

# **Results of LM evaluation projects within the Priority Program PQP**

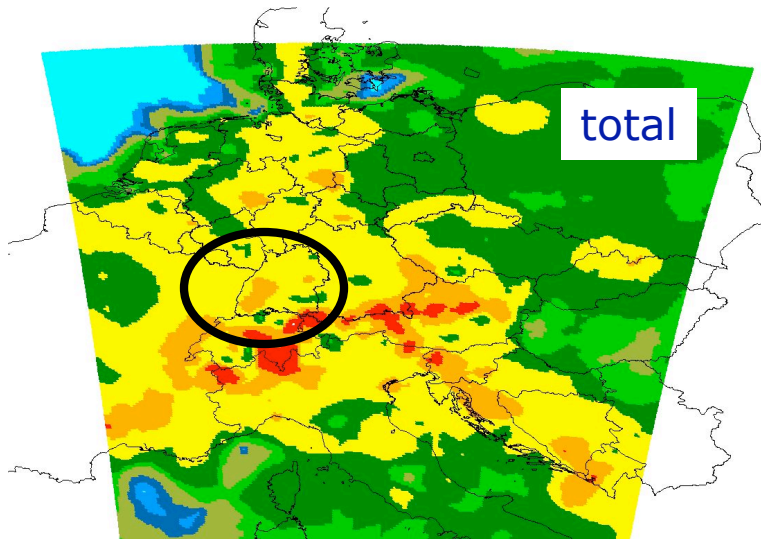
**Heini Wernli,  
Nicole v. Lipzig, Susanne Crewell,  
Leonhard Gantner, Andreas Behrendt**

**U Mainz, U Munich, FZK Karlsruhe, U Hohenheim**

**+ contributions from 5 projects**

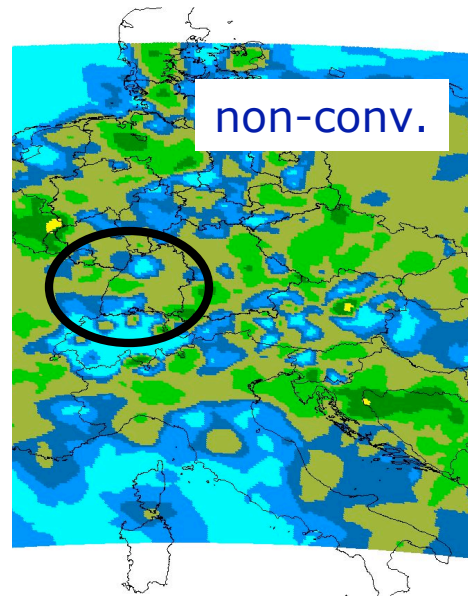
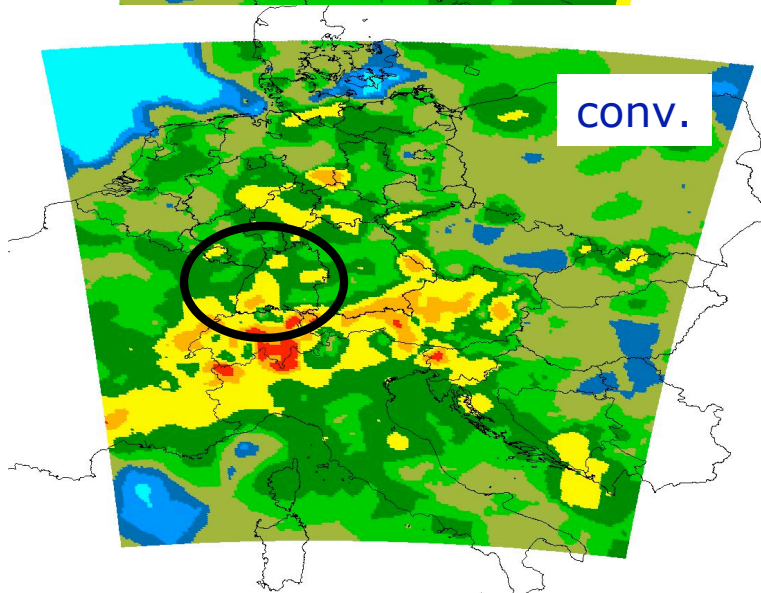
## Projects

- QUEST: U Munich, DLR, FU Berlin
  - STAMPF: FU Berlin
  - IMK (U Karlsruhe/FZK)
  - U Mainz
  - ETHZ
- 
- Projects started about 1 year ago
  - Here: selection of first preliminary results
  - Projects use different versions/resolutions of LM, different observational data sets and investigate different regions
  - Some oriented towards statistical verification, others towards case studies and detailed evaluation of processes



