Estimating the impact of seasonal extremal dependence with a Max-Stable process for modeling extreme precipitation events over Berlin-Brandenburg

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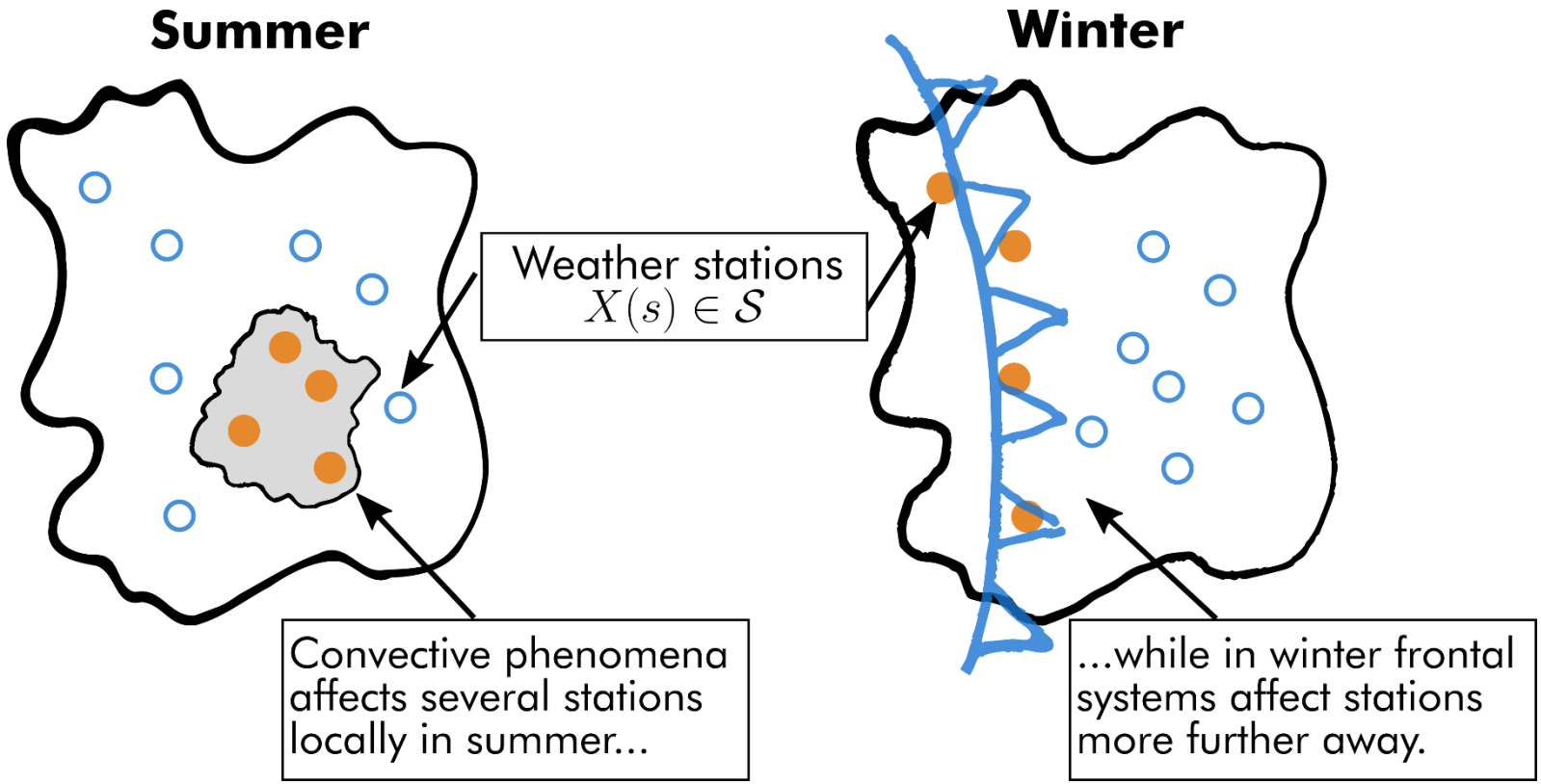
Goal: To find out how different types of extremal dependence affect marginal estimates
Why?: Different precipitation types lead to differences in the extremal dependence

Motivation: Different precipitation types lead to different spatial dependence structures...



