

COSMO Priority Project:
'Tackle deficiencies in precipitation forecasts'
Results of German cases

Axel Seifert

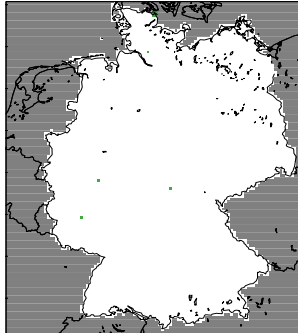
DWD, Offenbach

Case 06 Dec 2004: Cloud microphysics

- 06.12.2004 / Microphysics
- 06.12.2004 / Sensitivities
- 06.12.2004 / Precip
- 21.06.2005 / Convection
- 21.06.2005 / Precip
- 03.05.2005 / Convection
- 03.05.2005 / Precip
- 18.03.2005 / Sensitivities
- 18.03.2005 / Precip
- Summary of German cases:

Observations

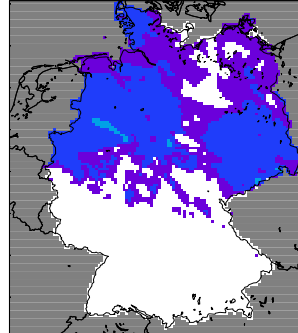
Precipitation 06.12.2004 06 UTC + 24h (Obs)



Mean: 0.0081 Min: 0 Max: 0.95 Var: 0.0017

CTRL

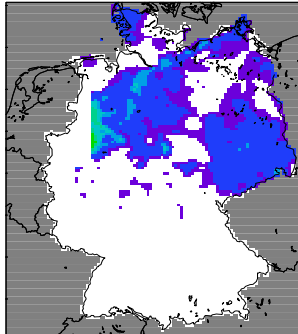
Precipitation 06.12.2004 06 UTC + 24h (LMQ)



Mean: 0.6931 Min: 0 Max: 3.7558 Var: 0.4600

MICRO1

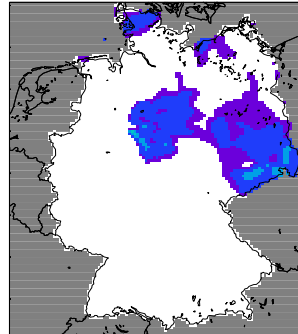
Precipitation 06.12.2004 06 UTC + 24h (LMQ)



Mean: 0.6383 Min: 0 Max: 17.523 Var: 1.4415

MICRO2

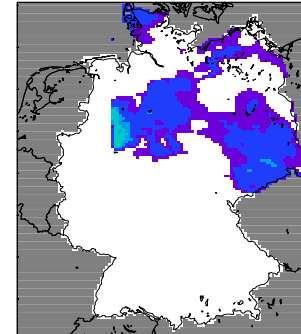
Precipitation 06.12.2004 06 UTC + 24h (LMQ)



Mean: 0.3297 Min: 0 Max: 6.3203 Var: 0.3890

MICRO3

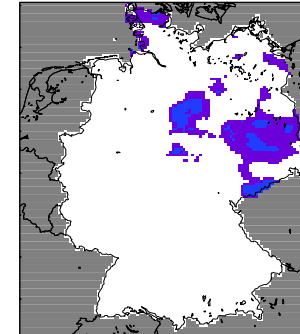
Precipitation 06.12.2004 06 UTC + 24h (LMQ)



Mean: 0.4127 Min: 0 Max: 11.359 Var: 0.7018

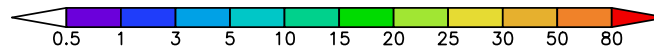
LM 3.22

Precipitation 06.12.2004 06 UTC + 24h (LMQ)



Mean: 0.1684 Min: 0 Max: 2.2959 Var: 0.0920

accumulated precipitation in mm

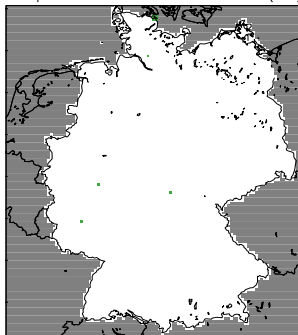


Case 06 Dec 2004: Other sensitivities

- 06.12.2004 / Microphysics
- 06.12.2004 / Sensitivities
- 06.12.2004 / Precip
- 21.06.2005 / Convection
- 21.06.2005 / Precip
- 03.05.2005 / Convection
- 03.05.2005 / Precip
- 18.03.2005 / Sensitivities
- 18.03.2005 / Precip
- Summary of German cases:

Observations

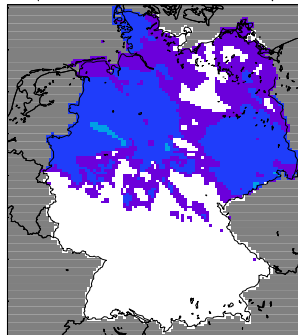
Precipitation 06.12.2004 06 UTC + 24h (Obs)



Mean: 0.0081 Min: 0 Max: 0.95 Var: 0.0017

CTRL

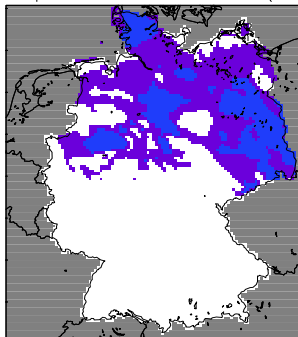
Precipitation 06.12.2004 06 UTC + 24h (LMQ)



Mean: 0.6931 Min: 0 Max: 3.7558 Var: 0.4600

QV090

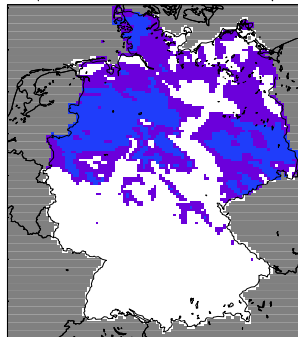
Precipitation 06.12.2004 06 UTC + 24h (LMQ)



Mean: 0.4140 Min: 0 Max: 2.7324 Var: 0.2082

RKtp

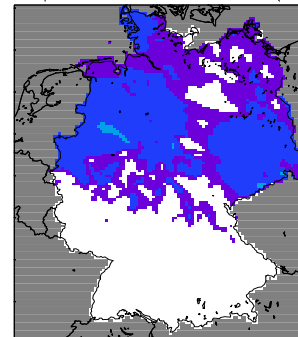
Precipitation 06.12.2004 06 UTC + 24h (LMQ)



Mean: 0.5087 Min: 0 Max: 2.8457 Var: 0.2493

Oro

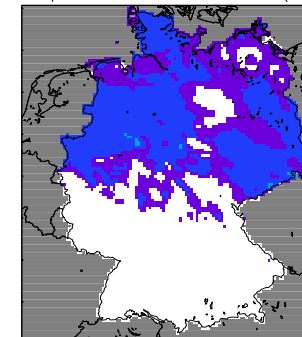
Precipitation 06.12.2004 06 UTC + 24h (LMQ)



Mean: 0.7205 Min: 0 Max: 3.7773 Var: 0.4604

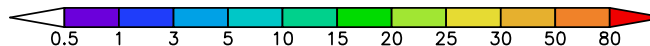
Sea01

Precipitation 06.12.2004 06 UTC + 24h (LMQ)



Mean: 0.7249 Min: 0 Max: 3.6709 Var: 0.4748

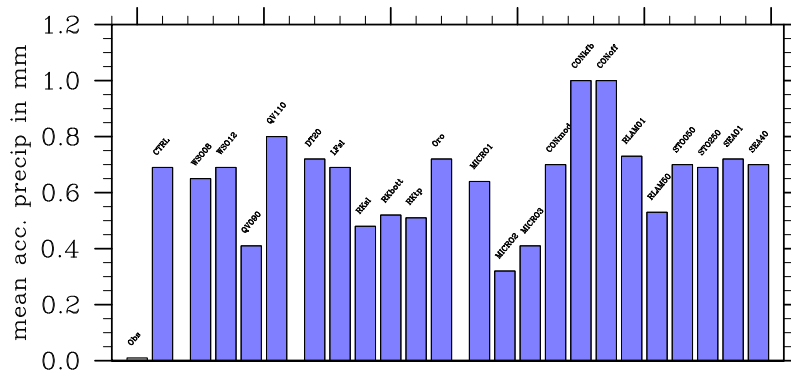
accumulated precipitation in mm



Case 06 Dec 2004: Mean and Max. Precip.

