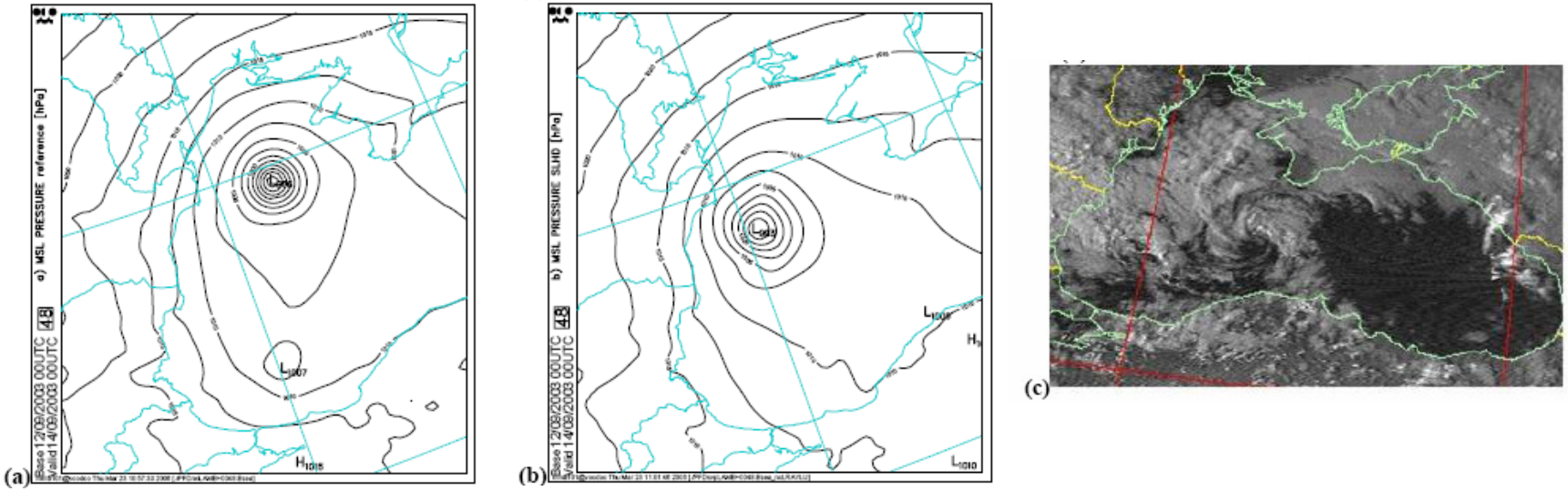
ALARO-0 experience in CHMI

History of ALARO-0 implementation in CHMI

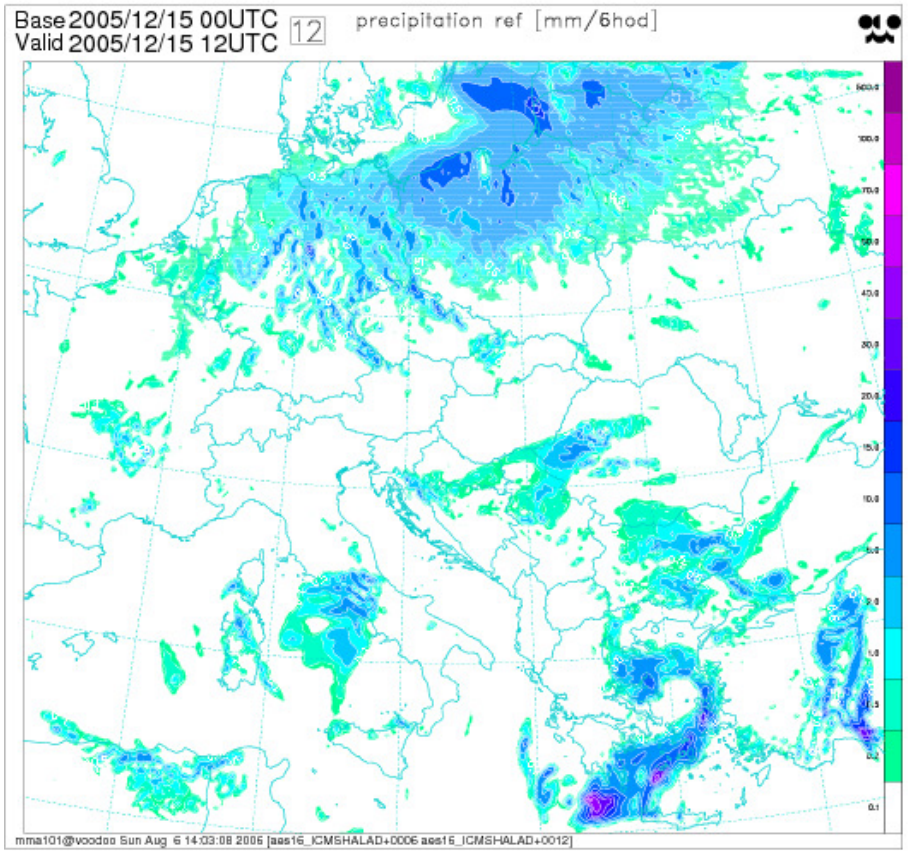
- June 2005 (ALADIN WS in Bratislava) – decision on ALARO-0 scope and roadmap;
- 2006: R&D Momentum from MFSTEP – work mostly on “dry” processes: gravity wave drag, SLHD, gustiness, pTKE, cloud model in radiation.
- 2007: Implementation of prognostic microphysics
- 2008: Implementation of prognostic convection in 3MT framework.

