

Temperature Distribution and Profile Characteristics in Urban and Suburban Areas of Urumqi: Postprint

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Abstract

Based on temperature observation data from 10 layers of five 100-m meteorological towers in Urumqi, the seasonal and diurnal variation characteristics of near-surface air temperature at different heights in the urban and suburban areas of Urumqi were analyzed in detail through statistical methods. The study indicates that temperature inversions exist in all four seasons in Urumqi, with the most obvious inversion in the northern suburbs. Within the 100-m near-surface layer, the diurnal temperature range in the main urban area is relatively small, approximately 3.5–5.5 °C; the diurnal temperature range in the suburban areas is relatively large, approximately 4.2–7.0 °C. In summer, suburban temperatures are higher than urban temperatures; in winter, the northern suburbs have the lowest temperatures and the southern suburbs the highest; during the daytime, the atmosphere is basically in a superadiabatic unstable state, while at night, urban temperatures are higher than suburban temperatures. In spring and autumn, the temperature difference between urban and suburban areas is small during the day and large at night, and the temperature difference increases closer to the ground; the temperature difference between the urban area and the southern suburbs can reach 2.4 °C in spring and 3 °C in autumn. The occurrence times of maximum and minimum temperatures are almost asynchronous across seasons and layers in both urban and suburban areas. Maximum temperatures occur at approximately 17:00–18:10 in summer, 16:00–17:20 in autumn, 14:30–15:50 in winter (lagging by 1.5 h in the northern suburbs), and 17:00–18:00 in spring (advancing by 1.5 h in the southern suburbs); minimum temperatures occur at approximately 7:10–8:20 in summer, 8:00–9:00 in autumn, at multiple times in winter (which is related to the occurrence of temperature inversions), and 7:30–8:40 in spring.

Full Text

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Abstract

We analyzed the characteristics of seasonal and diurnal variations of air temperature in Urumqi City and its suburbs, and constructed air temperature profiles using 10-layer air temperature data collected from five 100-meter meteorological towers in Urumqi, Xinjiang, China. The results show that pronounced temperature inversions occur in all seasons in Urumqi, especially in the northern suburbs. In the 100 m surface layer, the diurnal temperature range is small (3.5–5.5°C) in the main urban area but relatively large (4.2–7.0°C) in the suburbs. In summer, air temperatures are higher in the suburbs than in the urban area. In winter, temperatures are lowest in the northern suburbs but highest in the southern suburbs. During daytime, the atmosphere exhibits predominantly super-adiabatic instability. At night, air temperatures in the urban area are higher than those in the suburbs. In spring and autumn, the urban-suburban air temperature difference is large at night (but small during daytime), and this difference increases closer to the ground. The temperature difference between the urban area and the southern suburb is 2.4°C in spring and 3°C in autumn. The highest and lowest air temperatures did not occur simultaneously in the urban and suburban areas across all seasons. The highest temperature occurs from 17:00–18:10 in summer, 16:00–17:20 in autumn, 14:30–15:50 in winter (lagging by 1.5 hours in the northern suburbs), and 17:00–18:00 in spring (occurring 1.5 hours earlier in the southern suburbs). The minimum air temperature occurs from 7:10–8:20 AM in summer, 8:00–9:00 AM in autumn, during multiple periods in winter, and 7:30–8:40 AM in spring.

Keywords: boundary layer; air temperature; profile; Urumqi City

Note: Figure translations are in progress. See original paper for figures.

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