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Hailstorms and rainstorms vs. supercells - A comparison of severe thunderstorms in the Alpine region

Monika Feldmann, Marco Gabella, Alexis Berne

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Examples in Switzerland – June 21, 2021



Timelapse
Mettmenstetten



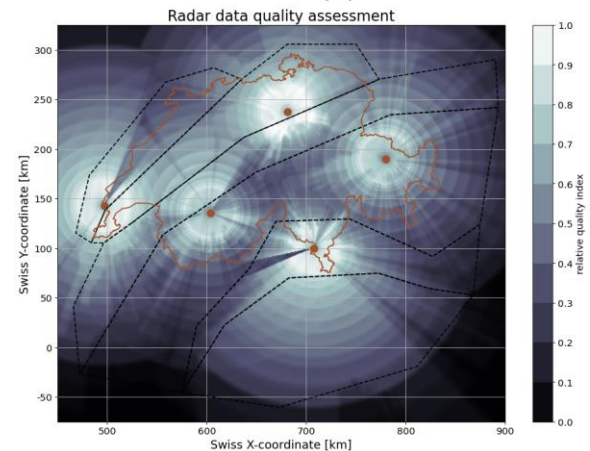
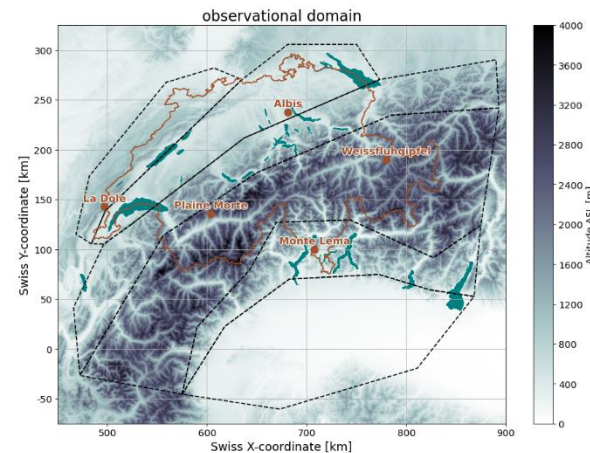
Images: Blog Meteoschweiz - U.Graf, R. Grabherr, Gary Soskin

Timelapse
Zürichsee



Swiss operational radar network

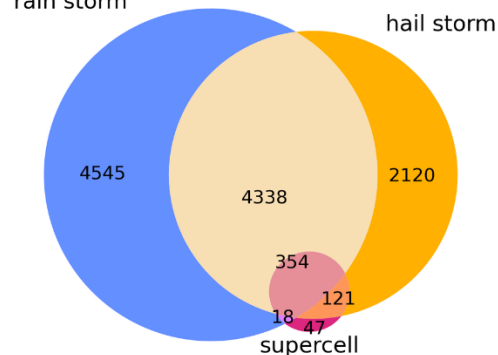
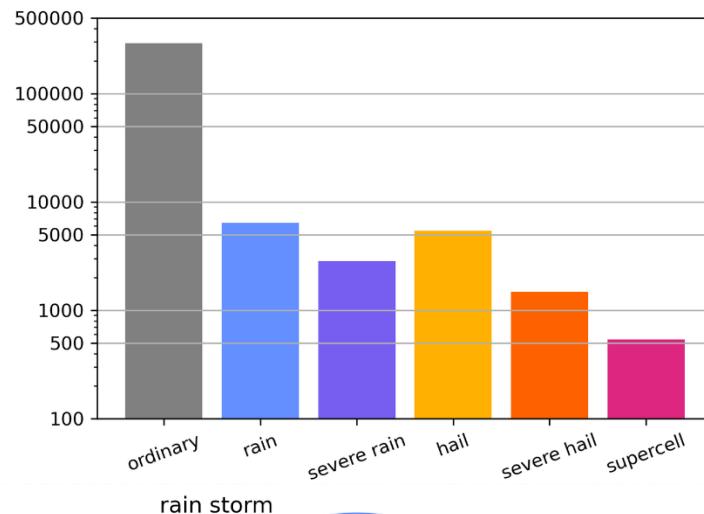
- 5 C-band radars
 - Altitudes 938m – 2937m
 - Target to cover Alpine areas
- Synchronized volume scan
 - Range up to 250 km
 - 20 elevations from -0.2 to 40°
 - Nyquist velocity as low as 8 m/s
- Quality of observations
 - Resolution, number of available scans, noise, altitude of measurements
 - Generally very high through overlap
 - Some issues in inner Alps and Jura





