



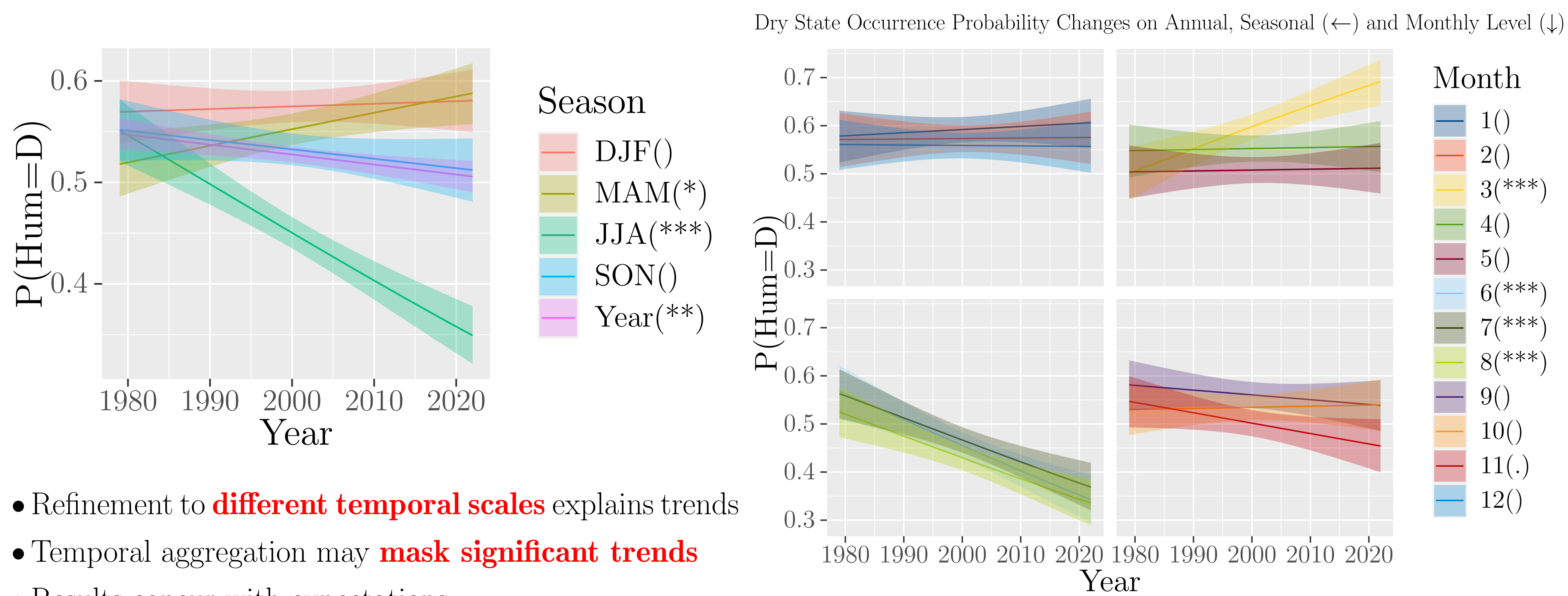
OCCURRENCE AND TRANSITION PROBABILITIES FOR TWO WEATHER CLASSIFICATION SYSTEMS OVER GERMANY

Henry Schoeller, Henning Rust
FU Berlin, Institute of Meteorology

Introduction & Research Questions

- Classification** methods: ubiquitous tools in science
- Statistical analysis of resulting **time series** should be done using **logistic regression** based on theoretical arguments
- Such analysis is surprisingly rare in **atmospheric sciences**
- Capabilities and Limitations** of logistic regression applied to **weather type classification** time series?
- Changes in **occurrence and transition probabilities**?
- Can such changes be **verified** and **explained**?

