

# Thunderstorms

## *What is a thunderstorm?*

For a storm to be considered as a thundercloud or a thunderstorm, we require that thunder must be heard. Since this peculiar and intense acoustic disturbance has no other natural source, the presence of lightning is necessarily required. These storms, invariably composed of strongly convective cumulonimbus clouds, are usually accompanied by strong wind gusts, lightning and rain, or sometimes hail or snow. Different weather conditions occur according to the climatic seasons of year.

## *Climate seasons of Sri Lanka*

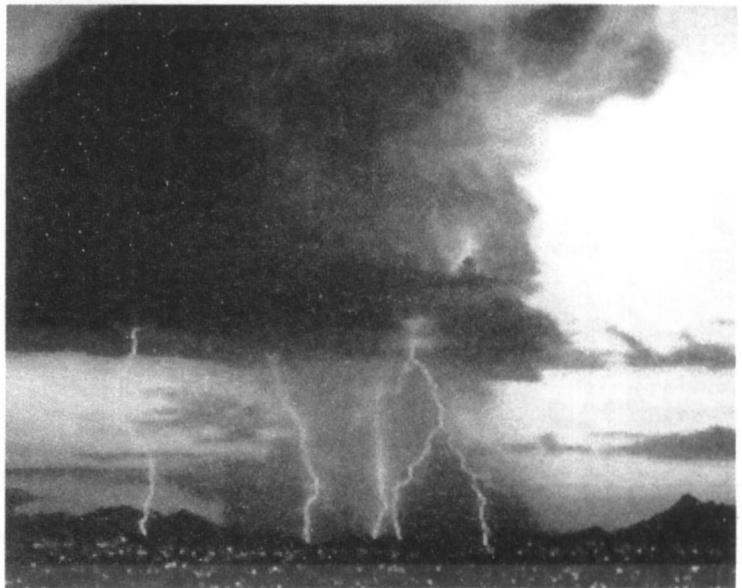
The climate experienced during a 12 - month period in Sri Lanka can be categorised into four climatic seasons as follows, each season having its typical features.

- i. First Inter-monsoon season (FIM)  
March-April (2 months)
- ii. Southwest Monsoon season (SWM)  
May-September
- iii. Second Inter-monsoon season (SIM) October-  
November  
(2 months)
- iv. Northeast Monsoon season (NEM)  
December-February

Enhanced convection during inter-monsoon periods produced large bank of cumulus and cumulonimbus clouds and also several layer of altostratus and cirrostratus clouds. They result in frequent thundershowers. If however, convergence occurs only at some distance to the north or south of Sri Lanka, only stratiform, medium and high clouds will be present over the island or part of it. The resulting precipitation over the affected area will then be in the form of occasional light showers. But under certain conditions thunderstorms occur in both main monsoon periods.

## *Weather systems and Thunderstorms*

Since the origin of the earth and our atmosphere, weather has experienced and change in different time and space



scales. Weather is the combine behavior of a number of parameters like atmospheric pressure, temperature, wind, moisture content, clouds, rain, sunshine and mist. Therefore, the globe or a particular geographical location is influenced by one or more weather parameters associate to form weather systems. Thunderstorms are very important since they are very common in almost all types of weather systems and climate seasons over many parts of the globe.

## *Requirement and Development of a thunderstorm*

When earth is heated by sunlight, much of the energy goes into warming the air in contact with its surface. At midday, the normal solar input is sufficient to heat a surface layer of air one-

meter in thickness by about one degree Celsius per second. As a result of this heating from below, the density of the lower air is decreased and the atmosphere can become unstable for vertical motion.

The lower atmosphere becomes unstable and can be overturned with a release of mechanical energy

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whenever the vertical lapse of air temperature becomes more negative than -9.8 degrees Celsius per Kilometer, the adiabatic lapse of temperature with altitude.

