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Tracking hail swaths on radar data between 2002 and 2016: a new perspective for climatological studies of hail in the Alps

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2nd European Hail Workshop, 19-21th April 2017

Storm and hail swath tracking

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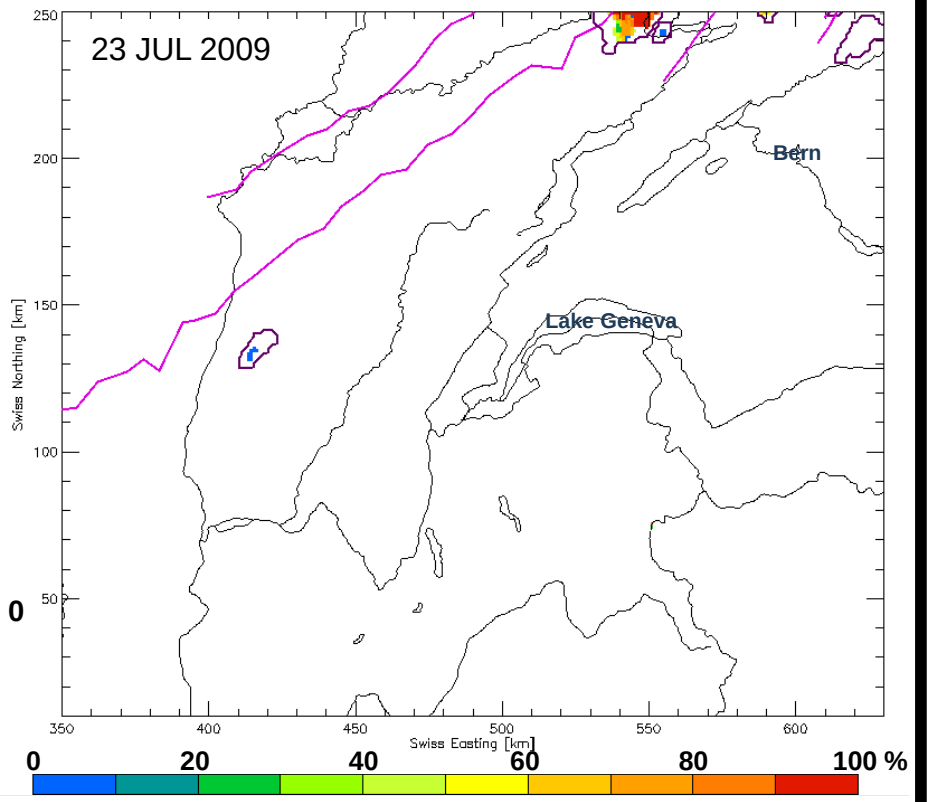
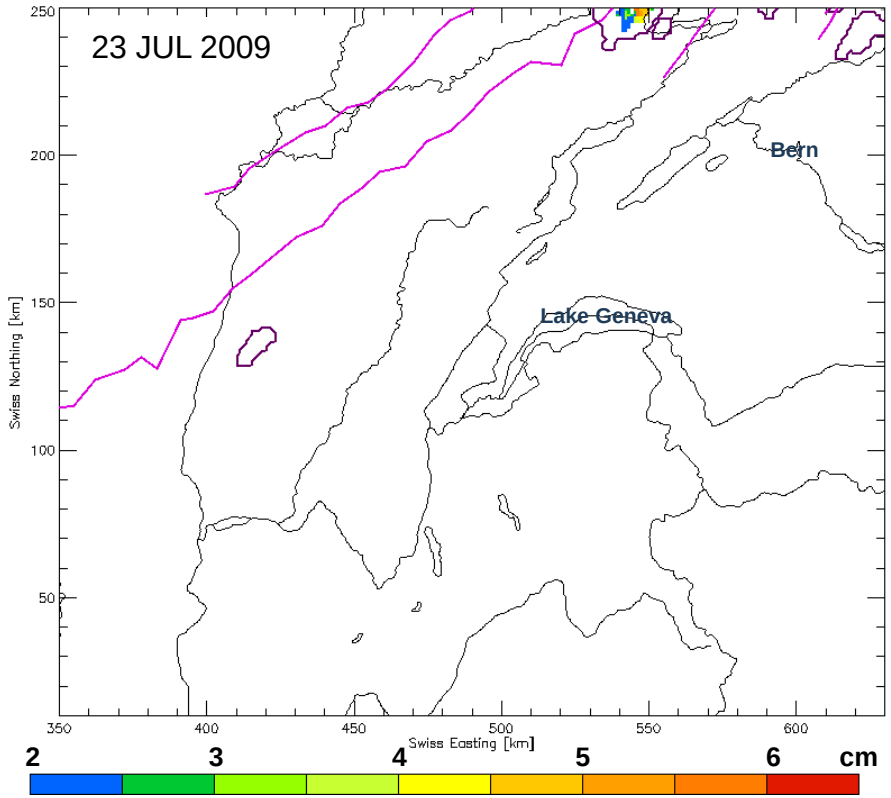
- **Thunderstorm Radar Tracking algorithm (TRT)**
- **1 km², 5min, APR-SEP 2002-2016**

Probability of Hail (0-100%)



Maximal Expected Size of Hail (>2cm)



