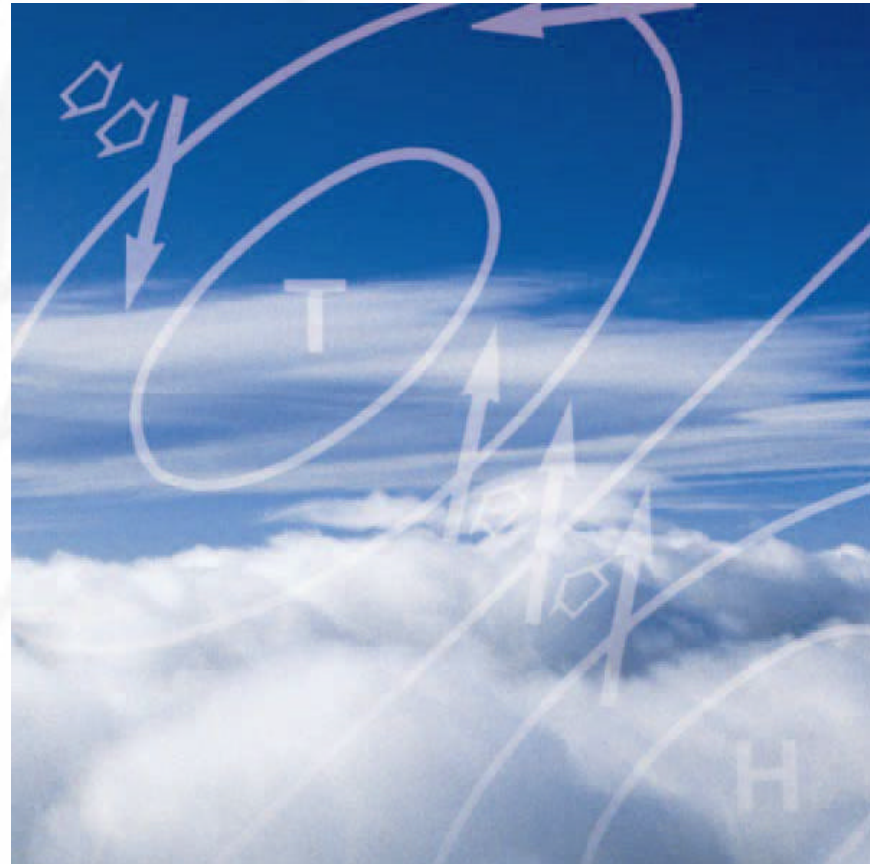


# Sensitivity of simulated precipitation towards the parameterization of convection

---

Silke Dierer and Marco Arpagaus  
MeteoSwiss, Switzerland





- ◆ Operational aLMo runs: convection parameterized following Tiedtke (1989)
  - Developed for large-scale models
  - Driven by moisture convergence near the surface
- ◆ Is a convection scheme based on Kain Fritsch more suitable for higher resolutions and orography?
- ◆ Positive impact on precipitation forecast?



- ◆ The convection schemes
- ◆ Model setup
- ◆ Comparison of results with different convection schemes
  - for Europe
  - for Switzerland
- ◆ Conclusions and outlook



# The convection schemes

## Tiedtke scheme

### Triggering

- ◆ Updraft source layer ~ model layer thickness
- ◆ Fixed value for  $\tau$
- ◆ near surface

### Closure

- ◆ Moisture convergence closure

### En-/Detrainment

- ◆ By turbulent mixing and organized inflow

## Bechtold scheme

- ◆ Updraft source layer ~60 hPa
- ◆  $\tau = f(w)$
- ◆ near surface and upper levels

