Convective and Orographically-induced Precipitation Study (COPS)

COPS contributors..

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- David D. Turner, University of Wisconsin-Madison, Madison, USA
- Tammy Weckwerth, NCAR,aboratory (EOL), Boulder, Colorado, USA
- Andreas Hense and Clemens Simmer, University of Bonn
- ....

27-29 February 2008 COPS workshop with > 120 participants

COPS

3 months operation of state-of-the-art instrumentation in Black Forest region

Improvement of quantitative precipitation forecasting in low-mountain regions

www.uni-hohenheim.de/spp-iop/cops/

Wulfmeyer et al., 2008 BAMS, accepted

Further COPS projects

- UK
- France
- Austria
- Italy
- Netherlands
- ..

PQP
Praecipitationis Quantitativae Praedictio

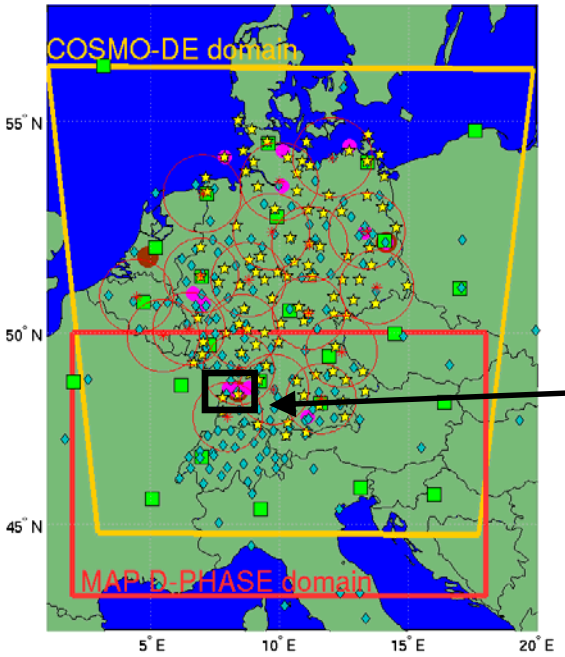
GOP

1 year of continuous data in central Europe currently not used for standard verification

Statistical assessment of model forecasts and identifiction of regime related deficits.

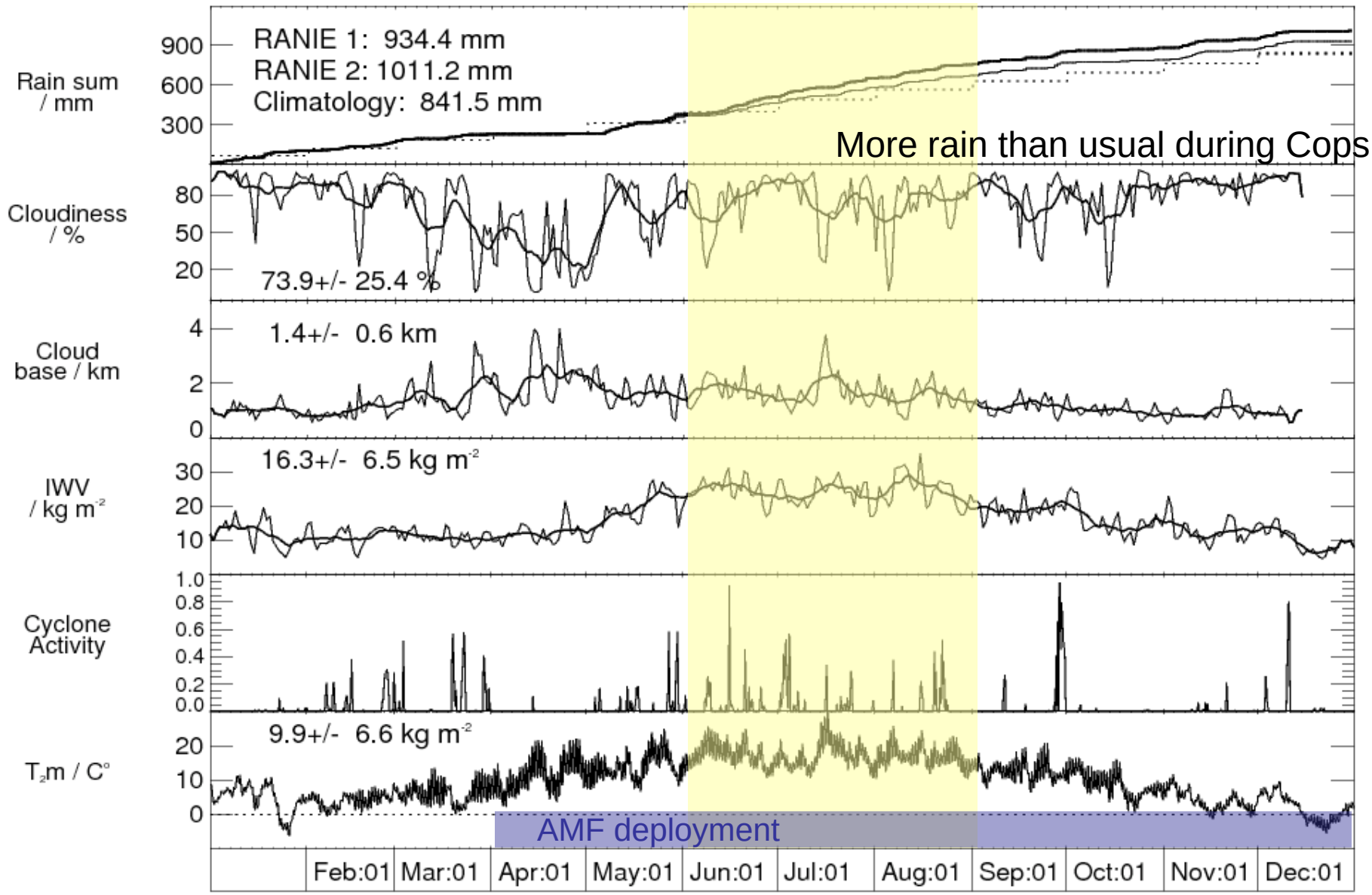
http://gop.meteo.uni-koeln.de/

Crewell et al., 2008 Met. Z., submitted

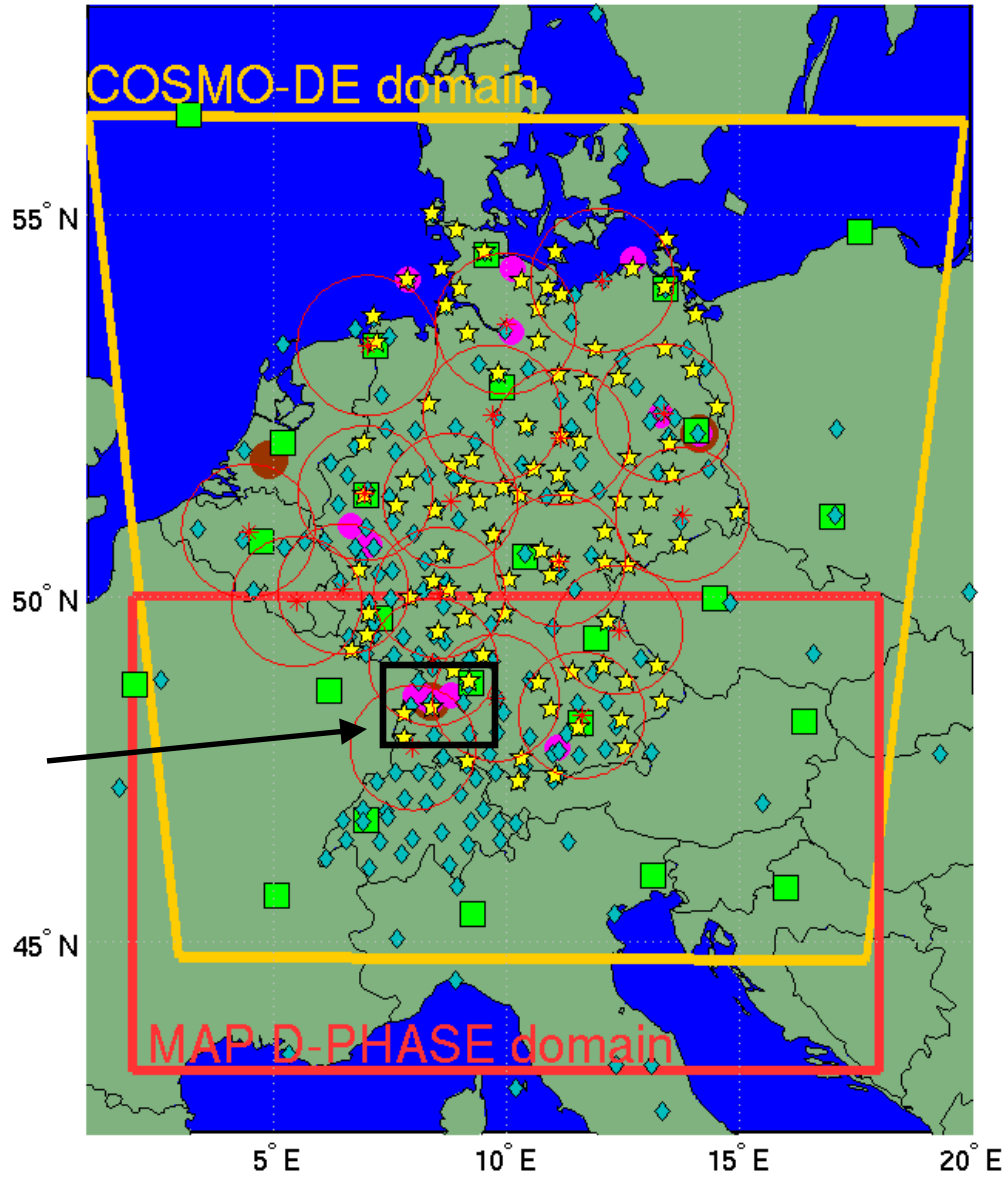


COPS area

GOP Overview 2007



GOP Area and Instrumentation



COPS area

- Radiosonde
- Cloudnet
- Micro Rain Radar
- GPS
- Ceilometer
- Weather radar

and Satellites

COSMO-DE Model

Pre-operational since 14 August 20

Operational since April 2007

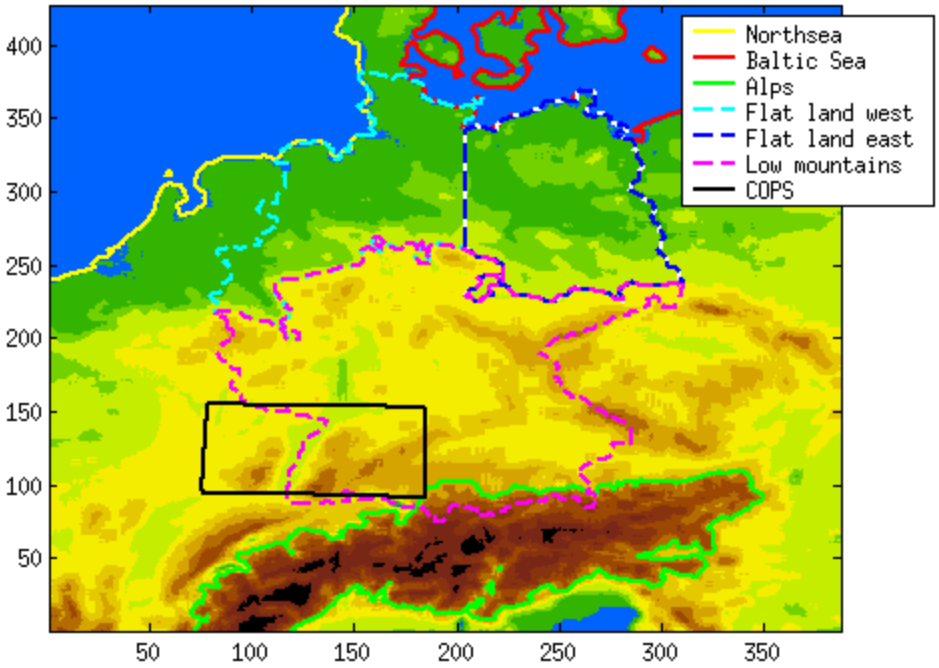
Δx = 2.8 km (resolved deep convection)