Research domain

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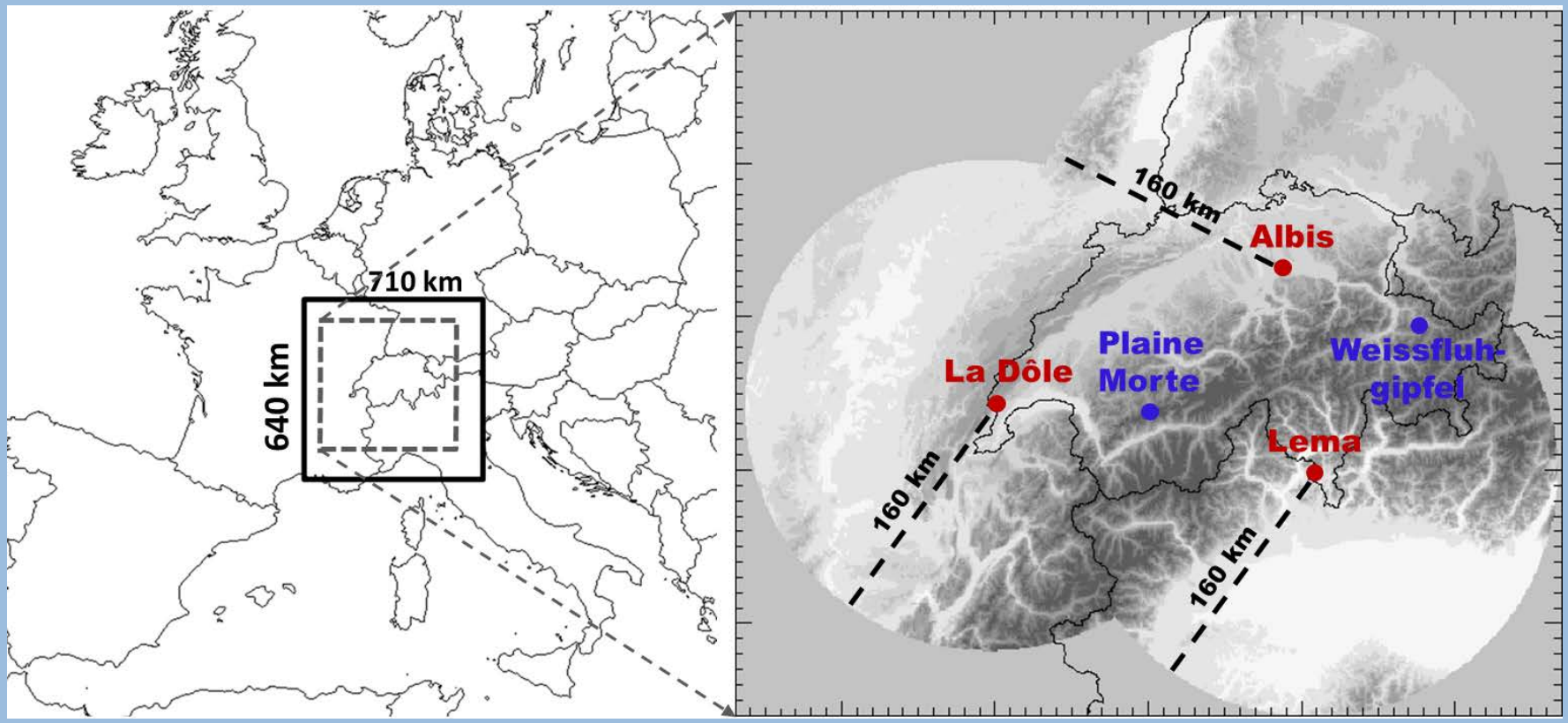

● radar sites included in the analysis

● new radar sites (after 2014)

