Evaluating model predictions of the atmospheric hydrological cycle by remote sensing observations – the case study and the long term perspective

N.P.M. van Lipzig[1], F. Ament[2], M. Schröder[3], S. Crewell[2]

(1) Katholieke Universiteit Leuven, Belgium

(2) LMU München, Germany

(3) Freie Universität Berlin, Germany

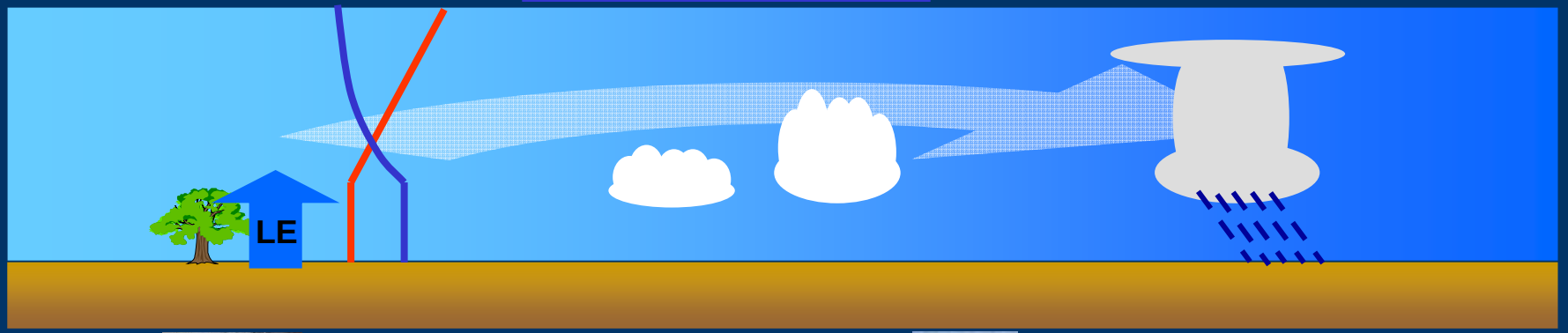
EGU 2006, Vienna

Quantitative evaluation of regional precipitation forecasts using **multi-dimensional remote sensing** observations (QUEST)

satellite

MSG ~ 5km; 15min
- Cloud Mask
- Cloud top pressure

MODIS ~ 1km; 1day
- Cloud Mask
- Optical thickness



IPT / Micro-wave

1D vertical; Lindenberg (and Cabauw)
- temperature profile
- humidity profile
- LWC

GPS

147 stations; Germany; 30min
- IWV

Ceilometer

17 stations; Germany; 1min; ranges up to 4km
- Cloud base height
- Cloud cover (<4km)

Radar

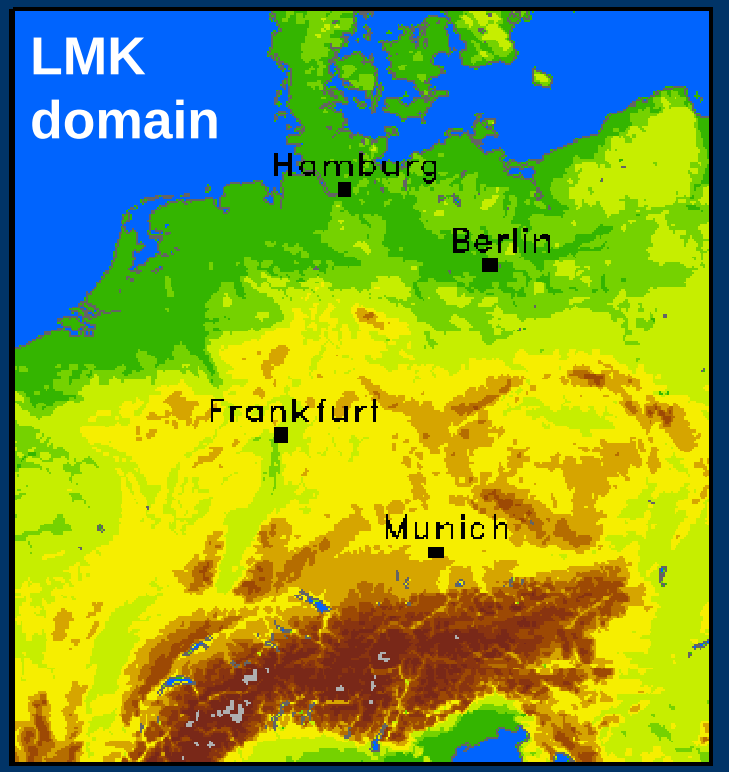
DX radar composite; 1km; 5min
- Rain rate

Polarimetric radar (DLR)

Short-range, high-resolution version of Lokal-Modell: LMK (LMKürzestfrist)

Pre-operational phase may 2006 – spring 2007

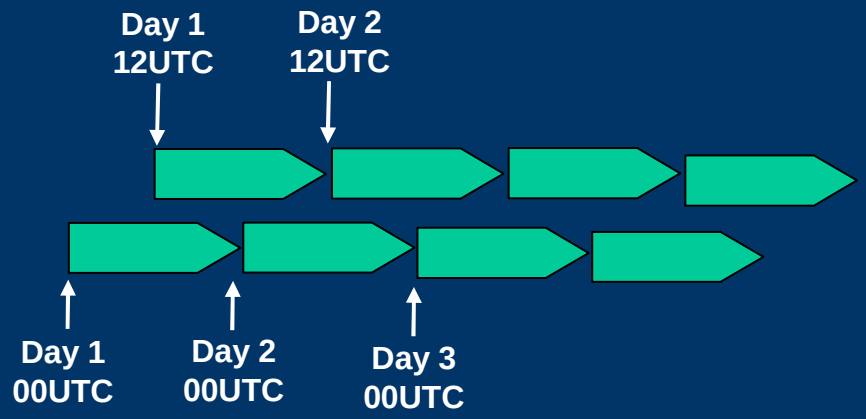
Operational expected spring 2007



Testsuite 2.2b: July 2004

- **Prognostic treatment of cloud water, cloud ice, rain and snow**
- **2.8km horizontal resolution, 50 vertical levels**