ΔT=30 sec

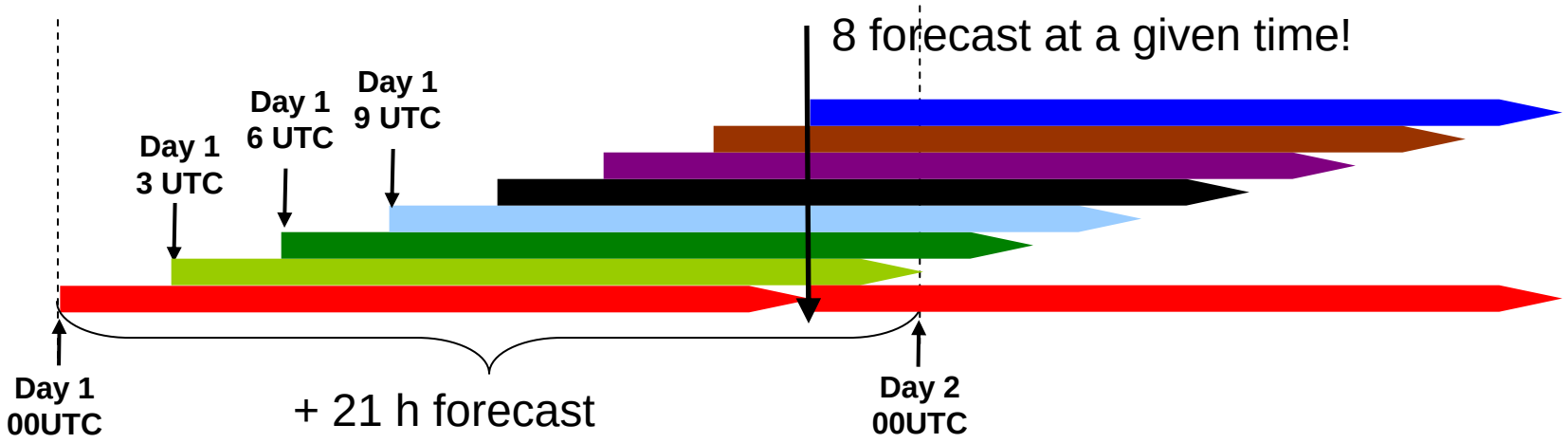
50 vertical levels

domain size: ~ 1200 * 1300 * 22 km³

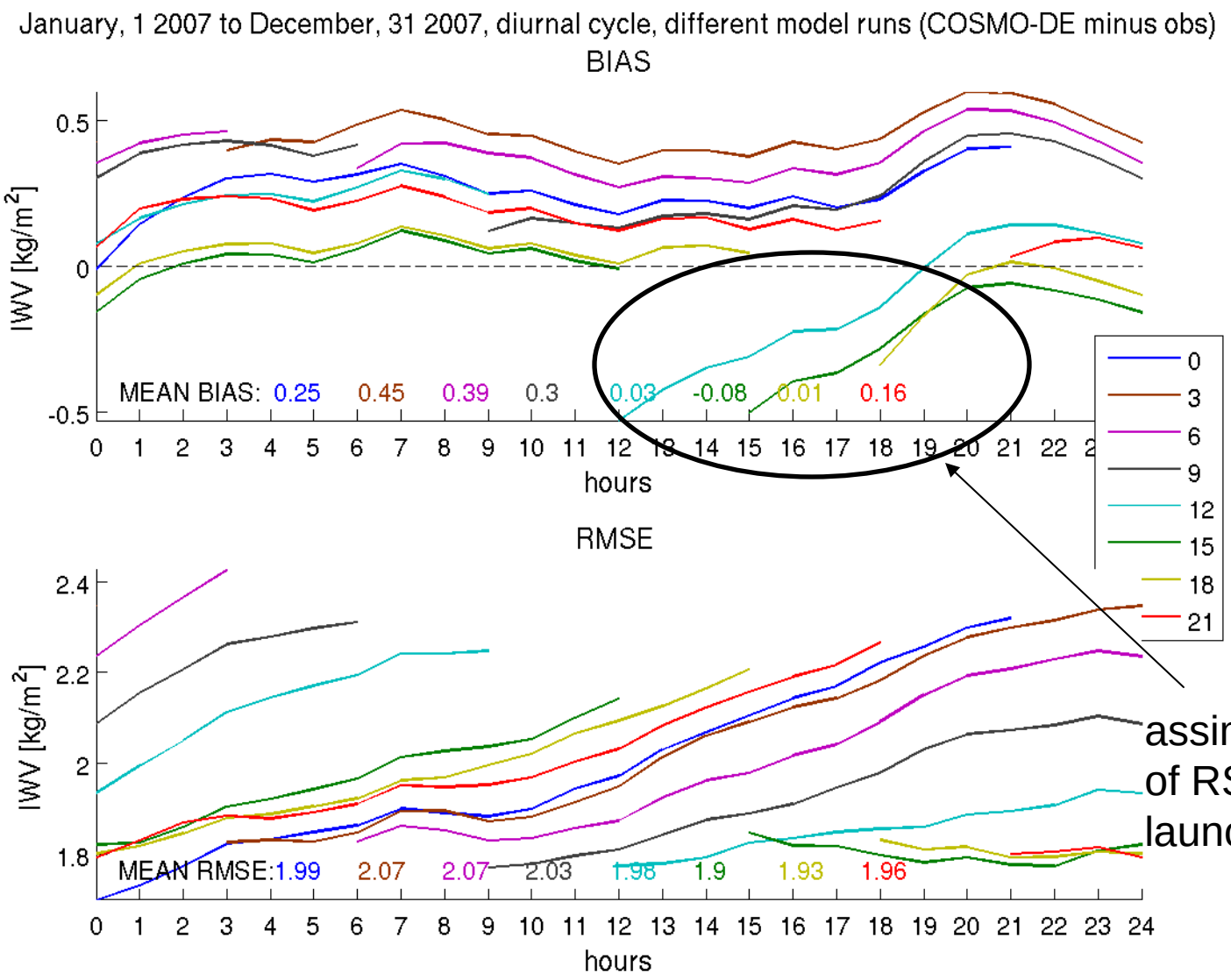
boundary conditions from LME



Lagged forecast ensemble



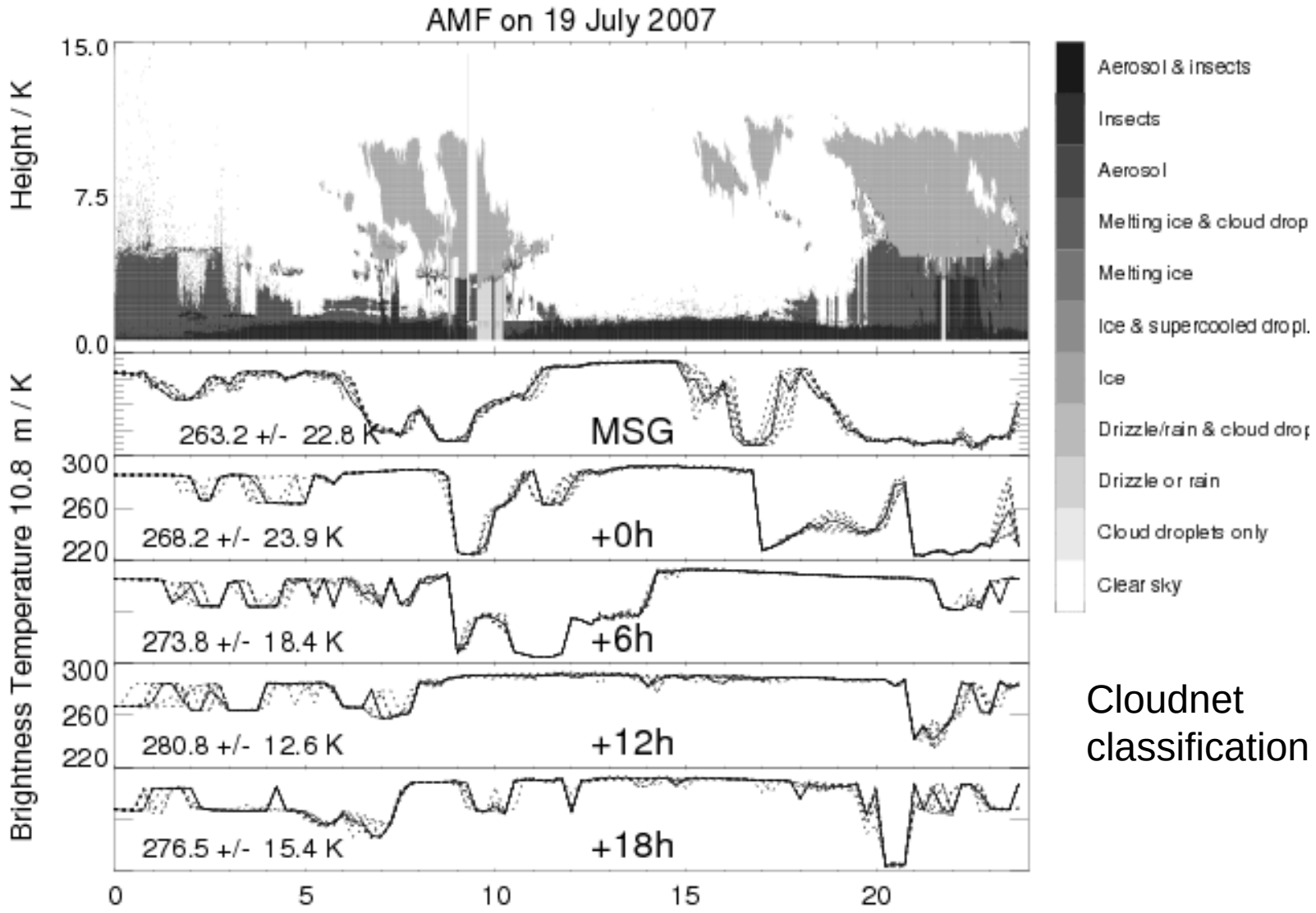
Evaluating NWP integrated water vapor with GPS



model start time

assimilation of RS92 sondes launched at noon

AMF & Satellite for model evaluation



Cloudnet classification

http://www.cloud-net.org/quicklooks/cops_sites.html

MAP D-PHASE

Mesoscale Alpine Project Forecast and Demonstration Project

www.map.meteoswiss.ch/map-doc/dphase/dphase_info.htm

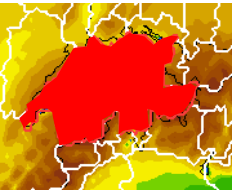
6 Month run of

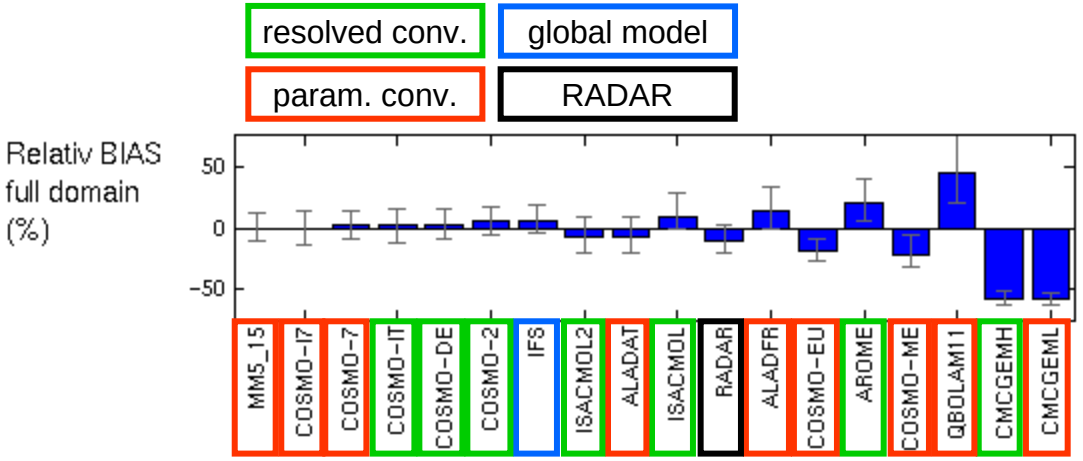
- 7 probabilistic and 23 high-resolution deterministic atmospheric models
- 7 coupled hydrological models (deterministic and probabilistic)

> 50‘000‘000 graphic files (only atmospheric)