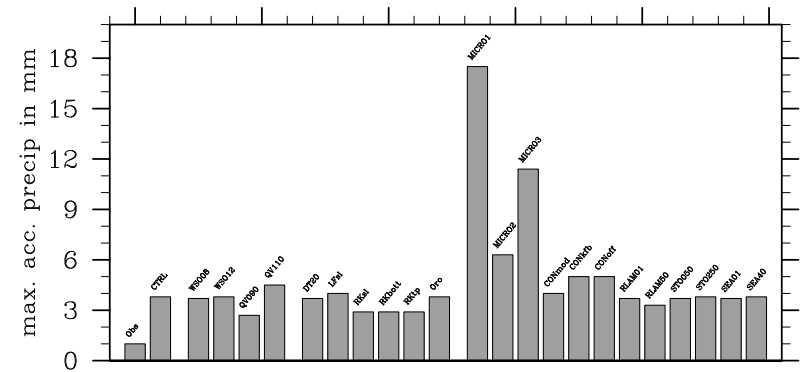
- 06.12.2004 / Microphysics
- 06.12.2004 / Sensitivities
- 06.12.2004 / Precip
- 21.06.2005 / Convection
- 21.06.2005 / Precip
- 03.05.2005 / Convection
- 03.05.2005 / Precip
- 18.03.2005 / Sensitivities
- 18.03.2005 / Precip
- Summary of German cases:

BRD average precip



(blue: grid-scale rain, red: convective precipitation)

BRD maximum precip



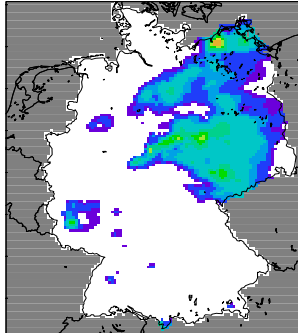
- Total precipitation amount shows a significant sensitivity to QV and cloud microphysics.
- LM 3.21 was a bit buggy regarding the microphysics change (has something to do with TKE scheme).
- LM 3.22 gives a good forecast for this case.

Case 06 June 2005: Convection and QV

- 06.12.2004 / Microphysics
- 06.12.2004 / Sensitivities
- 06.12.2004 / Precip
- 21.06.2005 / Convection
- 21.06.2005 / Precip
- 03.05.2005 / Convection
- 03.05.2005 / Precip
- 18.03.2005 / Sensitivities
- 18.03.2005 / Precip
- Summary of German cases:

Observations

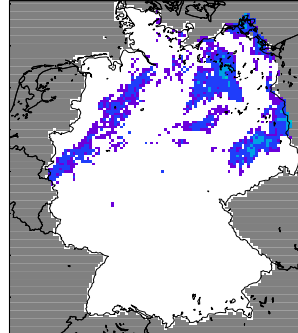
Precipitation 21.06.2005 06 UTC + 24h (Obs)



Mean: 1.6718 Min: 0 Max: 43.620 Var: 11.418

CTRL

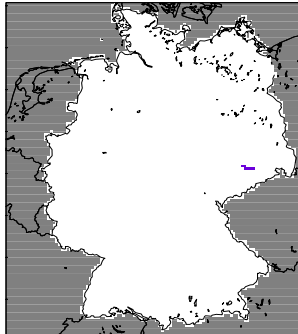
Precipitation 21.06.2005 06 UTC + 24h (LMQ)



Mean: 0.2640 Min: 0 Max: 6.2265 Var: 0.3709

conoff

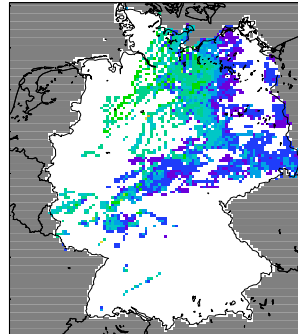
Precipitation 21.06.2005 06 UTC + 24h (LMQ)



