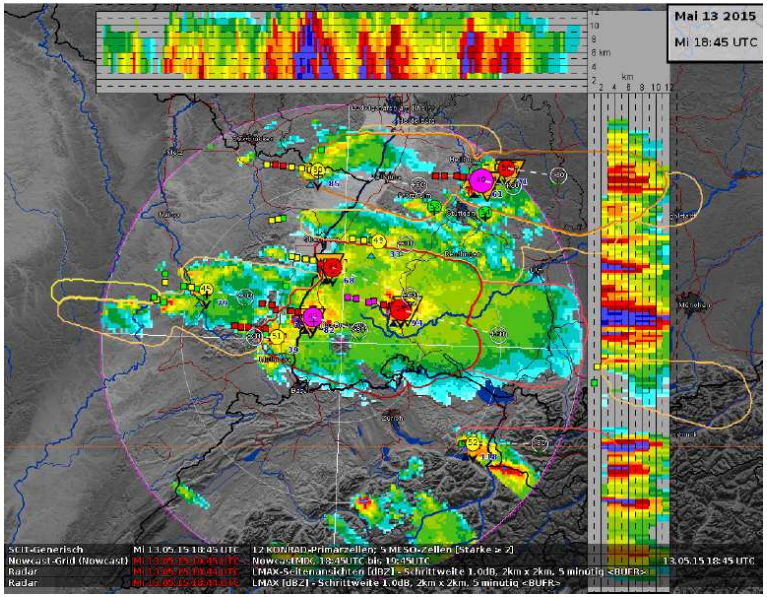


Characterisation of hail storms using a multi-data approach

Kathrin Wapler (DWD)

Objectives

What is the typical life cycle of hails storms?


DWD

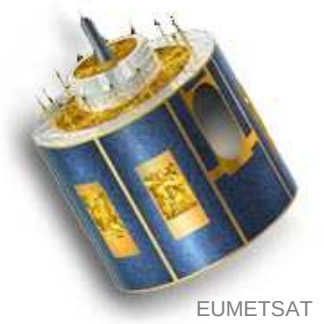
Which signatures are visible in …

… radar data?

… lightning data?


Nowcast GmbH

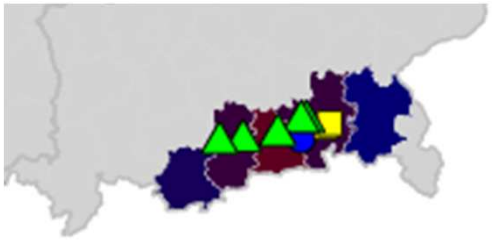
… satellite data?

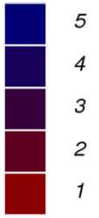

EUMETSAT

Hail storm in Oberbayern: 22 June 2011

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

damage data from insurances (relative to reference time)

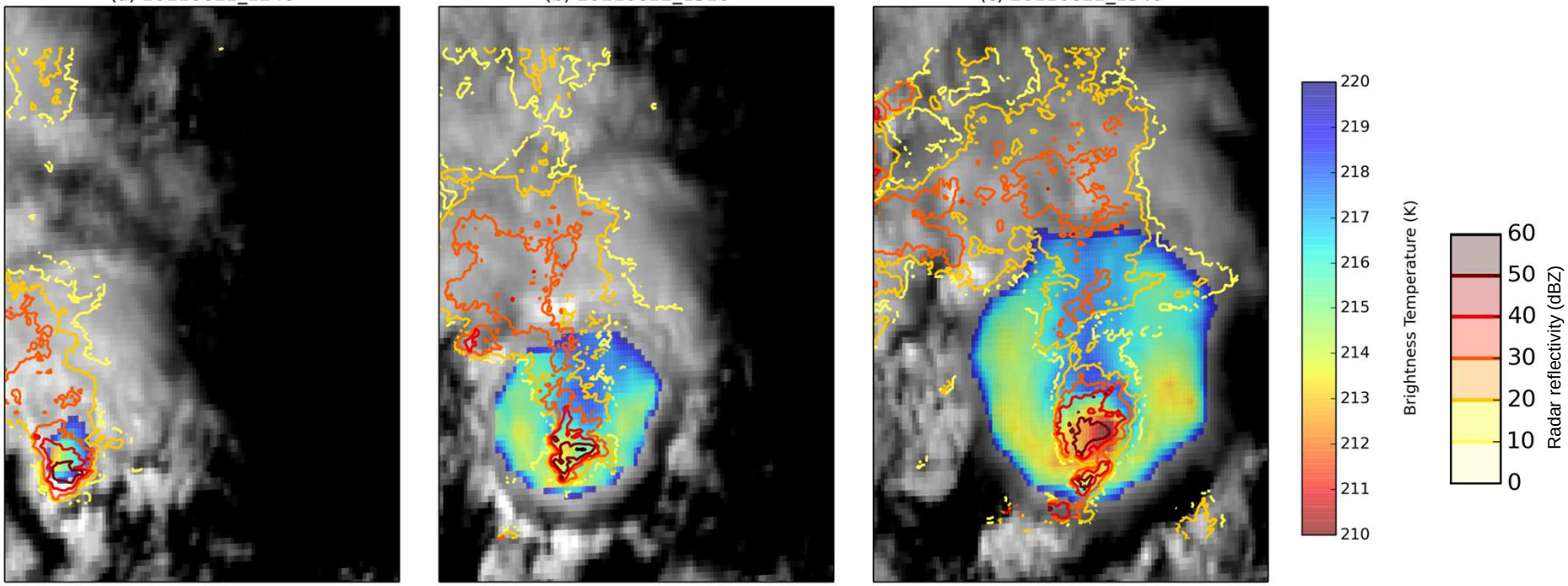




Heavy Rain [ESWD]
Tornado [ESWD]
Severe Wind [ESWD]
Large Hail [ESWD]

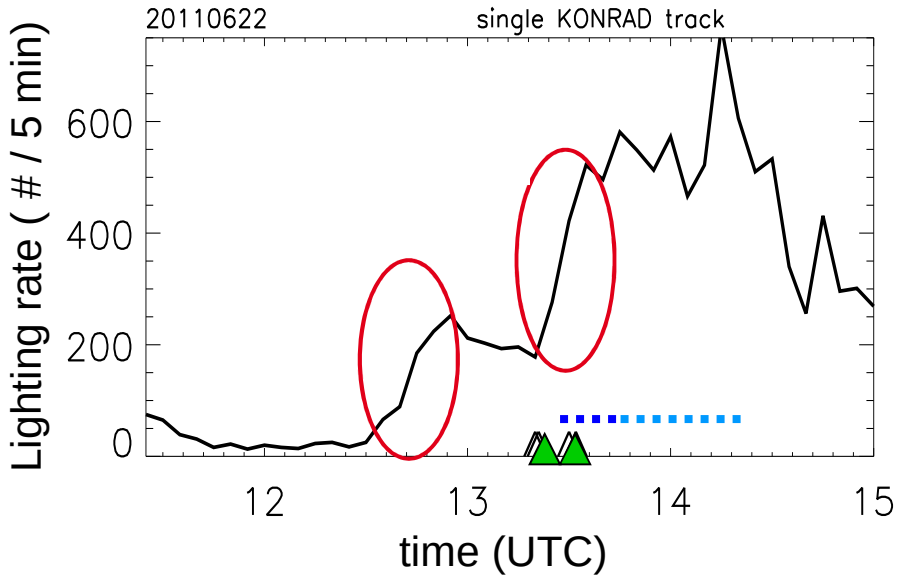
cold U signature indicates severe weather.

(a) 20110622_1240 (b) 20110622_1310 (c) 20110622_1340



WAPLER, K., F. HARNISCH, T. PARDOWITZ, F. SENF, 2014: Characterisation and predictability of a frontal and a weakly forced severe convective event – a multi-data approach. Meteo. Zeitschrift, *24 (4), 393-410.*

Hail storm in Oberbayern: 22 June 2011



Heavy precipitation

Hail

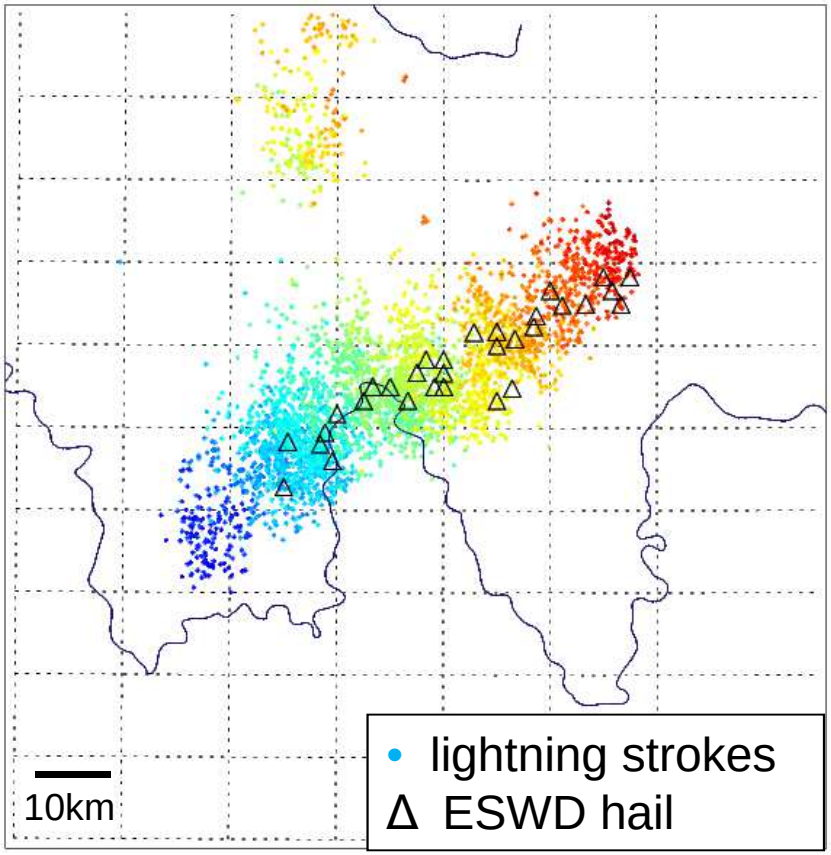
- two lightning jumps
- first lightning jump ~30 min prior to and second lightning jump during time of severe weather (hail and begin of heavy precipitation)

Use of lightning jumps in nowcasting may lead to improved warnings (longer lead time).