> 50‘000‘000 model fields (COPS domain, JJA) from high-resolution models

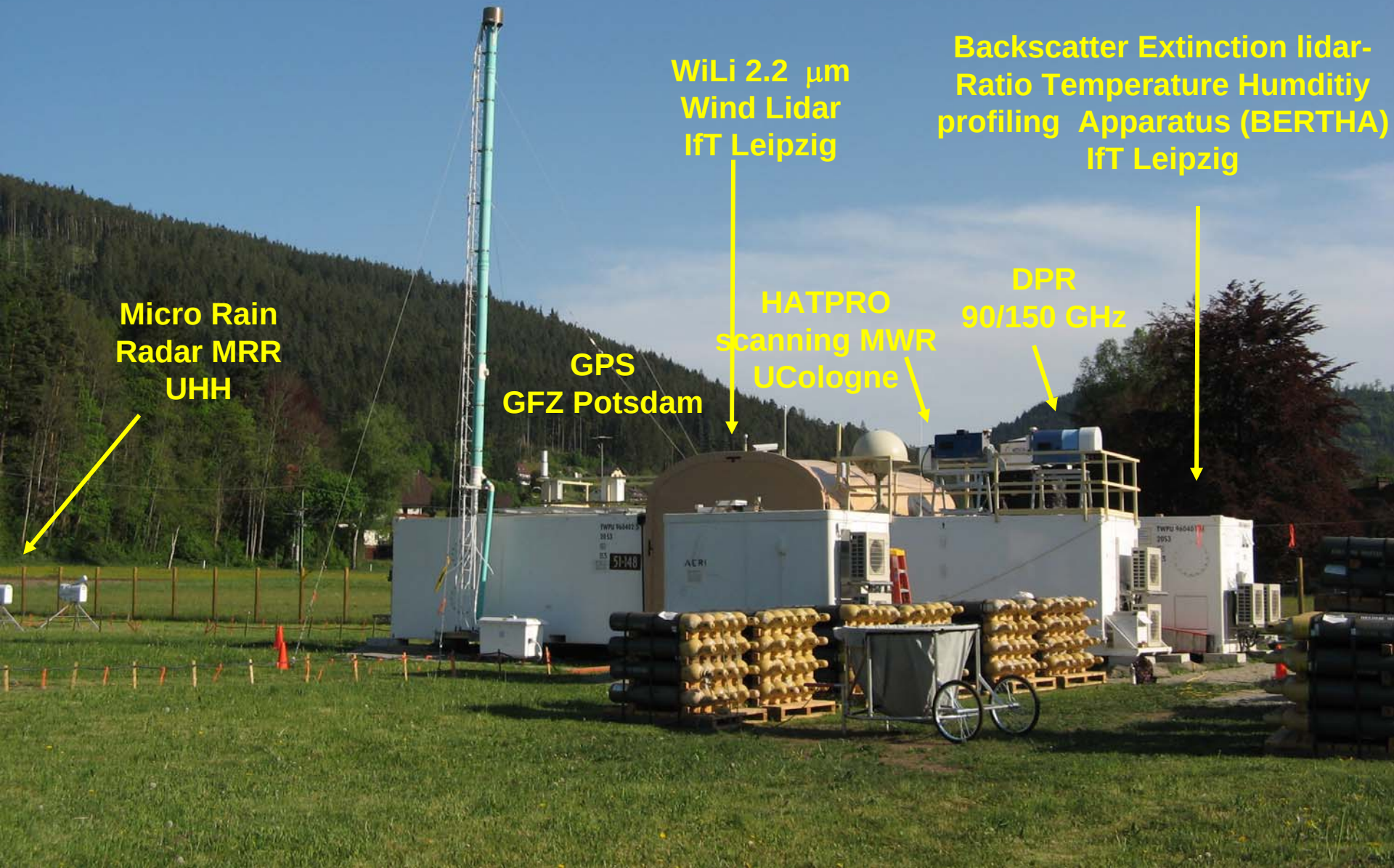
Example of Model evaluation for Switzerland, summer (JJA)