Thunderclouds are usually a consequence of atmospheric instability and develop as the warm, moist air near the earth rises and replaces the dense air aloft. This overturn often result in the condensation of atmospheric water vapor forming a visible cloud of water droplets. When this occurs, the heat associated with the phase changes of water acts to speed the overturn: release of heat of vaporization by condensing water vapor enhances the updrafts, while cooling, caused by evaporation of condensed water, can help drive the downdrafts which replace some of the ascending subcloud air.

Atmospheric pressure decreases with altitude so that rising air expands; this effect causes the temperature of rising air to decrease as it exchanges its internal heat energy for geopotential energy of height. If the ascent of a parcel of air continues, its cooling eventually causes some of the water vapor to condense onto dust particles in the air forming small liquid droplets scattered through the volume thus creating a cloud. The cloud droplets grow rapidly hereafter by further condensations of a hundred or more droplets per cubic centimeter.

### Characteristics and Effects

Thunderstorms associate a number of weather parameters, Some times hazardous. Some of the products (lightning, thunder, rain, snow and hail) can be observed only with the use of equipment.

Thunderstorms are hazardous because they produce lightning, tornado, waterspout, hailstorms, strong gusty winds and instant rainfalls that result in natural hazards.

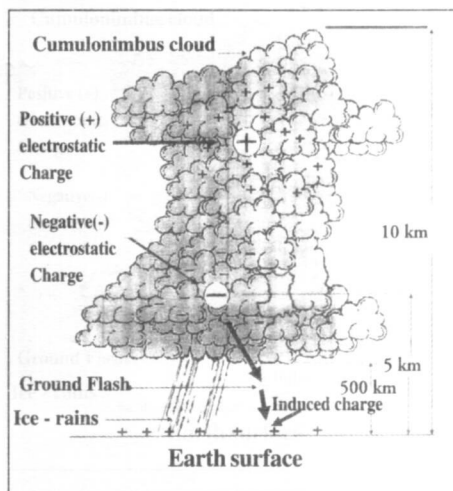
During the development stages thunder clouds are charged electro-statistically and the final configuration is so that negative charges concentrate over the lower part of the cloud while the positive charges occupy the upper part. These charges are about 100-200 coulomb and under their influence a positive charge is induced on the earth surface below the cloud. At a certain stage, electrical discharges occur between these charge centers and they are called lightning.

Lightning is a natural phenomenon. It has the potential to cause serious damage to both life and property because the electric current of a ground lightning flash is about 25000 Amperes (25000 A) and the potential difference between a charges clouds and the earth is about 100 million Volts. The resulting energy is about 500 million Watts per flash. Incidents of lightning normally tend to be more frequent in some areas but could occur anywhere.

In Sri Lanka, there have been a number of recorded incidents of death and injury to persons and animals and also to buildings and other structures. On average, the death toll due to lightning is around 50 persons per year.

### Hazard of Thunderstorms

Hazard by thunderstorms reach a peak in April every year in Sri Lanka. Statistical values show that the most of hazards occur during the evening, particularly after 3 p.m. with a peak during 4-6 p.m.



Under the normal conditions thunderclouds develop within 500 m and 10 km altitudes. The lower part of a cumulonimbus clouds mostly consists of water particles and drops but the region above about 5 km consists mainly of super-cooled water drops and ice. Since rain starts with the falling ice particles, we sometimes may experience rain with ice (Hailstorms). But fortunately we are living in a tropical country where the low level temperatures are very much above the freezing temperature of water.

Therefore, unlike in colder parts of the world, the ice tends to melt before reaching the earth saving us and our property from damages caused by hails (large ice balls).

Vigorous the normal convection leads to development of small-scale cyclone type systems usually called tornado which have a very short lifetime like 10 minutes but they are rich with very strong gusty winds which are capable in resulting considerable damage in a small area in a very short duration. When these systems develop over waterspouts.

Therefore one has to expect hazards caused by a number of parameters like heavy sharp rain, lightning, strong winds and hailstorms in thunderstorms.

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