National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: A Comprehensive Investigation of Tropical Cyclone Structure Through Composite Analysis, Encompassing Dynamic and Thermodynamic Characteristics
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Venue	: ER 303 CLASS ROOM
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Abstract	: This study presents a comprehensive investigation of tropical cyclones (TC) originating over the Bay of Bengal (BOB) and Arabian Sea (AS) basin between 2001-2020 period. The analysis includes 59 TC cases categorized into cyclonic storm (CS, 62-88 kmh-1), severe cyclonic storm (SCS, 89-166 kmh-1), and highly intensified cyclonic storm (HICS, 167221 kmh-1 and ≥ 222 kmh-1), employing composite bases analysis to evaluate the seasonal and structural variability. The investigation is conducted adopting numerical simulation using Weather Research and Forecasting (WRF) model (CTRL) and assimilating scatterometer wind datasets to modify initial conditions through 3DVAR techniques (DA). Composite analysis involving take average of across varying TC categories which are compared against India Meteorological Department best track data and the Indian Monsoon Data Assimilation and Analysis (IMDAA) datasets. Both the simulation uses similar set of parameterization scheme and utilized NCEP-FNL and NOAA Sea surface temperature dataset for initial and boundary condition. Also, an increase in the rate of convergence supported by well-defined wind fields is realized at the TC center. However, a limited impact of scatterometer wind data assimilation is realized on the behavior of CS category TCs over both BOB and AS. The impact is also found to be limited on the thermodynamic properties of all three categories, although the seasonal variation reveals a consistent increasing trend of temperature anomalies with TC intensity. The humidity profiles analysis reveals asymmetrical distribution influenced by TC movement, with significant values observed on the right forward and rear quadrants. Postmonsoon TCs demonstrate organized lower-tropospheric RH structures and higher moisture content compared to pre-monsoon TC composites. Assimilation significantly improves the prediction of structural features, particularly for SCS and HICS TCs, compared to CTRL, although overestimation of thermodynamic characteristics is observed.