Neue Studie: Das Industriezentrum einer Stadt und der Flughafen sind bis zu 12 °C wärmer als die umliegenden Wälder und Vegetation.

geschrieben von Chris Frey | 10. August 2025

Kenneth Richard

Der städtische Wärmeinseleffekt trägt weit mehr nicht-klimatische Wärme zu den Aufzeichnungen der Temperaturmessstationen bei als zuverlässig kontrolliert werden kann.

Eine Analyse von 10 Städten aus aller Welt (Kara und Yavuz, 2025) zeigt, dass Flughäfen und Industriezentren im Durchschnitt 2,5 °C bis 2,8 °C wärmer sind als benachbarte Grünflächen.

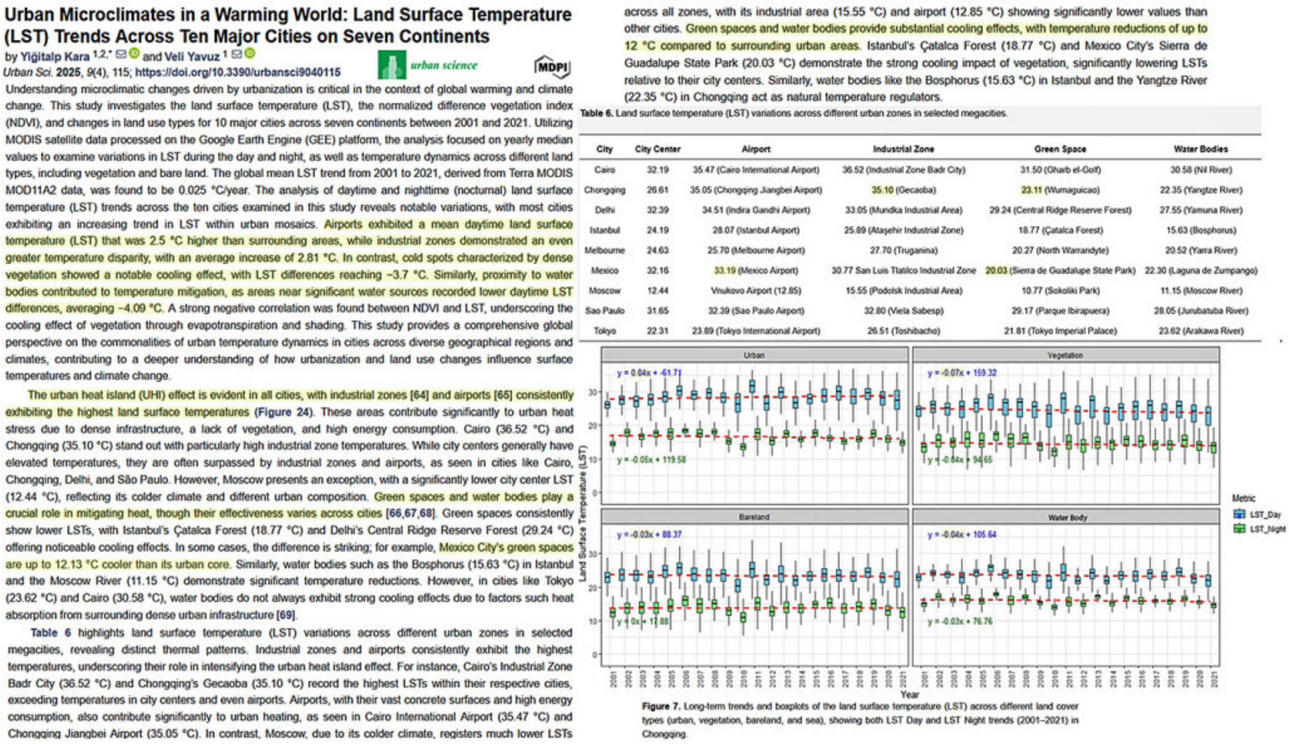
„Flughäfen wiesen eine durchschnittliche Tages-Landoberflächentemperatur (LST) auf, die 2,5 °C höher war als in den umliegenden Gebieten, während Industriegebiete mit einem durchschnittlichen Anstieg von 2,81 °C eine noch größere Temperaturdifferenz aufwiesen.“

Der städtische Wärmeinseleffekt kann dazu führen, dass Flughäfen und Industriezentren bis zu 12 °C wärmer sind als nahegelegene bewachsene, bewaldete Gebiete.