WAPLER, K., F. HARNISCH, T. PARDOWITZ, F. SENF, 2014: Characterisation and predictability of a frontal and a weakly forced severe convective event – a multi-data approach. Meteo. Zeitschrift, *24 (4), 393-410*.

Hail storm near Main river: 20 June 2013

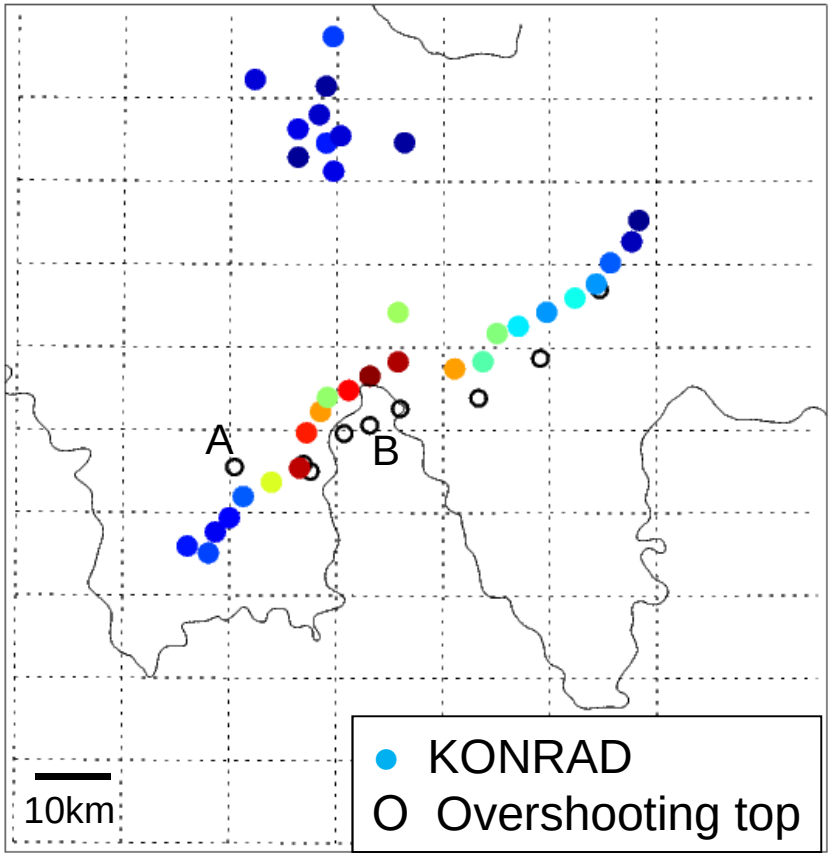
Hail storm near Main river: 20 June 2013

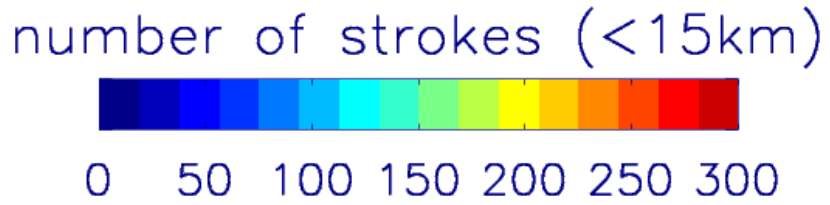


chronological sequence of lightning strokes

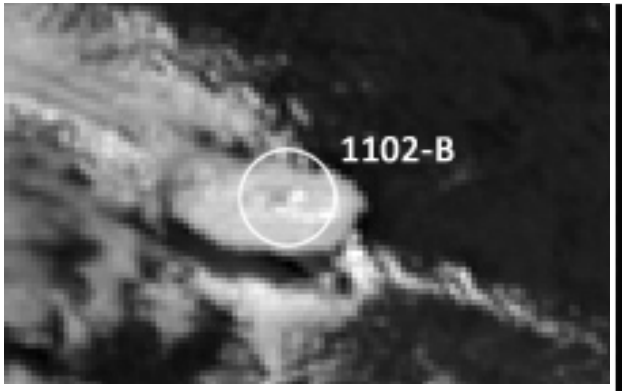
Hail storm near Main river: 20 June 2013

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

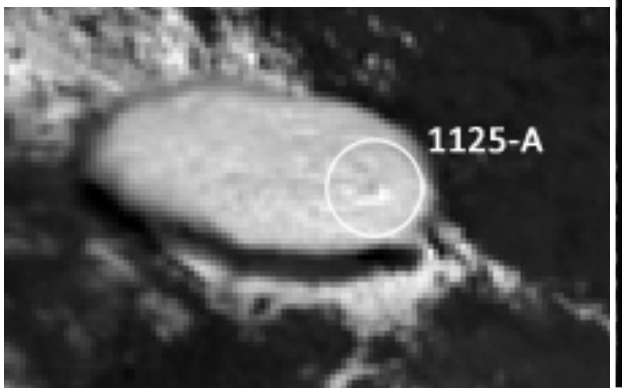




A



B



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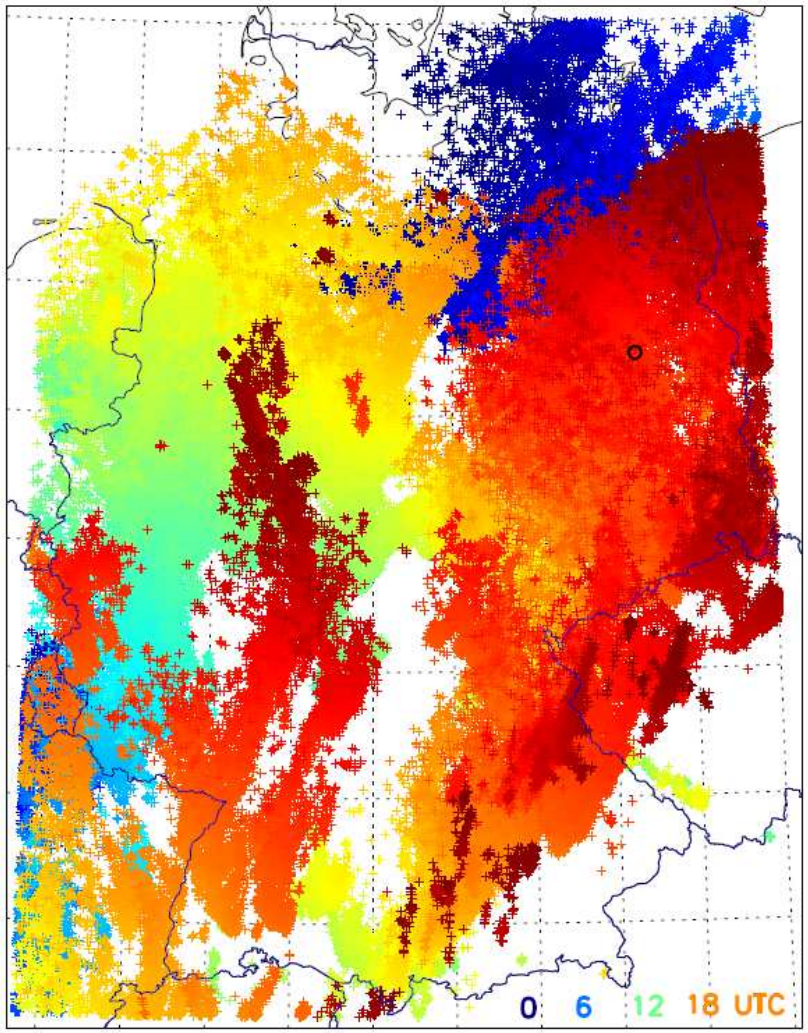
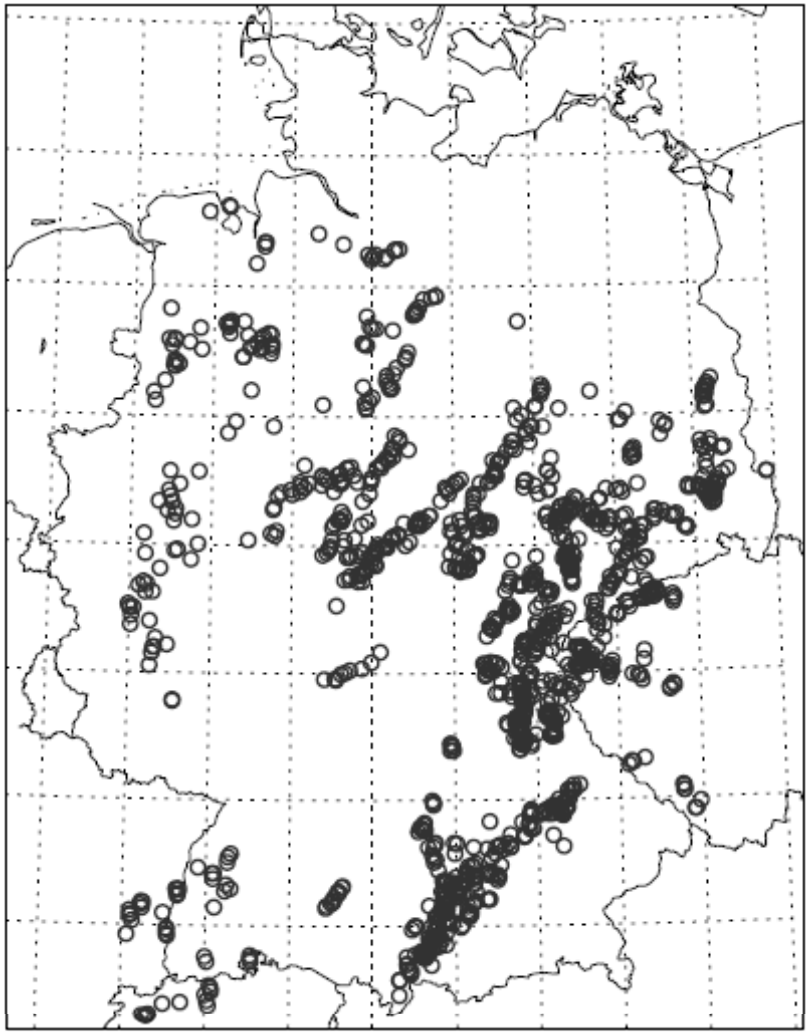
overshooting top data kindly provided by Martin Setvak and Michaela Radova, CHMI

