# COSMO Priority Project:

# 'Tackle deficiencies in precipitation forecasts'

## *Results of German cases*

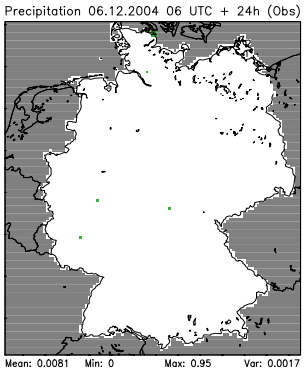
Axel Seifert

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

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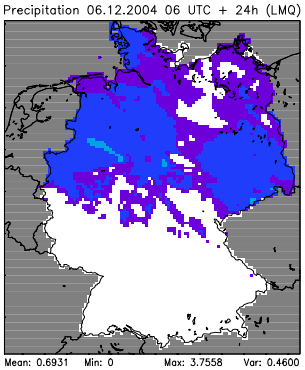
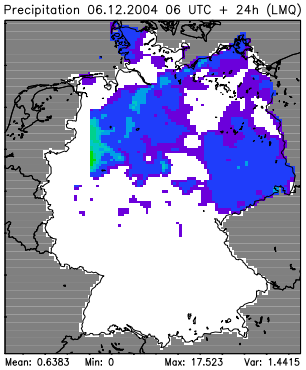



MICRO1

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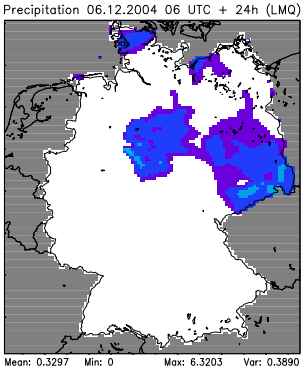


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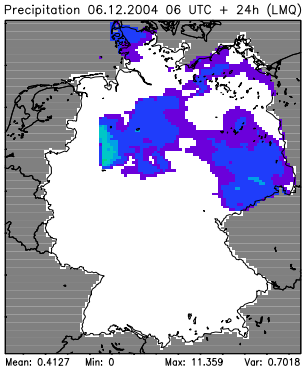
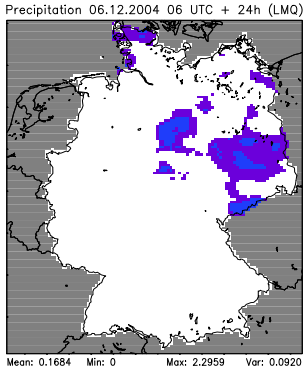
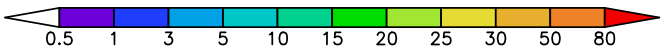



LM 3.22



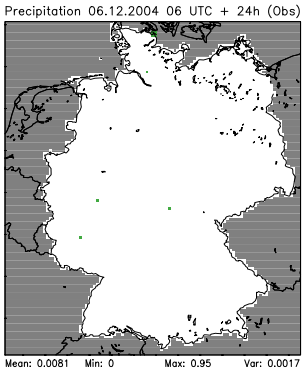

accumulated precipitation in mm



# 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

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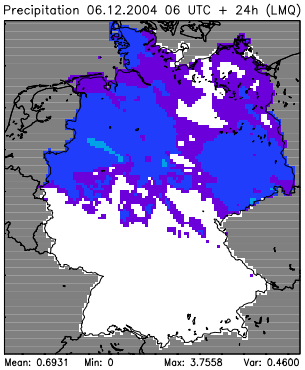
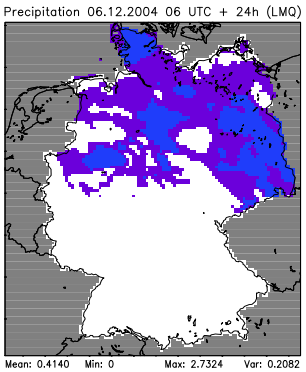



QV090

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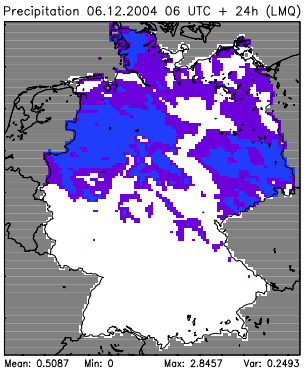
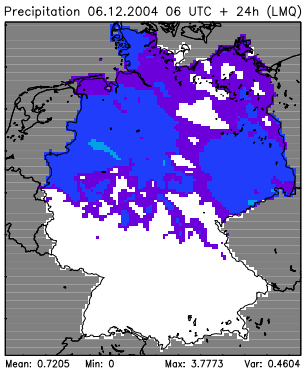
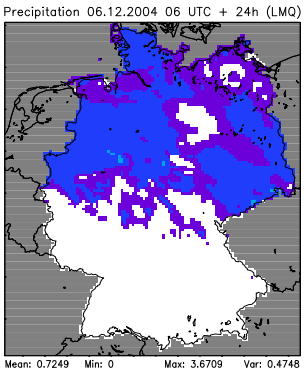