polarimetric hail detection→ J. Figueras talk, FRI 11:20

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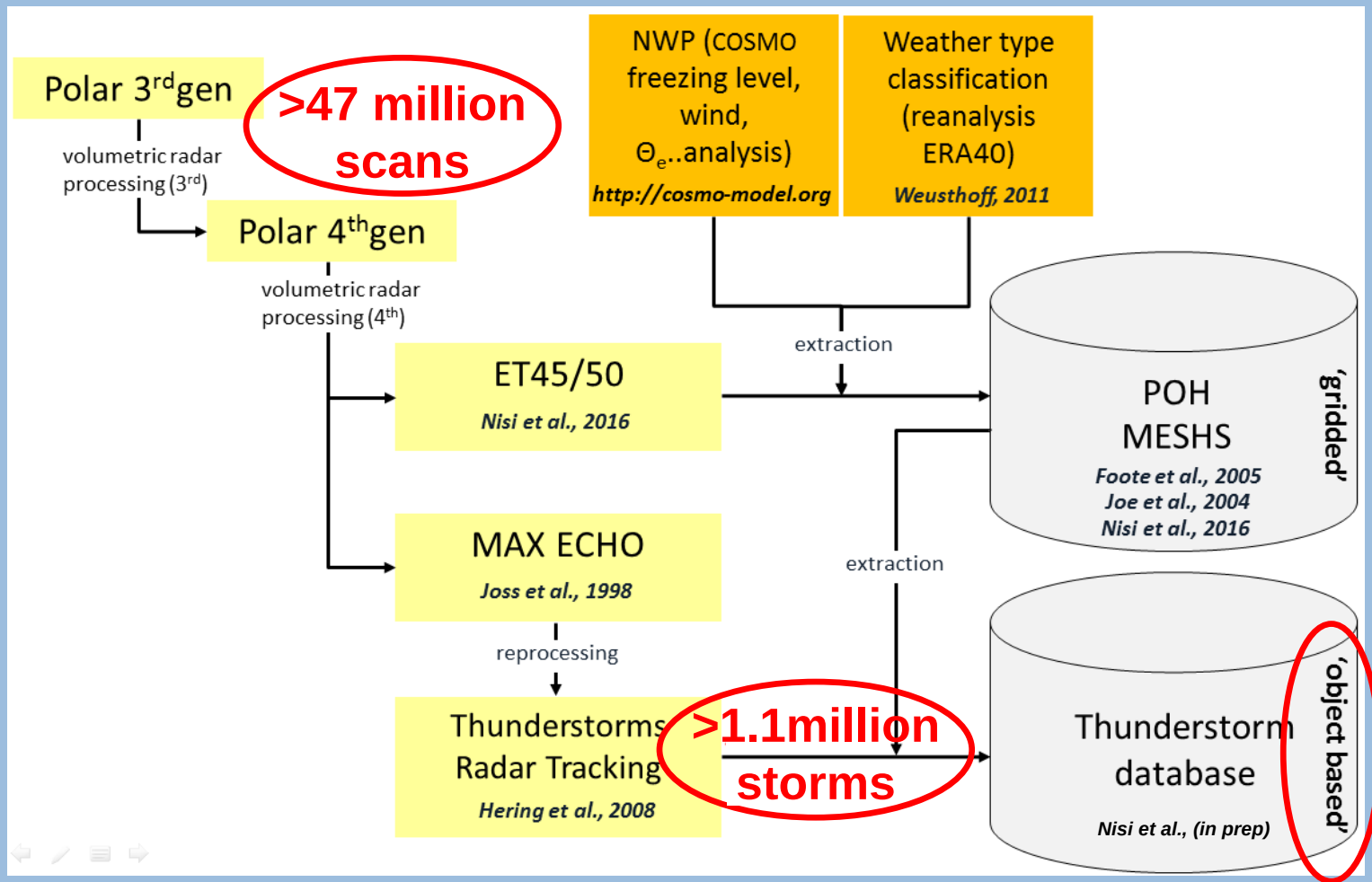
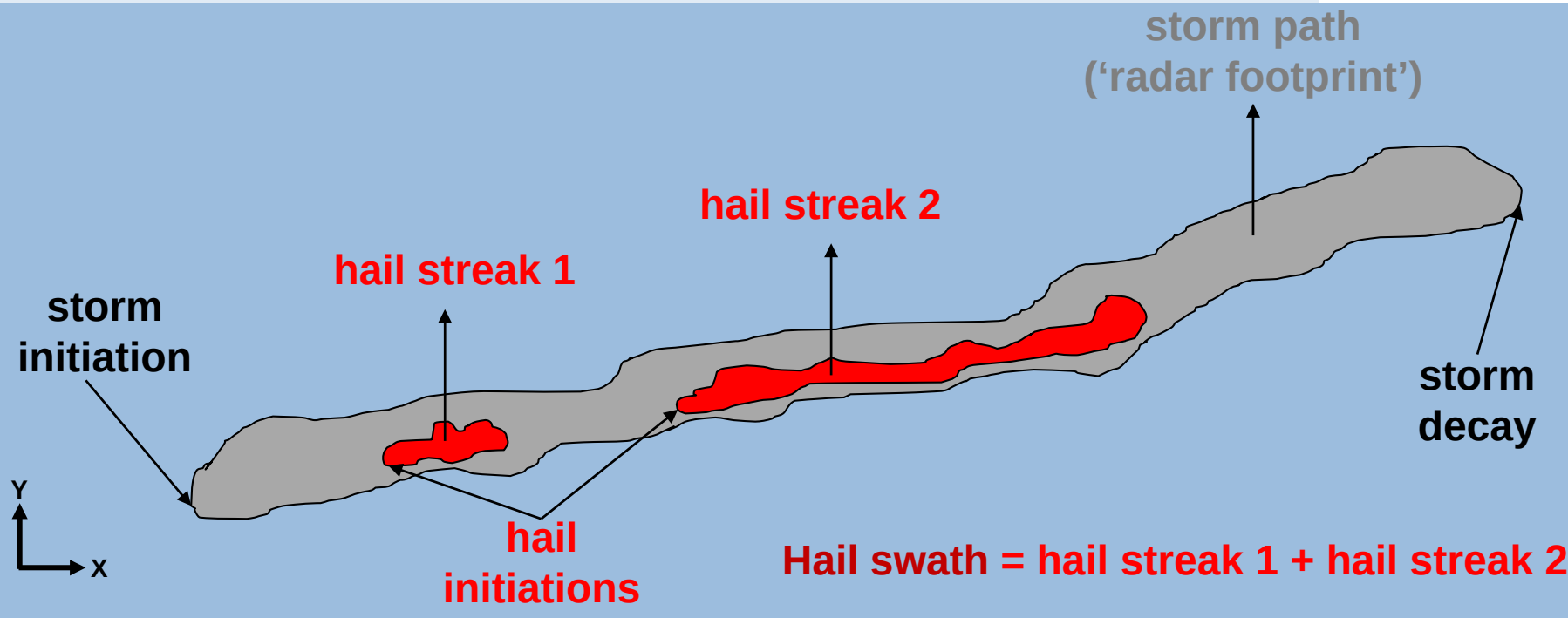
Hail swath database (2002 – 2016)



Nisi et al. (in prep)

Some definitions



4 storm classes:

a. Ordinary storms: POH < 60 %
b. Hail storms: POH ≥ 80 % (all sizes)
c. Hail storms: MESHS ≥ 2 cm
d. Hail storms: MESHS ≥ 4 cm

*Adapted: Changnon Jr SA. 1970. Hailstreaks. J. Atmos. Sci., **27** (1): 109-125*