Overshooting tops indicate severe weather.

Hail storms in central Europe: 20 June 2013

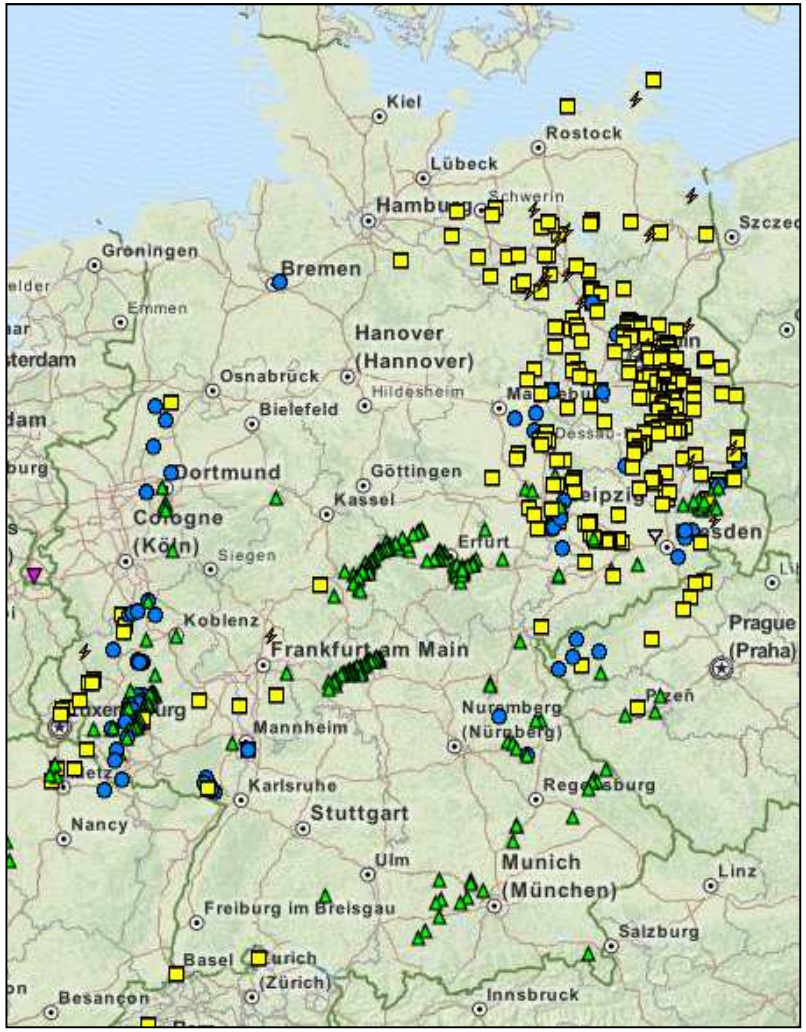


Lightning strokes measured by LINET
(colour indicates the time)

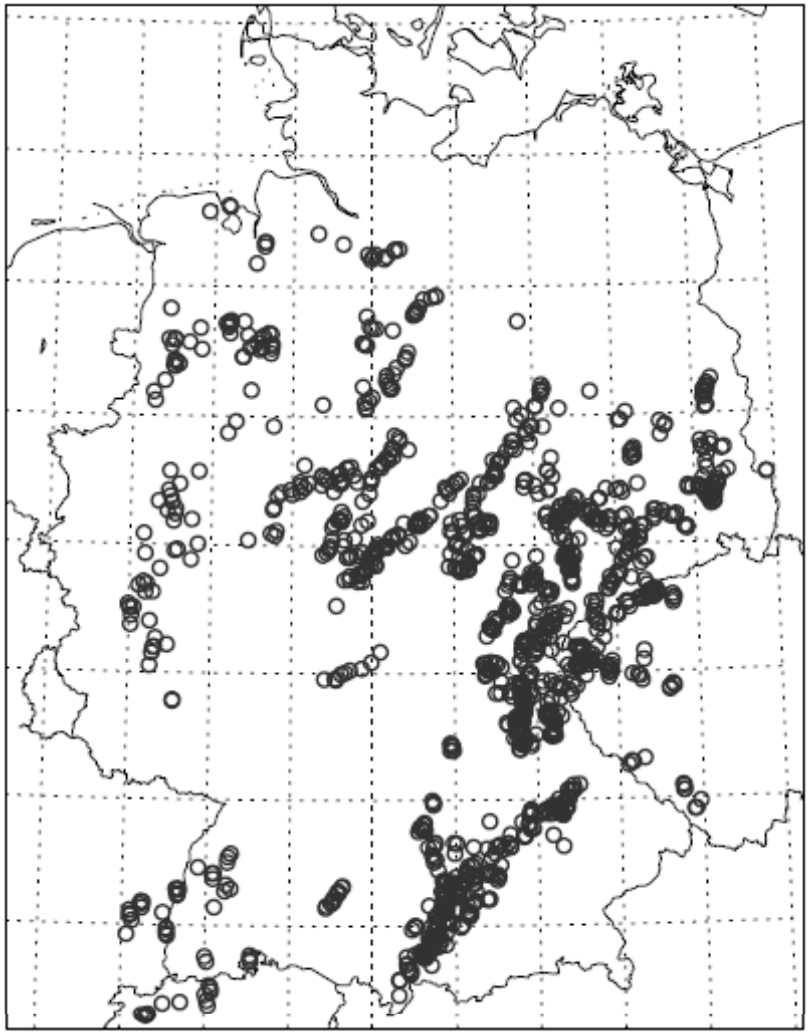


overshooting tops
(data provided by M. Setvak, M. Radova, CHMI)

Hail storms in central Europe: 20 June 2013



ESWD reports
(figure: www.eswd.eu)



