wind



Precautions against Strong Wind



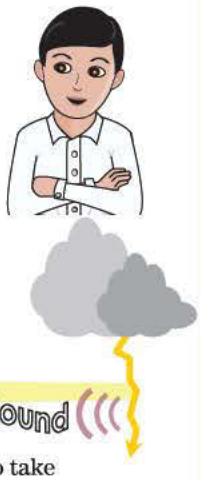
Lightning & Thunder



How far is the thunderstorm from Me?

If you see lightning, count the number of seconds until you hear thunder. Divide the number of seconds by 3 to calculate the distance in kilometers.

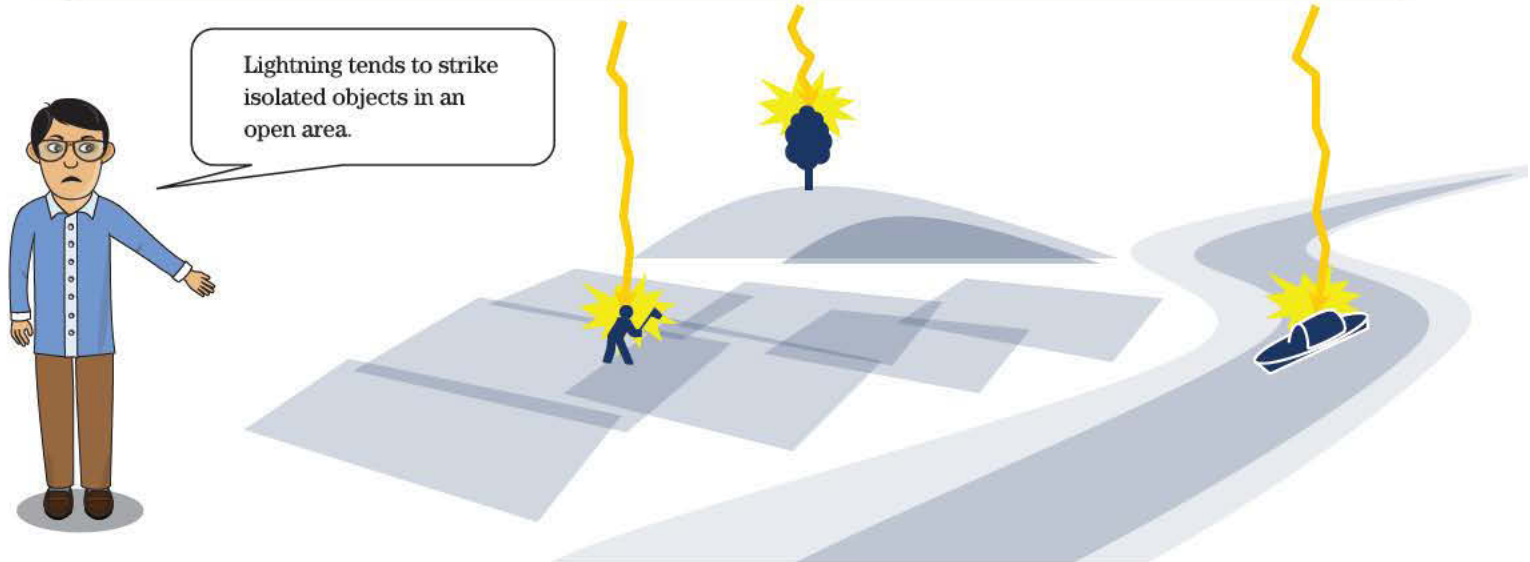
If thunder is heard	The lightning is…
3 seconds after a flash	1 kilometer away
6 seconds after a flash	2 kilometers away
9 seconds after a flash	3 kilometers away
12 seconds after a flash	4 kilometers away
15 seconds after a flash	5 kilometers away



Light

Sound travels in the air at about 340 m/s, on the other hand, light travels 300,000 km/s. That's why time lag between seeing a flash and hearing its thunder occurs.

Lightning about 10 km away is a warning to take shelter immediately because successive lightning strikes could be 10 km apart. It means, if the first lightning is 10 km away, the next one could hit you.



Safety Tips for Lightning

Outdoors

Take shelter indoors .

Safer area

45 degrees

4 meters

DO NOT take shelter under isolated trees. Stay away at least 4 meters from the tree.

Stay away from high ground.

In open areas or while working in the crop field with no shelter, sit low with less ground contact. DO NOT lie flat on the ground.

Stop fishing.

Get away from the water.

Take shelter under the shed of the boat.

Sit low with less surface contact of the boat.

DO NOT be close to broken cables.

Stay under power cables with safety distance from the electric pole.

Indoors

Unplug electrical equipment for avoiding damage.

Stay away from windows and electrical equipment for avoiding injuries.

DO NOT stay in the balcony.

Use lightning rod.

Rain & Hail

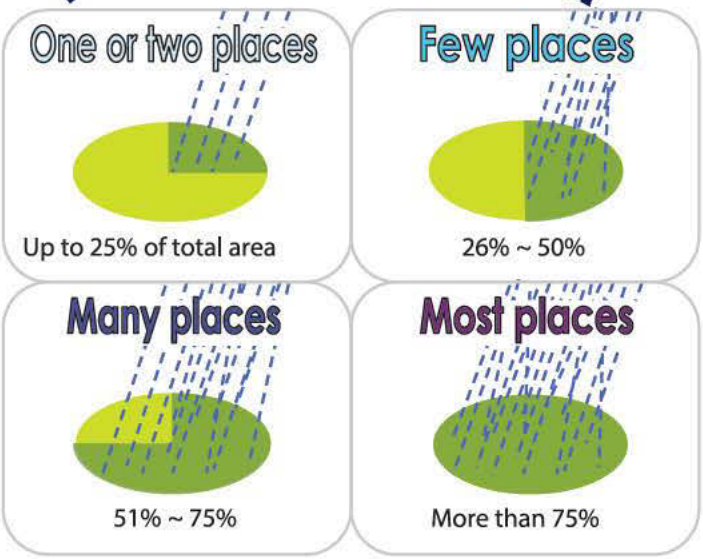
Weather forecast says that it will be moderate rain today. How strong is "moderate rain" , sir?

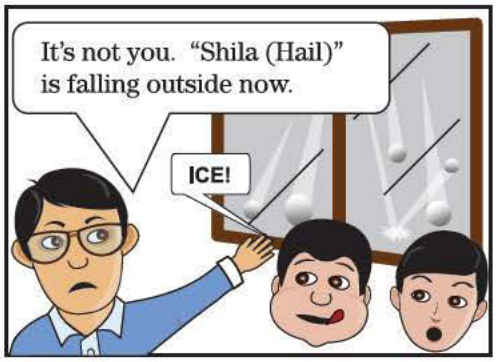
Badal, each expression for rain intensity has its own meaning as follows.

Rain Intensity

Trace	Not measurable
Light Rain	< 10 mm/day
Moderate Rain	11 ~ 22 mm/day
Moderately Heavy Rain	23 ~ 43 mm/day
Heavy Rain	44 ~ 88 mm/day
Very Heavy Rain	> 88 mm/day