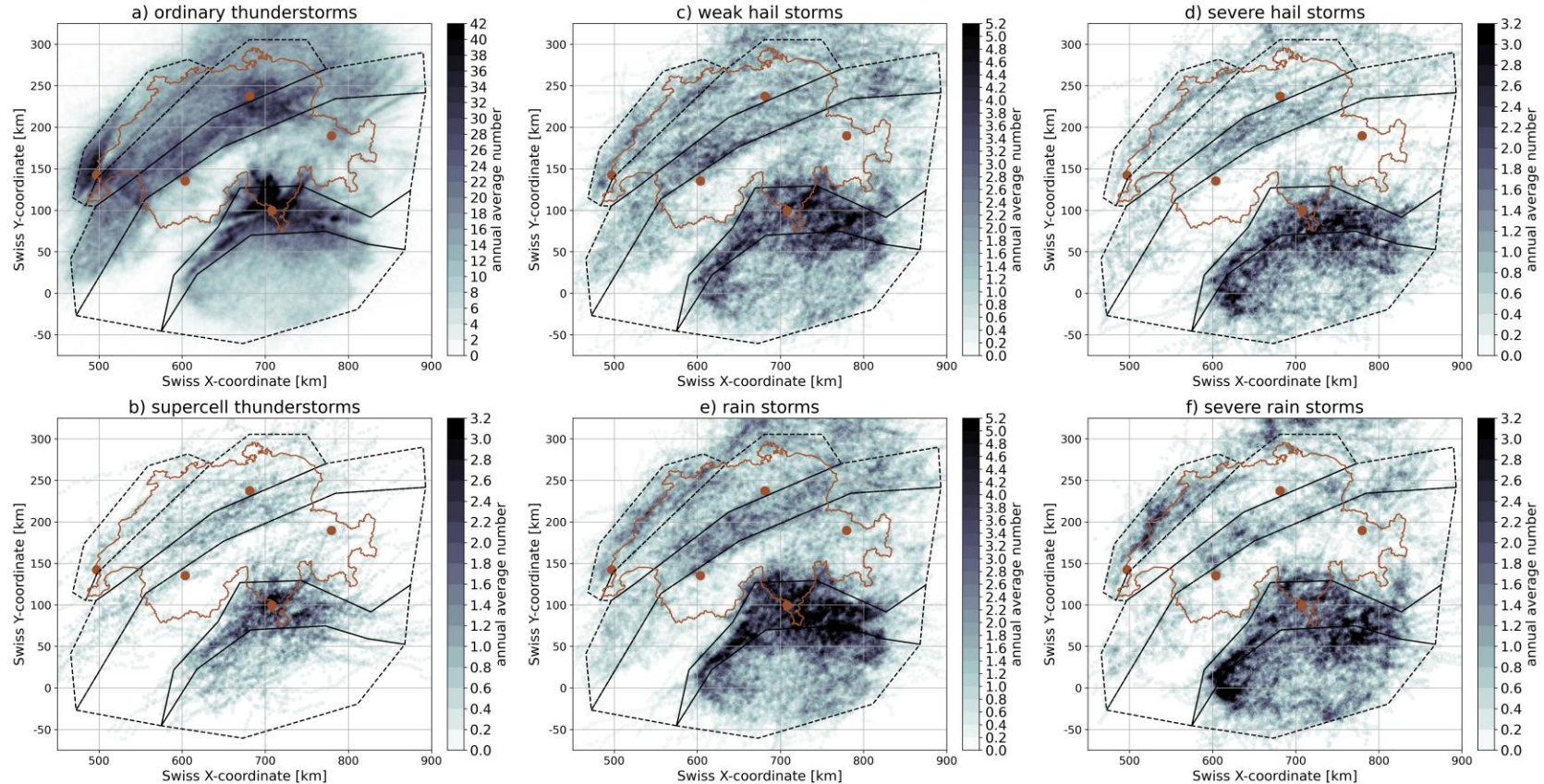
Context from other convective hazards

- Supercells bring other convective hazards
- Radar-derived categories
 - Ordinary
 - Rain storm
 - Severe rain storm
 - Hail storm
 - Severe hail storm
 - Supercell
- Significant overlap between categories