overshooting tops
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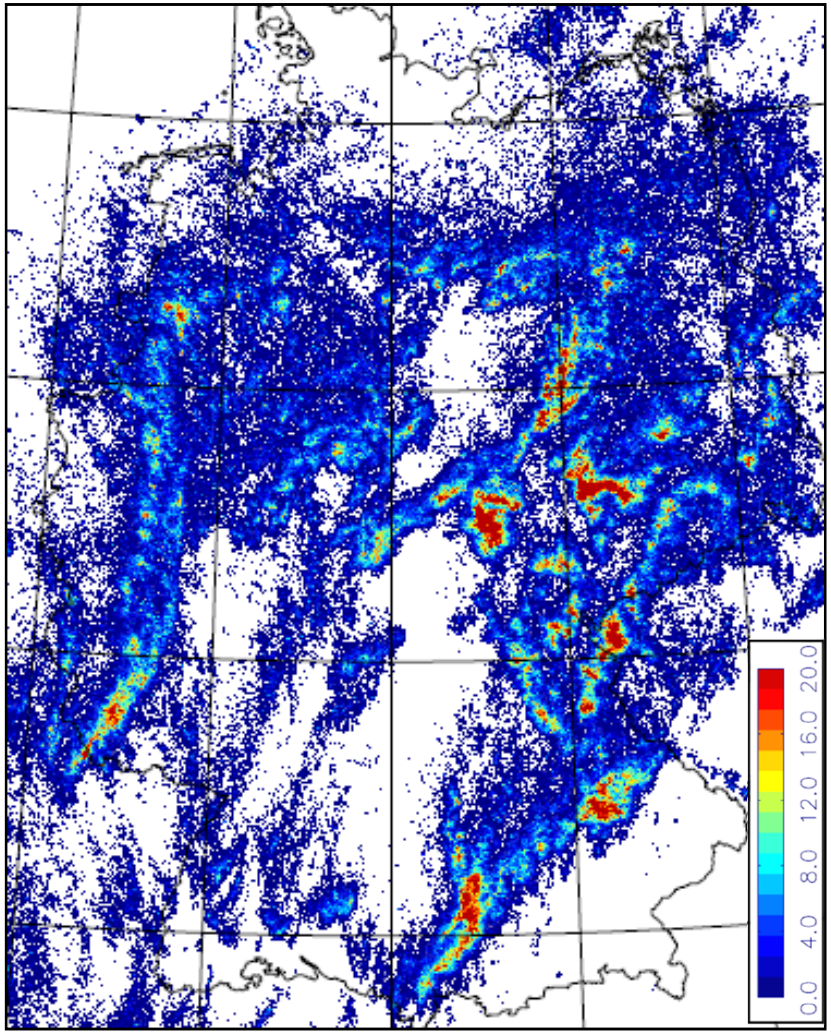
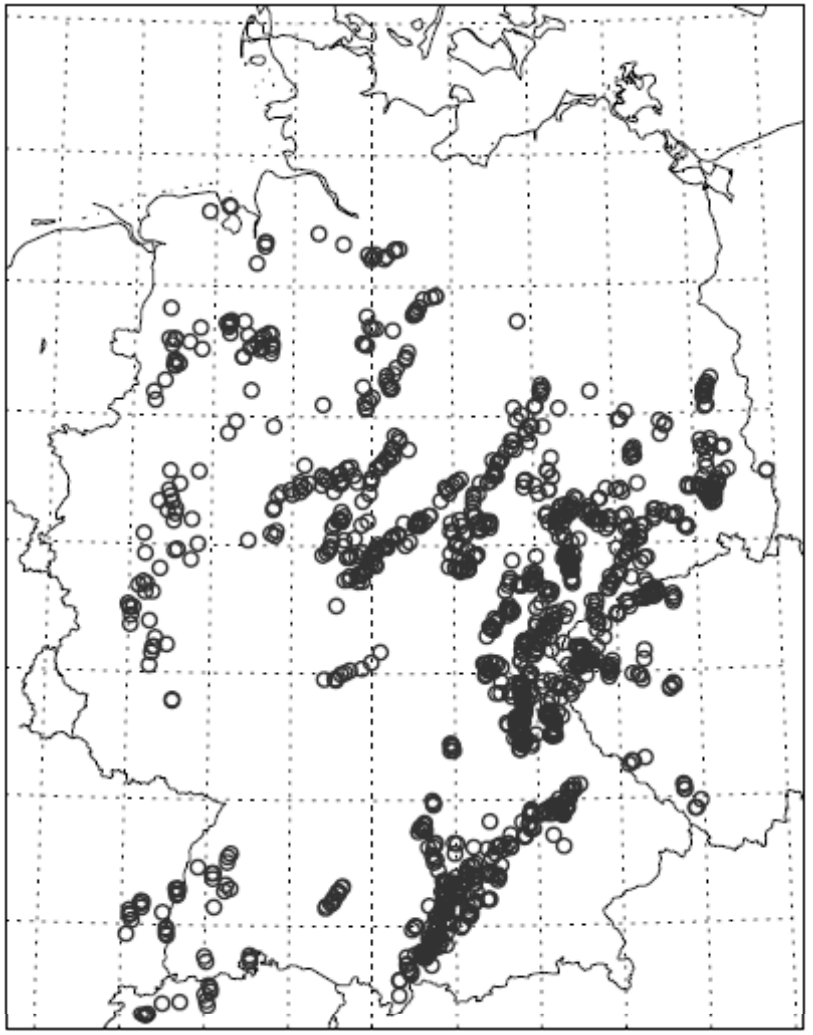
Hail storms in central Europe: 20 June 2013

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Lightning stroke density (1 / km² / day)

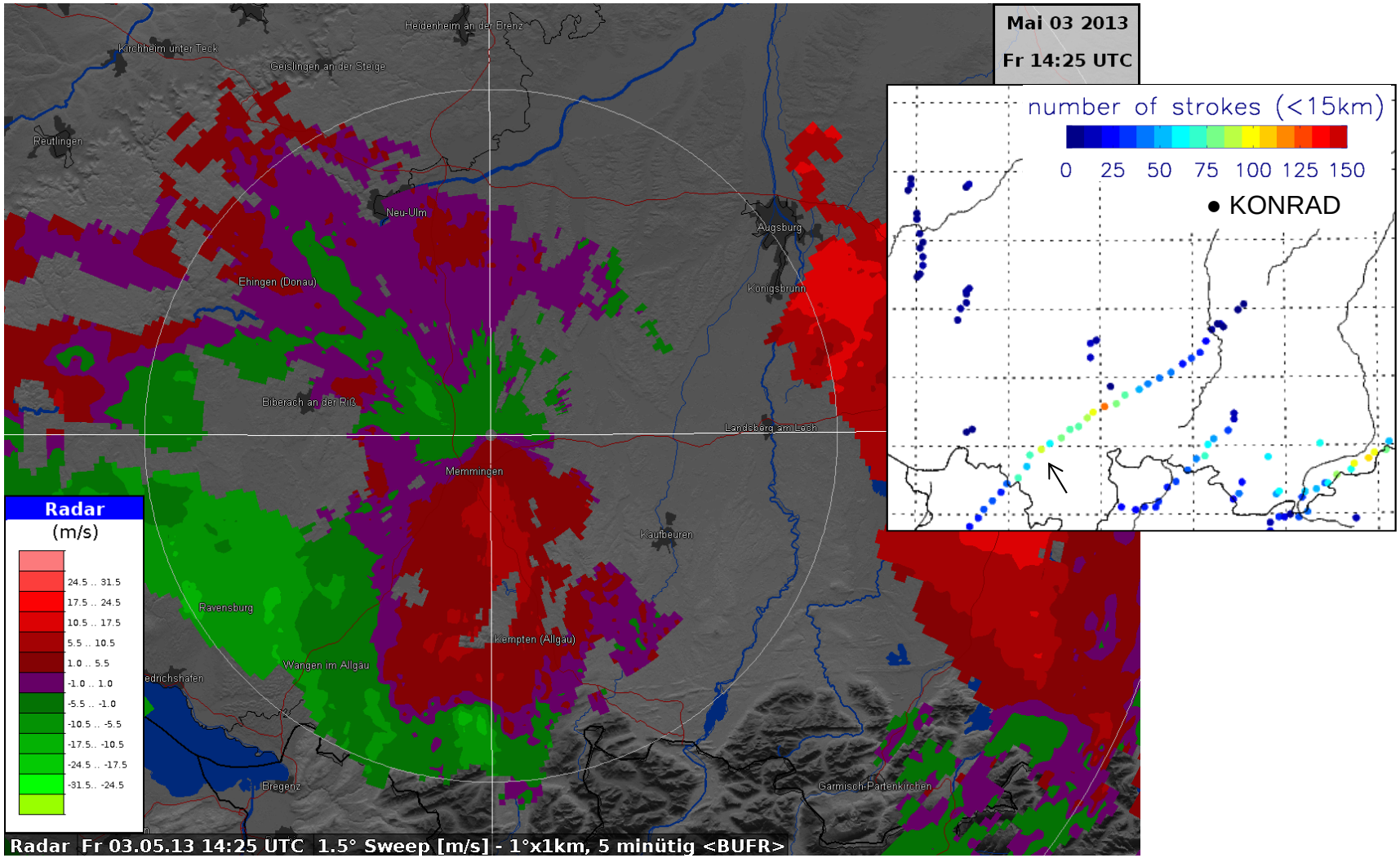


overshooting tops
(data provided by M. Setvak, M. Radova, CHMI)

