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Precipitation-driven storm types and their climatology across the Alpine range

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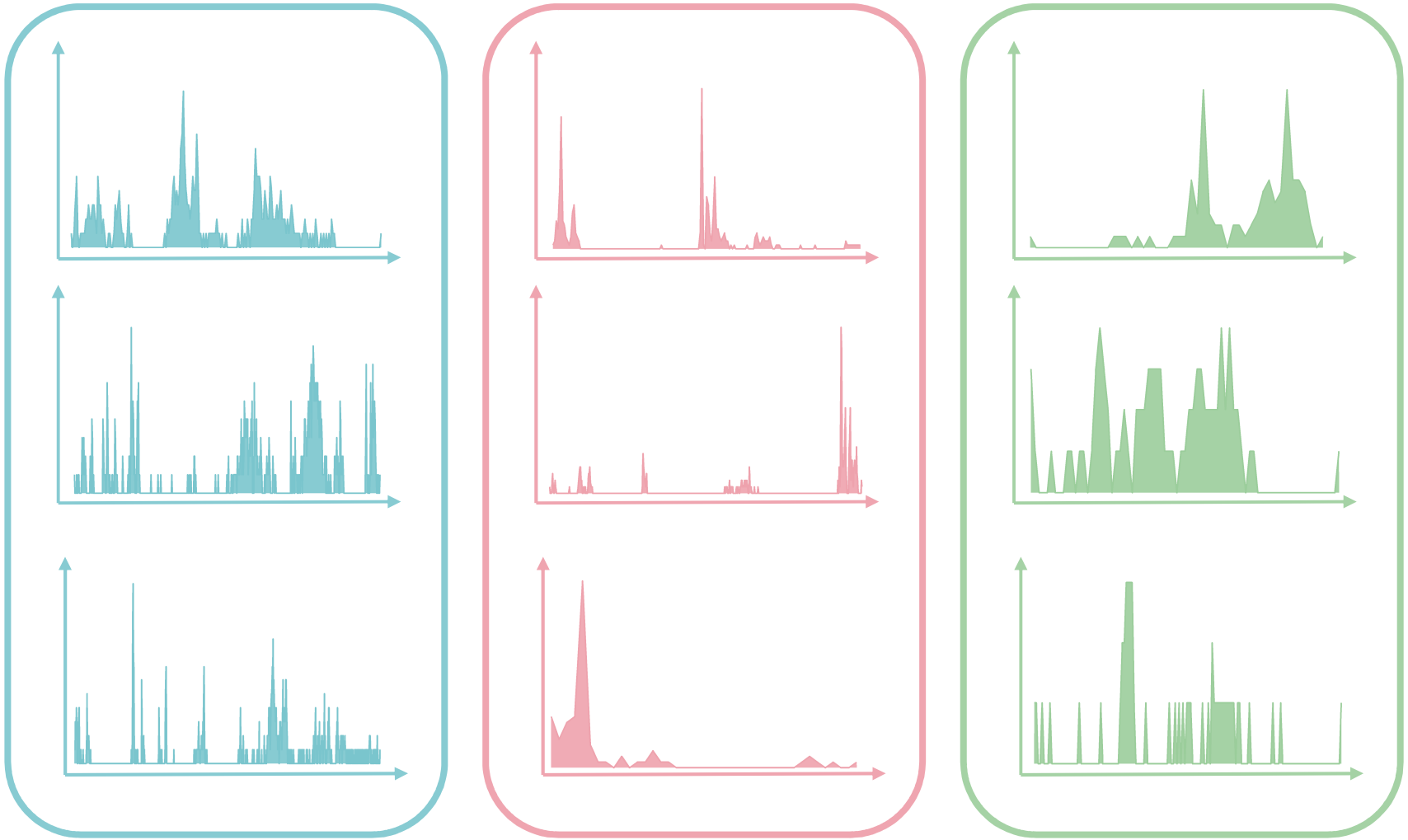
Storm typologies



Useful in:

Weather simulation

Operational forecasting

Bias correction of climate projections

Research questions

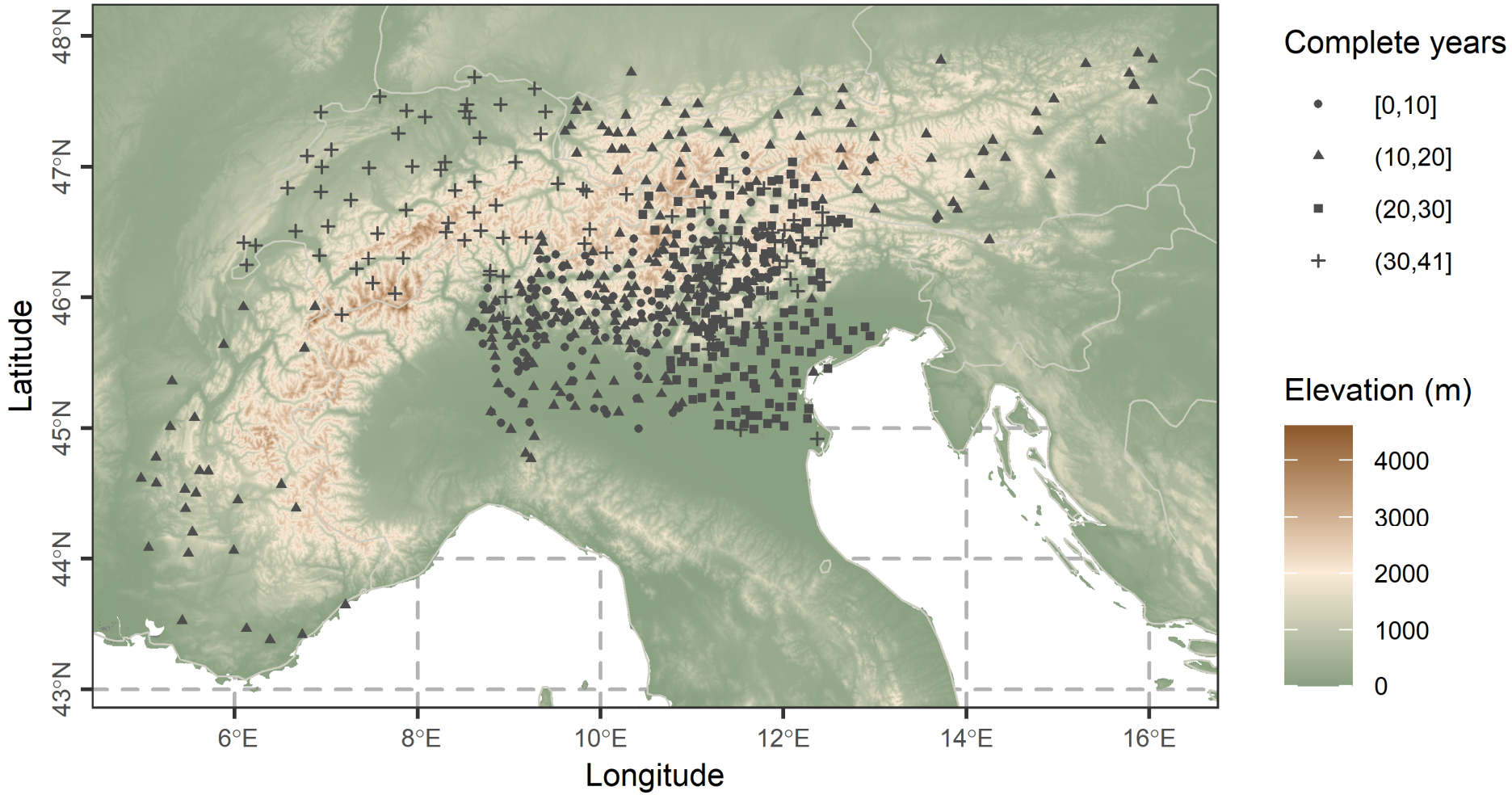
How can I categorize a precipitation storm database into physically meaningful classes?

