

Accepted Manuscript

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PII: S0378-7788(17)30861-7
DOI: <https://doi.org/10.1016/j.enbuild.2017.10.062>
Reference: ENB 8082

To appear in: *ENB*

Received date: 12-3-2017
Revised date: 18-9-2017
Accepted date: 18-10-2017

Please cite this article as: Aneesh Mathew, Sumit Khandelwal, Nivedita Kaul, Analysis of diurnal surface temperature variations for the assessment of surface urban heat island effect over Indian cities, Energy and Buildings <https://doi.org/10.1016/j.enbuild.2017.10.062>

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Analysis of diurnal surface temperature variations for the assessment of surface urban heat island effect over Indian cities

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Research Highlights

- This study investigates the contrast diurnal and temporal variations on LSTs.
- Inverse SUHI has been observed during daytime whereas clear SUHI during night period.
- In general, heat island phenomenon is apparent at nighttime.
- Thermal properties of various surface materials influence diurnal behavior of LST.
- Time of observation is important for analyzing the efficacy of satellite data for SUHI studies.

Abstract

Alterations in the urban surfaces elevate the surface and air temperature in the urban boundary than the surrounding rural area result in urban heat island effect. The present study has been carried out to explore the urban heat island effect for the two-time-frame i.e. day time and night time using remote sensing data from Moderate-Resolution Imaging Spectroradiometer (MODIS) sensor of two Indian cities, Ahmedabad and Jaipur. Land surface temperature is used as the key parameter for surface urban heat island studies in the present study. Inverse or negative surface urban heat island effect has been observed over Jaipur whereas moderate or very weak surface urban heat island effect is observed over Ahmedabad during the daytime, whereas strong surface urban heat island effect is observed during night time over both cities. The study indicates that the higher temperature has been observed during the daytime, but the phenomenon of urban heat island is prevalent only during night time. The contrast diurnal land surface temperature variations over these cities have been analyzed in the current study. To support this remote sensing analysis, in-situ surface temperature measurement study has been conducted on various surfaces (anthropogenic and natural) at Jaipur for 24 hours temperature monitoring. The study illustrates that soil has a property of rapidly heating up as well as cooling down than the anthropogenic materials like road and concrete observed under this in-situ temperature measurement. Thermal characteristics of various surface materials influence the diurnal behavior of land surface temperature. The study shows that vegetation cover has the lowest temperature during the entire duration of observation. Time of observation is very important for analyzing the efficacy of remote sensing data for surface temperature variations for different land covers and surface urban heat island studies. Urban heat island varies during the day, and it is more significant during the evening/night. In general, heat island phenomenon is apparent at nighttime.

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