Mean: 0.0012 Min: 0 Max: 0.8593 Var: 0.0005

conkfb

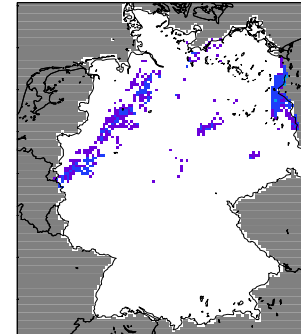
Precipitation 21.06.2005 06 UTC + 24h (LMQ)



Mean: 1.6984 Min: 0 Max: 30.502 Var: 13.988

conmod

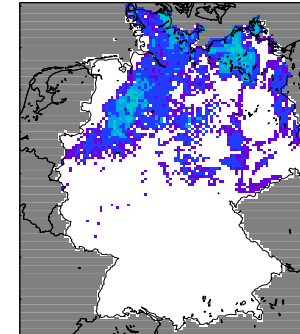
Precipitation 21.06.2005 06 UTC + 24h (LMQ)



Mean: 0.0894 Min: 0 Max: 3.1875 Var: 0.0758

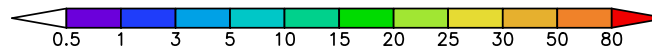
qv110

Precipitation 21.06.2005 06 UTC + 24h (LMQ)



Mean: 0.6225 Min: 0 Max: 9.5937 Var: 1.3553

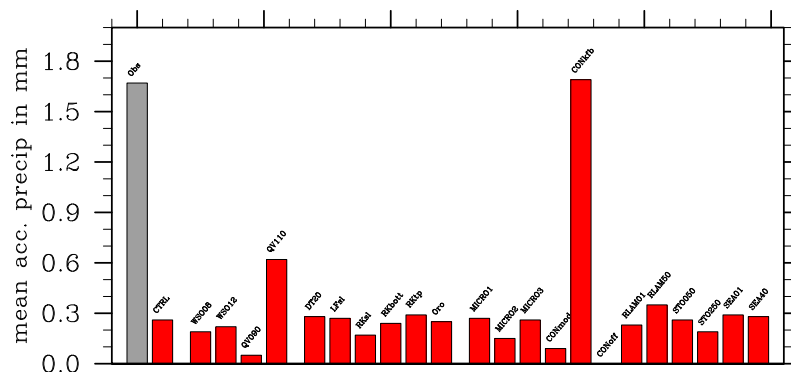
accumulated precipitation in mm



Case 21. June 2005: Mean and Max. Precip.

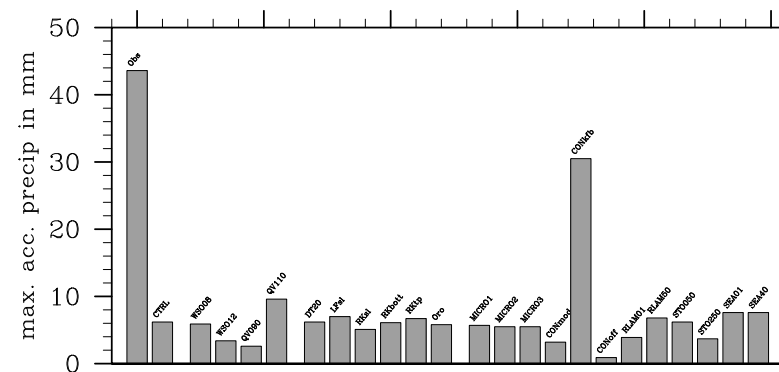
- 06.12.2004 / Microphysics
- 06.12.2004 / Sensitivities
- 06.12.2004 / Precip
- 21.06.2005 / Convection
- 21.06.2005 / Precip
- 03.05.2005 / Convection
- 03.05.2005 / Precip
- 18.03.2005 / Sensitivities
- 18.03.2005 / Precip
- Summary of German cases:

BRD average precip



(blue: grid-scale rain, red: convective precipitation)

BRD maximum precip



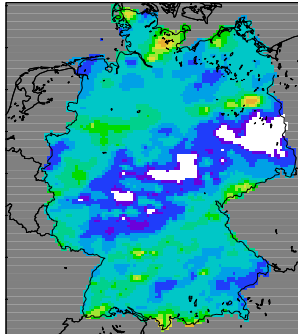
- Missed / too weak convection in this case
- KFB scheme shows a nice improvement, i.e. solves this problem.
- This case is quite sensitive to initial QV.