Which are the dominant precipitation storm types in the Alps?

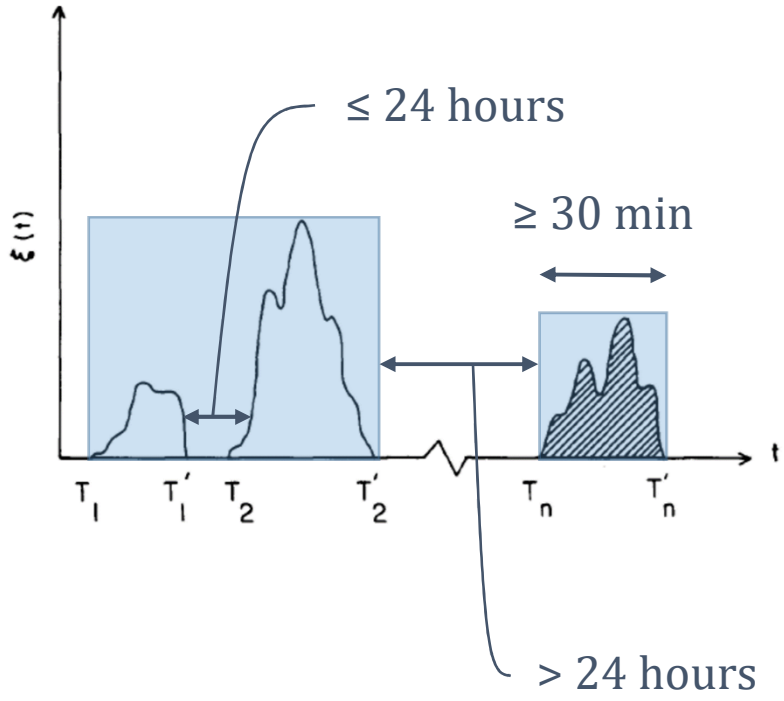
What is the climatology of these types across the Alpine range?