Lagged average forecast ensemble



Standard verification DWD

Synoptic

Upper air (radiosonde)

Radar

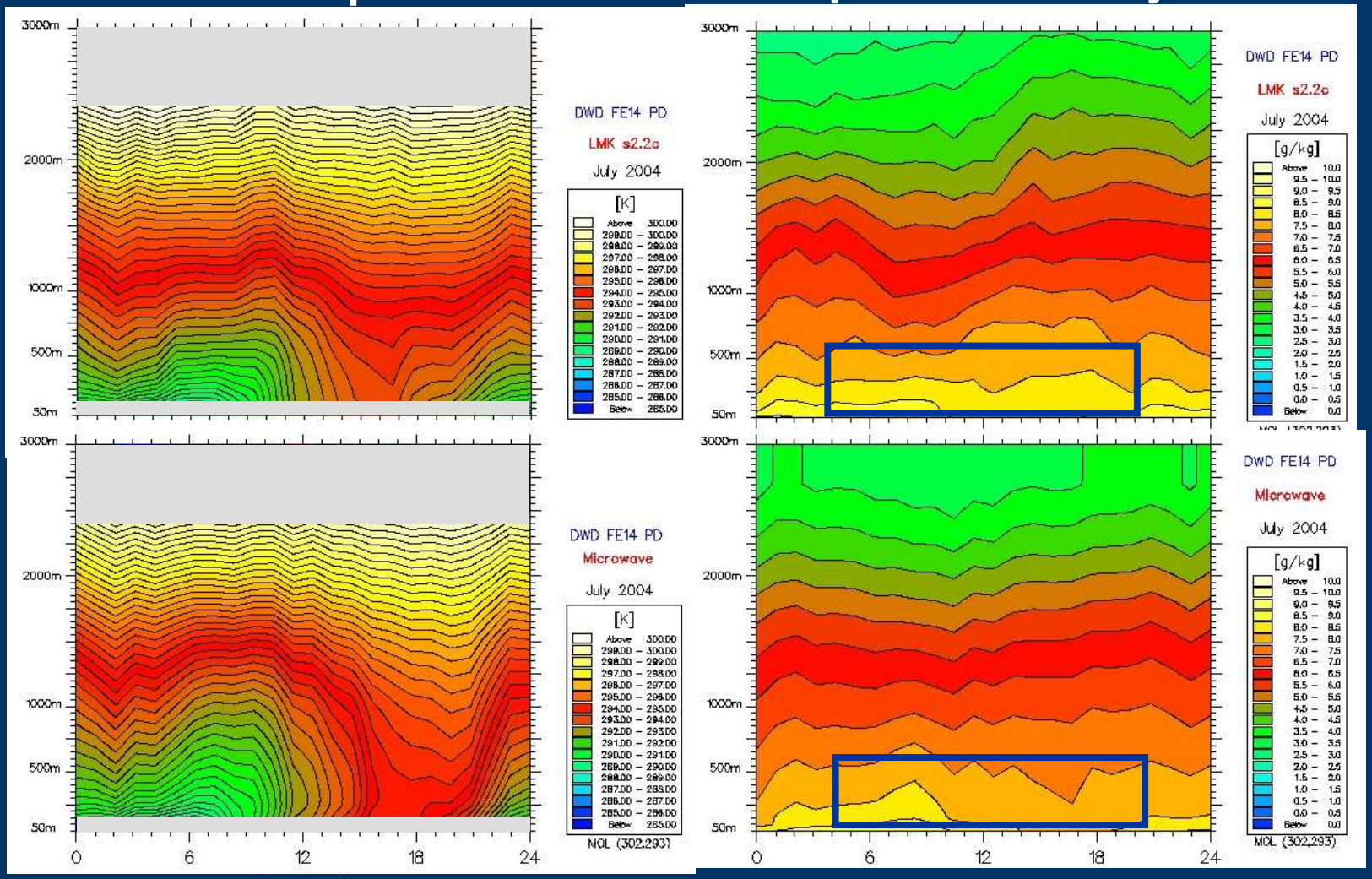
Boundary Layer Profiles at Lindenberg (by G. Vogel, DWD)