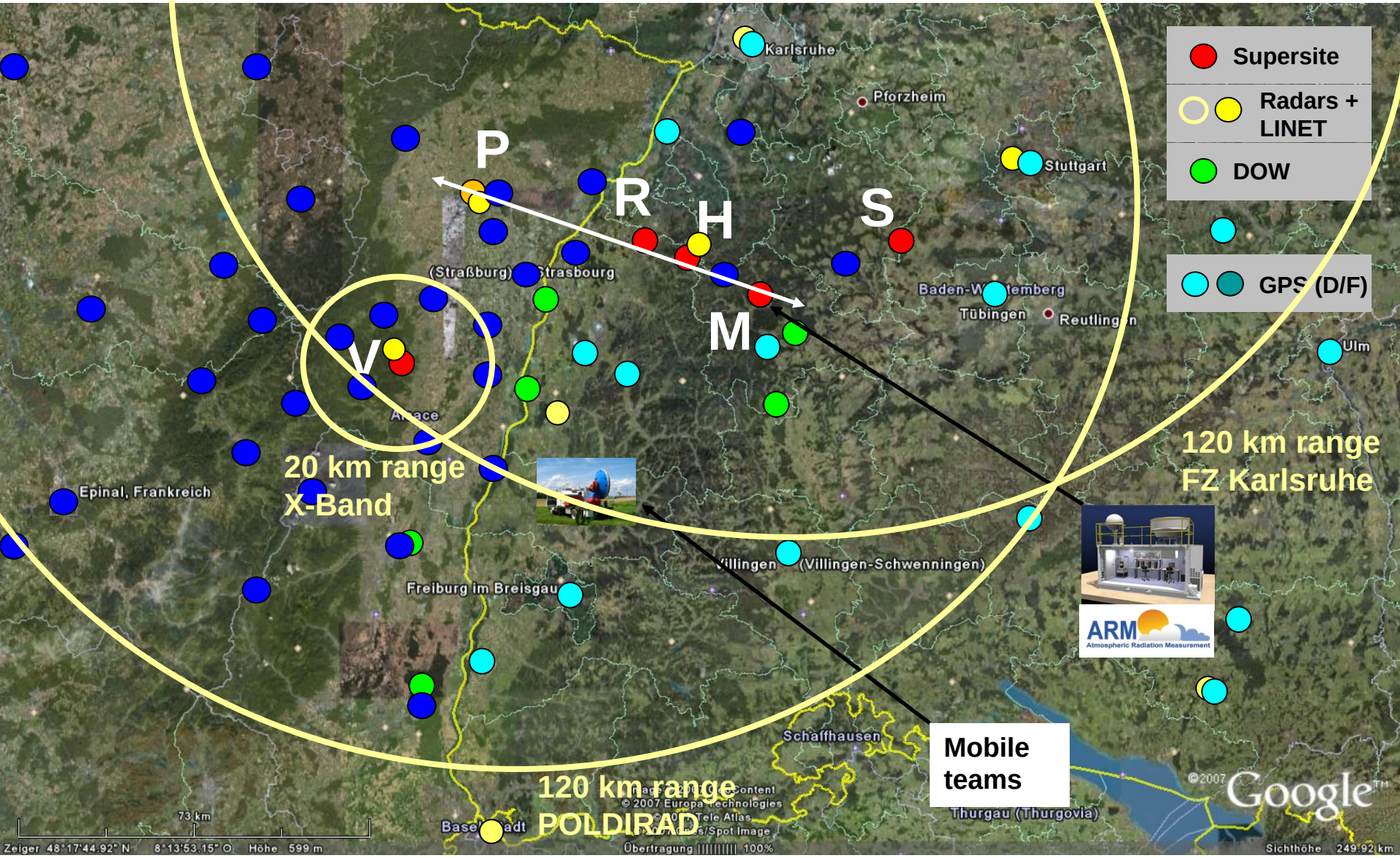




Matthias Rotach, Marco Apargaus, Felix Ament

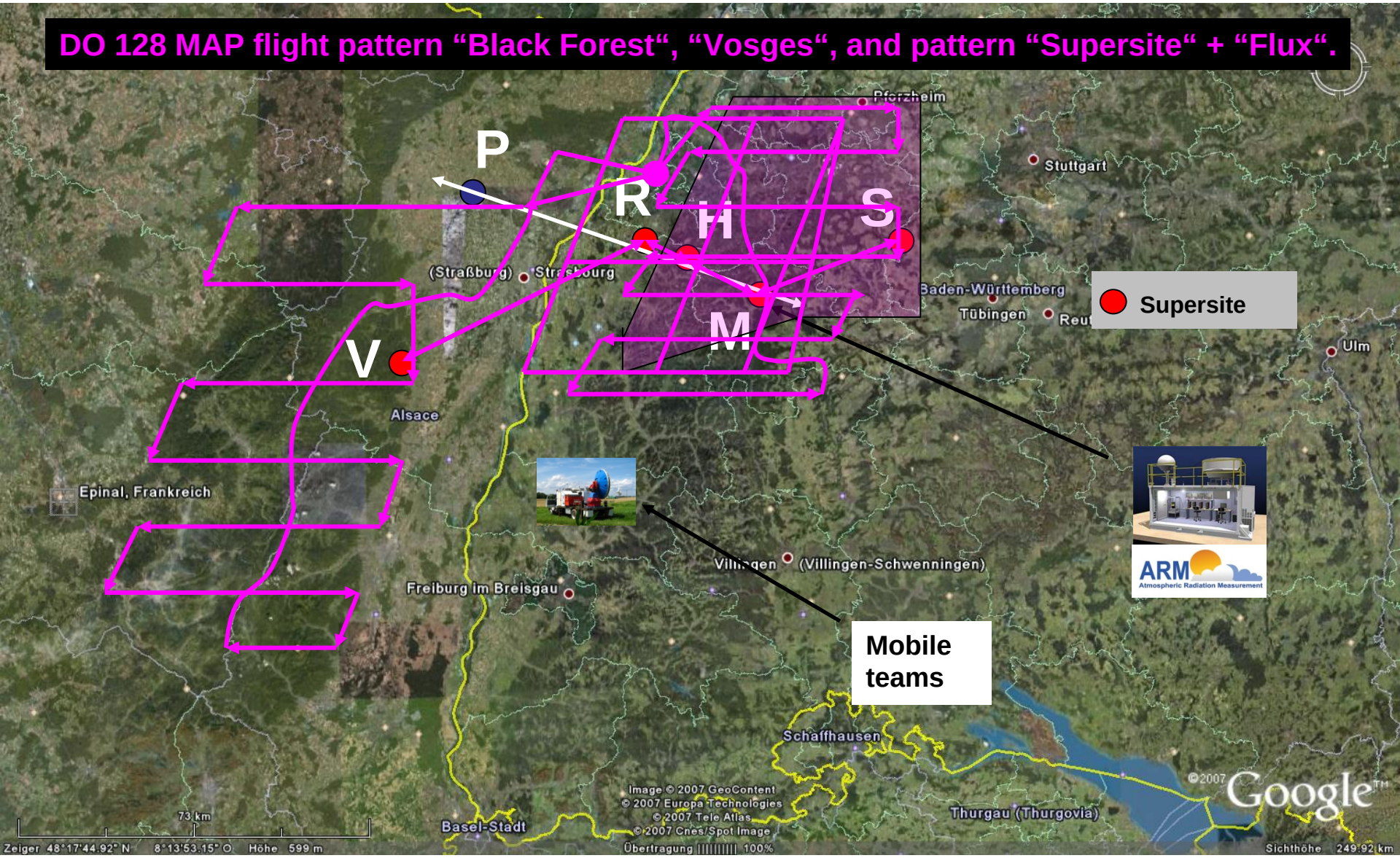
Additional instruments at AMF





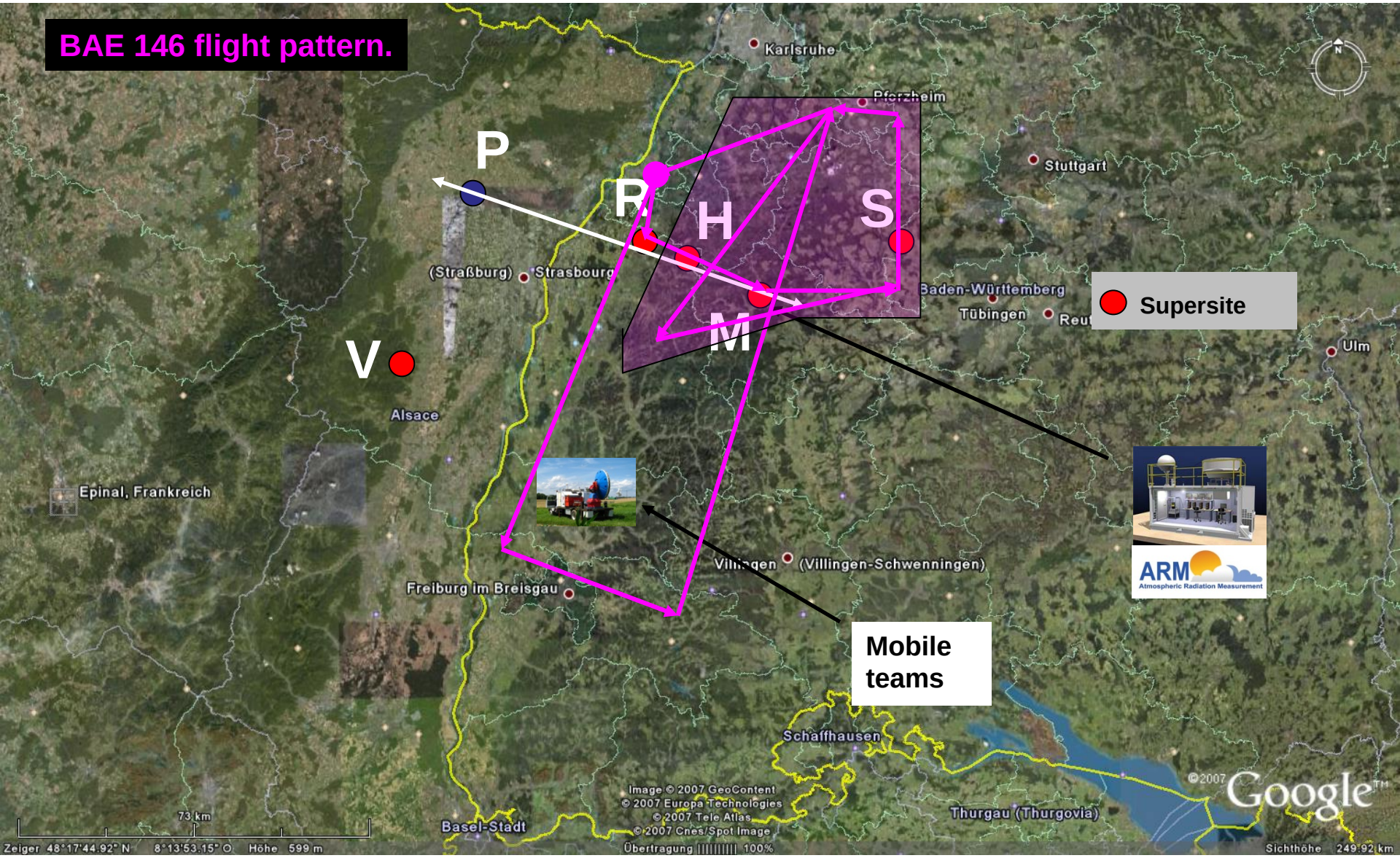
Further details are found in: COPS Field Report at www.uni-hohenheim.de/spp-iop/documents

DO 128 MAP flight pattern “Black Forest“, “Vosges“, and pattern “Supersite“ + “Flux“.

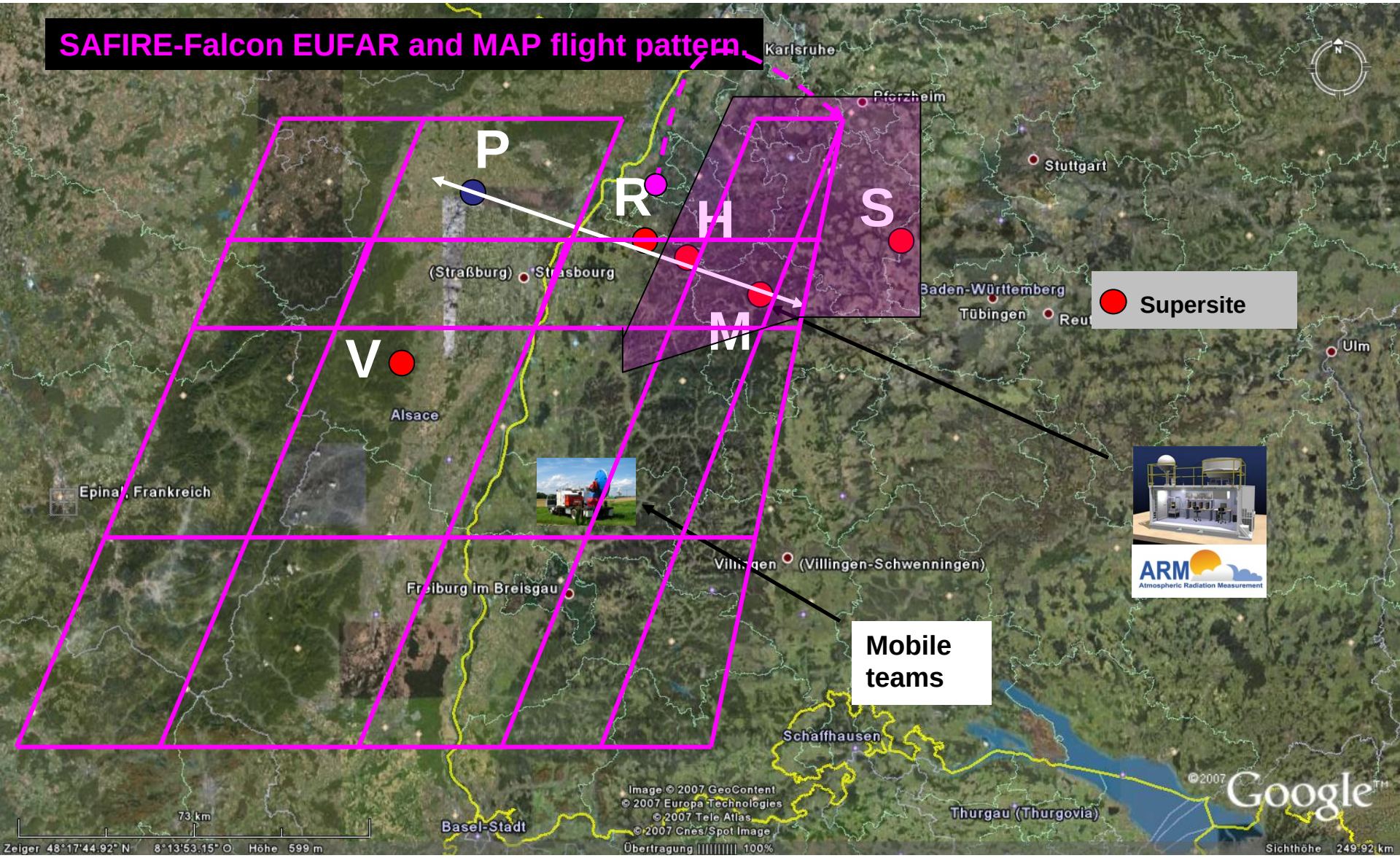


Further details are found in: COPS Field Report at www.uni-hohenheim.de/spp-iop/documents

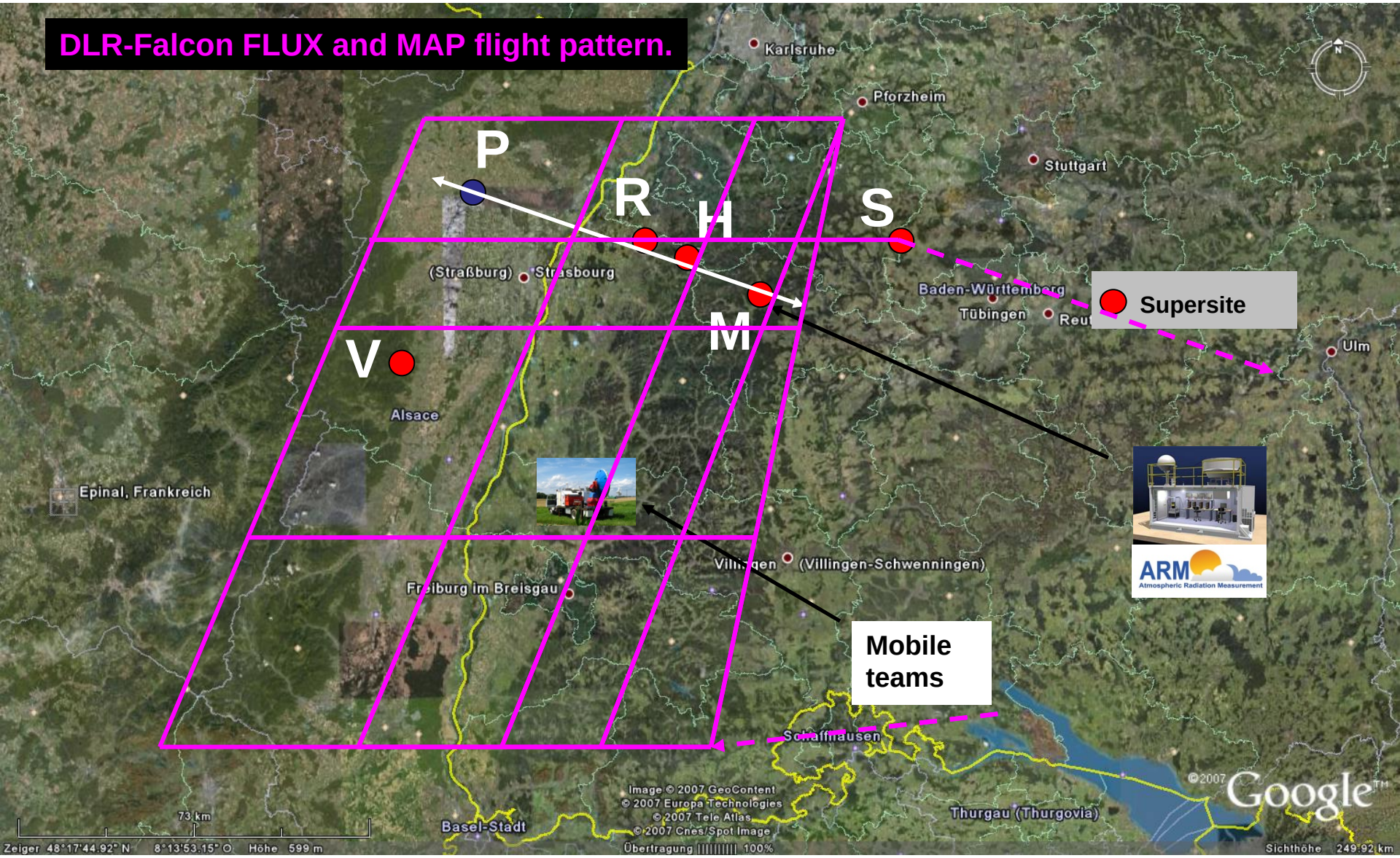
BAE 146 flight pattern.

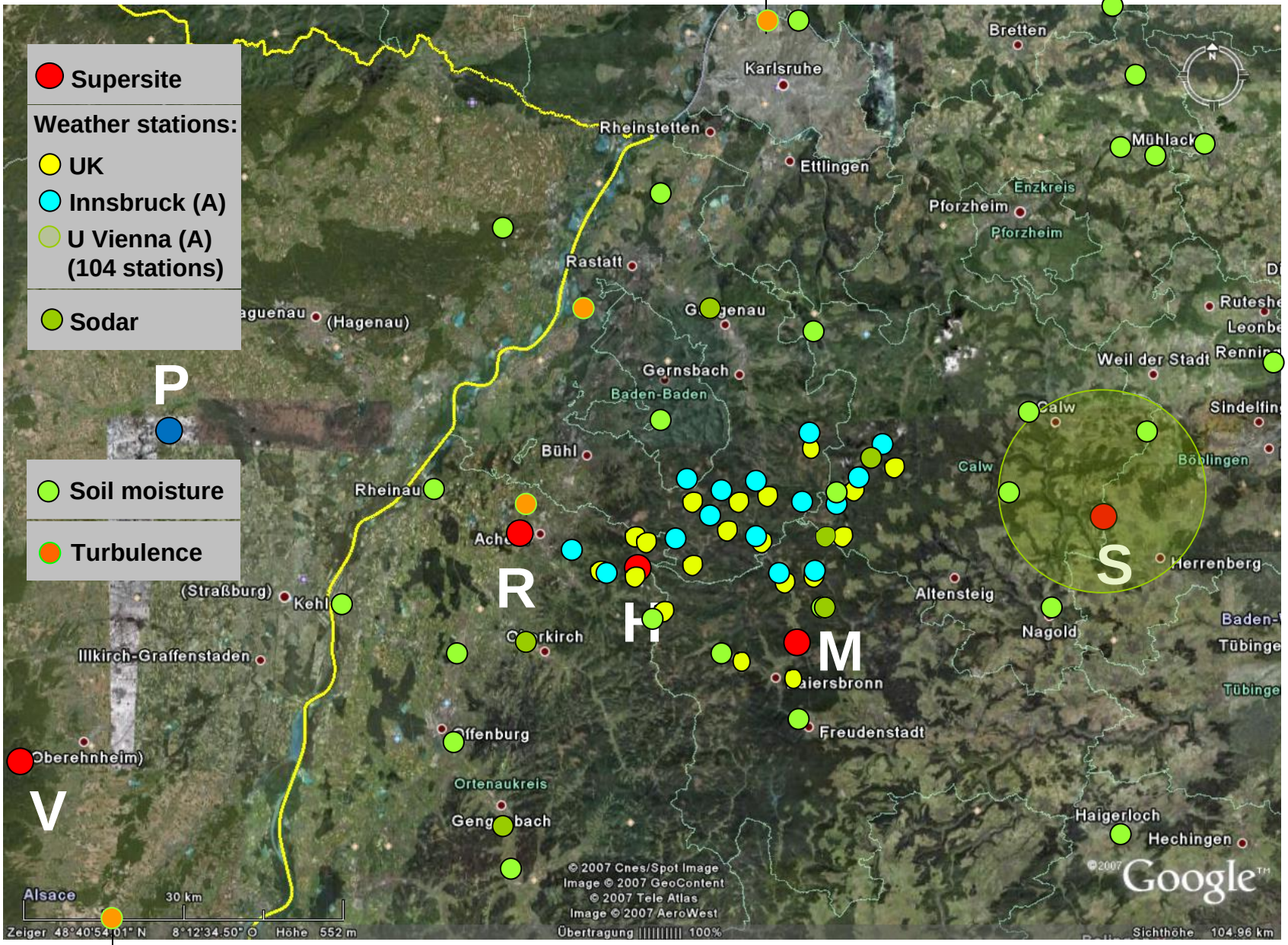


SAFIRE-Falcon EUFAR and MAP flight pattern.