Study area and data

Sub-hourly observations from 670 precipitation stations

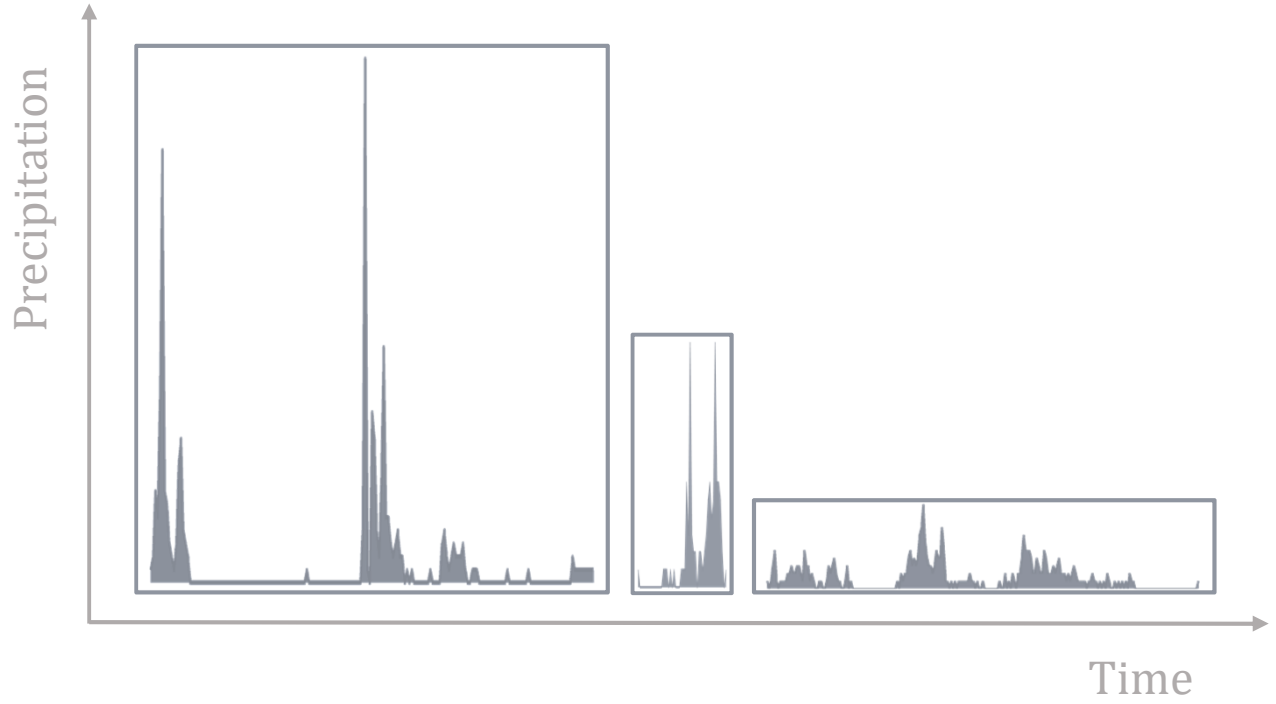


Storm identification



792,786 storm time series

Observed in the period 1981–2024



Storm clustering

- **Feature-based:**

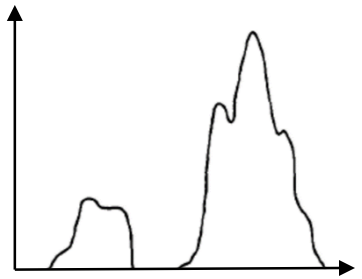