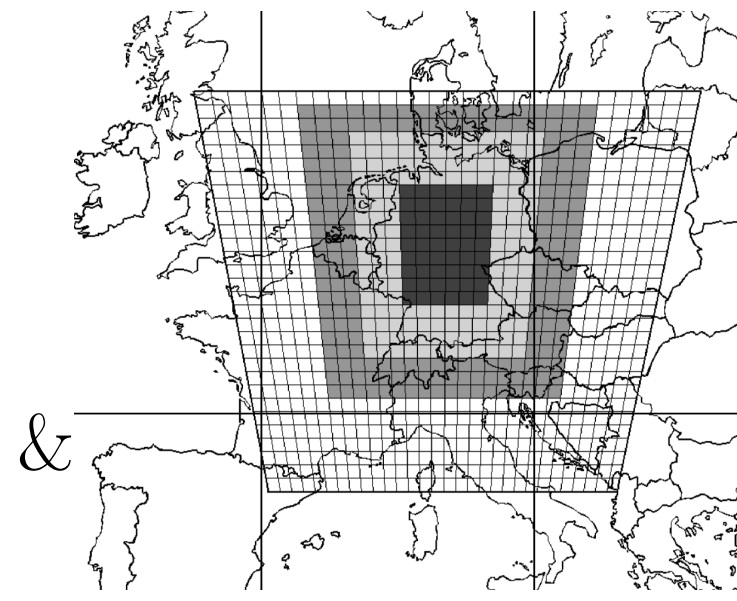
Binomial Models for Occurrence Probabilities (WLK)



Weather Type Data Sets

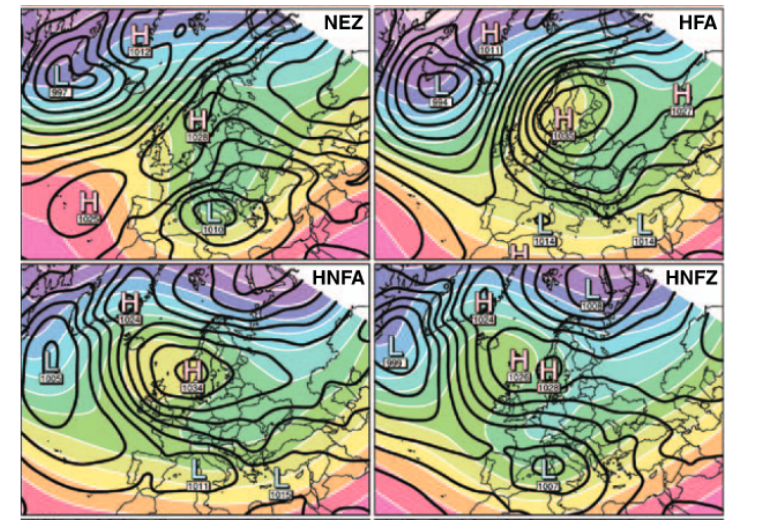
Wetterlagenklassifikation (WLK) [1]

- By DWD since 1979
- Threshold-based assignment
- Classifies wind direction cyclonality ($\nabla^2\phi$) & Humidity
- $\times 3, \times 2, \times 1$ wheighted regions (\rightarrow)



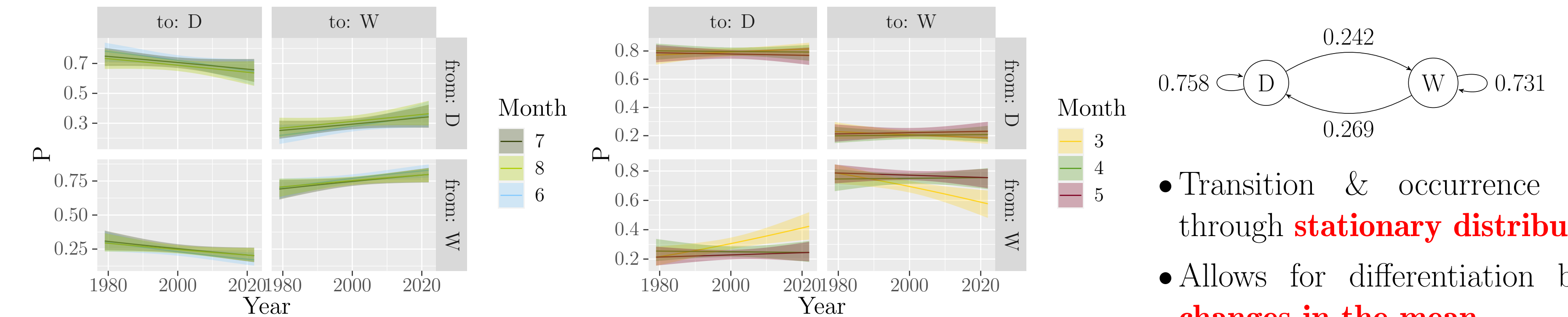
Großwetterlagen (GWL) [2], [3]