- ◆ CAPE-Closure

- ◆ By turbulent mixing





# Four convective situations in summer

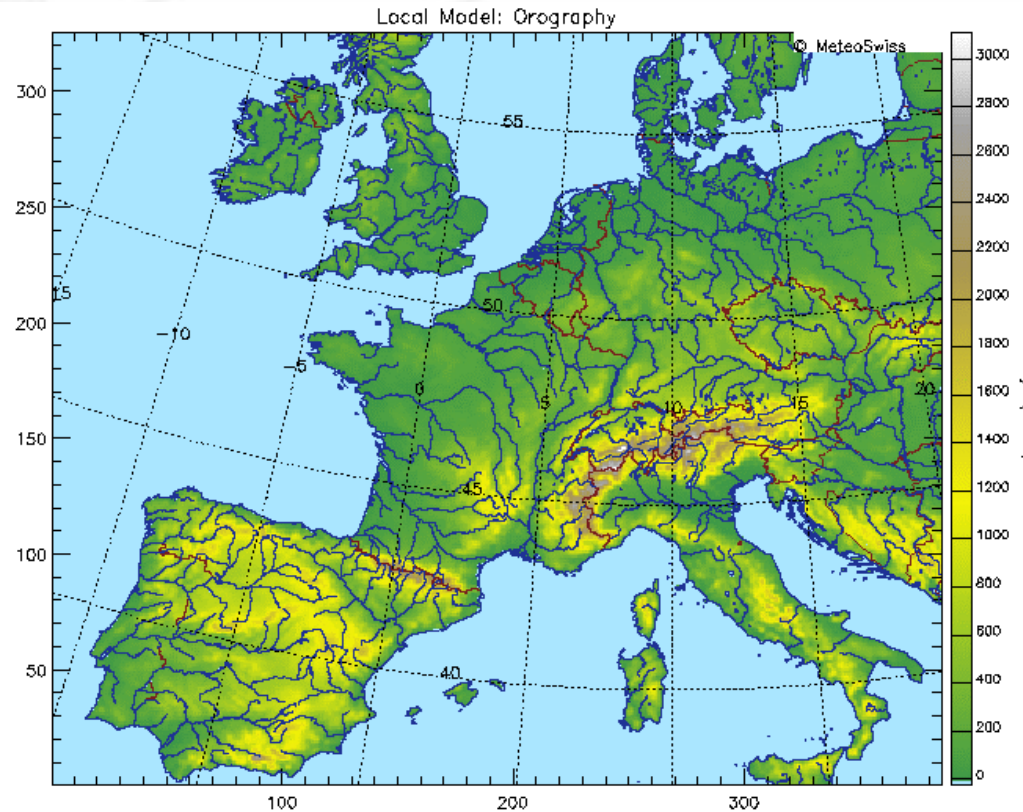
---

- ◆ 8<sup>th</sup> – 10<sup>th</sup> May 2003: trough over central Europe, S-SW flow, convective precipitation over northern Switzerland
- ◆ 12<sup>th</sup> – 13<sup>th</sup> June 2003: high pressure system over central Europe, thunderstorms over western Switzerland
- ◆ 23<sup>rd</sup> – 25<sup>th</sup> July 2004: high pressure system over western and southern Europe, thunderstorms in Switzerland
- ◆ 16<sup>th</sup> – 18<sup>th</sup> August 2004: high pressure system over Italy moving eastward, W-S flow, convective precipitation in Switzerland



# Model setup

- ◆ Operational Version of aLMo (similar to LM, but no soil moisture analysis)
- ◆ Horizontal grid size 7 km (385x325 grid points)
- ◆ 45 vertical levels
- ◆ Initial values from 6 h- assimilation run
- ◆ Boundary values: forecasts from ECMWF



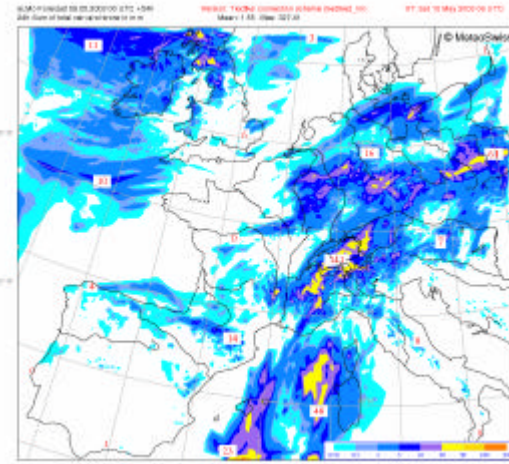
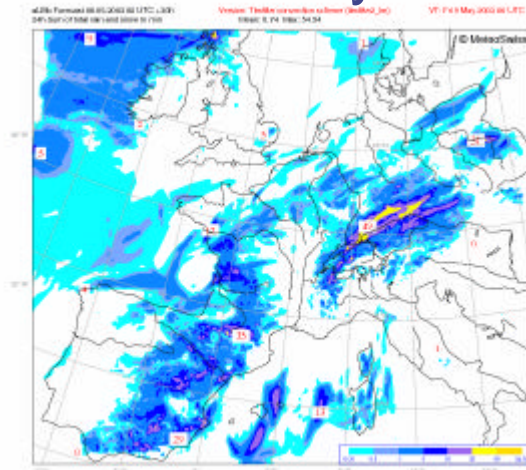