Forecast Rain Area



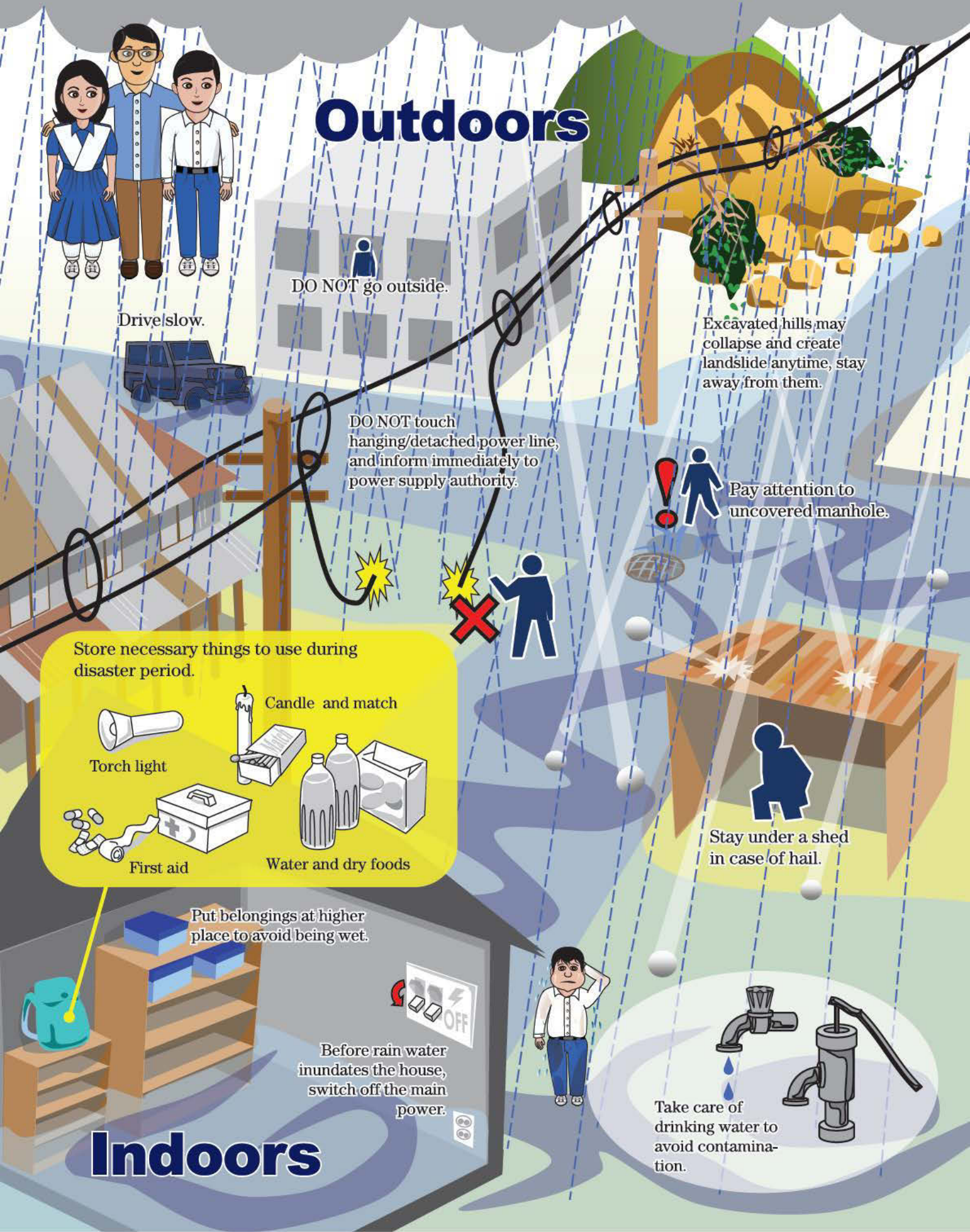


Falling Speed of Hail

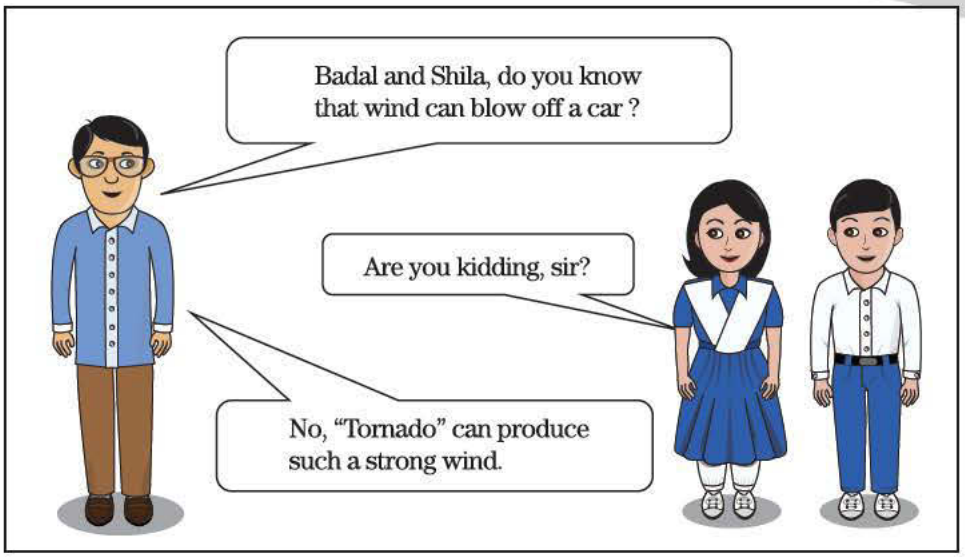
The bigger the size, the higher the falling speed.

Yes you are right. Falling speed of hail can be as fast as 100 km/h or more that causes damage to crops, vehicles, etc.

Safety Tips for Heavy Rain & Hail



Tornado



Tornadoes are one of the nature's most violent storms developed from powerful thunderstorms. A tornado appears as a rotating, funnel-shaped cloud that extends from a thunder-cloud to the ground with whirling winds that can reach 300 km/h or more.

"From Wikipedia"

Safety Tips for Tornado

Beforehand you should look for sky conditions.

Stay away from windows.

Go to the lowest building level.

Get under a strong furniture and use your arms to protect your head and neck.

Go to the center of an interior room.

Stay away from outside walls.

Indoors

If possible, rush into a nearby building.

Watch out for flying debris.

DO NOT take shelter in a small shed.

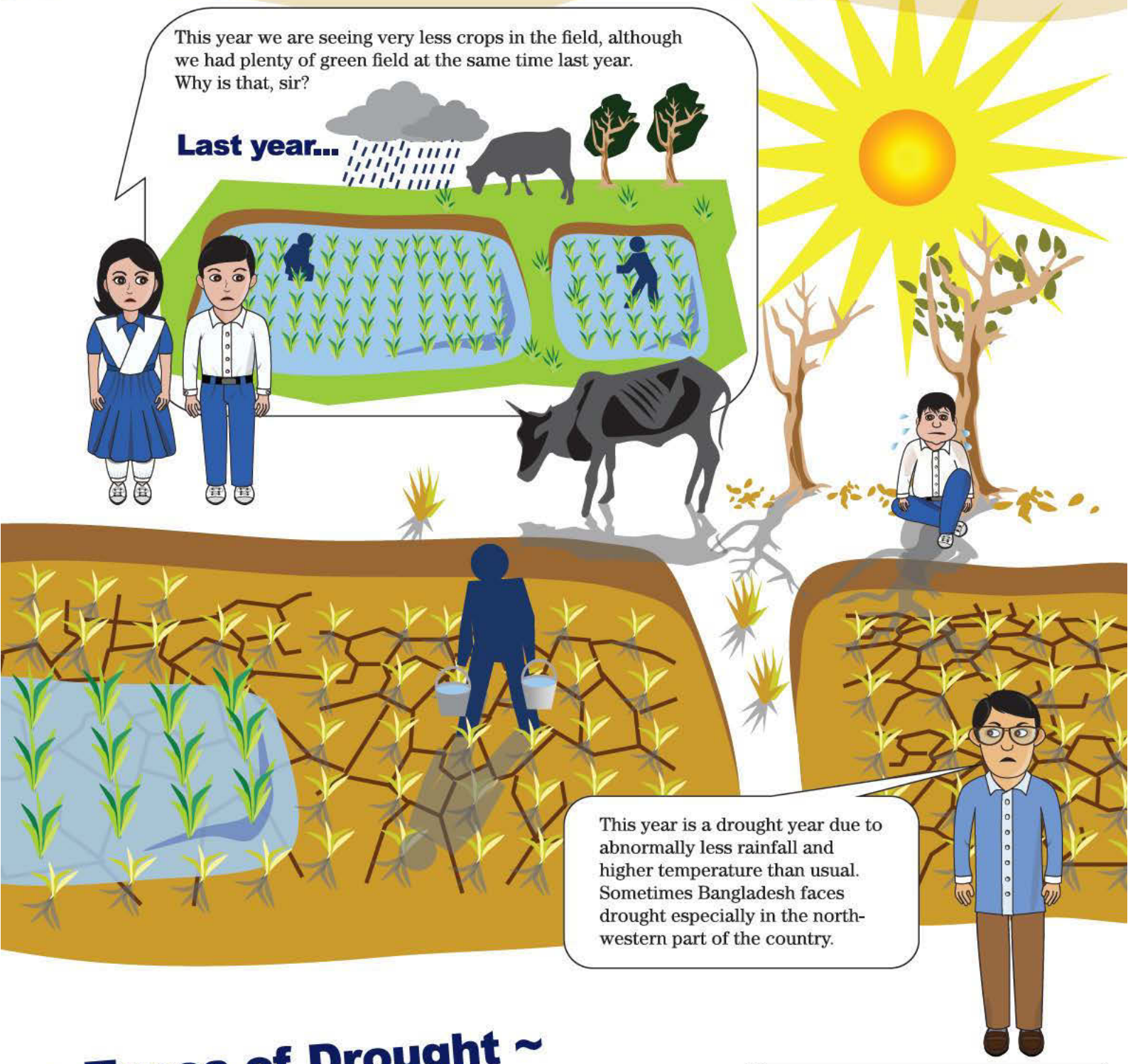
If you can not find any buildings...

Lie flat in a nearby ditch or depression and cover your head with your hands.

Take shelter in a concrete pipe, if available.

Outdoors

Drought



~ Types of Drought ~

Meteorological Drought:

Comparison between normal or average amount of rainfall and duration of the dry spell is defined as meteorological drought.

Agricultural Drought:

When agriculture is affected by less rainfall, soil moisture deficits, reduced ground water and/or reservoir levels then the situation are called agricultural drought.

Hydrological Drought:

When surface water supply is affected due to shortfall of precipitation, changes in land use, land degradation, construction of dams or climate change then the situation is called hydrological drought.

Countermeasures to Drought

Environment

Stop deforestation

Encourage forestation

Use community based bio-gas plant.

Cultivation

- Encourage crop diversification.
- Encourage homestead garden.
- Encourage drought-resistant & short-duration varieties.

Information

Follow Weekly Agro-met Bulletin/Advisories provided by BMD.

Irrigation

Dig small ponds for rain water harvest (storage of rain water) & fish culture.

