ABSTRACT

Urbanization results in the phenomenal shift in the human population towards urban centers, affecting the urban environment quality and standard of life. Urban growth, along with the increased impervious built infrastructure, determines the climate in cities resulting in a distinct climatic condition termed the “Urban Heat Island”. Tropical cities characterized by high temperatures and humidities, suffer extensively due to the urban heat island effect, and urban climate studies become crucial in improving the thermal comfort outdoors. Therefore, the focus of this study is to analyze the urban heat island effect and outdoor thermal comfort from the city level to the street level in the hot humid city of Chennai, India.

The study was done in five stages. The first two stages analyze the intensity of the urban heat island effect in relation to urbanization and its influence on thermal comfort. In the first stage, the impact of urbanization on climate trends was studied using the historic climate records and the thermal comfort trends were analyzed. The study revealed a significant decrease in the thermal comfort conditions due to urbanization. In the second stage, the intensity of the canyon layer urban heat island and the surface urban heat island were assessed. The study revealed that the maximum nocturnal heat island intensity of 4.1°C occurred in the canyon layer during winter, and the maximum daytime intensity of 5.5°C in the surface urban heat island.
The third and fourth stages examine the causes of the urban heat island in terms of the growth of the city structure and land use / land cover types. In the third stage, the land cover maps and the thermal imageries were compared to identify the correlation between the two. The results of the study indicated that the sprawl of hotspots correspond to the degree of urban built-up. In the fourth stage, the urban heat island profile in relation to land use / land cover types was analyzed. The analysis revealed a significant correlation between the urban heat island profile and the land use / land cover types during the day and night.

In the fifth stage, the urban built form of six residential neighbourhoods was analyzed, with respect to air temperatures and thermal comfort. The study identified that the increase in the H/W ratio of the street canyons and the percentage of built up area improved the daytime comfort conditions, while reducing the night time comfort conditions significantly.

Based on the results of the study, recommendations pertaining to some of the aspects of land use and development guidelines for built form are given in order to improve the outdoor thermal comfort.