Potential Temperature

Specific humidity

LMK

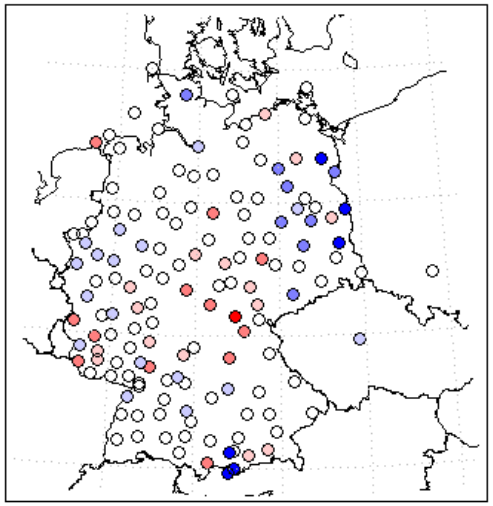
OBS Mircowave Radiometer



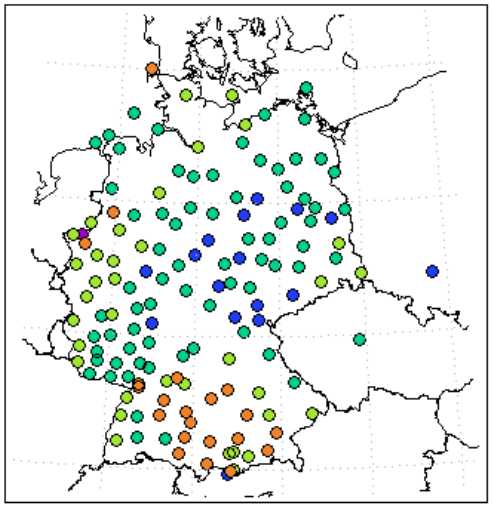
➔ LMK boundary layer too stable (shallow) and too wet

