

**REPORT ON NATIONAL SEMINAR “ Thunderstorm: Socio- Economic
Impacts,Early Warning and Risk Management” ON 29.4.2017 at
IIM,Mominpur, Kolkata**

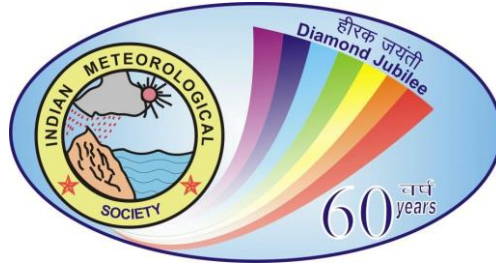
*You are cordially invited to be present in the 'National Seminar'
on
“Thunderstorm: Socio-Economic Impacts, Early Warning and Risk Management”
organized by
Indian Meteorological Society, Kolkata Chapter
and
Regional Meteorological Centre Kolkata
under the auspices of
Disaster Management Department, Government of West Bengal
in association with
CESC Ltd.
on
April 29, 2017, Saturday, at 10:00 hours IST
at
International Management Institute, Kolkata 700027*

*Prof. S. Chaudhuri
Chairperson*

*Dr. S. Bandyopadhyay
Dy. Director General, IMD Kolkata
Co-Ordinator*

*Prof. D. Lohar
Organizing Secretary*

*R.S.V.P.
9433545688*



Diamond Jubilee Celebrations
of
INDIAN METEOROLOGICAL SOCIETY (IMS)

NATIONAL SEMINAR
on
“THUNDERSTORM: SOCIO-ECONOMIC IMPACTS, EARLY WARNING AND RISK MANAGEMENT”

Organized by
IMS KOLKATA CHAPTER
and
REGIONAL METEOROLOGICAL CENTRE KOLKATA
under the auspices of
DISASTER MANAGEMENT DEPARTMENT
GOVERNMENT OF WEST BENGAL
in association with
CESC LTD.
at
International Management Institute, Kolkata
2/4 C, Judges Court Road, Alipore, Kolkata 700027
on
April 29, 2017

THUNDERSTORM: A GENERAL KNOW-HOW

Preamble

Thunderstorm is a severe weather phenomenon, which develops mainly due to intense convection. It is the towering cumulus or cumulonimbus clouds of the convective origin with high vertical extent. It produces heavy rain showers, lightning, thunder, hail-storms, dust-storms, surface wind squalls, down-bursts and tornadoes.

Thunderstorm is a Mesoscale phenomenon of spatial extent from a few kilometres to about 100 kilometres and may last for less than an hour to a few hours. However, multi-cell thunderstorms developed due to organized intense convection may have a life span of several hours and may travel over a few hundred kilometres.

In India, thunderstorms reach severity when continental air meets warm moist air from sea / ocean. The eastern and north eastern parts of the country i.e., Gangetic West Bengal, Bihar, Jharkhand, Orissa and Assam are normally affected by severe thunderstorms during the pre-monsoon season, in particular, during March-May. These thunderstorms are locally named as “Kalbaisakhi” which means calamities in the month of ‘Baisakh’. Strong heating of landmass during mid-day initiates convection over Chhotanagpur Plateau which moves southeast and gets intensified by mixing with warm moist air mass. These storms are also known as “Nor’wester” as they move from Northwest to Southeast. The severe thunderstorms associated with thunder, squall lines, lightening and hail cause extensive losses

agricultural crops, damage to structure and also loss of life. The casualty due to lightning associated with thunderstorms in this region is the highest in the world. The strong wind produced by the thunderstorm down drafts after coming in contact with the earth surface spreads out laterally and is referred as downbursts. These are real threat to aviation. The highest numbers of aviation hazards are reported during occurrence of these thunderstorms.

Formation

The thunderstorms mainly originate over the heated land masses that heats up the air mass above it and initiates convection and occurs mostly in the tropical belt. Thunderstorms are formed by a process called convection, defined as the transport of heat energy. Because the atmosphere is heated unevenly, an imbalance can occur which thunderstorms attempt to correct. Three things are needed for convection to be a significant hazard to flight safety: moisture, lift and instability.