  Maximum intensity

  Total volume

  Duration

  Coefficient of variation

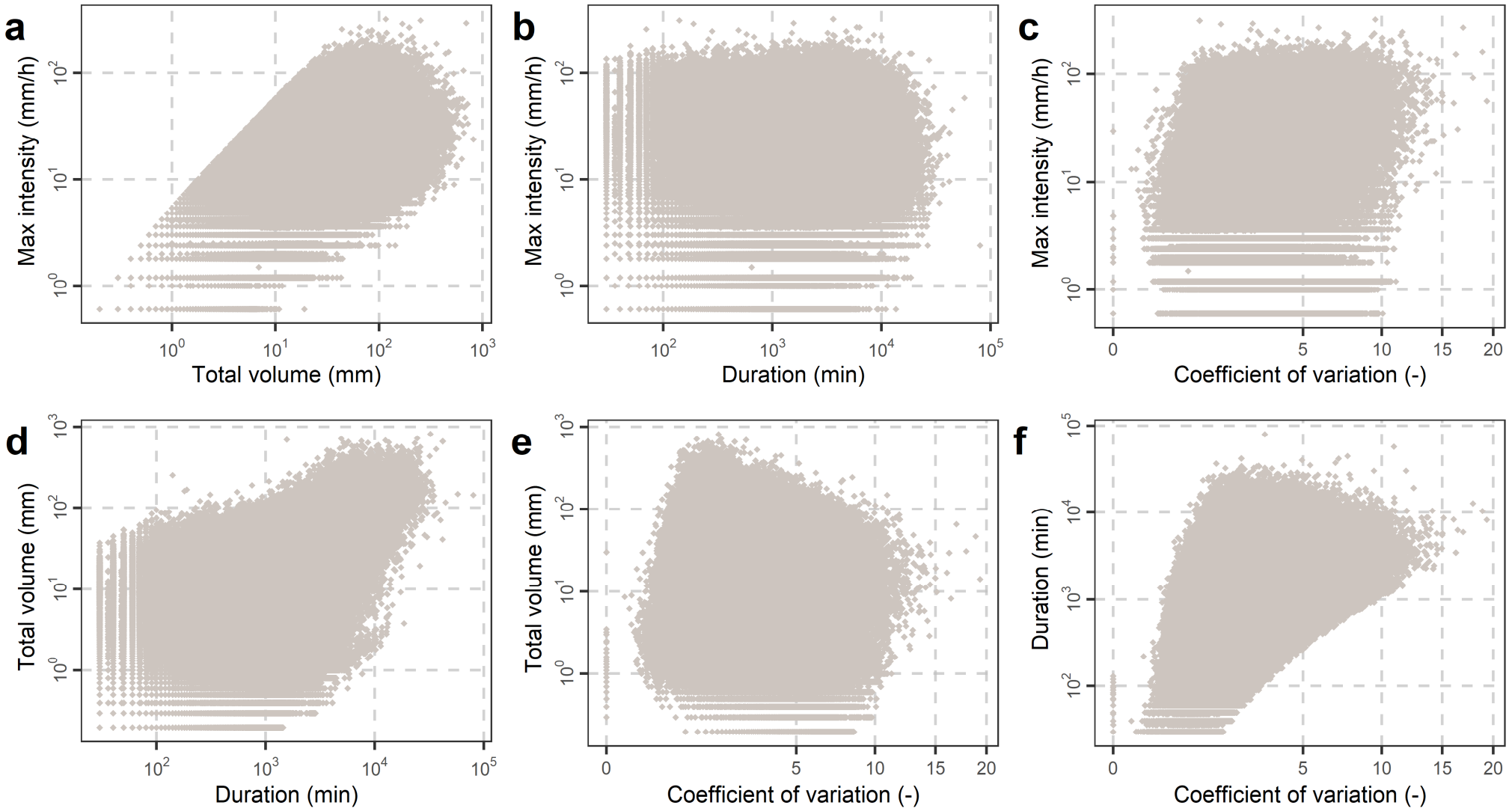
  Features estimated from each storm



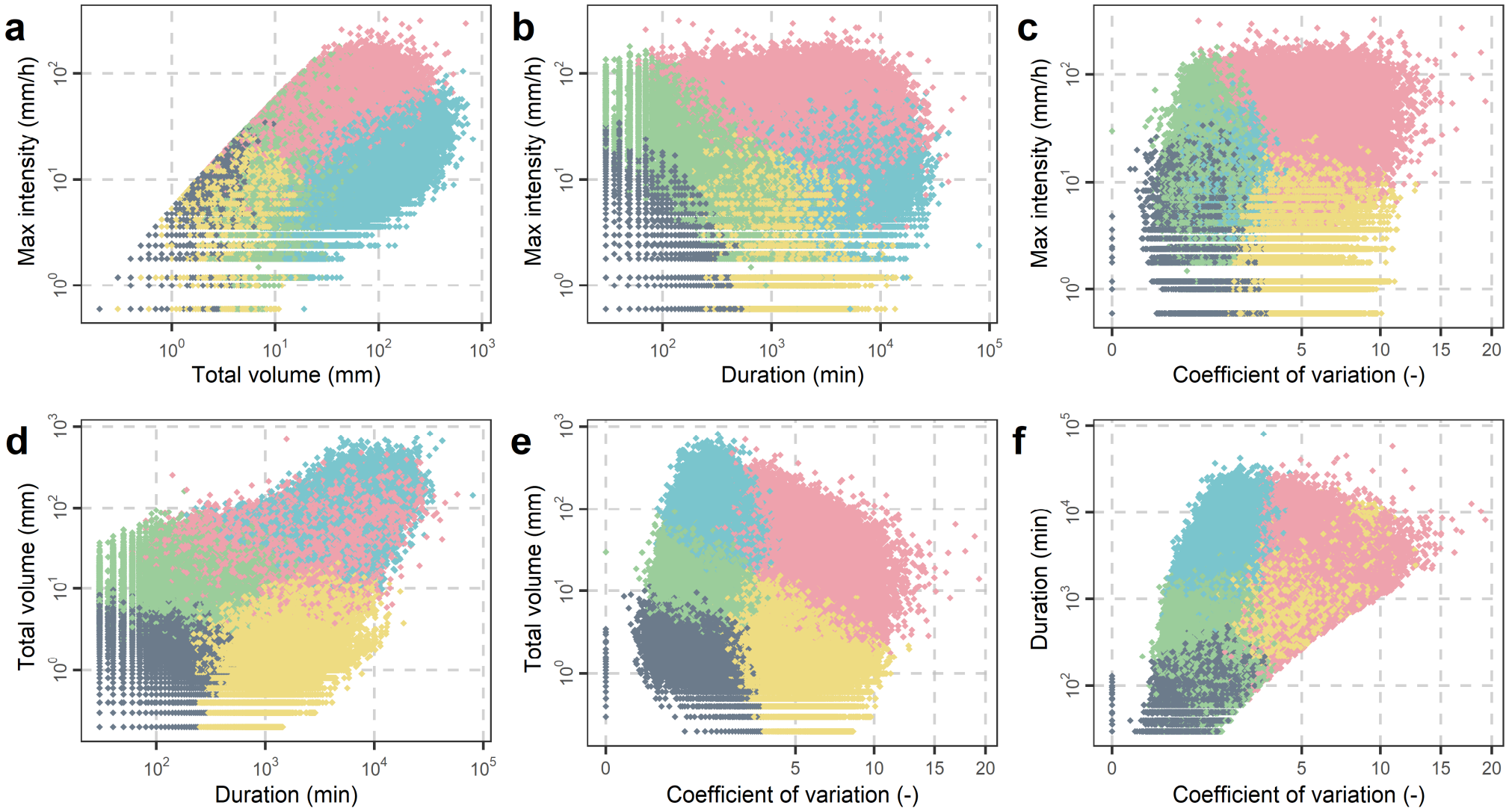
- **CLARA-based:**

  Resampling + k-medoids

