Session: C23 Poster: T209A

Observed surface warming induced by urbanization in East China

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China's rapid urbanization in the past three decades led to a quick transition of stations from rural into urban in a very short period. However, almost all of the previous studies did not consider this factor in their urban heat island (UHI) effects analysis. The type of station remained fixed throughout an entire analysis period once it was identified as rural or urban. Disregarding the effect of the conversion of stations from rural to urban on temperature records may give rise to a considerable underestimation of the UHI effect. In current study, monthly mean surface air temperature data from 463 meteorological stations, including those from the 1981-2007 ordinary and national basic/reference surface stations in east China and from the National Centers for Environment Prediction and National Center for Atmospheric Research (NCEP-NCAR) Reanalysis, are used to investigate the effect of rapid urbanization on temperature change. These stations are dynamically classified into six categories, namely, metropolis, large city, medium-sized city, small city, suburban, and rural, using satellite-measured DMSP/OLS nighttime light imagery and population census data. Both observation minus reanalysis (OMR) and urban minus rural (UMR) are utilized to detect surface air temperature change induced by urbanization. With objective and dynamic station classification, the observed and reanalyzed temperature changes over rural areas show good agreement, indicating that the reanalysis can effectively capture regional rural temperature trends. The trends of UHI effects, determined using OMR and UMR approaches, are generally consistent and indicate that rapid urbanization has a significant influence on surface warming over east China. Overall, UHI effects contribute 24.2% to regional average warming trends. The strongest effect of urbanization on annual mean surface air temperature trends occurs over the metropolis and large city stations, with corresponding contributions of about 44% and 35% to total warming, respectively. The UHI trends are 0.398 and 0.26 ∞C decade-1. The most substantial UHI effect occurred after the early 2000s, implying a significant effect of rapid urbanization on surface air temperature change during this period.