

Spatial and temporal characteristics of hailstorms over complex orography: a long-term radar-based analysis in the Swiss Alpine area

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Motivation

→ During the warm season of the year, intense thunderstorms regularly affect the Alpine area. In Switzerland severe summer storms are the costliest high-impact weather events.
→ Considering the variability of the phenomena, the involved different temporal and spatial scales, the chaotic nature of convective processes and the influence of terrain complexity, forecasting hailstorms is a very challenging task. Building climatological knowledge of temporal and spatial distribution of hailstorms is the best methodology for assessing hail risk over different regions.

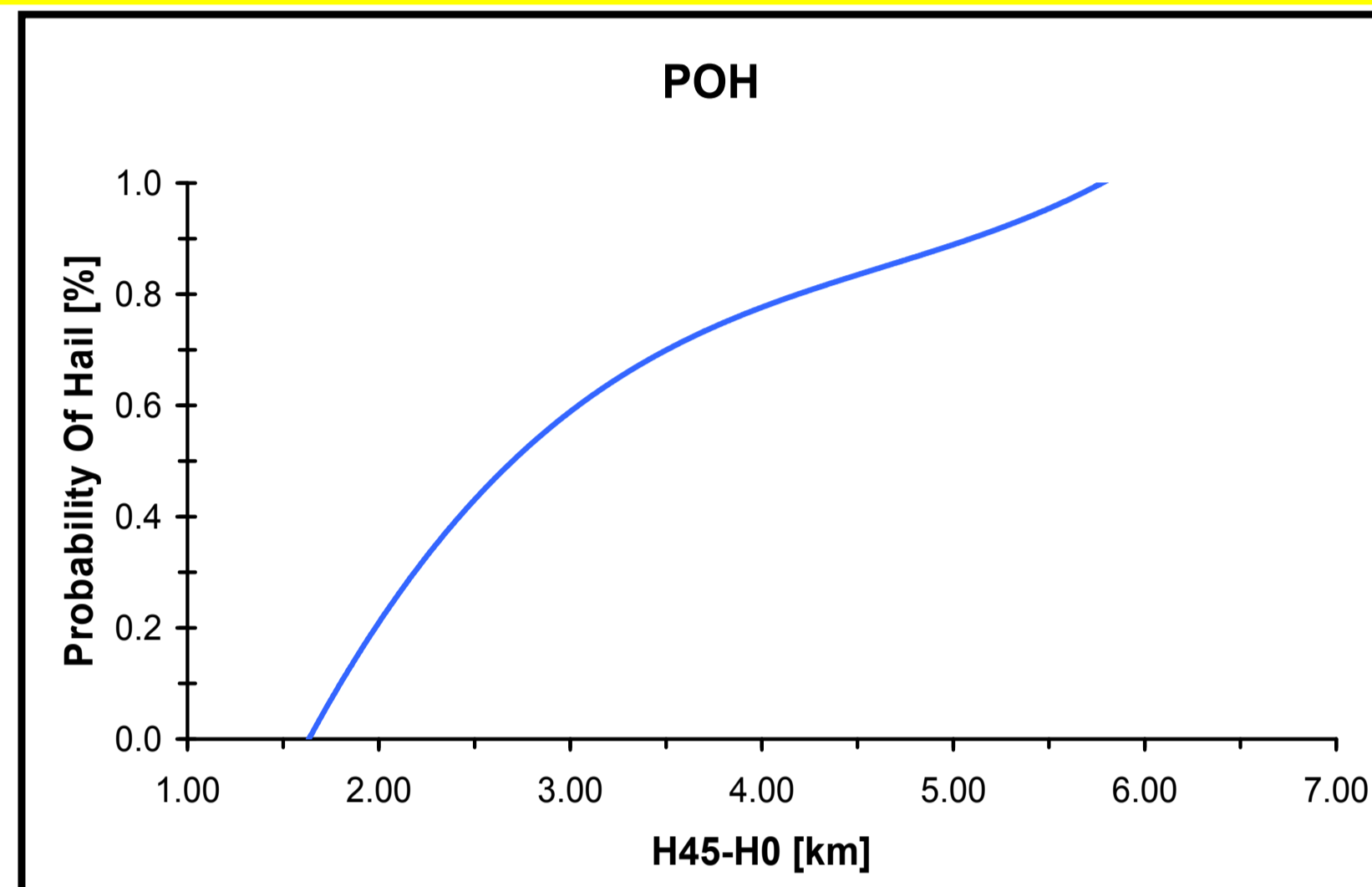
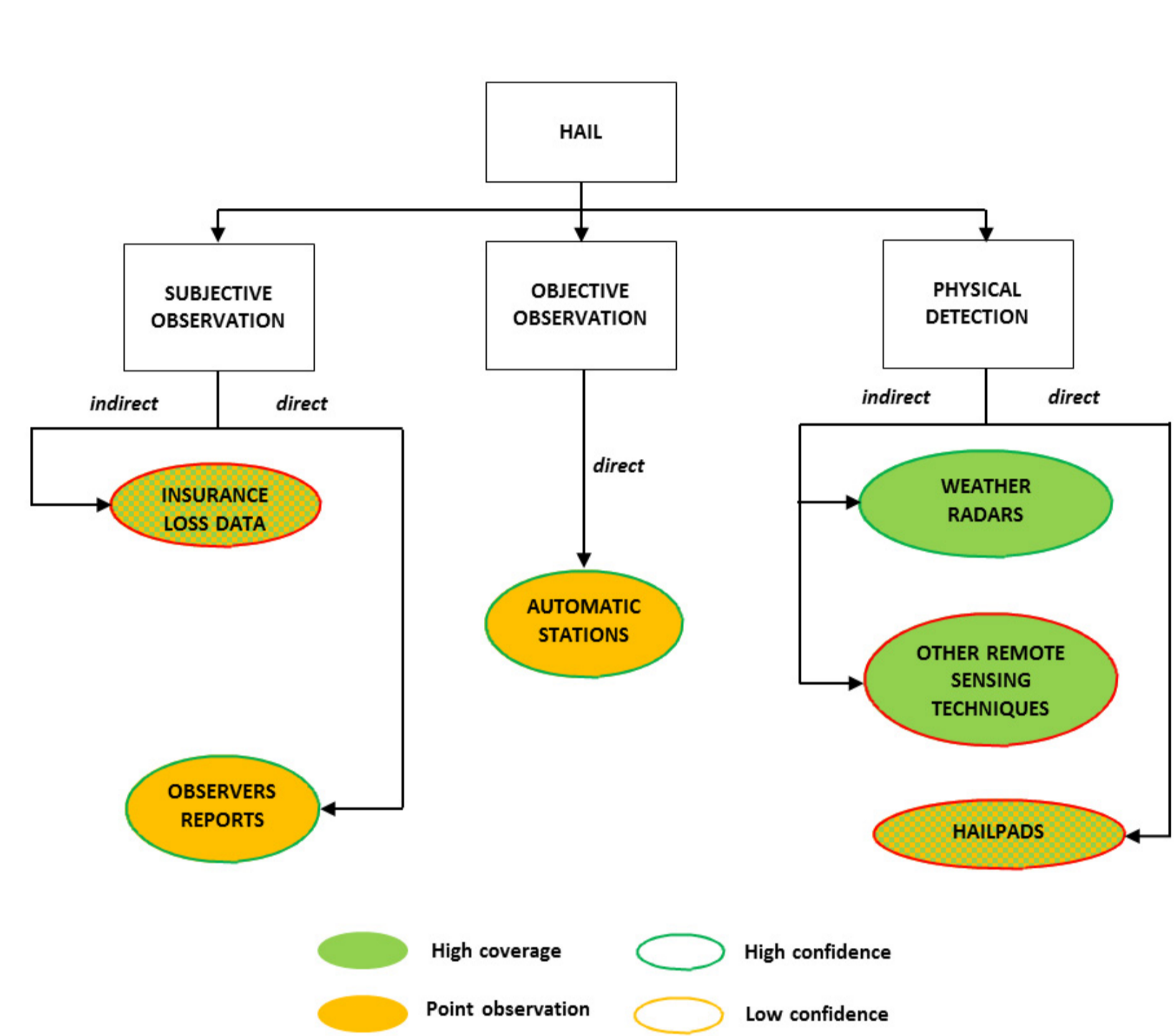
Objectives

