Forschungszentrum Karlsruhe
in der Helmholtz-Gemeinschaft

Andreas Wieser

PRINCE

Prediction, identification and tracking of convective cells

Photo: Andreas Behrendt

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PRINCE

Prediction, identification and tracking of convective cells

Convection field experiment in the northern Black Forest region during 6th to 21st July 2006 as test for the COPS measurement campaign 2007

Main goals:

- Application of mobile measurement systems for targeted observations of local convective systems
- Coordination of active remote sensing instruments

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- Universität Karlsruhe / Forschungszentrum Karlsruhe (IMK)
  Christoph Kottmeier, Ulrich Corsmeier, …..
- Universität Hohenheim (IPM)
  Volker Wulfmeyer, Andreas Behrendt, ….
- Universität Mainz (IPA)
  Heini Wernli, J. Trentmann, ….
- Technische Universität Braunschweig (IFF)
  Peter Hecker, Rudolf Hankers, …

Financed by:

COSI TRACKS
Convective Storms Virtual Institute
An Initiative of six Helmholtz-Centers

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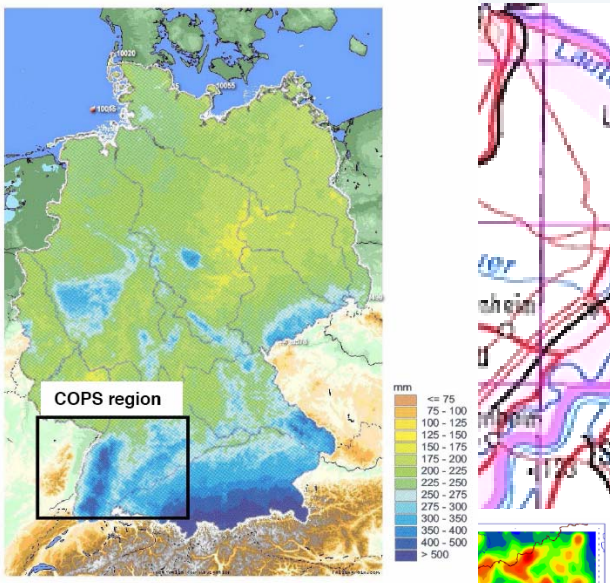
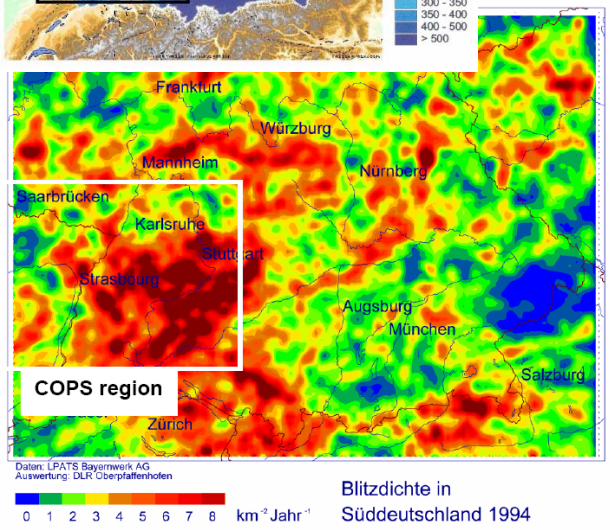
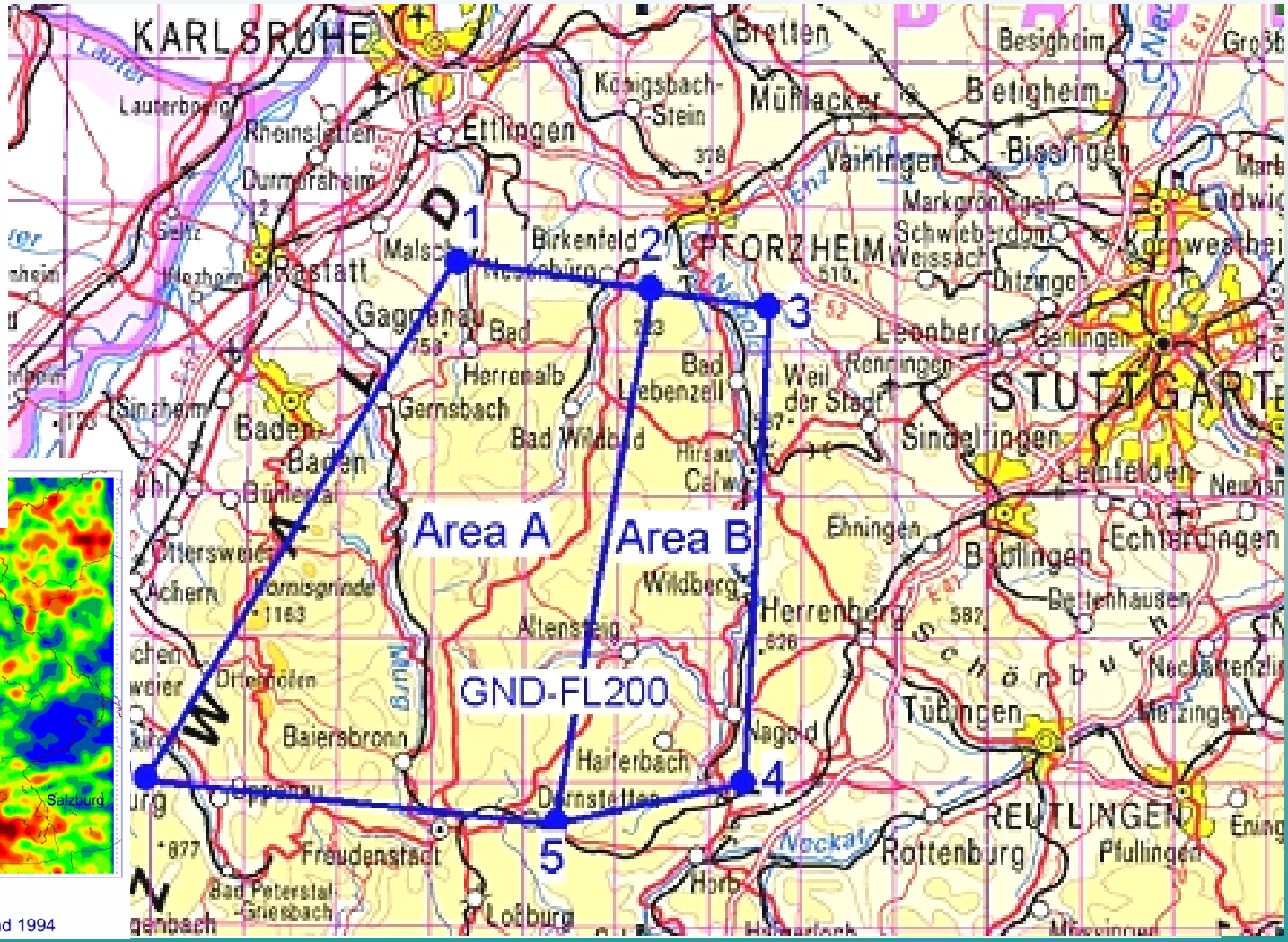
PRINCE measurement region







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PRINCE Alarm and Soluton Tower
@ University of Karlsruhe