# 8<sup>th</sup> – 10<sup>th</sup> May 2003: 24-hours precipitation sums

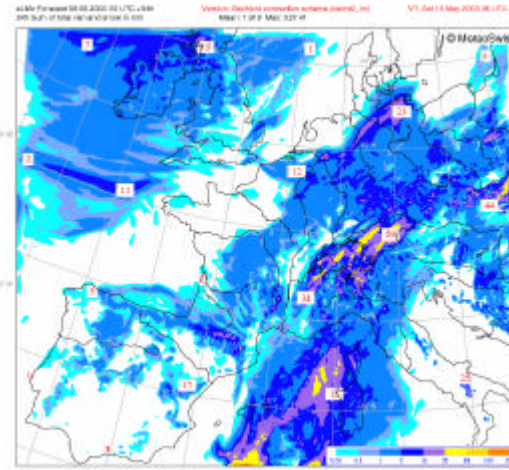
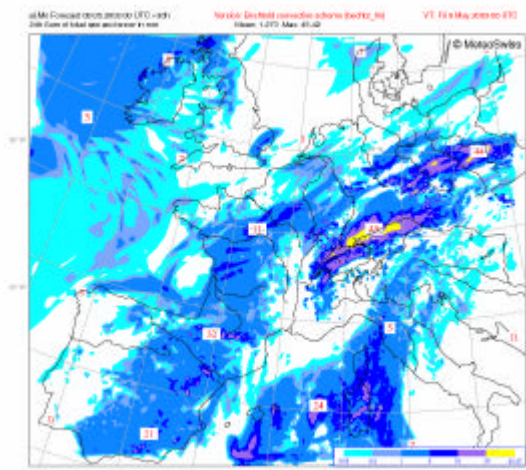
## 1st day

