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1 Study on correlation between air temperature and urban morphology 2 parameters in built environment in northern China

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8 Abstract

9 Air temperature in built environment is a critical indicator of both outdoor thermal comfort
10 and space cooling or heating loads in buildings. The objective of this work is to investigate
11 the correlation between air temperature variations in built environment and urban
12 morphology in northern China.

13 Field measurement was firstly carried out to record the air temperature at 46 points within an
14 8-km² urban area continuously in Tianjin city, China, from January 2015 to July 2016.
15 Weather conditions at a nearby meteorological station were also measured. A GIS model was
16 built up to extract the urban morphology parameters at 46 measurement points, such as the
17 Green Plot Ratio (*GnPR*), Sky View Factor (*SVF*), pavement area percentage (*PAVE*),
18 building area percentage (*BDG*), etc. Using multilinear regression analysis, models were
19 proposed to correlate air temperatures with urban morphology parameters and weather
20 parameters in both summer and winter seasons. The analyzed air temperatures included daily
21 maximum (*Tmax*), minimum (*Tmin*), average (*Tavg*), daytime average (*Tavg-day*) and
22 nighttime average (*Tavg-night*) temperatures. Models were validated by comparing the air
23 temperatures estimated by proposed models with the results measured on the days different
24 from those selected for model development. Parametric study was conducted to investigate
25 the impact of urban morphology parameters on air temperatures. In summer, it was found that
26 increasing *GnPR* by 0.5 could reduce *Tmin* and *Tavg-night* by 0.7°C and 0.5°C respectively.
27 In winter, only *Tavg*, *Tmin* and *Tavg-night* were affected by urban morphology, and they
28 increased with taller building height and narrower street width.

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