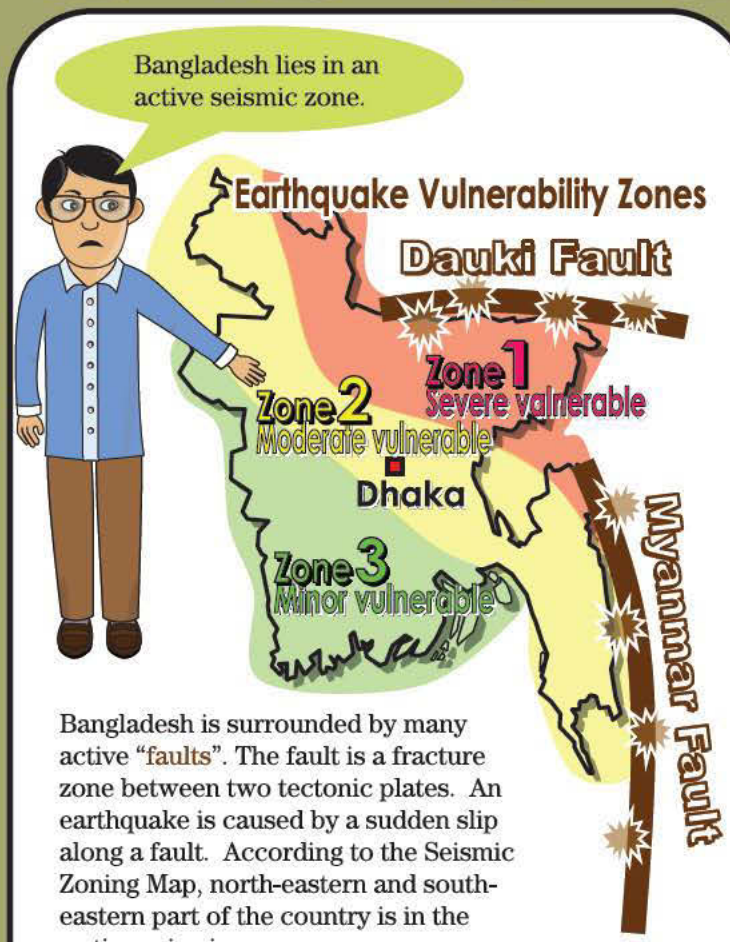
Use surface water as much as possible.

Make plan for applying irrigation, fertilizer and pesticide based on probability of rain. Use rain water as much as possible.

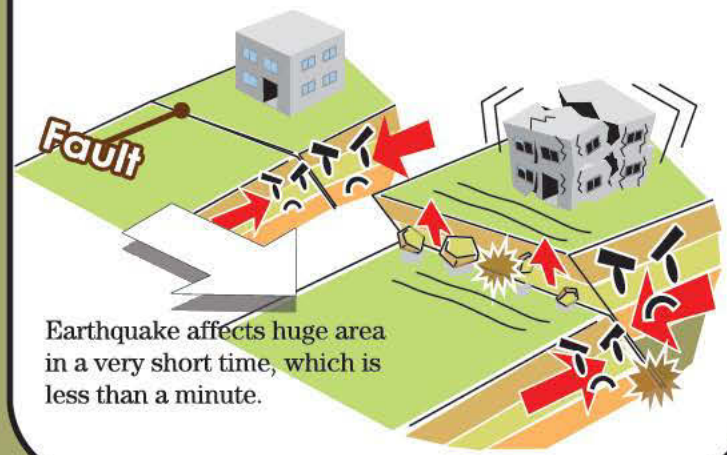
Re-excavate canals & traditional ponds.

Decrease dependency on underground water.

Earthquake



Bangladesh is surrounded by many active "faults". The fault is a fracture zone between two tectonic plates. An earthquake is caused by a sudden slip along a fault. According to the Seismic Zoning Map, north-eastern and south-eastern part of the country is in the active seismic zone.



Earthquake affects huge area in a very short time, which is less than a minute.

Richter scale is used to express the magnitude of earthquake. In this scale, a magnitude of 5.0 earthquake results in 10 times shaking amplitude larger than a magnitude of 4.0 earthquake, and 32 times as much as energy is released.

Seismic Magnitude and its description

Less than 3	Very minor
3~	Minor
4~	Light
5~	Moderate
6~	Strong
7~	Major
8 and higher	Great

Last 150 years Historic/Remarkable Earthquakes in/around Bangladesh

Jan. 1869	7.5	Kasar earthquake
Jul. 1885	7.0	Bengal earthquake
Jun. 1897	8.7	Great Indian earthquake
Jul. 1918	7.3	Srimongal earthquake
Jul. 1930	7.1	Dubri earthquake
Jan. 1934	7.0	Nepal earthquake
Aug. 1950	8.5	Assam earthquake

During the last 150 years, seven major earthquakes have affected Bangladesh. Out of the seven earthquakes, two had their epicenter within Bangladesh.

Bangladesh Meteorological Department is monitoring and analyzing seismic wave round-the-clock by using seismometers at four seismic stations, and find out location of epicenter, time of origin and magnitude when earthquake occurs.

Safety Tips for Earthquake

Before...

- ☐ Fasten shelves and heavy furniture securely to walls.
- ☐ Place large or heavy objects on lower shelves.
- ☐ Fix overhead light and other fixtures.
- ☐ Hang heavy items away from beds.
- ☐ Store breakable items in low, close cabinets with latches.
- ☐ Store necessary things to use during disaster period.
  - Torch light
  - Candle and match
  - First aid
  - Water and dry foods
- ☐ Make earthquake evacuation plan and try to build earthquake-proof house.
- ☐ Keep important telephone numbers in case of emergency.

Hospital 1234-56xx
Fire Service 5678-90xx
OUTDOOR KEY

☑ Check box

During...

Indoors

- Stay away from glass windows.
- Stay under strong furniture (table , bed, etc.) or corner of the beam.
- Turn off main power switch and gas burner.

OFF

Outdoors

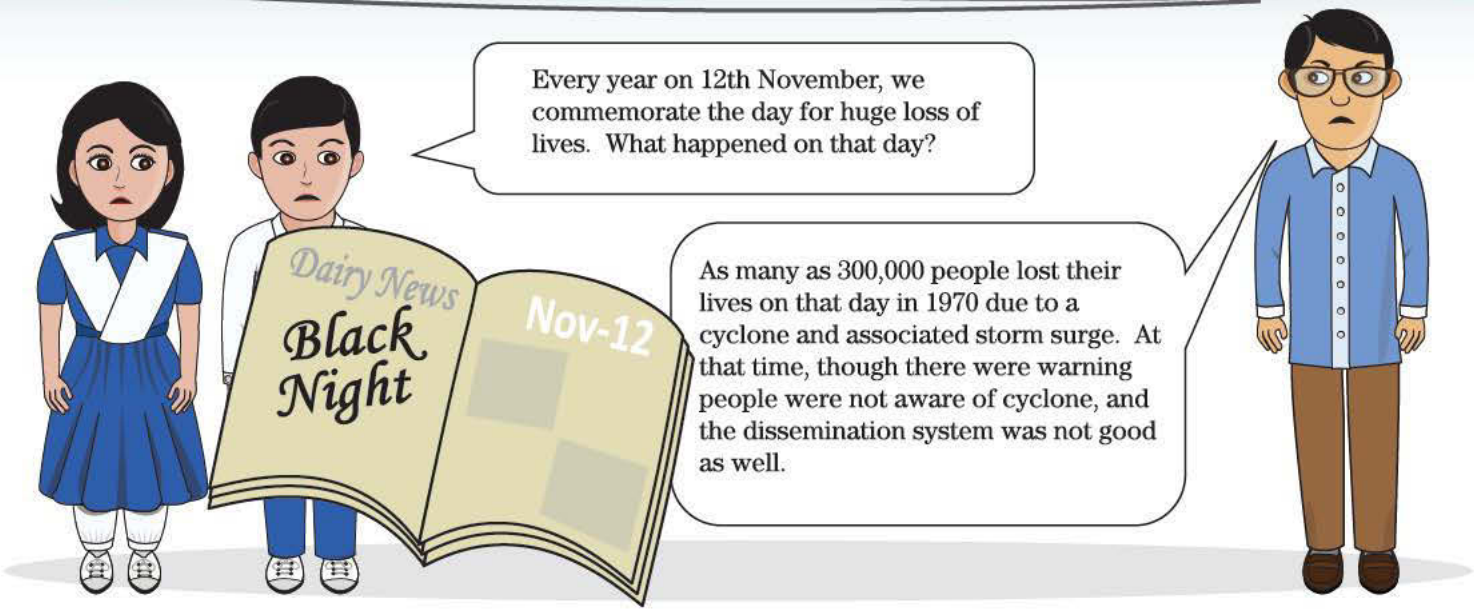
- Stay away from walls.
- Watch out for falling debris.

After...

Call in case of emergency.