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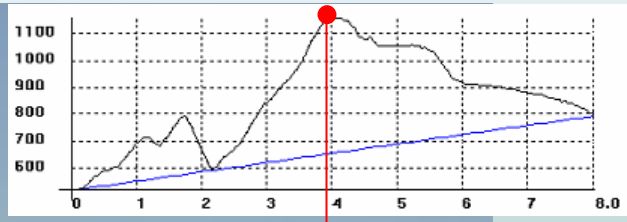
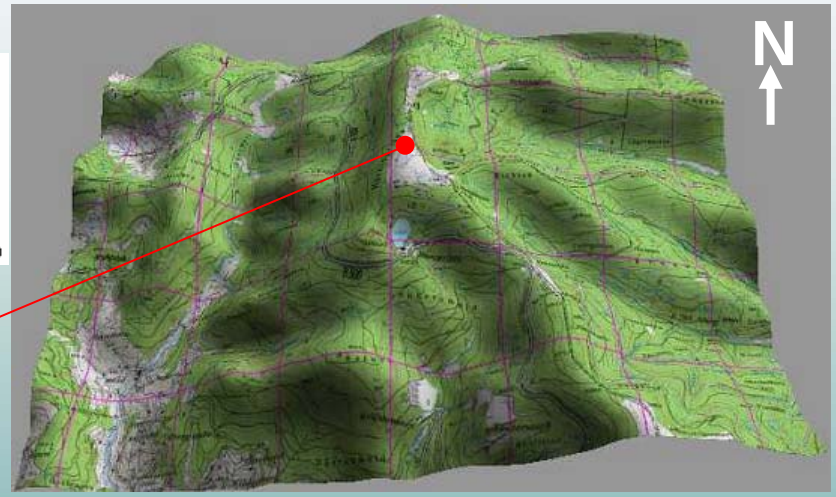
Fixed measurement systems:

Cross section W-E



Lidar site (1161 m, asl)



Hornisgrinde:

- Raman Lidar , IPM
- X-Band Radar, IPM
- Cloud Radar, IMK
- Doppler-Lidar, IMK

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Fixed measurement systems:

Brandmatt:

•Radiosondes (IMK)

 Color Photos: Philipp Reutter

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Fixed measurement systems:

Leopoldshafen

- C-Band Radar (IMK)

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Mobile measurement systems:

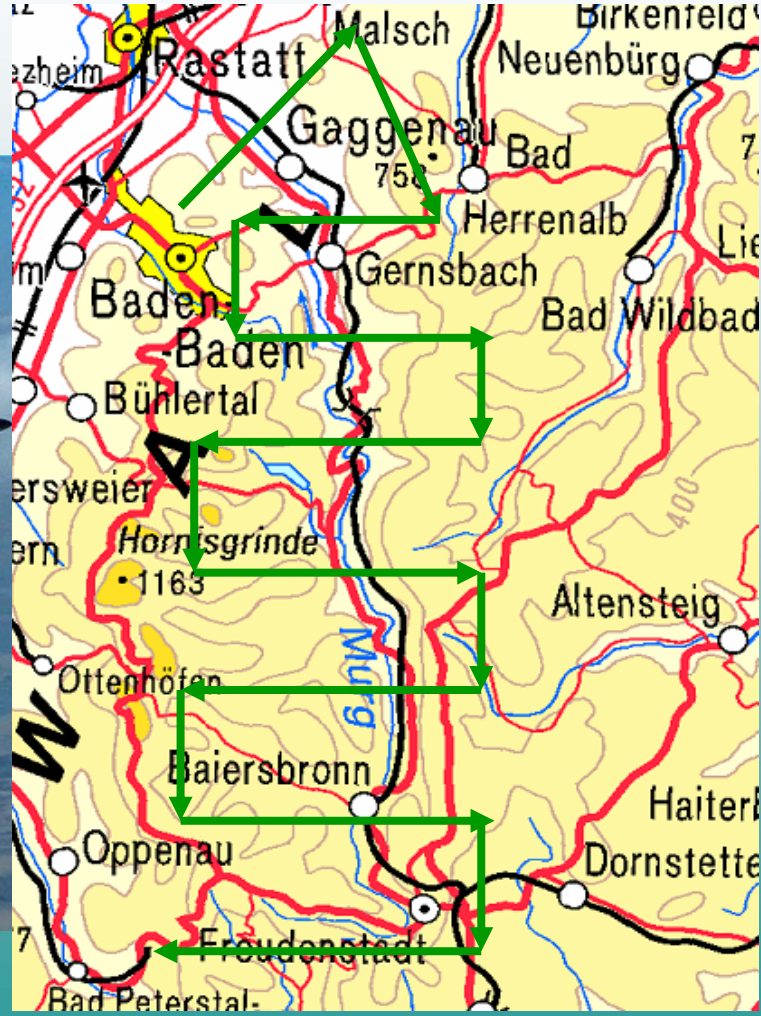
Aircraft (Dornier 128-6, D-IBUF)

In situ measurements:

- pressure, temperature, humidity, wind

Photo: IFF

+ dropsondes



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Mobile measurement systems:

4 mobile Teams with tower and drop-upsondes

Tower:

- temperature
- relative humidity
- pressure
- wind
- precipitation

Photos: unknown

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Mobile measurement systems:

4 mobile teams with tower and drop-upsondes


Photo: Holger Mahlke


Photo: Holger Mahlke


Photo: Holger Mahlke

Drop-upsonde

- temperature
- humidity
- pressure
- position
- brightness


Photo: unknown

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- Reusable sondes developed at the IMK
- Usable as dropsondes (aircraft) or drop-upsondes (balloon)
- Local storage of measurement data (temperature, humidity, pressure, wind, brightness)
- Sends text messages via GSM mobile phone system with position data below a selectable minimum height for recovery
- Dimensions and weight: 20 cm x 30 cm x 15 cm, 950 g
- First intensive use of a large number of these sondes

Benefits:

- Higher accuracy compared to standard radiosondes
- Reusability reduces costs
- No telemetry – unlimited number of sondes in the air without interference

Drawbacks:

- No real time data online available – lost sonde means lost data!
- Launches must be approved by air traffic control

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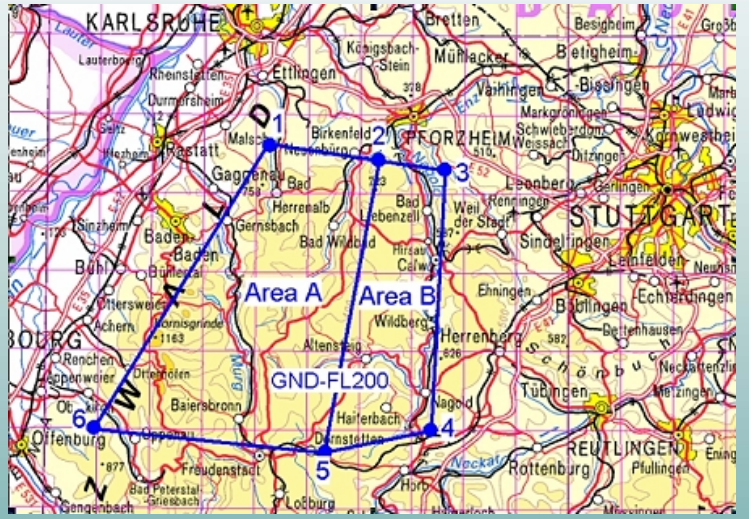
PRINCE Stationsbuch