Goals of the project are twofold:

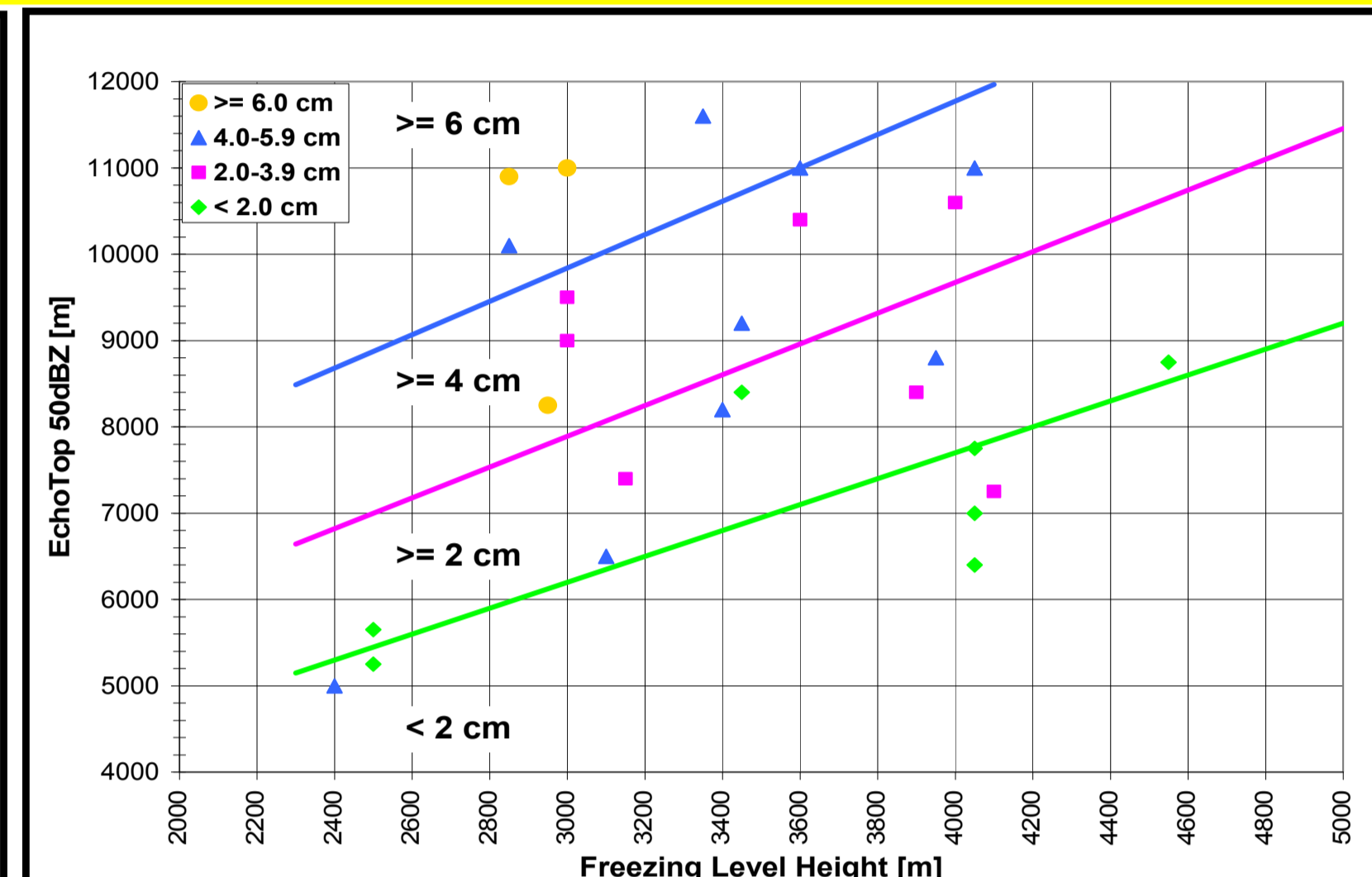
- (I) establishment and analysis of a comprehensive hail climatology in Switzerland based on high resolution radar data (2002-2012) → preliminary results are presented in this poster
- (II) identification and characterization of hailstorms and surrounding environments at different scales and using data from different sources;

An in-depth analysis of the phenomena, taking into account different measurement systems and scales, will give the possibility to investigate potential precursors of hail.

Hail detection techniques and reprocessing



- $\Delta H = H_{45dBZ} - H_{0^\circ C}$
- Hail: $\Delta H \geq 1.6$ km
- 100%: $\Delta H \geq 5.8$ km



- H_{50dBZ}
- $H_{0^\circ C}$
- Hail size ≥ 2.0 cm from Treloar nomogram

Reprocessing POH (2002-2012):

