Netban, toward an opensource, efficient ML software for urban temperature mapping.

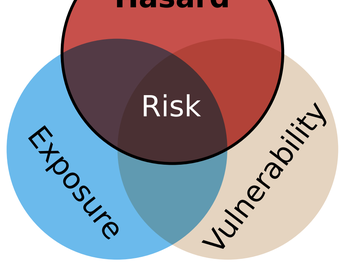
Ugo Martinez, Emmanuel Dellandrea, Lionel Soulhac, Pietro Salizonni

Introduction

Health Impact: High air temperatures pose severe health risks, preventing nighttime thermal relief[1].

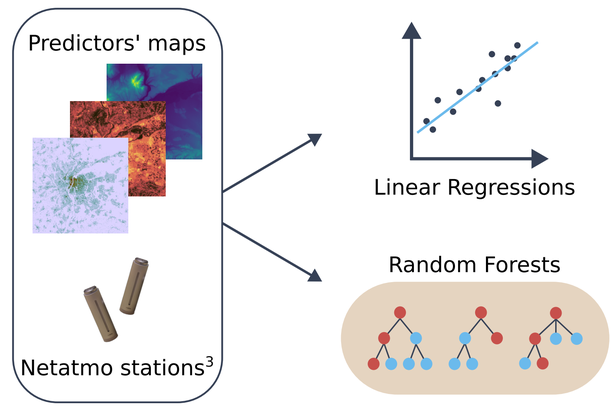
Urban Exacerbation: Urban Heat Island (UHI) effect and climate change provoque very high nocturnal air temperatures in european cities[2].

Prediction Gap: Accurately mapping temperatures at a 100m scale remains a major challenge for risk mitigation and urban design.



Materials and methods

We trained linear regression and random forest models by coupling crowdsourced Netatmo weather station data with spatial predictor maps derived from IGN and satellite measurements.

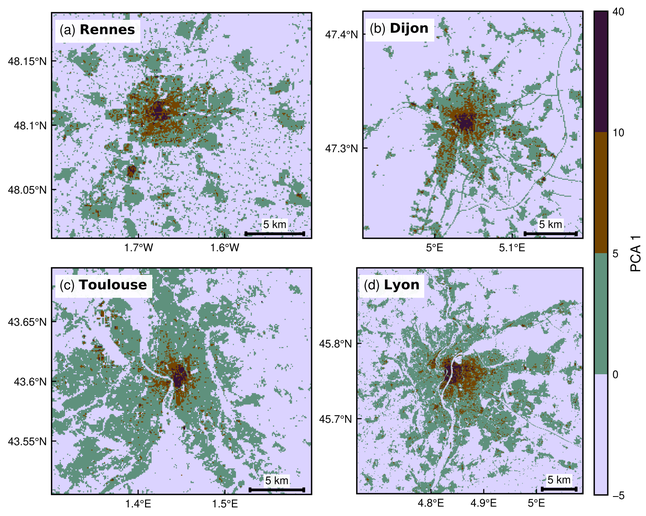


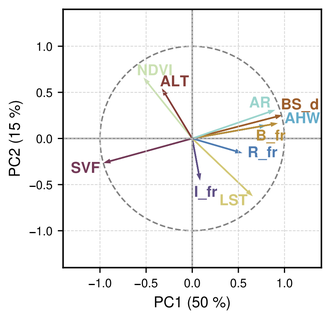
Results

Caracterising urbanity

A group PCA was conducted onto the 4 cities' datasets, leading to the determination of 1 principal component as a combination of all predictors. Looking at the coefficents, this axe can be interpreted as the *urbanity* of the area.