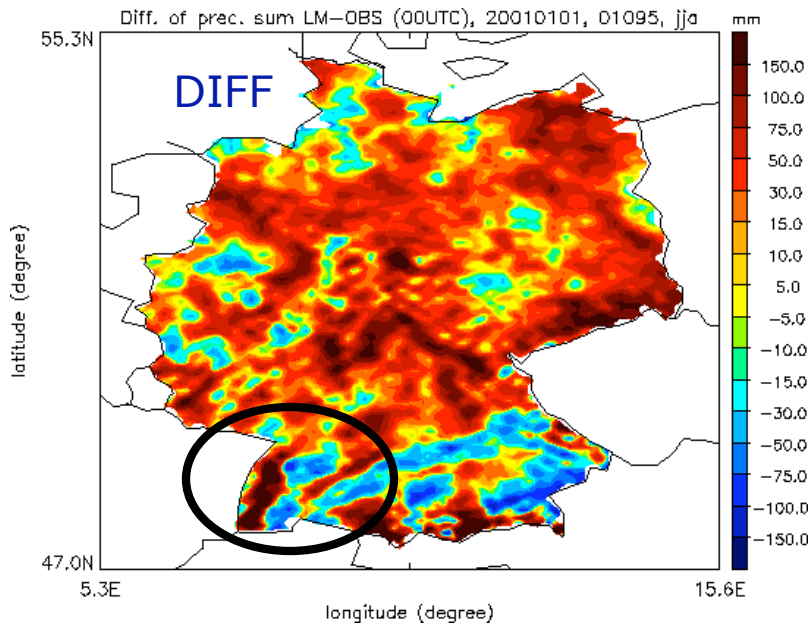
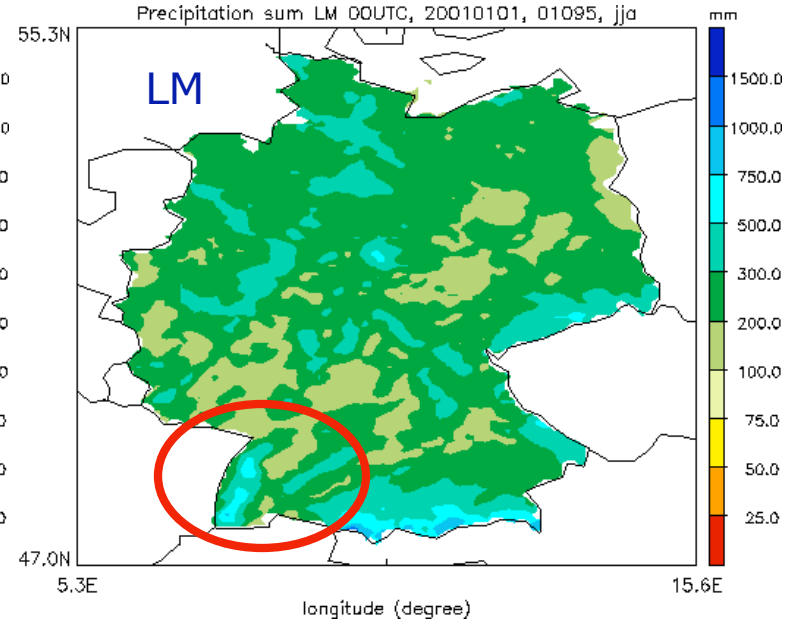
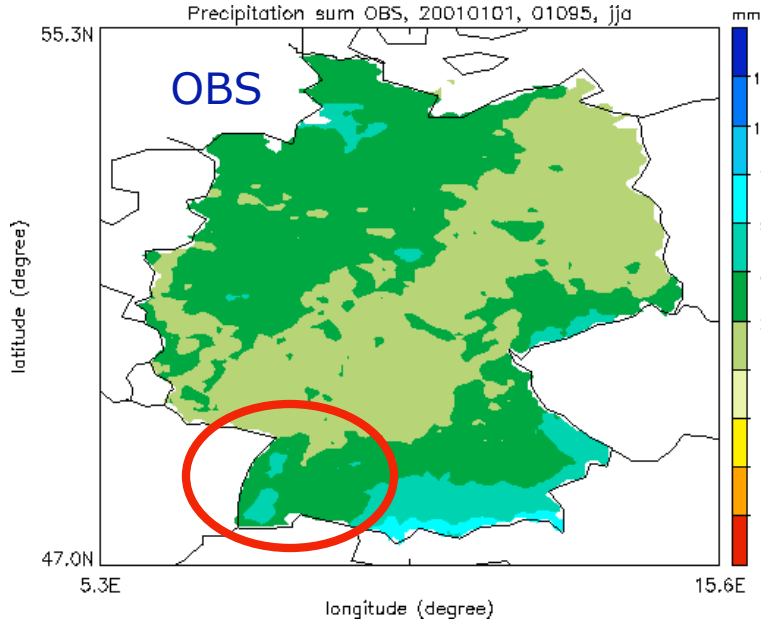
## Characterization of precipitation

- distinction between convective and non-convective precipitation based upon reports from synop stations
- entire year 2002
- COPS area: 60-70% convective



- 0.1 - 100
- 100 - 200
- 200 - 300
- 300 - 500
- 500 - 700
- 700 - 1000
- 1000 - 1500
- 1500 - 2000
- 2000 - 3000