→ U. Hamann talk, FRI 11:35

Storm type fraction

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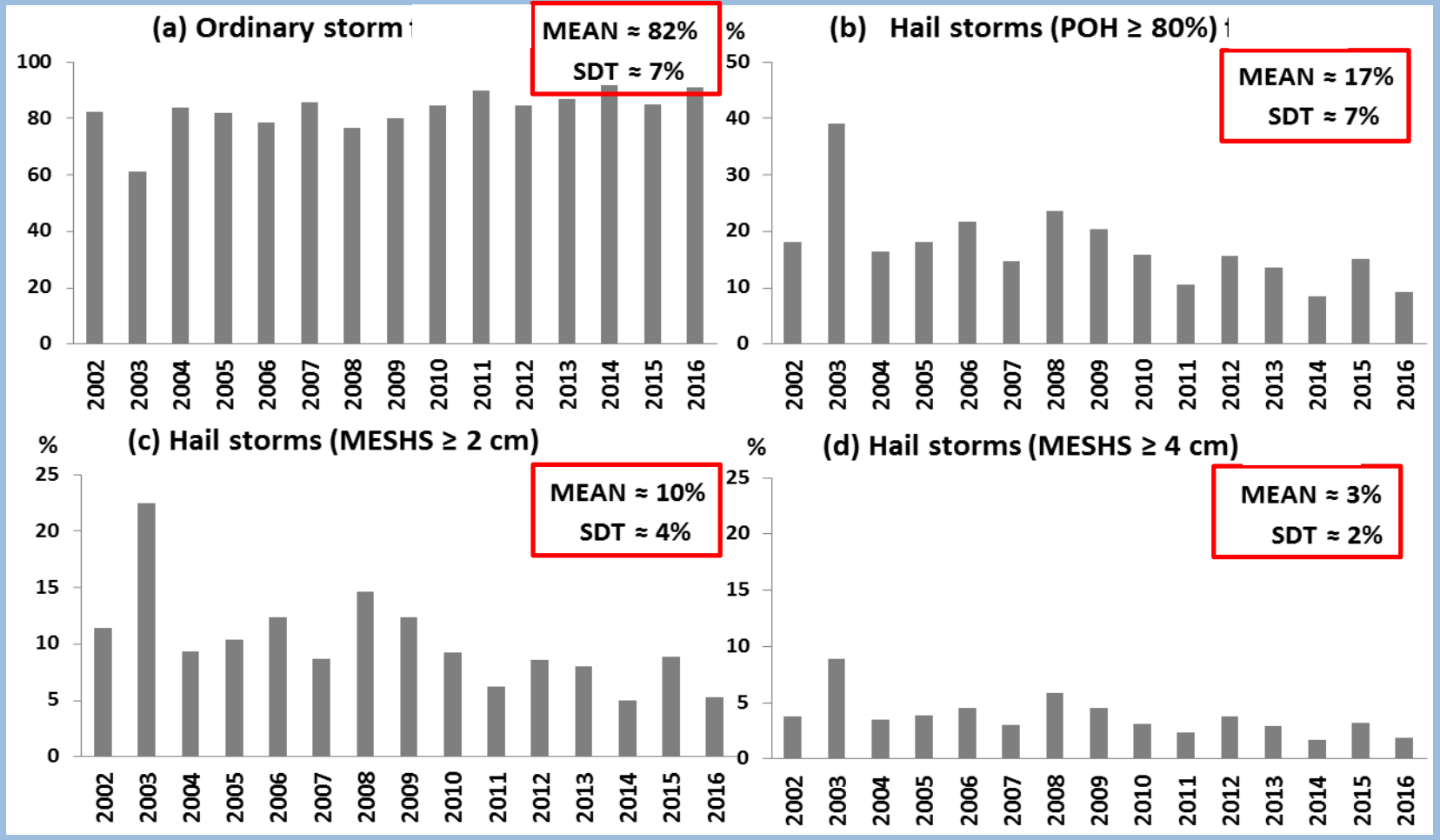