Case 03 May 2005: Convection and microphysics

- 06.12.2004 / Microphysics
- 06.12.2004 / Sensitivities
- 06.12.2004 / Precip
- 21.06.2005 / Convection
- 21.06.2005 / Precip
- 03.05.2005 / Convection
- 03.05.2005 / Precip
- 18.03.2005 / Sensitivities
- 18.03.2005 / Precip
- Summary of German cases:

Observations

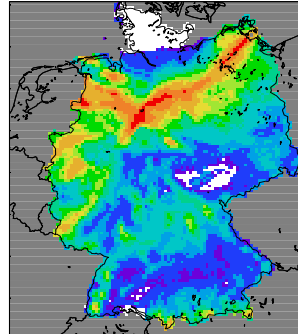
Precipitation 03.05.2005 06 UTC + 24h (Obs)



Mean: 6.9324 Min: 0 Max: 38.994 Var: 26.766

CTRL

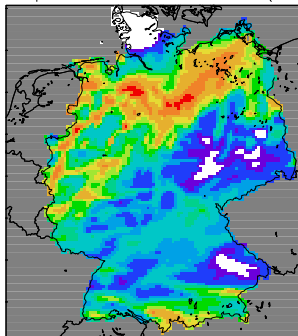
Precipitation 03.05.2005 06 UTC + 24h (LMQ)



Mean: 12.464 Min: 0 Max: 136.63 Var: 240.21

conoff

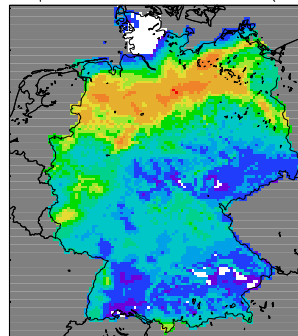
Precipitation 03.05.2005 06 UTC + 24h (LMQ)



Mean: 14.191 Min: 0 Max: 113.12 Var: 244.57

conkfb

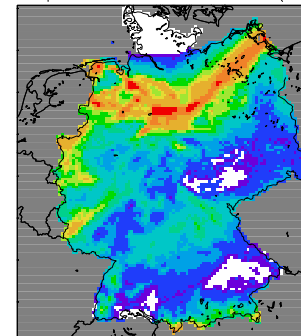
Precipitation 03.05.2005 06 UTC + 24h (LMQ)



Mean: 11.957 Min: 0 Max: 88.420 Var: 150.52

conmod

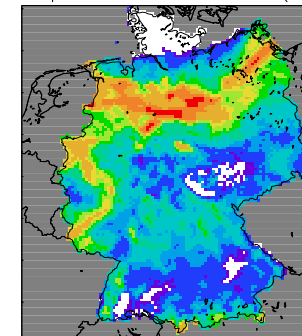
Precipitation 03.05.2005 06 UTC + 24h (LMQ)



Mean: 11.683 Min: 0 Max: 188.37 Var: 256.70

micro3

Precipitation 03.05.2005 06 UTC + 24h (LMQ)



Mean: 12.518 Min: 0 Max: 160.26 Var: 252.76

accumulated precipitation in mm

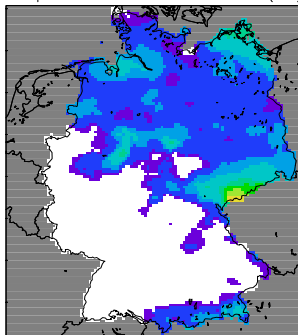


Case 18 March 2005: Various sensitivities

- 06.12.2004 / Microphysics
- 06.12.2004 / Sensitivities
- 06.12.2004 / Precip
- 21.06.2005 / Convection
- 21.06.2005 / Precip
- 03.05.2005 / Convection
- 03.05.2005 / Precip
- 18.03.2005 / Sensitivities
- 18.03.2005 / Precip
- Summary of German cases:

Observations

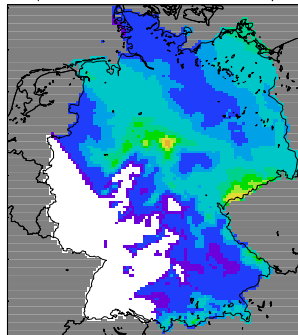
Precipitation 18.03.2005 06 UTC + 24h (Obs)



Mean: 1.8639 Min: 0 Max: 30.4 Var: 7.5387

CTRL

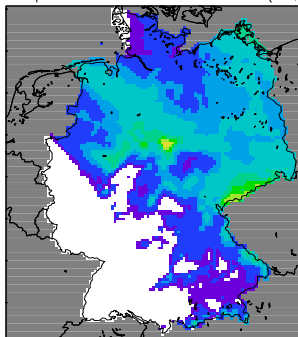
Precipitation 18.03.2005 06 UTC + 24h (LMQ)



Mean: 4.0087 Min: 0 Max: 34.757 Var: 17.924

qv090

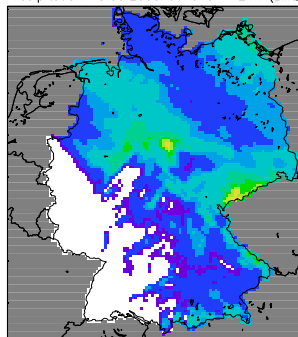
Precipitation 18.03.2005 06 UTC + 24h (LMQ)



Mean: 3.1939 Min: 0 Max: 28.368 Var: 12.089

rktp

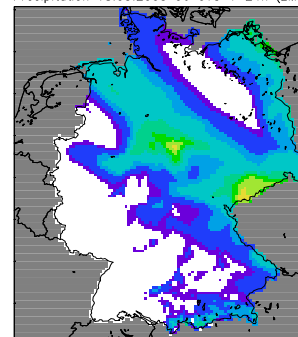
Precipitation 18.03.2005 06 UTC + 24h (LMQ)



Mean: 3.5458 Min: 0 Max: 29.73 Var: 13.611

micro3

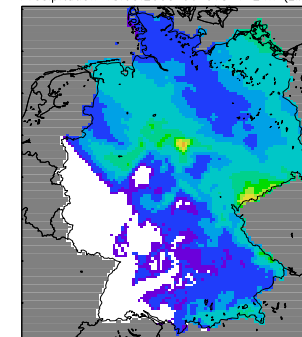
Precipitation 18.03.2005 06 UTC + 24h (LMQ)



Mean: 3.3230 Min: 0 Max: 27.666 Var: 19.132

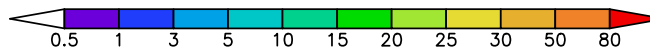
conkfb

Precipitation 18.03.2005 06 UTC + 24h (LMQ)



Mean: 4.0173 Min: 0 Max: 30.928 Var: 15.405

accumulated precipitation in mm



Summary of German cases:

- 06.12.2004 / Microphysics
- 06.12.2004 / Sensitivities
- 06.12.2004 / Precip
- 21.06.2005 / Convection
- 21.06.2005 / Precip
- 03.05.2005 / Convection
- 03.05.2005 / Precip
- 18.03.2005 / Sensitivities
- 18.03.2005 / Precip

● Summary of German cases:

- Cloud microphysics has an impact on orographic precipitation patterns and drizzle forecasts.
- Kain-Fritsch-Bechtold scheme can improve some forecasts of convection.
- Runge-Kutta numerics seems to improve precipitation forecasts slightly by reducing the total precipitation amount.
- Some cases show a strong sensitivity to initial QV. Predictability issues? Data assimilation? Lack of measurements?
- Overall the model is very robust, esp. to the suggested modifications of the PBL/surface scheme.
- Problem in convective situations: Overestimation by contributions for parameterized convection and grid-scale precipitation. Inherent problem of the 7-km resolution?