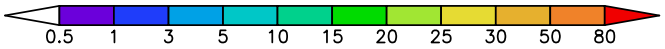

Oro




Sea01




accumulated precipitation in mm



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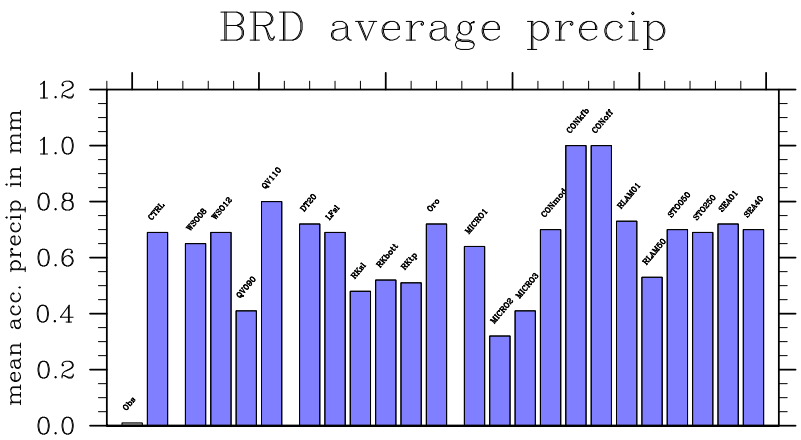
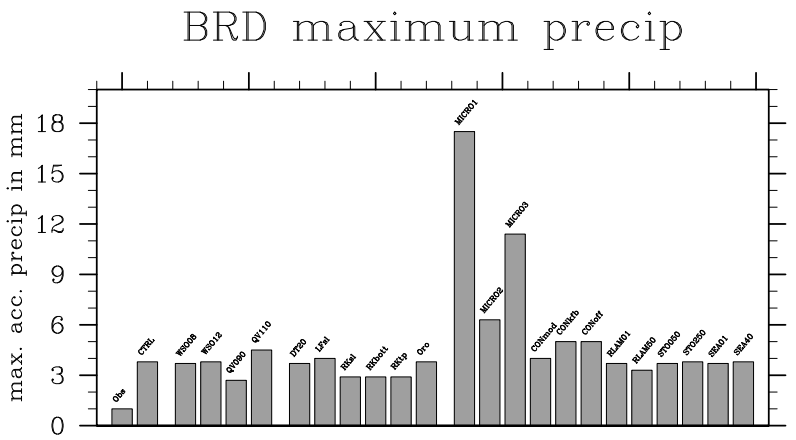
# Case 06 Dec 2004: Mean and Max. Precip.




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

- 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
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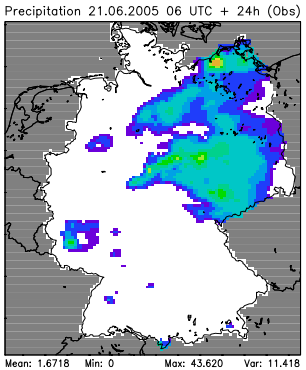
Observations

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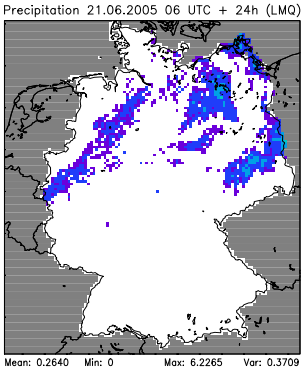
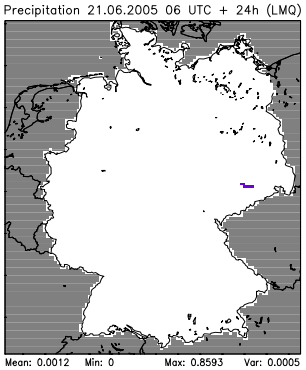
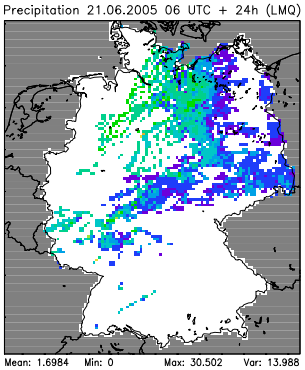