DLR-Falcon FLUX and MAP flight pattern.





Further details: COPS Field Report at www.uni-hohenheim.de/spp-iop/documents

COPS Goals ..

Advance the quality of forecasts of orographically-induced convective precipitation by four-dimensional observations and modeling of its life cycle.

Working Groups

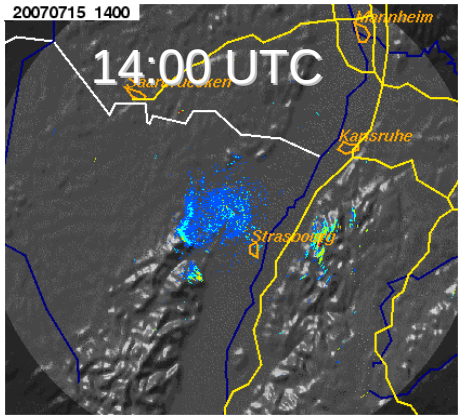
- **Convective Initiation (CI)**
  - influence of surface fluxes & aerosol loading
  - relative importance of the large-scale flow versus local orographic and surface processes
  - variations in the depth of the convective boundary layer & wind shear across ridges
- **Aerosol and Cloud Microphysics (ACM)**
- **Precipitation and its Life Cycle (PLC)**
  - initiation of cells in relation to orography, surface wind field related to orography, moisture ..
  - live cycle of precipitation, variation of rain drop size distribution
  - enhancement or weakening in relation to orography
  - decay of cells, relation to orography, modification of rain drop size distribution
- **Data Assimilation and Predictability (DAP)**
  - relative roles of synoptic forcing versus local orographic/surface influences on predictability
  - impact of the assimilation of high resolution remote sensing data (assimilation methods)
  - identification of better observation strategies