## 2nd day

Tiedtke

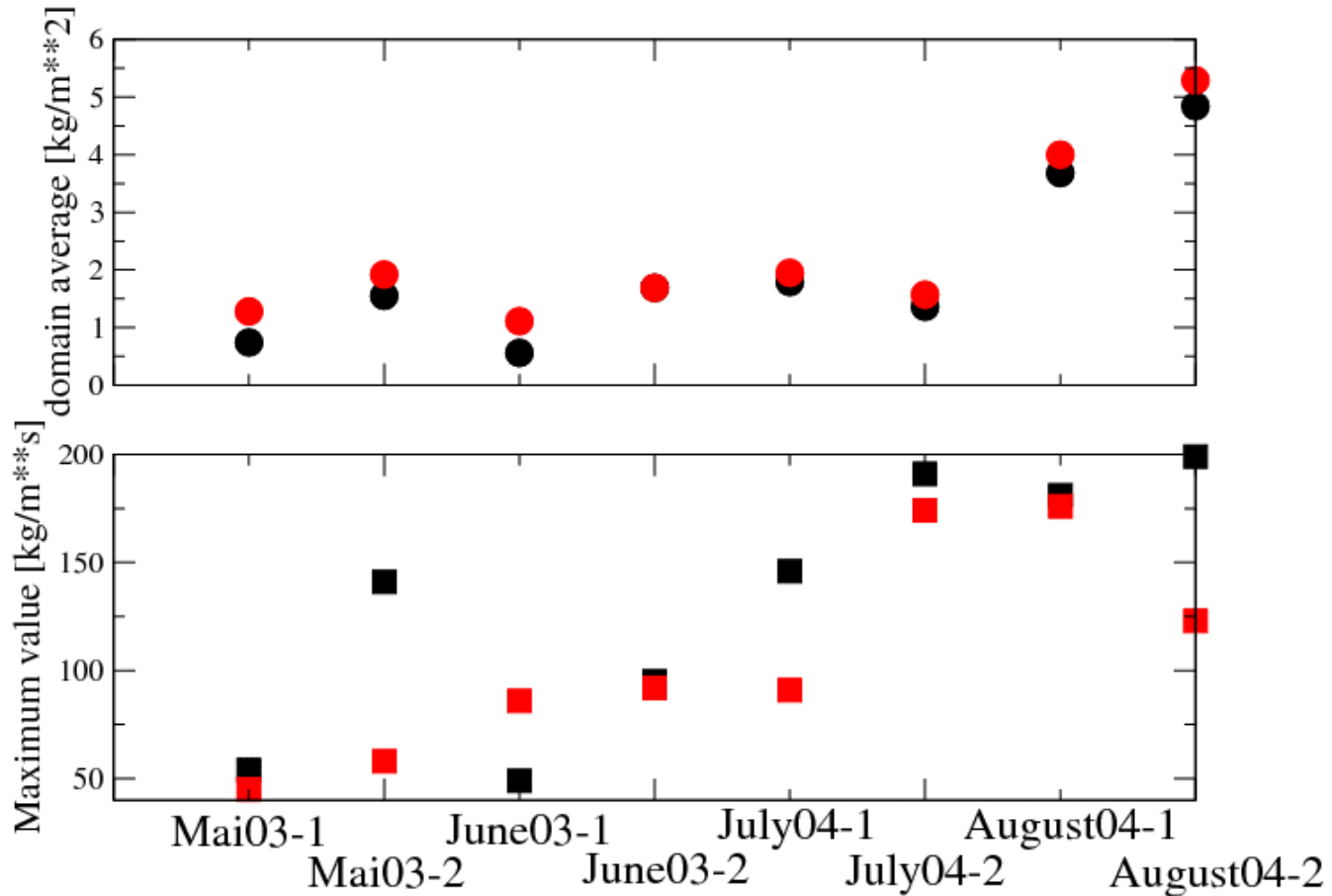


Bechtold



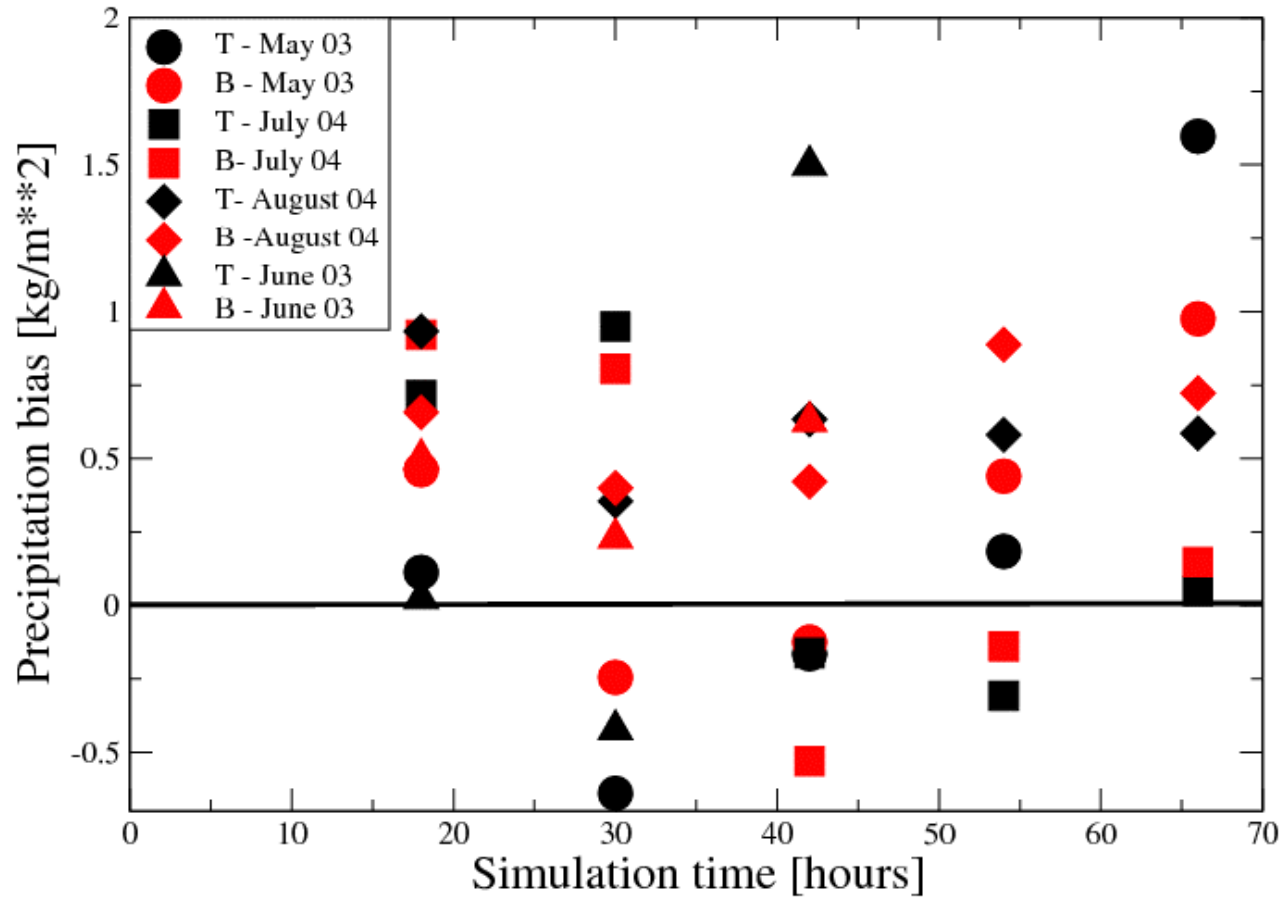


# Mean and maximum 24 hours precipitation sums

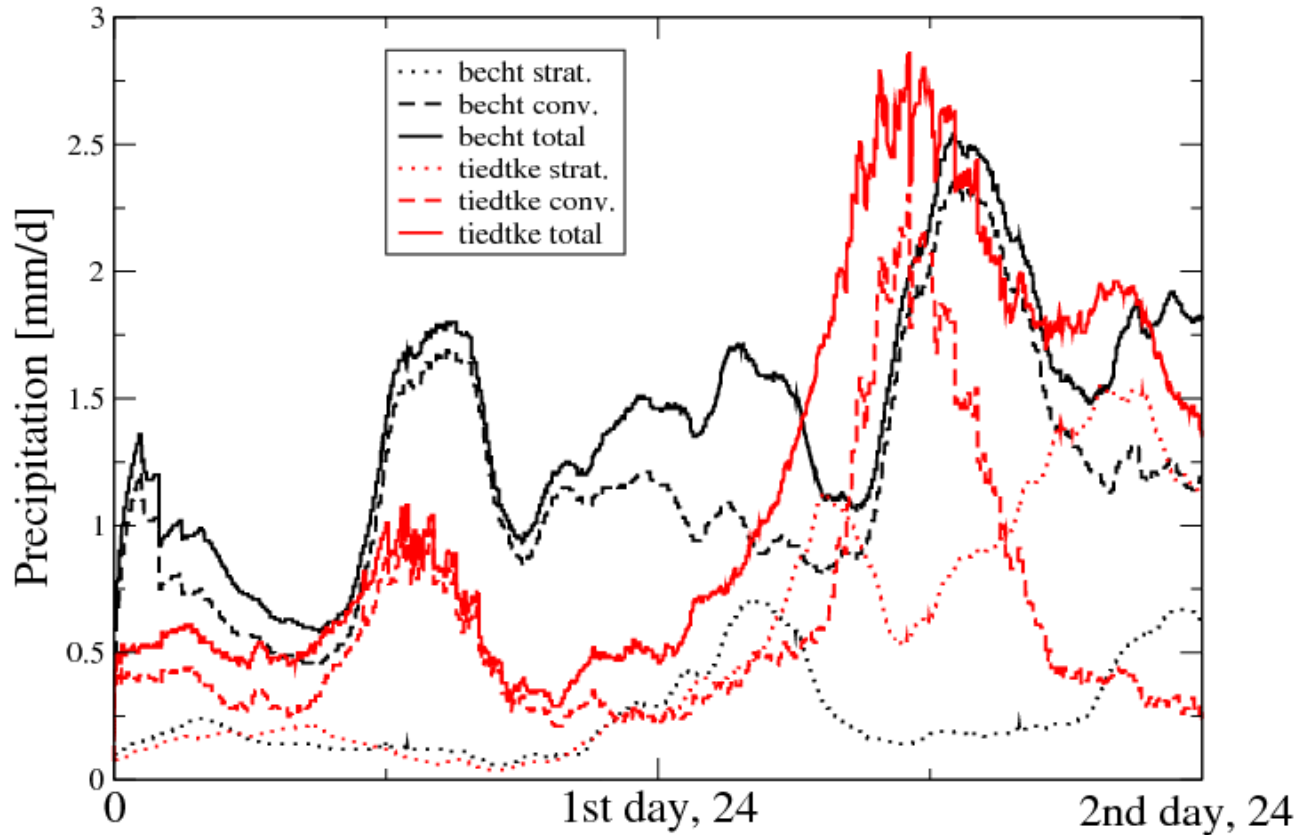