„Die Grünflächen um Mexiko-Stadt sind bis zu 12,13 °C kühler als der Stadtkern.“

Die Erwärmungstendenzen der letzten Jahrzehnte beschränken sich im Allgemeinen auf städtische Gebiete, während sich nicht-städtische Gebiete abgekühlt haben. So erwärmten sich beispielsweise von 2001 bis 2021 die städtischen Gebiete um +0,04 °C/Jahr, während sich die bewachsenen, unbebauten und mit Gewässern bedeckten Gebiete in der Stadt Chongqing um -0,07 °C, -0,03 °C bzw. -0,04 °C/Jahr abkühlten.

„Im Gegensatz dazu zeigten kalte Stellen mit dichter Vegetation einen deutlichen Abkühlungseffekt, wobei die LST-Unterschiede bis zu −3,7 °C erreichten. Ebenso trug die Nähe zu Gewässern zur Temperaturminderung bei, da Gebiete in der Nähe bedeutender Wasserquellen niedrigere LST-Unterschiede während des Tages verzeichneten, die im Durchschnitt bei −4,09 °C lagen.“



Urban Microclimates in a Warming World: Land Surface Temperature (LST) Trends Across Ten Major Cities on Seven Continents

by Yiğitalp Kara [1,2,*] and Veli Yavuz [1]

Urban Sci. **2025**, *9*(4), 115; https://doi.org/10.3390/urbansci9040115

urban science MDPI

Understanding microclimatic changes driven by urbanization is critical in the context of global warming and climate change. This study investigates the land surface temperature (LST), the normalized difference vegetation index (NDVI), and changes in land use types for 10 major cities across seven continents between 2001 and 2021. Utilizing MODIS satellite data processed on the Google Earth Engine (GEE) platform, the analysis focused on yearly median values to examine variations in LST during the day and night, as well as temperature dynamics across different land types, including vegetation and bare land. The global mean LST trend from 2001 to 2021, derived from Terra MODIS MOD11A2 data, was found to be 0.025 °C/year. The analysis of daytime and nighttime (nocturnal) land surface temperature (LST) trends across the ten cities examined in this study reveals notable variations, with most cities exhibiting an increasing trend in LST within urban mosaics. Airports exhibited a mean daytime land surface temperature (LST) that was 2.5 °C higher than surrounding areas, while industrial zones demonstrated an even greater temperature disparity, with an average increase of 2.81 °C. In contrast, cold spots characterized by dense vegetation showed a notable cooling effect, with LST differences reaching −3.7 °C. Similarly, proximity to water bodies contributed to temperature mitigation, as areas near significant water sources recorded lower daytime LST differences, averaging −4.09 °C. A strong negative correlation was found between NDVI and LST, underscoring the cooling effect of vegetation through evapotranspiration and shading. This study provides a comprehensive global perspective on the commonalities of urban temperature dynamics in cities across diverse geographical regions and climates, contributing to a deeper understanding of how urbanization and land use changes influence surface temperatures and climate change.

The urban heat island (UHI) effect is evident in all cities, with industrial zones [64] and airports [65] consistently exhibiting the highest land surface temperatures (Figure 24). These areas contribute significantly to urban heat stress due to dense infrastructure, a lack of vegetation, and high energy consumption. Cairo (36.52 °C) and Chongqing (35.10 °C) stand out with particularly high industrial zone temperatures. While city centers generally have elevated temperatures, they are often surpassed by industrial zones and airports, as seen in cities like Cairo, Chongqing, Delhi, and São Paulo. However, Moscow presents an exception, with a significantly lower city center LST (12.44 °C), reflecting its colder climate and different urban composition. Green spaces and water bodies play a crucial role in mitigating heat, though their effectiveness varies across cities [66,67,68]. Green spaces consistently show lower LSTs, with Istanbul's Çatalca Forest (18.77 °C) and Delhi's Central Ridge Reserve Forest (29.24 °C) offering noticeable cooling effects. In some cases, the difference is striking; for example, Mexico City's green spaces are up to 12.13 °C cooler than its urban core. Similarly, water bodies such as the Bosphorus (15.63 °C) in Istanbul and the Moscow River (11.15 °C) demonstrate significant temperature reductions. However, in cities like Tokyo (23.62 °C) and Cairo (30.58 °C), water bodies do not always exhibit strong cooling effects due to factors such heat absorption from surrounding dense urban infrastructure [69].

