

Assimilation of Radar Reflectivity into the LMK

LHN – does it trigger Convection in a correct way

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Radar Data

Latent Heat Nudging

Performance during Prae-OP

Convection triggering

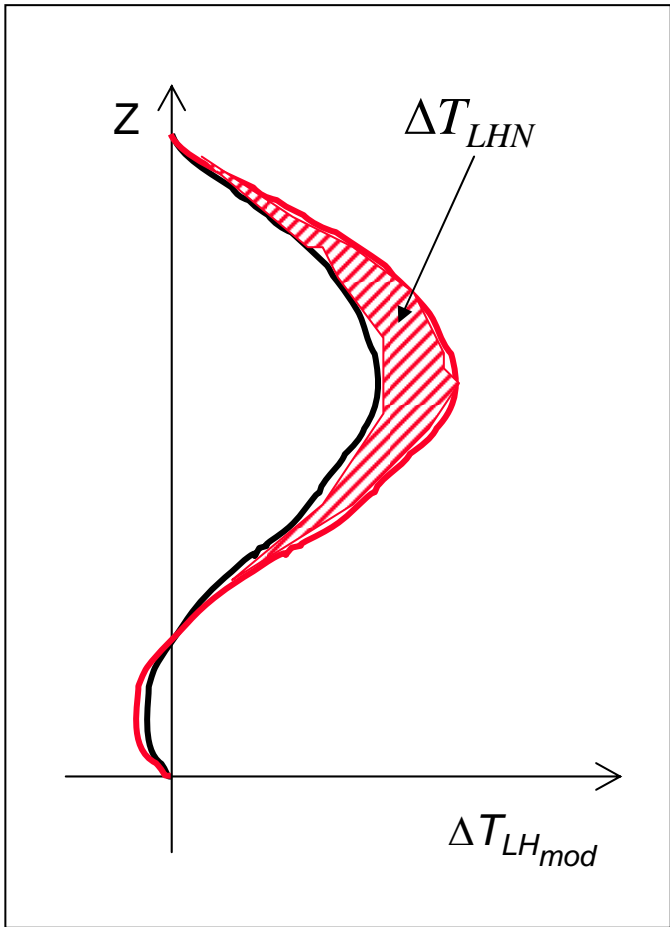
Conclusions and Outlook

Radar Data

- Reflectivity and Quality flags from „precipitation scan“:
 - lowest elevation angle varies between 0.5° and 1.8°
 - spatial resolution: $1\text{ km} \times 1^\circ$, max. range 120 km
 - temporal resolution: 5 minutes (lines between)
- Data processing:
 - correction of orographic attenuation
 - use of
 - Detection of rain echoes (work by K. Helmert and B. Hassler):
 - spokes of positive or negative attenuation;
 - circular arcs of positive or negative attenuation;
 - echoes of small extension (smaller than 9 pixels);
 - special case of anomalous propagation („German Pancake“)
 - **Composit of the 16 German doppler radars in consideration of the quality product** (interpolation to LMK-grid)

BUT: BRIGHT BAND

Latent Heat Nudging

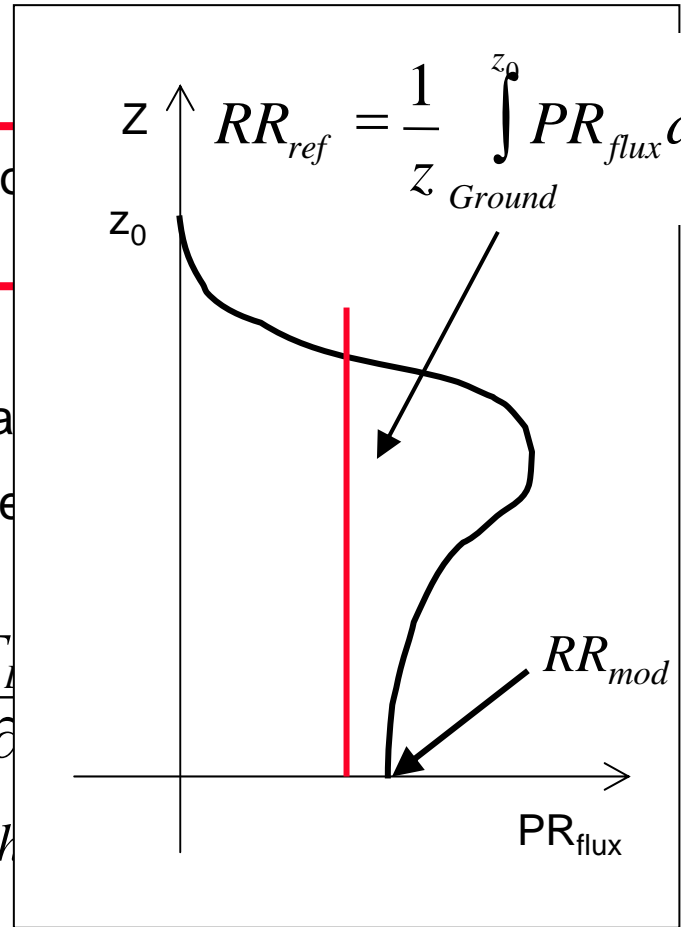


derived rain rate
 evaporation rate at the ground
 in latent heating

of modelled latent
 observed precipita
 the nudging increme

$$T) + \frac{\partial T_{Nudging}}{\partial t} + \frac{\partial T_{LH}}{\partial t}$$

$$-1) \cdot \Delta T_{LH_{mod}} \quad \text{with}$$



Pre-Operational phase of LMK:

14.08.2006 21 UTC : start of LMK Assimilation with LHN

15.08.2006 00 UTC : start of LMK Forecasts

...