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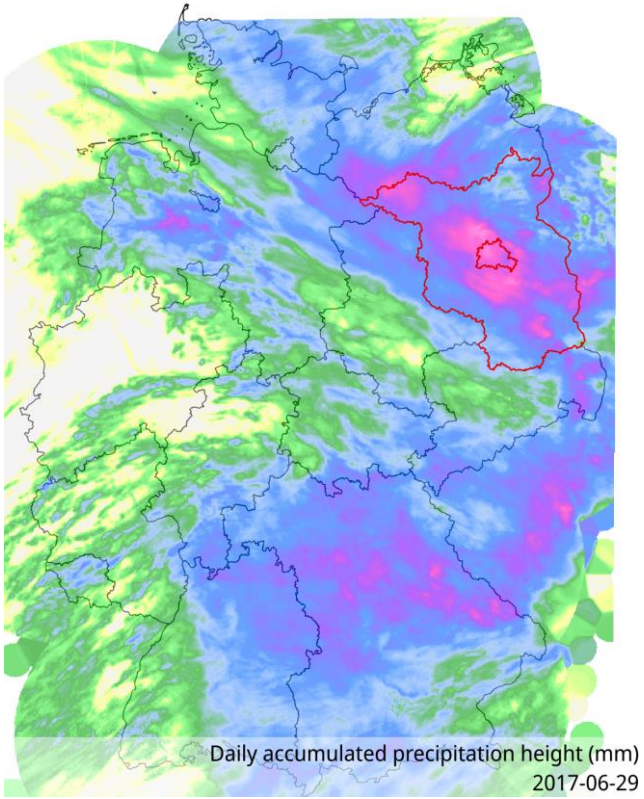
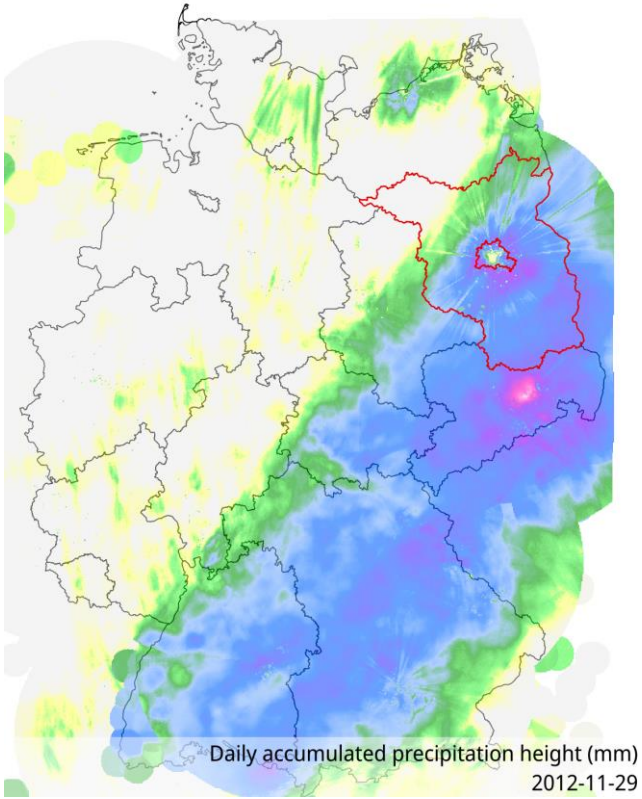
...which then lead to differences in the extremal dependence structure

Convective extreme event (summer 2017)



Frontal extreme event (winter 2012)