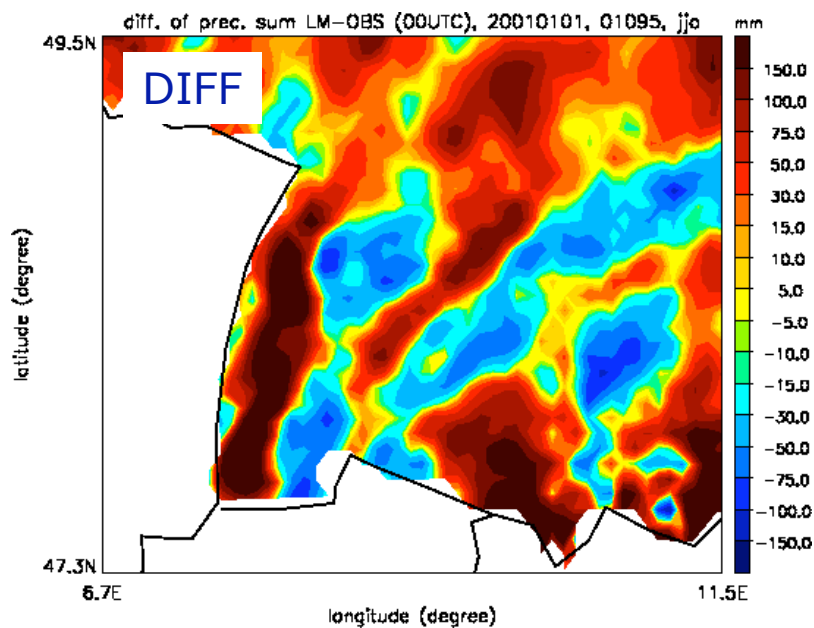
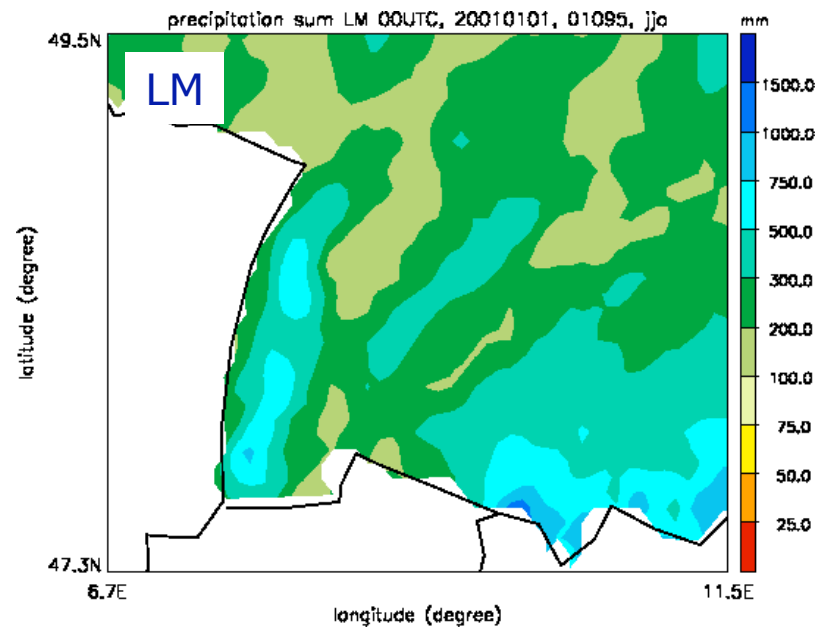
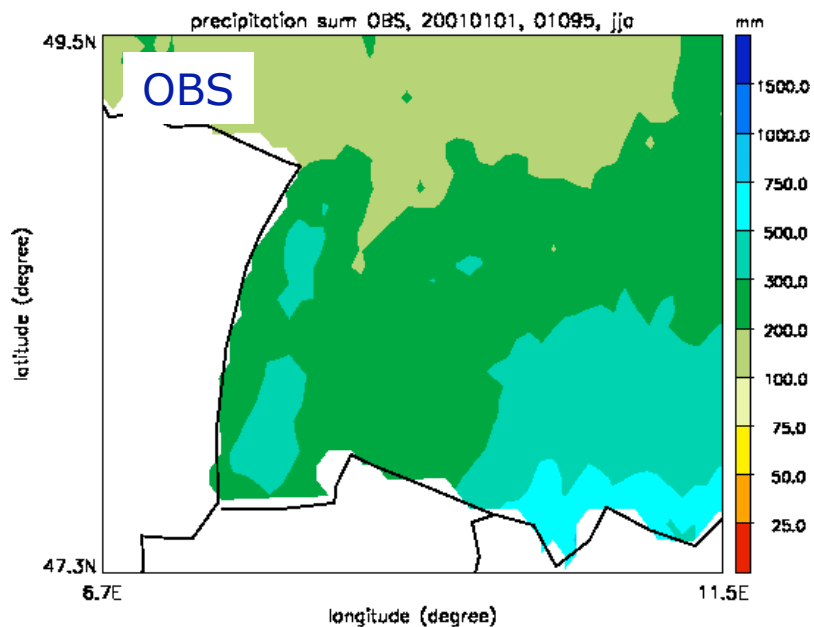
from I. Langer (FU Berlin)



## Summer precipitation

- OBS: 3000 rain gauge stations
- operational LM from MeteoCH/DWD
- summers 2001-2003
- LM overall too wet, more complex  
wet/dry bias in COPS area

from M. Paulat (U Mainz)