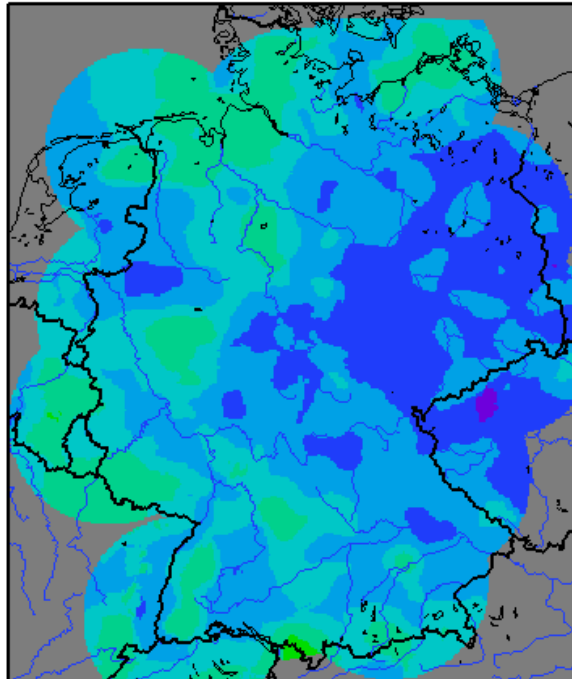
19.12.2006 until now: LMK Assimilation without LHN
(bright band features)

(but: a control experiment runs with LHN)

Precipitation sums for 15.08. – 31.08.2006

Synop-Analyse

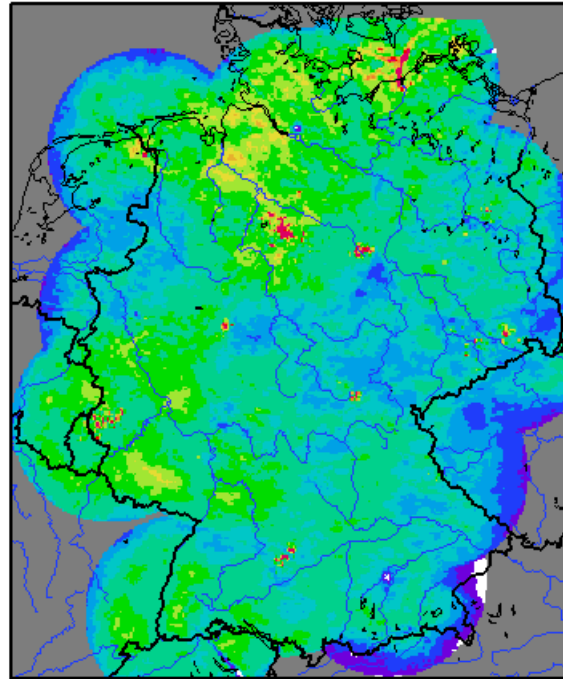
Nied.-Summe 15.-31. August 2006 (Synop-Analyse)



Mean: 72.8568 Min: 22.5591 Max: 193.599 Var: 563.37

Radar (LMK-Input)

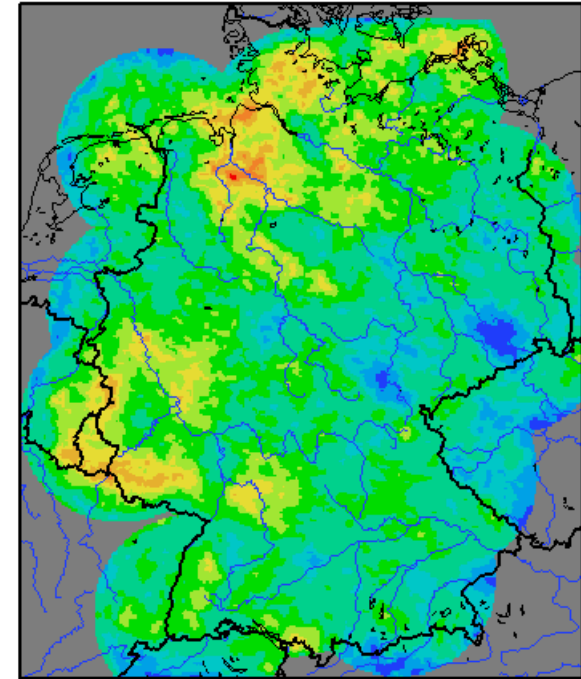
Niederschlagssumme 15.-31. August 2006 (Radar)



Mean: 120.872 Min: 0.710693 Max: 3301.87 Var: 3739.53

LMK-Analyse (LHN)

Nied.-Summe 15.-31. August 2006 (LMK Proe-op. Ana.)



Mean: 154.728 Min: 28.994 Max: 412.606 Var: 3325.07



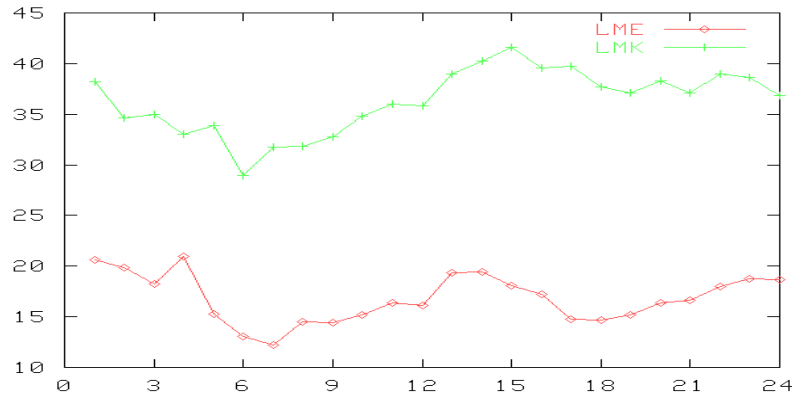
Mean: 72.8

Mean: 120.8

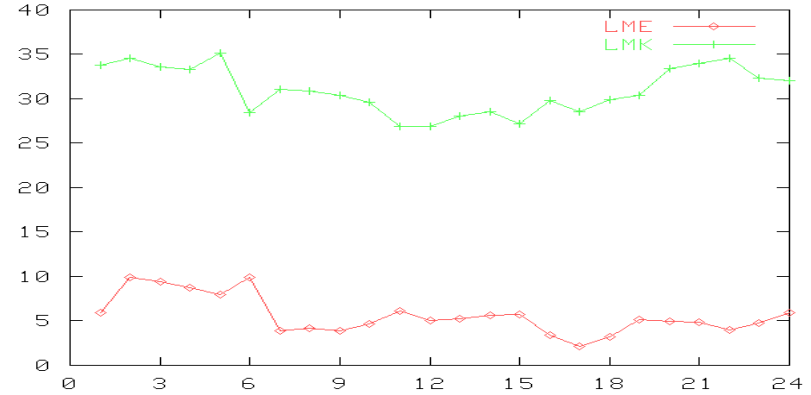
Mean: 154.7

Skill scores during ASSIMILATION (15.08.-31.08.2006)