# SYNOP-Verification for all test periods



# Temporal development of precipitation, June 2003





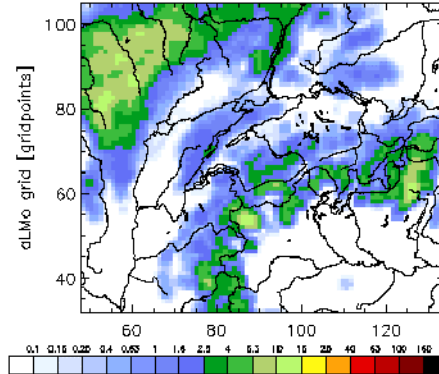
# Verification with Radar for Switzerland, 12th June 03

## Simulation

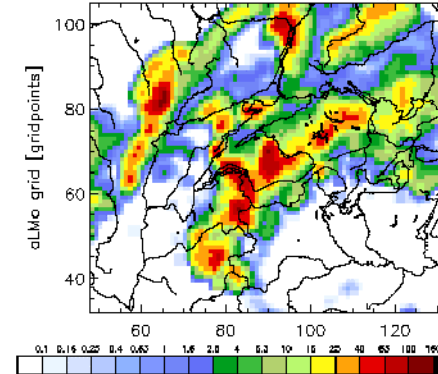
## Radar

Comparison of aLMO and Radar 24-hly QPE, ending at Jun 13 00:00 2003

aLMO Forecast of Jun 12 00:00 2003



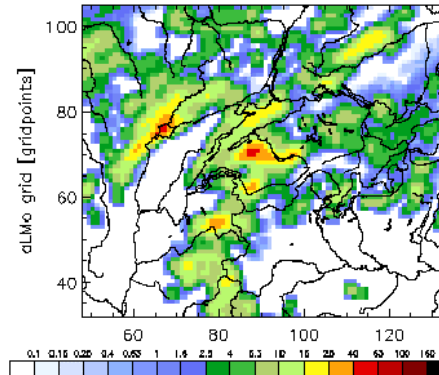
Radar (PLC@aLMO-Grid)



