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Assessing urban heat islands and thermal comfort in Noida City using geospatial technology

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ABSTRACT

Incessant conurbation in Noida has exacerbated its microclimate, causing rise in the thermal anomalies within the city. Between 2011 and 2019, there is an immoderate increase in the hotspots and overall decrease in the thermal comfort of the city, evaluated using the Urban Thermal Field Variance Index (UTFVI). The study further explores the association between land surface temperature (LST) and spectral indices - Normalized Difference Vegetation Index (NDVI) and Index-based built-up Index (IBI) for both the years. The results highlight that there is an increase of 6.42 °C in eight years. The NDVI values have increased from 0.06 to 0.14 during these years, suggesting increase in the total urban greenness in the city. The observed increase in IBI values explains the rising LST of the city. LST exhibits negative correlation with NDVI ascertaining the cooling impact of green spaces and positive correlation with IBI highlighting the heating effect of built-up on urban microclimate. Measuring and monitoring the intensity of these UHI in space and time is important to analyse the thermal environment at the city scale. Identification of such anomalies in the urban thermal environment can provide the best input for equipping urban areas to be more resilient and sustainable.

1. Introduction

Climate change is a worldwide critical challenge, with wide ranging impacts across various sectors and regions. Greater than 50% of the population of the world now are urban inhabitants and, it is projected that 68% of the population of the world will be dwelling in urban areas by the year 2050 (UNDESA, 2018). The same study states that India will add 416 million urban dwellers by 2050. With ever increasing number of people moving in the cities, there is an enormous burden on the existing natural resources and therefore, people living in the cities are particularly vulnerable and exposed to the risks and to the impacts of climate change. Increasing urban densities leads to increased energy consumption, carbon emissions, and enormous amounts of waste generation (Rotem-Mindali et al., 2015). Climate change impacts on city functions, infrastructure, and services and exacerbates many existing stresses. One of the main challenges is that these fast growing cities are not well equipped for a changing climate.

Activities like fossil fuel combustion, vehicular emissions, industrial effluents, construction and waste generation make cities a net emitter of greenhouse gases and a key contributor to global climate change. Therefore, cities are now experiencing higher temperatures with very less green cover. Fast paced urbanisation further exacerbates urban temperatures with increasing amount of paved surfaces, decrease in vegetation cover and open grounds, and waste heat emission from industry, buildings, and vehicles (Emilsson and

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