Integrated water vapor (IWV) at GPS sites

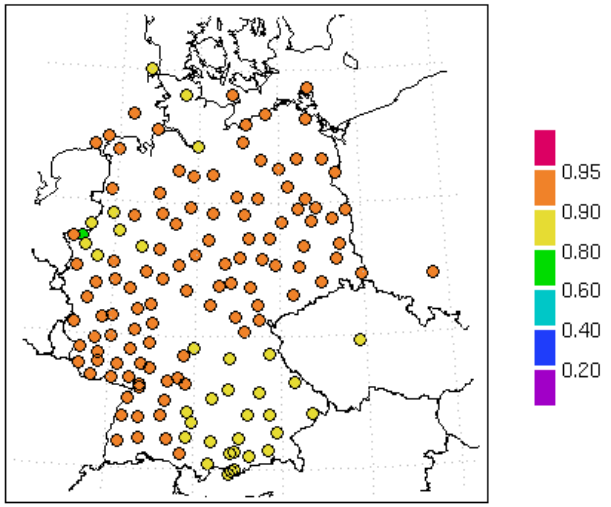
BIAS



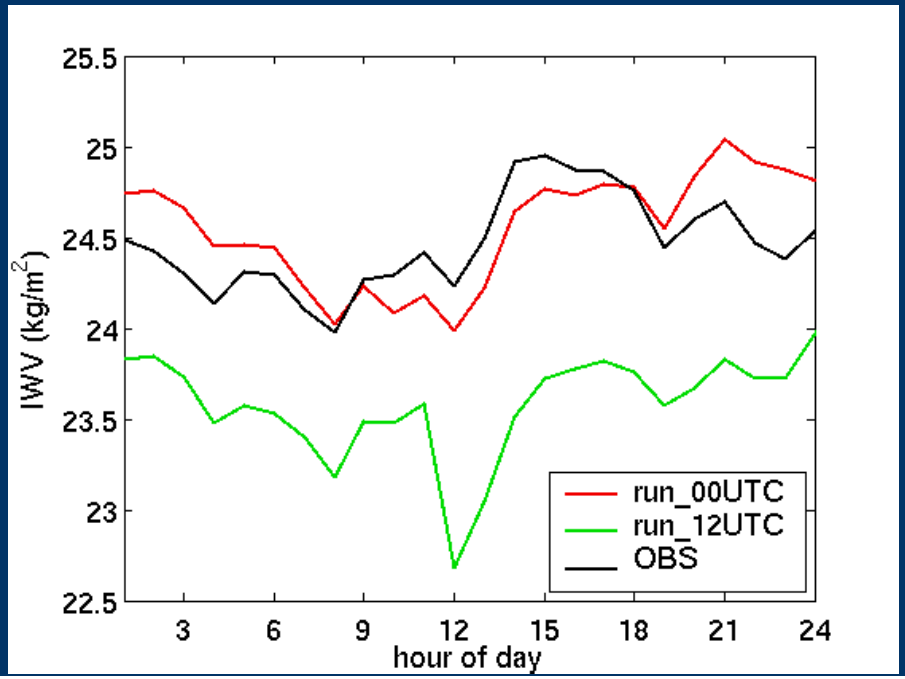
Standard deviation



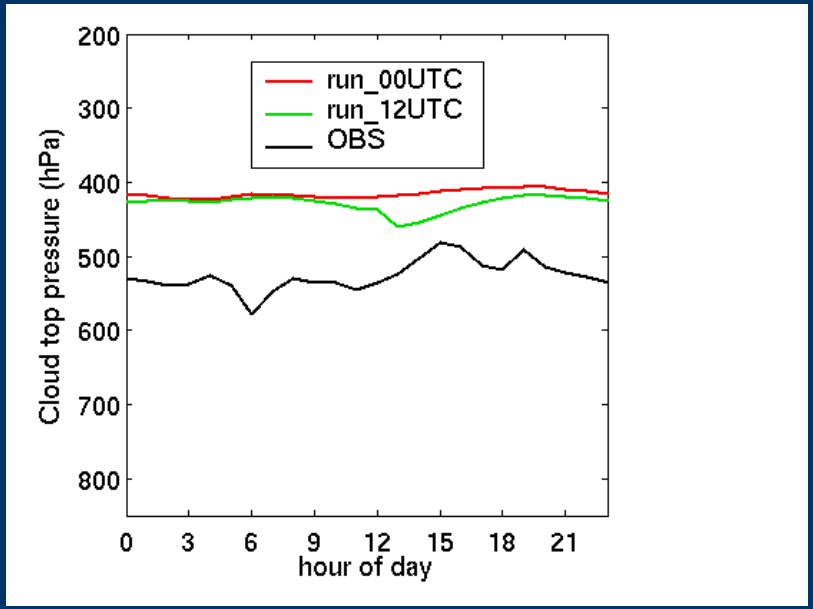
Correlation



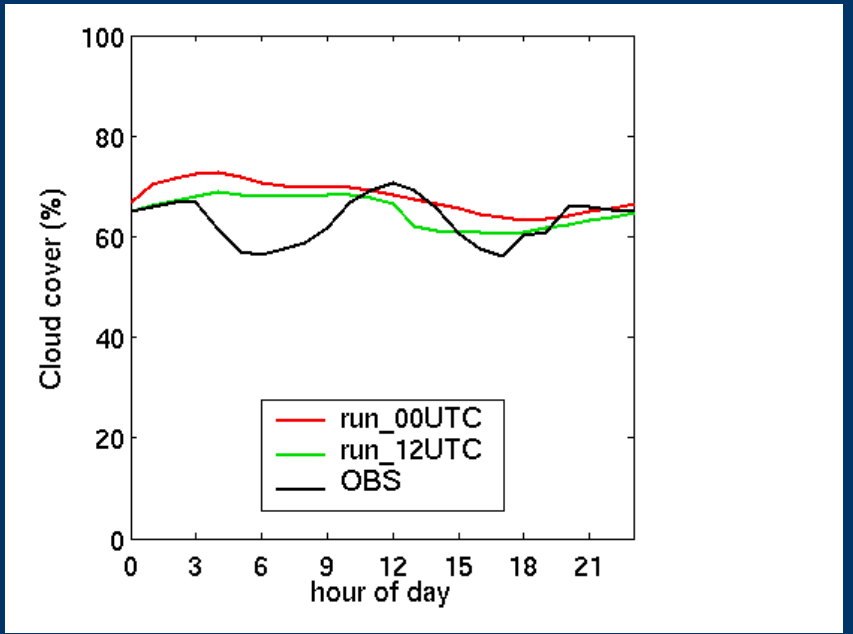
(LMK runs +24h started at 00UTC)