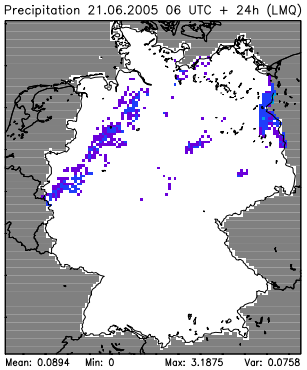

conoff



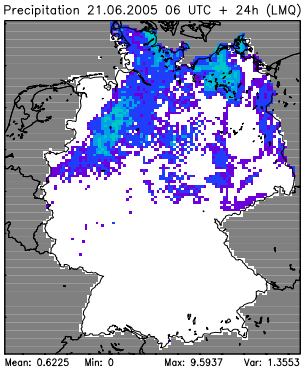

conkfb



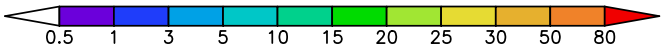

conmod




qv110




accumulated precipitation in mm



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- 03.05.2005 / Precip
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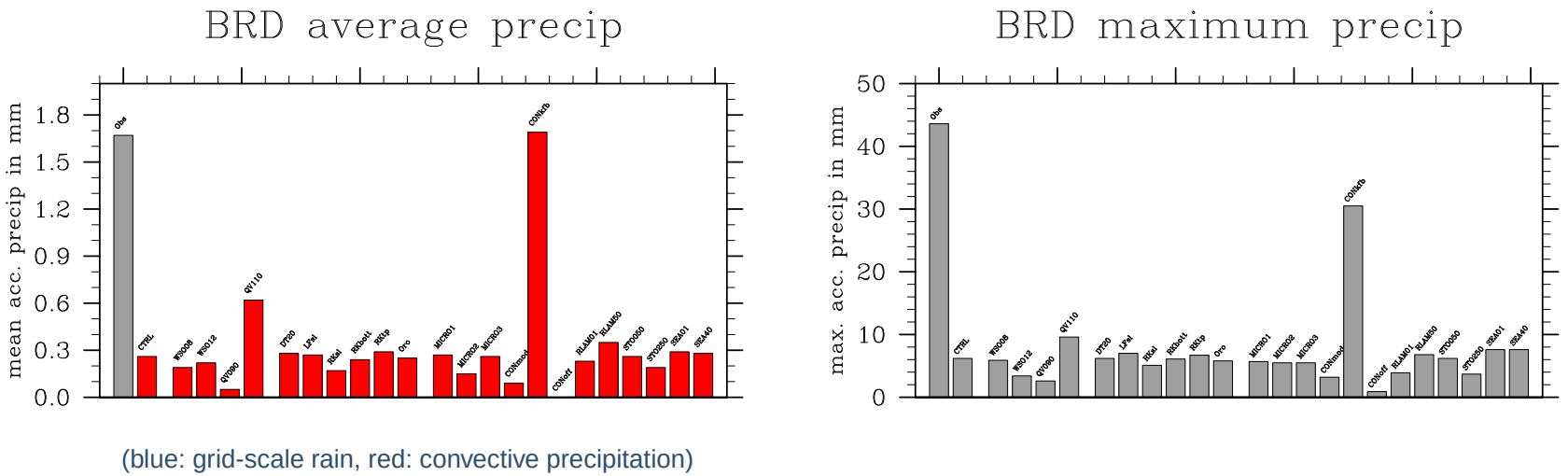
# Case 21. June 2005: Mean and Max. Precip.




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

- 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
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- 18.03.2005 / Precip
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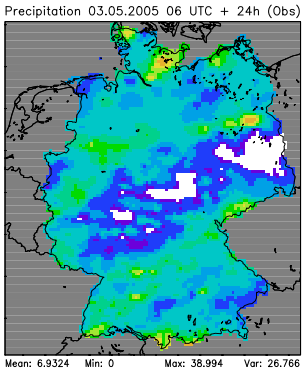
Observations

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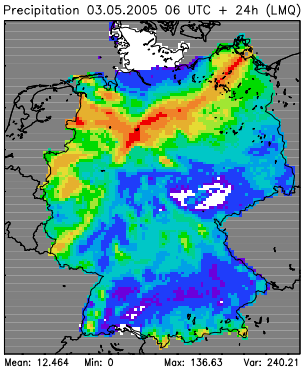
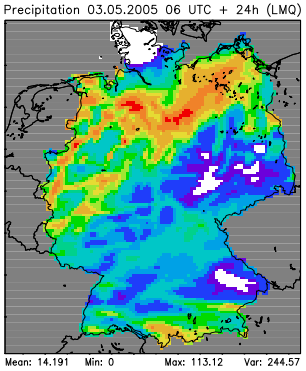
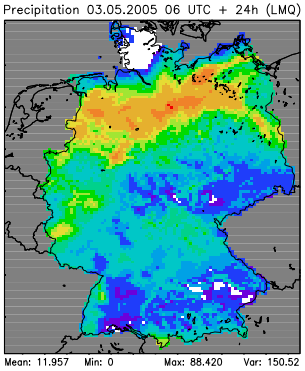