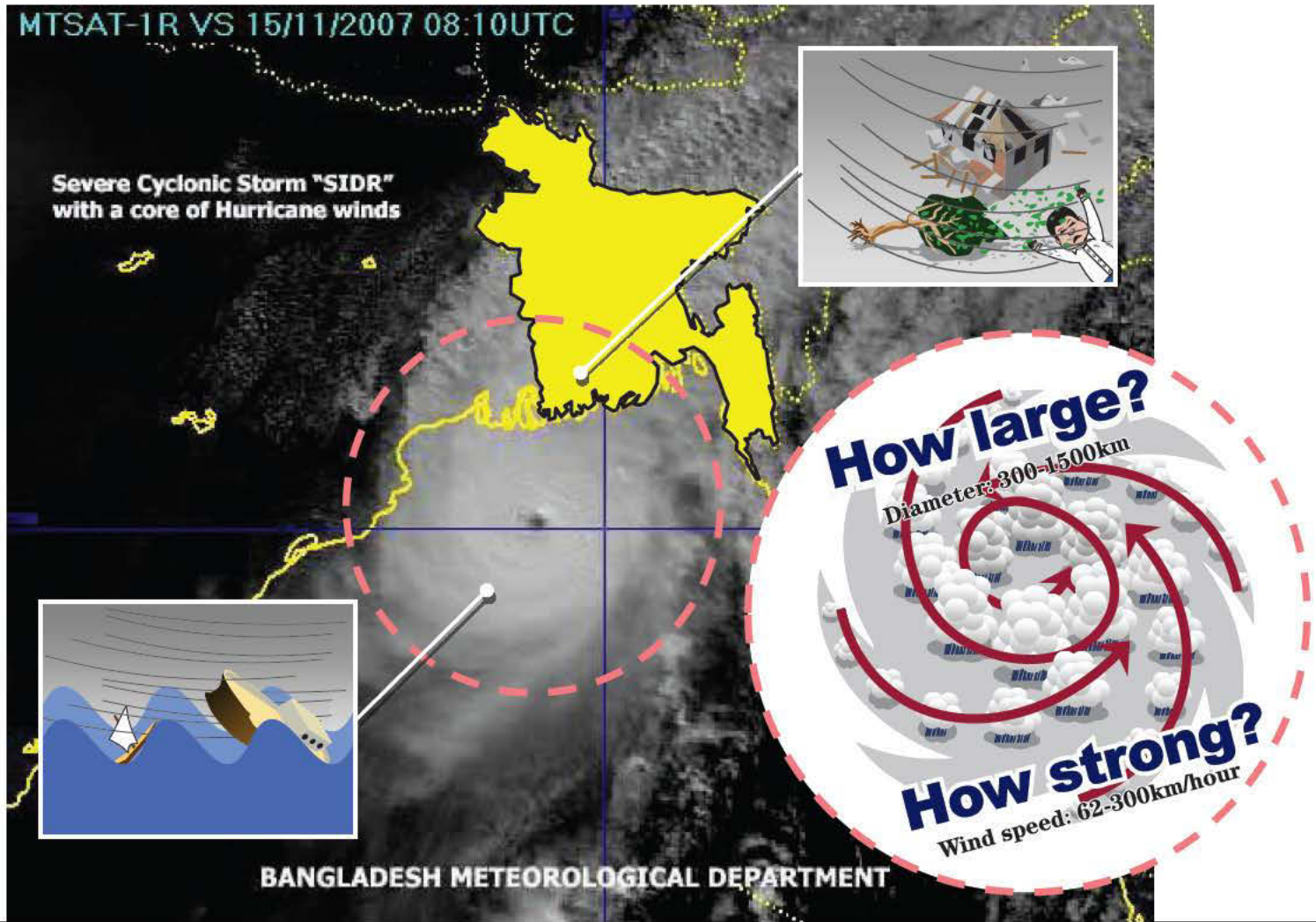
Fire Service & Civil Defense	
Local Administration	
Hospital	Police

Cyclone



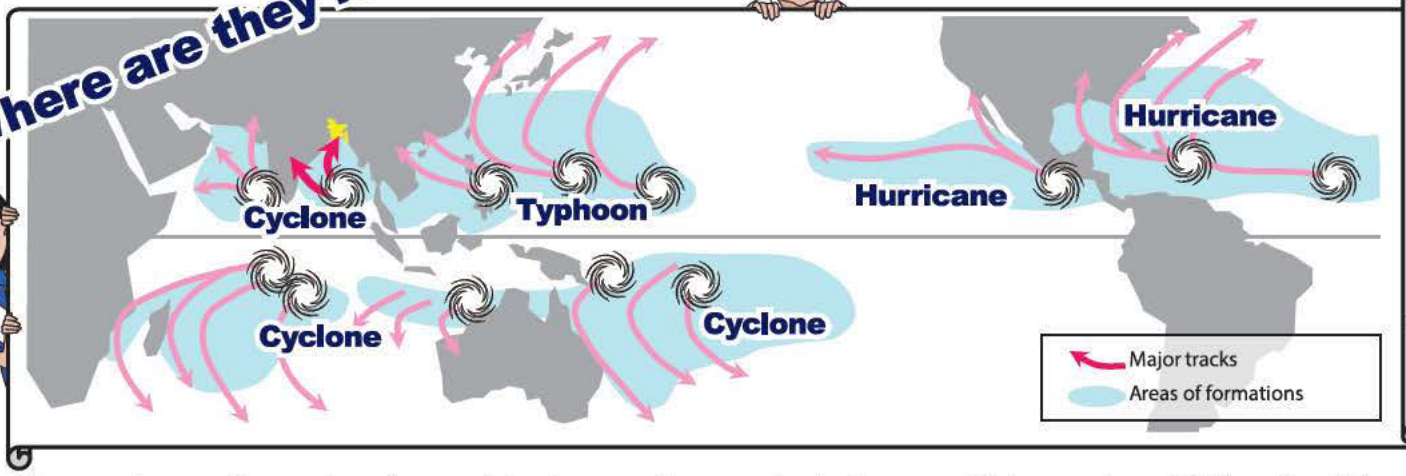
What's cyclone?

Cyclone is a large tropical revolving storm consisting of numerous thunderstorms, and one of the most devastating weather phenomena. It comes from the ocean and sometimes hit our country bringing extremely powerful winds and torrential rain as well as damaging storm surge.



Climatology of Cyclone

Where are they formed?



Storm systems such as cyclone form and develop over the warm tropical ocean with temperature of 27 deg. C or higher. They move into high latitude and then occasionally reach land. Depending on their location and strength, they are referred to as Hurricane, Typhoon, and simply Cyclone, etc.

The Bay of Bengal has a double peak of cyclone activity: one in April and May, so-called pre-monsoon season, and another in October and November, post-monsoon season. The countries affected by the cyclones in this region are India, Bangladesh, Sri Lanka, Myanmar and Thailand.

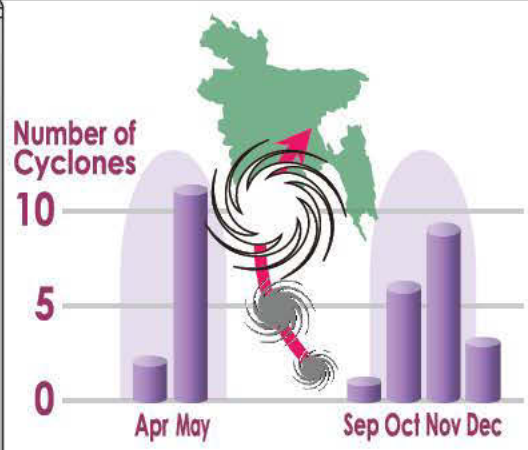
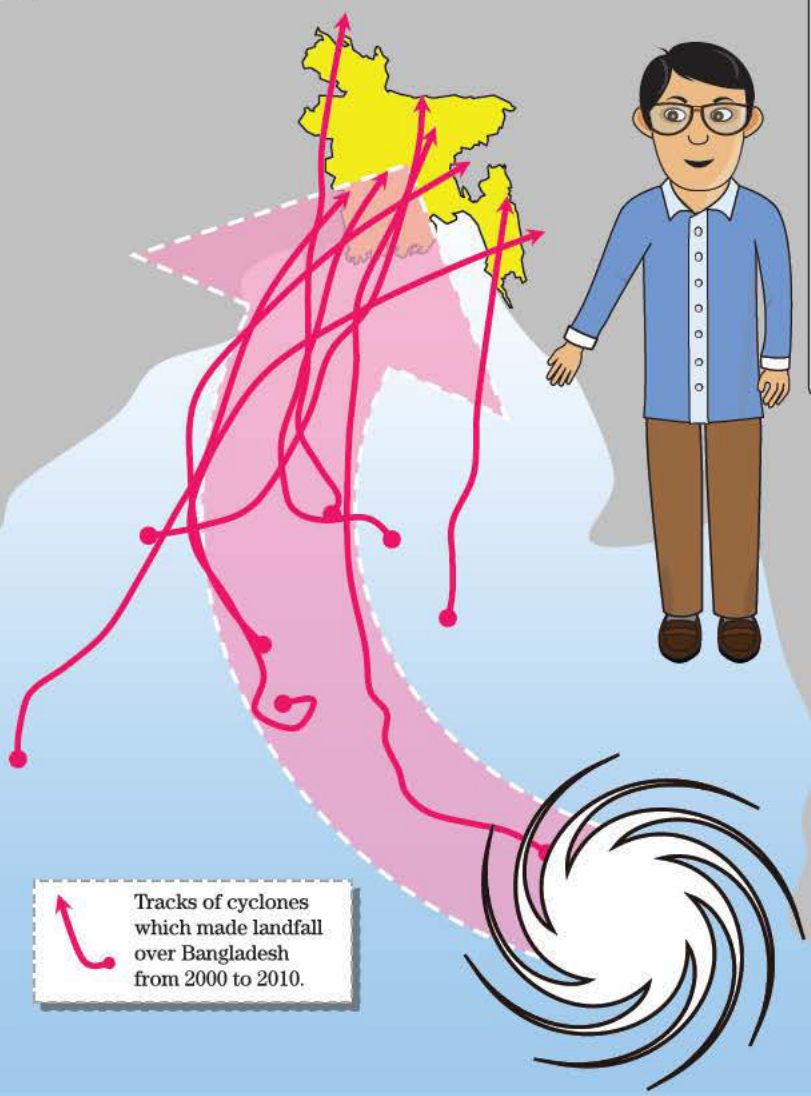


Fig.: Monthly frequency of cyclone which made landfall over Bangladesh from 1960 to 2011.



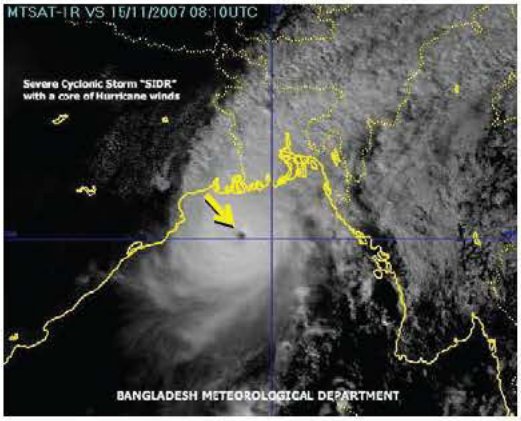
Cyclone is referred to as making landfall when its center, not its edge, gets on shore after moving over the ocean.