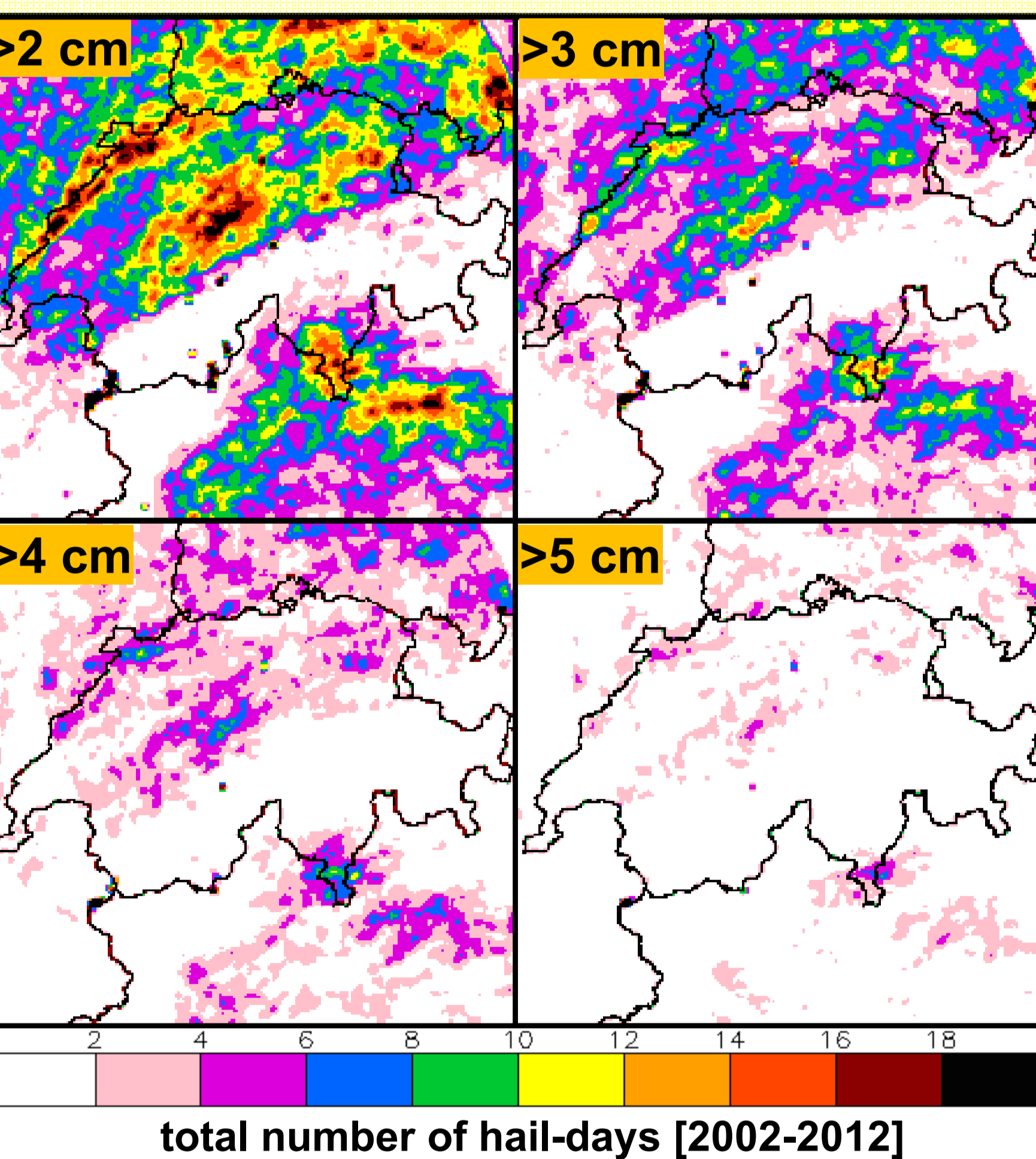
freezing level height NWP
COSMO2 and COSMO-7
Radar ECHOTOP Height
45 dBZ

Reprocessing MESHS (2002-2012):