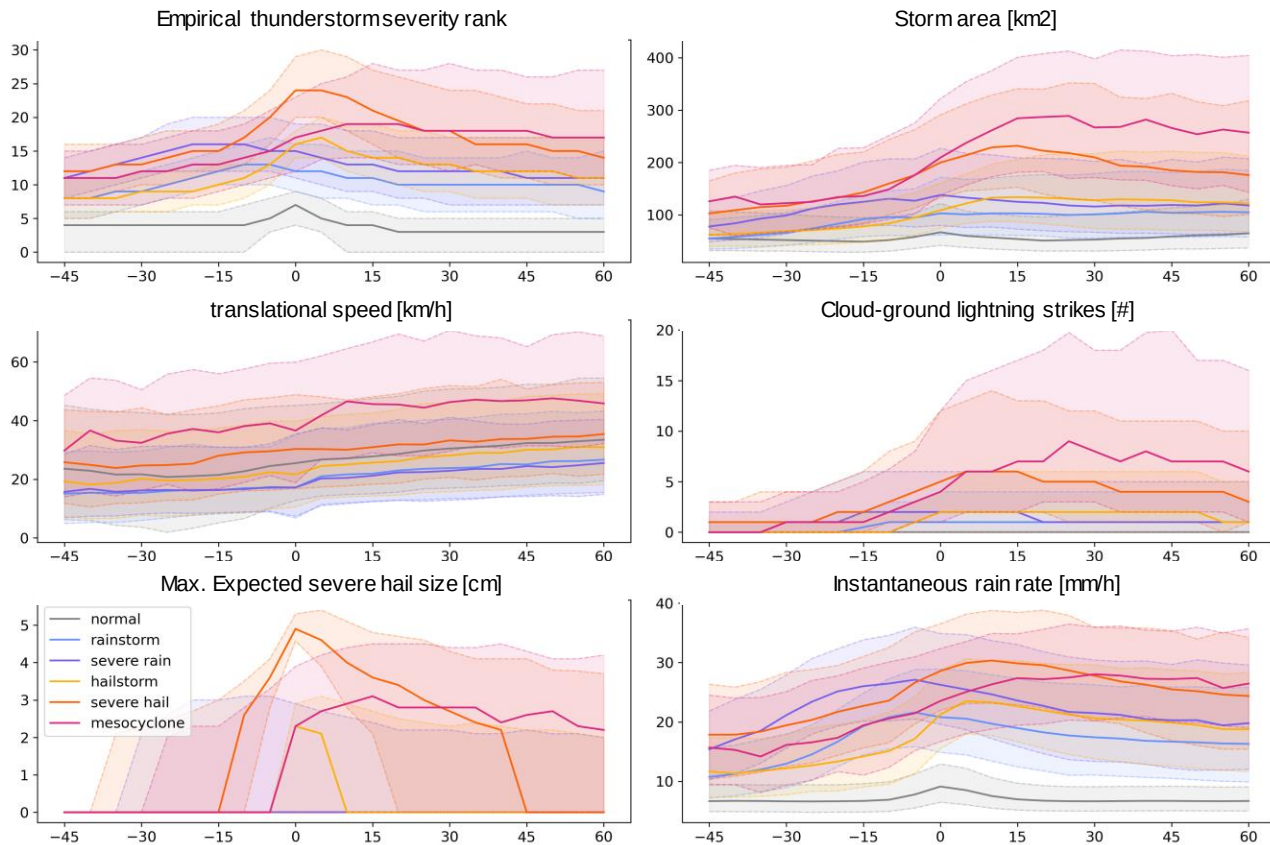


Convection in Switzerland





Lifecycle comparison