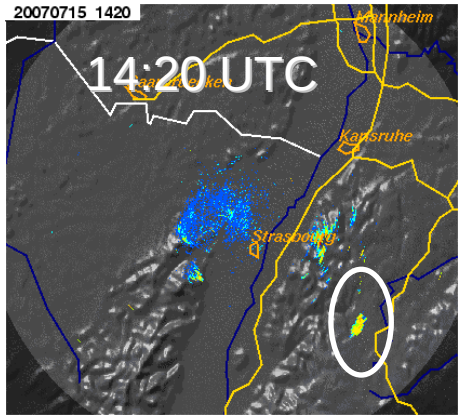
CI: Initiation of Convection

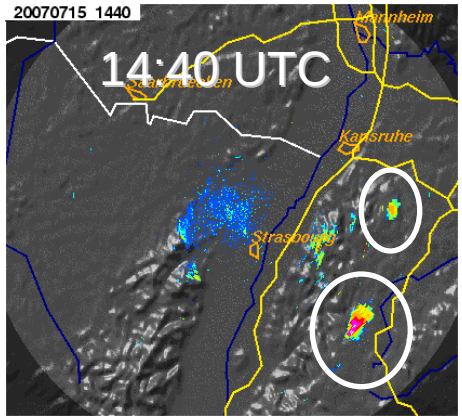
IOP 8B : 15 July 2007

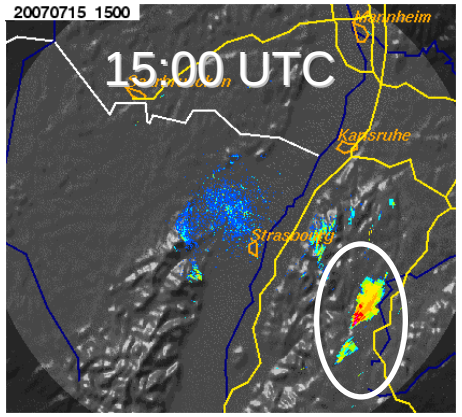
BAE146

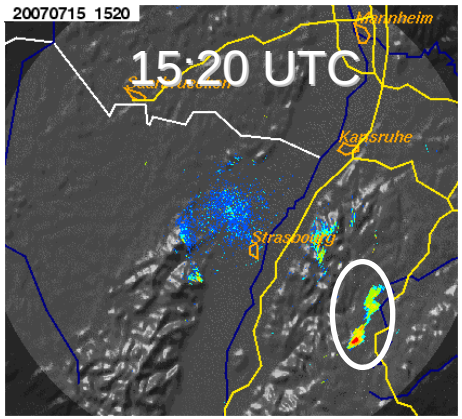
CI: An isolated thunderstorm

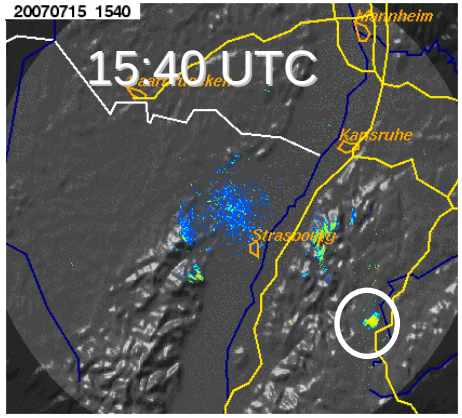


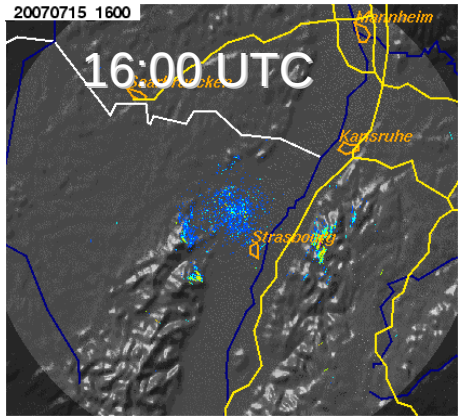


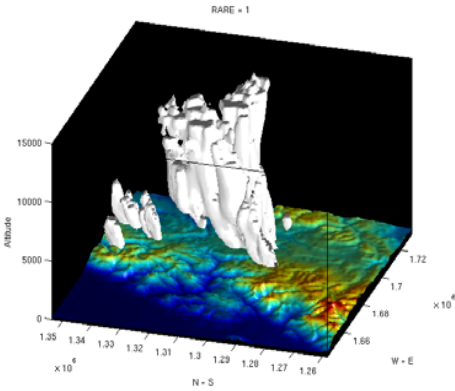








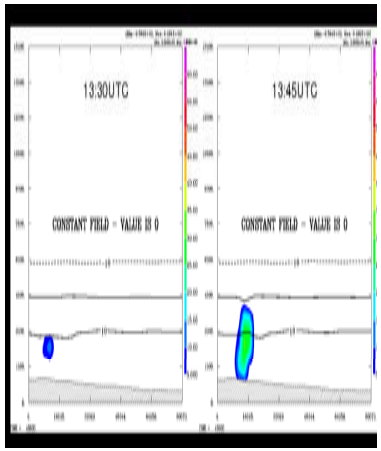




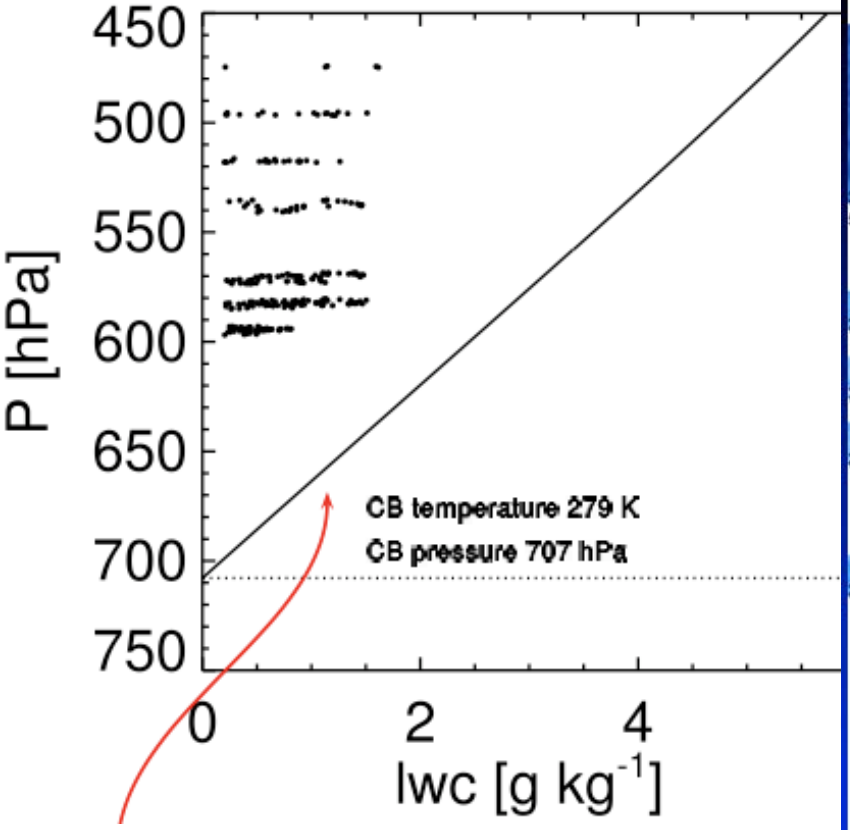
IOP 8B : 15 July 2007

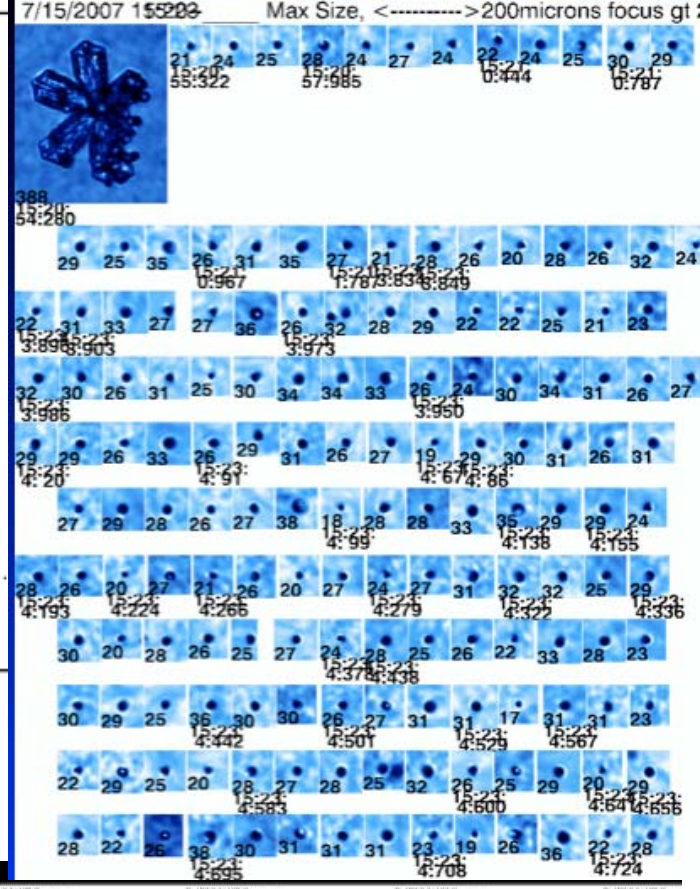
Martin Hagen, Evelyn Richard

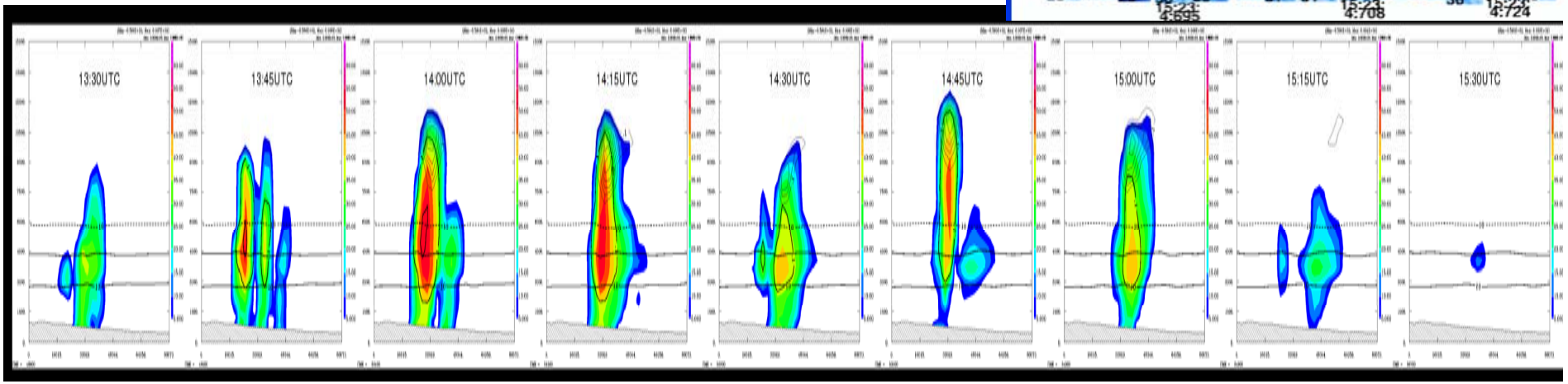
Vertical cr



Meso-NH (2km





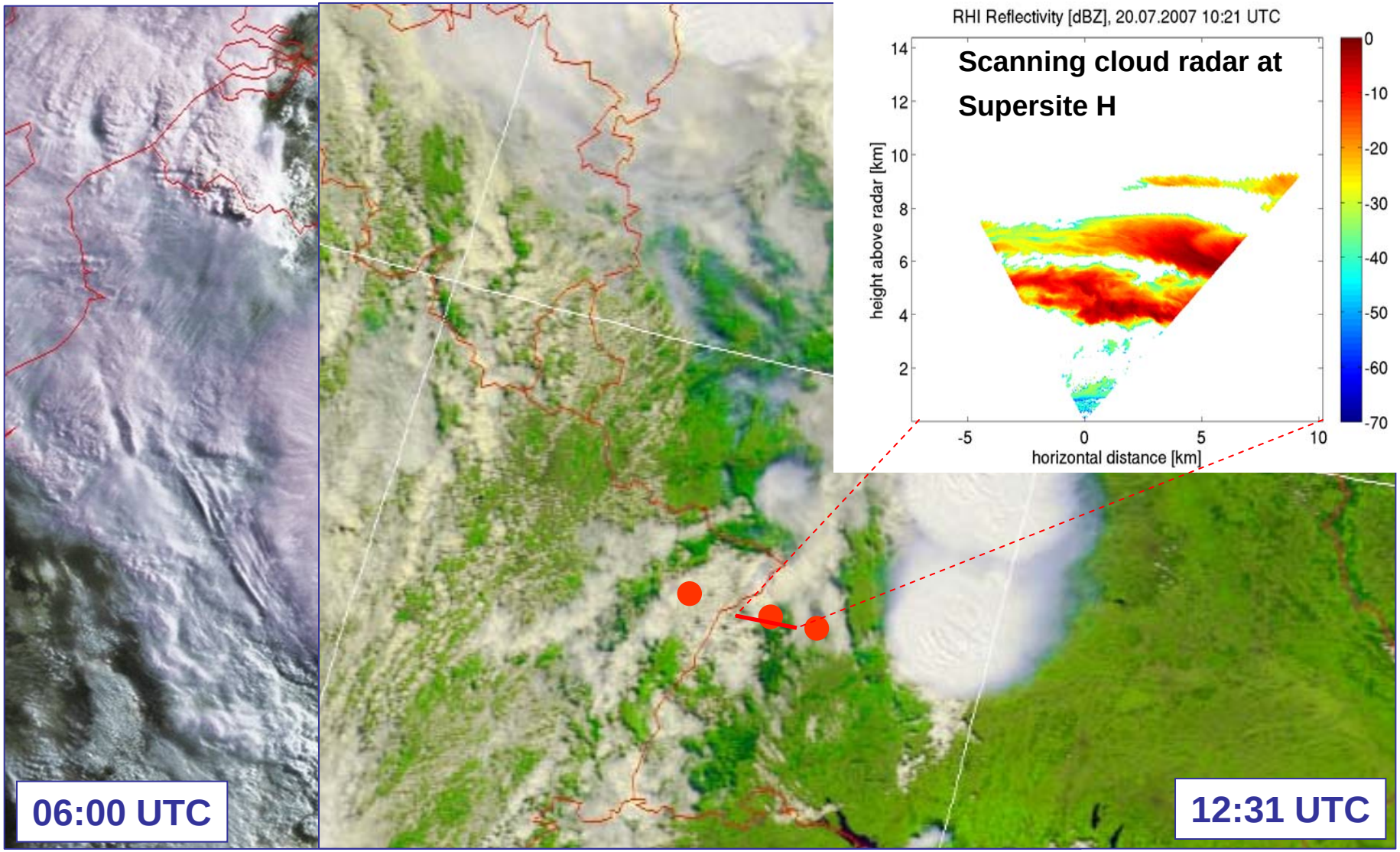


Meso-NH (2km - ARPEGE driven)

E. Richard, J.-P. Chaboureau, A. Blyth

IOP 9c: Embedded convection along convergence line

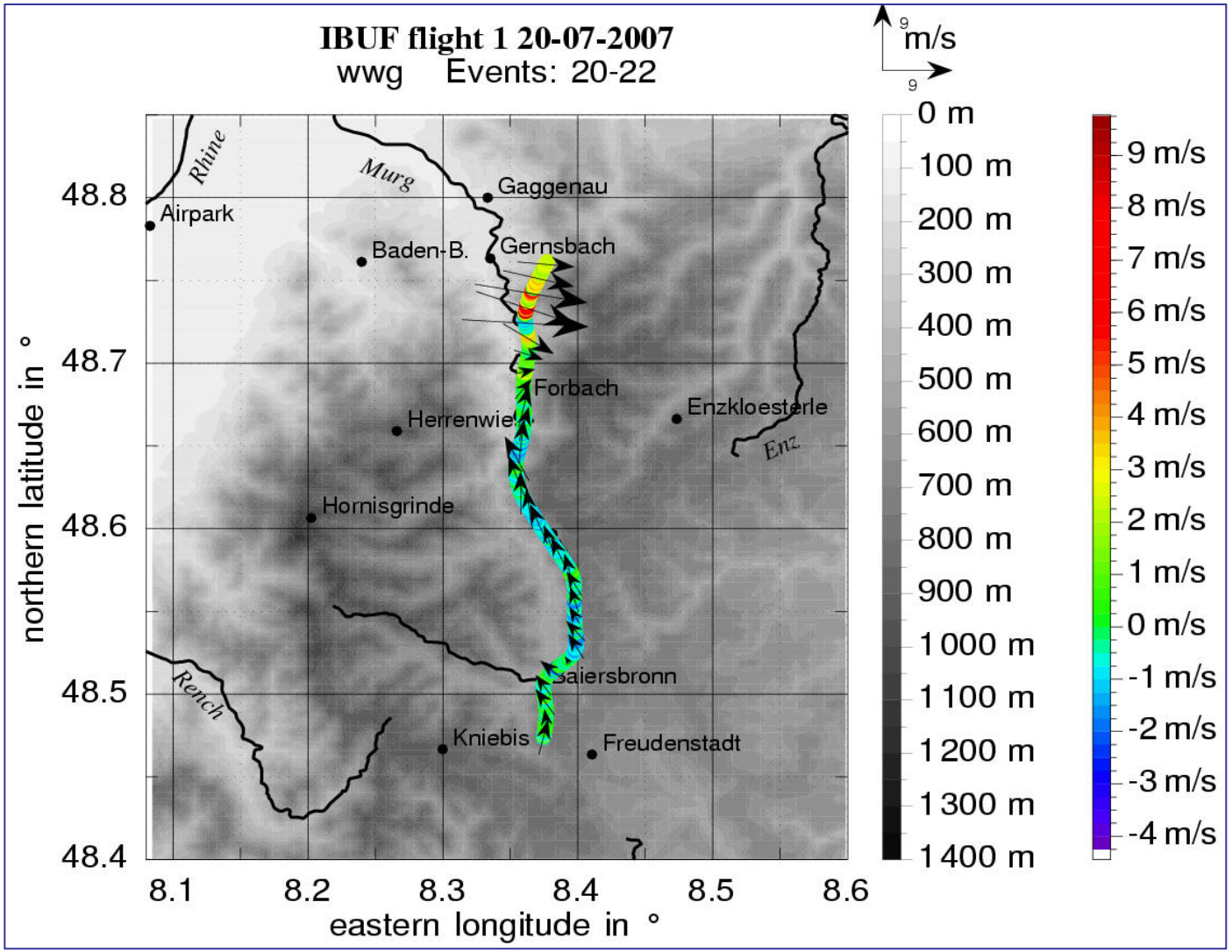
20 July 2007



U. Coarsmeier

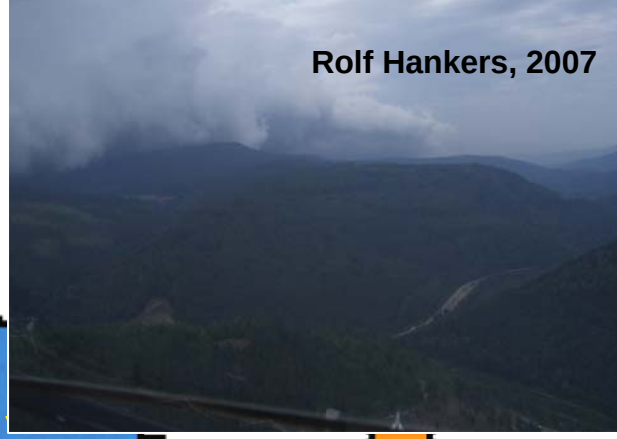
DO 128 within the Murg valley with vertical and horizontal wind

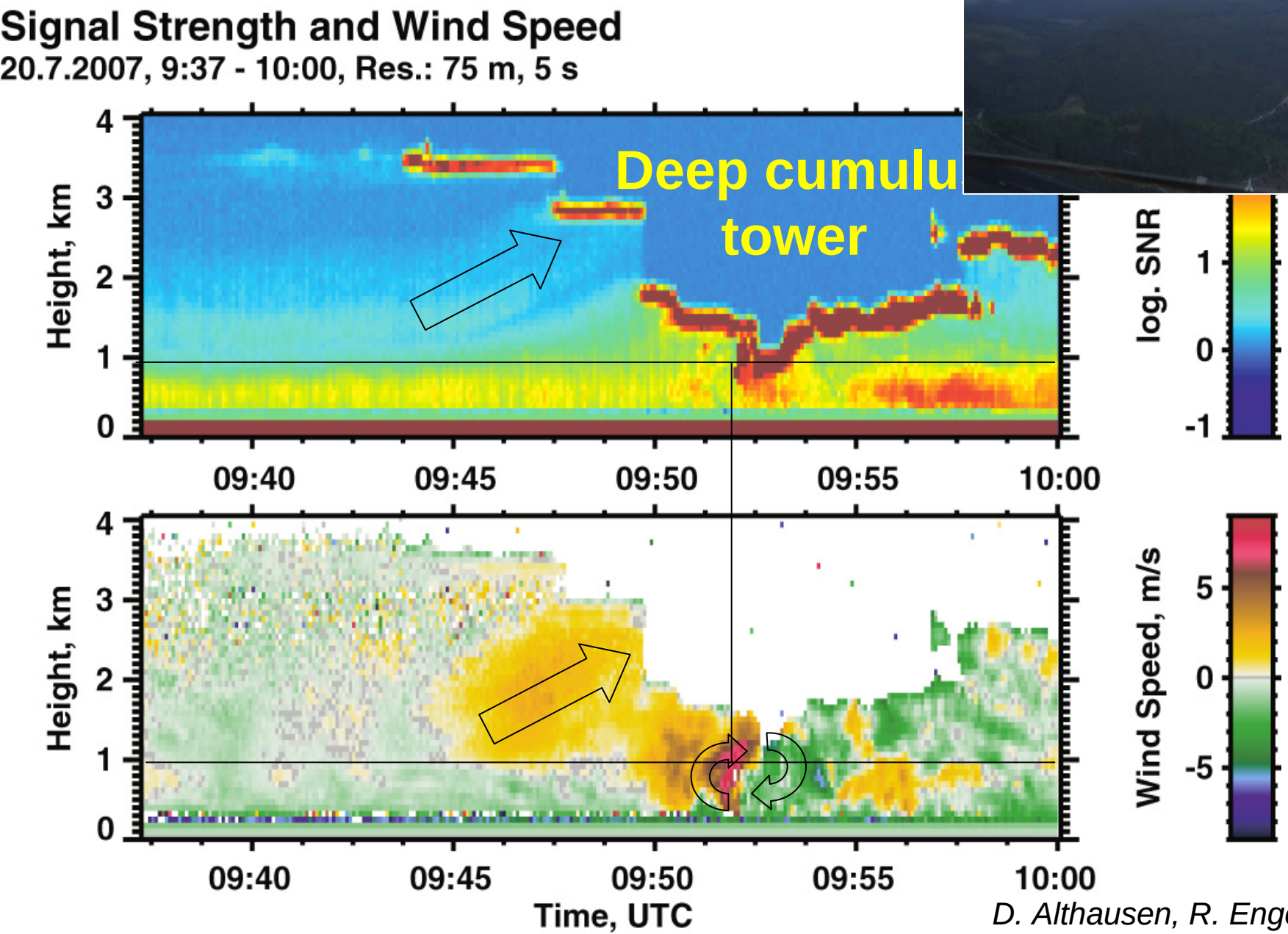
The gust front arriving at 09:45 UTC in the lower Murg valley



