National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Urbanization over selected Indian cities, association with local environment and beyond
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Venue	: ER-303, Department of Earth and Atmospheric Sciences
Date and Time	: 09 Sep 2025 (04:15 PM)
Abstract	: Uncontrolled urbanization has deep-rooted impacts on the environment, including weather, climate, and pollution, threatening the sustainability of cities. Urban agglomerations across the world have witnessed unprecedented growth in the recent past, giving rise to urban sprawl. The urbanized landscape of the 25 Indian cities (with distinct morphological settings) has mainly portrayed dispersive outward growth since the beginning of the 21st century, with significant compaction (infill urban growth) near the urban core in recent years. Forecasting urban growth is carried out using Convolutional Long Short-Term Memory (ConvLSTM) model, where all 25 cities considered, are experiencing substantial urban growth, with trends indicating continued expansion till 2035. Overall, the higher growth is observed in the case of the IGP cities, like Chandigarh-Mohali, Lucknow, and Patna (> 97% built-up expansion between 1990-2023). In the forecasted period (2024 to 2035), Jaipur (~46%) might experience the highest growth, followed by Mumbai (~42.5%). The research also forecasted local microclimatic parameters and associated them with urbanization. The future microclimatic conditions which indicates that temperature variables in all three riverine cities are expected to increase by ~1 °C accompanied by the escalation in RH by the end of 2035. WS is expected to vary considerably in the compactly urbanized or emerging patches. For the coastal cities, the rainfall climatological trends indicate no significant trends for the considered cities, with Mumbai being the exception that shows a rising trend. The future trend (realized through the ConvLSTM model) is projected to be unaltered except for Vishakhapatnam, where it is expected to increase in the coming years. For the IGP cities, Kolkata exhibited an increasing trend for all four air pollutants while demonstrating higher values of $PM_{2.5}$ (200-450 $\mu g/m^3$), and strong correlation signatures (between urban heat and pollution islands) are present in all cities, either at the core or near the periphery. Forecasting of two extreme event scenarios is also performed to associate urbanization with heatwaves and heavy rainfall. In the peninsular and western cities, Jaipur experienced maximum heatwaves between 1990 and 2023. A similar scenario might be expected in the coming years (till 2035) as indicated by the 3D-Unet model forecasts. For the heavy rainfall events in the mountainous cities, it is observed that a higher number of heavy rainfall events is experienced with enhanced occurrences observed in recent years in the case of Gangtok. Although, an overall decreasing rainfall trend (based on MK trend test) is ovserved across the mountainous cities. The health related risks have also accentuated in recent years due to rapid urbanization, changing climate, and weather extremes. Therefore, to overcome the concerned challenges, coordinated and sustained steps should be implemented at multiple levels, ranging from policy, technology, and planning to citizen engagement. Without robust and collective action, the health and well-being of billions, along with the long-term sustainability of the cities, are at serious risk.