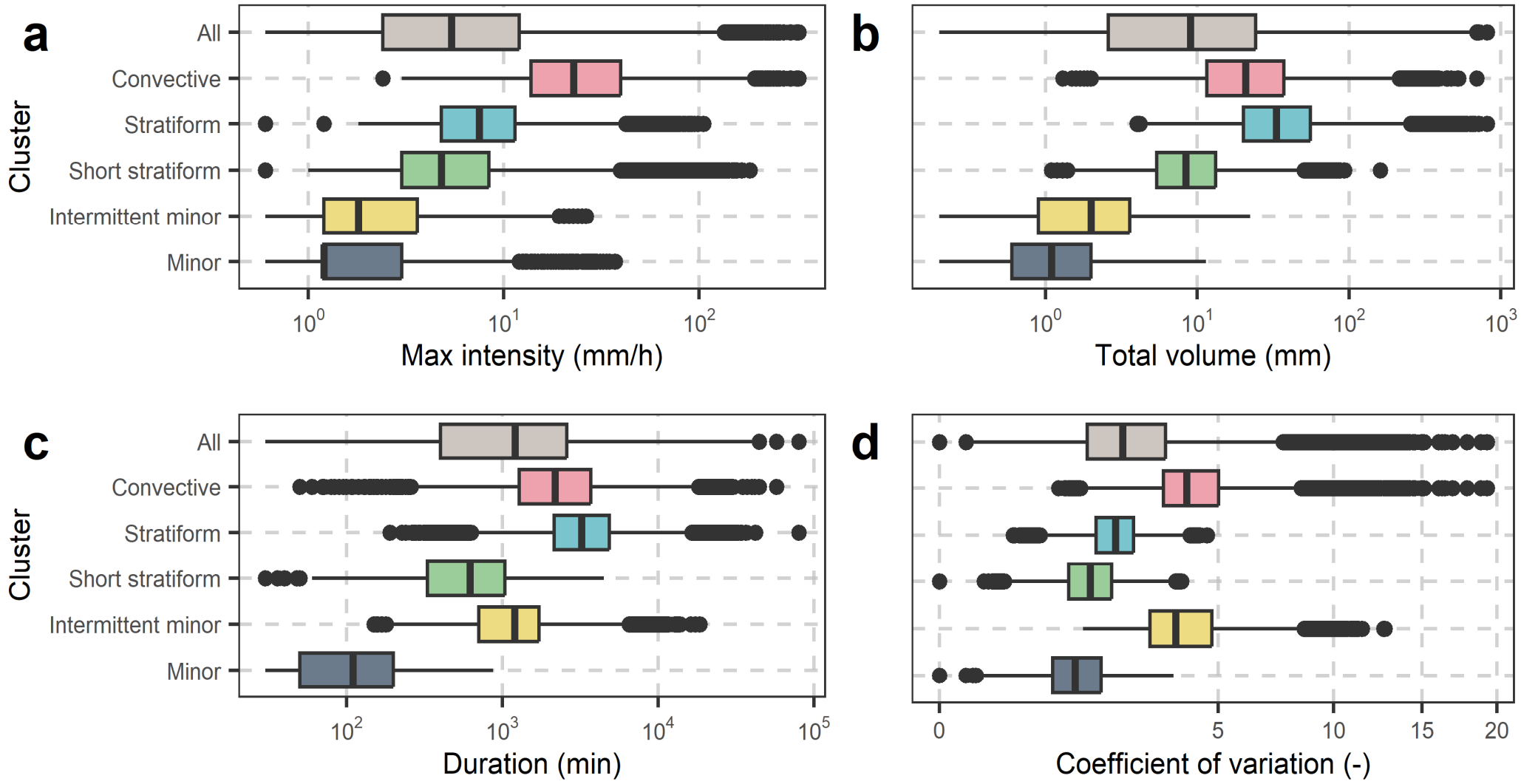
Features driving the clustering



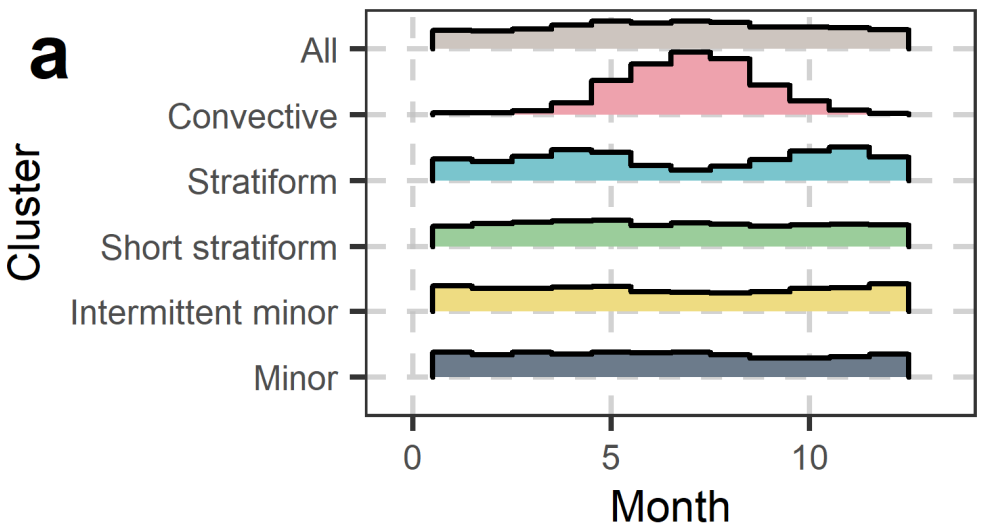
Features driving the clustering

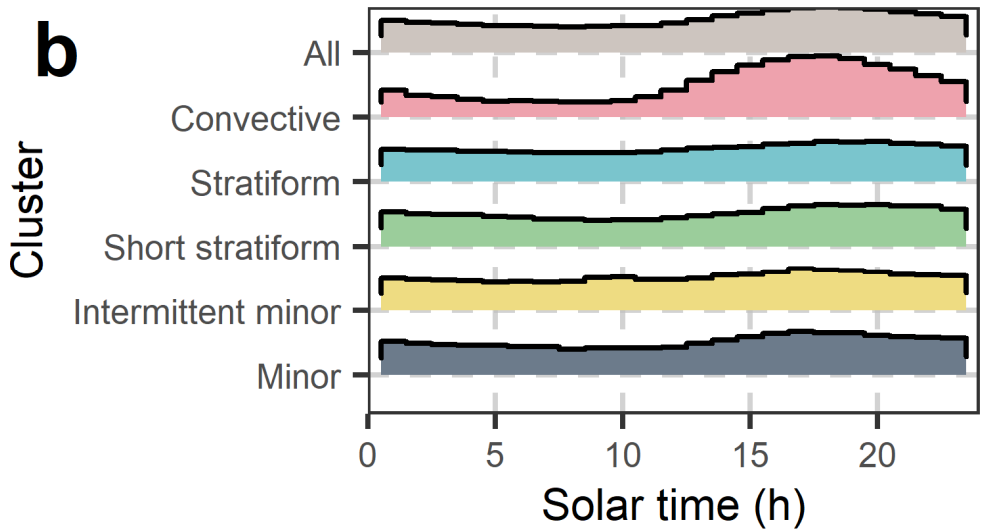


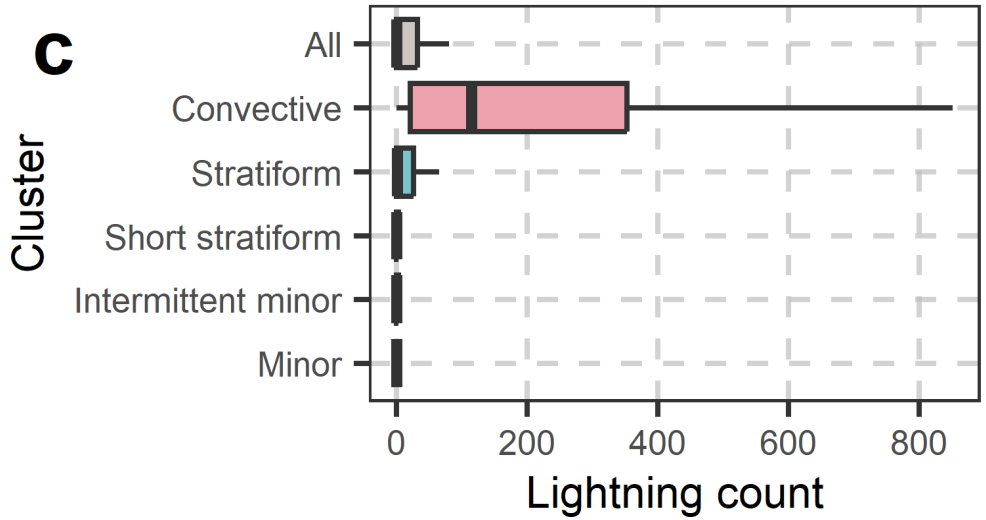
Analysis of storm types through their driving features