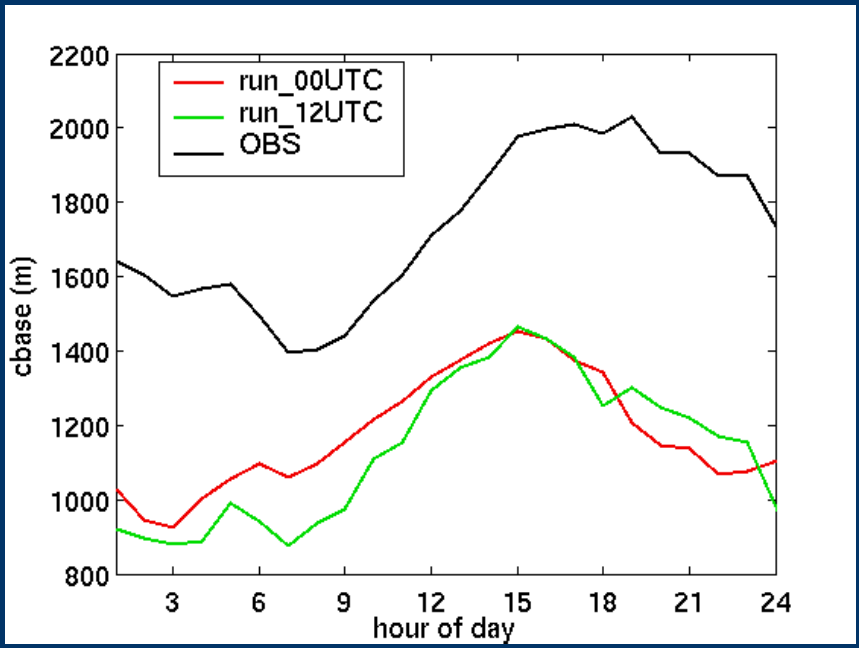
Cloud top MSG

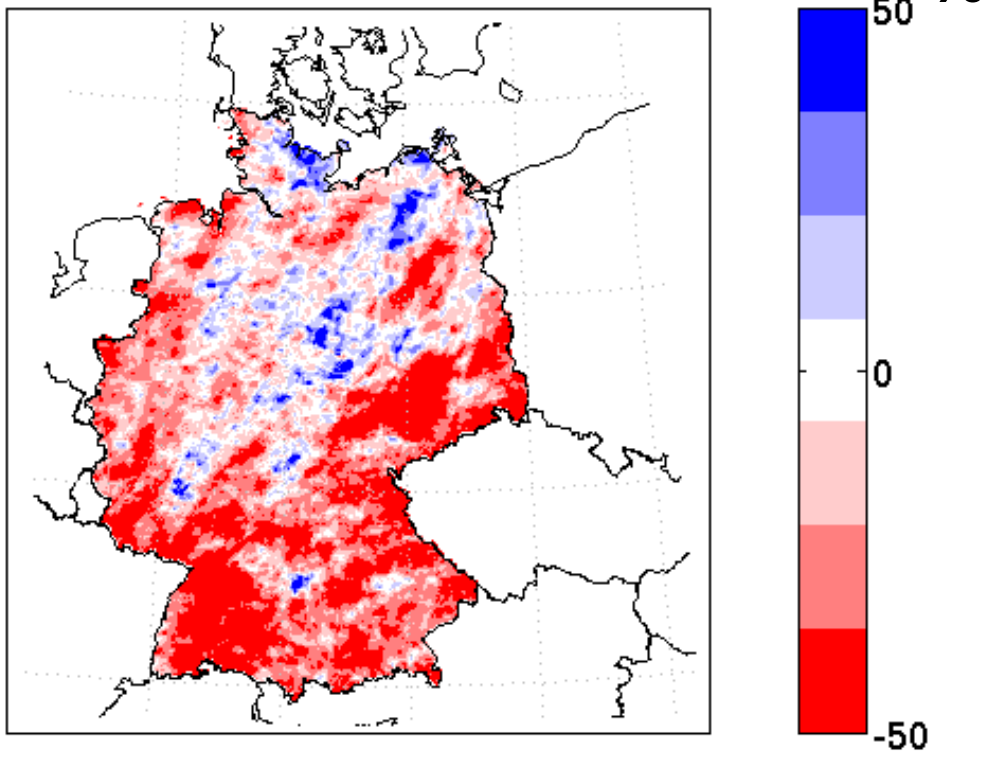


Cloud cover MSG



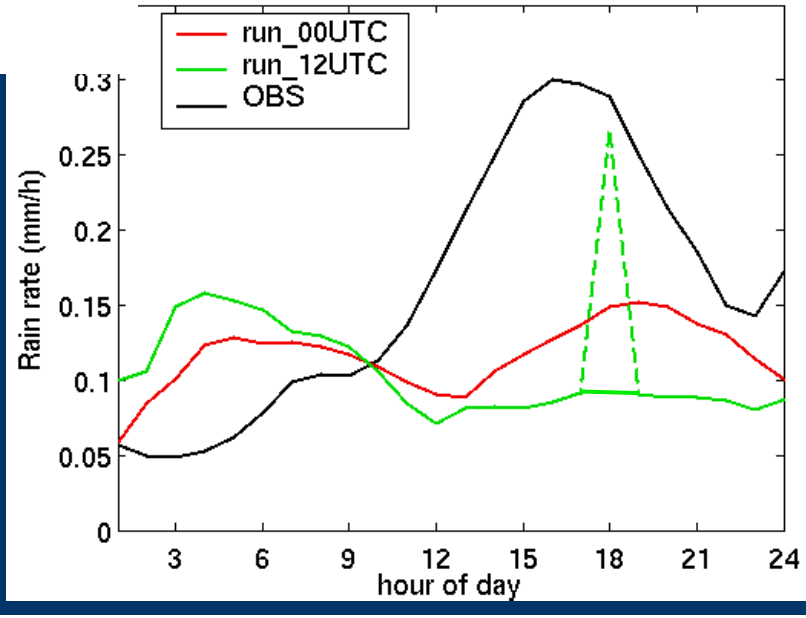
Cloud base ceilometer



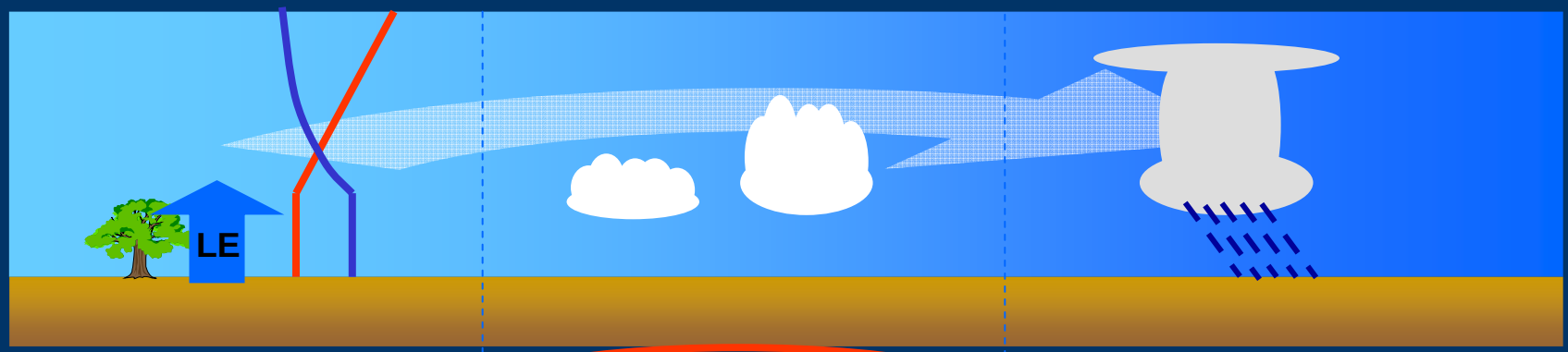


Relative bias in accumulated precipitation over the month compared to radar

Daily cycle of accumulated precipitation over the month compared to radar



Summary of long term evaluation of LMK



- Boundary layer too thin and too wet
- IWV predicted very well
- IWV bias of -0.85 kg/m2 for run started at 12UTC