Hail storm in Allgäu: 03 May 2013

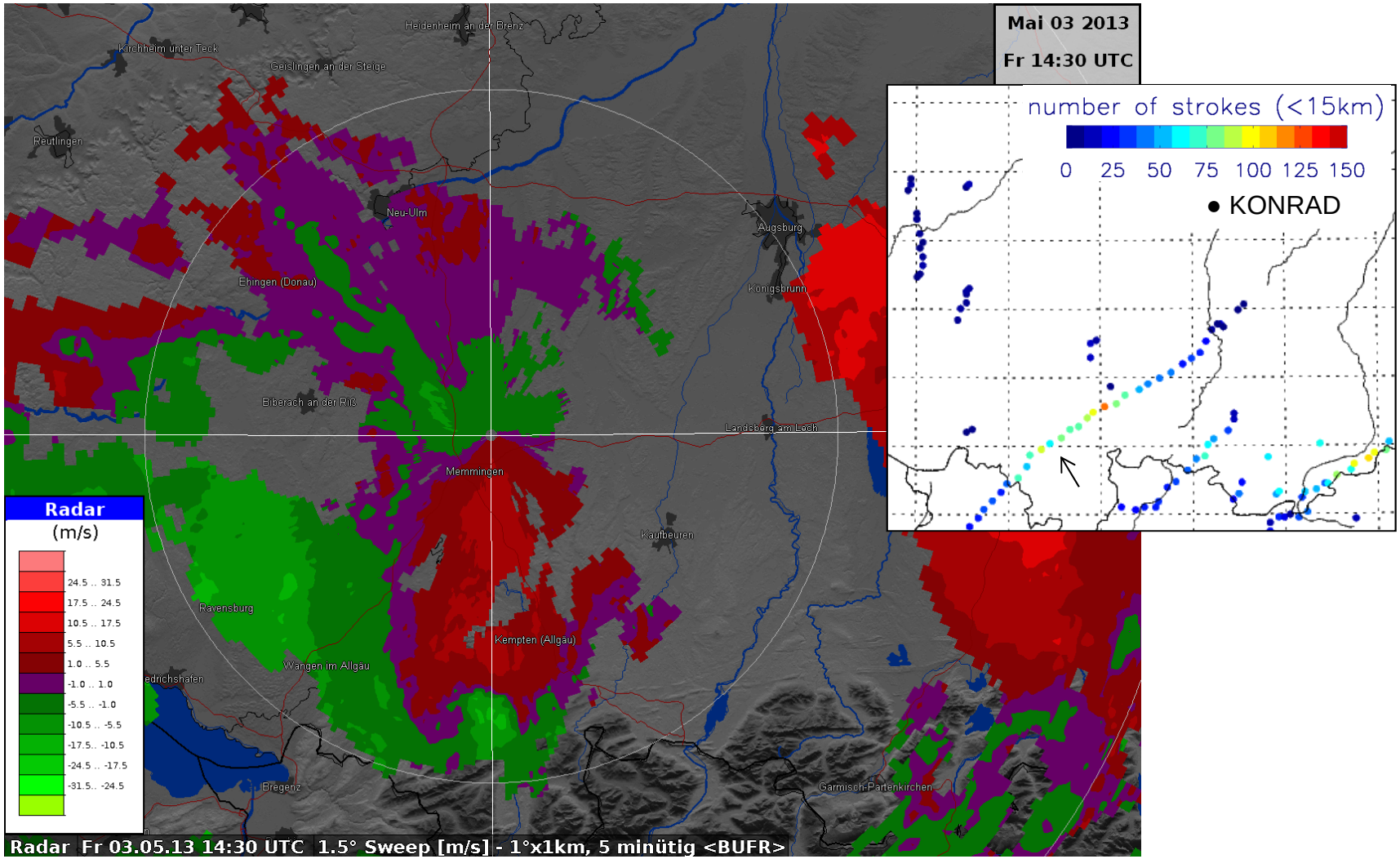
Hail storm in Allgäu: 03 May 2013

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Hail storm in Allgäu: 03 May 2013

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Hail storm in Allgäu: 03 May 2013

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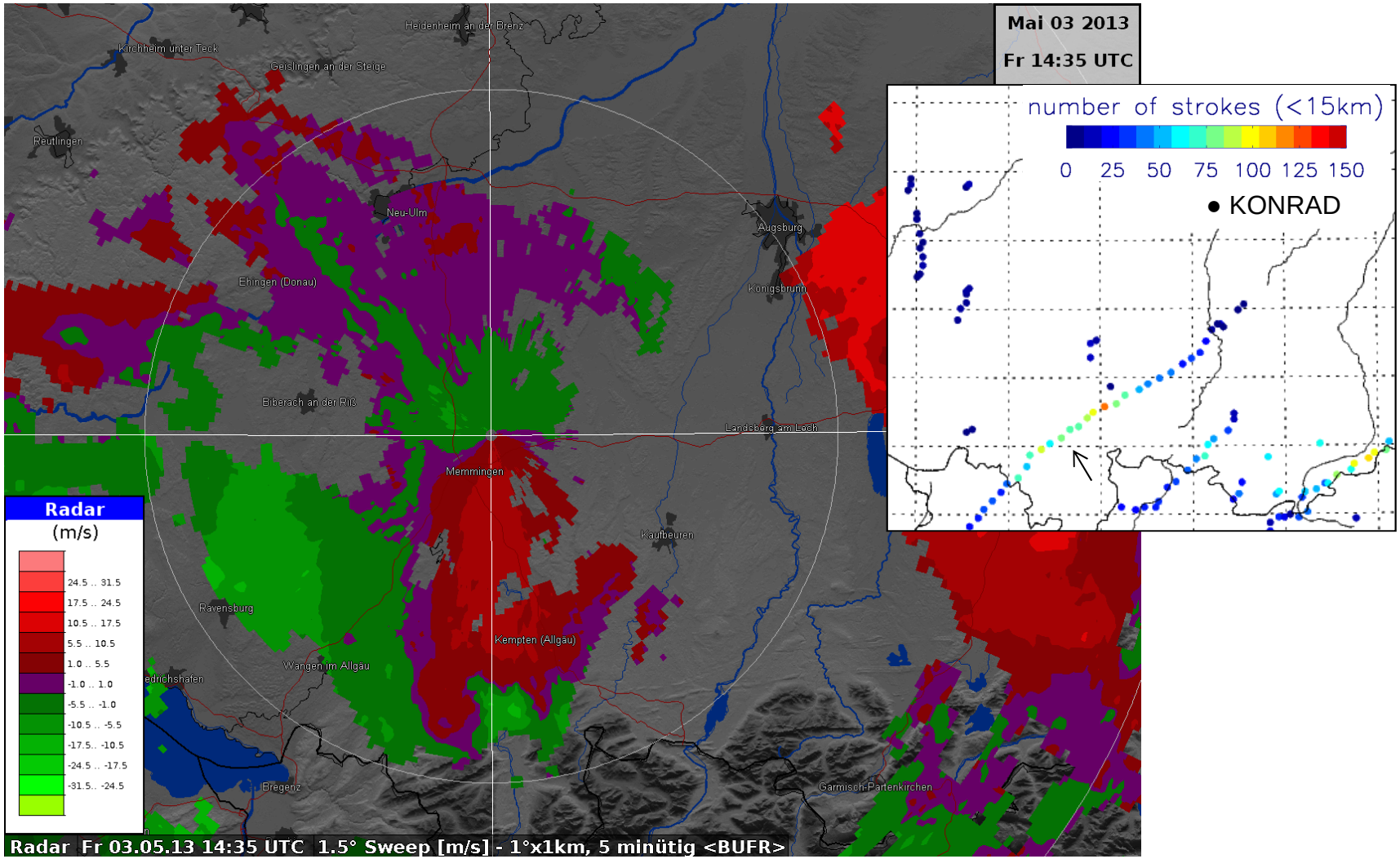
Wetter und Klima aus einer Hand



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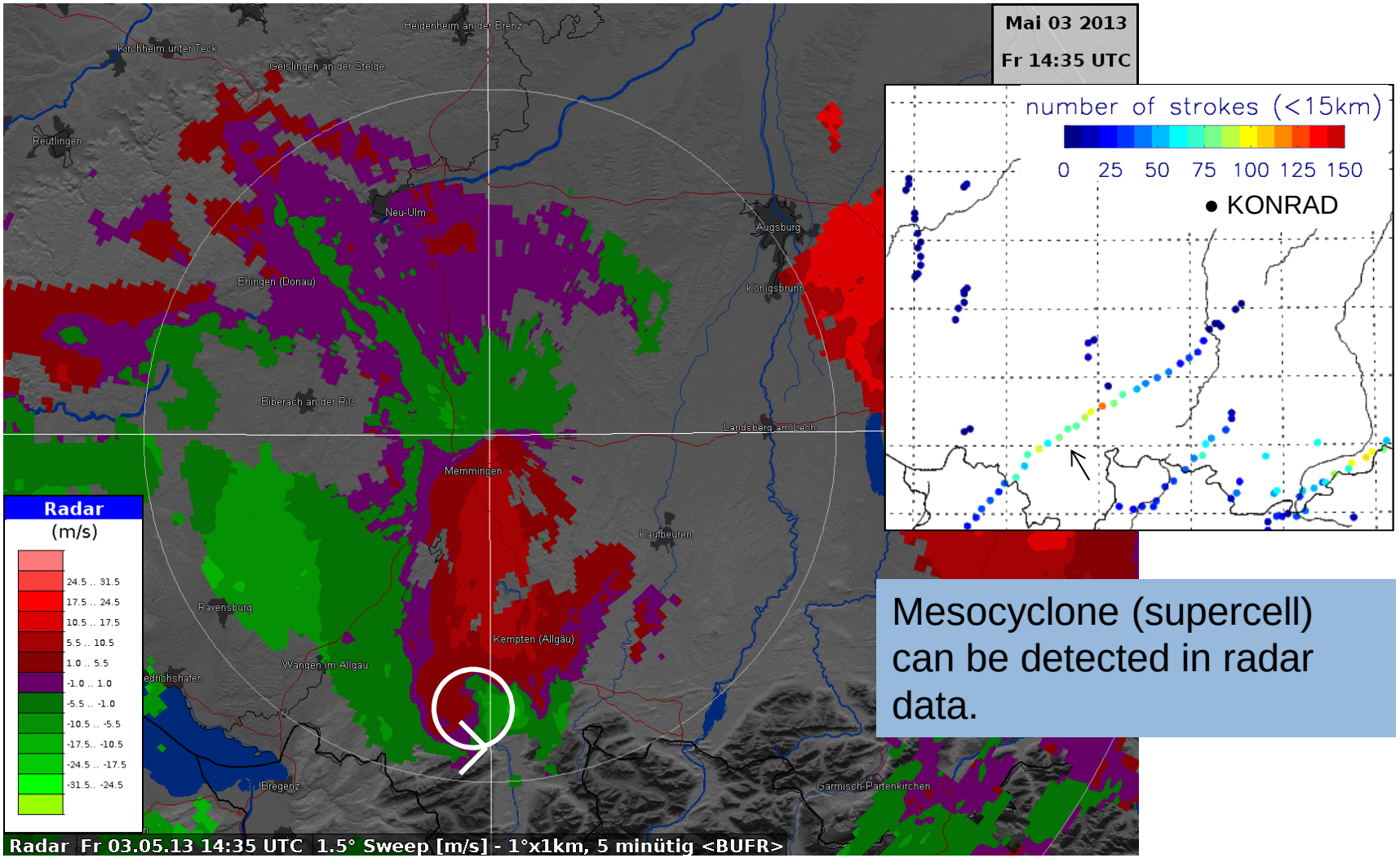
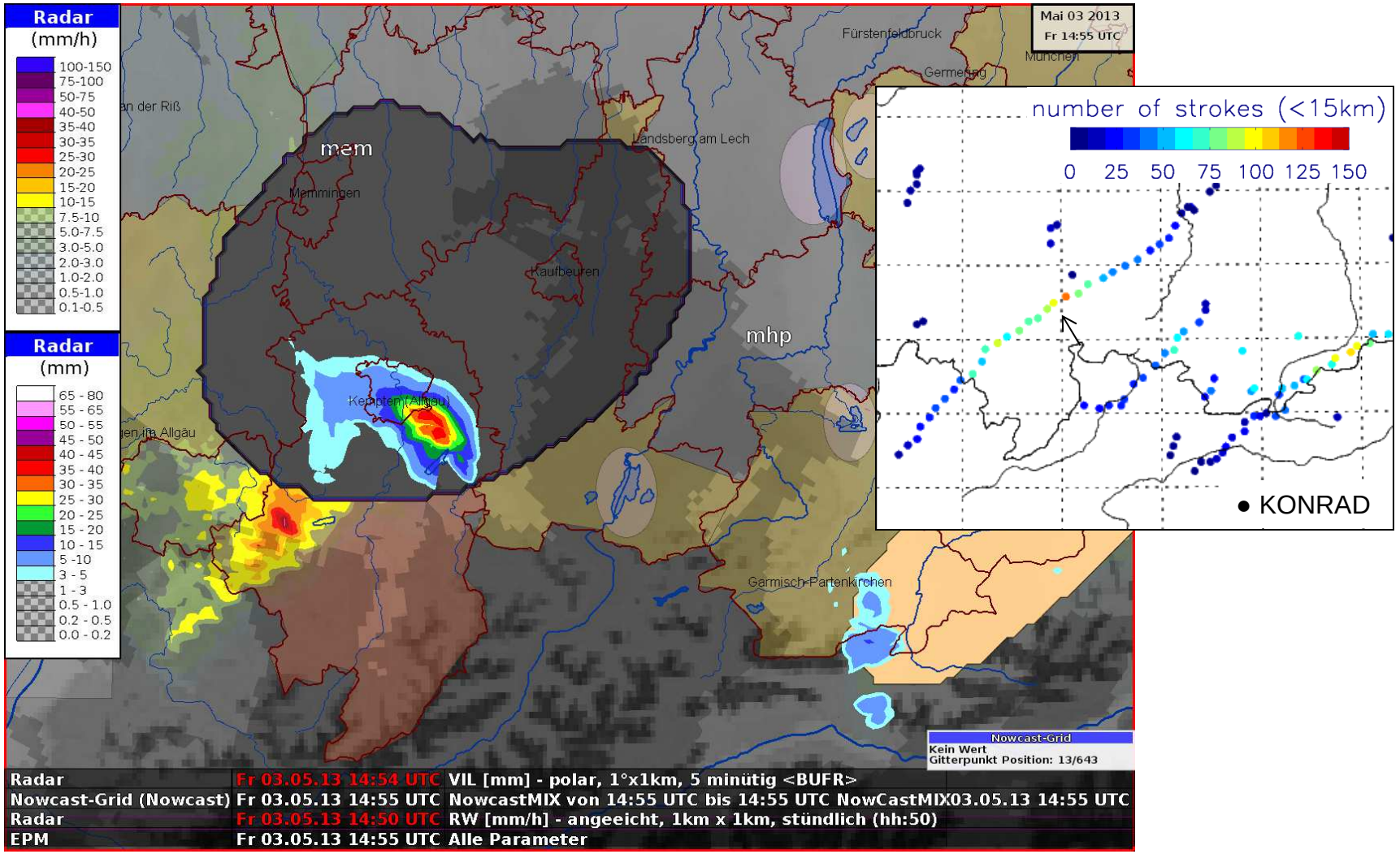