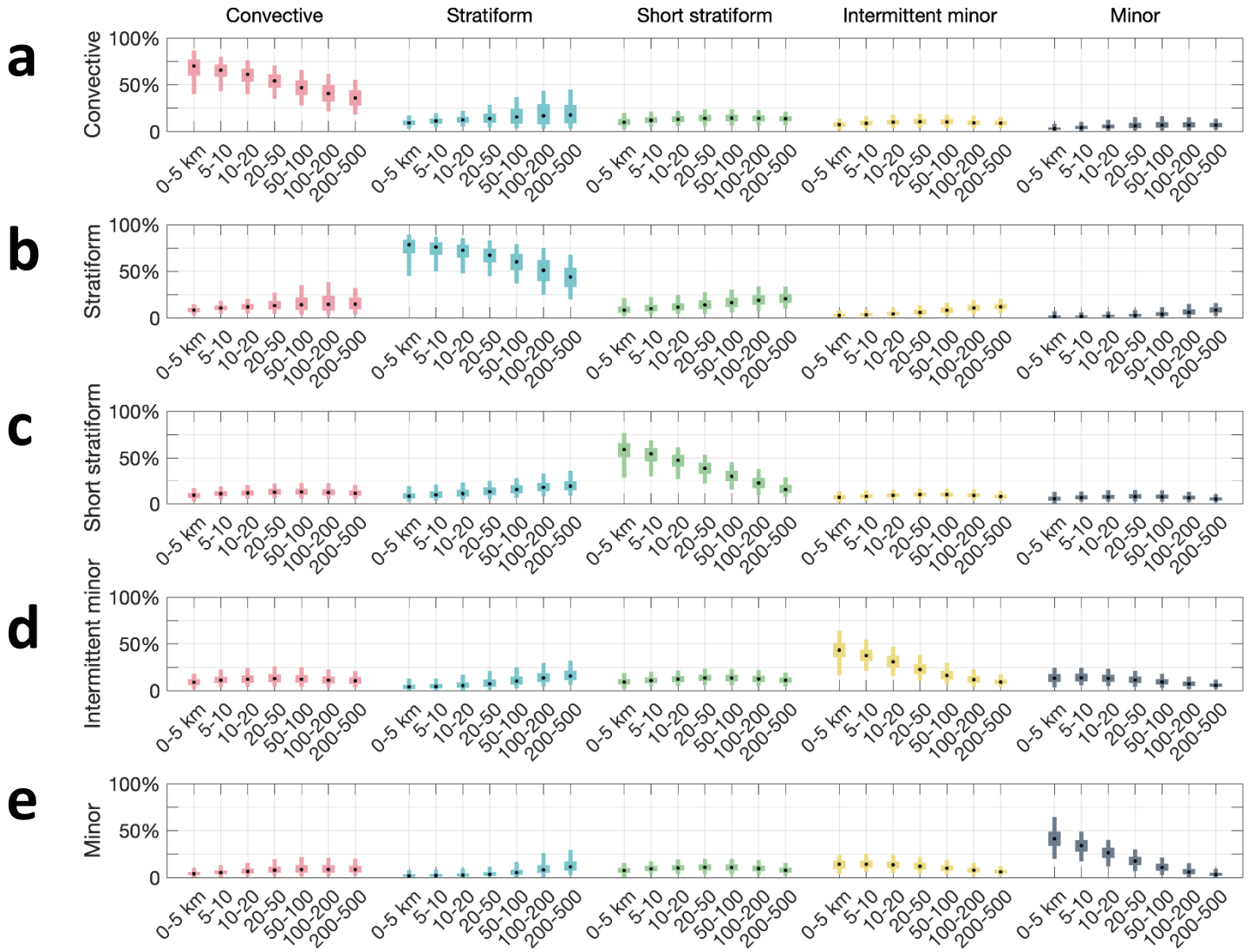
Validation using independent features



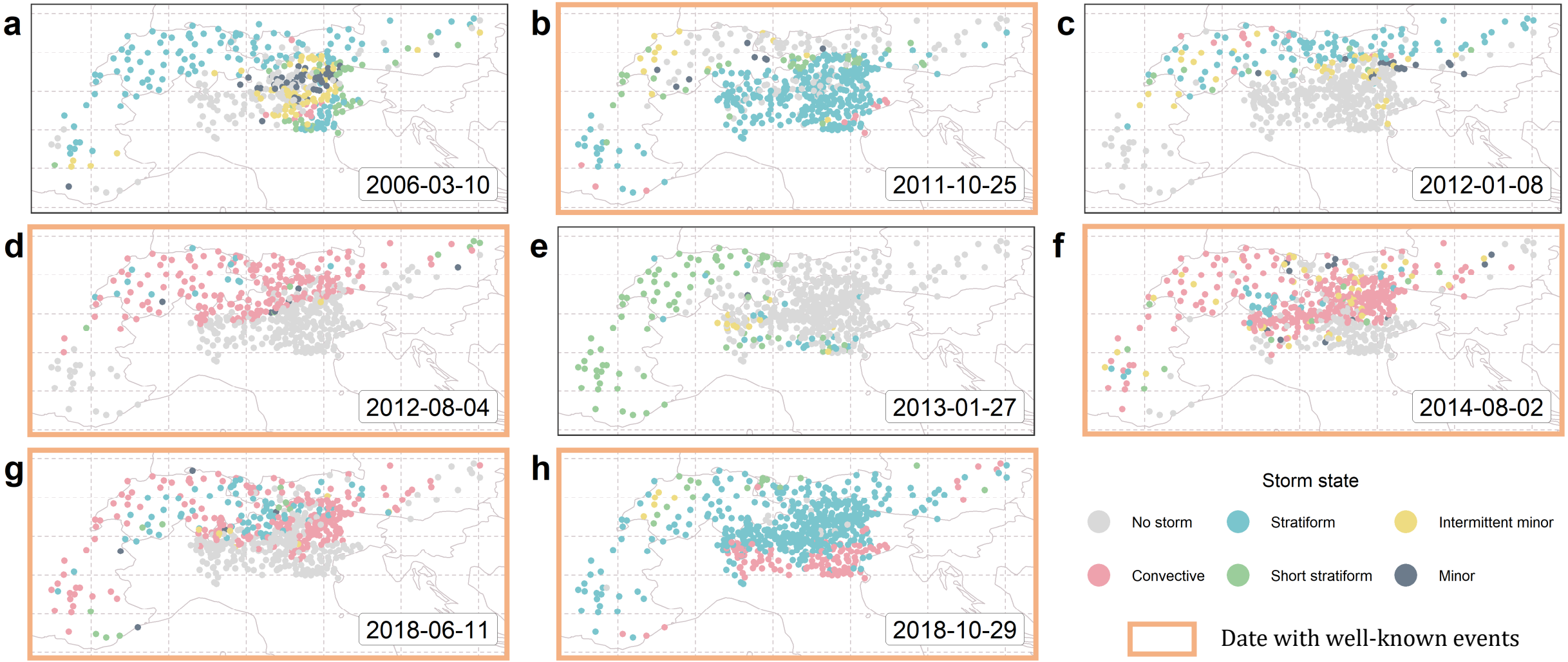




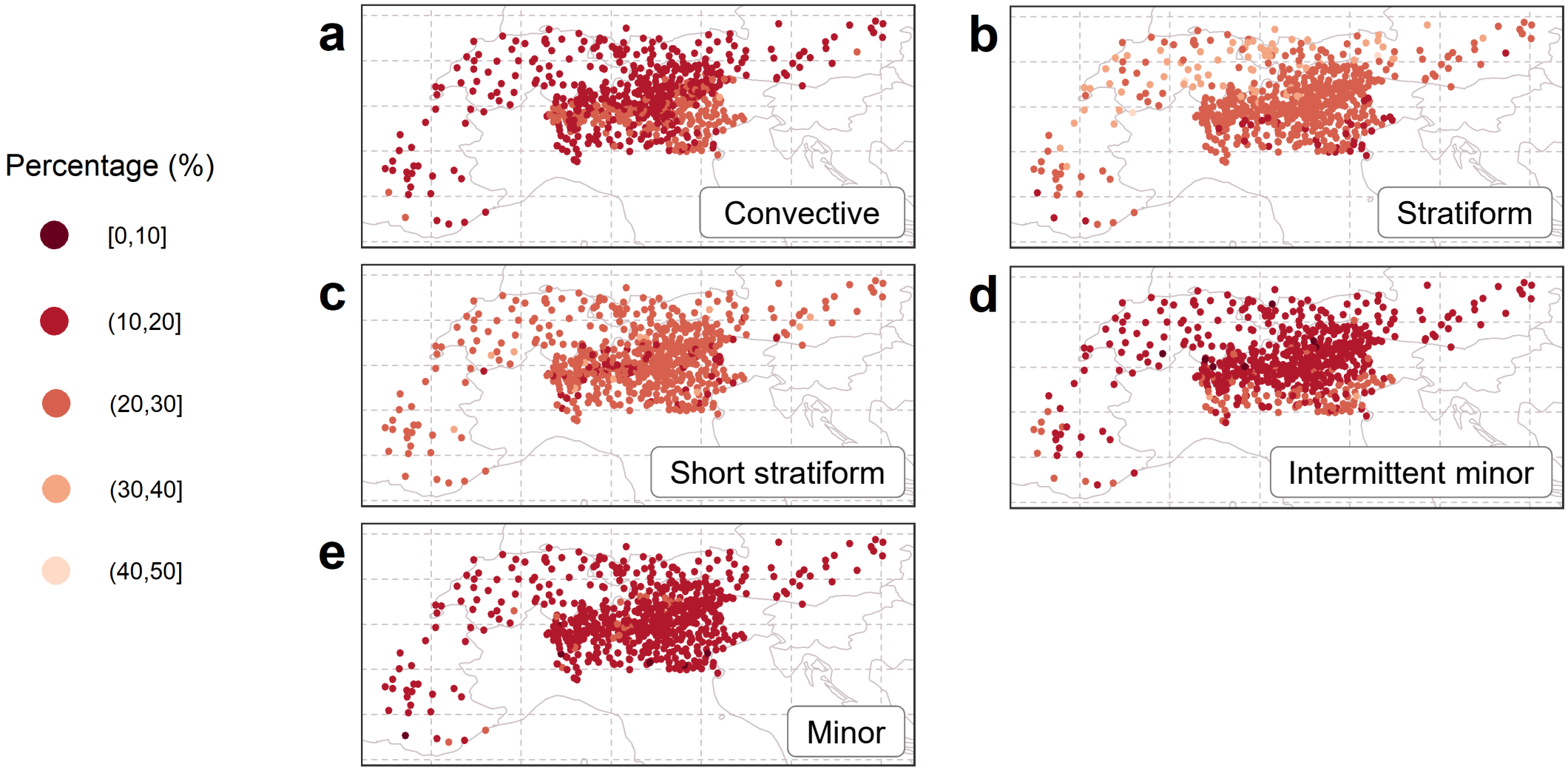
Validation through spatial clustering investigations



