



Research on urban heat island effect based on concentric circle division of urban structure - Take the Beijing-Tianjin-Hebei and Shanghai metropolitan areas as examples

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In 2015, Limin Jiao et al. used concentric circles and inverse S function curves to analyze the construction land density of 28 major cities in China and successfully divided the internal structure of urban areas. Based on this, this study takes Beijing-Tianjin-Hebei core area (Beijing, Tianjin and Langfang) and Shanghai metropolitan area (Yangtze River Delta region) as the research objects, analyze the changes in construction land structure and urban heat island effect from 2001 to 2020.

It is feasible to use the Anselin local Moran I tool of Arcgis to analyze urban centers based on population density (Yingcheng Lia; Xingjian Liu, 2018). We established a fishing net analysis, and the grid with HH significant clustering (high population density surrounded by those of similar high densities) can be regarded as the center of the city. Then, concentric circles with a diameter of 1KM are established based on these center points, and the proportion of construction land in each circle is extracted. And use the inverse S function (Formula 1) to fit the extraction results.

(1)

$$f(r) = \frac{1 - c}{1 + e^{a(\frac{2r}{D} - 1)}} + c$$

The determination coefficient R² of all fitting results is greater than 0.98, and the results are highly reliable. Then the fitted function is differentiated twice. The two extreme points correspond to the concentric radius of the inner city and the suburbs (R₁, R₂, and R₁<R₂) respectively. We found that the radius of the central city and peripheral urban areas of both metropolitan areas has expanded over the past 20 years, with Shanghai's peripheral cities expanding at a faster rate. In addition, the urban radius of Beijing-Tianjin-Hebei is about twice that of Shanghai.

In this study, the urban heat island effect is represented by the difference in surface temperature between suburban areas and Inner City. The results show that the urban heat island effect in the two regions has shown an increasing trend over

