

Spatiotemporal Assessment of the Correlation between Surface Thermal Field Variance and Human Thermal Discomfort in Dhaka

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INTRODUCTION & AIM

Rapid urban expansion in tropical megacities like Dhaka significantly modifies local energy balances, causing severe microclimatic degradation (Kafy et al., 2021). While traditional urban climatology relies on Land Surface Temperature (LST) and the Urban Heat Island (UHI) effect, these physical metrics often fail to capture the actual physiological heat stress experienced by urban dwellers (Di Napoli et al., 2021). **Problem:** High-density built environments exacerbate localized heat retention. **Knowledge Gap:** Limited research integrates surface thermal anomalies (UTFVI) with human-centric atmospheric indices (UTCI) at high spatial resolutions. **Objective:** This study evaluates the spatiotemporal dynamics of human thermal discomfort in Dhaka from 2005 to 2025 to inform microclimatic interventions.

METHOD

The research utilizes a cloud-based computational pipeline via the Google Earth Engine (GEE) Python API to synthesize multi-source geospatial data.

2.1 Data Acquisition and Processing

Satellite Data: Multi-temporal Landsat 5 TM and Landsat 8 OLI/TIRS imagery (30m resolution) for LST and UTFVI derivation.

Atmospheric Data: ERA5-HEAT reanalysis data providing Universal Thermal Climate Index (UTCI) parameters.

Spatial Downscaling: Bilinear spatial interpolation translates coarse atmospheric data (0.25°) into 30m resolution UTCI gradients.

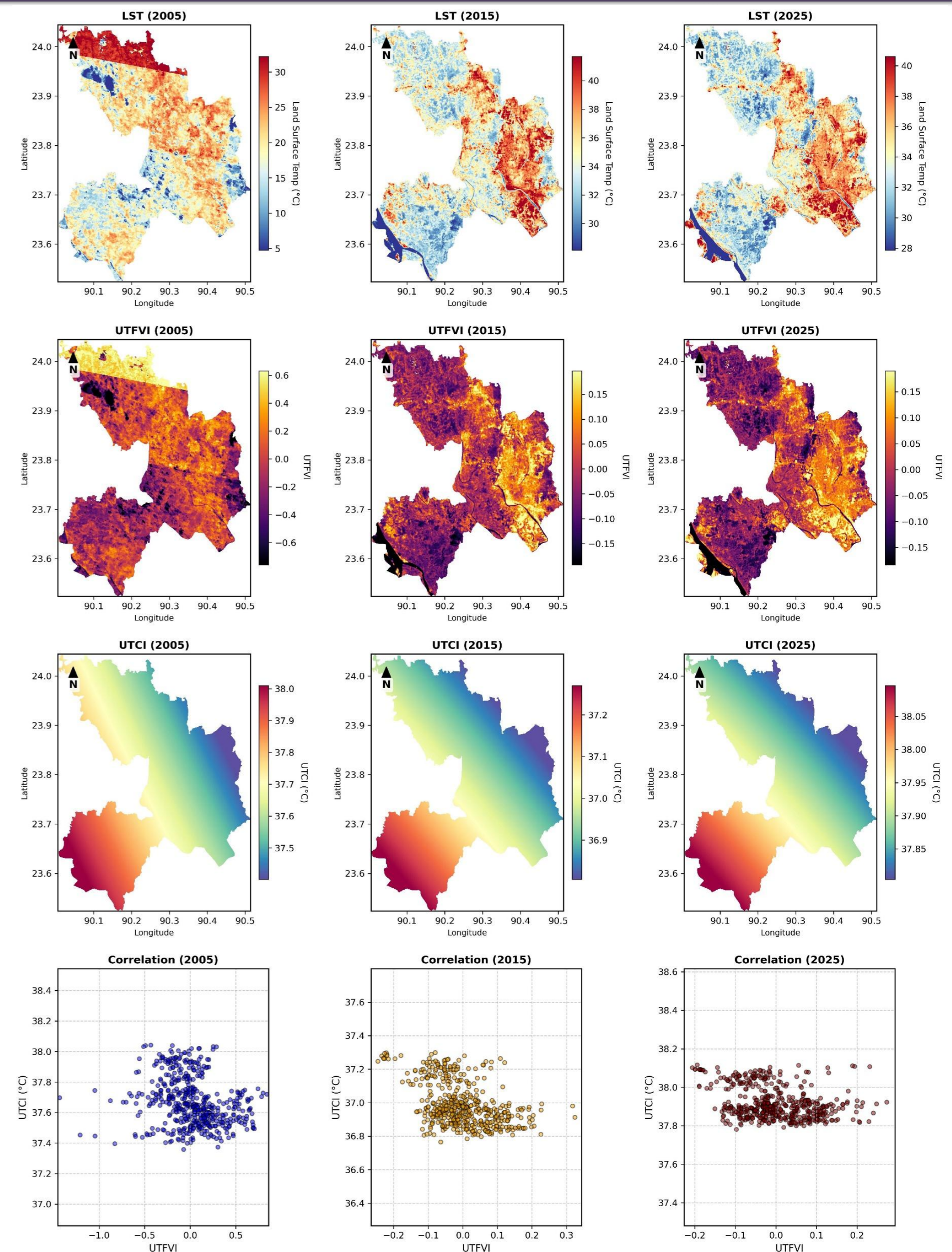
2.2 Analytical Framework

Urban Thermal Field Variance Index (UTFVI): Quantifies the contribution of specific urban zones to the heat island effect using the formula:

$$UTFVI = LST - LST_{mean} / LST_{mean}$$

Spatiotemporal Correlation: A Pearson correlation analysis at 500 random sample points identifies the relationship between structural surface heat (UTFVI) and physiological stress (UTCI).

RESULTS & DISCUSSION



	2005	2015	2025
Peak LST	32.4°C	36.8°C	>40.2°C
Mean UTCI	33.1°C	35.4°C	38.1°C
Stress	Moderate	Strong	Extreme

CONCLUSION

Framework: Replicable dual-index model for Global South urban planning.

Future Action: High-UTFVI zones require immediate green infrastructure to mitigate life-threatening atmospheric stress.

REFERENCES

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- Kafy et al., 2021. Sustain. Cities Soc., 70, 102902.