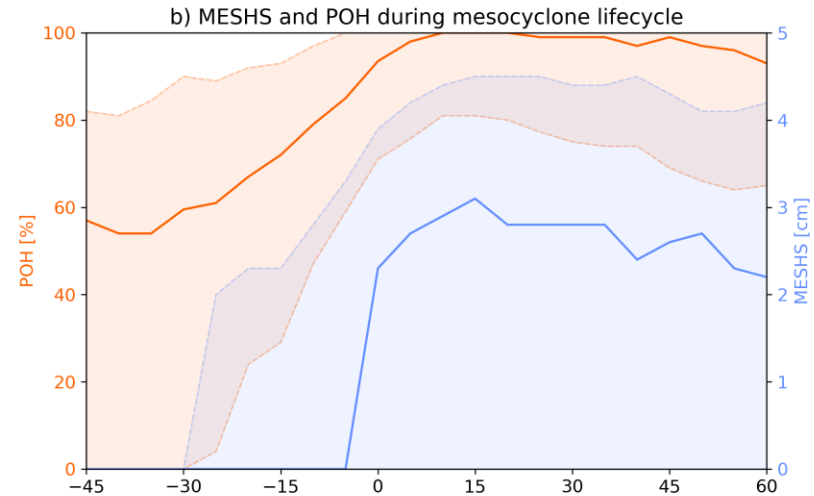
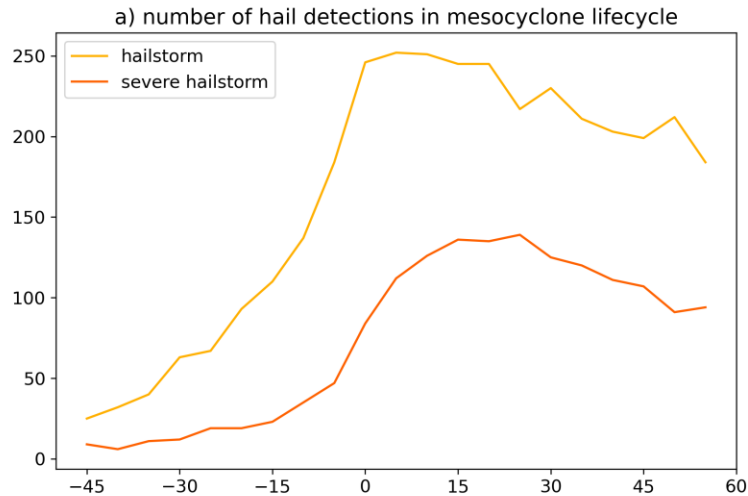