Near the center of a cyclone is where most of the damage occur, because damaging aspects, such as core of strong winds, heavy flooding rains and peak of storm surge, are concentrated under the area.

However, before landfall of cyclone, stormy weather may already affect the coast and inland for hours; in fact, a cyclone can bring its strongest winds over land before making landfall.

Expected Weather During Cyclone

The center of a cyclone is called "eye". What do you expect the weather condition in the eye?

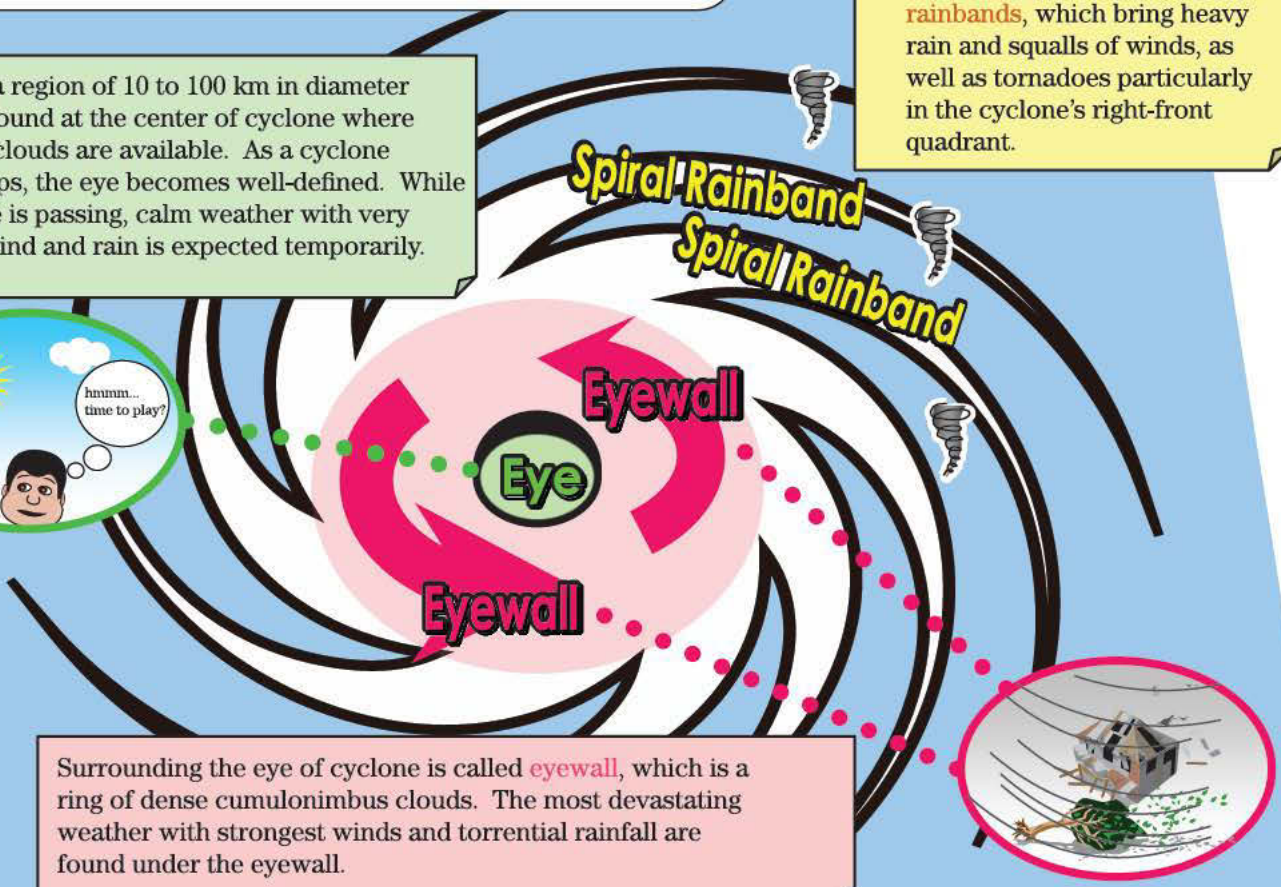


Of course, we encounter heaviest rain and strongest winds, right?

It is not correct. You can experience calm weather with clear sky at the cyclone eye. As you can see the schematic view of a cyclone below, we can find that the most severe weather condition is located at the surrounding area of the eye, called "eyewall", instead of the center of a cyclone.

The cloud bands that spiral inward toward the center of cyclone are called spiral rainbands, which bring heavy rain and squalls of winds, as well as tornadoes particularly in the cyclone's right-front quadrant.

Eye is a region of 10 to 100 km in diameter often found at the center of cyclone where fewer clouds are available. As a cyclone develops, the eye becomes well-defined. While the eye is passing, calm weather with very little wind and rain is expected temporarily.



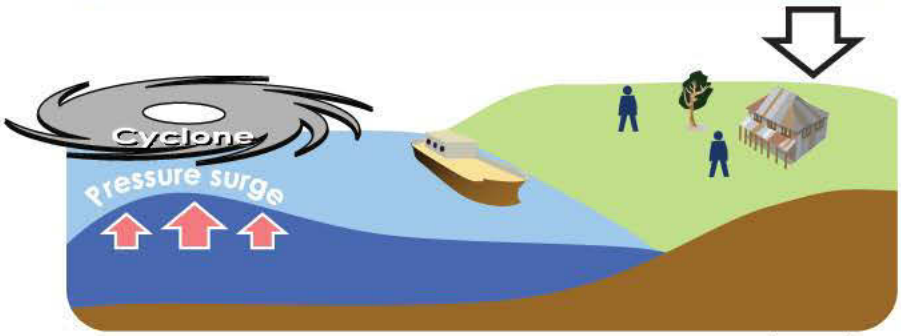
Surrounding the eye of cyclone is called eyewall, which is a ring of dense cumulonimbus clouds. The most devastating weather with strongest winds and torrential rainfall are found under the eyewall.

A common mistake is that people tend to think the cyclone has ended while its eye is passing because dangerous winds are completely declined. But in fact, if you are outdoors, then you will suddenly encounter the violent winds again when the other side of the eyewall comes.
That's why it is strongly discouraged to leave shelter while the eye passes over.

Cyclone's Storm Surge

Storm surge is water being pushed toward the coast by the force of strong winds swirling around a cyclone. Greatest damage during cyclones are resulted from the devastating inundation caused by storm surge. Actually most of casualties by cyclones are killed by the storm surge.

There are several steps to produce storm surge during cyclone.

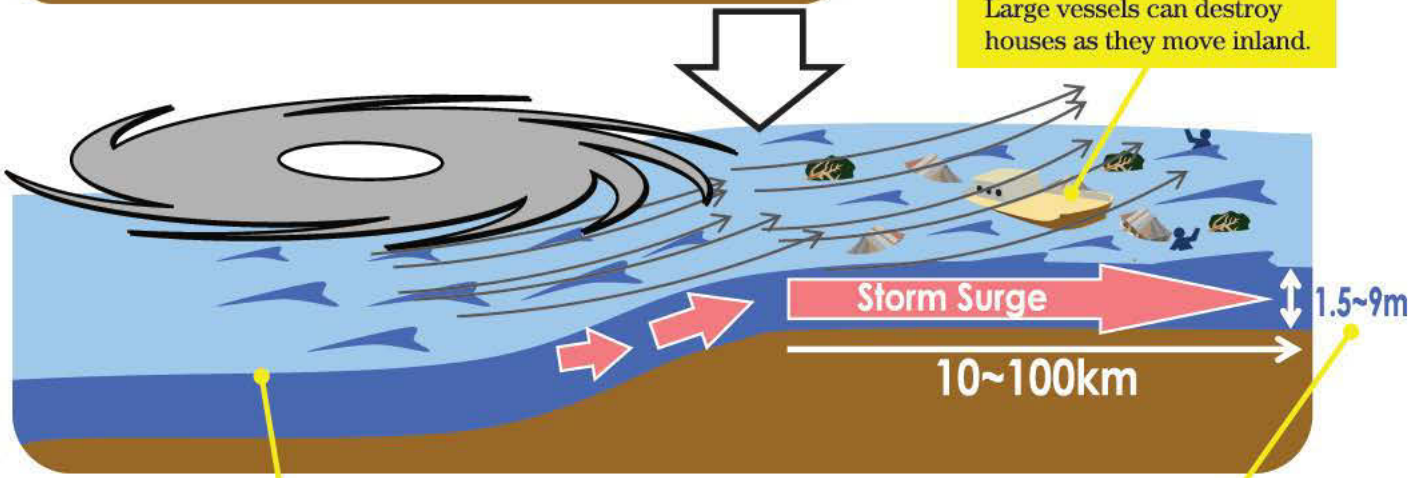


First, the ocean water is pulled upward in the region of cyclone center due to pressure effect.

Next, persistent onshore wind over a shallow water body piles up water into the head of bay.

As a cyclone center is approaching to the coastline, wind-driven surge as well as pressure surge invades coastal area.