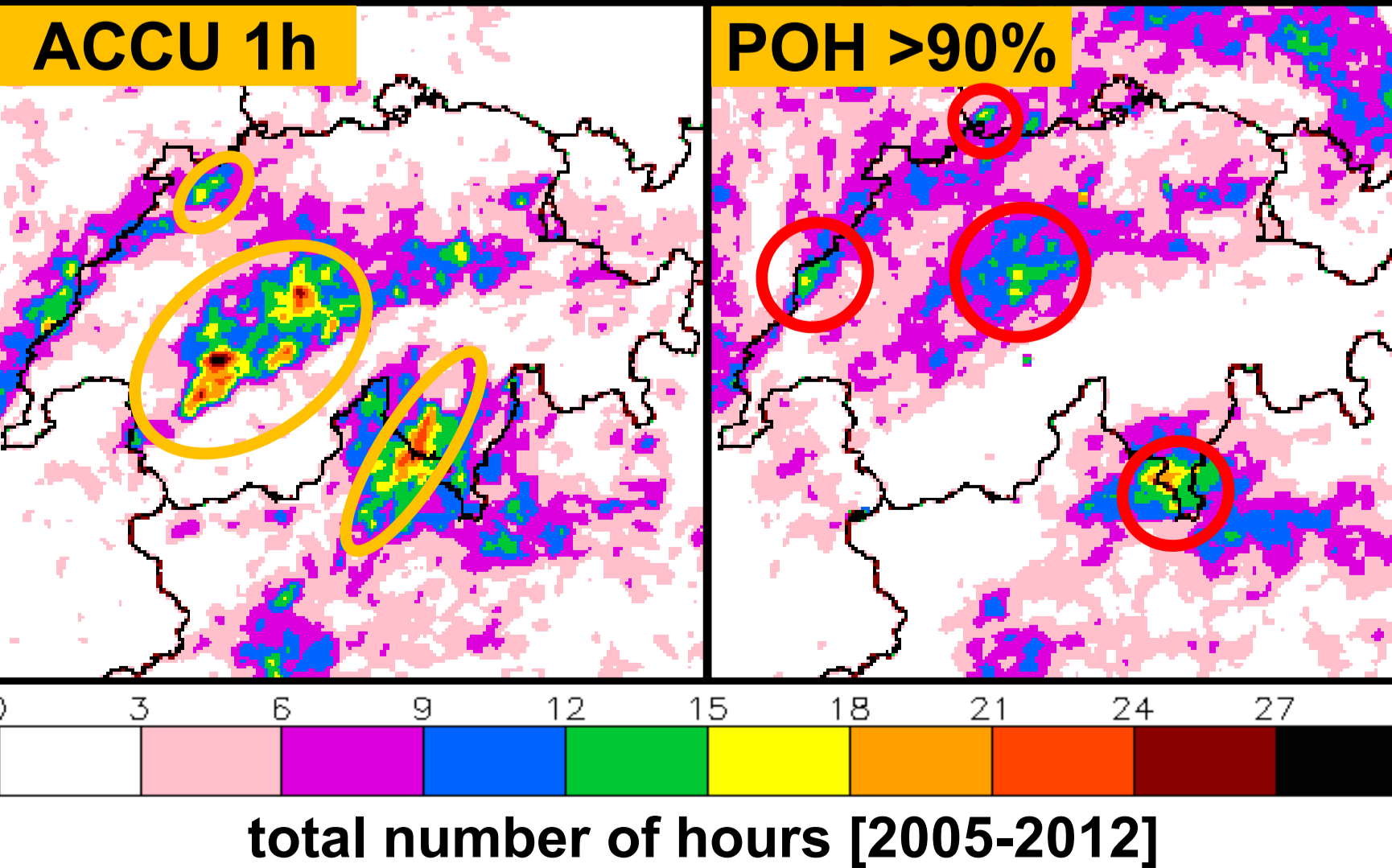
freezing level height NWP
COSMO2 and COSMO-7
Radar ECHOTOP Height
50 dBZ

Preliminary results

Number of hail-days according to hail-stone size (MESHS): global climatology APR-SEP 2002-2012