- normal
- rainstorm
- severe rain
- hailstorm
- severe hail
- mesocyclone



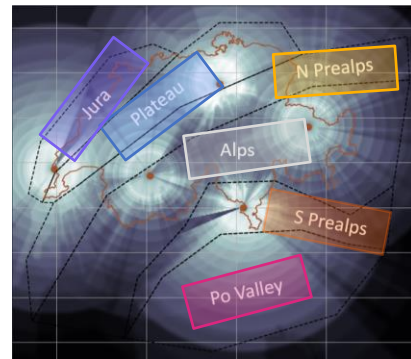
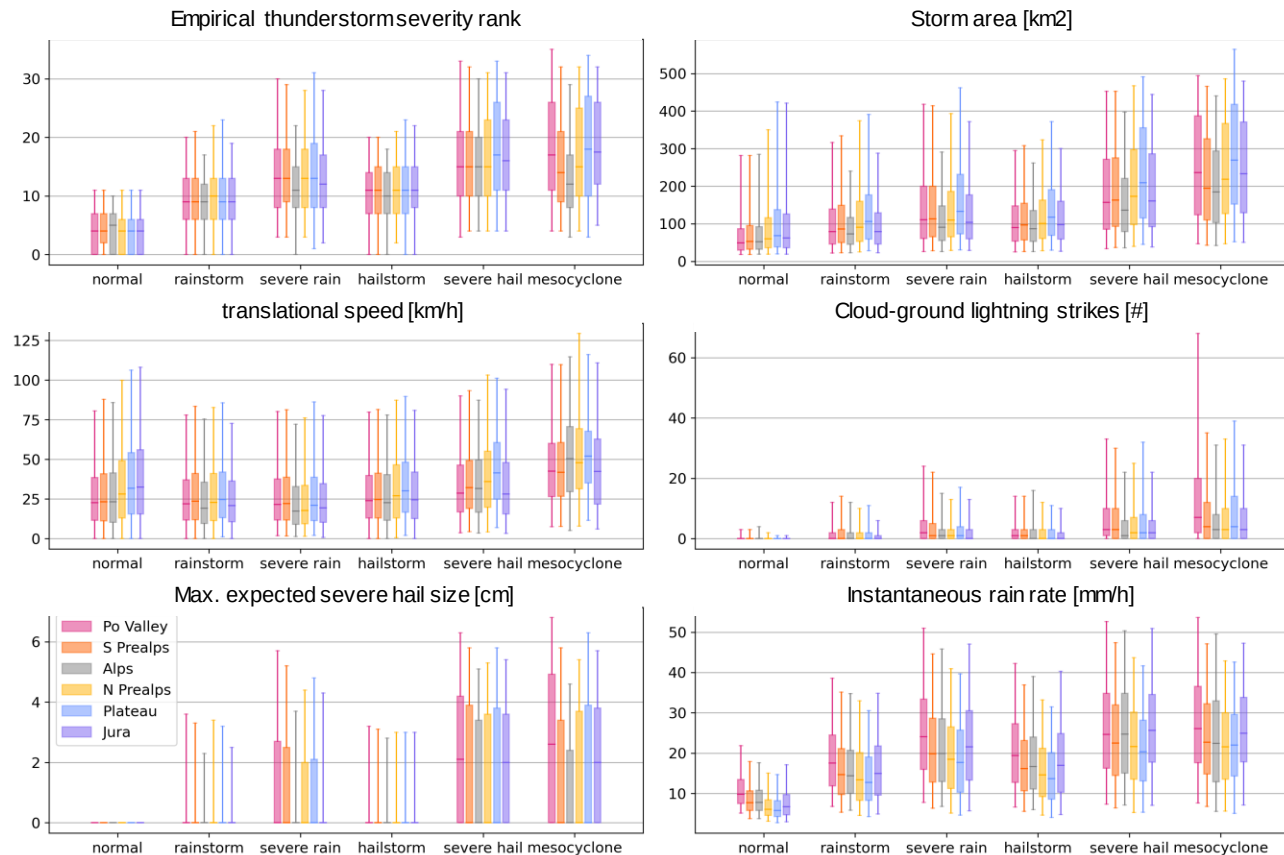
Potential for nowcasting

- In supercellular storms the mesocyclone usually precedes the initiation of hail
- If hail is already present, it tends to increase subsequently



