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RETRIEVING LAND SURFACE TEMPERATURE FROM SATELLITE DATA AND ANALYZING URBAN GROWTH IMPACT ON DEVELOPMENT OF URBAN HEAT ISLAND EFFECT IN PAKISTAN

Abstract

Urban Heat Island (UHI) is one of the most prominent phenomenon of anthropogenic impacts on urban micro climate. Land Surface Temperature (LST) being an indicator of UHI can be retrieved from Satellite mounted sensors very effectively. This study assesses the urban thermal behavior of three megacities of Pakistan (Karachi, Lahore, and Islamabad) by retrieving diurnal and nocturnal LSTs from Landsat-8 OLI/TIRS and MODIS data. Relationship between LST and built-up infrastructure and green space densities of cities is investigated by incorporating different geospatial techniques like urban-rural gradient and multi resolution grid based analysis. Spatial patterns of daytime and night-time UHIs in these cities are identified and quantified. It is found that distribution of the surface UHI appears to be clearly linked to landuse. Mean LST showed positive correlation with built-up density and negative with green space density over urban-rural gradient in the study area. Statistical and grid based analysis are made to describe the formation of day/night time UHIs. Strong nocturnal UHI is found as compared to Diurnal UHI in all three cities. Results reveal that maximum UHI effect is observed in Lahore city with about 4C higher temperature as compared to nearby rural areas at nighttime and about 2.5 C higher at day time. Karachi has 3C nocturnal and 2C diurnal UHI. Islamabad has least UHI effect with 2.5 C at night and 1.5 C, at day time. Spatial correlation analysis between LST and Normalized difference vegetation/built-up index (NDVI/NDBI) indicate that LST has significant positive linear relationship with built up land and negative with green spaces in all three cities. Grid based analysis also illustrate that mean LST has positive trend line with impervious surface density and negative with green space density. This emphasizes the importance of urban green spaces as their ability to mitigate UHI effect. On the bases of this study it is suggested that density and spatial pattern of urban built up surfaces and green spaces should be considered in the landscape of a city for urban cooling and for a climate resilient urban planning.

Keywords: Urban Heat Island (UHI), Land surface temperature (LST), diurnal, Nocturnal, Impervious surface density, Green Space, Megacities