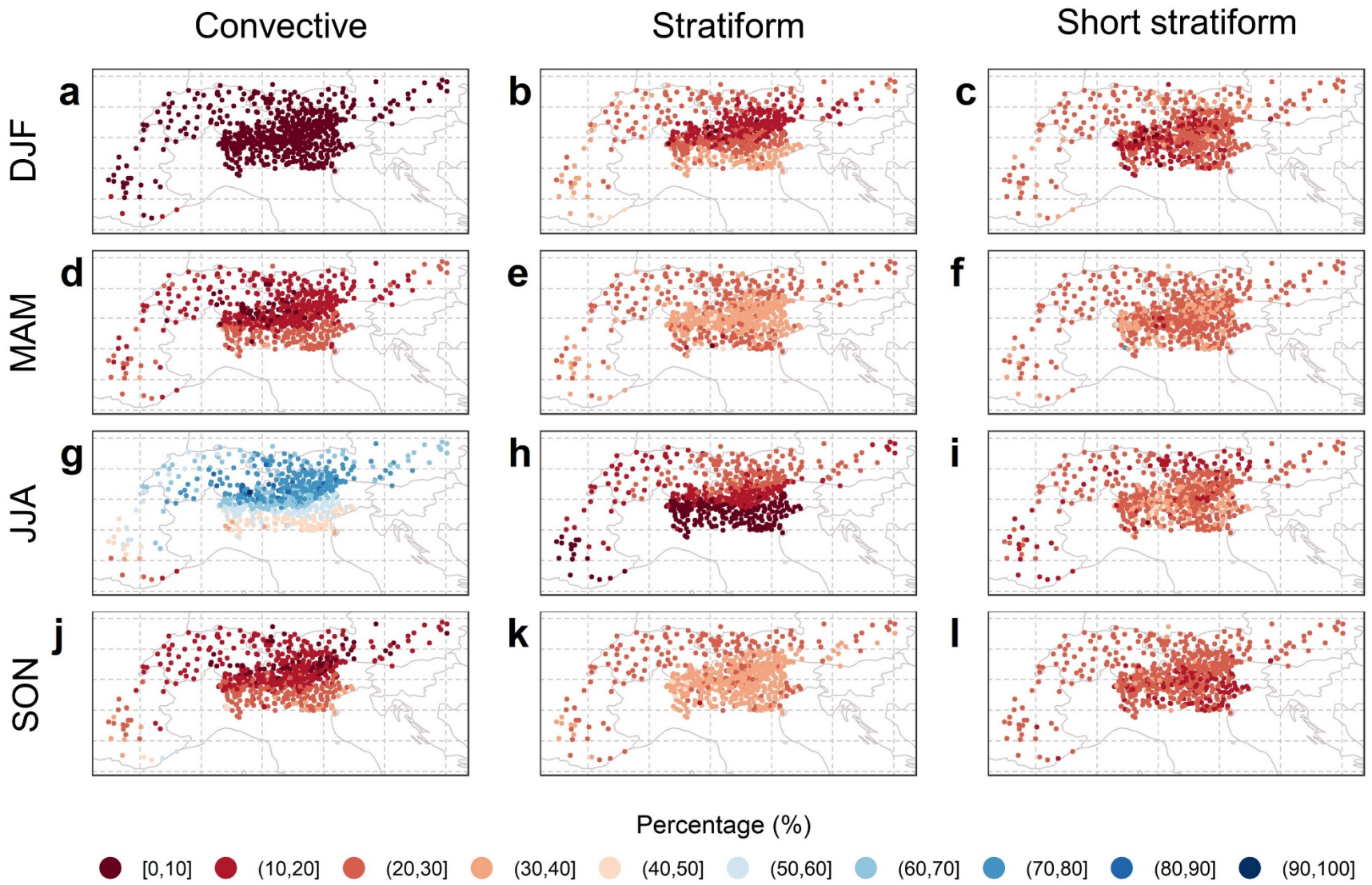
Well-known and random events



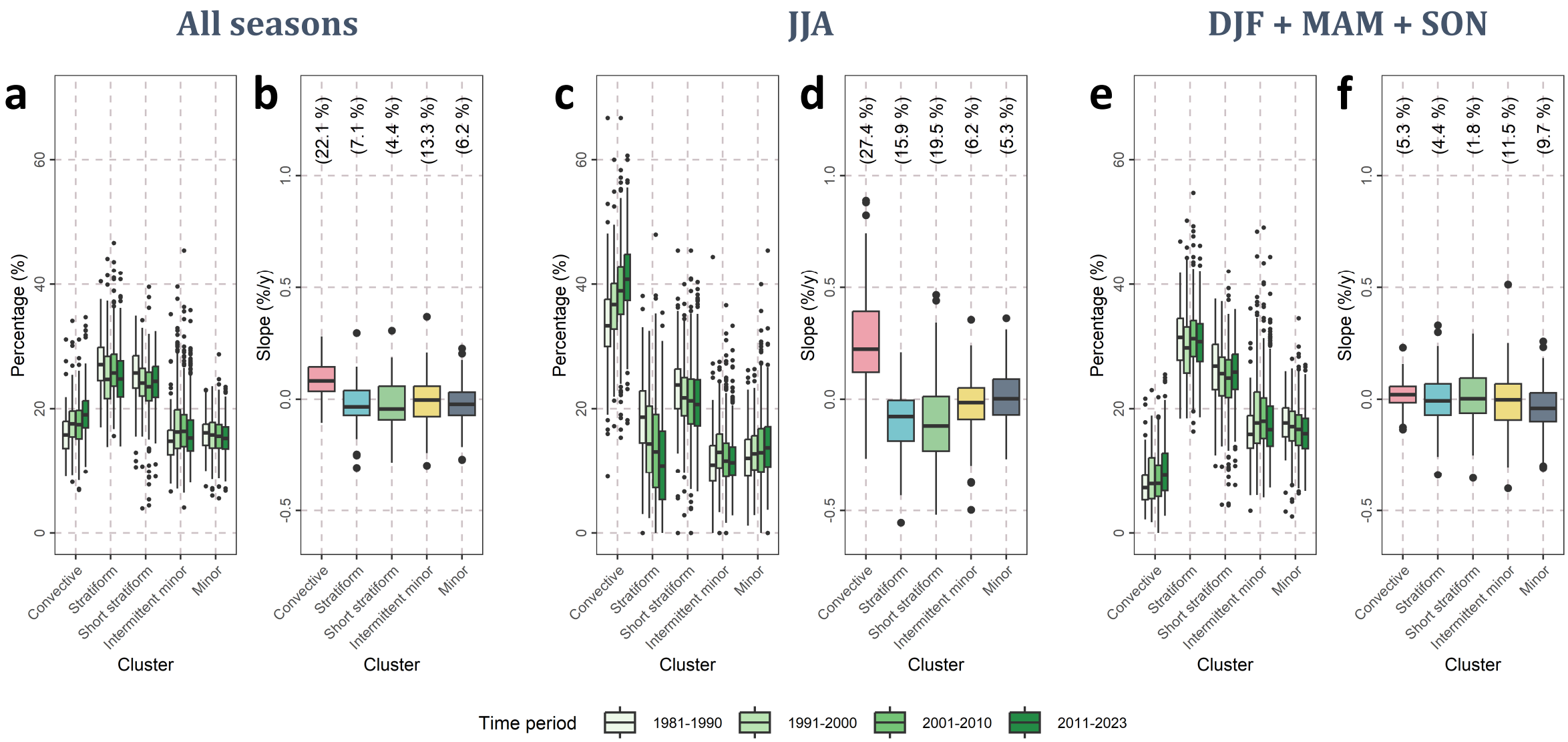
Proportion of the classes at each location