Predefined stations for mobile teams

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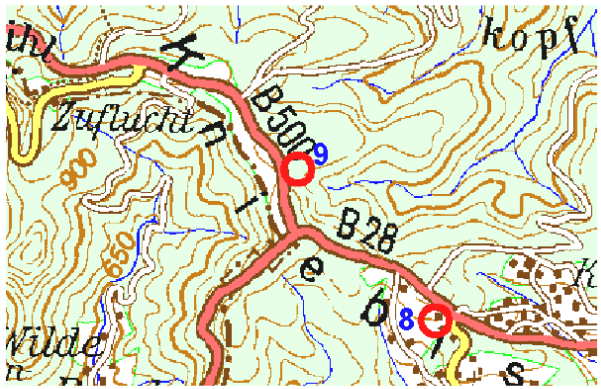
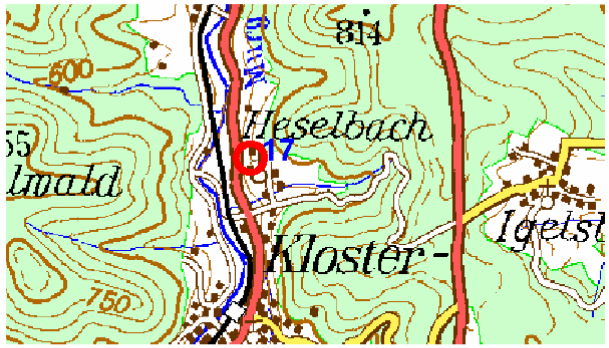
Station 9 – Parkplatz „Zimmerholz



Station 9

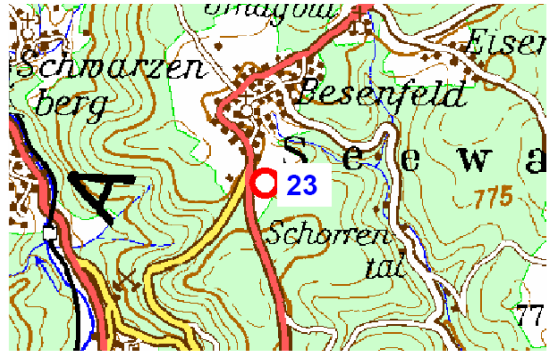
Station 17

Station 17 – Parkplatz „Karl-Transporte“



Station 23

Station 23 – Wiese



Photos: IMK

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- 10th to 21st July: daily weather forecast, availability of all involved staff
- Continuous measurements at ground stations
- Intensive observation periods with aircraft:
  IOP1/2: 11.7./12.7.
  IOP3/4: 19.07./20.7.
- During IOPs: Short term forecasts and coordination of mobile teams in **PRINCE Alarm and Solution Tower (PALAST)**, University Karlsruhe
- Students from University Mainz lodged in Terrassenpark Brandmatt

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Wettervorhersage von Montag, 10. Juli 2006

Tomorrow, Tuesday, 11.7.2006
During the morning mid altitude clouds which will disappear later during the day – then temperatures reaching 34 to 35 deg. in the Rhine valley. Convective clouds over the Black Forest in the afternoon with cloud bases rising from 2000 m to 2300 m. Convective clouds over the Rhine valley later during the day. **In the evening isolated thunderstorms over the Black Forest possible.**

Wednesday, 12.7.2006
Initially some low and mid altitude clouds. During the day increasing **shower and thunderstorm activity**. Hard to estimate intensity and occurrence at this moment.

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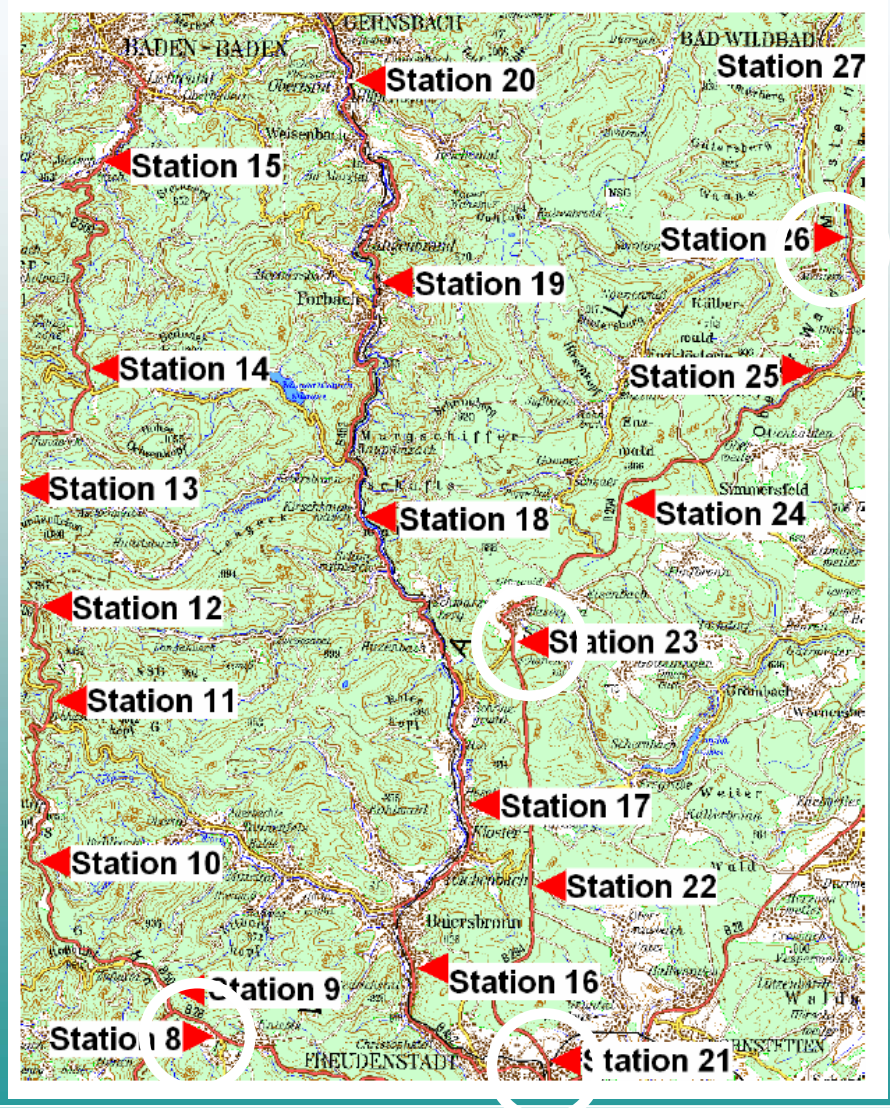
IOP1: Tuesday, 11.7.2006
- 4 mobile teams
- 2 flights with D-IBUF



