Assessing heat risk in a sub-Saharan African humid city, Lagos, Nigeria, using numerical modelling and open-source geospatial socio-demographic datasets

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Introduction

- Sub-Saharan African cities are facing an increased risk of heat due to climate change and rapid urbanization. This poses a particular threat in areas with limited adaptive capacity
- There is however lack of comprehensive heat risk assessment in the region due to unavailability of urban weather data.
- This study aims to address this gap by proposing and demonstrating a methodology for mapping high-risk areas in a tropical humid city, specifically focusing on Lagos, Nigeria.

Methods

- Heat risk = $\int$(Hazard *Vulnerability * Exposure)

Hazard
Humidex
uWRF- Simulated

Vulnerability
(Vulnerable age, RWI & NDVI)

Exposure
Population density

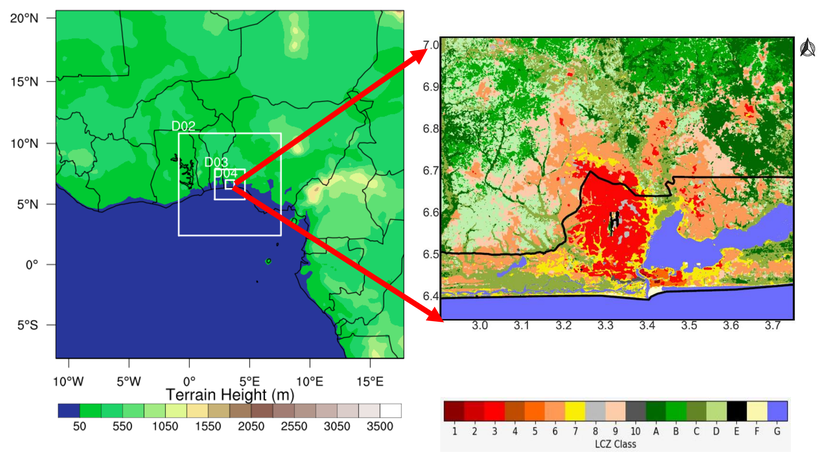

Fig. 1 WRF simulation at 300m resolution with WRF-BEP and the LCZ of Lagos metropolis

Results

- Highly urbanized LCZs in the city centre consistently exhibit elevated heat risk when compared to their suburban and rural areas.
- LCZ 3 characterized by densely packed buildings, high PD, and sparse vegetation, stand out as having significantly higher heat risk:
- 58 % of "very high" heat risk areas are located in this LCZ 3.
- This is followed by LCZ 6 with 24 % and LCZ 7 with 14 %.
- For "medium" to "high" heat risk. We noted that the largest proportion of these areas are located in LCZ 6 followed by LCZ 3 and 7.
- The highest proportion (46 %) of areas with "low" and "very low" heat risks are observed in suburban LCZ.

Hot Spot Analysis

- The hot spot region with $\alpha \geq 99$ % covers 8 % of the domain.
- The hot spots with confidence level (90 % < α < 99 %) only occupy a combined 3 % of the domain.
- A significant portion (89 %) of the study area is classified as areas with no statistically significant heat risk, representing sub- urban and natural areas with little or no heat risk