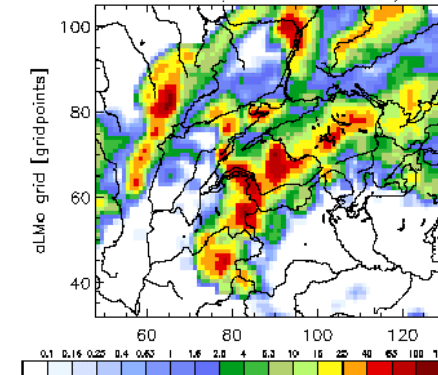
Tiedtke

Comparison of aLMO and Radar 24-hly QPE, ending at Jun 13 00:00 2003

aLMO Forecast of Jun 12 00:00 2003



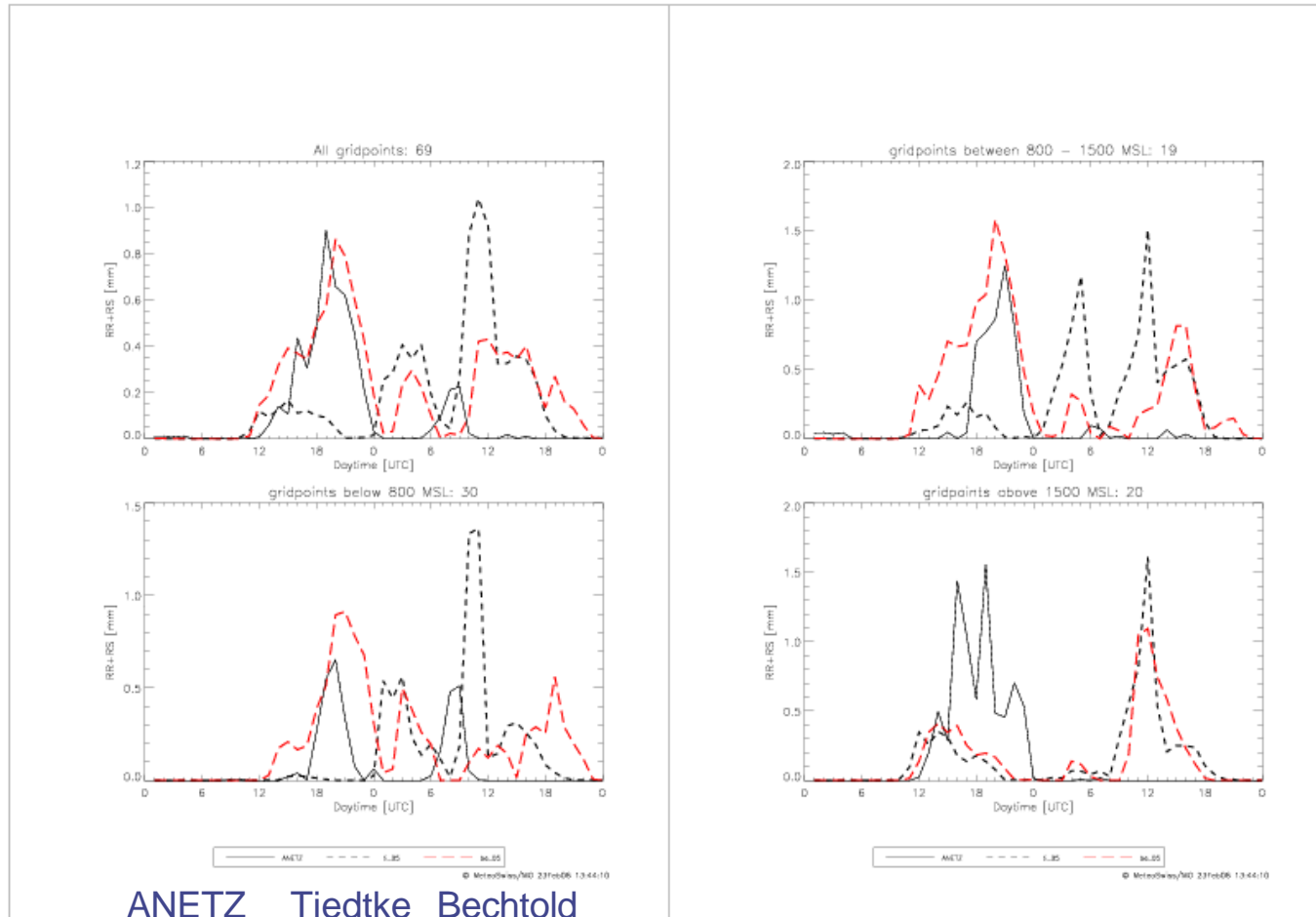
Radar (PLC@aLMO-Grid)



Bechtold



# Verification for Switzerland with ANETZ, June 03





# Conclusions and Outlook

---

- ◆ Results with the Tiedtke and the Bechtold scheme show similar biases compared to SYNOP data
  - ◆ Bechtold scheme tends to overestimate convective precipitation over Sardinia and Spain and slightly overestimates stratiform precipitation over Great Britain
  - ◆ Maximum of the diurnal precipitation cycle is delayed by about 2-3 hours
- ⇒ Investigation of precipitation over Sardinia, Spain and Great Britain
- ⇒ Simulations for other synoptic conditions, possibly in comparison to the operational runs