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IMK Rain Radar, 12 – 18 h

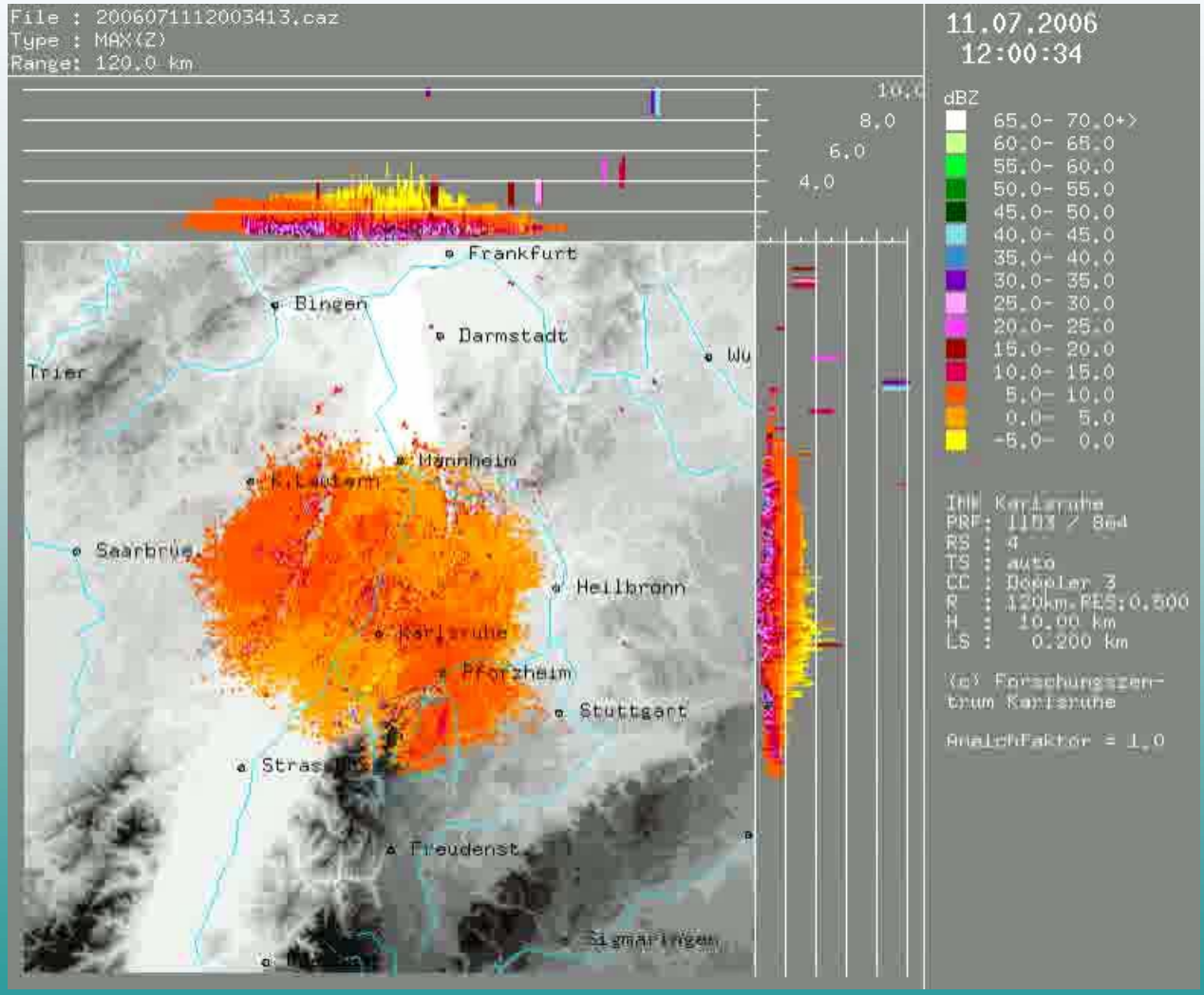

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Photo: Andreas Behrendt

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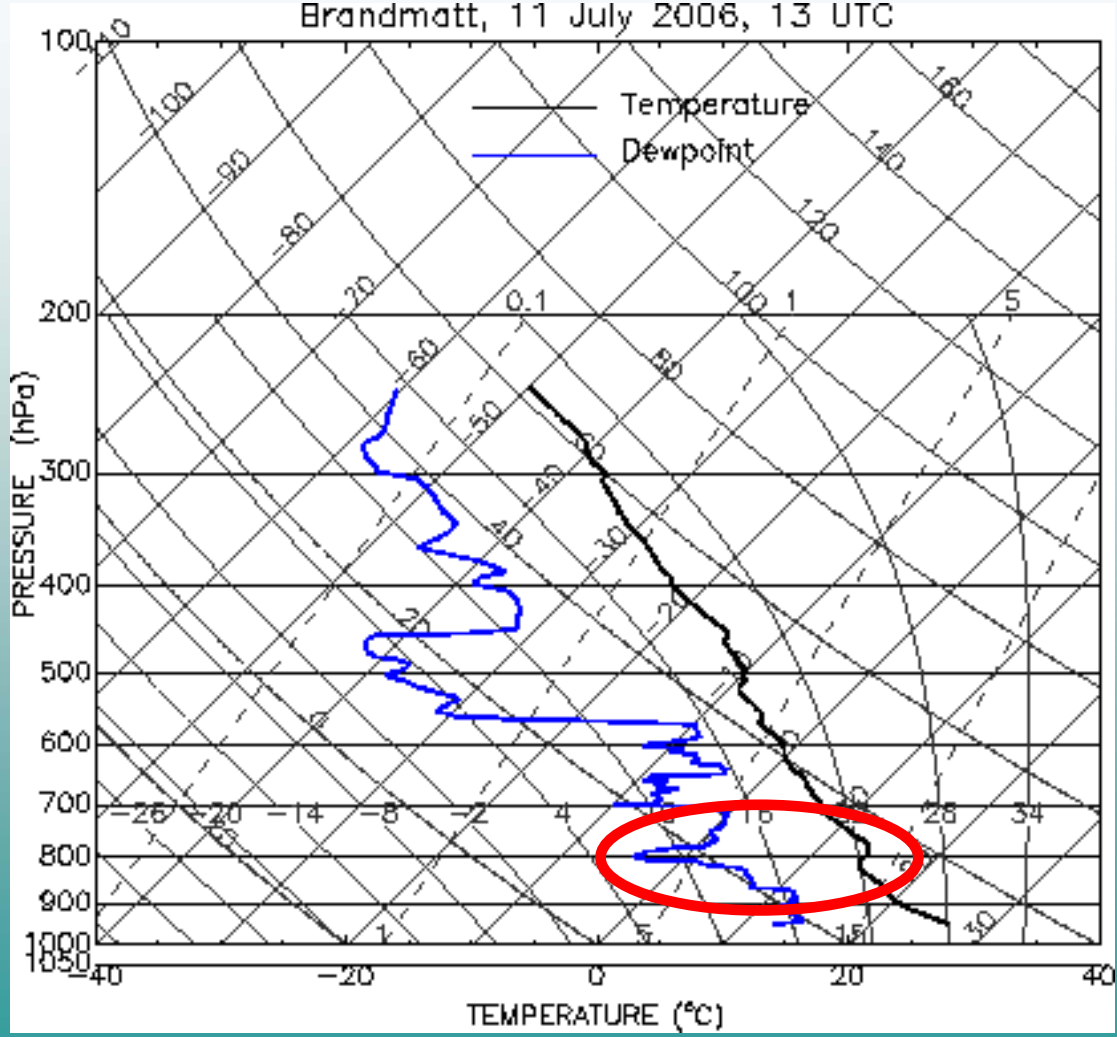
Radiosonde
Brandmatt
11 July 2006