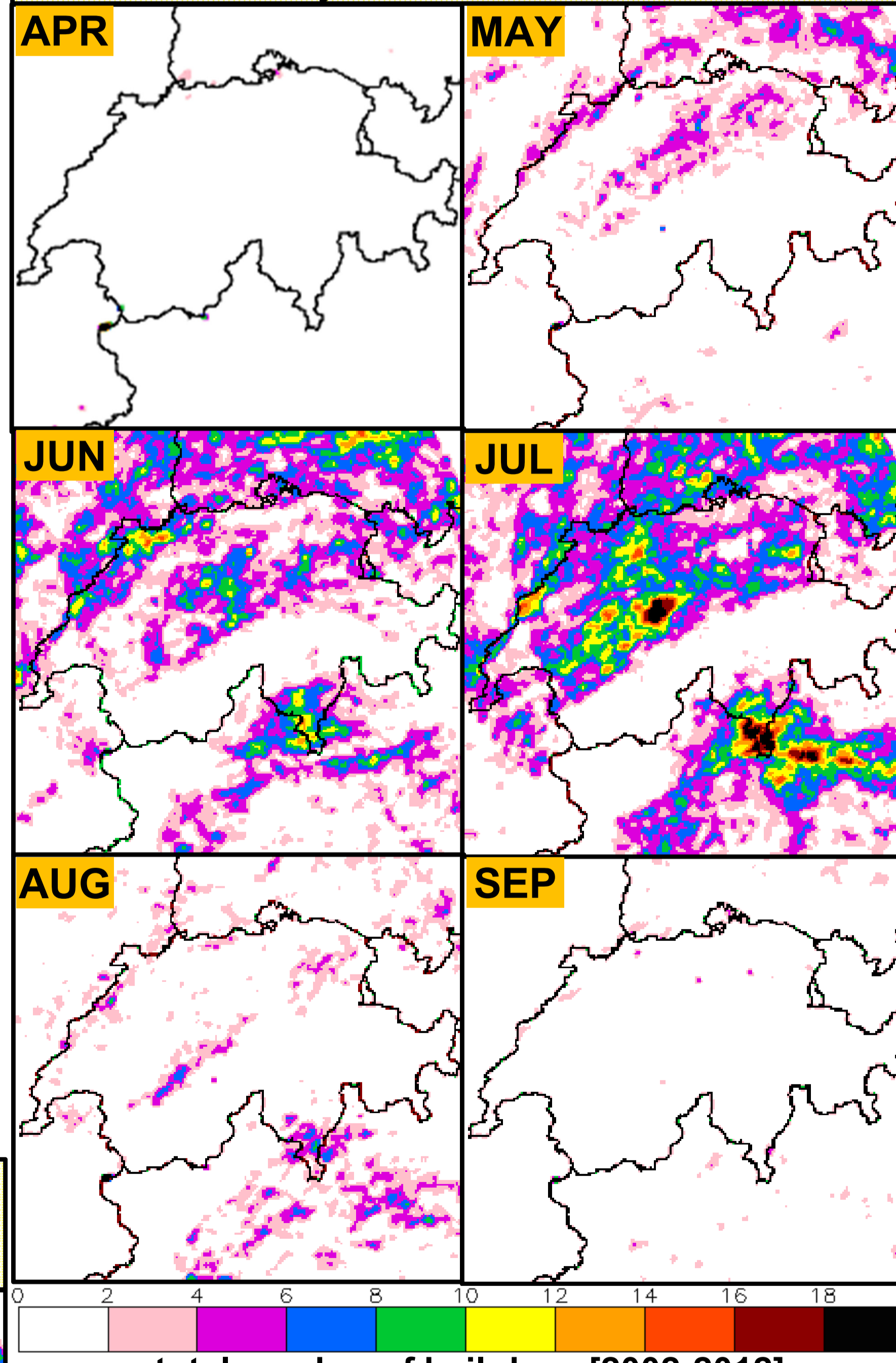


number of hours with strong rain (RR1h > 25 mm) VS. number of hail-hours (POH > 90%)