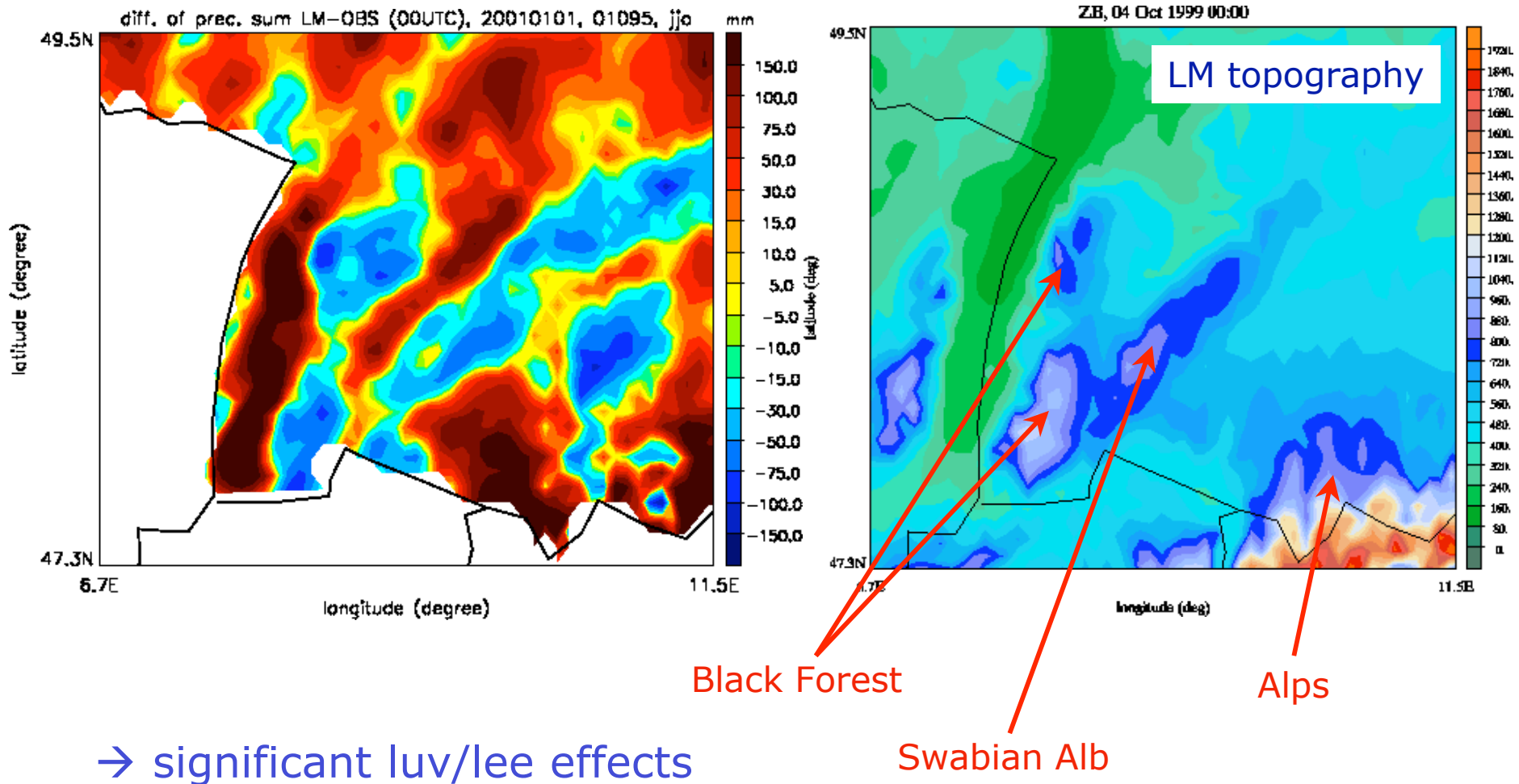


## Summer precipitation: focus on COPS area

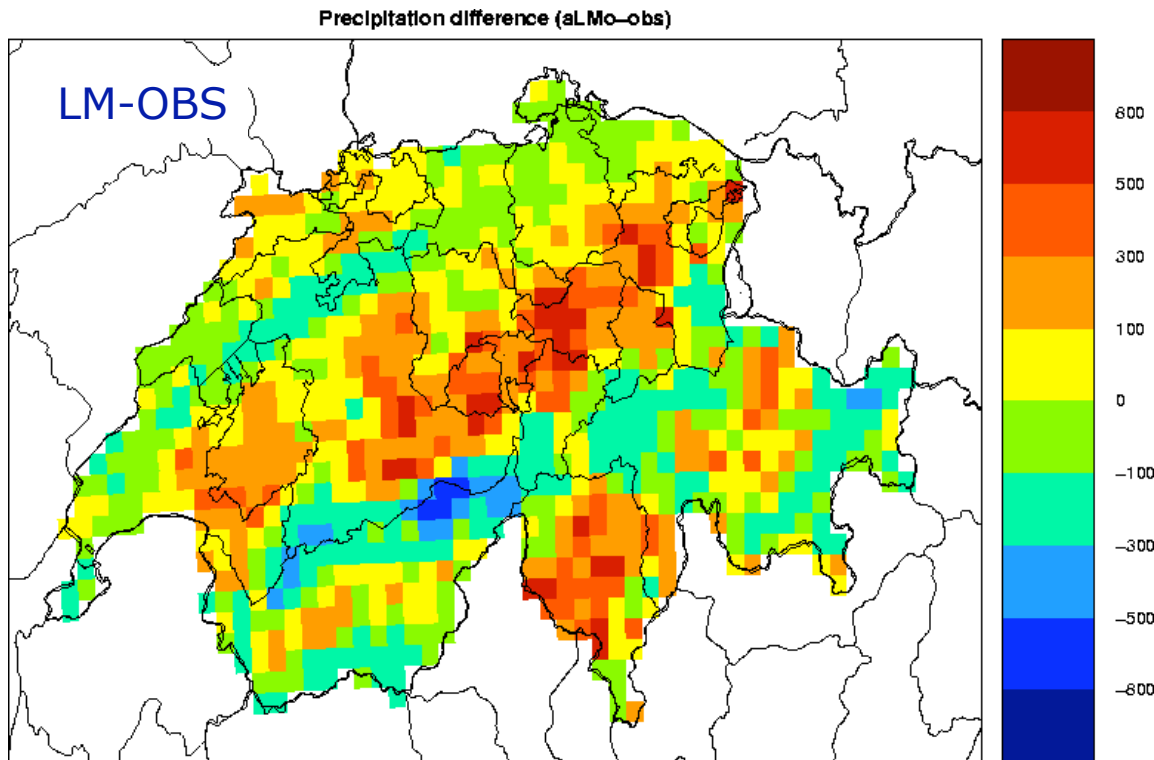
- OBS: 200-500 mm in JJA
- LM: more structured precip field
- LM over/underestimations:  
-75 ... +150 mm in 90 days

from M. Paulat (U Mainz)