Proportion of each season in the class occurrences

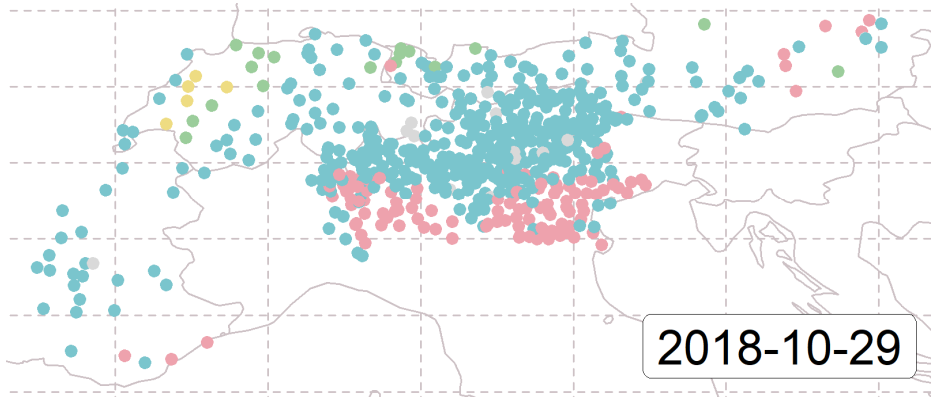


Temporal changes in the proportion of the classes

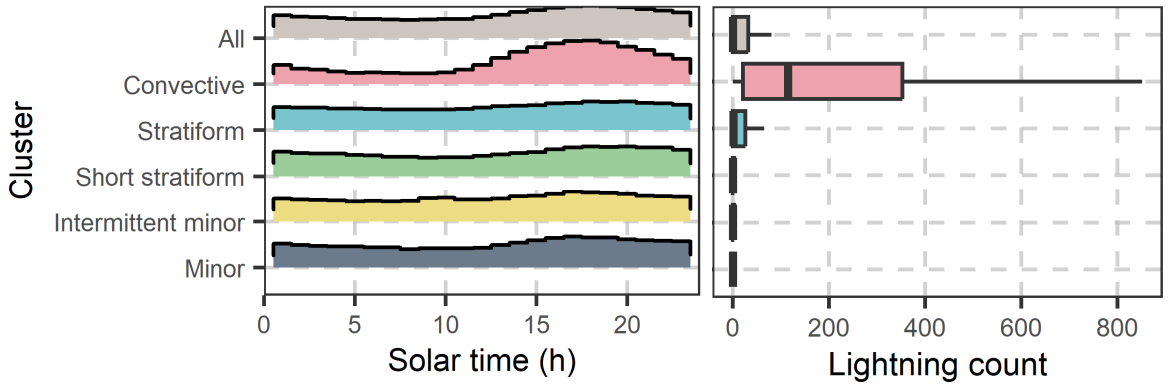


Conclusions

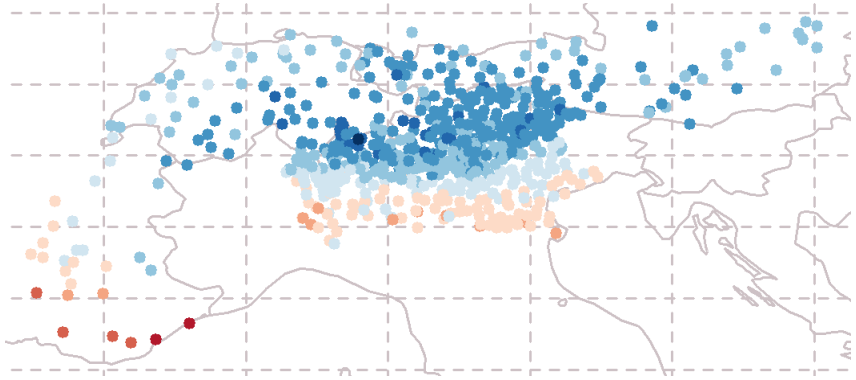
Spatial clustering characterizes the class occurrences.



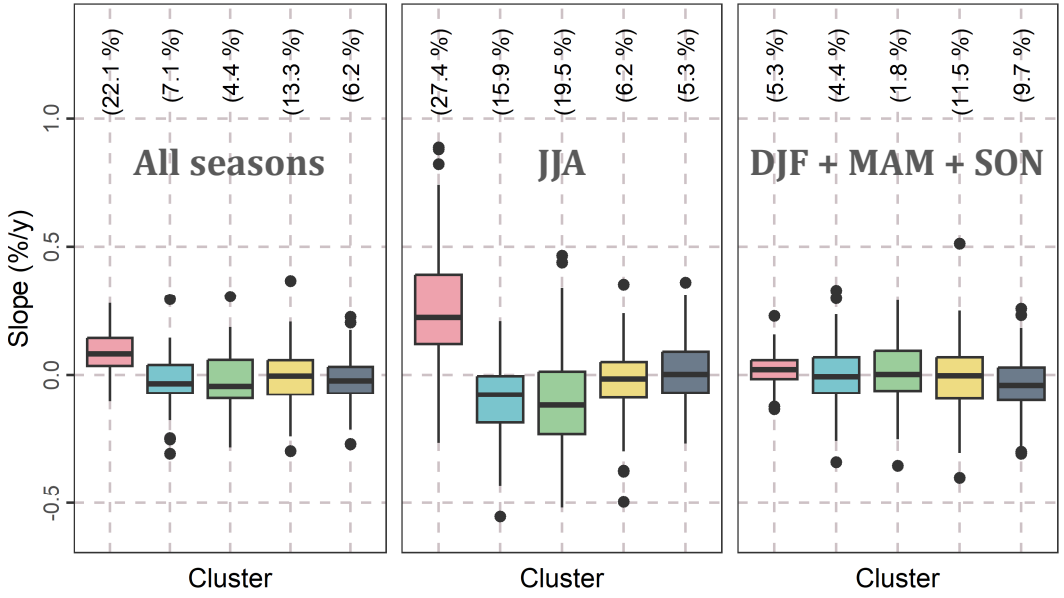
The convective storms were successfully grouped together.



Distinct regions with consistent occurrence rates were identified for key storm classes.



The convective storms are trending upward.



Coming soon

Preprint on arXiv

“Precipitation-driven typology of storms in the Alps”

Open data on Zenodo

“Precipitation-driven typology of storms in the Alps: Data”

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