- Clouds too thick
- Total cloud cover agrees well with MSG

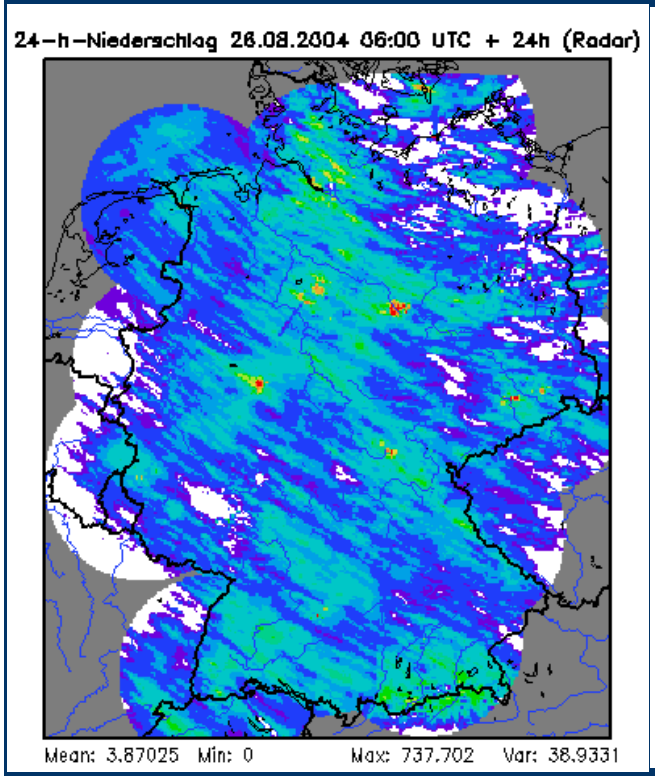
- Precipitation underestimated by 20%
- Observed timing maximum not reproduced

Case studies to look into more detail in the problems

Case study 26-08-2004 (M. Baldauf DWD)