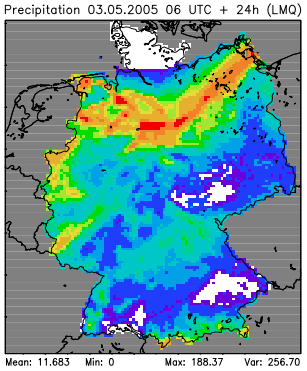

conoff



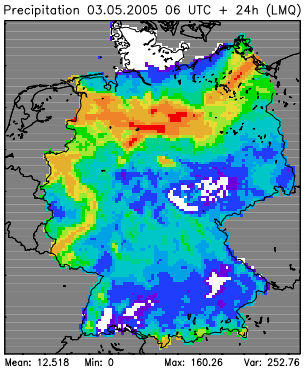

conkfb



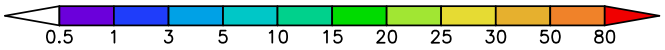

conmod




micro3




accumulated precipitation in mm



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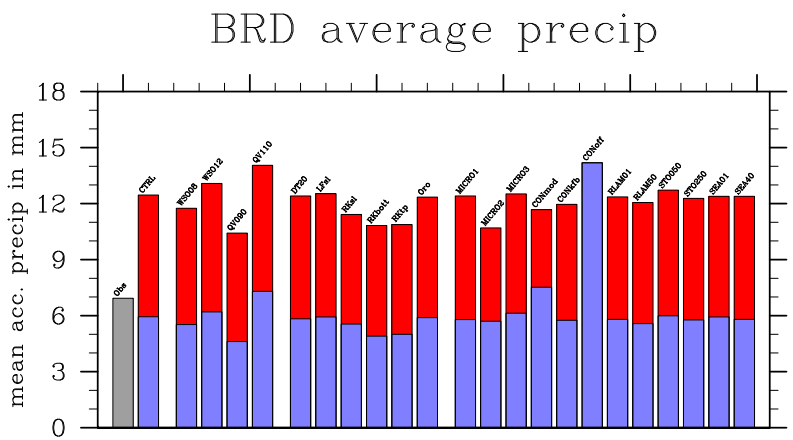
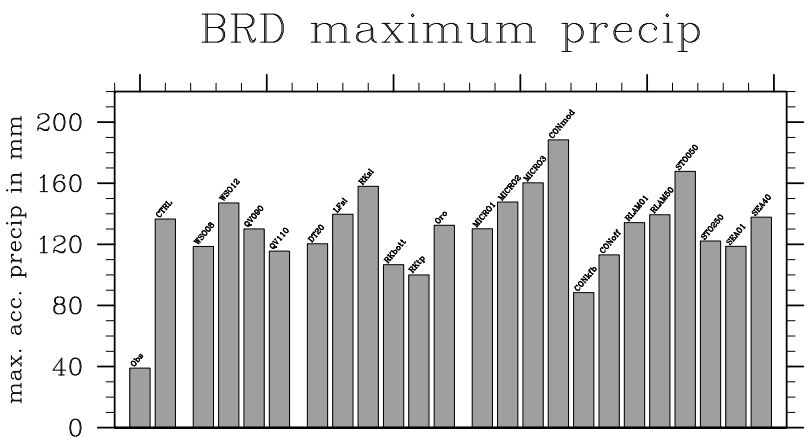
- Summary of German cases:


# Case 03 May 2005: Mean and Max. Precip.




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

- ’Double-counting’ of convective and grid-scale precip
- KFB scheme shows a minor improvement by reducing maximum precip
- Might be a fundamental problem of the 7km-grid.