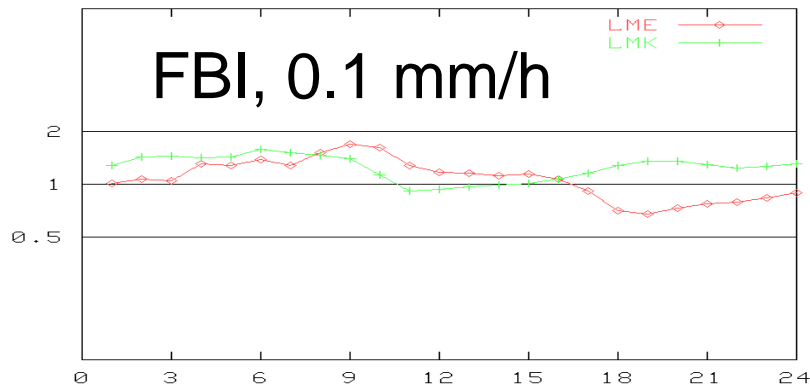
ETS, 0.1 mm/h



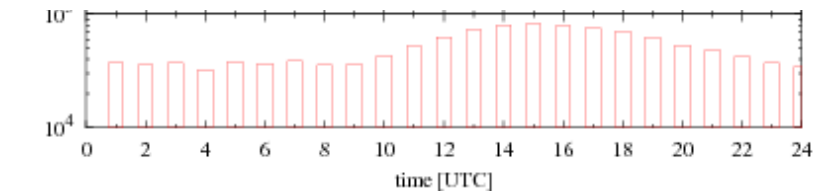
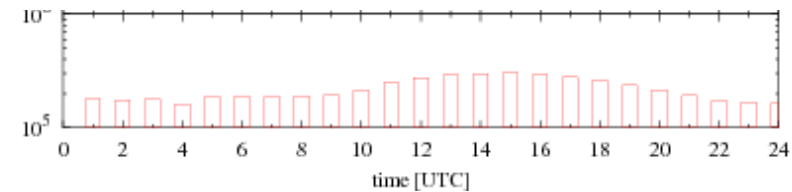
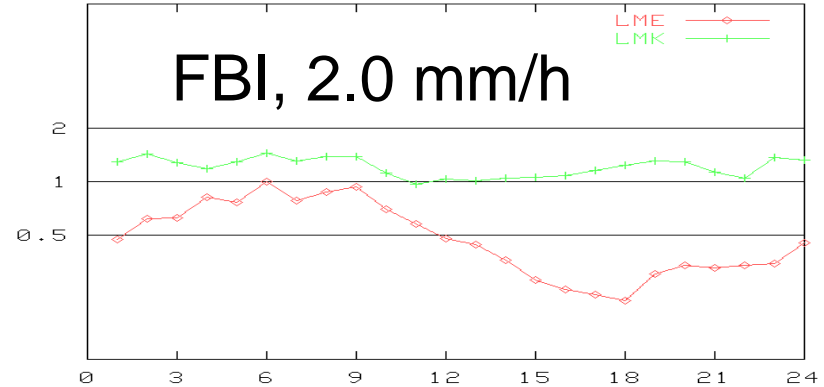
ETS, 2.0 mm/h



FBI, 0.1 mm/h

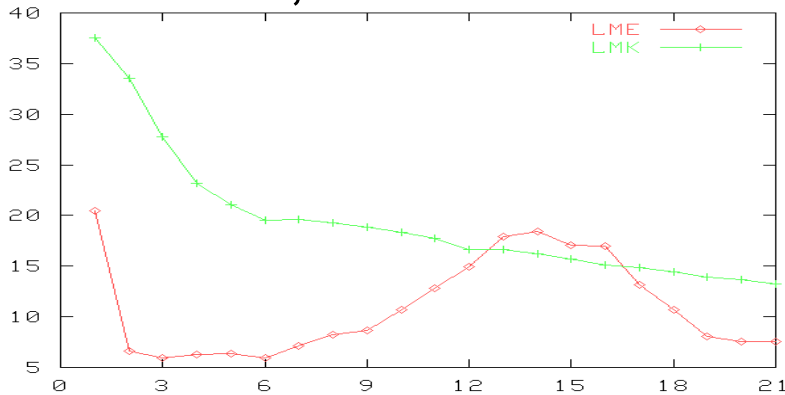


FBI, 2.0 mm/h

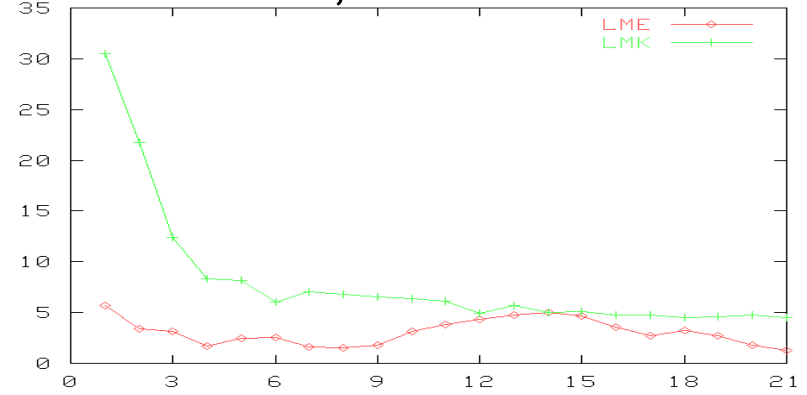


Skill scores FREE FORECAST (15.08.-31.08.2006 ,102 forecasts)

