Quantification of Urban Heat Island effect and assessment of rescaled temperature

Period 3 - Metrics & Quantitative Insight

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Systematic bias of ERA5-Land

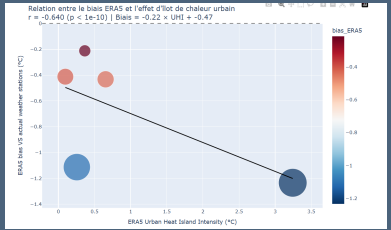
Main result

ERA5-Land systematically underestimates actual urban temperatures

Some figures

- Average bias : $-0{,}68\,^{\circ}\mathrm{C}$
- Maximum deviation : $-1{,}23\,^{\circ}\mathrm{C}$ (Nice)
- Pearson Correlation : $r = -0.64,\ p < 10^{-10}$

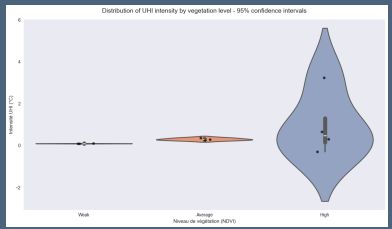
Negative bias is all the stronger when the UHI is intense. Rescaled ERA5-Land does not capture the full extent of the actual heat island effect.



Vegetation role : a counterintuitive effect

Link between vegetation level (NDVI) and UHI intensity

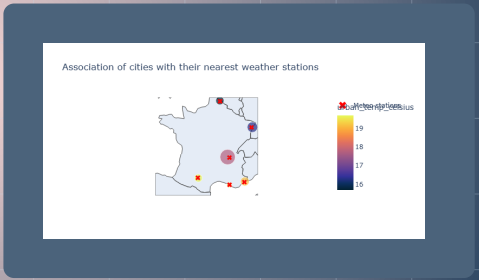
Level	number cities	Mean NDVI	Mean UHI
Low	3	0.22	0,1 °C
Medium	3	0.45	0,3 °C
High	4	0.53	0,98 °C



The cities with the highest NDVI (preserved green belts) are those with the highest intensity and variability of UHI : dominated effect by central urban density.

Quantitative indicators

IX	Indicator	Completed
Tables with gaps (vegetation)		Yes - NDVI tertiles + standard deviation + 95% CI
Additional geographical factors		Yes - latitude, distance to sea
Boxplots / violins		Yes - violin + integrated boxplot
95% confidence intervals		Yes - computed and displayed
Explanatory variables for model		Yes - NDVI, distance to sea, latitude, T_{era5}



SUMMARY

Key Interpretations

ERA5-Land shows a systematic cold bias in urban areas ($-0{,}7\,^{\circ}\mathrm{C}$ on average).

UHI intensity is highest in cities with high NDVI (urban density effect)

perspectives

All explanatory variables are quantified and ready for modeling

Construction of a predictive model for actual UHI that is superior to ERA5-Land

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