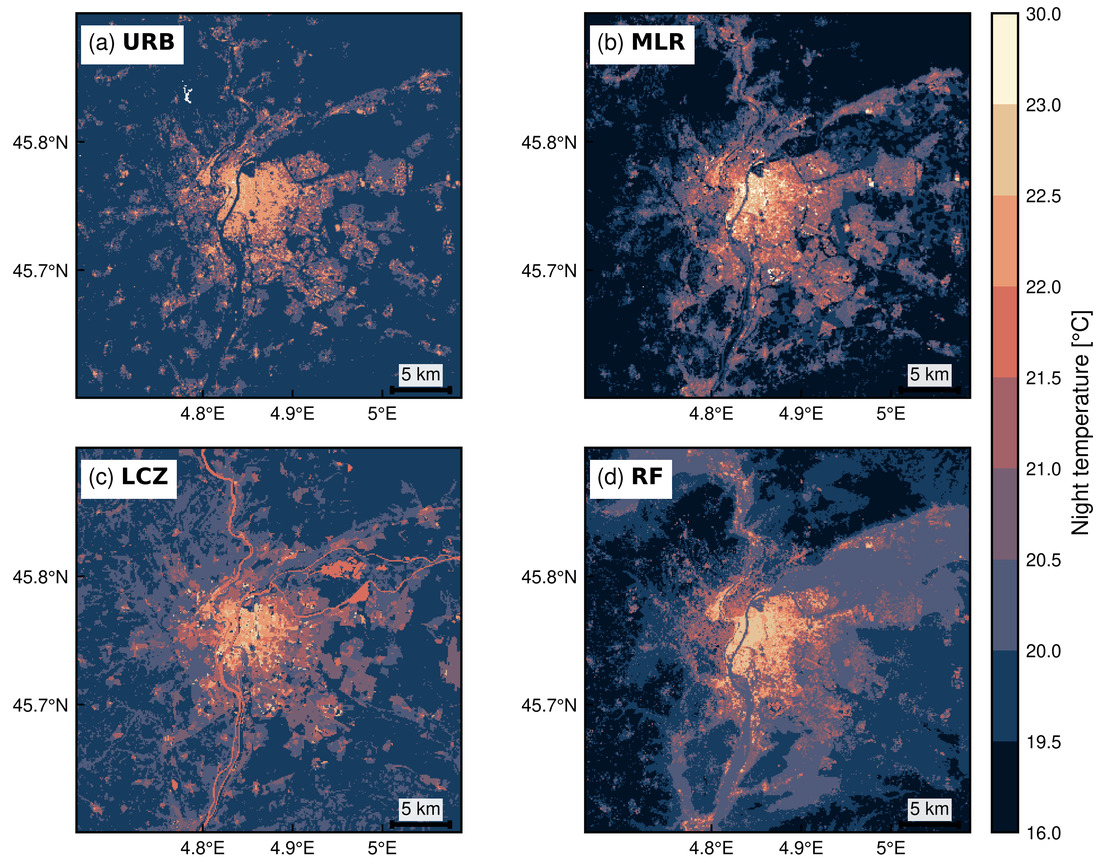
Rural stations where then defined as having negative *urbanity*, enabling to define the UHI intensity.





Mapping temperatures

With the trained algrorythms (MLR and RF), we made maps of predicted temperature (and UHI).



Conclusion

UHI Computation: Spatial characteristics define urbanity, establishing a rural baseline to define UHI with citizen networks.

Improved Mapping: Given sufficient data, statistical models outperform the standard LCZ framework for city temperature mapping.

Future Works

Ensemble Predictions: Future iterations will forecast other variables, including maximum temperatures and number of tropical nights.

City Implementation: We aim to integrate these models directly into municipal urban planning strategies.



Aknowledgment

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Data provided by Netatmo, INSEE and Copernicus Sentinell.
Data treated with Geoclimates[4] software.

References

[1]Vanos et al, 2023, A Physiological Approach for Assessing Human Survivability and Liveability to Heat in a Changing Climate.
[2]Oke et al, 2017, Urban Climates.
[3]From seblinux78, CCASA 2.0
[4]Bocher et al, 2021, GeoClimate: a Geospatial processing toolbox for environmental and climate studies.

Further information

Gitlab: https://gitlab.pmcs2i.ec-lyon.fr/hmartine/netban