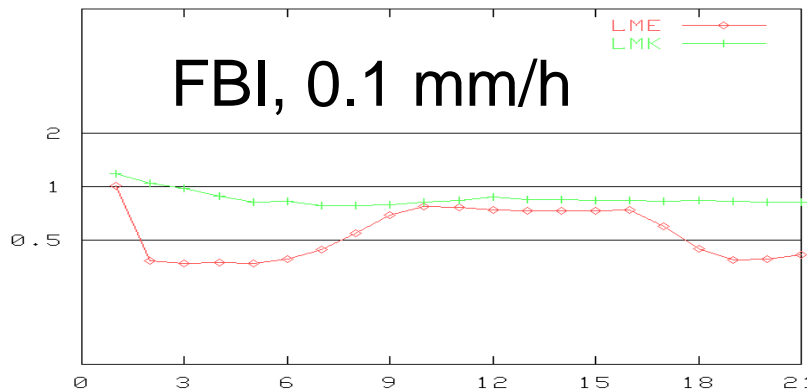
ETS, 0.1 mm/h



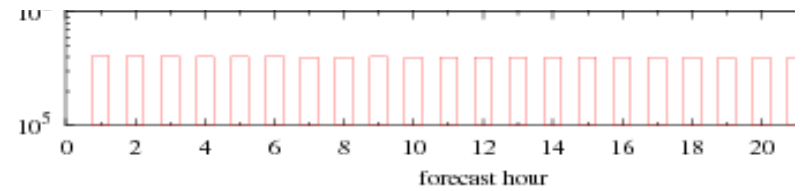
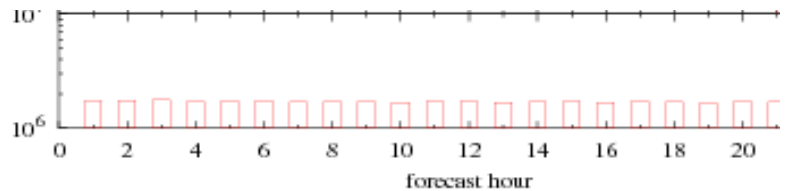
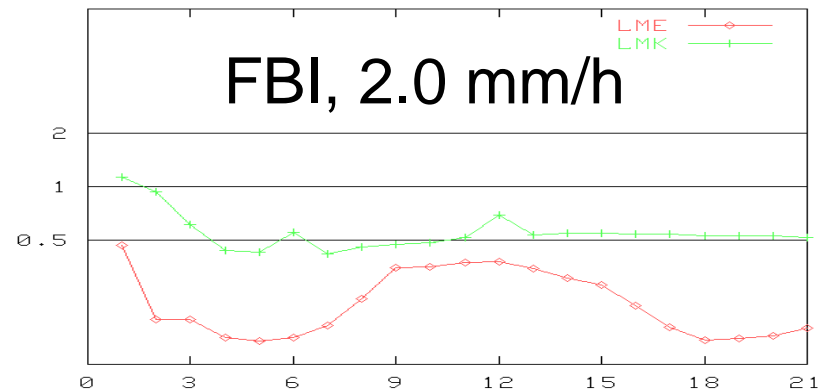
ETS, 2.0 mm/h