# Case 18 March 2005: Various sensitivities


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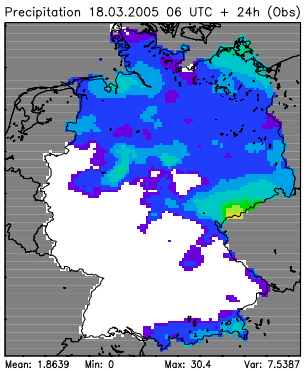
Observations

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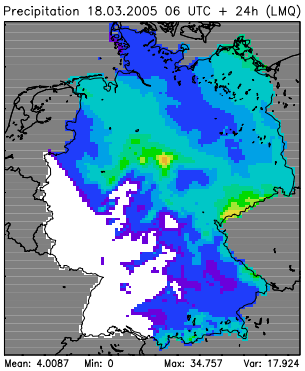
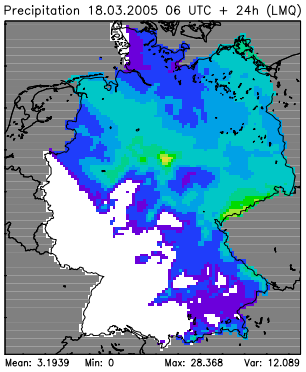



qv090

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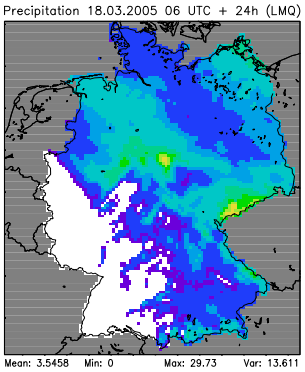
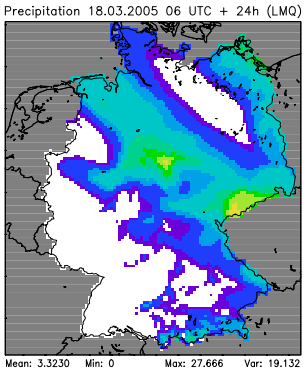
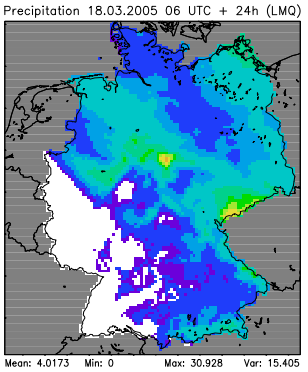



micro3




conkfb




accumulated precipitation in mm

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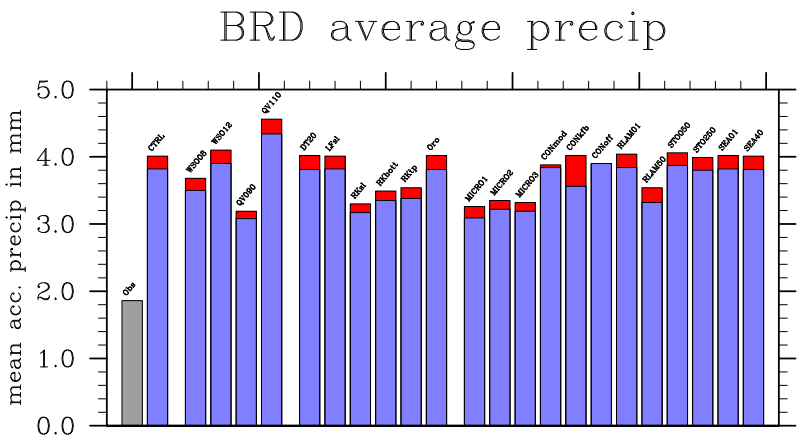
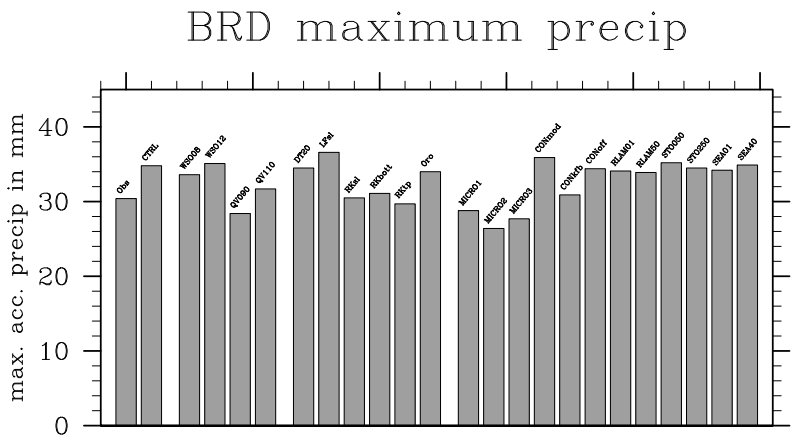
# Case 18 March 2005: Mean and Max. Precip.




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

- Very robust, but wrong forecast. Problem maybe large-scale flow?
- Some minor sensitivities to RK-numerics, cloud microphysics as well as initial QV

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# 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?