CAPE: n/a
CIN: 140 J/kg
Lifted Index: -1 K

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Measurements 11 July 2006

- 4 radiosondes @ 10, 13, 16 and 19 h UTC
- 2 flights with D-IBUF (2 x mattress pattern, 3 drop sondes)
- 3 mobile towers starting measurements at 16 h
- 4 drop-upsondes at 19 h

Photos: Holger Mahlke

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IMK Rain Radar, 18 – 21 h

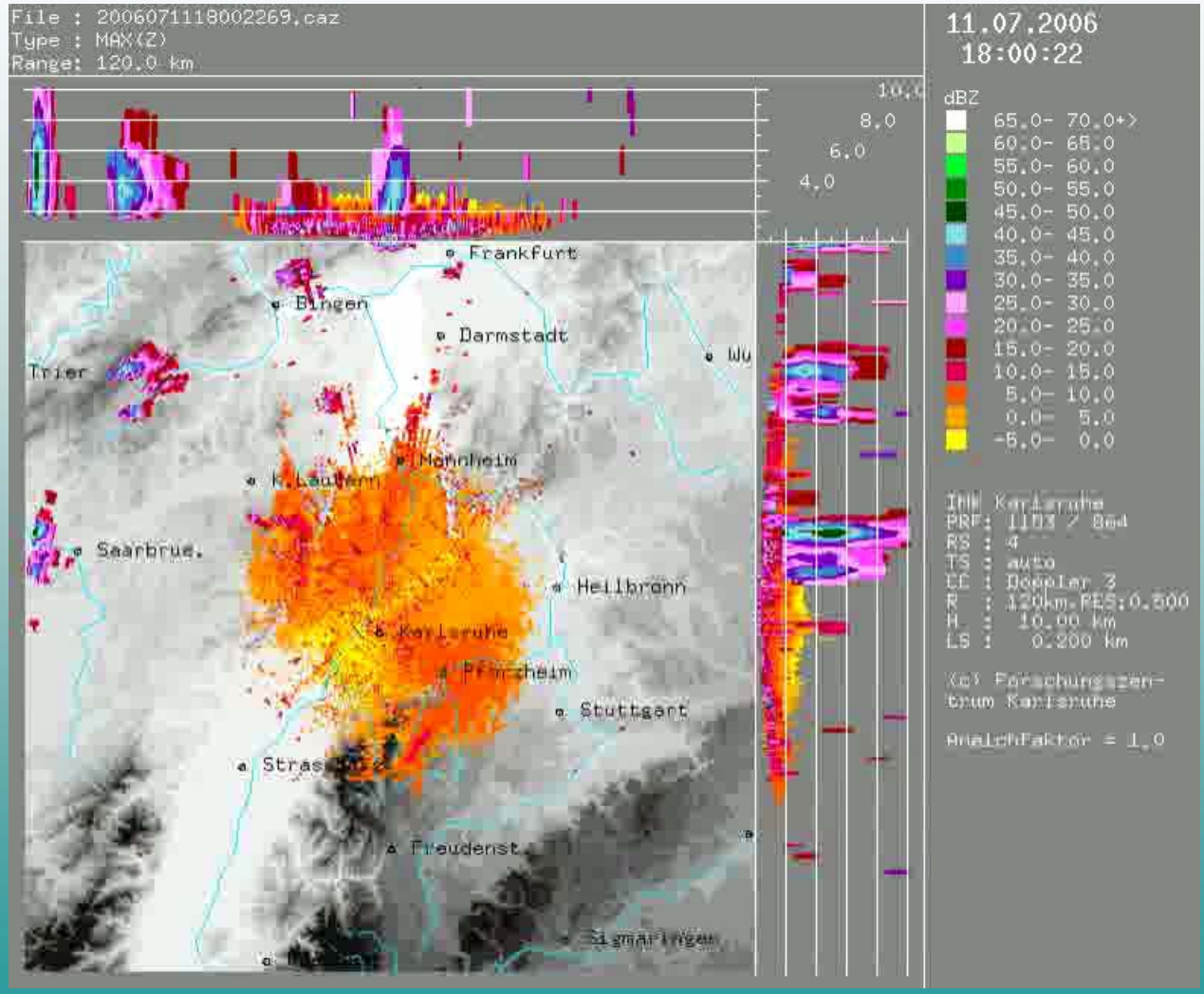

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Photo: Philipp Reutter

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IOP2, Wednesday 12. July 2006

Forecast valid for Wednesday

Today, Wednesday, 12.7.2006
Initially in the Karlsruhe region and westerly rests of thunderstorms, elsewhere nice and dry.
During the day formation of cumulus clouds, later, starting at noon, showers and thunderstorms. It is impossible to predict preferred regions. Isolated mostly stationary convective cells with hail will develop.
Warm and sticky conditions with 31 deg. In the Rhine valley.

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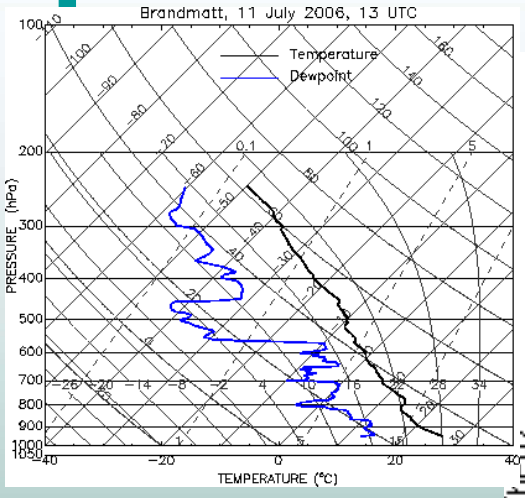
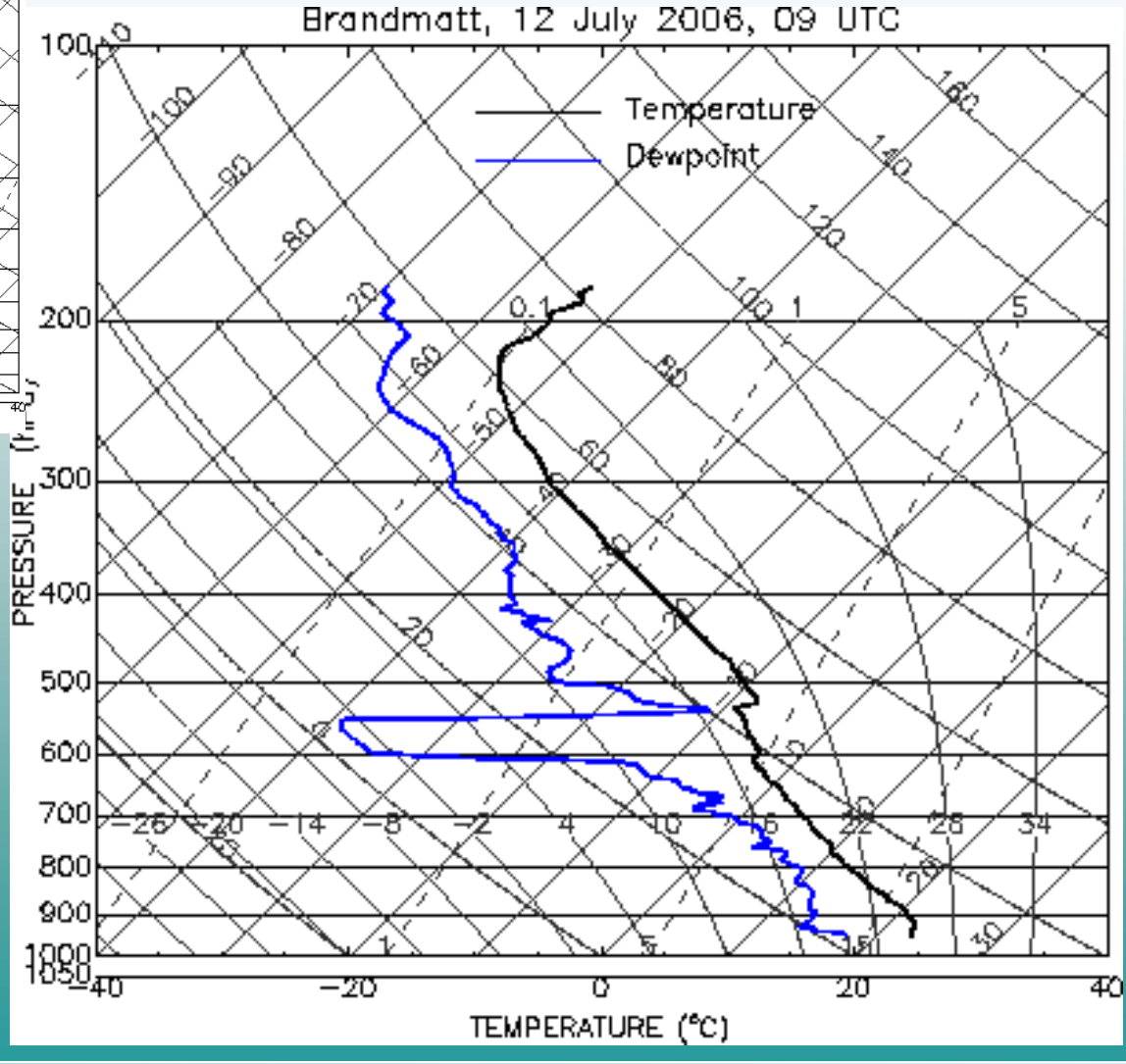


