National Institute of Technology Rourkela

Progress Seminar

Seminar Title	: Role of Land Use Land Cover Changes in the Regional Climate Forcings in Governing Extreme Rainfall over India
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Venue	: ER 303 Class Room
Date and Time	: 12 Mar 2025 (04:30 PM)
Abstract	: Adequate and consistent rainfall patterns are fundamental to maintaining water resources, agricultural productivity, and economic stability across India. Understanding rainfall variability has become increasingly critical in the context of climate change. While extensive research has explored the mechanisms driving Indian monsoon rainfall patterns, the spatial and temporal variability of extreme rainfall events (EREs), along with their underlying physical and dynamical processes, remains poorly understood. Previous studies have primarily focused on large-scale dynamics as key drivers of EREs, leaving a significant gap in our understanding of local and regional factors' influence on these events. This study addresses this knowledge gap by investigating the impact of land surface modifications specifically Land Use and Land Cover (LULC) changes, on ERE patterns across India from 1950 to 2023. We analyse rainfall patterns using six indices recommended by the Expert Team on Climate Change Detection and Indices (ETCCDI). Out of these three are General Rainfall Characteristics (GRCs) and remaining as Extreme Rainfall Characteristics (ERCs). The GRCs include annual total rainfall (Asum), summer total rainfall (Ssum), and annual frequency of wet days (Nwet). The ERCs comprise two magnitude-based percentile measures (P95, P85) and a simple daily rainfall intensity index (SDII). Our analysis of LULC changes utilizes ISRO data from 2005 and 2024, revealing significant transformations during this period. We have grouped the original 24 LULC categories into 9 primary categories based on characteristic similarities, enabling more focused analysis of land use changes. The spatial and temporal patterns of these changes demonstrate substantial modifications in land use across India during the study period. To quantify the impact of LULC changes on EREs, we employed the mesoscale Weather Research and Forecasting (WRF) model. Our experimental design includes two scenarios: one using historical LULC data from USGS and another using contemporary LULC data from ISRO. We analyzed five ERE cases during 2020-2022, encompassing both metropolitan and non-metropolitan cities. Initial findings indicate that the heterogenic behaviour in rainfall and extreme rainfall patterns in the most-recent period (2001-2023) when compared to the previous decades. This study enhances our understanding of how land surface modifications influence EREs, contributing valuable insights for extreme rainfall forecasting and climate change adaptation strategies.