FBI, 0.1 mm/h



FBI, 2.0 mm/h

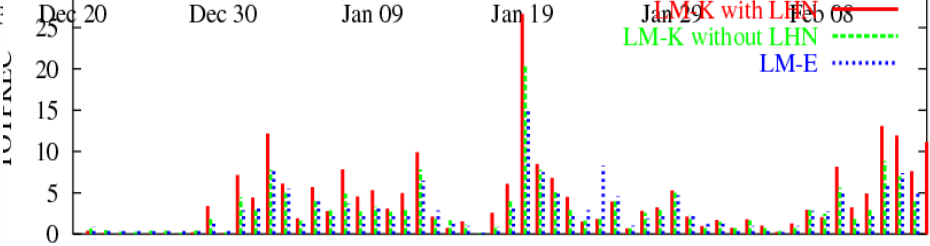
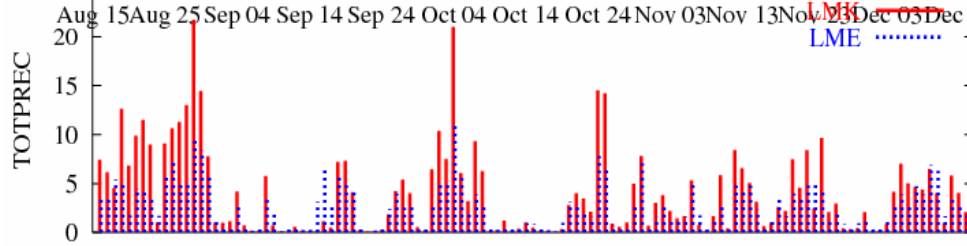
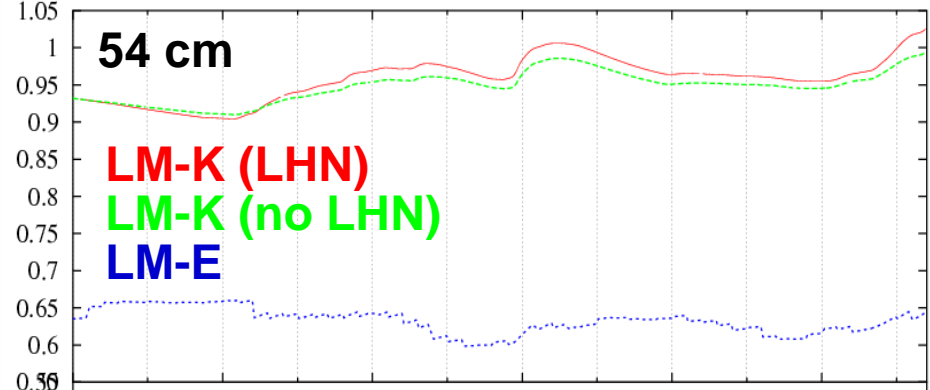
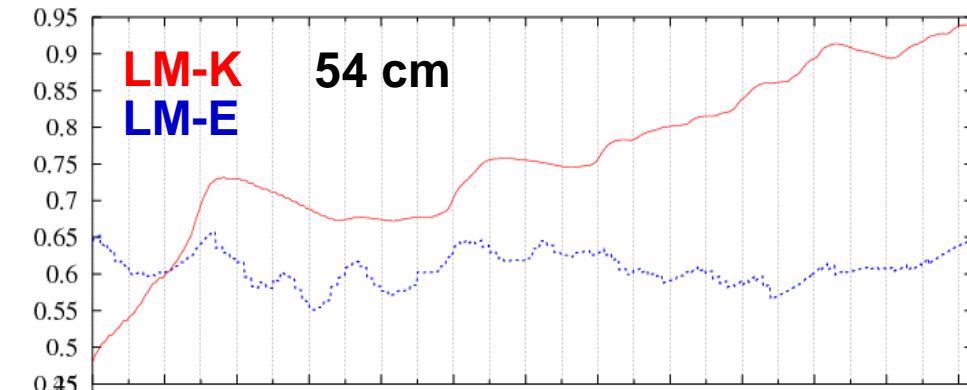
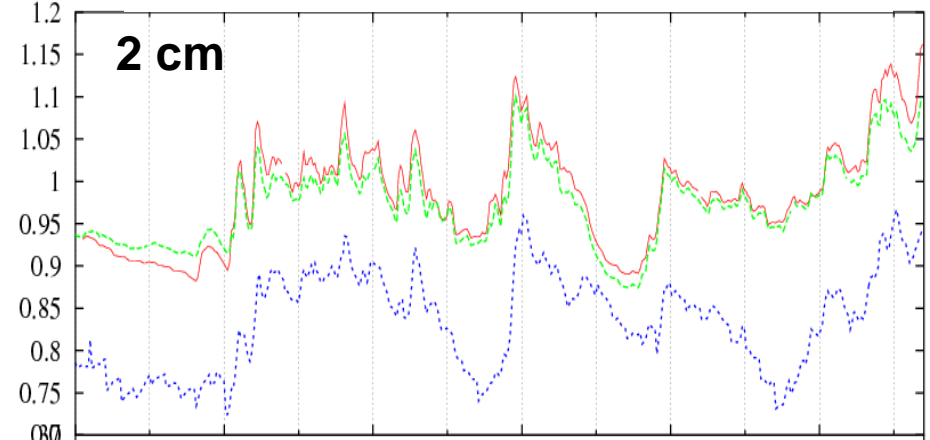
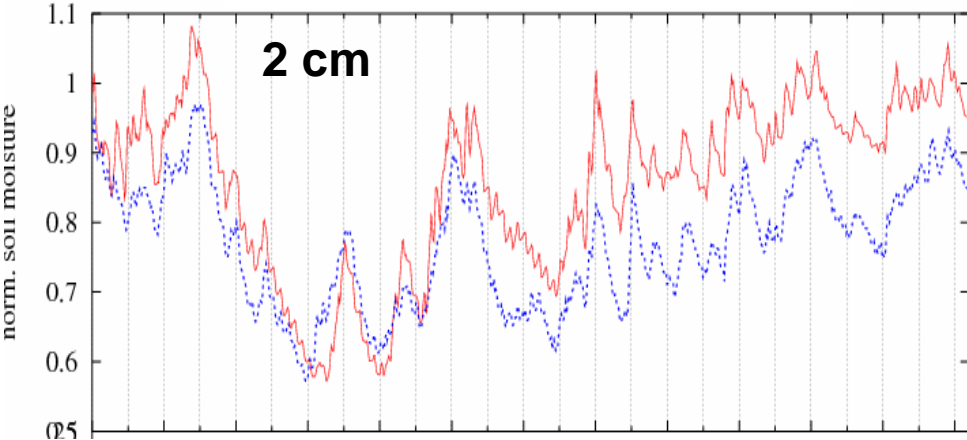


normalised soil moisture (radar composite area)