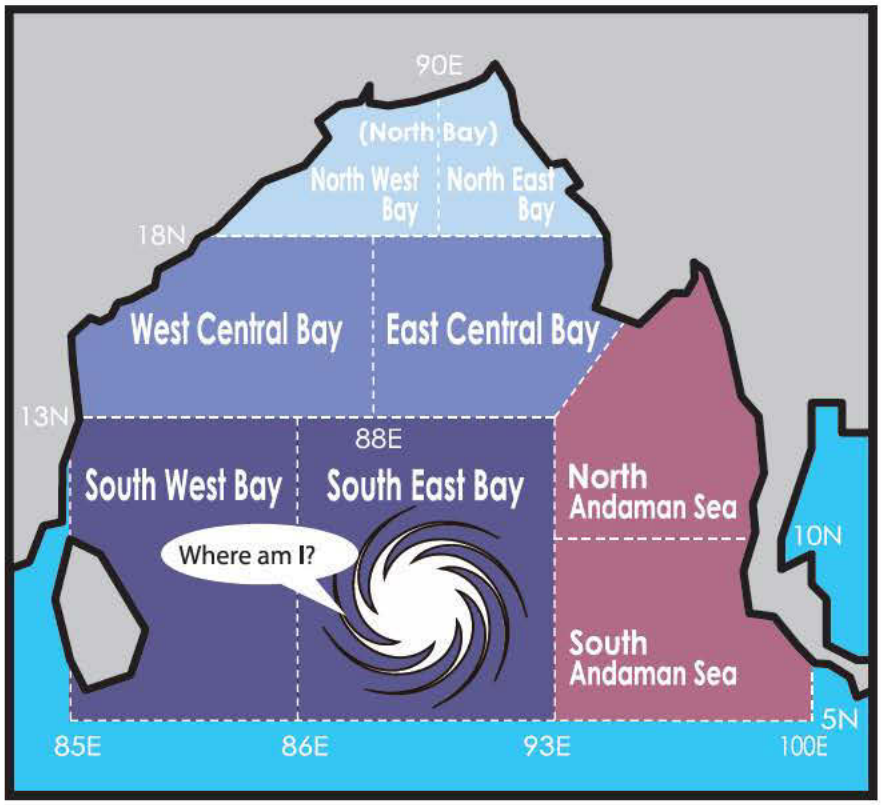
Large vessels can destroy houses as they move inland.

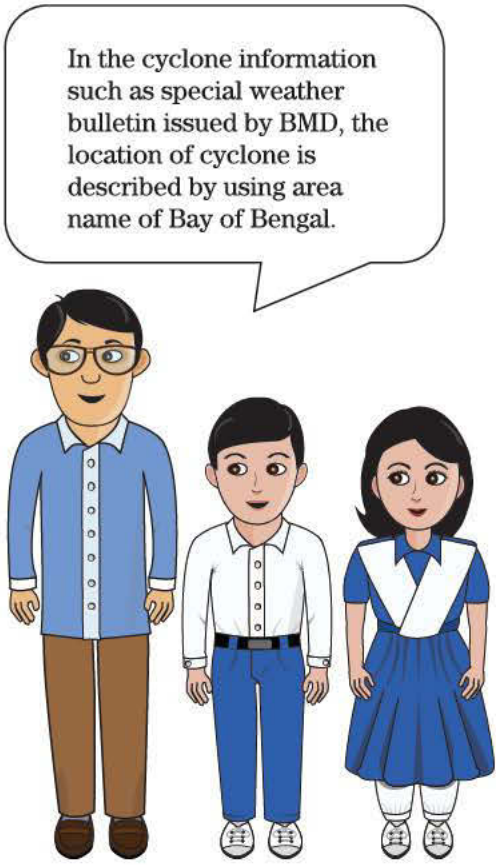


If storm surges are superimposed on highest astronomical tides, the situation becomes worse.

Rising speed of water associated with storm surge can be as fast as 1 meter/hour.

Classification of Cyclone





This type of storms receive cyclone names once maximum average wind speed exceeds 62 km/hour.
Cyclones are officially categorized into several ranks according to maximum wind strength.

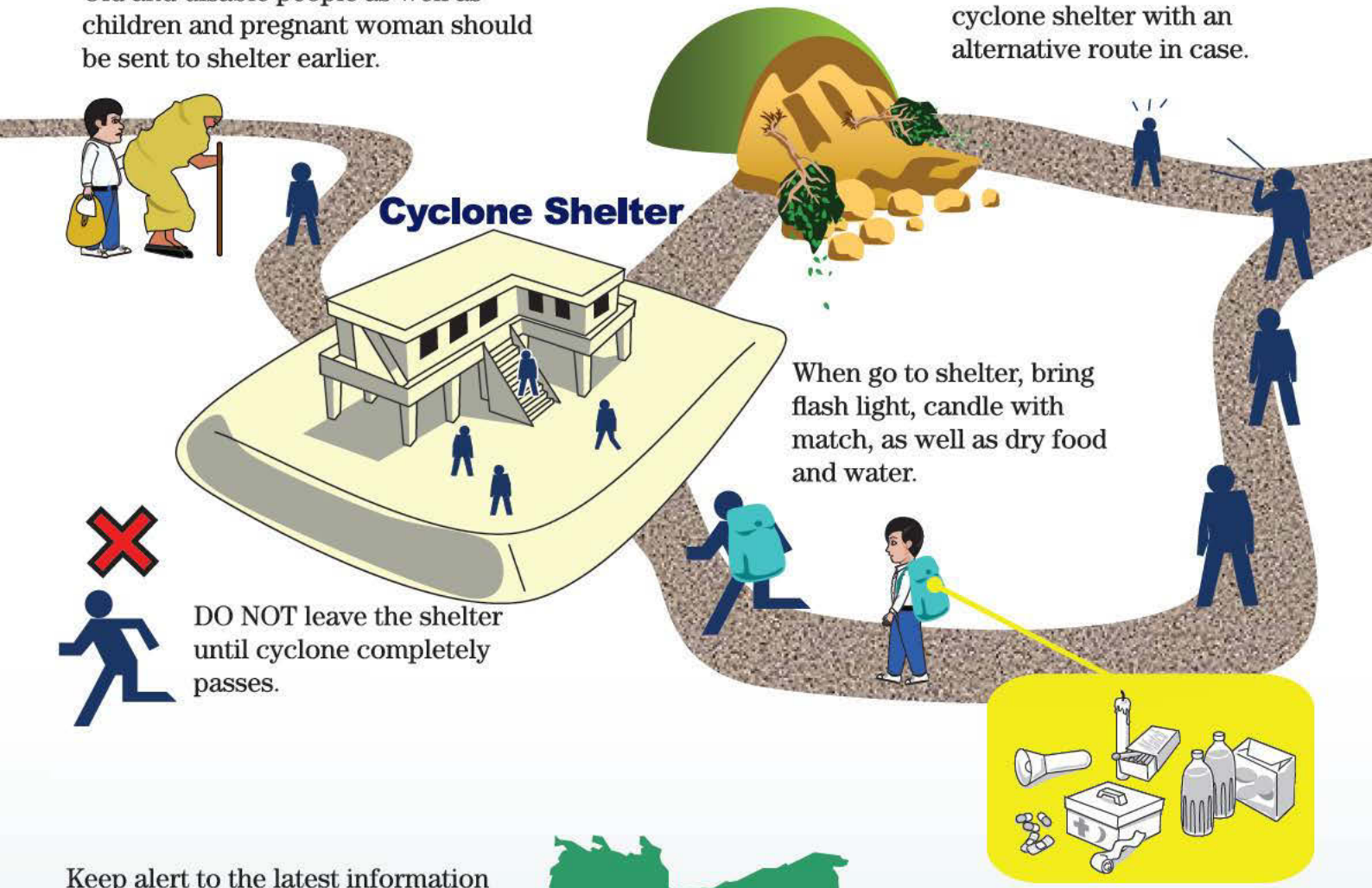
Category	Wind Speed (Maximum Average)
Cyclone	
Super Cyclone	≧220 km/h
Severe Cyclonic Storm with a core of Hurricane wind	118~219 km/h
Severe Cyclonic Storm	89~117 km/h
Cyclonic Storm	62~ 88 km/h
Deep Depression	51~ 61 km/h
Depression	41~ 50 km/h
Well-marked Low	31~ 40 km/h
Low	17~ 30 km/h

When the wind speed reaches 90km/hour or higher, following impacts are expected.
- Severe structural damage occurs. - Trees uprooted. - Too hard to walk against the wind.

Safety Tips for Cyclone

Old and disable people as well as children and pregnant woman should be sent to shelter earlier.

Check the access road to cyclone shelter with an alternative route in case.