Storm types yearly standardized anomaly

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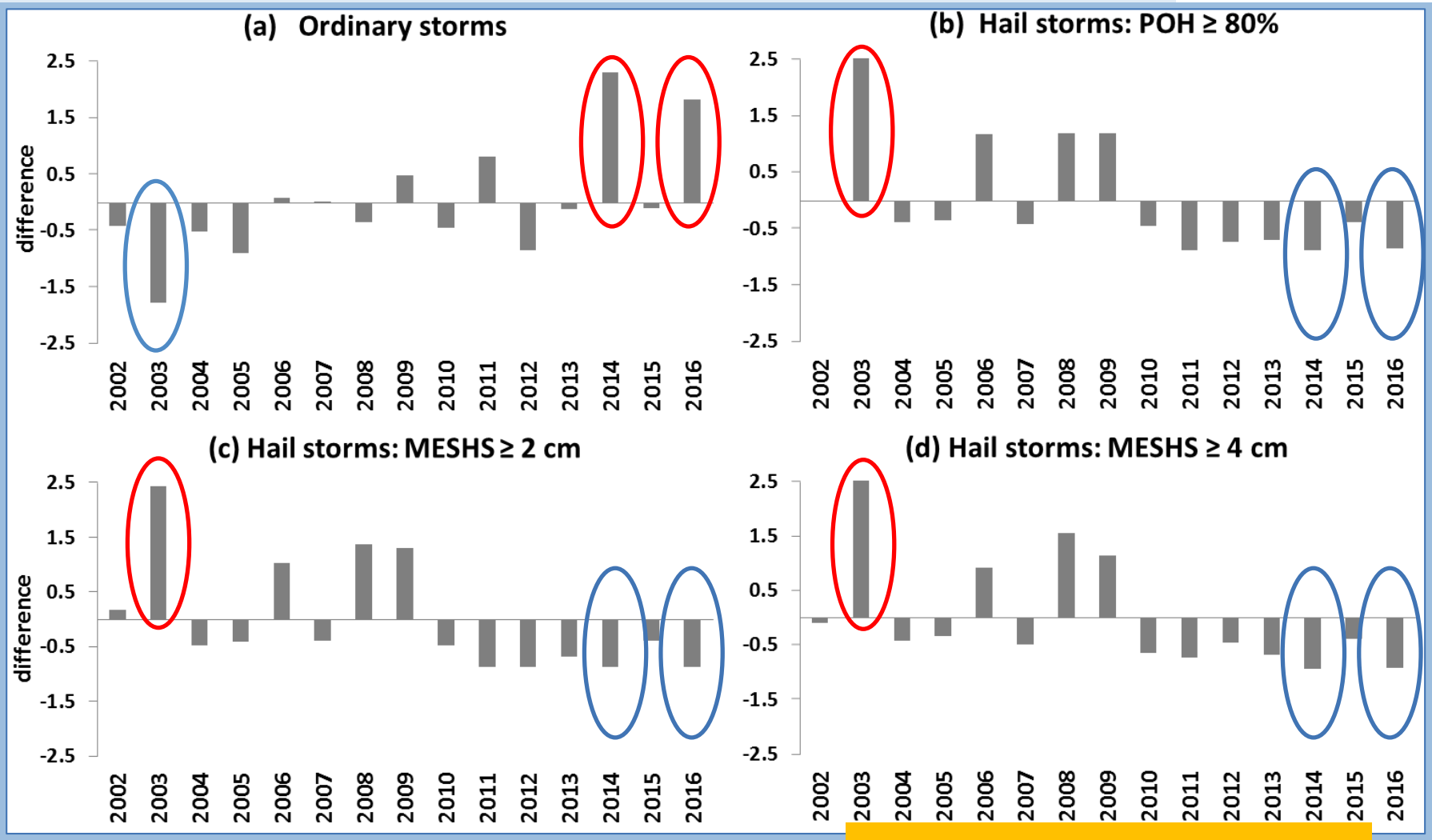

Low polar jet, NAO-

Storm splits, number of hail streaks (HST)

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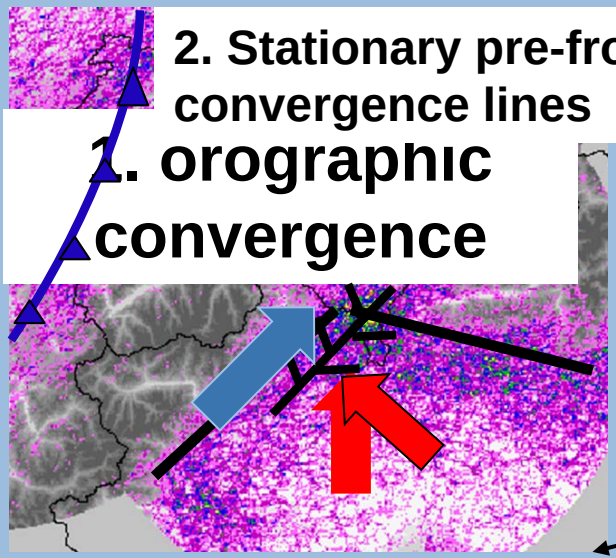
Cell type	Number of cells	Cells split (in %)
Ordinary	159439	17
POH≥80%	31823	32
MESHS≥2cm	18725	41
MESHS≥4cm	6892	48

→ 2 separated hail streaks: if $\Delta t \geq 15$ min

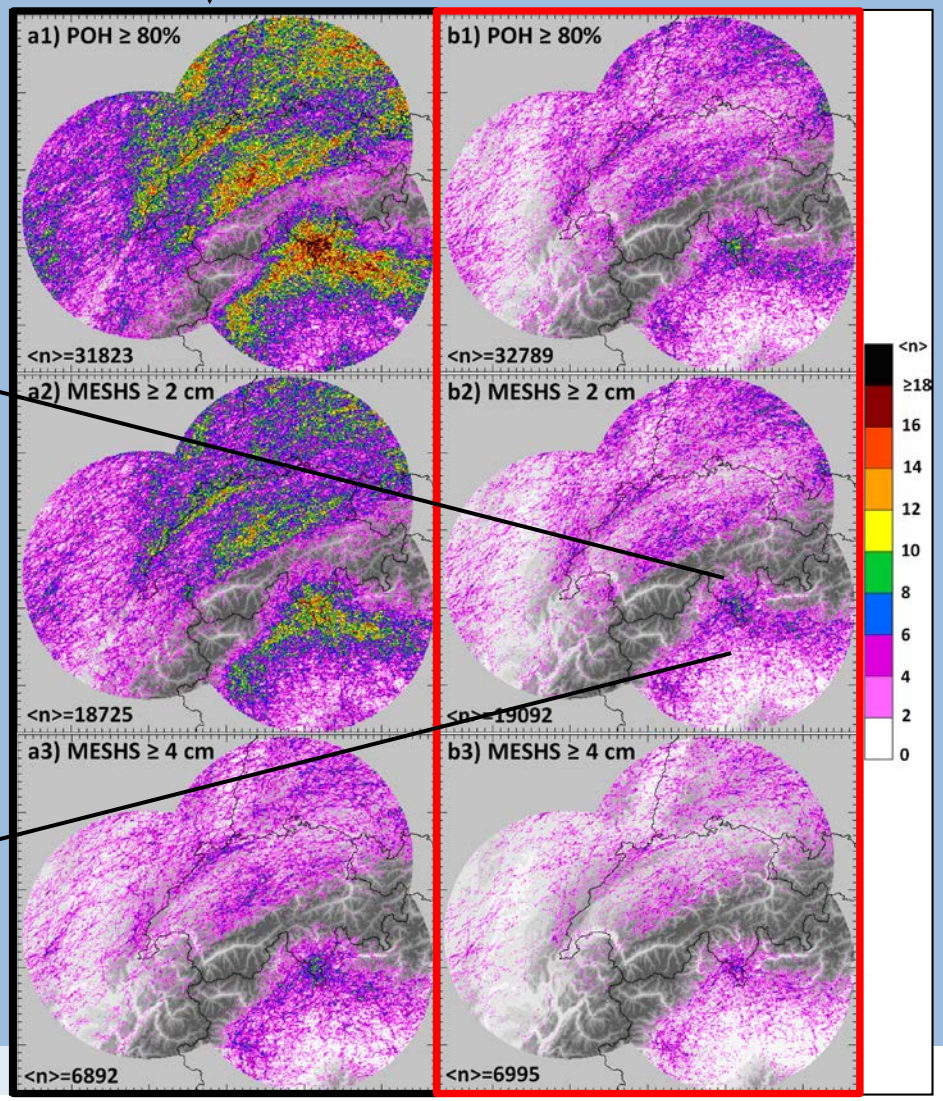
Storm paths and hail streaks distribution