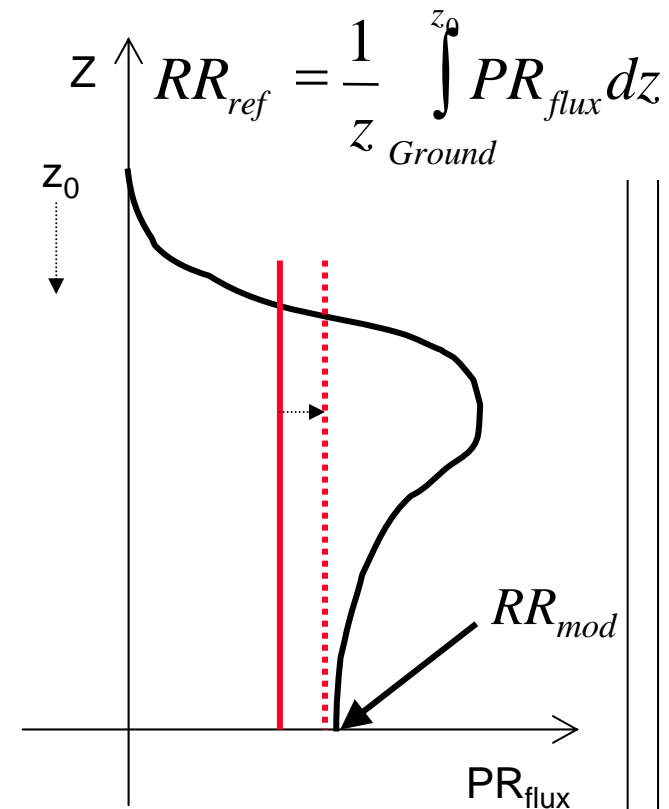
15.08. – 15.12. 2006

20.12.2006 – 15.02. 2007



Summary of Pre-OP and first Conclusions

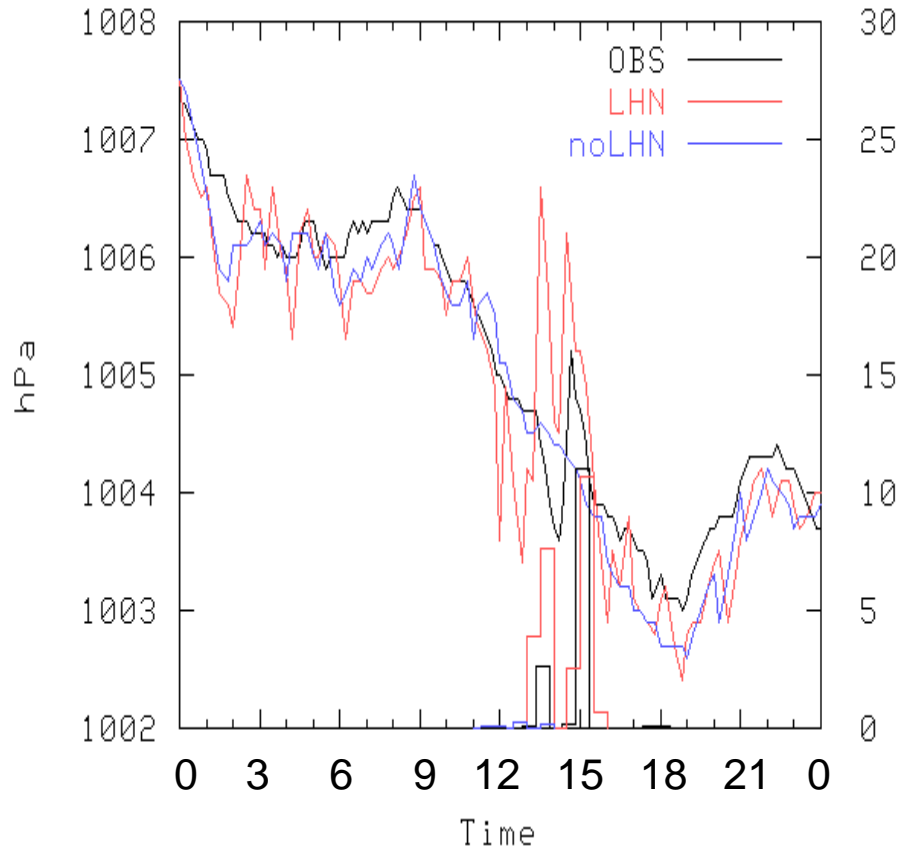
- Radar measurements overestimate rain rates more than model
- LMK with assimilation of radar derived rain rates shows better results than model measurements during the assimilation
- Reasons: a) compositing method of the radar introduces bias between reference and model precipitation rate
- The impact of LHN lasted up to 5 hours, depending on the model free forecast. The scores are better than for LMK
- LHN have a significantly influence on the soil moisture. The results are not clear at the moment.



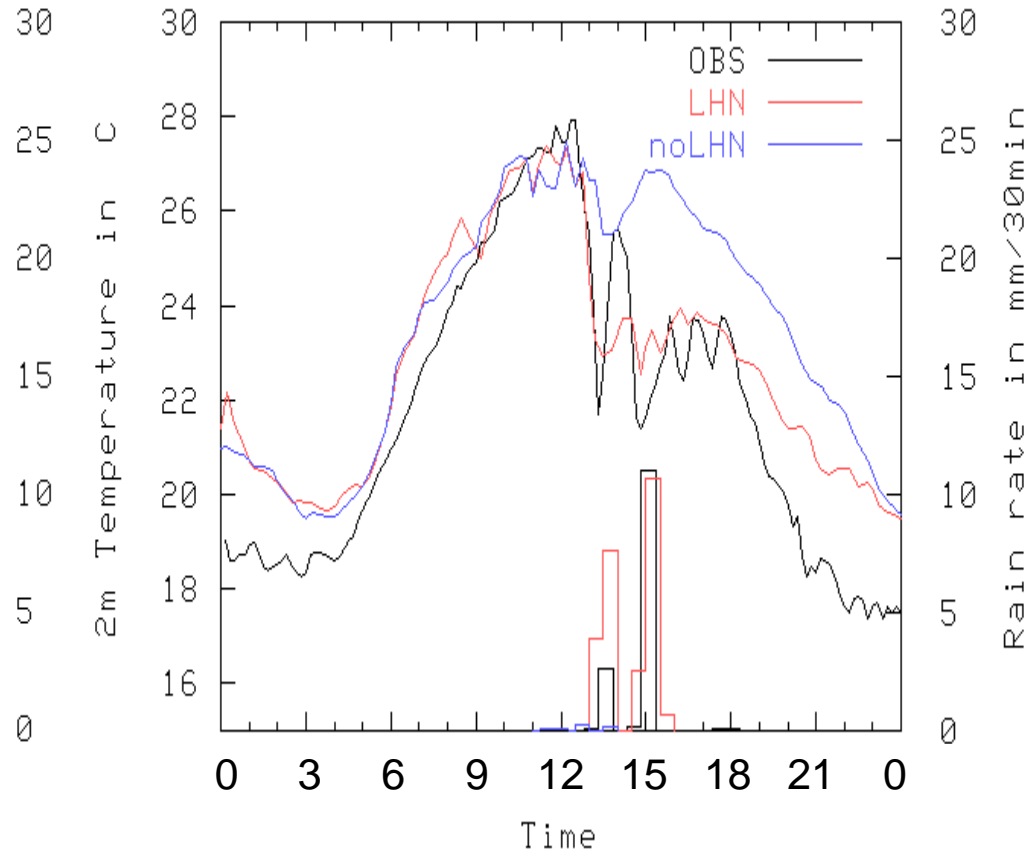
But what is about the convection?