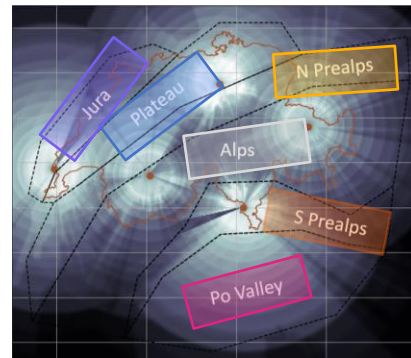
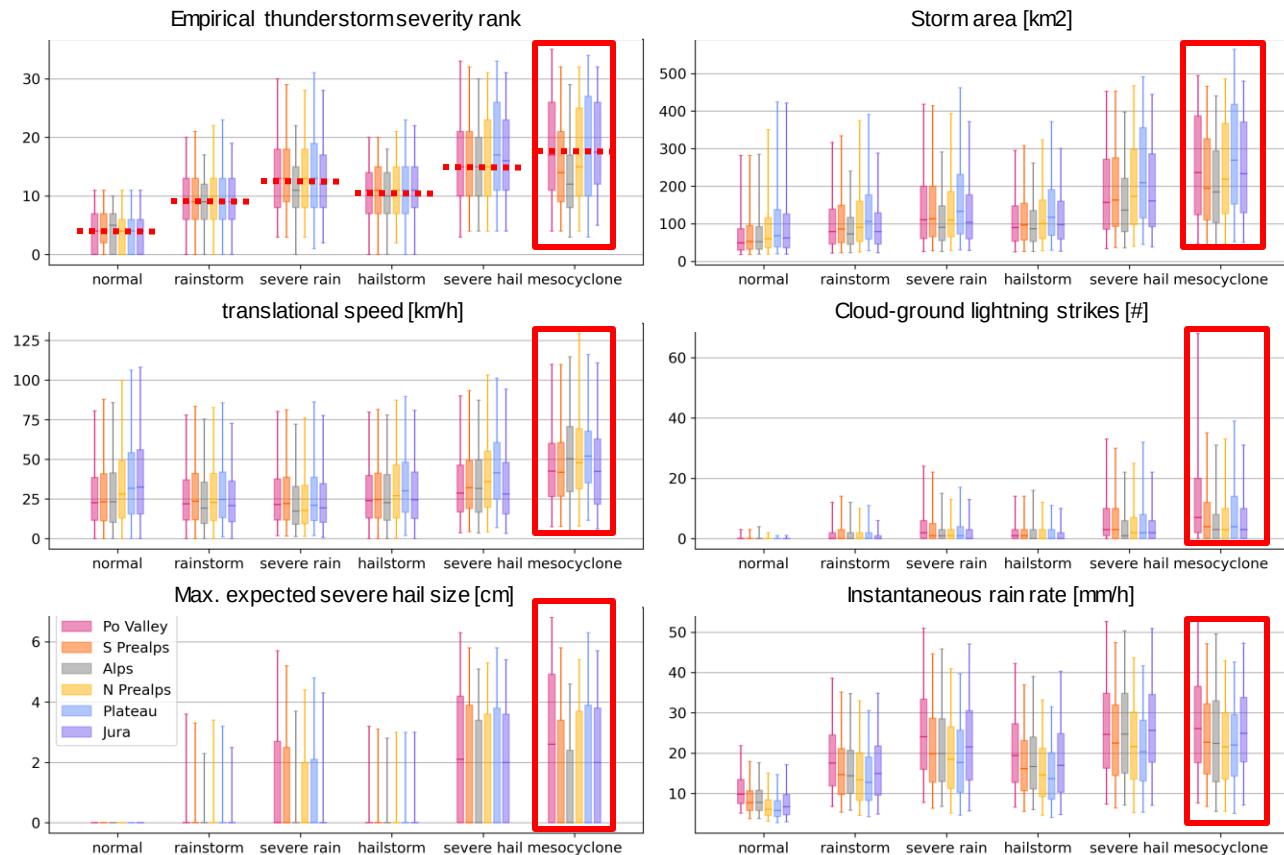