Radiosonde Brandmatt 12 July 2006

CAPE: 1960 J/kg
CIN: 70 J/kg
Lifted Index: -4 K



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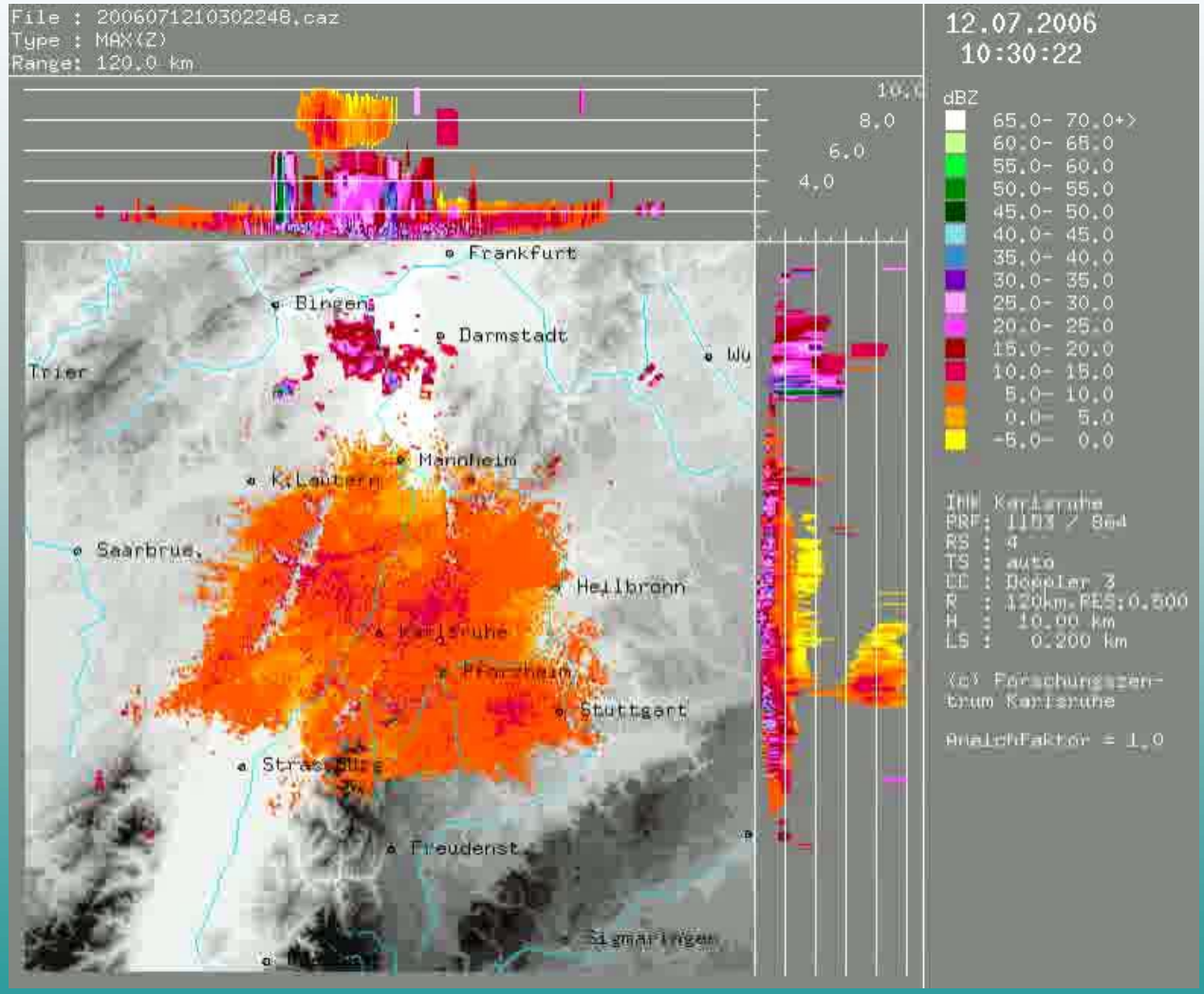
IMK Rain Radar, 10:30 – 16 h