- **Moisture:** Sufficient moisture must be present for clouds to form. Although convection occurs in the atmosphere without visible clouds, think thermals on a warm afternoon, moisture not only is the source of a visible cloud, but also fuels the convection to continue. As the warm air rises, it cools, and the water vapor in the air condenses into cloud droplets. The condensation releases heat, allowing the rising air to stay buoyant and continue to move upward.
- **Instability:** In general, as you increase in altitude, the air temperature cools up to the top of the troposphere. Of course, around fronts, mountains and in shallow layers near the ground, this is not always the case. How fast air cools is a measure of atmospheric stability. Meteorologists refer to this vertical change in temperature as the lapse rate. If the actual rising air cools slower than the environmental lapse rate, the air remains relatively warm compared to the surroundings, and it continues to rise. Air is considered unstable if it continues to rise when given a nudge upward (or continues to sink if given a nudge downward). An unstable air mass is characterized by warm moist air near the surface and cold dry air aloft. In these situations, if a bubble or parcel of air is forced upward it will continue to rise on its own. As this parcel rises it cools and some of the water vapor will condense forming the familiar tall cumulonimbus cloud that is the thunderstorm.
- **Lifting:** Typically, for a thunderstorm to develop, there needs to be a mechanism which initiates the upward motion, something that will give the air a nudge upward. This upward nudge is a direct result of air density. Some of the sun's heating of the earth's surface is transferred to the air which, in turn, creates different air densities. The propensity for air to rise increases with decreasing density. This difference in air density is the main source for lift and is accomplished by several methods.

Lifecycle

The lifecycle of these air mass thunderstorms are categorized in to three phases on the basis of growth of the thunderclouds.

- **Towering Cumulus Stage:** This is the stage of a thunderstorm once convection has begun and a cloud is visible. These building clouds are made entirely of liquid water. This stage is characterized by upward motion throughout the entire cloud. Aviation hazards from this stage include turbulence and icing. Even though the cloud is composed of all liquid, some of the liquid is “super-cooled,” in other words, liquid water can exist at temperatures below the normal freezing point.

- **Mature Stage:** This stage is characterized by the production of precipitation. Both updrafts and downdrafts are present. Lightning is being produced. The mature thunderstorm contains water, super-cooled water and ice.
- **Dissipating Stage:** During this final stage, the updraft has ceased and the storm is dominated by downdrafts. Precipitation may still occur, but will decrease with time as moisture is depleted. This dissipating thunderstorm contains mostly ice.

Severe Thunderstorms of India

The main regions of high thunderstorm activity in India during the pre-monsoon season March to May are:

- Northeast India, the area of genesis of Nor'wester
- Southwest peninsula particularly Kerala and
- Northwest India outside Rajasthan

Thunderstorm activity progressively increases from March to May. Though there is considerable thunderstorm activity in India during the monsoon season, the severity of thunderstorms is marked only in the pre-monsoon season when they are accompanied by violent thunder squalls and hailstorms.

Climatological Conditions for severe thunderstorms in India

The climatological causes for the occurrence of severe thunderstorms over north India during the pre-monsoon season are the following:

- The lowest layers of the atmosphere, particularly in the afternoon / evening attain high temperatures due to the quick response of land to heating by the overhead sun. Whenever moisture content in this layer is large conditions become favourable for thunderstorms.
- In the upper troposphere, the warm east – west ridge line is still over latitudes south of 15°N as in winter and cold sub-tropical westerlies prevail over the region north of 20°N. Occasionally wave troughs in these westerlies make this region still colder.
- Presence of the sub-tropical jet-stream over north India giving large vertical wind shears below 500 hPa together with the large conditional instability and Convective Available Potential Energy (CAPE), produces favourable condition for severe thunderstorms, with strong updrafts to support large hail.
- The middle troposphere being very cold and dry, the air in the downdraft is cooled to very low temperatures by the evaporation of the falling precipitation, which results in strong downdrafts and strong wind squalls at the leading edge of the cold downdraft air spreading on the ground, which in a severe thunderstorm can be as high as 100 to 200 km/hour.

Research on Thunderstorms in India

The meteorological community of the pre-partition India had the wisdom and foresight to plan and conduct three elaborate field experiments on the Nor'wester thunderstorms of Bengal. The first one in 1928 led by S.N. Sen detected a time sequence in the occurrence of Nor'wester. A second Nor'wester experiment was undertaken in the spring of 1941 with a dense network of surface observatories over Bengal and special sounding balloon ascents. A third Nor'wester experiment was undertaken in Bengal during the spring of 1944. These were much before the famous Thunderstorm Project of the United States which was conducted in the post World War-II period in USA culminating in the publication of its oft quoted report by Byers and Braham (1949). In the 1950s and 1960s weather radars were established at a number of stations in India that led to a surge in thunderstorm studies.

We have now two powerful tools for the study of thunderstorms, one the weather satellite and the other the Doppler weather radar. Since 1983 our own geostationary satellite of the INSAT series has given us a tool for the continuous monitoring and study of thunderstorms. We have now other important tools like the TRMM satellite carrying radar in space whose data is easily accessible for research on thunderstorms. With the establishment of Doppler radars at Calcutta and Chennai recently and plans to expand the network we have now another powerful tool to study severe thunderstorms and their three dimensional structure and spatial and temporal evolution.