# Link with model topography



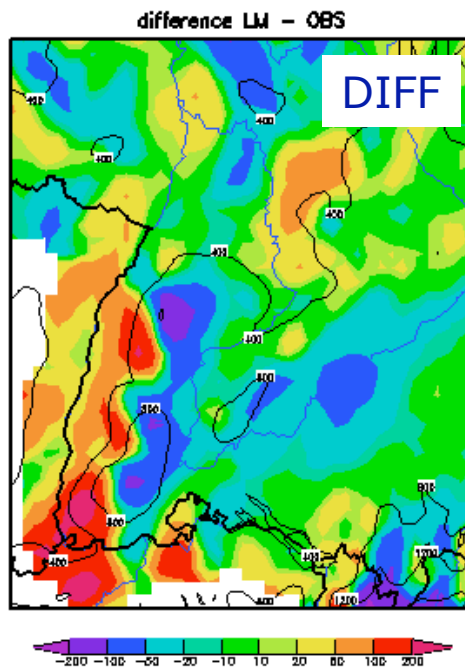
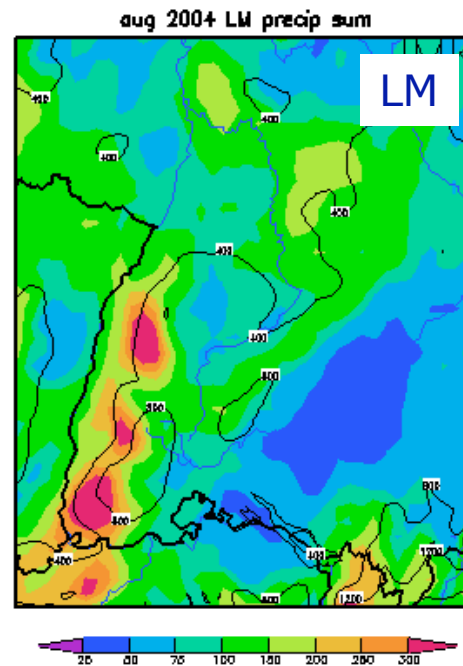
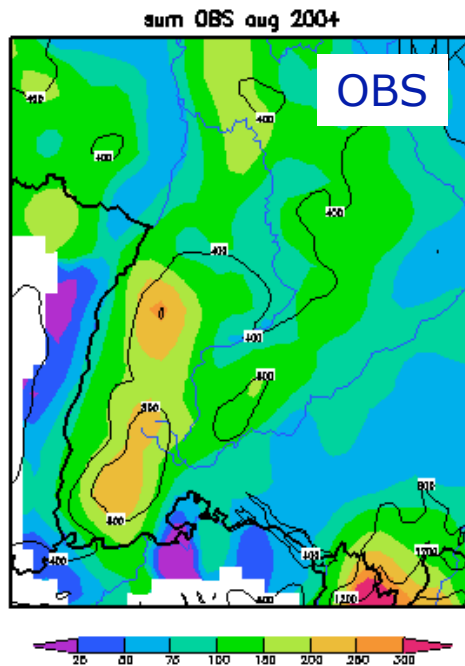
## Comparison with LM performance over Switzerland



- summer precip for 2001-2004
- operational LM from MeteoCH
- LM over/underestimations:
  - 300 ... +500 mm in 90 days

from J. Jenkner (ETHZ)





## Improvement with prognostic precip?

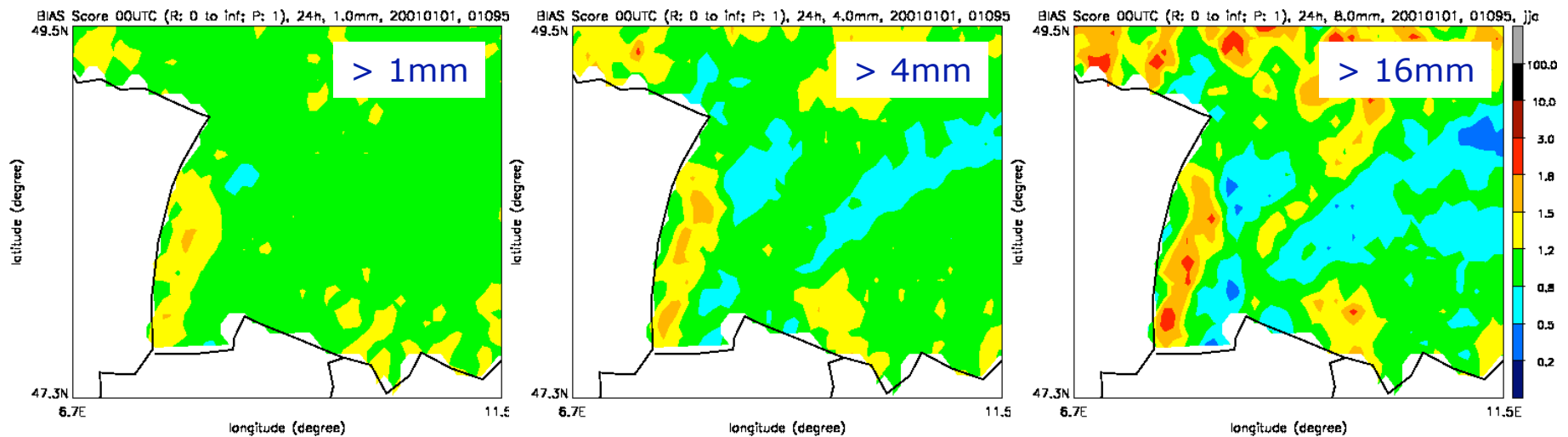
- operational LM (DWD) for summer 2004
- similar patterns as for 2001-2003
- LM over/underestimations  
in luv/lee of Black Forest still  
-100 ... +100 mm in 90 days