- Since 1881
- Subjective classes and assignment
- Assignment by weather maps (ϕ at 500hPa & SLP)
- Currently continued by DWD

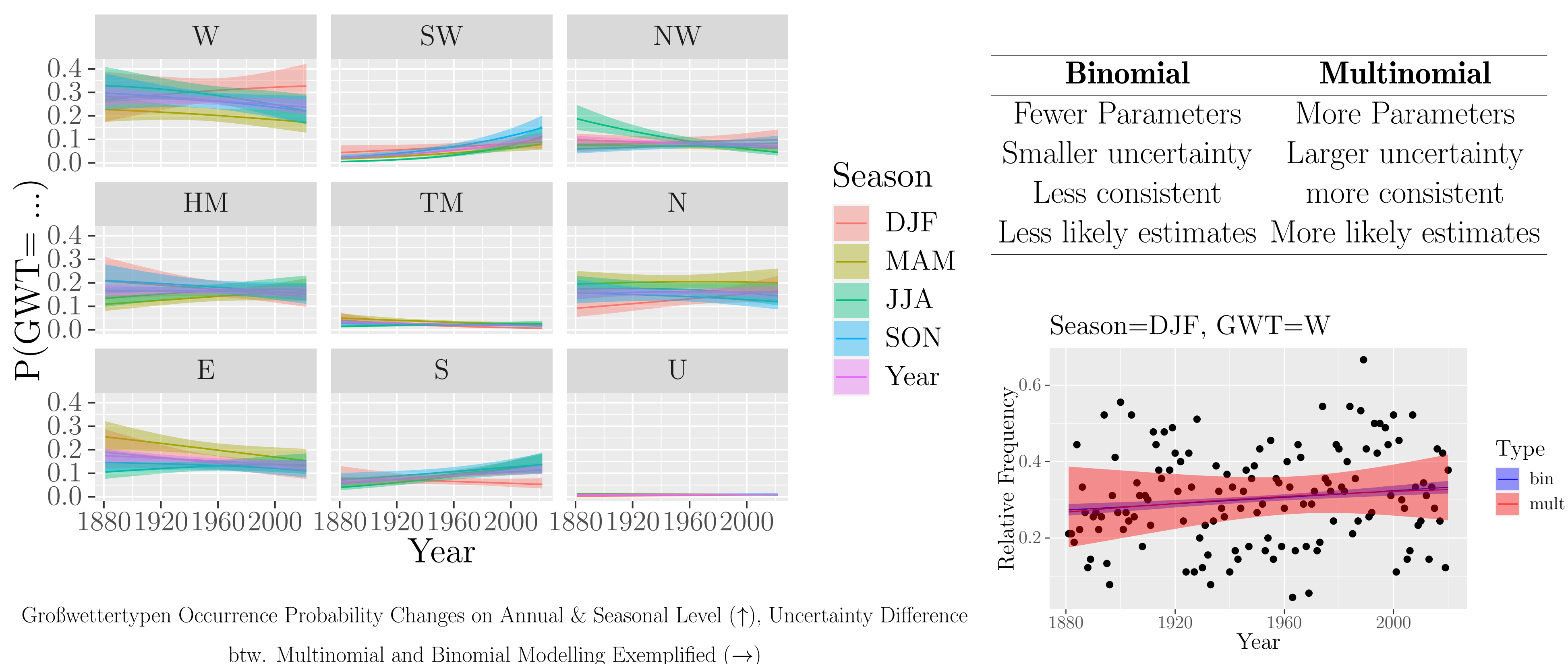


Binomial Models for Transition Probabilities (WLK)

Dry/Wet State Transition Probability Changes on Monthly Level (↓), Homogeneous Markov-Chain (→)

