COMPUTATIONAL MODELS FOR THE PREDICTION OF SEVERE THUNDERSTORMS OVER EAST INDIA REGION

Thunderstorm is one of the most spectacular weather phenomena in the atmosphere. Many parts over the Indian region experience thunderstorms at higher frequency during pre-monsoon months (March-May), when the atmosphere is highly unstable because of high temperatures prevailing at lower levels. Most dominant feature of the weather during the pre-monsoon season over the eastern Indo-Gangetic plain *and* northeast India is the outburst of severe local convective storms, commonly known as 'Nor'wester' or 'Kalbaishakhi'. The severe thunderstorms associated with thunder, squall line, lightning and hail cause extensive losses in agriculture, 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 highest numbers of aviation hazards are reported during occurrence of these thunderstorms. In India, 72% of tornadoes are associated with this thunderstorm.

The severe thunderstorms have significant socio-economic impact over eastern and northeastern parts of India. An accurate location specific and timely prediction is required to avoid loss of lives and property due to strong winds and heavy precipitation associated with these storms. Forecasting thunderstorms is one of the most difficult tasks, due to their rather small spatial and temporal extension and the inherent non-linearity of their dynamics and physics. The improvement in prediction of these important weather phenomena is highly handicapped due to lack of observations and insufficient understanding. Realizing the importance of improved **understanding** and prediction of this weather event, an attempt is **made to study severe** thunderstorms during the pre-monsoon **season of 2006, 2007 and 2009.** The improvement in the prediction **of this severe weather phenomenon** has been done in this work **using empirical and dynamical** approaches. The most widely used empirical **approach for weather prediction** is artificial neural network (ANN). ANN **based approach** can be used to model complex **relationships between inputs** and outputs or to find patterns in data. The recent **advances in neural** network methodology for modeling nonlinear, **dynamical phenomena** along with the impressive successes in a wide **range of applications,** motivated to investigate the application of ANNs for the prediction of thunderstorms.

The second approach is based upon equations and forward simulations **of the** atmosphere, and is often referred to as computer modeling (Numerical Weather Prediction (NWP)). These models are computer programs that take the analysis as the starting point and evolve the state of the atmosphere forward in time using the understanding of physics and fluid dynamics. The complicated equations which govern how the state of a fluid changes with time require high performance computers to solve them. The output from the model provides the basis of the thunderstorm forecast. Accurate prediction requires knowledge about "where" and "when" storms will develop and how they will evolve. NWP models can allow forecasters to anticipate not only, whether or not thunderstorms will develop in an environment, but also such things as thunderstorm movement, type, severity and longevity. In India, studies related to modeling of clouds are very scarce, particularly in intense thunderstorm events. Understanding the importance of these weather events and their socio-economic impact, this research has been initiated for analyzing and predicting severe thunderstorm events over east Indian region with most commonly known NWP models namely Non-hydrostatic Mesoscale Model (NMM) and Advanced Research WRF (ARW) model core of Weather Research and Forecasting (WRF) system