NATIONAL SEMINAR ON THUNDERSTORM IN KOLKATA

A national seminar on “Thunderstorms: Socio-Economic Impacts, Early Warning and Risk Management” was organised by IMS, Kolkata Chapter & RMC Kolkata under the auspices of Department of Disaster Management & Civil Defense, Govt. of West Bengal, in association with Calcutta Electric Supply Corporation Limited on Saturday, 29th April 2017 at International Management Institute, Kolkata. The programme was started with the registration of the members and guests at 0930 IST sharp. The inauguration started at 1030 IST by welcoming the dignitaries at the dias. Hon’ble Minister in Charge, Department of Disaster Management, Janab Javed Ahmed Khan graced the occasion as Chief Guest. Presence of Distinguished Meteorologist and President of IMS national council AVM (Dr.) Ajit Tyagi as the guest of honour was a great impetus to the ceremony. Dr. Sanjib Bandyopadhyay, DDGM and chairman IMS Kolkata Chapter coordinated the entire programme very nicely. Also present organizing chairperson Prof. Sutapa Choudhury and secretary Prof. Debasish Lohar, representative of CESC Ltd. and Joint Secretary, Department of Disaster Management. Organizers welcome them with flower bouquet, badge, uttario and also presented a small token gift and a pleasing memento. All dignitaries then assembled for the ceremony of lightening of lamp in front of the dias and wish the success of the programme. An obituary message was then read out as a mark to pay homage to Late Dr. D.R. Sikka, followed by offerings of floral pedals to the image of Late Sikka by Dr. Sanjib Bandyopadhyay, DDGM amid respectful silence of the auditorium.

Dr. Sanjib Bandyopadhyay, DDGM briefly narrated the objective of the seminar in his welcome address. In his key note address AVM (Dr.) Ajit Tyagi praised the organizer for choosing the subject of the seminar and touched almost every aspect the “Thunderstorm” in his power point presentation. Hon’ble Minister expressed his thanks for the service rendered by the IMD to the society and also detailed about the planning and preparedness of his department for combating natural disaster.

This year IMS celebrate its diamond jubilee as it started journey since 1957 with some enthusiastic and farsighted meteorologist. As a mark to pay

respect to some veteran soldier of the society IMS felicitated three senior members of the society namely 1. Dr. S.K.Ghosh 2. Dr. A.K.Sen Sharma & 3. Dr. K.K.Basu for their service in the field of meteorology. They were presented flower bouquet, Uttari, gift, sweet & memento with love and respect. Secretary, IMS Kolkata Chapter wished the vote of thanks at end of the inaugural ceremony followed by high tea.

There were three technical sessions consisting two themes in each session. The themes were (A) Climatology and Dynamics of Thunderstorm (B) Thunderstorm and Mesoscale/Climate Modeling (C) Socio Economic Impact (D) Early Warning (E) Extreme Weather Management (F) Thunderstorm and Aviation Safety. First technical session was during pre lunch session and other two were during post lunch session. There was a tea break between second and third session.

There were total twenty five papers presented orally in this seminar and additional fifteen papers were placed in the form of posters in the lobby of the venue. Presenters were assembled from all over India. All the presenters were encouraged with "Certificate of Participation" at the end of the session. At the valedictory session a panel of experts coordinated by Dr. Sanjib Bandyopadhyay summed up the salient features of the day long discussions and put forward some recommendations considering the objectives of the seminar. Many local and national print and electronic media covered the programme throughout the day. The programme concluded by the vote of thanks by the organizing secretary at 06.30 pm.

Panel Discussion and Recommendation

The Experts are:

Dr S Bandyopadhyay, Dr Sutapa Choudhury, Dr. GC Debnath, , Dr. Debasis Lohar, Dr. Lalu Das, Shri R.K Sharma, Prof D.K Khan, Prof Arun Chakraborty, Shri A. K Sen and others.

The recommendations are:

1. Efforts may be made to involve different sector of society in awareness programs for thunderstorm disaster.
2. Media workshop may be organized on public awareness on precautions to be taken to mitigate disasters due to thunderstorm especially lightning, hail and squall.
3. It is felt DWR is very effective for now cast method of thunderstorm events and DWR may be installed by IMD in North Bengal.
4. Students/ Scholars may be encouraged to do research work on genesis, evolution movement and intensification of thunderstorm cells and its risk management.
5. Strong collaboration between IMD and leading universities of Kolkata and West Bengal for development of early warning forecasts of severe thunderstorm.
6. IMD/IMS may participate at district level awareness program organized by state Govt.

Thank You