U. Coarsmeier

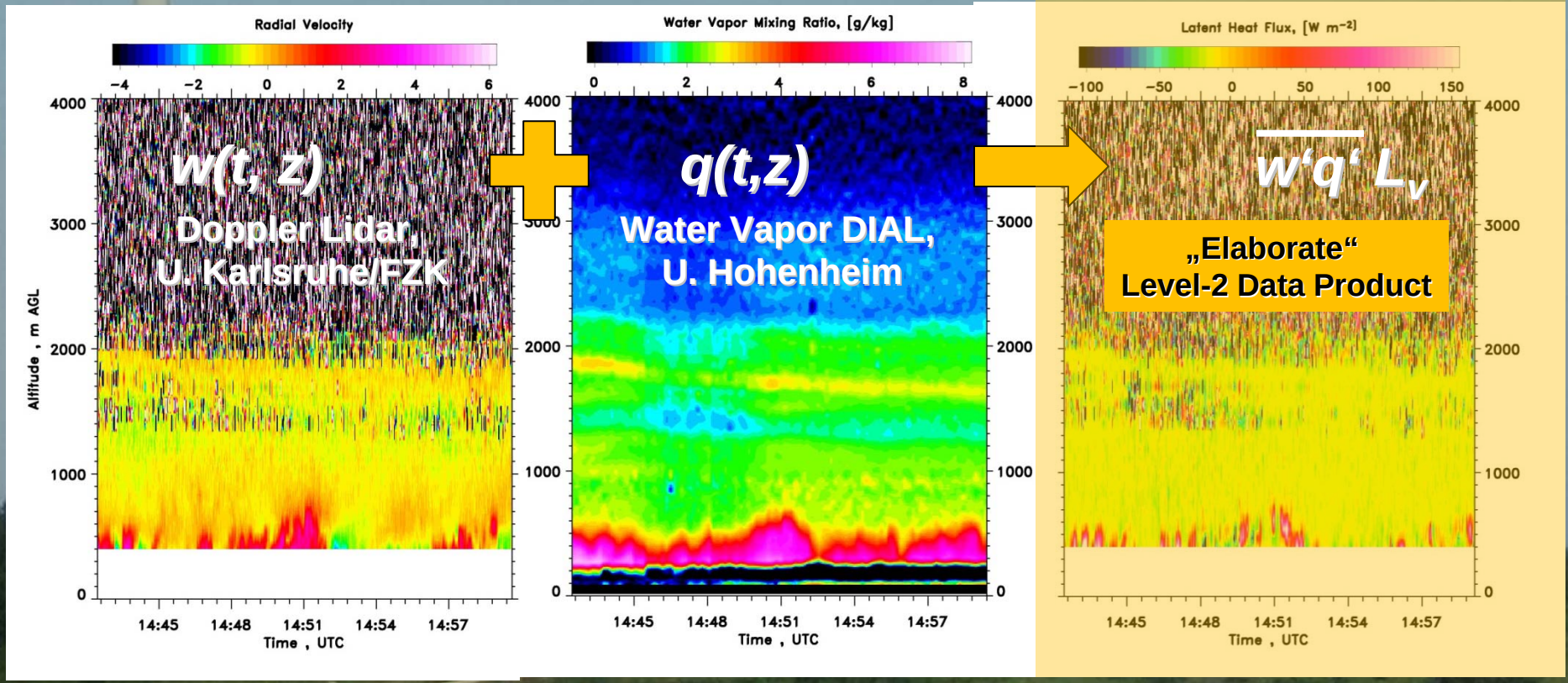
Gust front arriving at AMF 9:51





D. Althausen, R. Engelmann

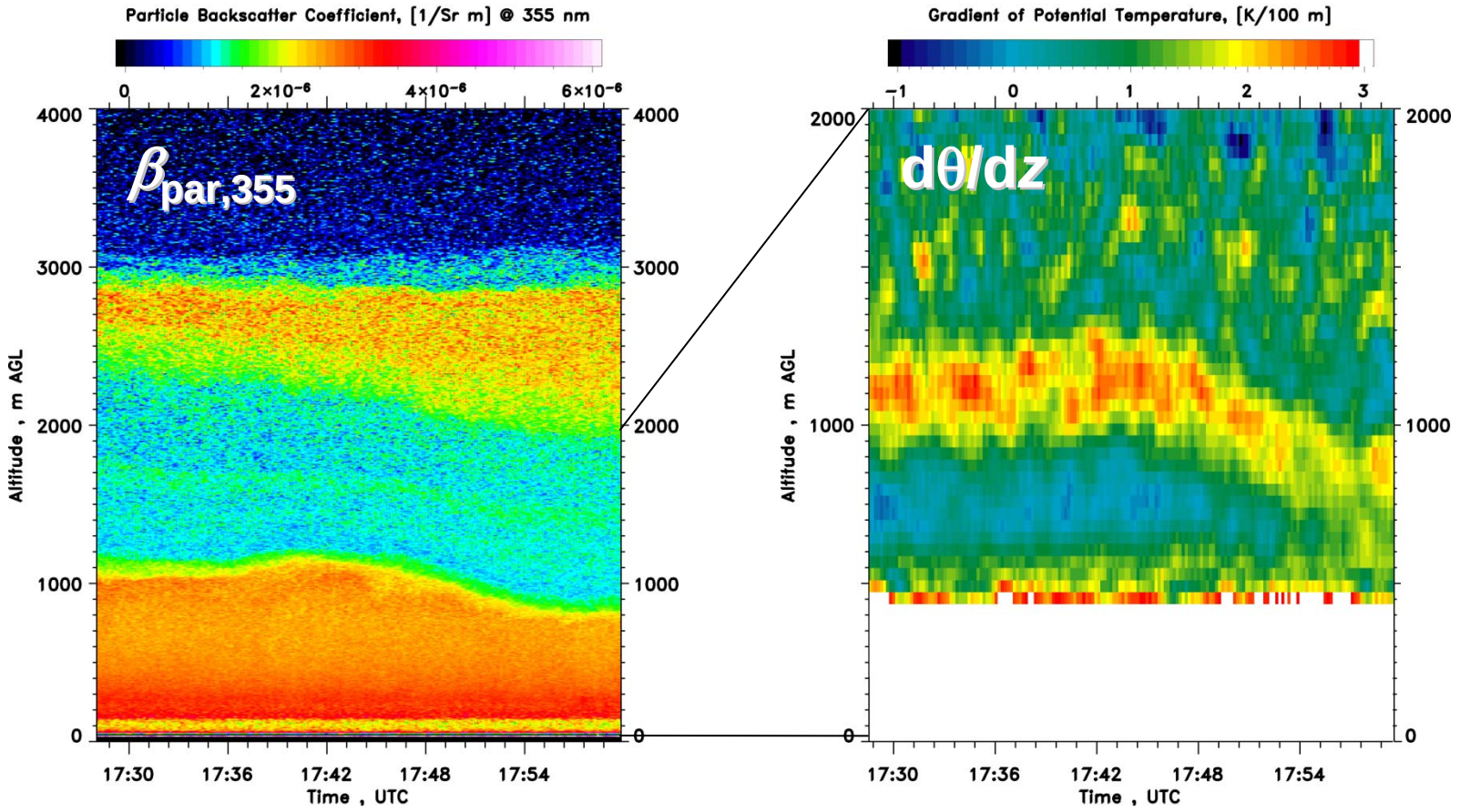
Measurement of Flux Profiles at Supersite H, IOP 8b



