Synopsis Seminar

Seminar Title	: Understanding the role of multi-scale Atmospheric Variability on Tropical Cyclones over the Bay of Bengal
Speaker	: Gorja Mohan Murali Krishna (Rollno : 520er1001)
Supervisor	: Naresh Krishna Vissa
Venue	: ER 303, Earth and Atmospheric Sciecnces
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Abstract : Tropical cyclones (TC) are rapidly rotating, non-frontal atmospheric vortices that form over tropical warm ocean waters and unleash destructive weather phenomena, as they are often associated with vigorous winds, heavy rainfall, and storm surges. The Bay of Bengal (BoB) region is a semi-enclosed basin in the North Indian Ocean (NIO) and accounts for approximately 85% of TC occurring within the NIO. Moreover, the development of severe TC over this region with more erratic track behavior in recent years heightened risks for coastal communities and economies in the surrounding countries. Despite the significant progress achieved by the scientific community in forecasting or predicting TC over this region, challenges remain in accurately estimating these systems with sufficient lead time. Those challenges arose for TC over the BoB region because of uncertainty about the moisture sources contributing to TC formation, inadequate understanding of large-scale atmospheric features and their variations due to scale interactions, influencing the TC characteristics. This work addresses the role of various moisture sources in contributing to TC genesis and multi-scale atmospheric interactions in modulating TC movement over the BoB region. Results signify that for TC formation, the moisture source contribution of 20&ndash90% and &le20% from local and remote sources, respectively, occurs just before three days and beyond. Further, the thesis also highlights the significance of convection-circulation feedback processes at different temporal scales, ranging from sub-seasonal (SO 10&ndash90 days) to inter-annual (IAs &ge91 days), on variations in TC tracks. Using reanalysis data and numerical modeling experiments (WRF-ARW model), findings demonstrate that the movement of TC is primarily determined by the interaction of the mean background environment with convection and circulation anomalies generated by the SO. These SO include quasi-biweekly oscillations which last 10&ndash20 days, and intra-seasonal oscillations lasting 20&ndash90 days. Their interaction alters steering flow patterns, vorticity, and moisture budget processes, thereby influencing TC movement.