Table 6 highlights land surface temperature (LST) variations across different urban zones in selected megacities, revealing distinct thermal patterns. Industrial zones and airports consistently exhibit the highest temperatures, underscoring their role in intensifying the urban heat island effect. For instance, Cairo's Industrial Zone Badr City (36.52 °C) and Chongqing's Gecaoba (35.10 °C) record the highest LSTs within their respective cities, exceeding temperatures in city centers and even airports. Airports, with their vast concrete surfaces and high energy consumption, also contribute significantly to urban heating, as seen in Cairo International Airport (35.47 °C) and Chongqing Jiangbei Airport (35.05 °C). In contrast, Moscow, due to its colder climate, registers much lower LSTs across all zones, with its industrial area (15.55 °C) and airport (12.85 °C) showing significantly lower values than other cities. Green spaces and water bodies provide substantial cooling effects, with temperature reductions of up to 12 °C compared to surrounding urban areas. Istanbul's Çatalca Forest (18.77 °C) and Mexico City's Sierra de Guadalupe State Park (20.03 °C) demonstrate the strong cooling impact of vegetation, significantly lowering LSTs relative to their city centers. Similarly, water bodies like the Bosphorus (15.63 °C) in Istanbul and the Yangtze River (22.35 °C) in Chongqing act as natural temperature regulators.

Table 6. Land surface temperature (LST) variations across different urban zones in selected megacities.

City	City Center	Airport	Industrial Zone	Green Space	Water Bodies
Cairo	32.19	35.47 (Cairo International Airport)	36.52 (Industrial Zone Badr City)	31.50 (Gharb el-Golf)	30.58 (Nil River)
Chongqing	26.61	35.05 (Chongqing Jiangbei Airport)	35.10 (Gecaoba)	23.11 (Wumaguicao)	22.35 (Yangtze River)
Delhi	32.39	34.51 (Indira Gandhi Airport)	33.05 (Mundka Industrial Area)	29.24 (Central Ridge Reserve Forest)	27.55 (Yamuna River)
Istanbul	24.19	28.07 (Istanbul Airport)	25.89 (Ataşehir Industrial Zone)	18.77 (Çatalca Forest)	15.63 (Bosphorus)
Melbourne	24.63	25.70 (Melbourne Airport)	27.70 (Truganina)	20.27 (North Warrandyte)	20.52 (Yarra River)
Mexico	32.16	33.19 (Mexico Airport)	30.77 San Luis Tlatilco Industrial Zone	20.03 (Sierra de Guadalupe State Park)	22.30 (Laguna de Zumpango)
Moscow	12.44	Vnukovo Airport (12.85)	15.55 (Podolsk Industrial Area)	10.77 (Sokoliki Park)	11.15 (Moscow River)
Sao Paulo	31.65	32.39 (Sao Paulo Airport)	32.80 (Viela Sabesp)	29.17 (Parque Ibirapuera)	28.05 (Jurubatuba River)
Tokyo	22.31	23.89 (Tokyo International Airport)	26.51 (Toshibacho)	21.81 (Tokyo Imperial Palace)	23.62 (Arakawa River)

Figure 7. Long-term trends and boxplots of the land surface temperature (LST) across different land cover types (urban, vegetation, bareland, and sea), showing both LST Day and LST Night trends (2001–2021) in Chongqing.

Image Source: Kara and Yavuz, 2025

Link:
https://notrickszone.com/2025/08/07/new-study-a-citys-industry-center-airport-up-to-12c-warmer-than-nearby-forests-vegetation/

Übersetzt von Christian Freuer für das EIKE