Data source:
RADOLAN, DWD

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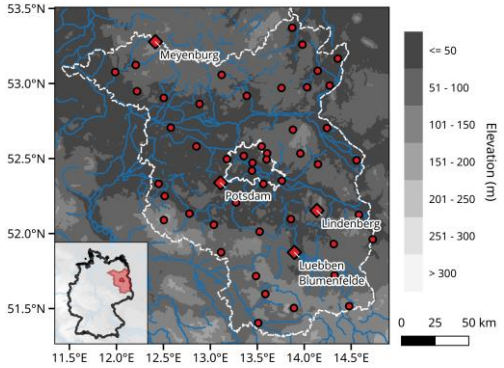
Method: max-stable process as model, GLM as control.

Data: 43 rain gauges in Berlin-Brandenburg

model

Verification: Quantile score

Comparison: QSI



1970-2020 daily observations
Transformed to semi-annual block maxima:

- Summer (convective): MJJA
- Winter (frontal/stratiform): NDJF

Brown-Resnick max-stable process w/response surfaces

- Assuming isotropy
- Pairwise likelihood

QS_{mod}

Including dependence

Ignoring dependence

GLM for location and scale parameter

- Assuming all data is i.i.d.

QS_{ref}

QSI

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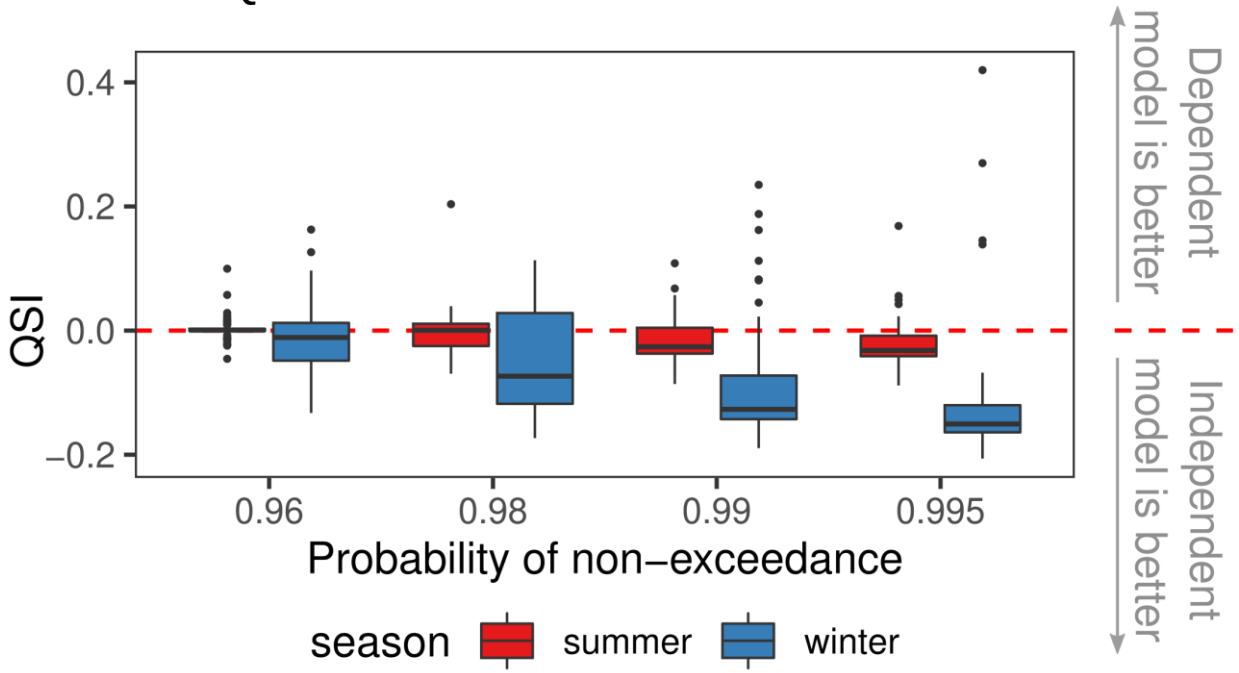
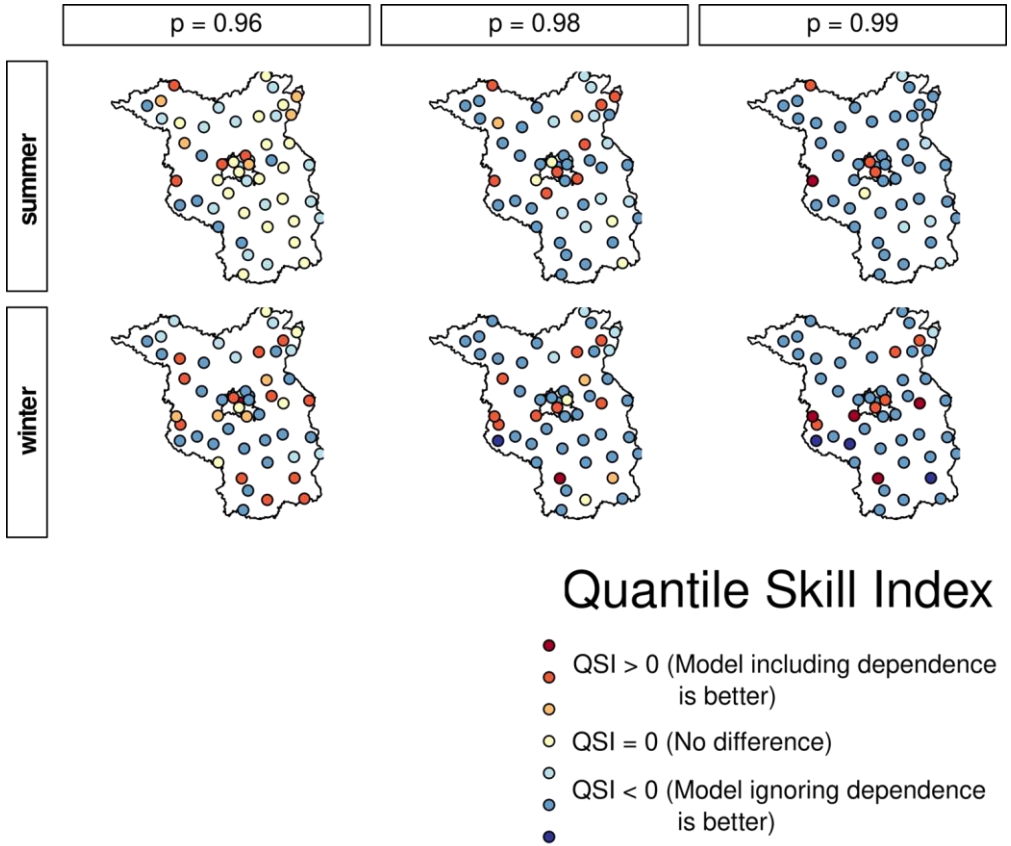
Results: Neutral performance in summer, bad in winter

In **summer** QSI values over the 43 stations are close to zero...



...but in **winter** QSI values are strongly negative (loss of skill)

Results: Neutral performance in summer, bad in winter



- No discernible spatial pattern

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Summary and Outlook

Main result: Isotropic Brown-Resnick max-stable model:

- Equal or better estimates for summer (convective) events
- Worse estimates for winter (frontal/stratiform events).

Modeling for non-convective events: anisotropy? Non-stationarity? (future work)

Paper preprint coming soon

Acknowledgments

We thank the German Research Foundation (DFG) through the graduate research training group “Natural Hazards and Risks in a Changing World (NRC)” for financial support.

The first author thanks both the Mexican Science Council for Science and Technology (CONACyT) and the German Academic Exchange Service (DAAD) for their financial support.