Regional intensity differences



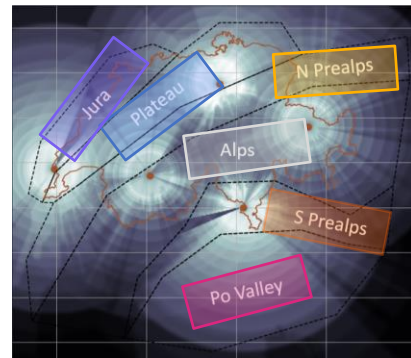
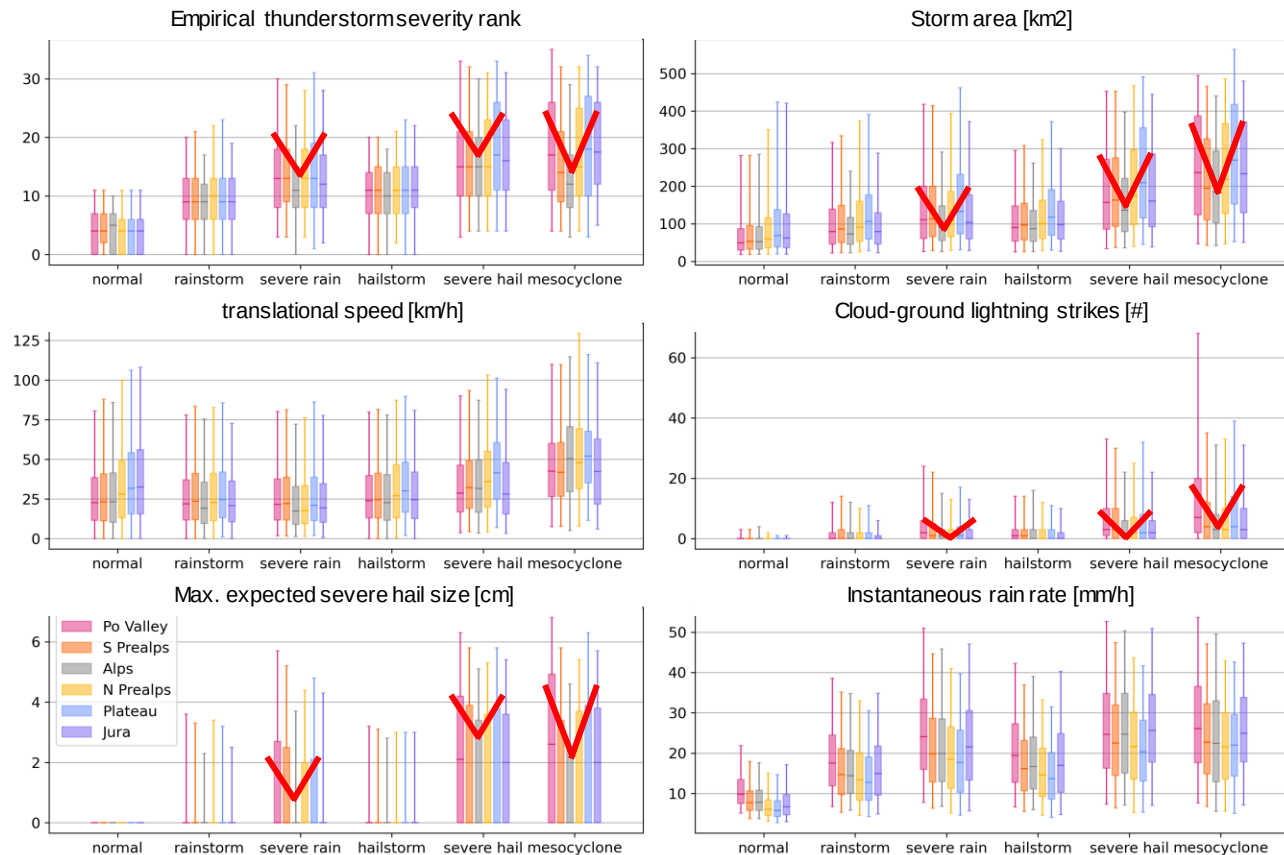


Regional intensity differences





Regional intensity differences





Conclusion

- Supercell thunderstorms occur regularly in the Swiss Prealps
- Systematic detection over 6 years allows for characterization of the situation
- In comparison with severe rain and hailstorms they represent the most severe fraction of storms
- Comparisons with hail- and rainstorms highlight long-lived severity of supercells
- Regional decomposition shows influence of terrain complexity on overall intensity



Sources

- Feldmann, M., Germann, U., Gabella, M., and Berne, A.: A characterisation of Alpine mesocyclone occurrence, *Weather Clim. Dynam.*, 2, 1225–1244, <https://doi.org/10.5194/wcd-2-1225-2021>, 2021.
- Hering, A. M., Morel, C., Galli, G., Ambrosetti, P., and Boscacci, M.: Nowcasting thunderstorms in the Alpine Region using a radar based adaptive thresholding scheme, in: *Proc. ERAD Conference 2004*, 206–211, available at: https://www.researchgate.net/profile/Paolo-Ambrosetti/publication/238716076_Nowcasting_thunderstorms_in_the_Alpine_region_using_a_radar_based_adaptive_thresholding_scheme/links/02e7e533991efe4d62000000/Nowcasting-thunderstorms-in-the-Alpine-region-using-a-radar-based-adaptive-thresholding-scheme.pdf (last access: 20 January 2020), 2004.
- <https://www.meteoschweiz.admin.ch/home/aktuell/meteoschweiz-blog/meteoschweiz-blog-suche.subpage.html/de/data/blogs/2021/6/rueckblick--gewitter-mit-sturmboeen-und-hagel-2-0.html> (last access 3 March 2022), 2021.