from L. Gantner (IMK Karlsruhe)



## BIAS scores for daily accumulated precipitation

- operational LM from MeteoCH/DWD
- years 2001-2003

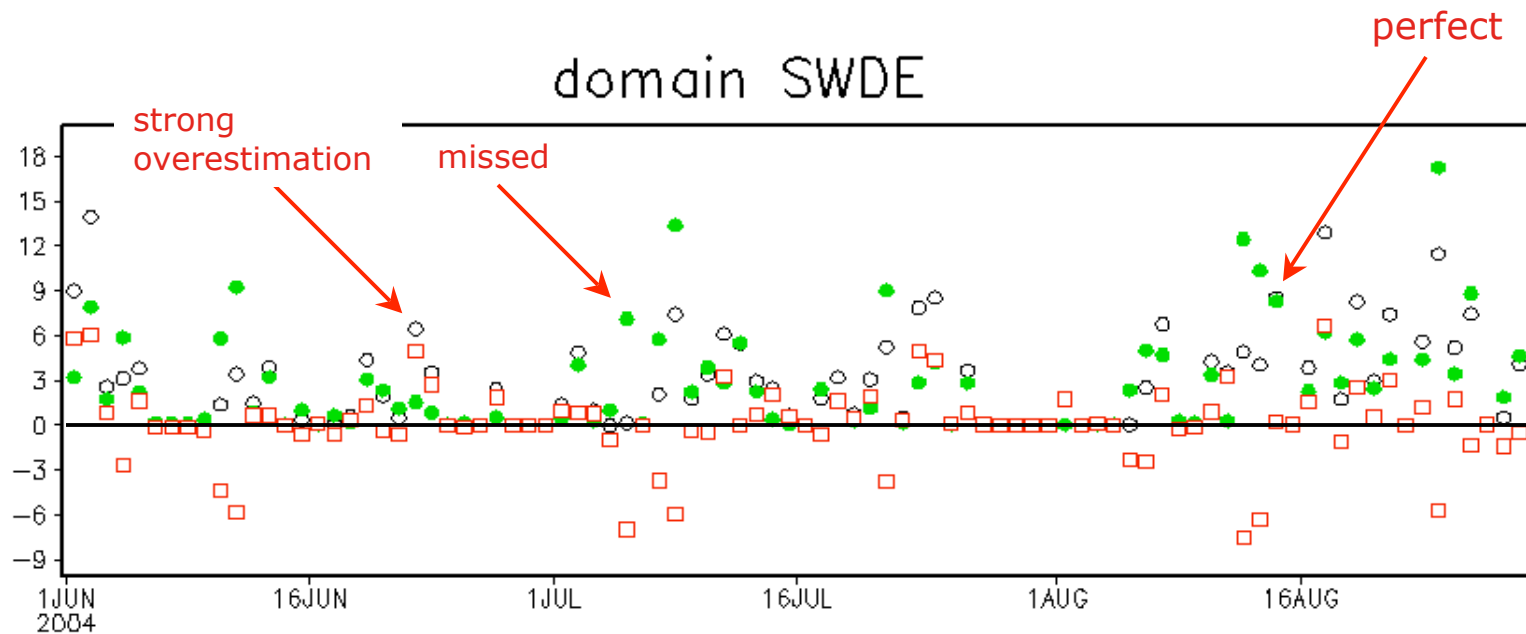


- slight overestimation of frequency of light precipitation
- significant over/underestimations of frequency of intense events

from M. Paulat (U Mainz)

## Is there simply a shift of daily rain patterns?

- daily accumulated area average of precip for summer 2004
- region of SW Germany