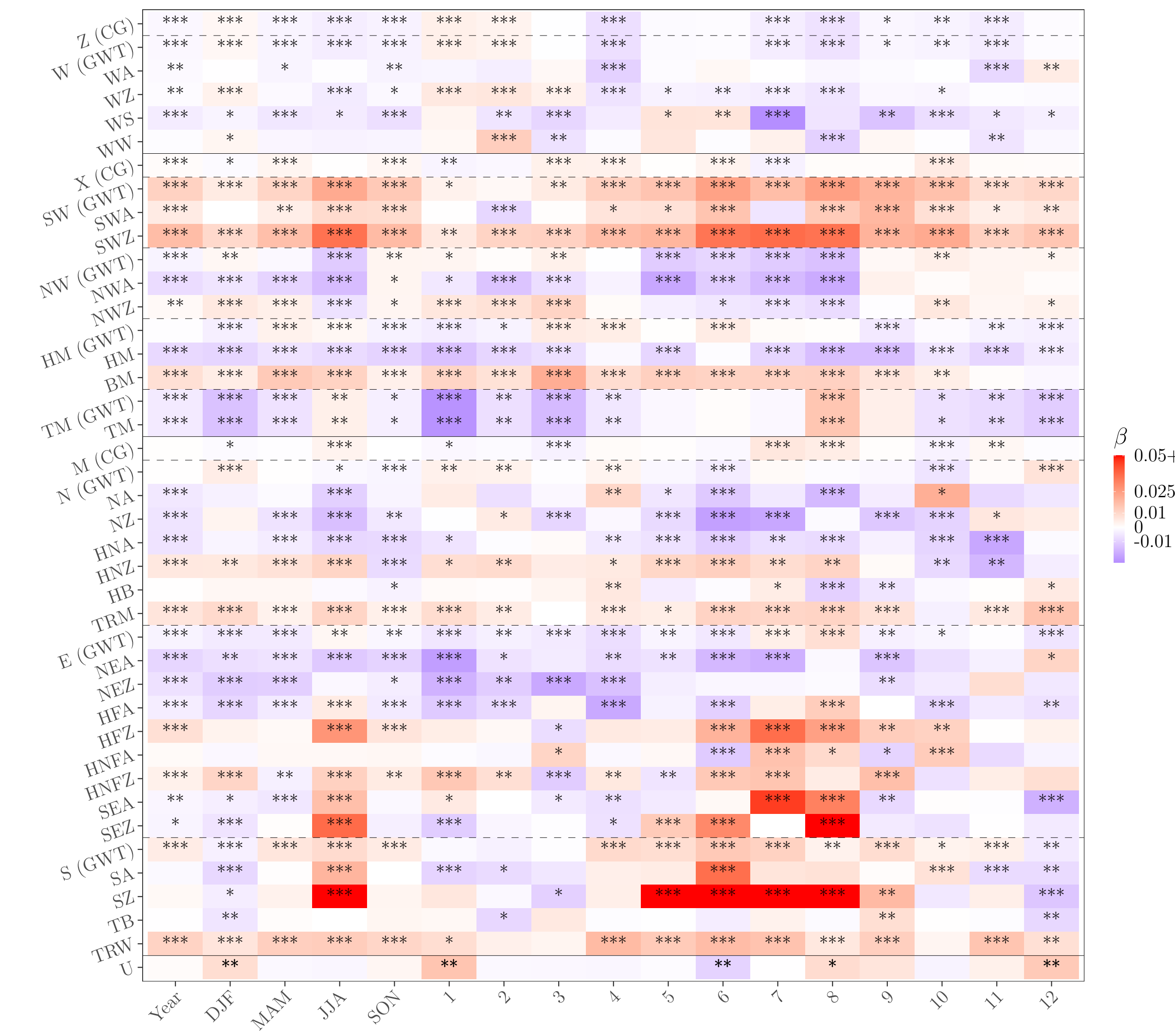


Multinomial Models for Occurrence Probabilities (GWL)



Binomial Models for Multinomial Variables

Parameter Estimates of Individual Binomial Models for Changes in Occurrence of Respective GWL or GWT



Conclusions

- Markov chain logit models** enable understanding of synoptic changes
- Temporal refinement** may reveal signals masked on more aggregated levels
- Careful choice of binomial/multinomial models allows **adjusting to sample size**
- Observable changes both reflect existing knowledge and offer **new insights**

References

- Ernst Dittmann et al. *Objective classification of meteorological situations; Objektive Wetterlagenklassifikation*. Offenbach am Main, Germany: Berichte des Deutscher Wetterdienstes, 1995.
- Paul Hess and Helmuth Brezowsky. "Katalog der Großwetterlagen Europas (catalogue of European large scale weather types)". In: *Berichte des Deutschen Wetterdienstes in der US-Zone 33* (1952).
- P. M. James. "An objective classification method for Hess and Brezowsky Grosswetterlagen over Europe". In: *Theoretical and Applied Climatology* 88.1 (2007), pp. 17–42.