Intraurban heterogeneity of space-time land surface temperature trends in six climate-diverse cities

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Abstract

Surface urban heat islands (SUHIs) are present in all cities, derived from their thermal properties. While looking at the spatiotemporal variability of land surface temperature (LST), there is still a gap in understanding patterns of change. In this paper, we analysed diurnal and nocturnal annual mean LST trends in continental (Beijing), temperate (Mexico City and Santiago), and arid (Cairo, Hyderabad, and Riyadh) cities employing 1 km MODIS data (2003–2019). Each time-series was assessed with the structure of a space-time cube. Hot and cold spots were detected for each year and the LST trends were analysed. Each pixel was classified into different space-time LST trends and their SUHIs were estimated. Cities exhibit trends of increasing temperatures in cold and hot spots for diurnal and nocturnal data. Temperatures are increasing faster in hot spots for diurnal and in cold spots for nocturnal scenes. Steady hot spots and warming hot spots exhibit the highest SUHIs for day and night. Our approach provides a framework to empirically delineate the spatial intraurban heterogeneity of LST patterns over time. This spatially explicit information provides insights into urban areas requiring heat mitigation strategies and can be used to monitor the performance of measures already implemented for climate adaptation.

Author keywords

MODIS; Time-series; Urban climate; Urban heterogeneity; Urban warming