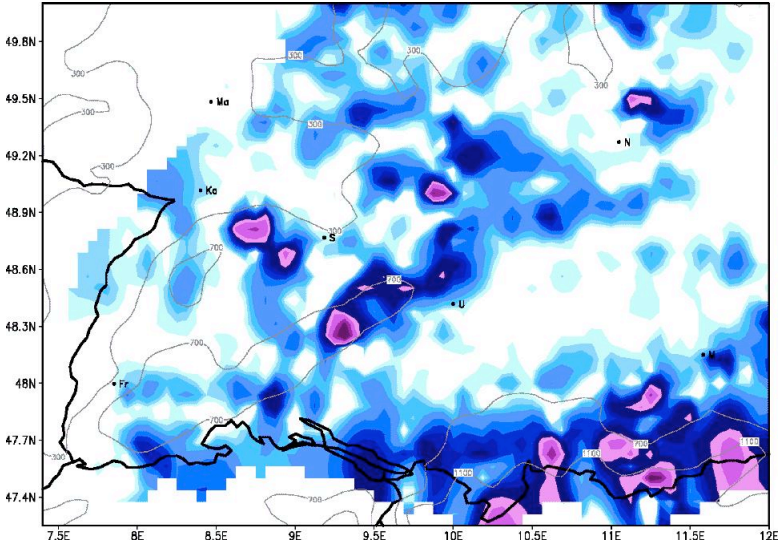
OBS - LM - DIFF

→ some days with large differences in area averaged values

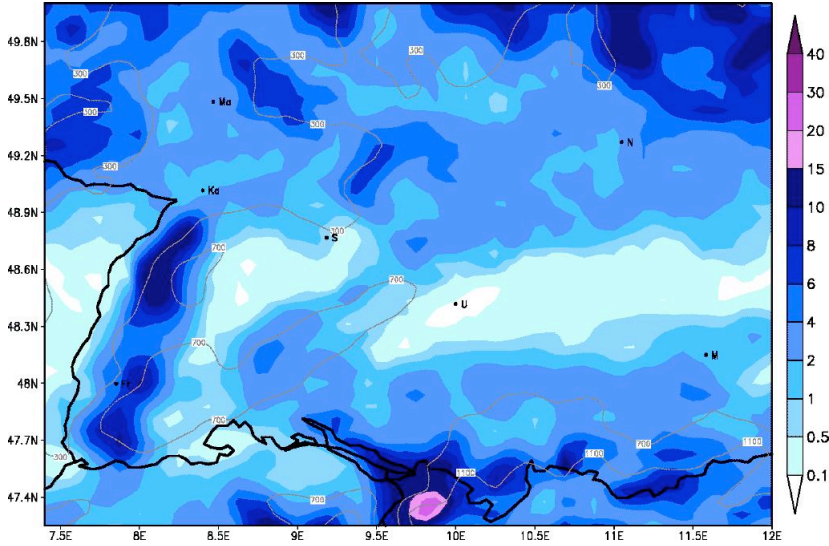
from L. Gantner (IMK Karlsruhe)

# Example for poor LM forecast

08 June 2003



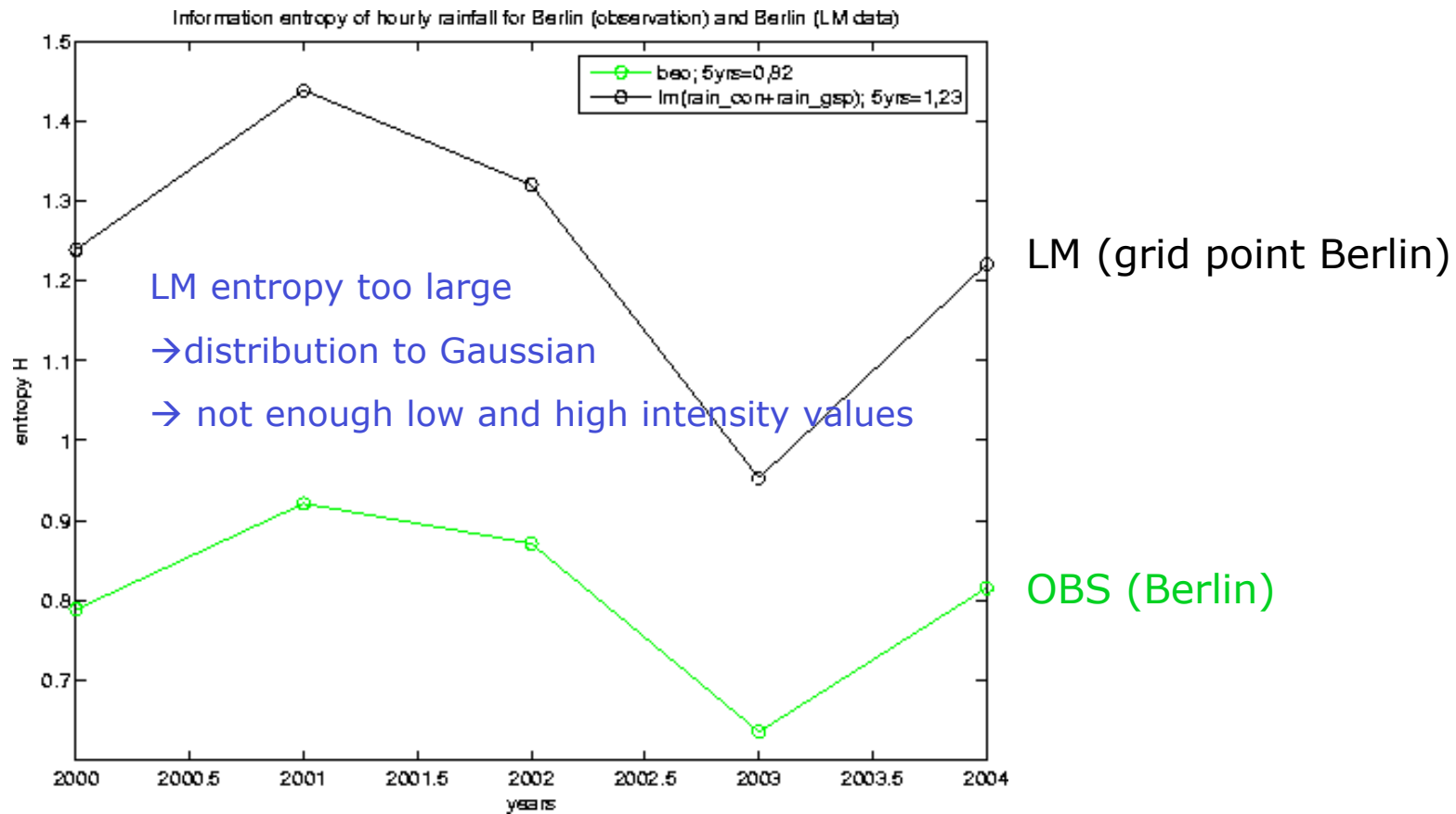
OBS



operational LM

from M. Eisenmann (IMK Karlsruhe)

