THE SURFACE URBAN HEAT ISLAND IN CASABLANCA, MOROCCO

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L'îlot de chaleur urbain de surface à Casablanca, Maroc

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Introduction

The Urban Heat Island (UHI) effect is due to difference in heat flow between urban and rural areas, with urban areas generally absorbing and storing more sensible heat than rural ones (Oke, 1982). The UHI effect is a detrimental phenomenon for climate change, the environment and human health. It is interrelated with climate change (Lim, 2021). First, global warming will increase already higher temperatures in heat island areas. Second, mitigating and cooling strategies to reduce heat islands can help communities adapt to the impact of climate change as well as lowering the greenhouse gas emissions that cause climate change (Rainham and al., 2003).

The objective of this work is to estimate the LST of the city of Casablanca, Morocco from Landsat 8 and 9 satellite images via a single window algorithm, using the ArcGIS spatial analysis tool that generates a surface temperature map, in order to study Spatio-temporal variability of the UHI in Casablanca. The determination of the LST was based on the calculation of the NDVI index, the luminosity temperature and the LSE using ArcGIS.

1. Data and methods

A combined use of the Landsat 8 infrared band for the years 2020, 2021, 2022, and 2023 based on a multiple linear regression model was an efficient to improve the spatial resolution of land surface temperature maps during summer days. The combined use of this land surface emissivity (LSE), the wavelength of radiance emitted and the upper brightness temperature of the atmosphere were used to extract the Land Surface Temperature (LST) and surface UHI (Rajeshwari and Mani, 2014; Anandababu and al., 2018). ArcMap 10.8 was used for classification, LST and Normalized Difference Vegetation Index NDVI derivation, and UHI calculation (Rahman and al. 2022).

2. Results

The UHI, calculated using the LST values, varies between 9.7°C and 18.7°C during all the years of study (Fig. 1). While, the UHI intensity varies from one city to another. Most of them are in the north of Casablanca, like Ain sebaâ, Bernoussi, Tit mellil, Ain Harrouda. Yet, the surface UHI is reduced in the southern neighborhoods of the city. The hottest areas are It is located in the regions characterized by high building density and high industrial activity (Fig. 1), as well as the bare areas and non-grassy ones especially in the north and northeast of the city of Casablanca.

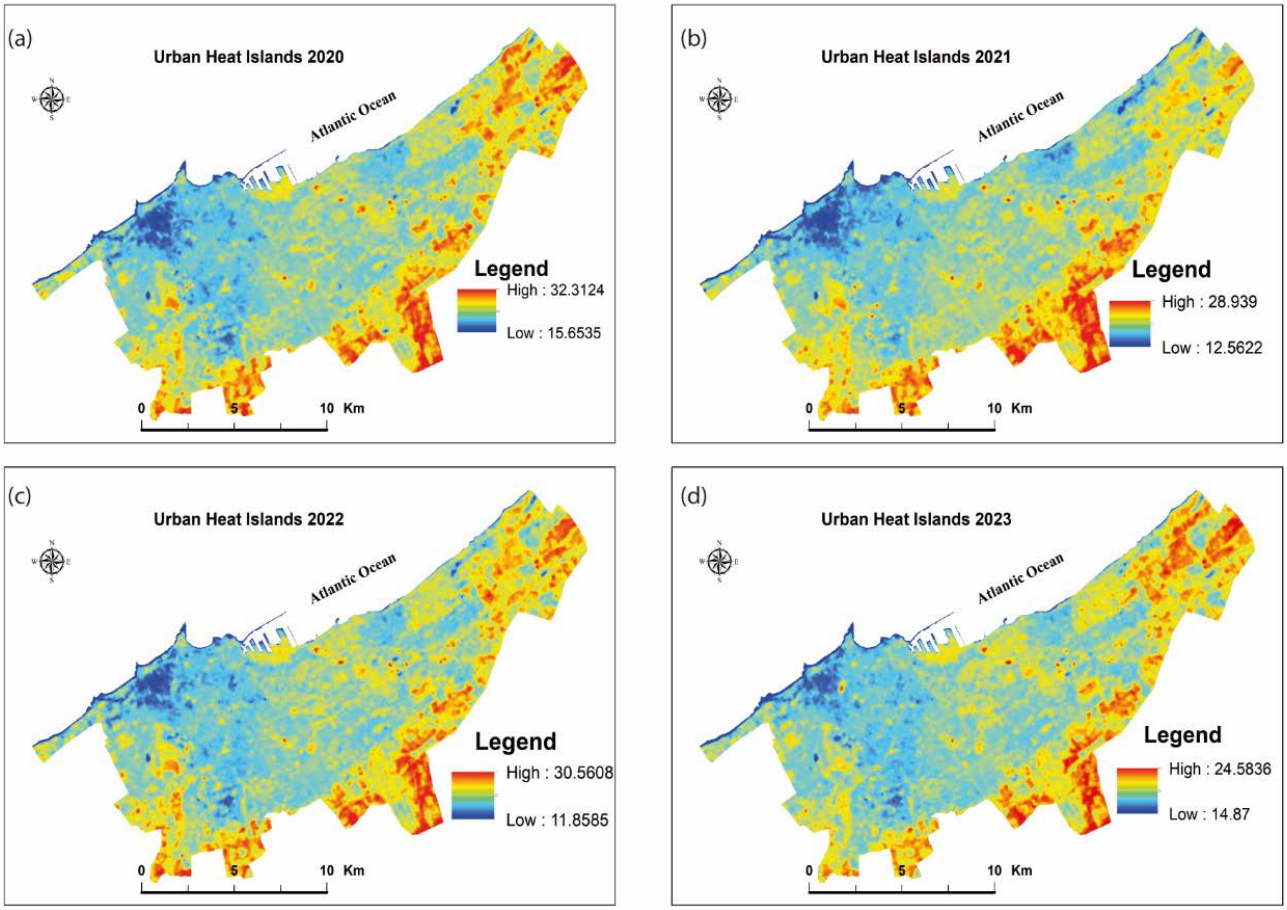

Figure 1. Surface temperature maps of Casablanca for the years 2020 (a), 2021 (b), 2022 (c) and 2023 (d).

Conclusion

In conclusion, the current study has revealed new evidence concerning the relationship between LST, NDVI and UHI, and their temporal and spatial variability in the city of Casablanca, through the application of Landsat satellite imagery. The findings reveal that UHI intensity fluctuates across different neighborhoods of Casablanca, with northern regions exhibiting higher temperatures attributed to dense urbanization and industrial activities. Thus, LANDSAT 8/9 data can provide a credible basis for estimating the temperature of the earth's surface which allows the monitoring of the evolution of urban heat islands and at the same time guarantees an additional precision in terms of thermal measurements at the level of the city of Casablanca. Further research and monitoring efforts are necessary to better understand the dynamics of UHI and inform targeted interventions aimed at promoting sustainable urban development.

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