Departmental Seminar

Seminar Title	: Pre-monsoon Thunderstorm Rainfall Over Delhi: Climatological Insights and the Role of Updated LULC in Enhancing Model Performance
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Abstract	: Urbanization plays a crucial role in modifying local meteorological conditions, which can significantly alter the precipitation distribution and pattern during pre-monsoon thunderstorms. A long-term climatological analysis of thunderstorm rainfall over Delhi is conducted using observational datasets and reanalysis products. This analysis provides insights into spatial and temporal trends and the role of urbanization in modulating storm intensity. Results indicate that urban areas significantly enhance convective activity mainly in boundary regions of the city. Furthermore, storm-induced rainfall exhibits a spatial shift, with higher rainfall accumulations, observed downwind of the urban core, highlighting the urban-modulated redistribution of precipitation. This study also investigates the impact of urbanization on thunderstorm-induced rainfall over Delhi, one of India's most densely populated megacities. Using high-resolution numerical simulations with the WRF model coupled with the Noah-MP land surface scheme. For this purpose, ten distinct thunderstorm cases between 2008 and 2020 have been identified. Different land surfaces parameters like latent heat flux, sensible heat flux, vertical velocity, moisture transport from long-range sources, and precipitation efficiency have been thoroughly analyzed. Results indicate that incorporating updated Land Use Land Cover (LULC) data in the model significantly improved its efficiency in simulating precipitation and other land surface parameters. This enhancement is attributed to the improved representation of surface heterogeneity, which directly influences land-atmosphere interactions. Updated LULC data provide more accurate information on urban expansion, vegetation cover, and impervious surfaces, leading to better estimation of surface heat fluxes, moisture availability, and boundary layer processes. As a result, the model more realistically captures urban-induced modifications to convective activity, moisture convergence, and storm dynamics, thereby reducing biases in precipitation simulations.