- **Hail streaks hotspots are smaller but stronger in the South than in the North**



Panziera et al., 2015

<n> : number of storms (hailstreaks)



Hail storm (POH ≥ 80%) initiation locations vs weather types (wind @ 500 hPa)

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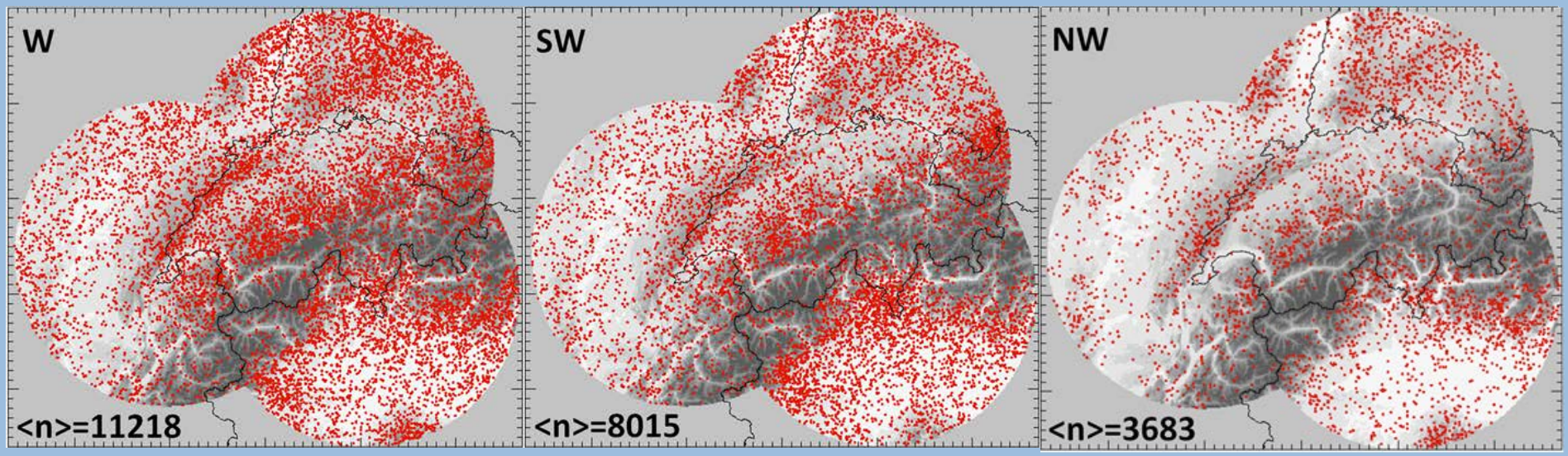
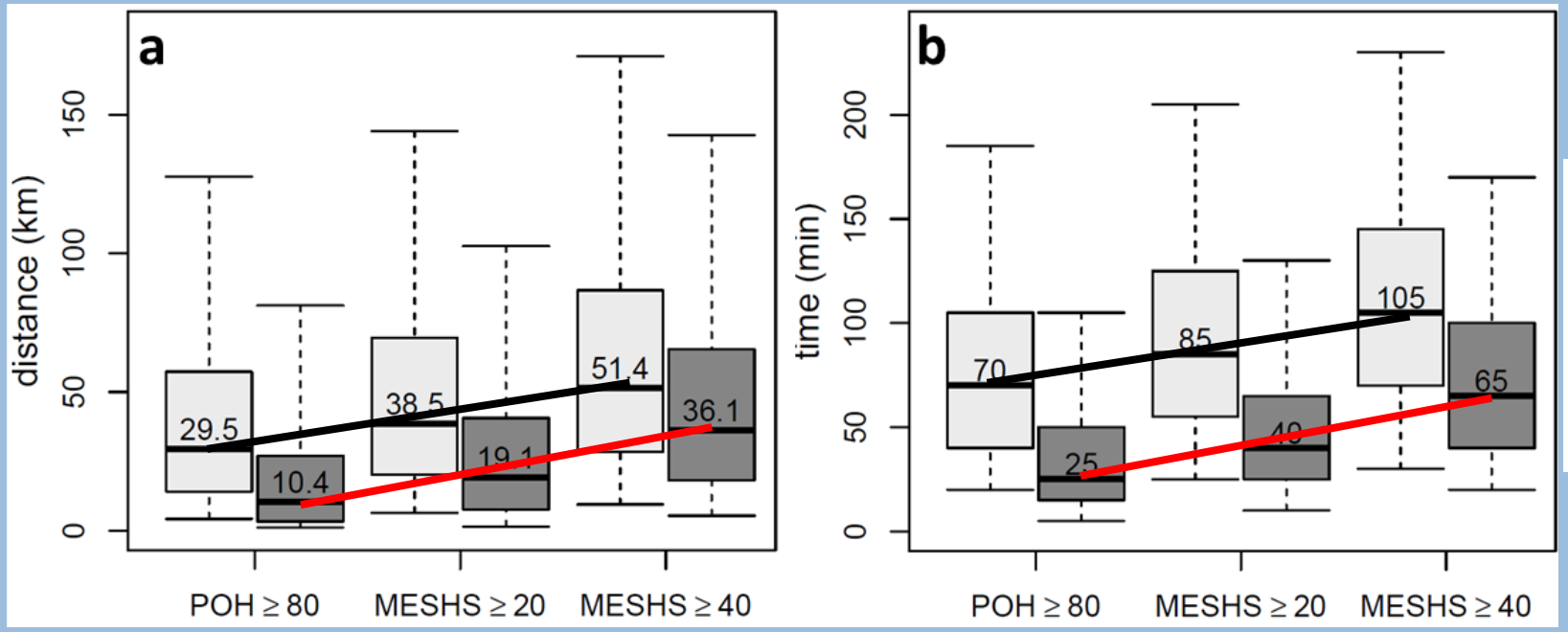