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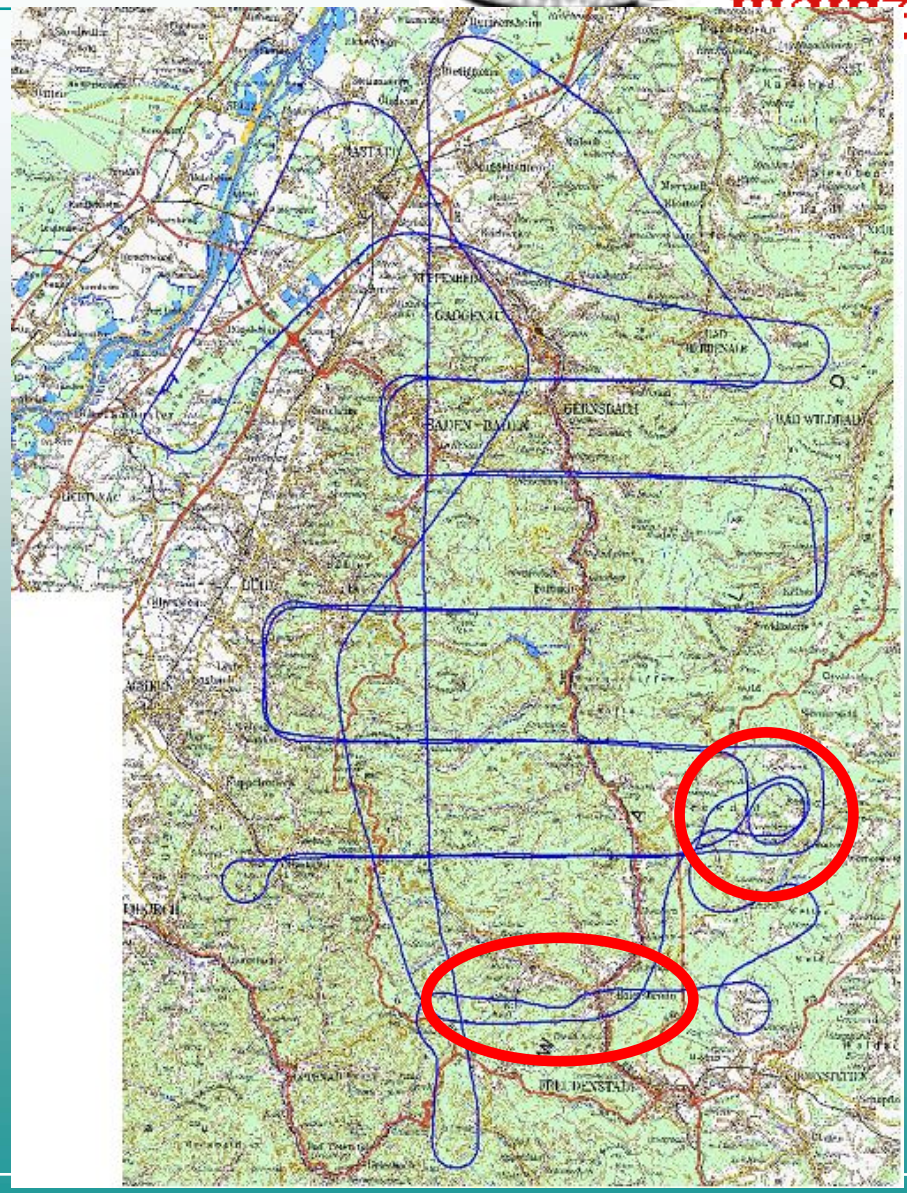
Flight pattern D-IBUF,
12.7.2006, 10:30 – 15:00 h

First probing convective cells, then mattress pattern over the Black Forest.

8 dropsondes launched



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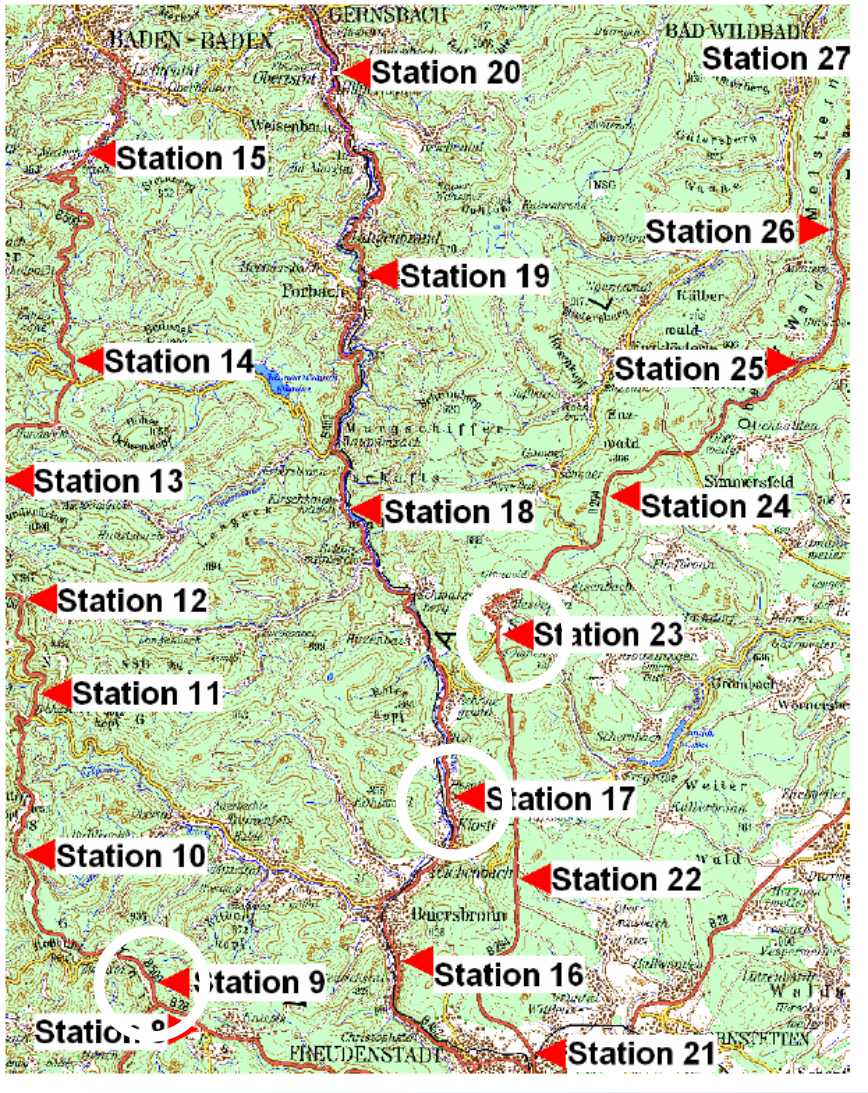
IOP2:
3 mobile Teams,
1 recovery team

- Tower measurements starting at noon
- 4 drop-upsondes launches per team starting at ca. 13:15, every 30 minutes
- End of tower measurements at 16 h
- 5 radiosondes @ 7, 9, 11, 13, 15 UTC



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Photos: Markus Radlach

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Photo: Philipp Reutter

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IOP4, Thursday, 20.7.2006

Forecast from Wednesday, 19.7.2006

Tomorrow, Thursday, 20.7.2006
In the morning hours high and mid altitude clouds with embedded convective cells leading to sporadic showers and thunderstorms not only in the mountains. In the late morning thunderstorms over the mountains possible. Starting at noon it is getting sunny later convective clouds (up to Cu con). In the evening and during the night some showers and thunderstorms possible. Temperatures around 36 deg. in the Rhine valley. Light wind from south to southwest.