Comparison of LHN assimilation with Observatory Lindenberg

Surface Pressure 21.06.2006



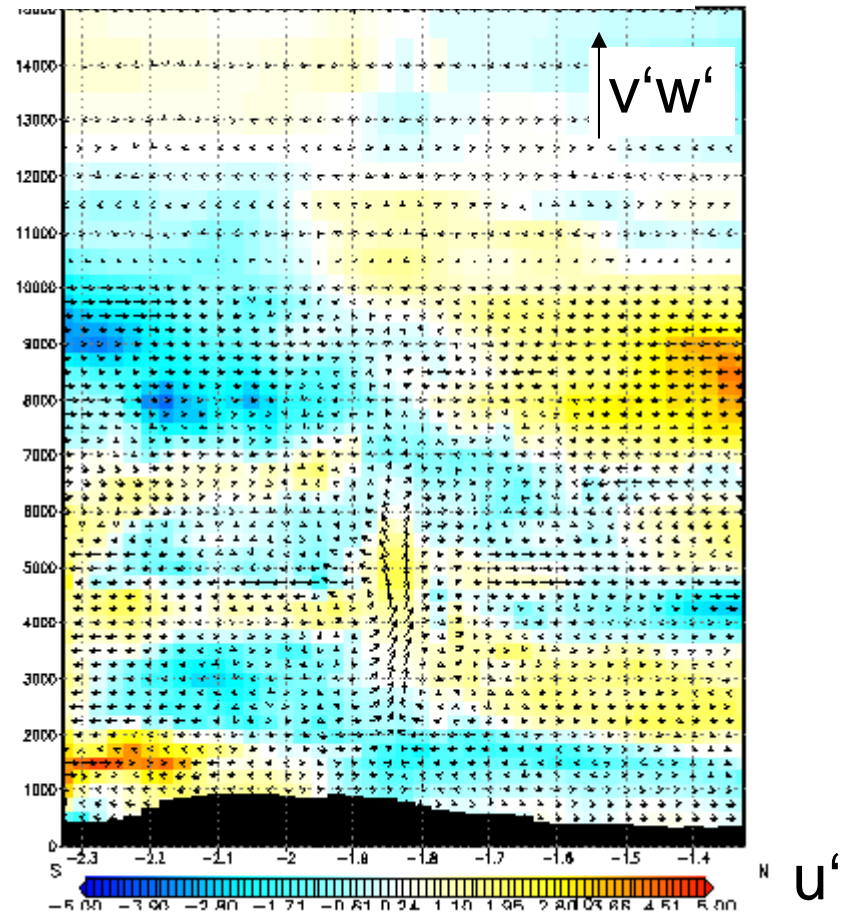
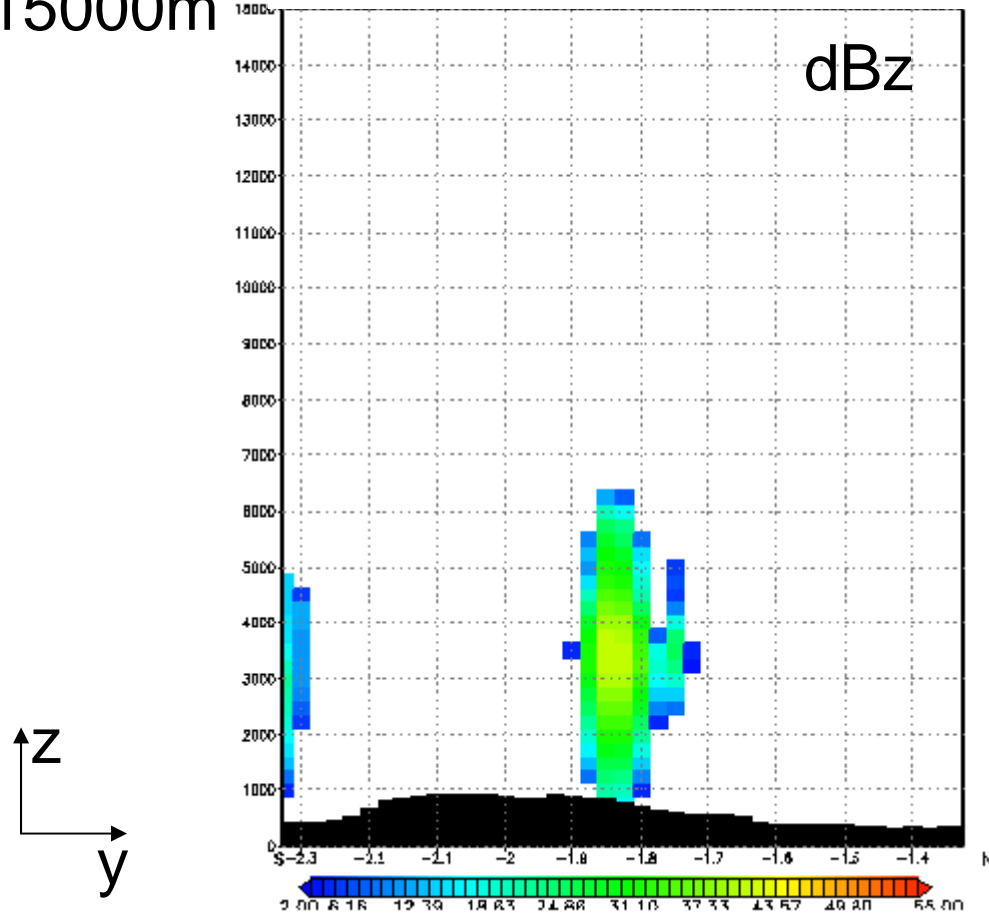
2m Temperature 21.06.2006



Convection Cell at 11.09.2006 12:10 – 15:00 ($\Delta t=10\text{min}$)