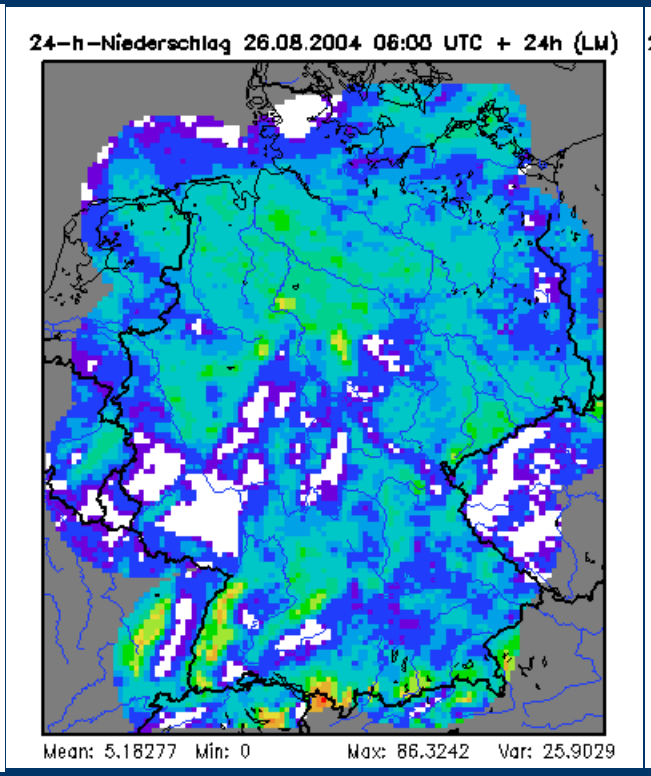
Accumulated precipitation over 24 hr

Radar



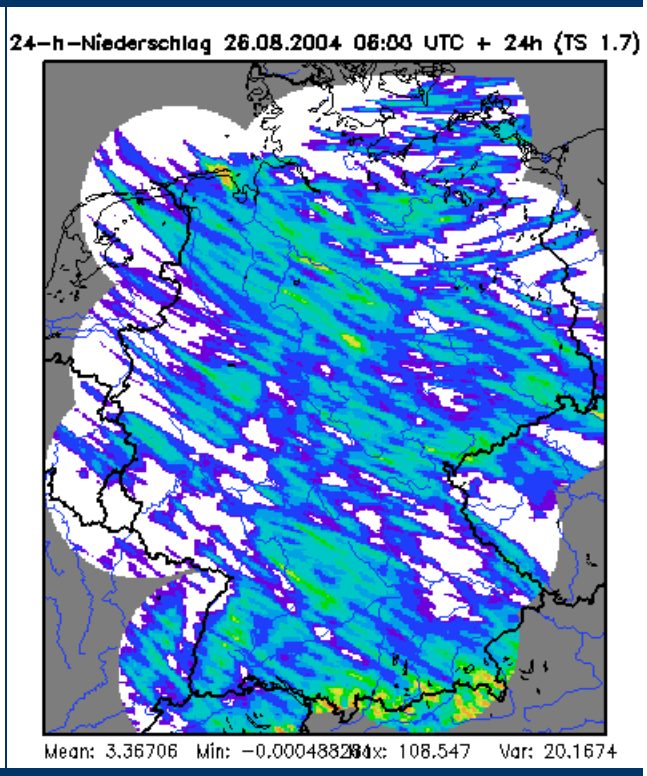
3.9 mm/day

LM

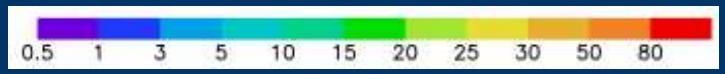


5.2 mm/day

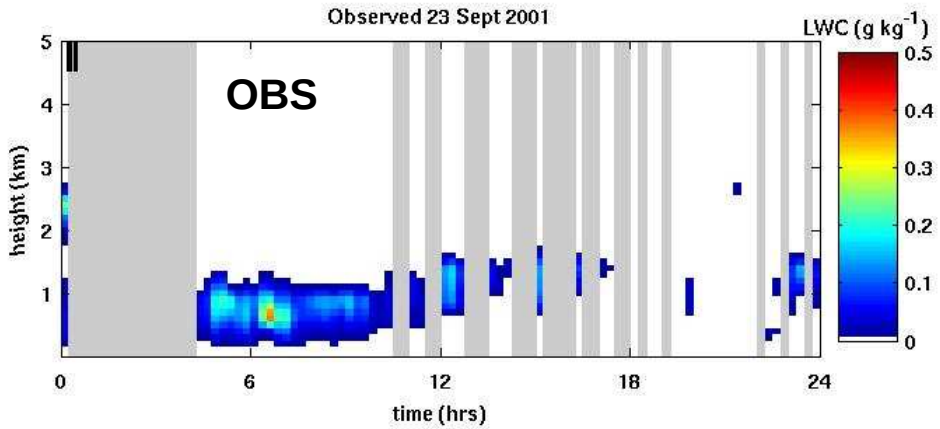
LMK

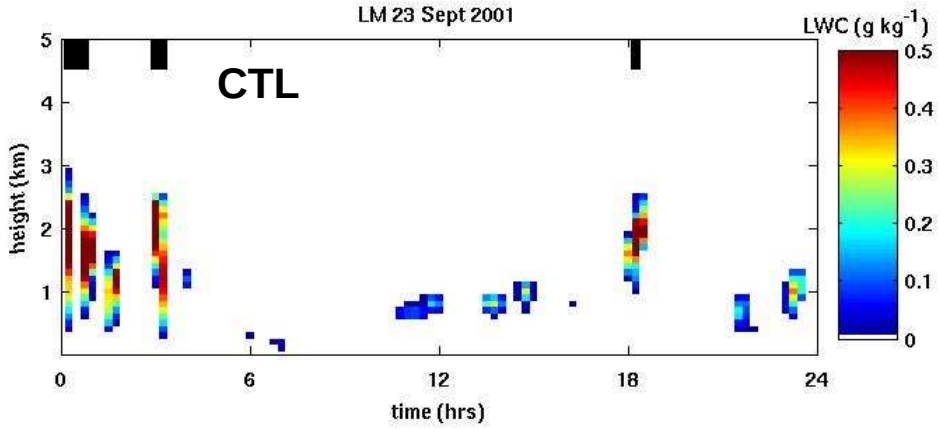


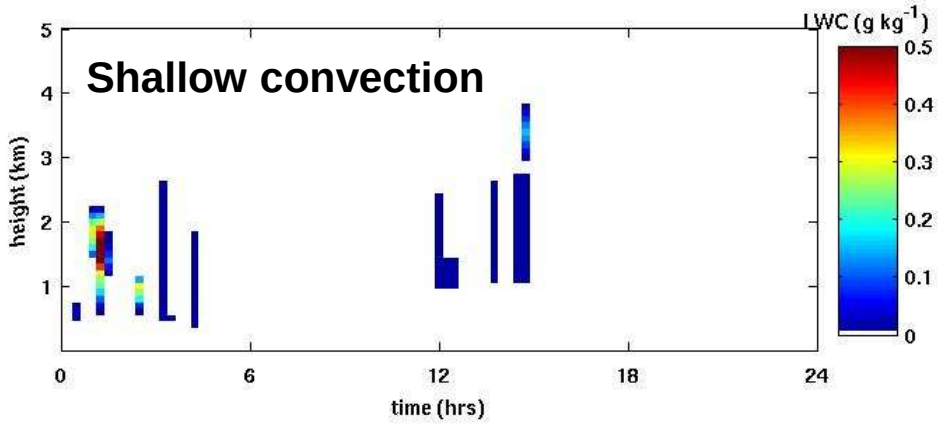
3.4 mm/day