Mesocyclone (supercell) can be detected in radar data.

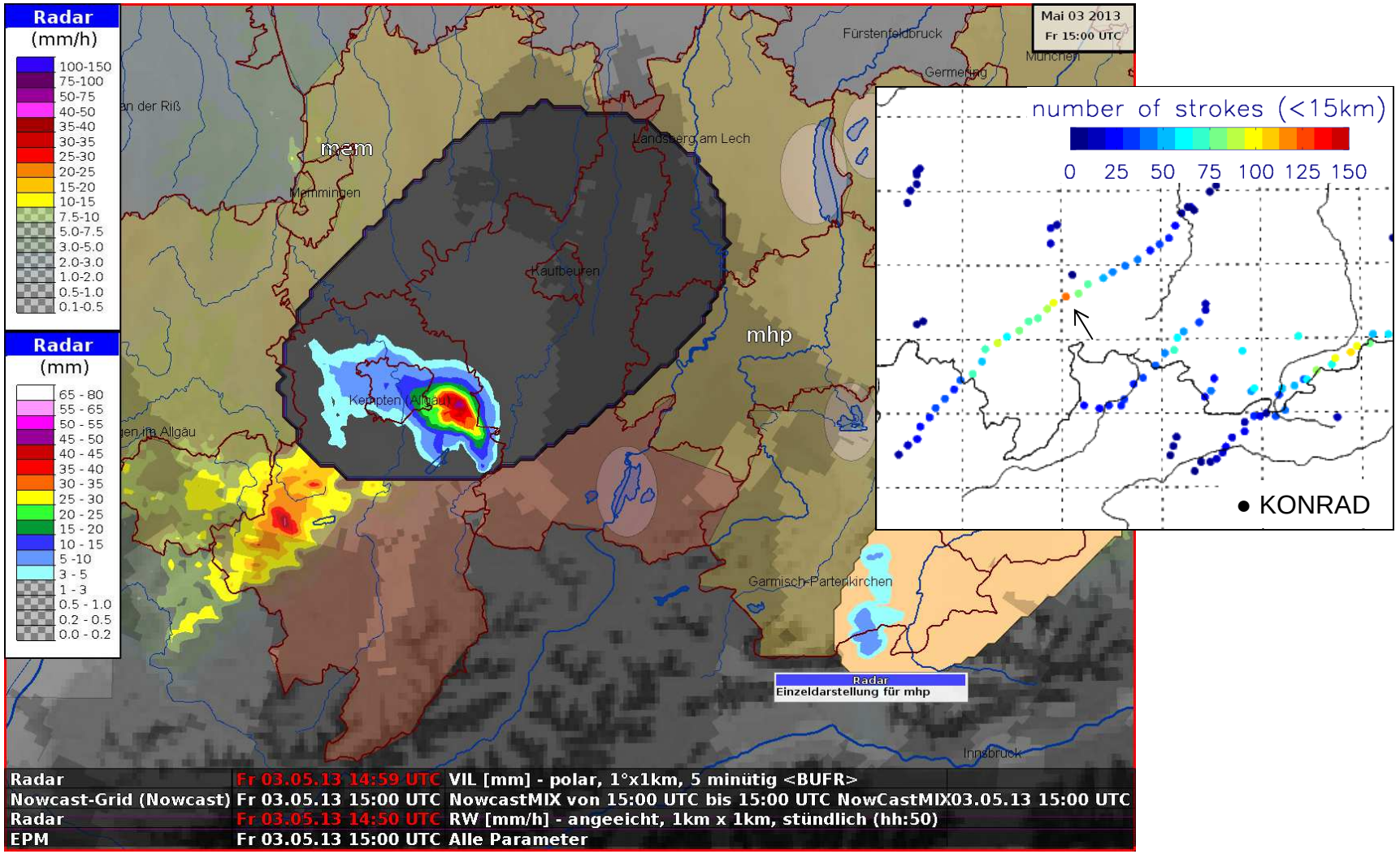
Hail storm in Allgäu: 03 May 2013

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Hail storm in Allgäu: 03 May 2013

