



1. introduction

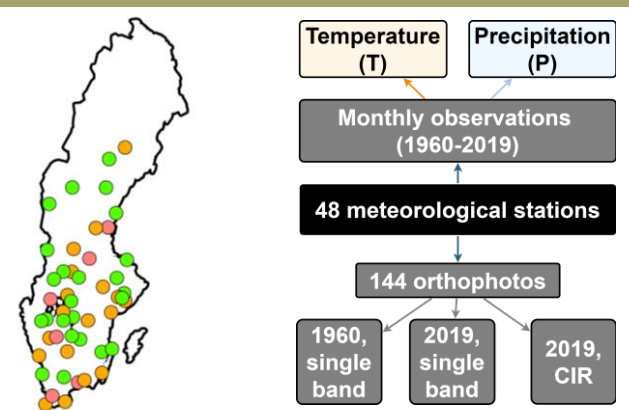
A. Background

Urban land cover (ULC) has been expanding in Sweden (SCB, 2015). Studies explored the effects of such expansion on climatic trends (Paranunzio et al., 2019), but its influence on meteorological observations remains largely unquantified.

B. Research questions

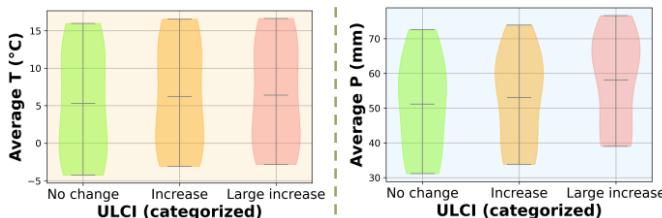
- Have the expansion of ULC in the vicinity of meteorological stations influenced their long-term trends in climatic observations?
- Are there systematic differences between the trends of urban and rural stations, that may be attributed to the urban heat island effect?

2. The Data



4. Results

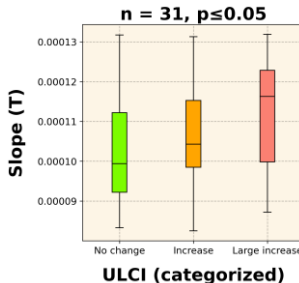
A. What do the data say?



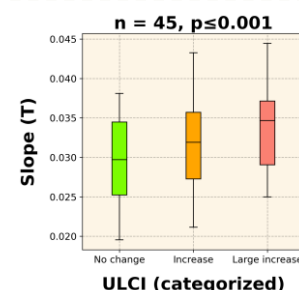
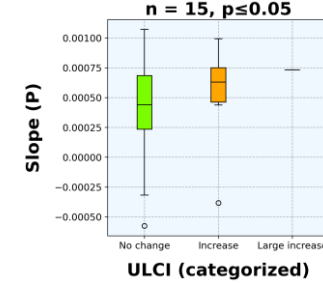
Average monthly temperature observations: stations with high ULCI had higher median and minimum temperature values. The three ULCI categories had similar distributions.

Average monthly precipitation observations: ranges and median values increased with ULC increases. The distribution became skewed towards higher values as ULC increased.

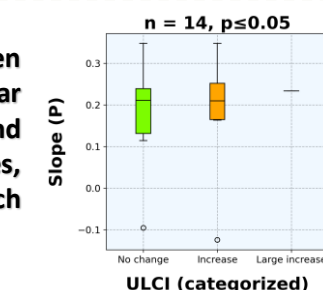
B. Trends among stations with different levels of ULC expansion (1960-2019)



Simple linear regression: higher upper and lower quartiles, and median slope values, for stations experiencing large increases in ULC, for both temperature and precipitation observations.

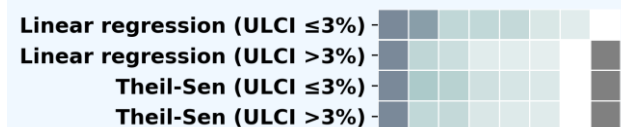


Seasonal Mann-Kendall test, with Theil-Sen estimator: Trends (slopes) were higher than linear regression. The result from both temperature and precipitation observations show higher ranges, quartiles and medians as ULC increases for each category.



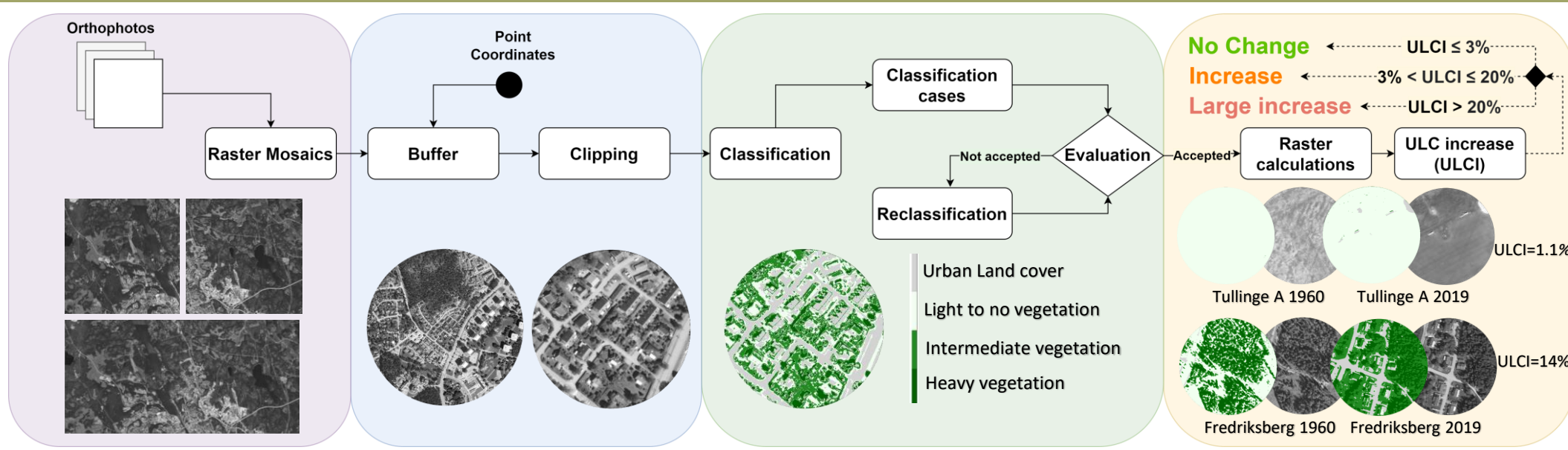
C. Stations with ULC expansion vs. stations with no change in ULC

Normalized linear regression and Theil-Sen slopes were higher (lighter shades) in stations where ULC increased, for both temperature and precipitation.



Linear regression results for temperature had numerous values that are not statistically significant ($P > 0.05$) (shown in grey). For precipitation, in addition to the three statistically insignificant values shown in the figure, all other stations yielded statistically insignificant trends.

3. ULC classification



5. Summary

Our results suggest that increases in temperature and precipitation observations are more pronounced in stations with substantial ULC increase.

References

- Statistics Sweden (SCB). (2019). *Land use in Sweden* (7th ed.). edition. Available at: https://www.scb.se/contentassets/ea00bda68634c1dbdec1bb4f6705557/mi0803_2015a01_br_mi03br1901.pdf
- Paranunzio, R., Ceola, S., Laio, F., Montanari, A. (2019). Evaluating the Effects of Urbanization Evolution on Air Temperature Trends Using Nightlight Satellite Data. *Atmosphere*. 10(3):117. <https://doi.org/10.3390/atmos10030117>

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