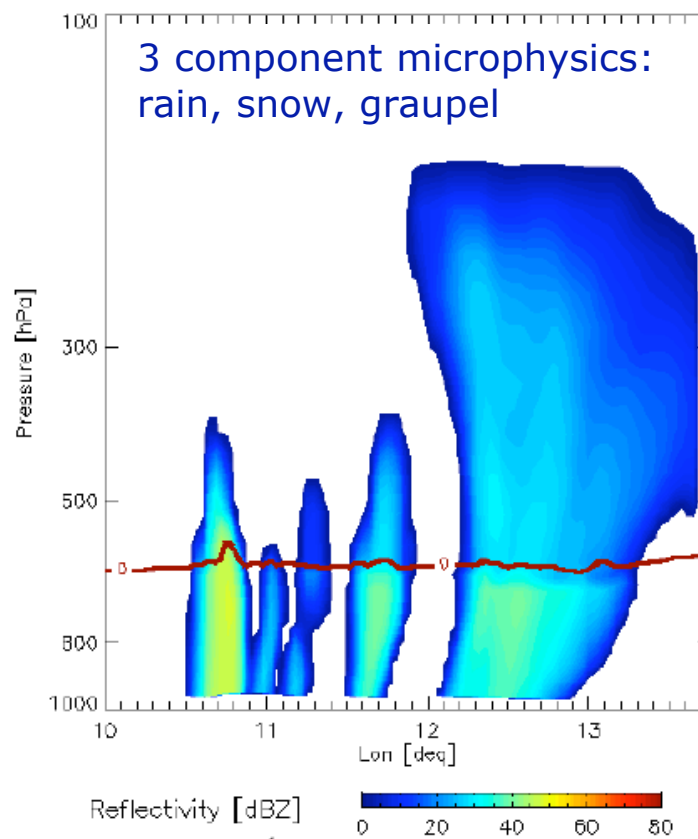
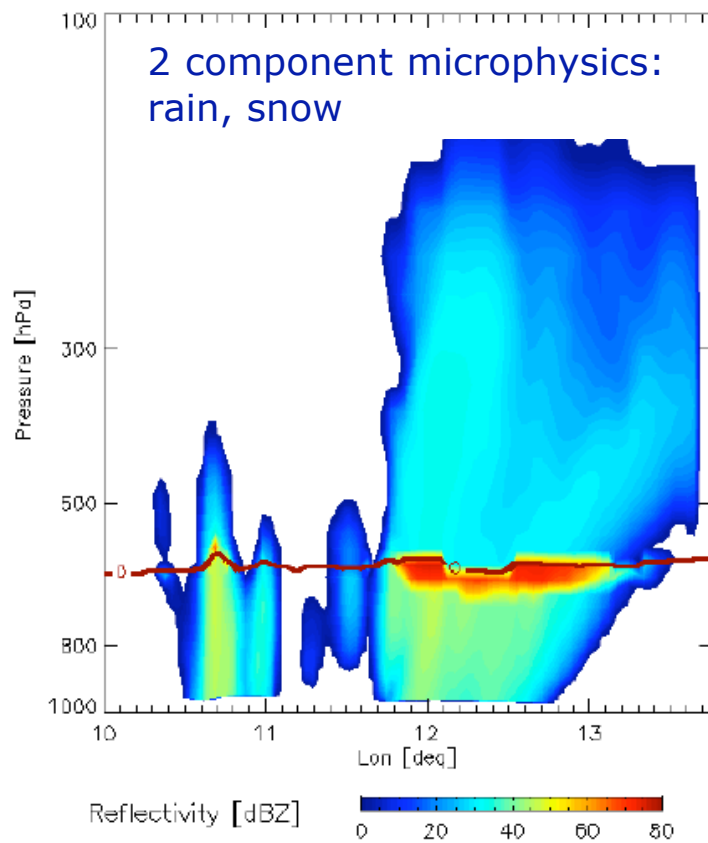
# Information entropy as an integral measure for the rainfall probability distribution



from A. Claußnitzer (FU Berlin)

# Cloud structures: synthetic radar reflectivities from LM and comparison with POLDIRAD

12 Aug 2004: Munich thunderstorm



from M. Pfeiffer (QUEST)

## Conclusions

- LM (7 km): systematic QPF deficiencies in luv/lee of orography with altitude of 500-1000 m - possibly reduced but not eliminated with prognostic parameterization scheme
- particularly problematic: intense, convective events; interaction with topography; daily cycle
- some cases with totally wrong precipitation pattern
- future LMK (< 3 km, no parameterization of convection): things will change!
- high-resolution QPF requires novel verification techniques and observational data sets
- QPF in situations with small-scale convection should not be treated as a deterministic problem

# Investigation of luv/lee problem

## Possible reasons (hypotheses)

- flow structure in complex topography  
(lines of convergence, flow over vs. flow around)
- thermodynamics (vertical profiles of temperature and moisture through troposphere in luv/lee regions)
- surface fluxes and soil moisture

→ investigation of WE cross sections