Deutscher Wetterdienst
Wetter und Klima aus einer Hand



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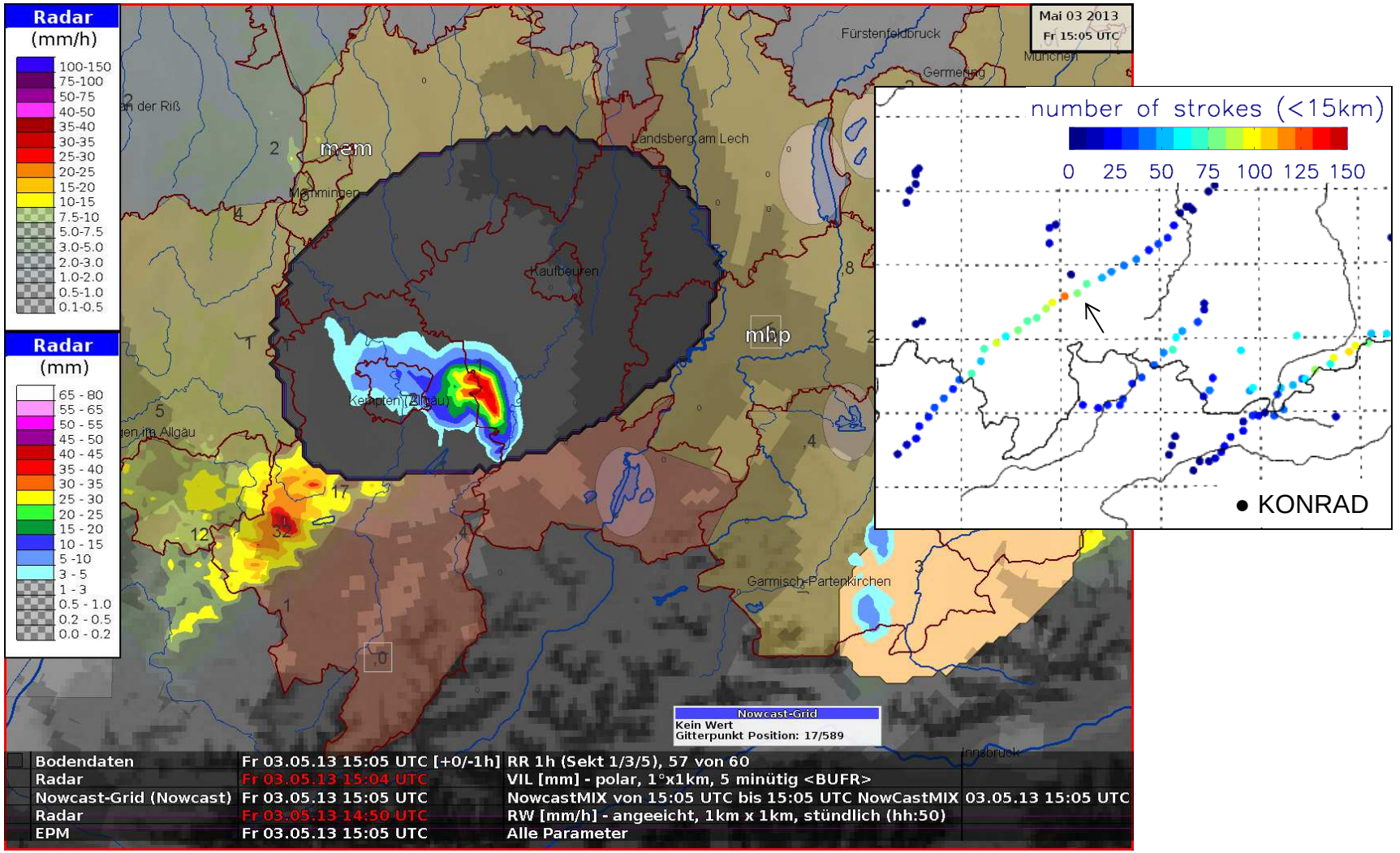
Wetter und Klima aus einer Hand



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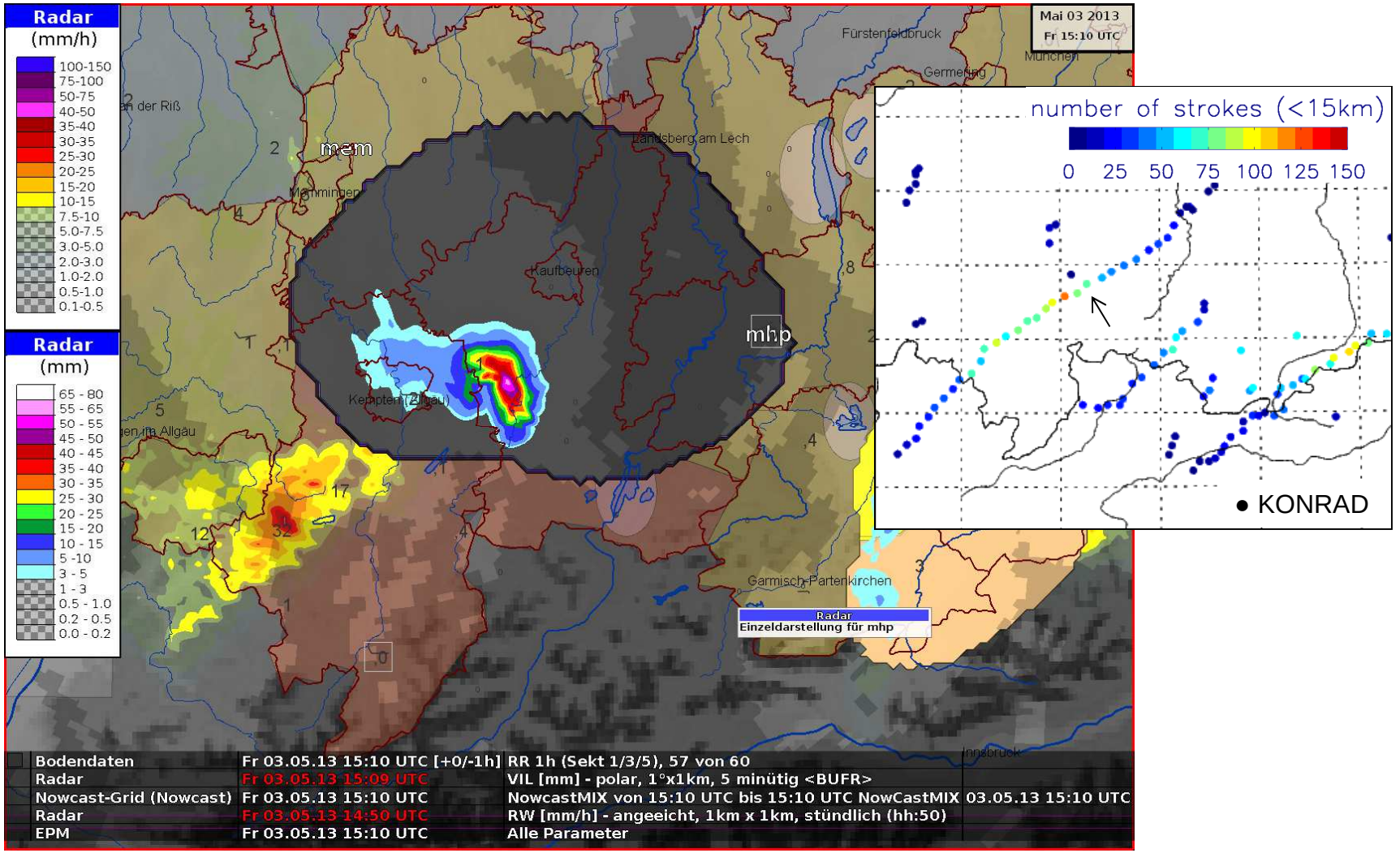