See Poster CI 2

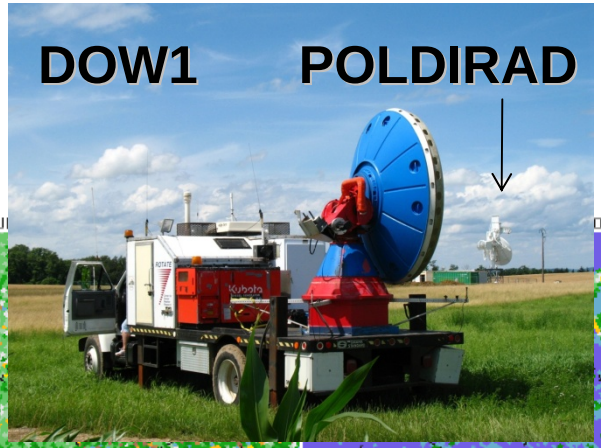
Andreas Behrendt

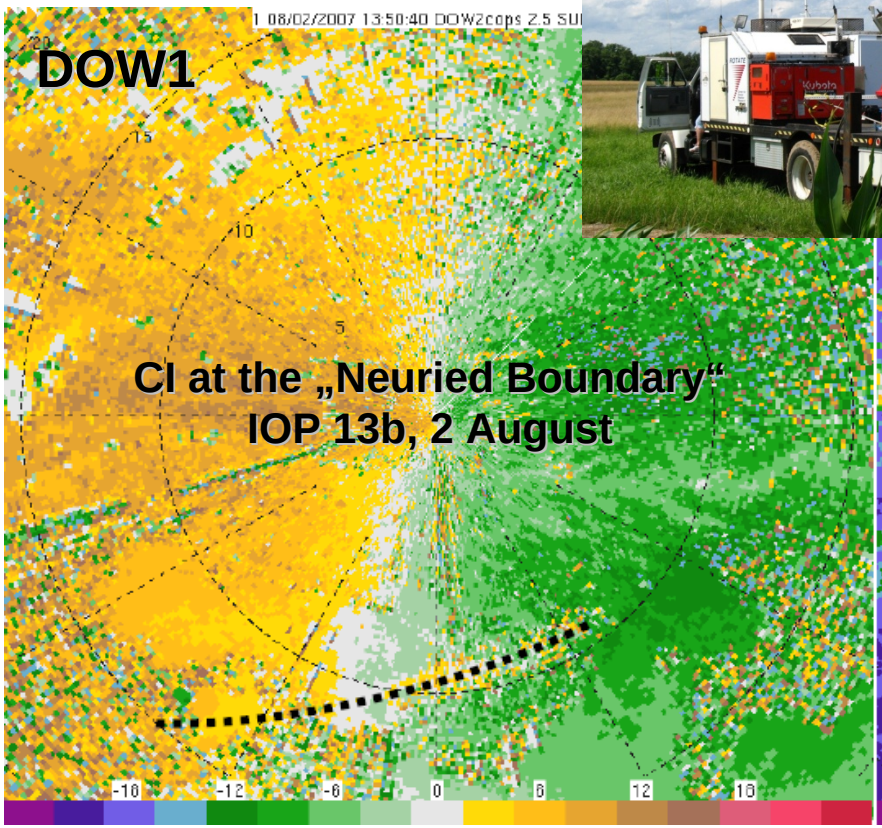
CI: Temperature Lids

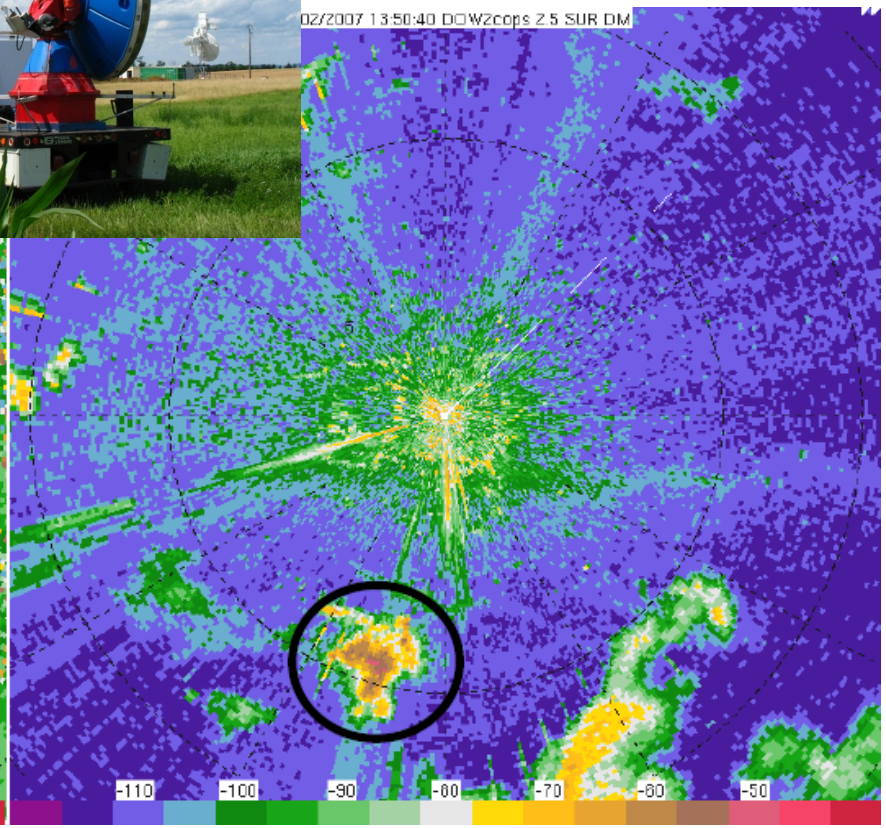


Andreas Behrendt, Andrew Russell

CI: Employ Clear-Air Radar Echos for CI Studies





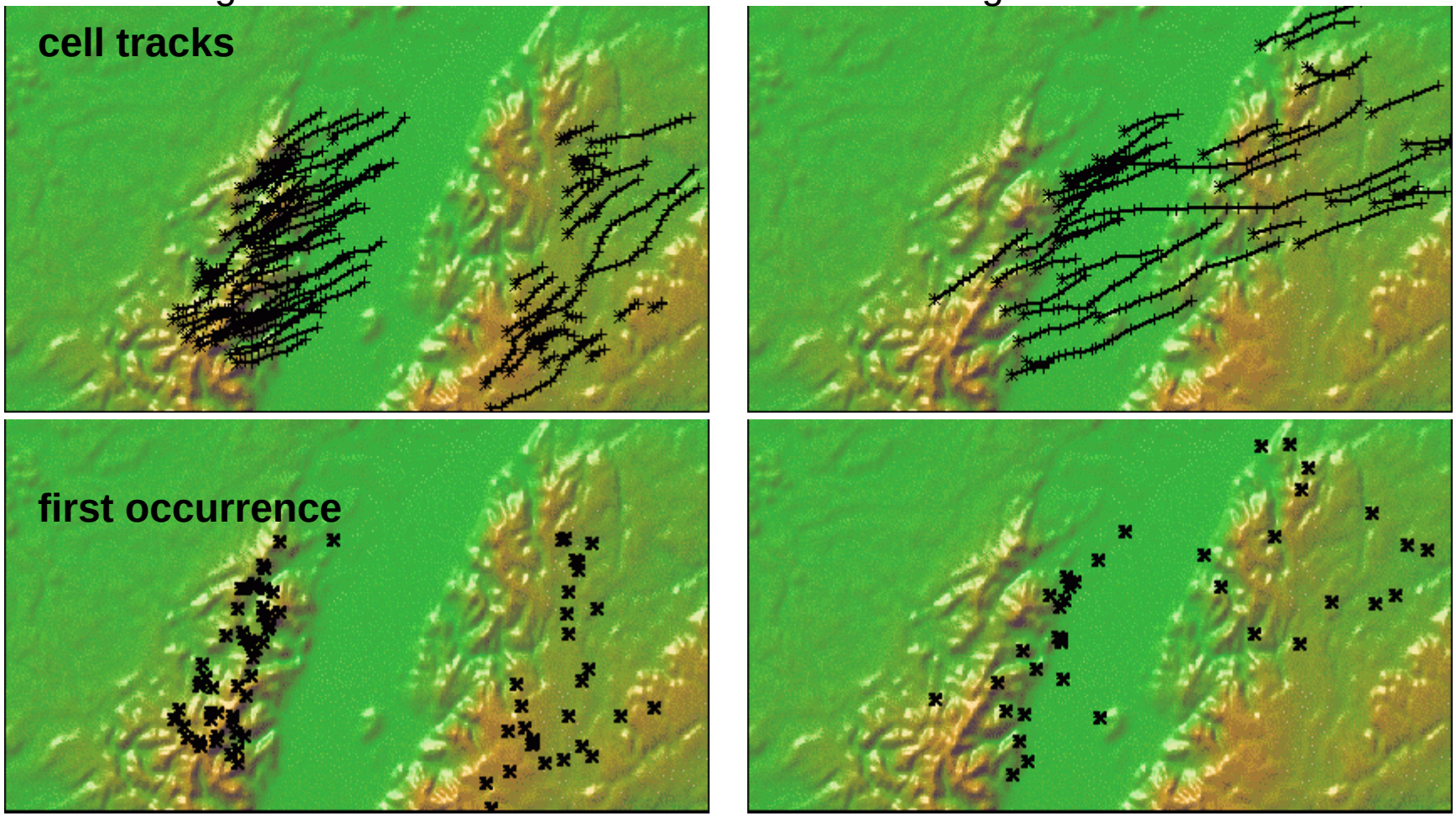


Tammy Weckworth

PLC: Cell Tracking IOP 15

12 Aug. 2007 11-17 UTC

13 Aug. 2007 8-15 UTC

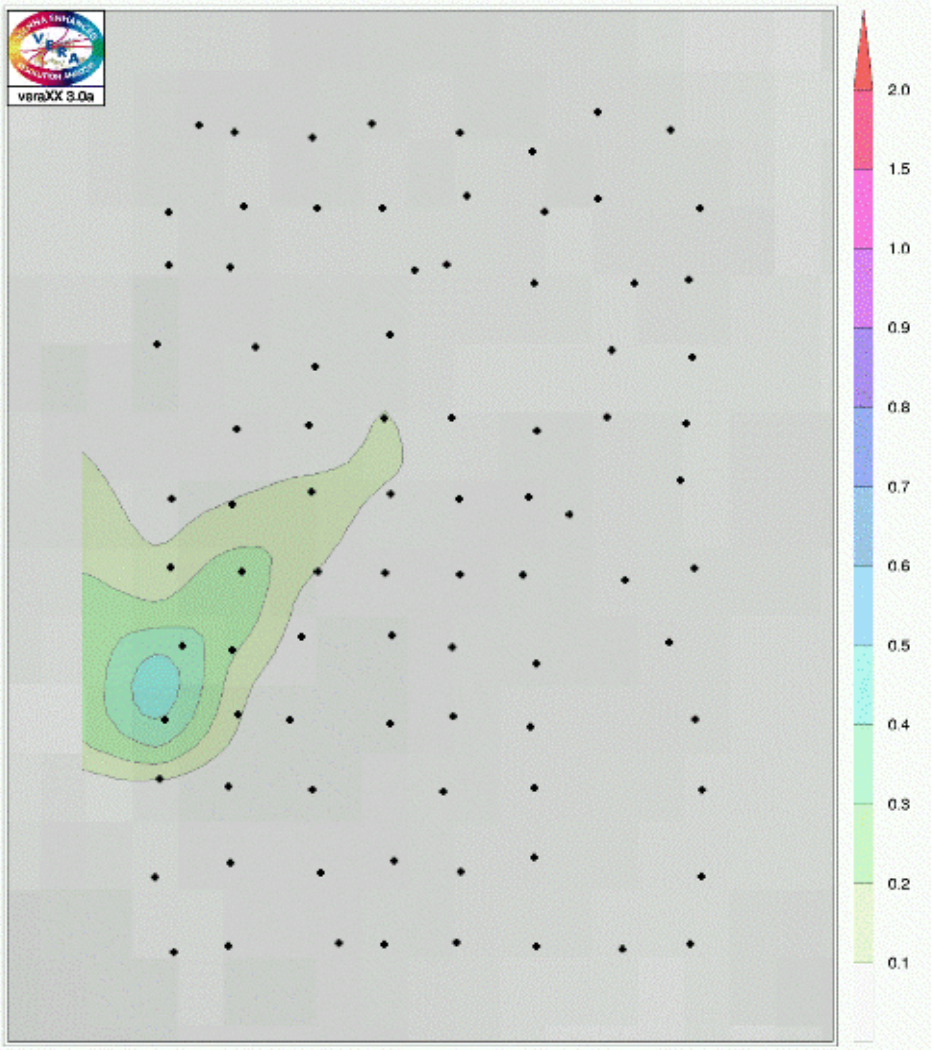


M. Hagen

High resolution precipitation fields

100 automatic weather station

1 min resolution for precipitation



12 km

R. Steinacker, M. Dorninger

Further research

German projects in PQP

- Reanalysis of COPS period using various data sets (DWD)
- Surface fluxes and valley convection (Foken, Kalthoff)
- Lower and Upper Tropospheric Forcing of Convection (Barthlott,FZ Karlsruhe)
- Cumulus parametrization (Bott, UBonn)
- Life cycle of deep convection (M. Hagen, DLR)
- Aerosol characterization, vertical wind at cloud base, heterogeneous ice formation (Ansmann, IfT Leipzig)
- Map-DHASE (Wulfmeyer, Hohenheim) for process studies
- GOP (Crewell, Cologne) analysis for long-term statistics
- ...

THORPEX: impact of observations in sensitive areas - FALCON flights (Craig, DLR)

Further research

and many more

COPS - UK A. Blyth; Leeds, Manchester, Reading and Salford
(ground-based and airborne obs, modelling)

- Convective Initiation (Gadian, Mobbs, Smith, Blyth,Collier, Davis, Burton..)
- Aerosols and Microphysics (Crossier, Gadin, Blyth, Choularton, Coe, Carslaw, ..)
- Precipitation (Hölzl, Gohm, Smith, Mobbs, Blyth, Clark..)
- Model studies and predictability (Gadin, Burton, Belcher, O'Connor, Illingworth)

COPS - France (E. Richard)

- Supersite Vosges (Cuesta, Van Baelen)
- Reinforcement of the GPS network (Champollion)
- Safire Falcon / Leandre II operation (Flamant)
- Numerical modelling (Chaboureau, Richard)
- High-resolution assimilation (Brousseau, Caumont)

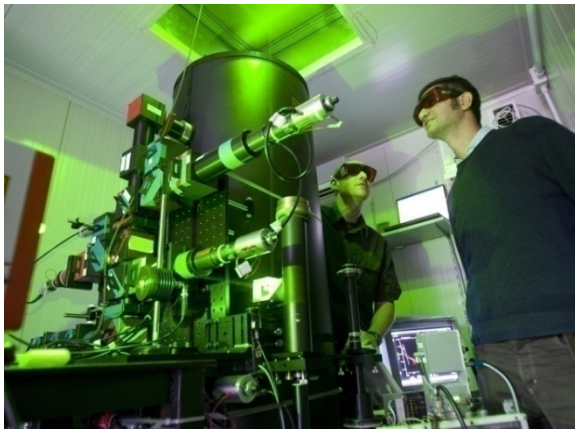
Italian Contributuion (lidar and microwave observation)

- Water vapor intercomparison (di Giralomo, Basilicata)
- Sensor synergy (Pappalardo, Madonna, CNR)

Dutch Contribution (Polarimetric Radar and Eufar Flights)

- Mixed phase clouds and snsor synergy (Russchenberg, Doufornet, Brandau)
- Vertical velocity (Unal, Russchenberg)

COPS Impressions



COPS Research Aircraft