mm/day





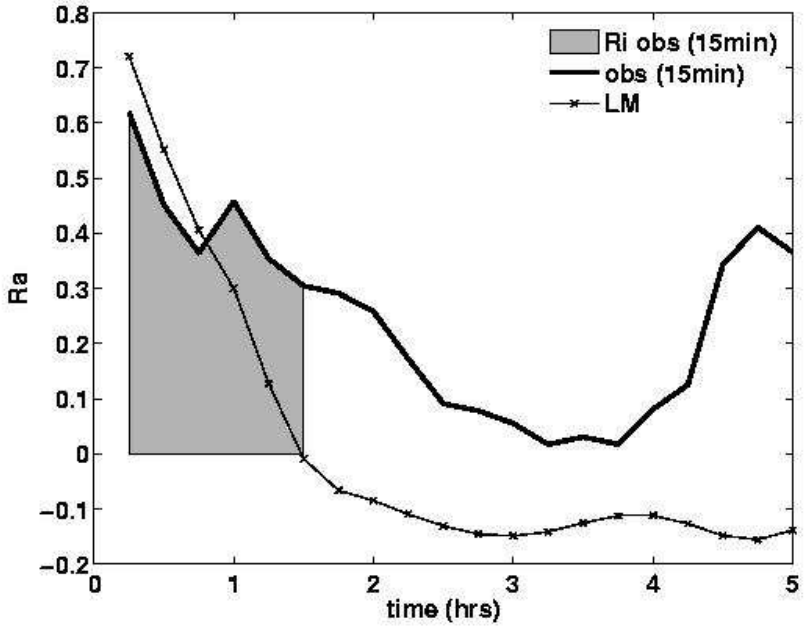


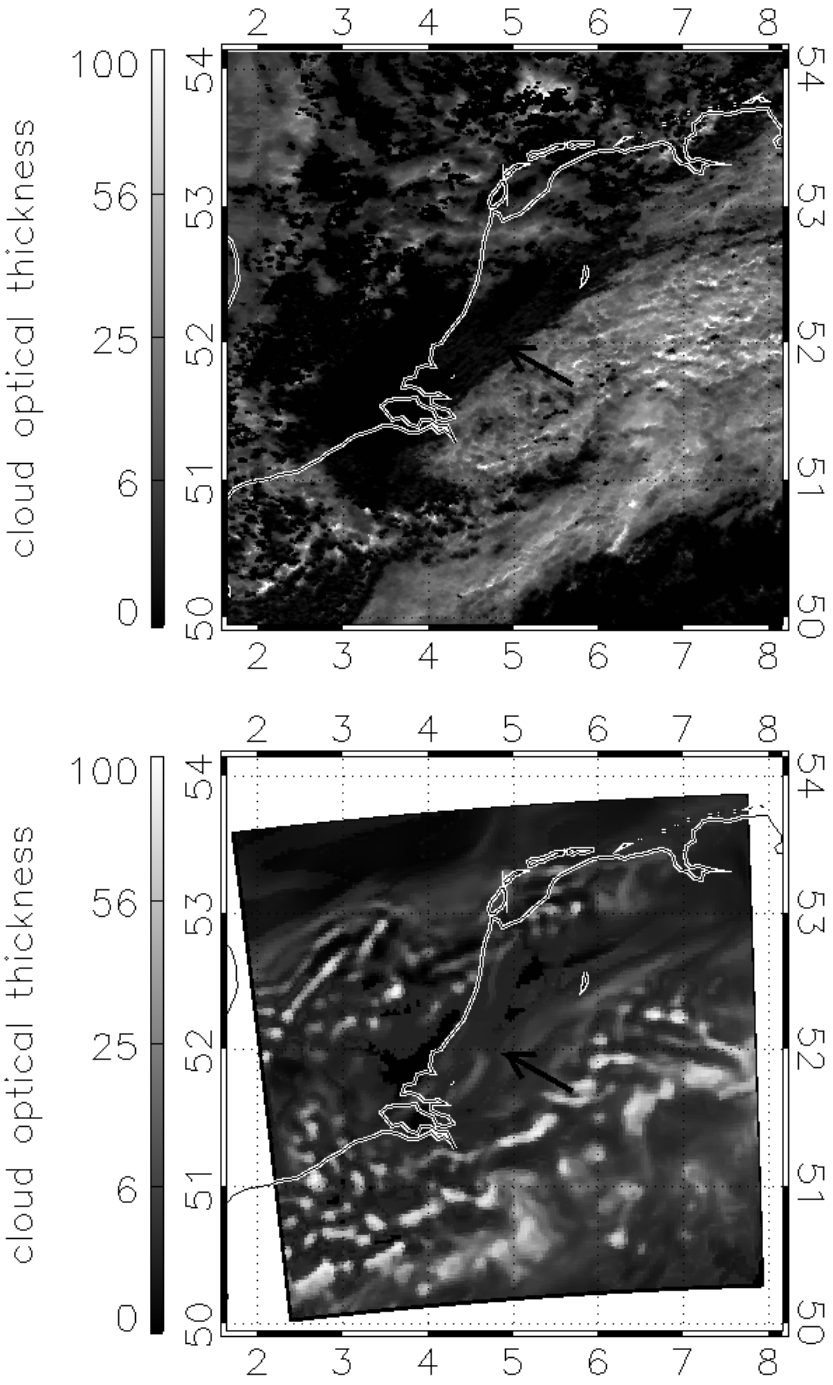
Case 23 Sept 2001

BBC case for

WMO workshop 2004

Van Lipzig et al., 2006





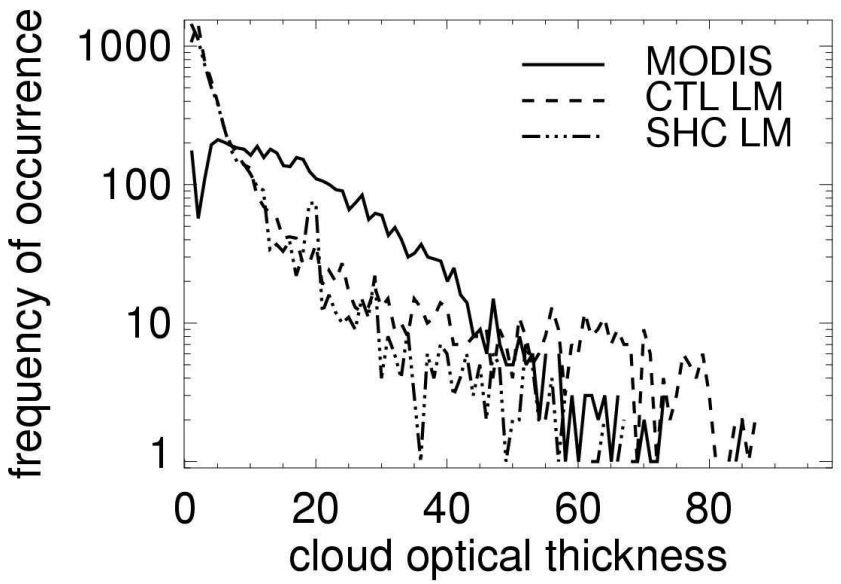
10:05 UTC

Case 23 Sept 2001

BBC case for

WMO workshop 2004

Schröder et al., 2006



Case studies versus long-term evaluation