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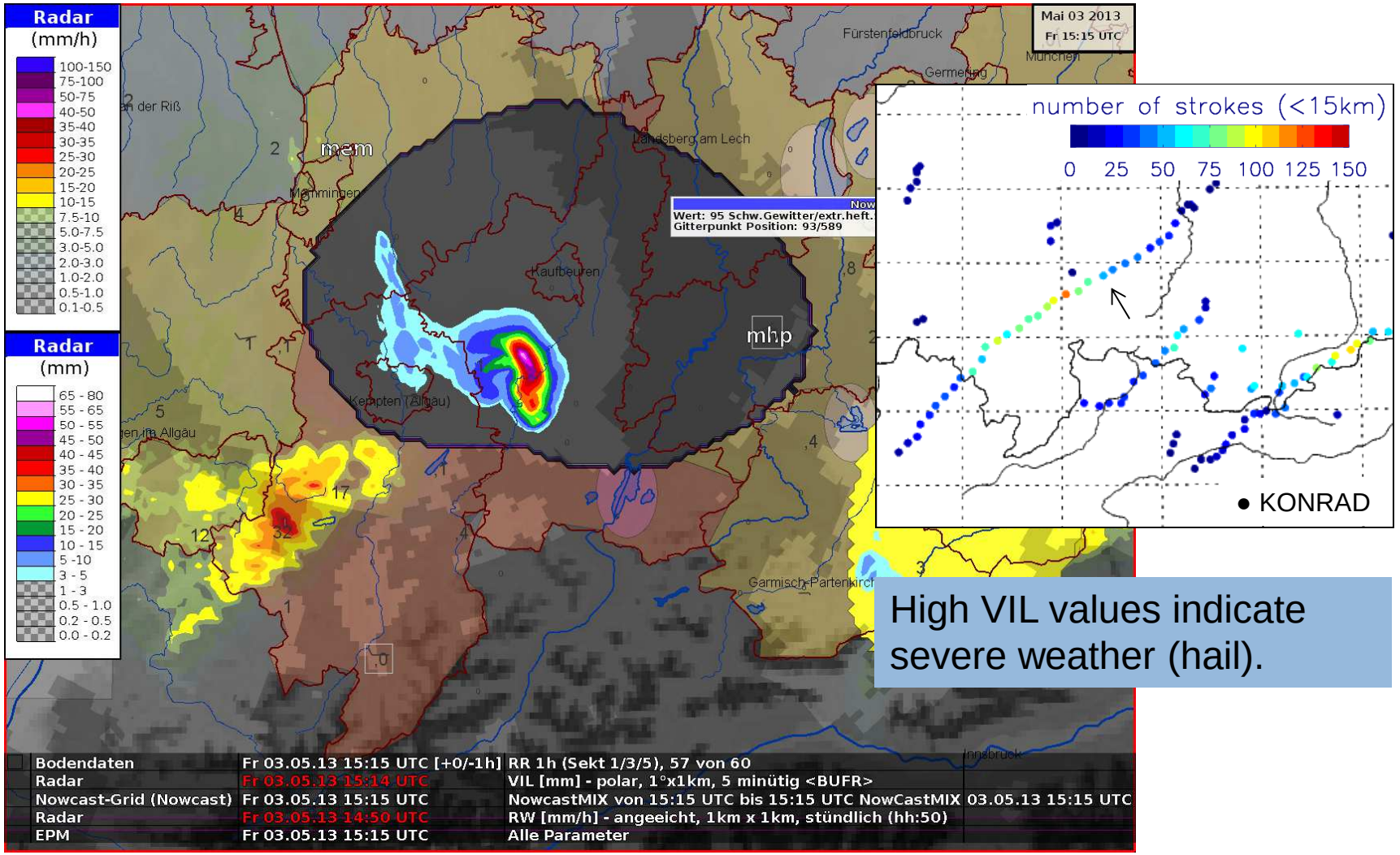
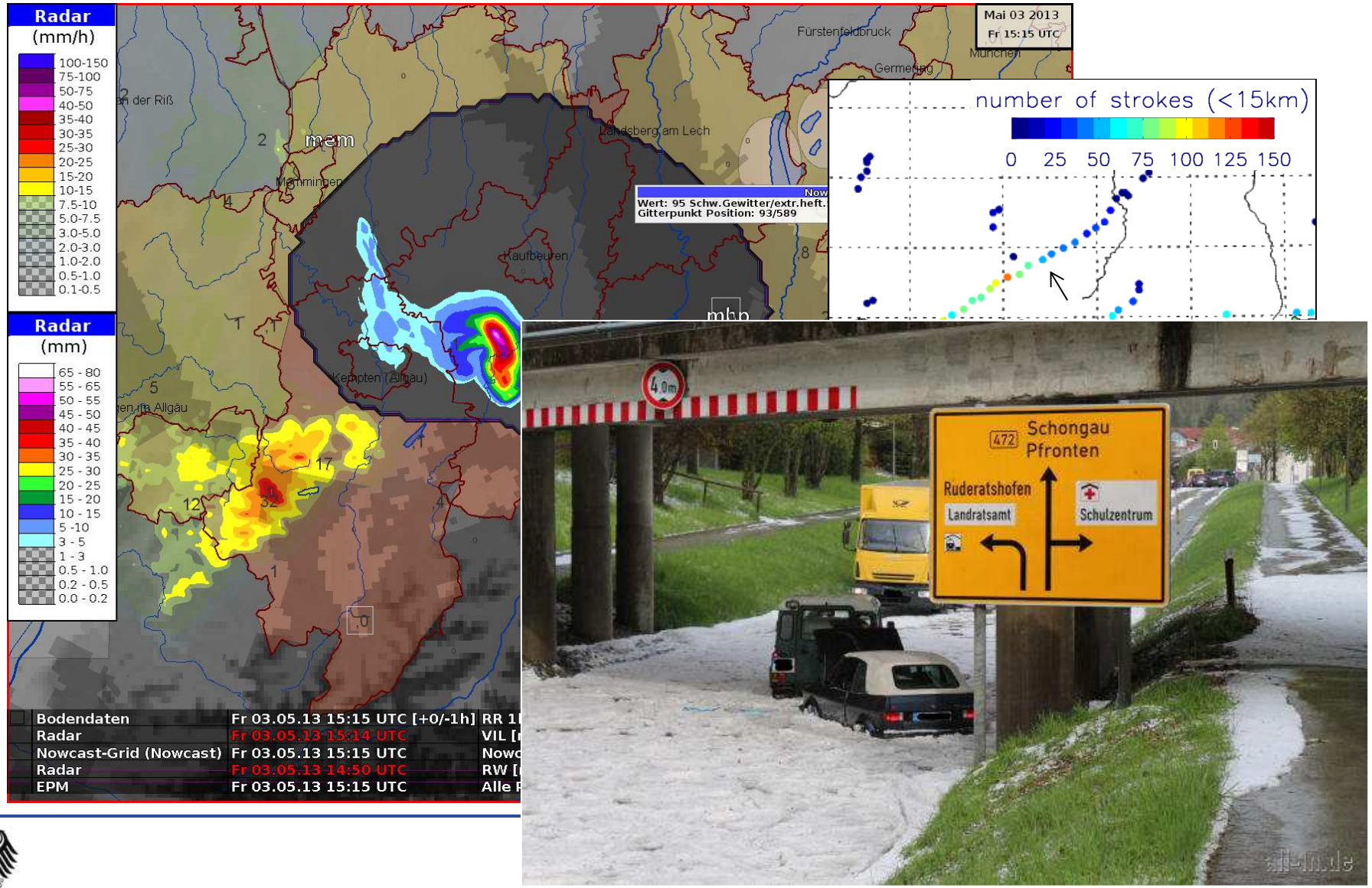


High VIL values indicate severe weather (hail).

Hail storm in Allgäu: 03 May 2013

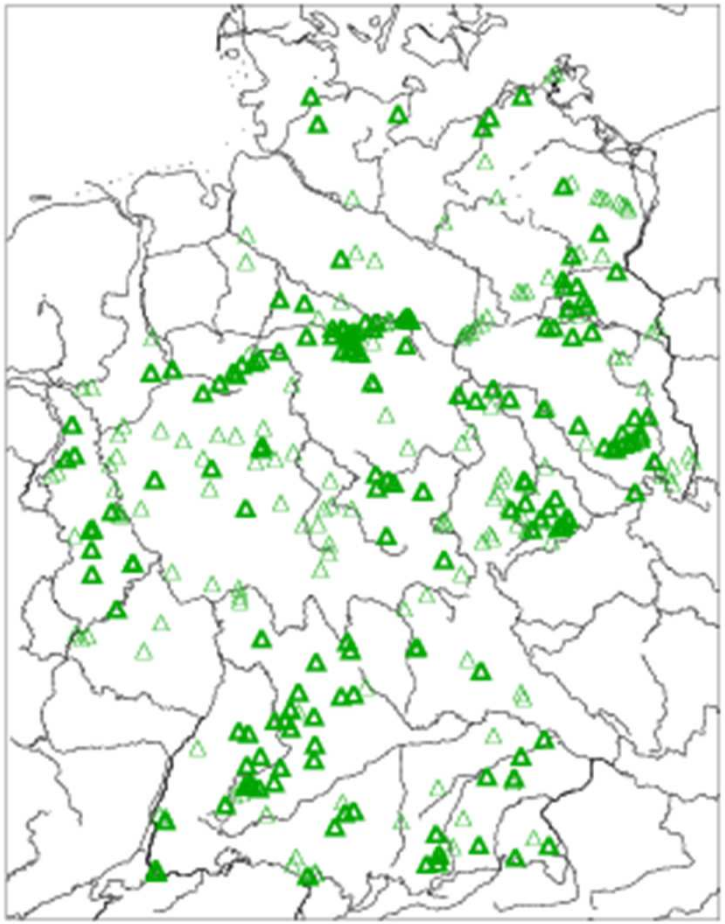
Deutscher Wetterdienst
Wetter und Klima aus einer Hand



Mesocyclone statistic

- April to September 2012, 2013 and 2014
- ESWD hail events with QC1 or QC2
- 286 **hail events** on 75 days:

  48% associated with mesocyclone detected in radar data (within 10 km and 10 min)



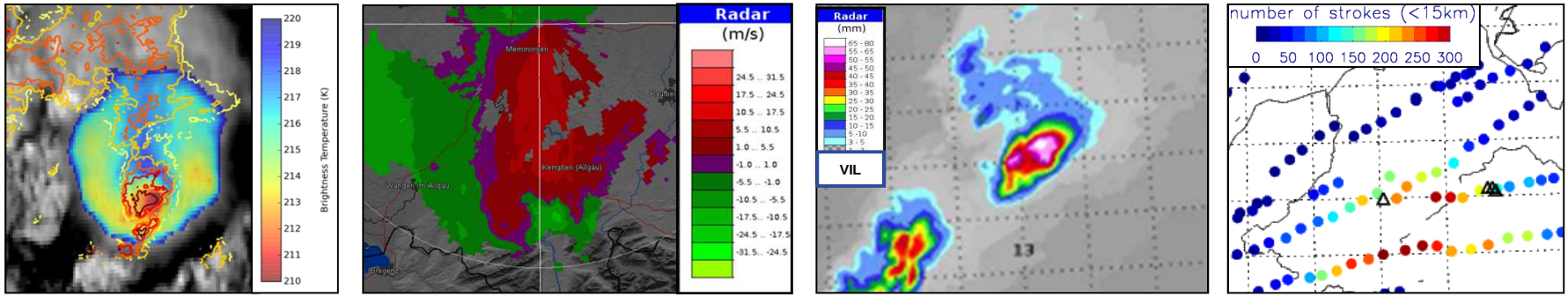
ESWD hail reports 2012-2014
with/without mesocyclone

Wapler, K., Hengstebeck, T. and P. Groenemejier (2016): Mesocyclones in Central Europe as seen by Radar. *Atmos. Research*, 168, 112-120.

Summary

Case studies and statistical analyses

- Satellite signatures like *cold U* and *overshooting tops* indicate severe weather.
- Half of all hail events associated with mesocyclone.
- Hail cells have high values of VIL, VIL density and echotop.
- Hail cells have high lightning densities,
  lightning jumps precede many hail events.



Interested in more information?

Wapler, K., et al. (2016): Mesocyclones in Central Europe as seen by Radar. *Atmos. Research*, 168, 112-120.
Wapler, K., et al. (2014): Characterisation and predictability of a frontal and a weakly forced severe convective event – a multi-data approach. Meteo. Zeitschrift, *24 (4), 393-410.*

First Announcement:

2nd European Nowcasting Conference

3 - 5 May 2017

Offenbach, Germany

EUMETNET

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

http://www.dwd.de/enc2017

2nd European Nowcasting Conference

EUMETNET

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

3 - 5 May 2017

Offenbach, Germany

Topics include:

- Nowcasting techniques and systems
- Observation and NWP
- Verification and societal impacts
- Application and user support

The conference is organised in the frame of EUMETNET (European Meteorological Network) which includes the project ASIST dedicated to nowcasting.

The scientific program will feature keynote addresses as well as contributed presentations and offer room for discussions.

http://www.dwd.de/enc2017