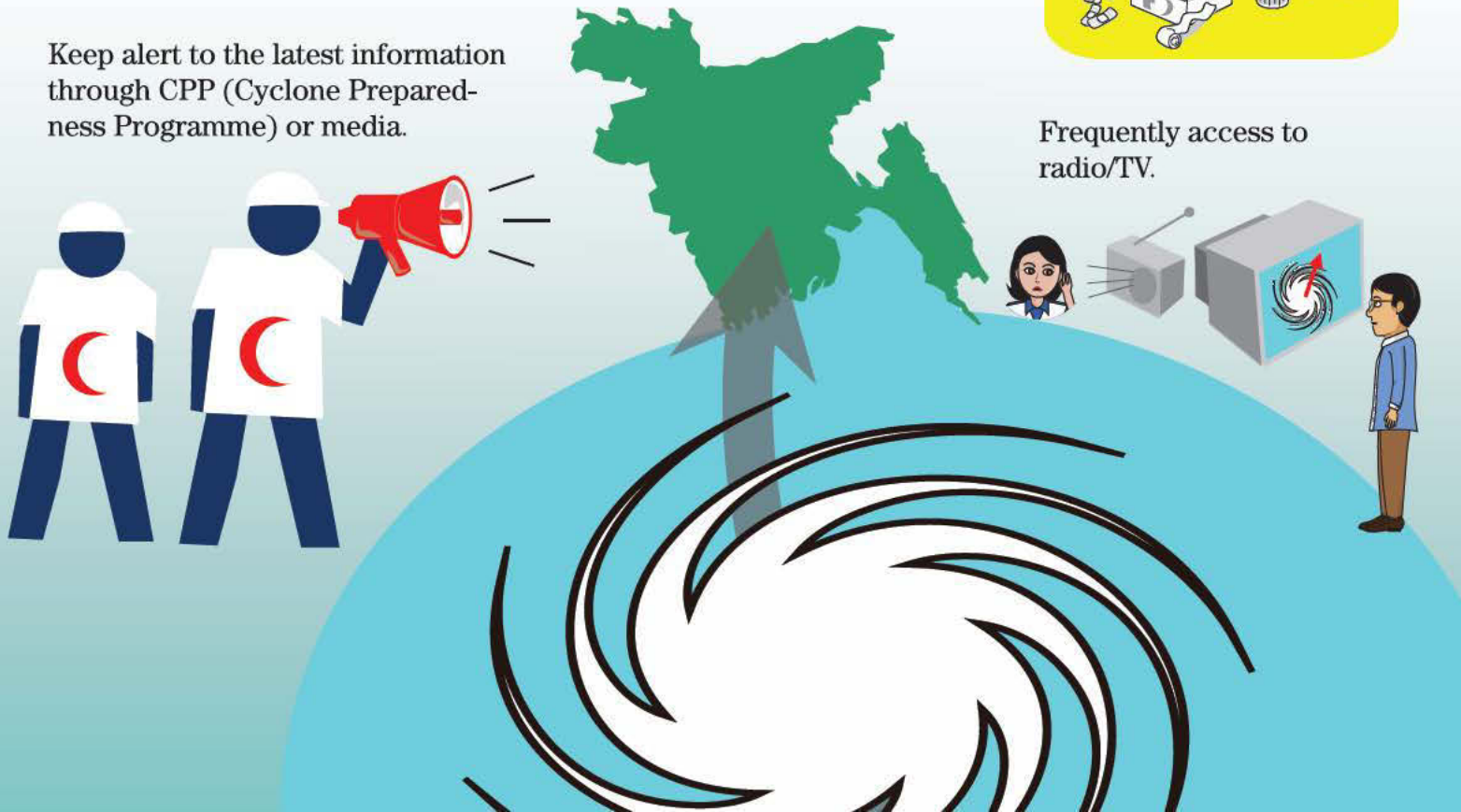


When go to shelter, bring flash light, candle with match, as well as dry food and water.

DO NOT leave the shelter until cyclone completely passes.

Keep alert to the latest information through CPP (Cyclone Preparedness Programme) or media.

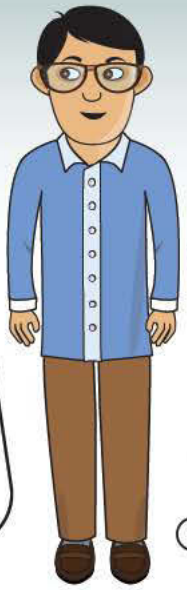
Frequently access to radio/TV.



Flood

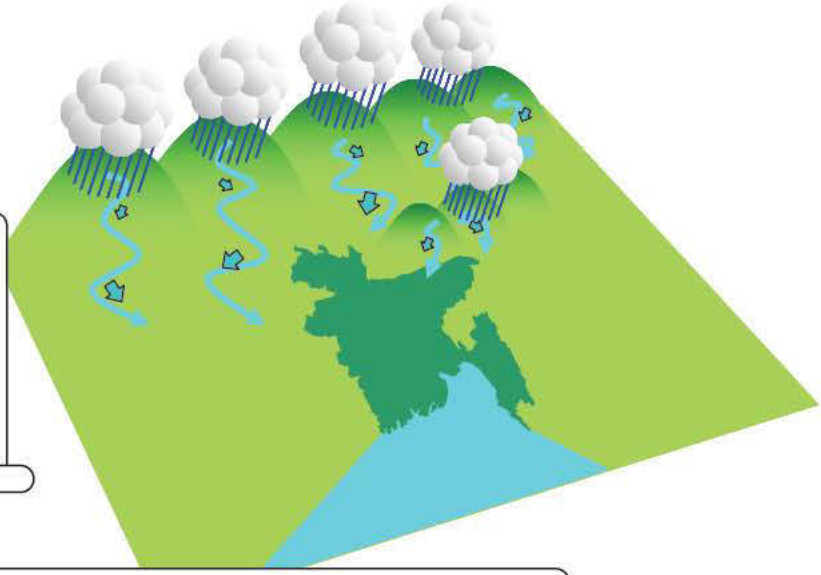
June-September

Every year during monsoon season, from June to September, about one-fifth of Bangladesh is flooded, and in extreme years, two-thirds of land can be submerged in flood water. It is because of its topography and climate.

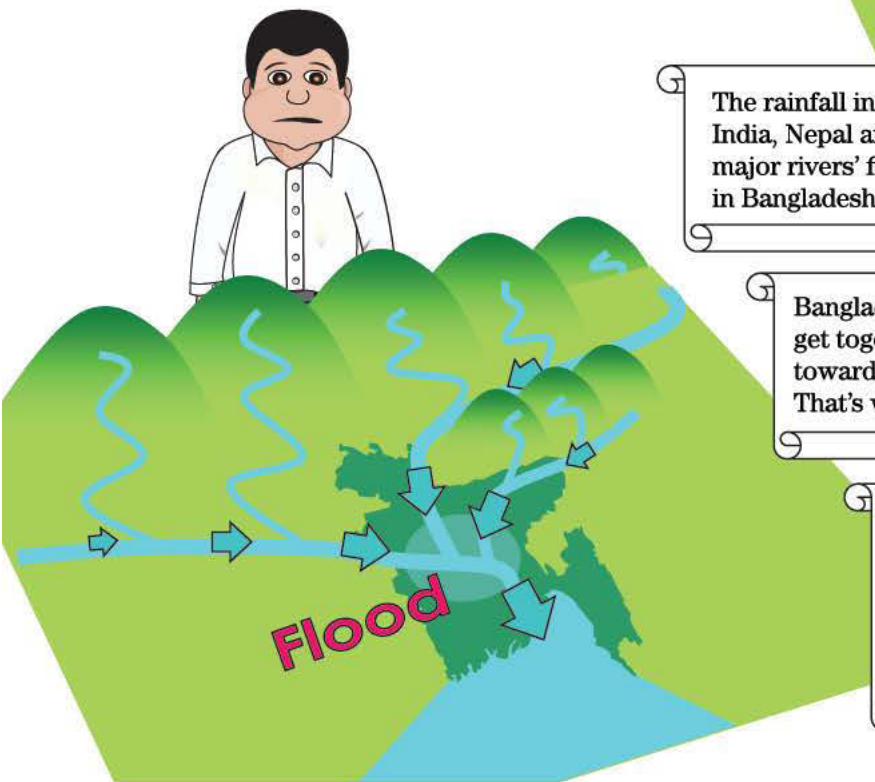


Regarding topography, Bangladesh is at the foot of the world's highest mountain range - the Himalayas, and one of the world's highest precipitation zones - the Meghalaya.

Regarding Bangladesh's climate, it receives a lot of rain from June to September because of southwest monsoon. When this moist air hits the high Himarayas north of Bangladesh, rainclouds are enhanced, then huge amount of rainwater including snow-melted water comes down the slope and flow into Bangladesh.



The rainfall in surrounding countries such as India, Nepal and China is contributing to the major rivers' flow much more than local rainfall in Bangladesh.



Bangladesh is almost flat, thus, river water which get together in Bangladesh can not quickly flow towards the sea and it stays longer in the lands. That's why Bangladesh often experiences flood.

Usually the peak of water level in the major rivers are recorded from the end of July to the beginning of September. During flood season, people must always listen to the news and the flood warnings issued by FFWC (Flood Forecast and Warning Center).

Flash Flood

On the other hand, we are also facing another type of flood, 'Flash Flood'.

When a large amount of rain falls over hilly area in a short time, surface water runoff or mud flows are triggered, which can kill people because of its fast speed.

Bangladesh Meteorological Department (BMD) is operating weather radars for watching not only cyclone but also rainfall over the hills which can trigger flash floods. So it is important to keep attention to information by radio, TV as well as rain forecast issued by BMD.

Safety Tips for Flood

Do not allow children to play in flood waters.

Stay away from fallen electrical line in wet areas because electrical current can travel through water.

Store necessary things to use in case of evacuation.

Watch your step. After a flood the ground is covered with debris including broken glass and sharp objects just below the mud.

Put belongings at higher place to avoid being wet.

Before river water inundates the house, switch off the main power.

Beware of snakes that may have moved into your house.

Be careful about drinking water which might be contaminated or get dirty by flood waters. Boil it before using.

In case of diarrhea, take saline water to avoid dehydration.

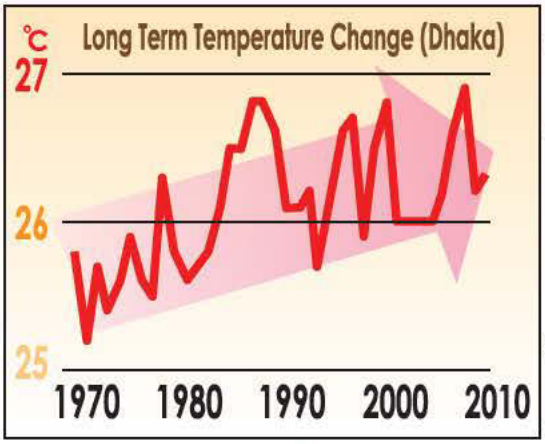
Climate Change

Look at these photos. Children, do you know what's currently going on at the beach of our country?

Salt water has killed or is killing trees along the coast.

These photos are evidence of **sea level rise** induced by **climate change**. This climate change is caused by **global warming**.

Global warming?