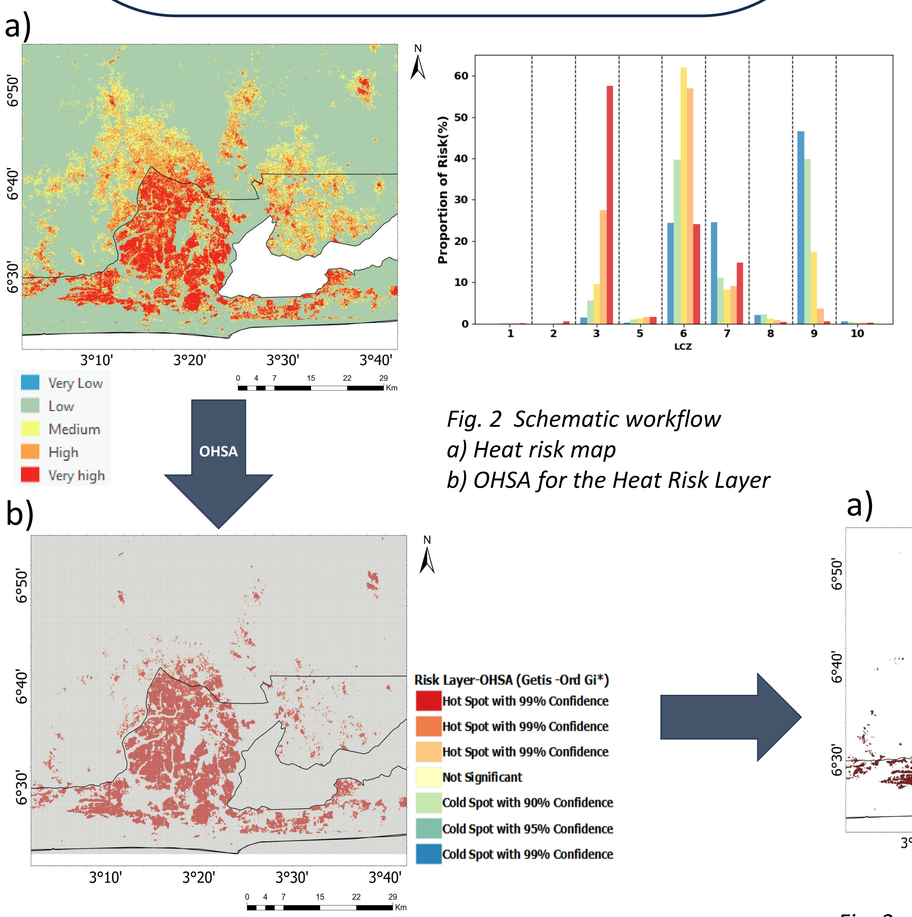

Fig. 2 Schematic workflow
a) Heat risk map
b) OHSA for the Heat Risk Layer

Conclusion

- The study conducted a quantitative analysis of three components of risk: hazards, exposure, and vulnerability, based on Crichton's triangle.
- The final risk layer revealed that urbanized LCZs are more susceptible to heat risk compared to suburban LCZs. LCZ 3, 6 and 7 were particularly identified as having the highest proportion of areas at risk of heat.
- The Critical Heat Risk Zone (CHRZ) representing areas with heat risk at the 99 % significance level.
- This zone covered approximately 423 km^2 and mostly comprises of informal areas in LCZ 3 and 7.

Key References

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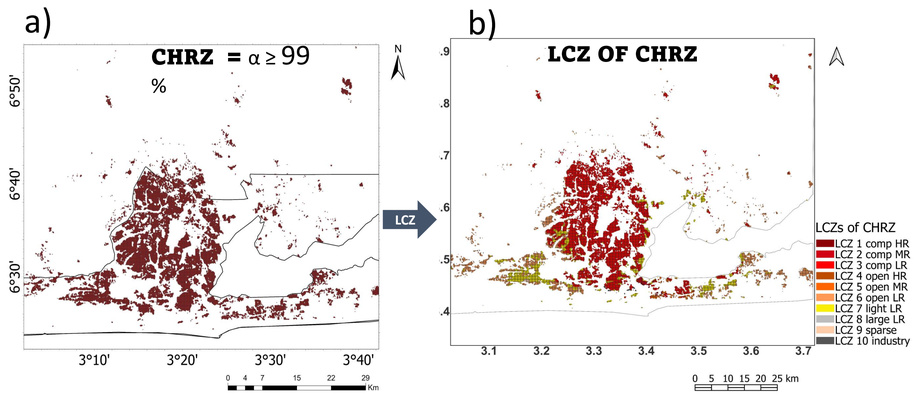

Fig. 3 a) Critical Heat Risk Zone ($\alpha \geq 99\%$, b) CHRZ classified according to LCZ