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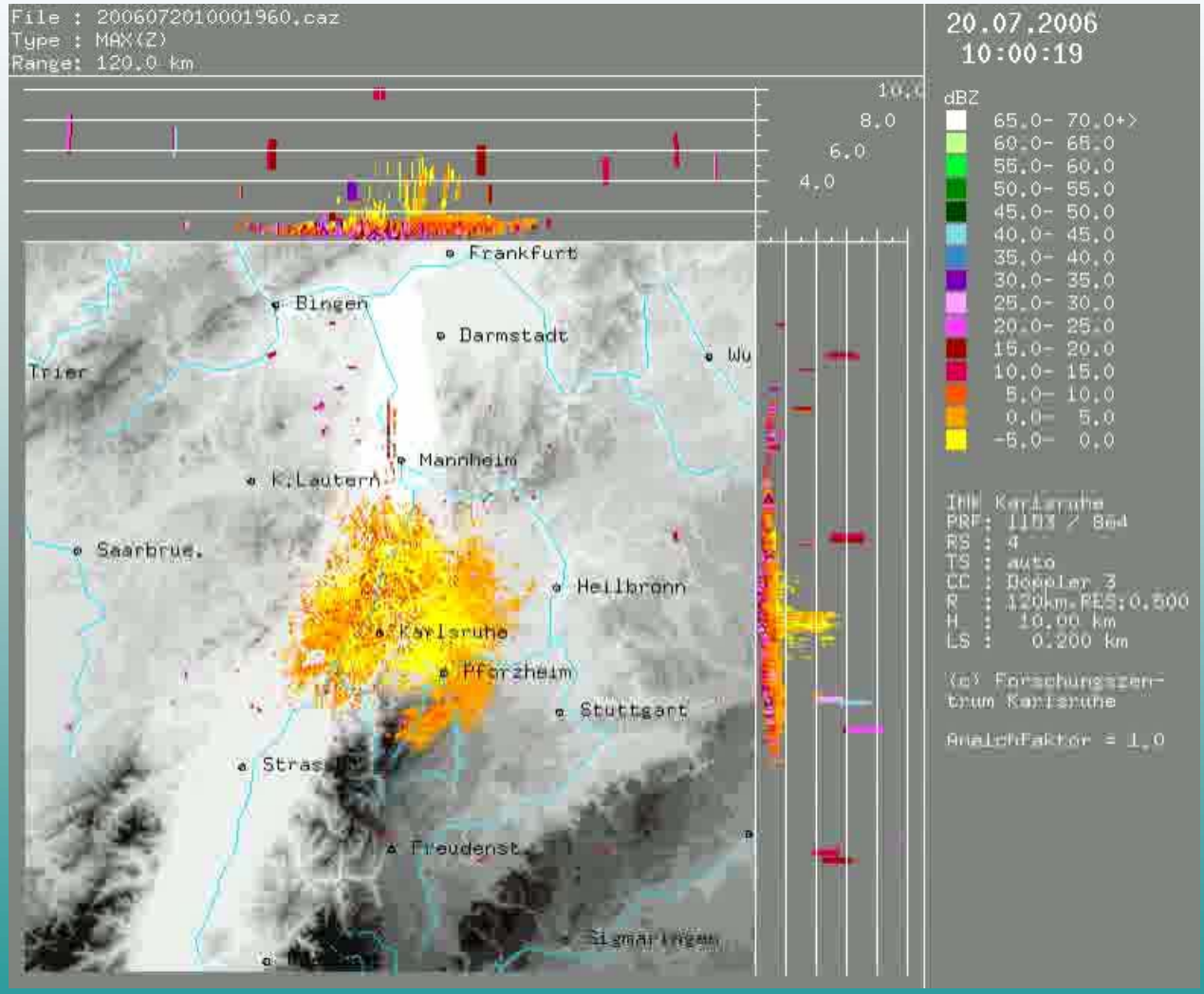
IMK Rain Radar, 10 – 19 h



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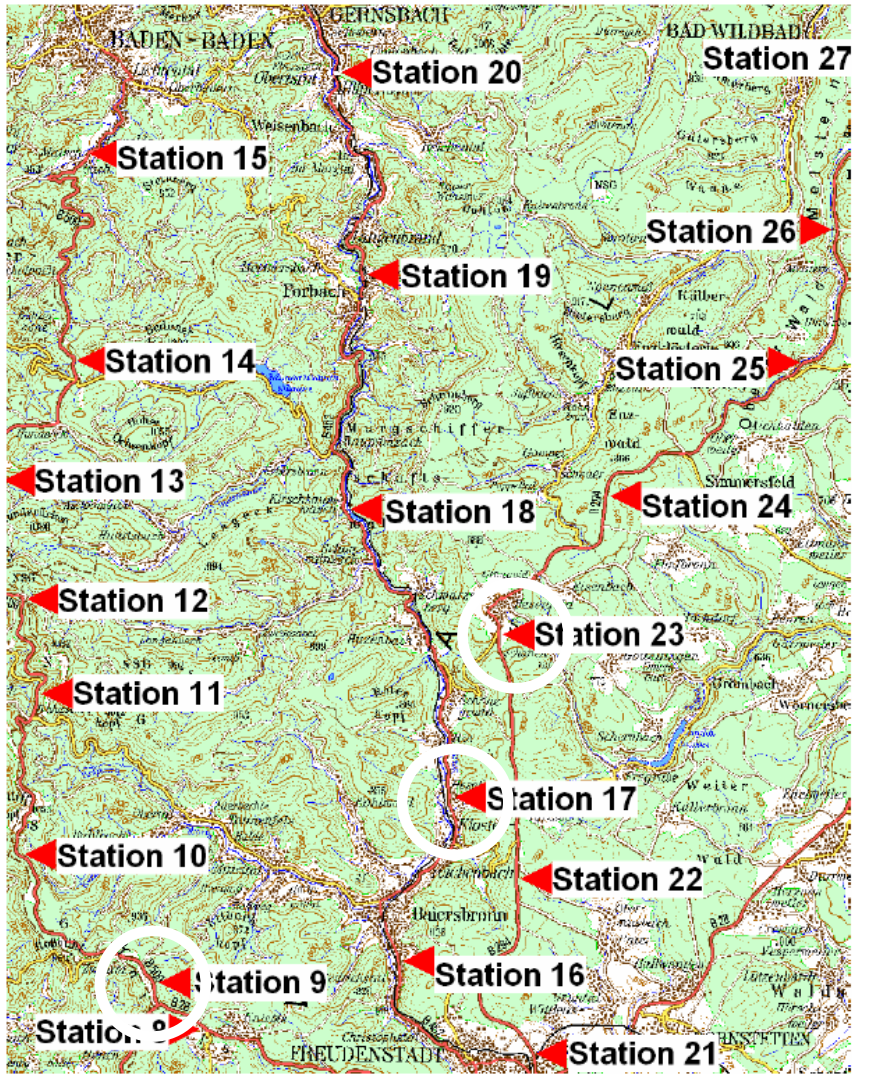
IOP4

- 3 Flights with D-IBUF
  - morning: mattress pattern
  - ca. 16 h: Probing of individual shower cells (4 dropsondes)
  - ca. 19 h: searching for convective cells (no success)
- Mobile Teams
  - continuous measurements with the towers
  - 2 drop-upsondes per Team at 18 h and 18:40 h
  - 4 radiosondes @ 7, 10, 13, 15 UTC



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Preliminary Conclusions

- It is possible to conduct targeted measurements in convective systems in the Black Forest region.
- Logistic needs some improvement
- Analysis of PRINCE is ongoing using data from:
  - 32 recovered dropsondes (34 launched)
  - Mobile towers
  - Radiosondes from Brandmatt
  - In situ aircraft measurements
  - Lidar- and Radar systems from Hornisgrinde
  - Rain Radar und satellite measurements
  - Model forecasts und -analyses

Photo: Carolin Schmitt
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