<n> : number of storms (hailstreaks)

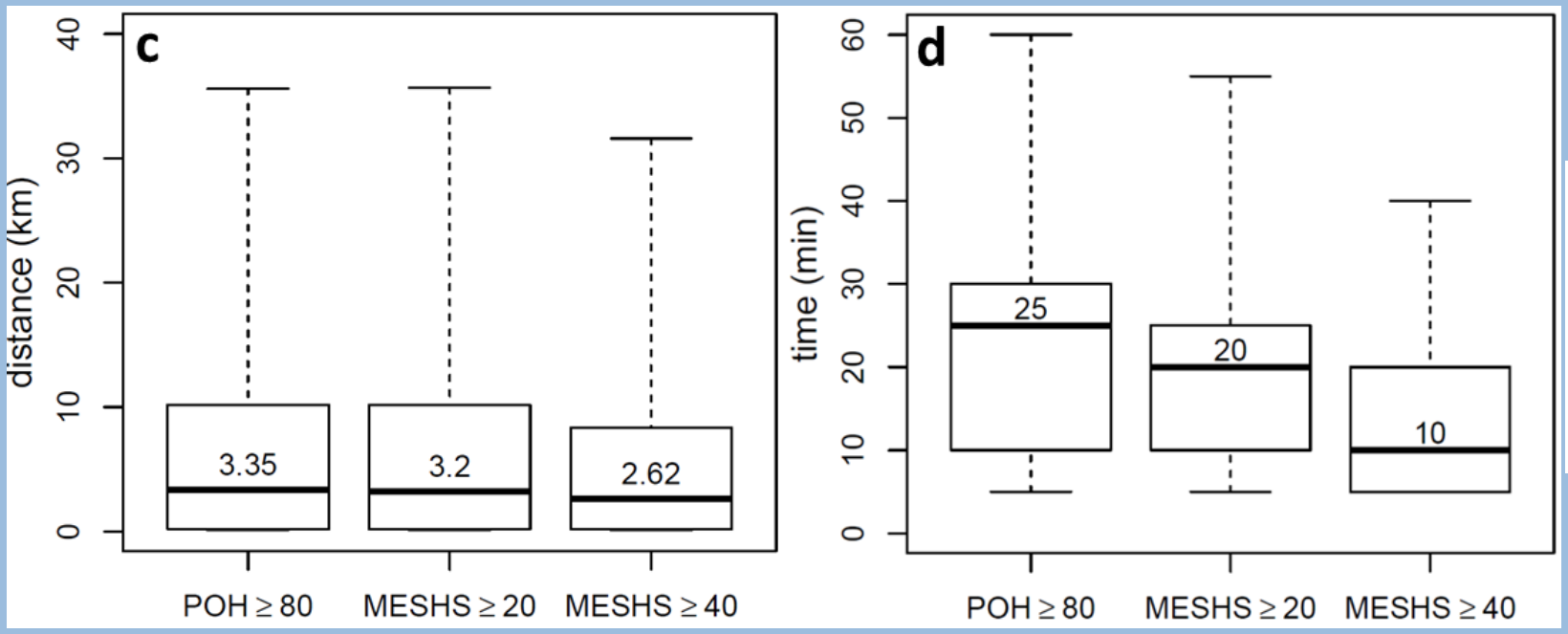
→ S. Trefalt talk, FRI 09:55

Storm / hail swaths durations



- **Most severe hailstorms are long lasting and cover longer distances**

Storm explosivity



- **Most severe hailstorms are more explosive at first stages**

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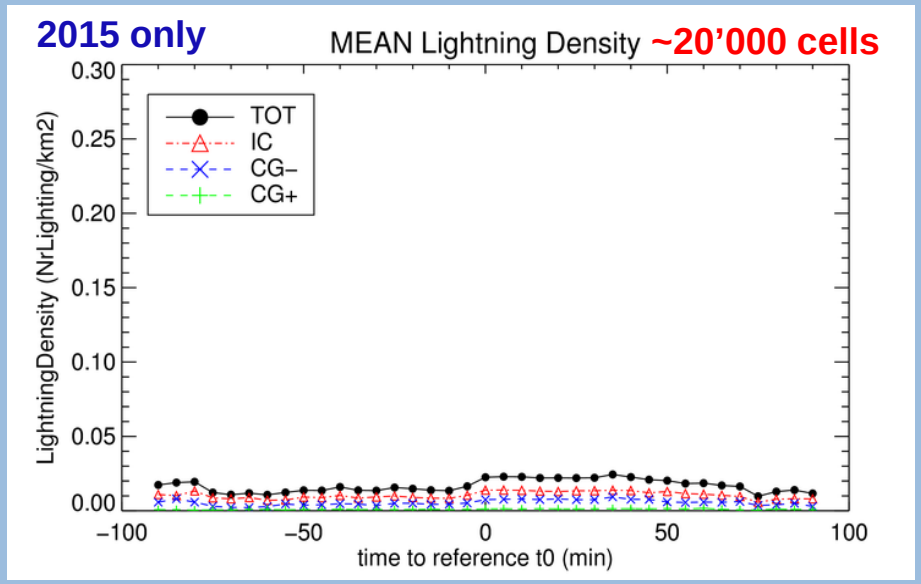
Investigating Nowcasting potential using additional data sets (e.g. lightning)

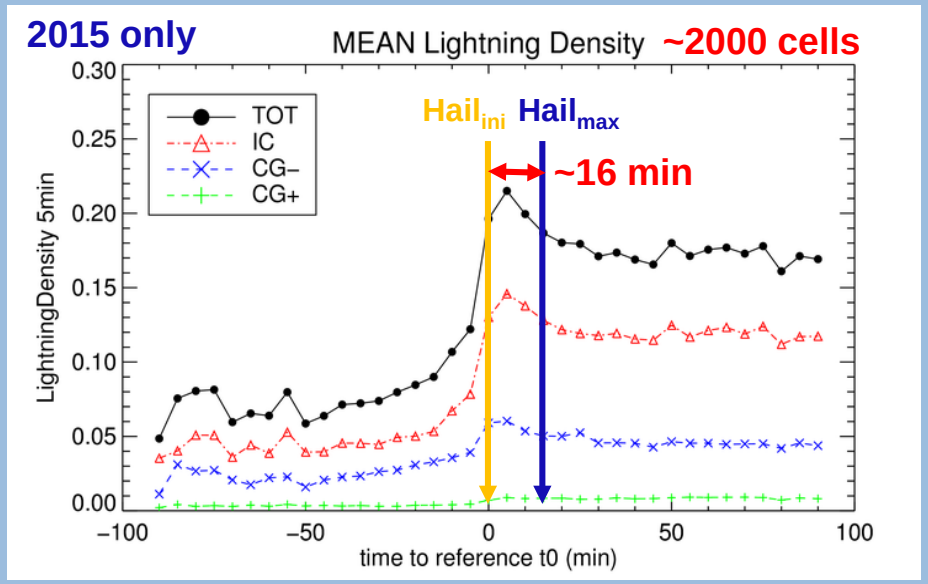
cell-based lightning-density (Lightning-rate/TRT-cell area)

no-hailcells

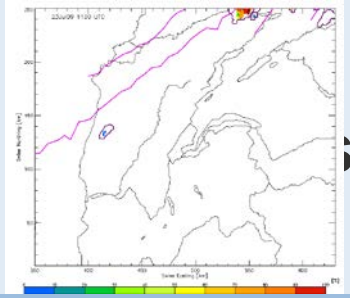


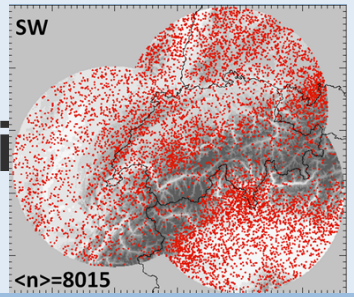
Reference t0: time of the highest cell-based MaxEcho in the trajectory

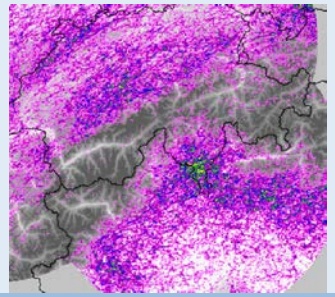
hailcells (POH≥80%)

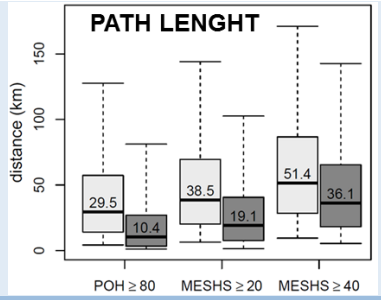


Reference t0: time of hail-initiation (POH ≥80%)









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Thank you !

- **Automatic reprocessing increases the data homogeneity over long periods (15 years, 1.1 million storms, >30’000 severe hailstorms)**

- **Storm-type fraction, yearly anomalies, storm characteristics along trajectory, explosivity**

Nisi L, Martius O, Hering A, Kunz M, Germann, U. 2016. ***Spatial and temporal distribution of hailstorms in the Alpine region: a long-term, high resolution, radar-based analysis.*** Q.J.R. Meteorol. Soc., 142: 1590–1604.

- **Object-based approach allows investigation of potential precursors and the interaction with complex terrain**

Schemm S, Nisi L, Martinov A, Leuenberger D, Martius O. 2016. ***On the link between cold fronts and hail in Switzerland.*** Atmos. Sci. Lett., 17: 315–325.

Nisi L, Hering A, Germann U, Martius O. (in prep) ***Tracking hail streaks on radar data between 2002 and 2016: a new climatological perspective for hail in the Alps.***