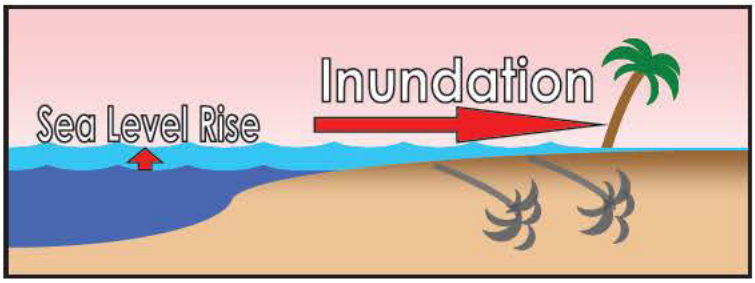
In the past 100 years, global average air temperature has risen 0.7 to 0.8 degrees Celsius.

As you can see this graph, our country has also been experiencing long term temperature rise.

Due to this, global average sea level has risen about 20 cm because expansion of ocean water and ice melting in the polar regions.

Why do we need to worry about those small amount of temperature or sea level rise?

No, Teemul. Even though this temperature rise is negligible for human, it has great impact on animals and plants. And in case of flat land, small amount of sea level rise causes large area of inundation as shown below.

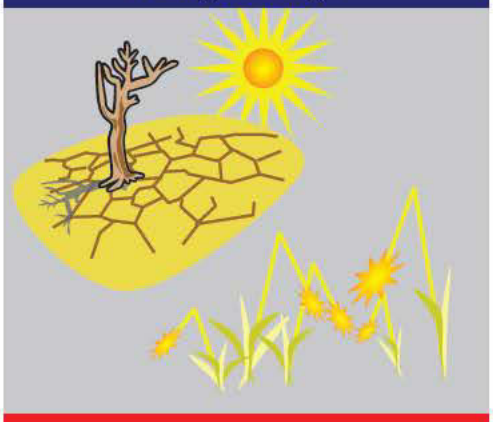


Unfavourable Outcome of Climate Change

Heavier rain and lightning

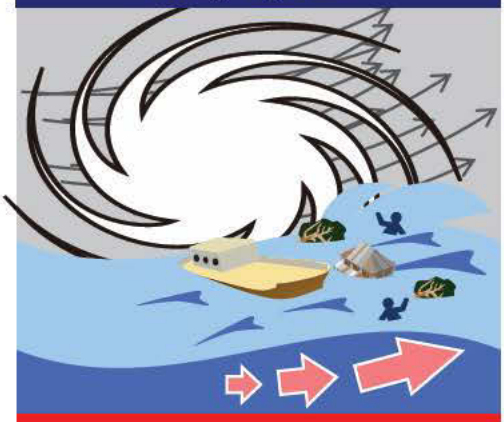
Higher risk of flash flood and lightning

Prolonged drought



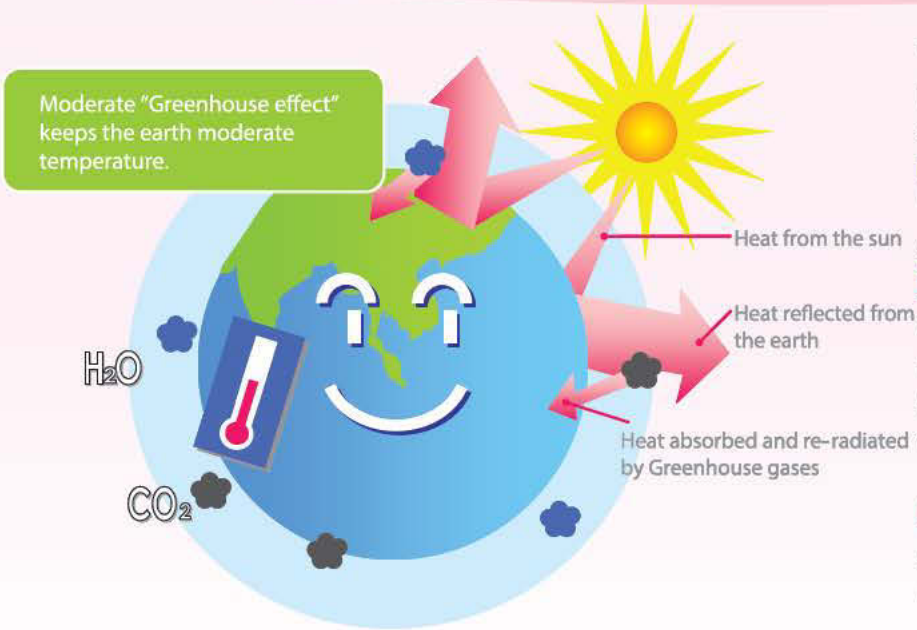
Higher risk of food shortage

Stronger cyclone



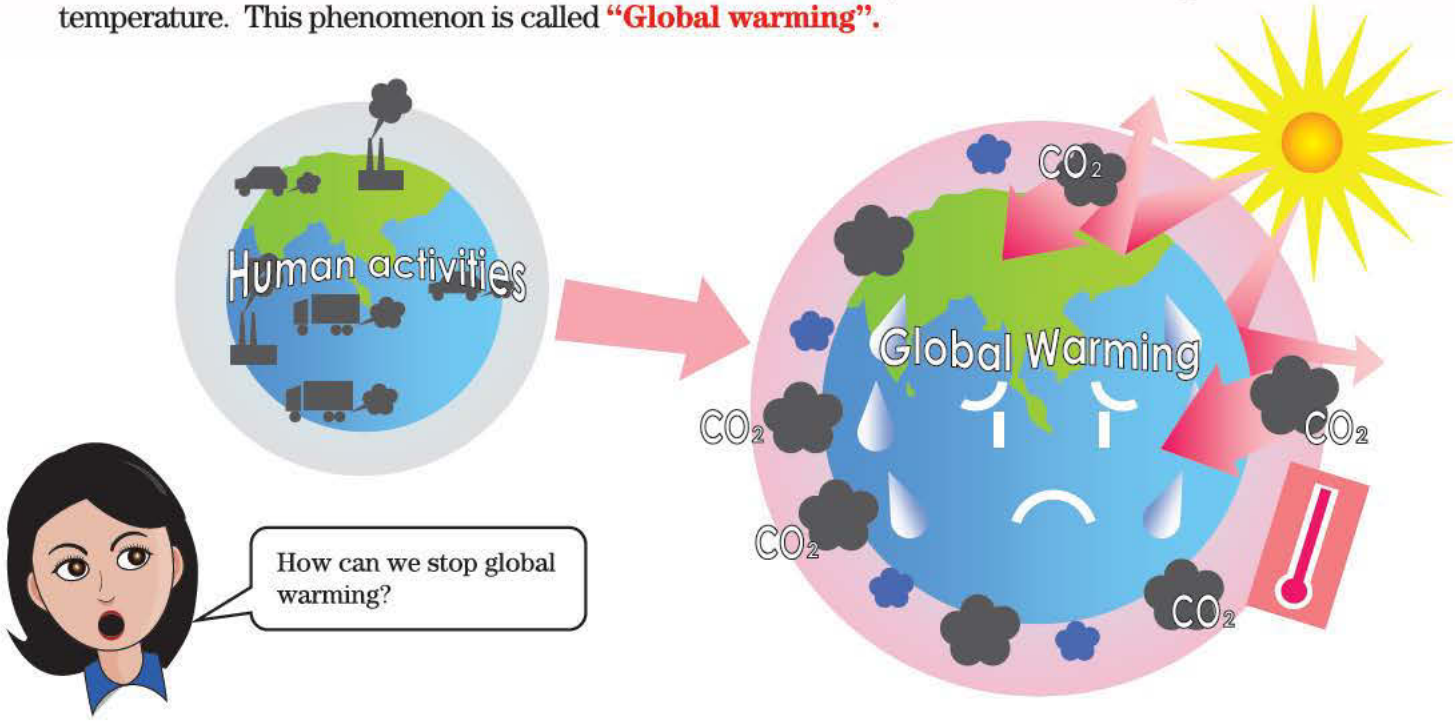
Higher risk of storm surge

Why does Global Warming occur?



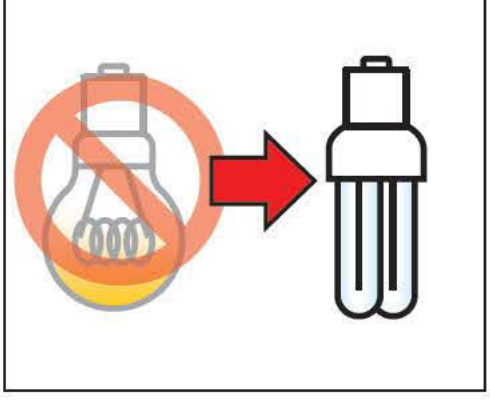
The air temperature is determined by the balance among **heat from the sun,** heat reflected from the earth to the space and **heat absorbed by "Greenhouse gases"**. The Greenhouse gases are heat absorbing gases such as Water Vapor (H_2O), **Carbon Dioxide (CO_2)** and Methane which absorb a certain percentage of heat reflected from the earth and then radiates back toward the surface of the earth. Accordingly, the air temperature near surface is kept at around 14 deg. C on global average now **(Greenhouse effect)**. Without any greenhouse gases, the air temperature near surface could go down to as low as minus 19 deg. C.

But from 200 years ago, Greenhouse gases, mainly CO_2, have been rapidly increasing by human activities such as industrialization and motorization, which causes breaking of the heat exchange balance and rise of temperature. This phenomenon is called **"Global warming"**.



Countermeasures against Climate Change

Plant Trees

Cut CO_2 Emission

Use Energy Saving Light Bulbs