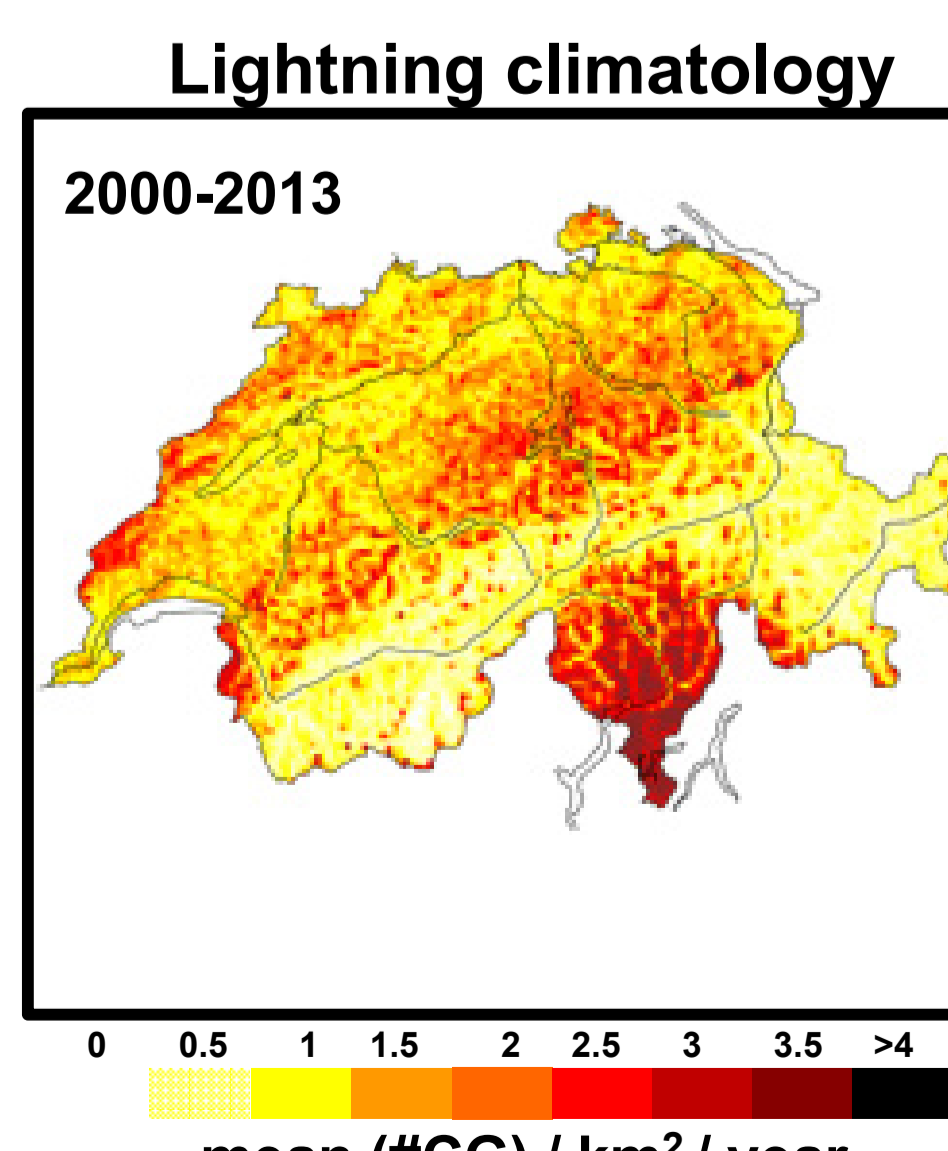
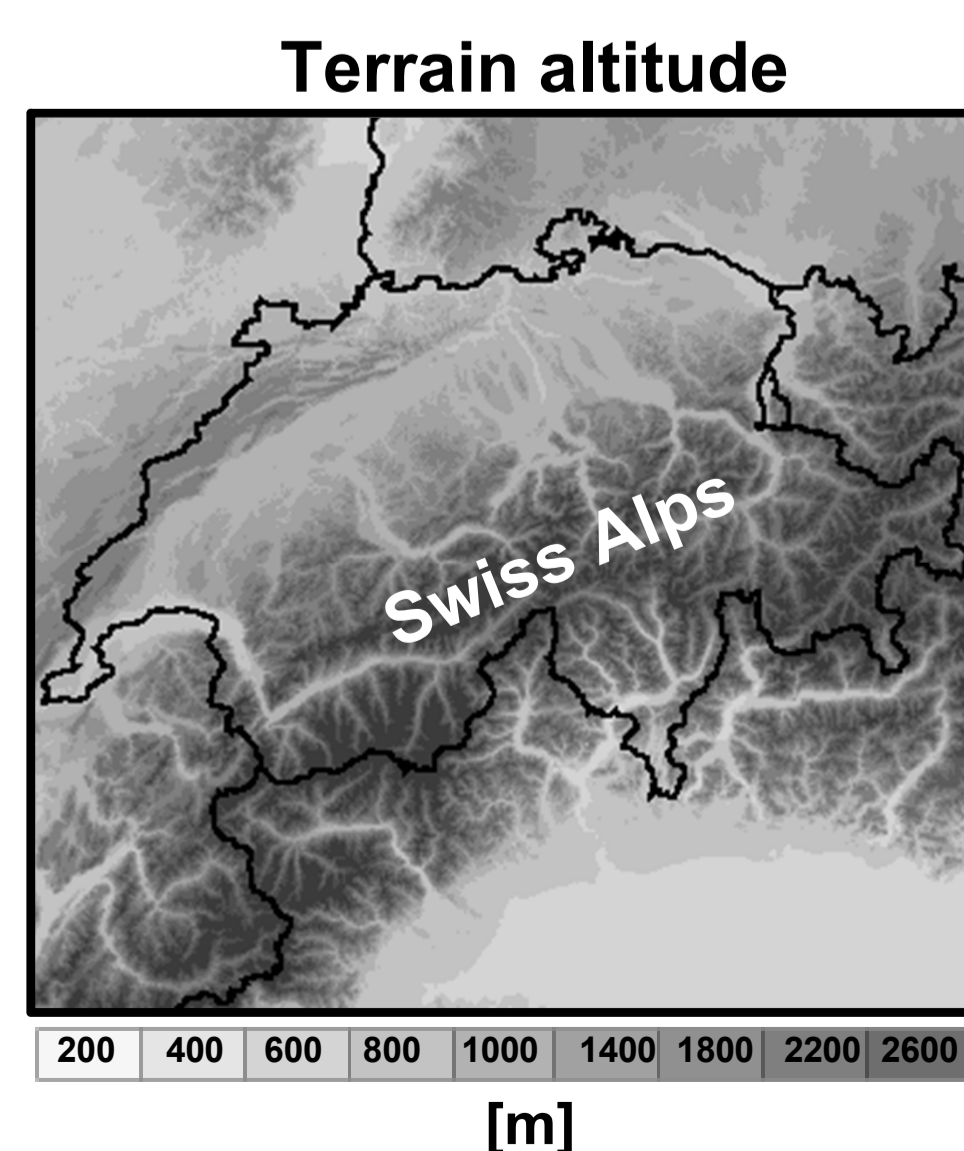
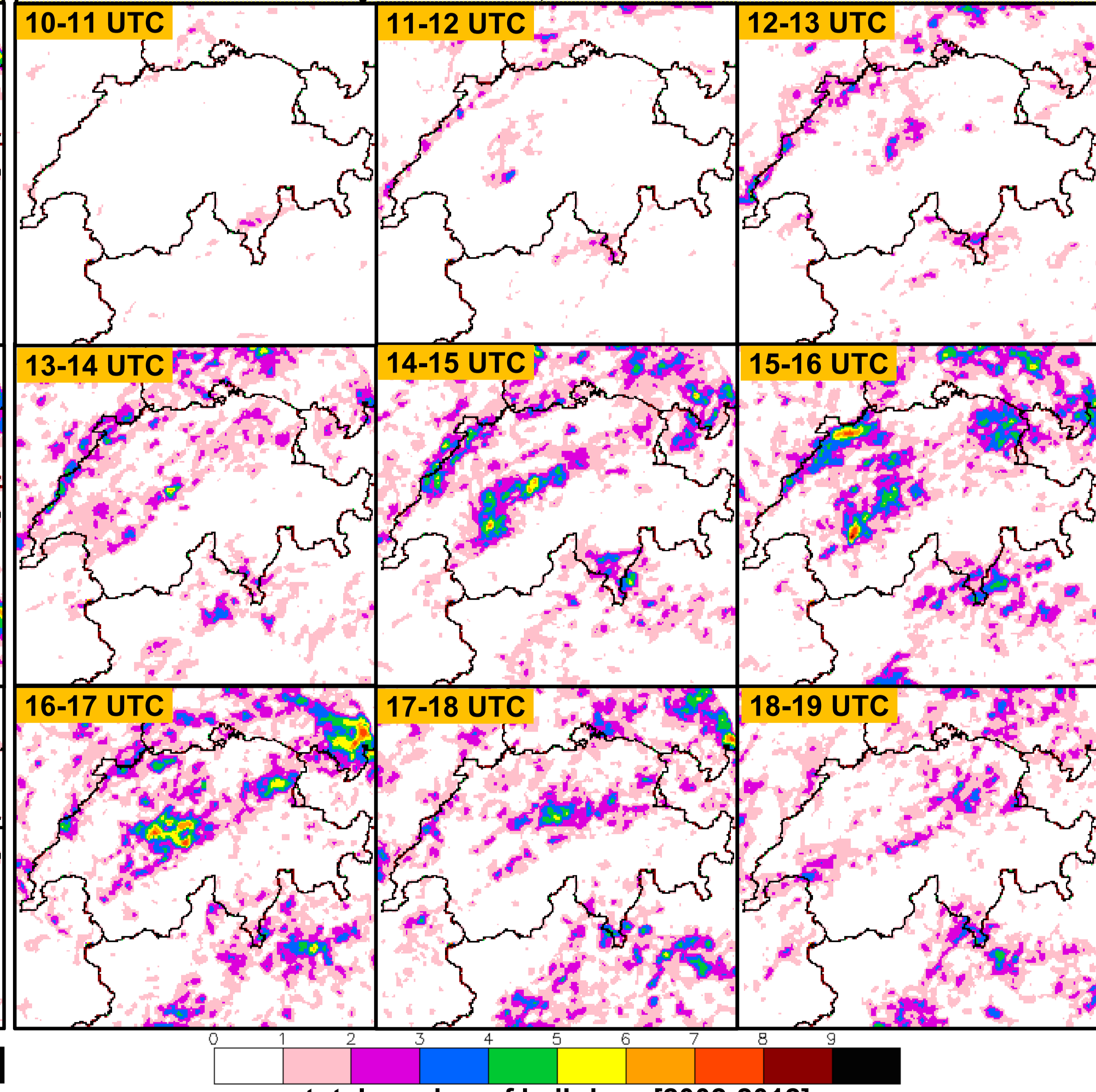


Hail preferred regions are not the same regions of intense rain
 → some regions are affected by severe thunderstorm where strong rain is predominant
 → other regions are affected by severe thunderstorm where hail is predominant

Number of hail-days (POH > 90%): monthly distribution 2002-2012



Number of hail-days (POH > 90%): hourly distribution, APR-SEP 2002-2012



Conclusions and outlook

- Different types of severe thunderstorms over Switzerland: in some regions strong rain is predominant, in others hail is predominant. High spatial and temporal variability.
- Orographic influence (hypothesis): mountains trigger convective cells, but disturb the formation of well structured hail cores.
- Preliminary results of pixel-based investigations are presented. An object based methodology (by means of an external radar cell tracking algorithm) will be used for further investigations (hailswath tracks, length, extensions...).
- In the second part of the project the 3D structure of several severe hailstorms will be investigated by using polarimetric radar data.
- Furthermore hail environmental conditions will be investigated by using data from different sensors (e.g. satellites, soundings, NWP...).