LHN increments over the whole vertical column

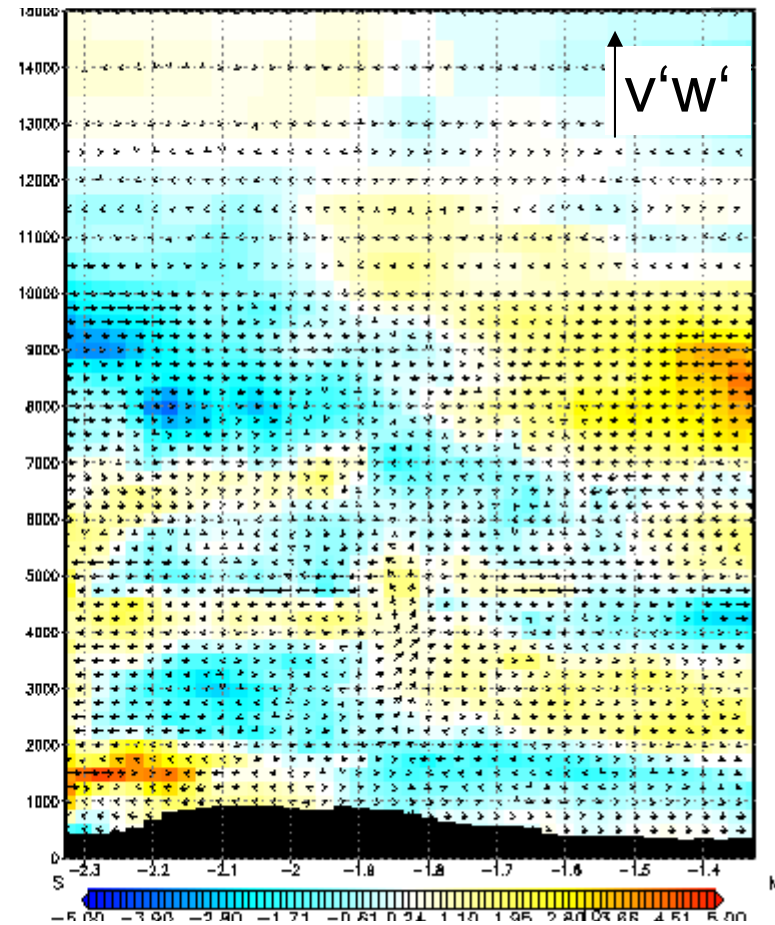
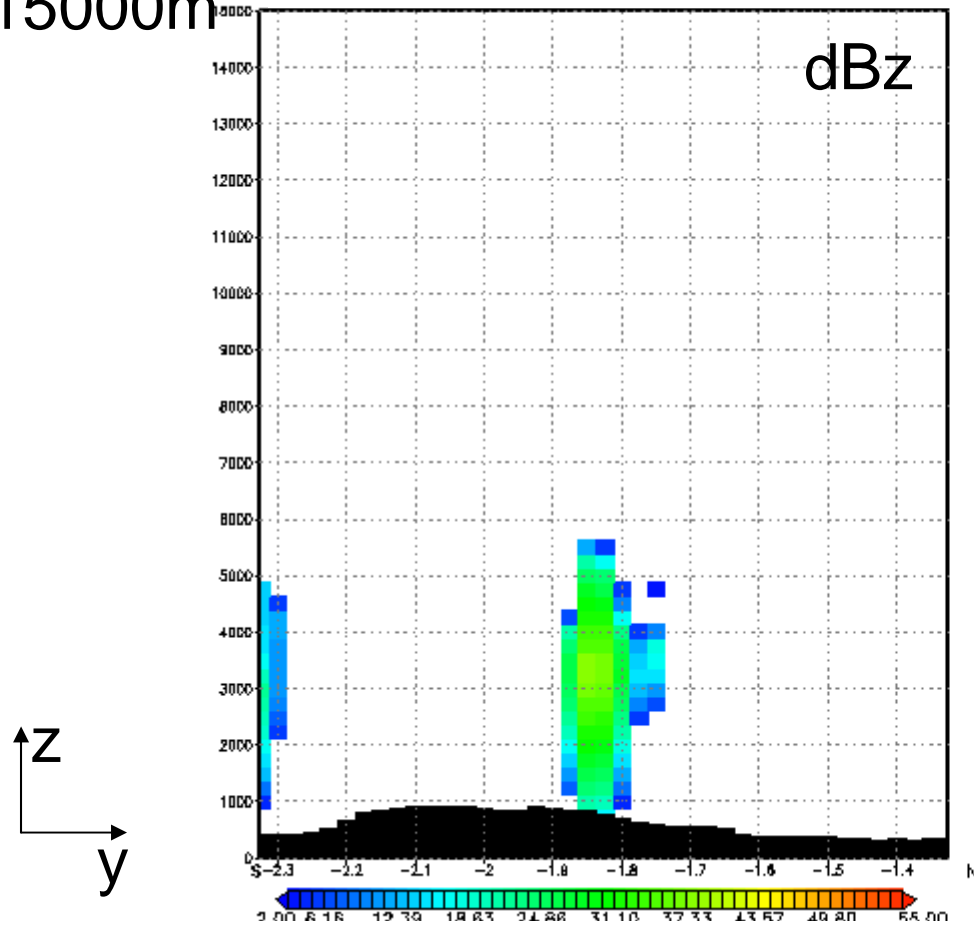
15000m



Convection Cell at 11.09.2006 12:10 – 15:00 ($\Delta t=10\text{min}$)

LHN increments within a certain vertical range

15000m



Conclusions and Outlook

- Surface parameters can be simulated very well during a LHN assimilation
- Dynamical forcing by LHN seems to be too strong, i.e. its vertical extent
- Does a vertical restriction or redistribution of the LHN-increments change the results?
- Investigation of the local stability and the local wind fields with respect to its temporal development.
- further investigation on the 3-d fields especially in the storm cells and its surroundings to understand what does trigger the model convection most. (comparison to 3d radar information)