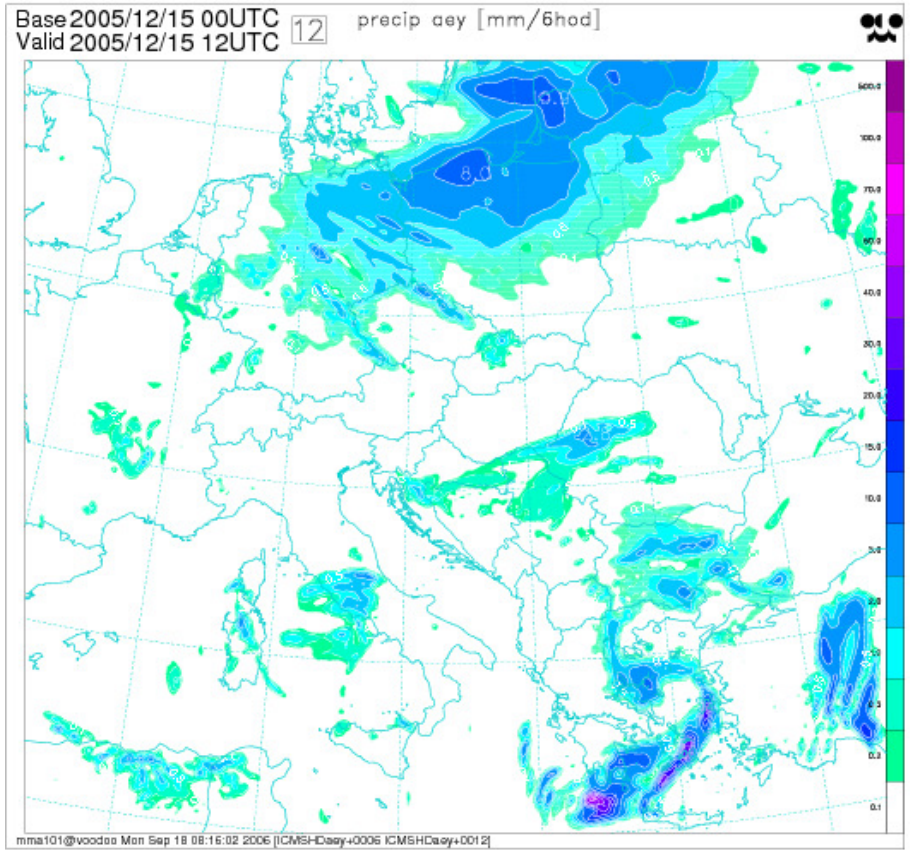
To recall: SLHD



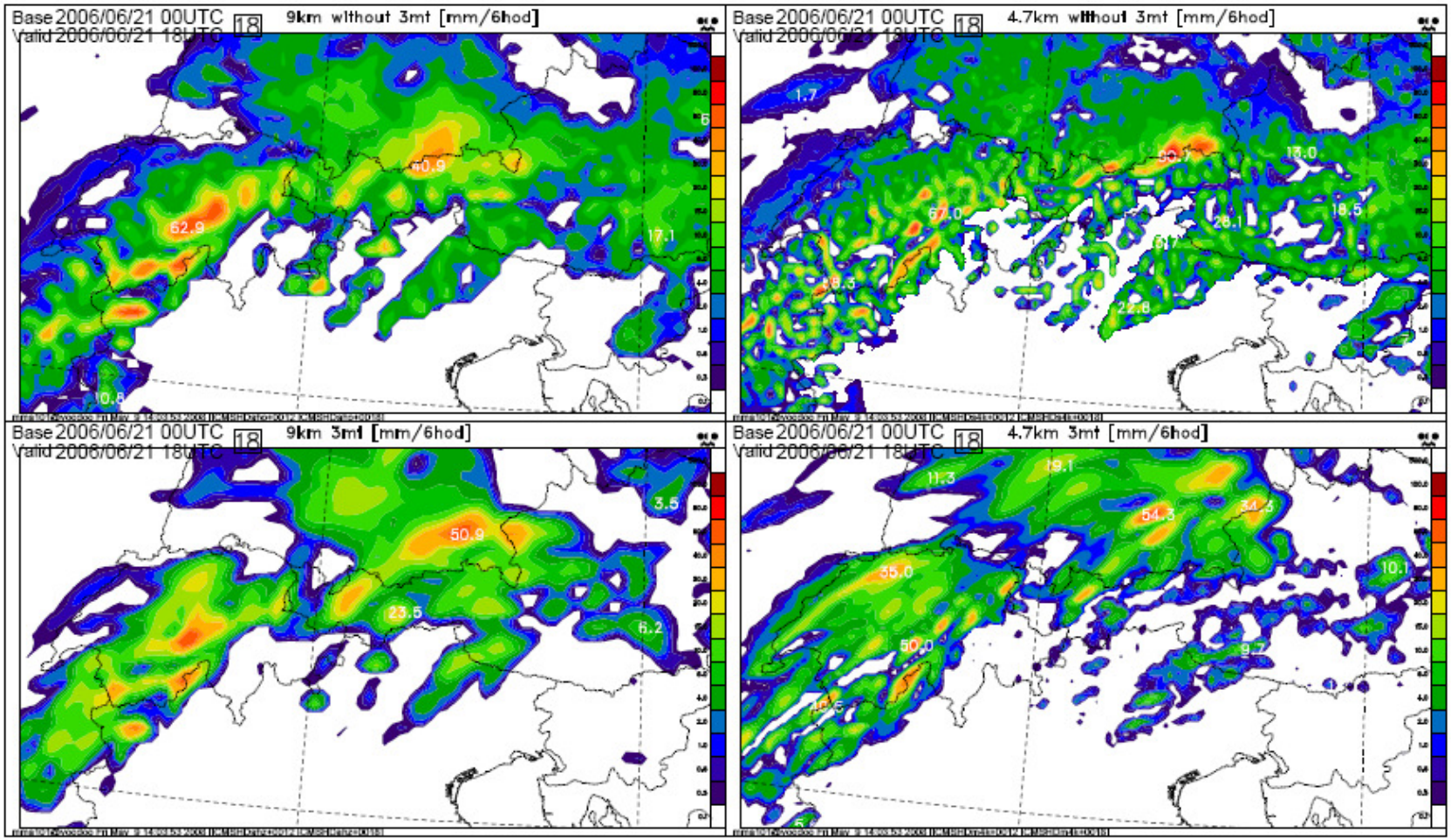
Among other improvements: - cure for pathologic cyclogenesis

To recall: prognostic microphysics





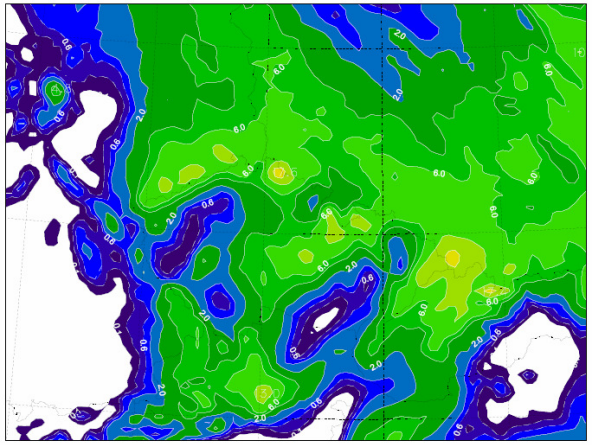
To recall – 3MT



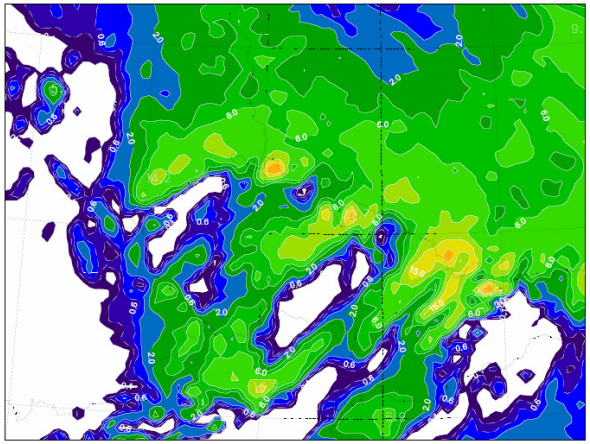
Forecast skills with ALARO-0 (1)

- Microphysics – quite reasonable quality of precipitation forecast. Tests of the statistical sedimentation scheme give expected results both in academic and real cases.

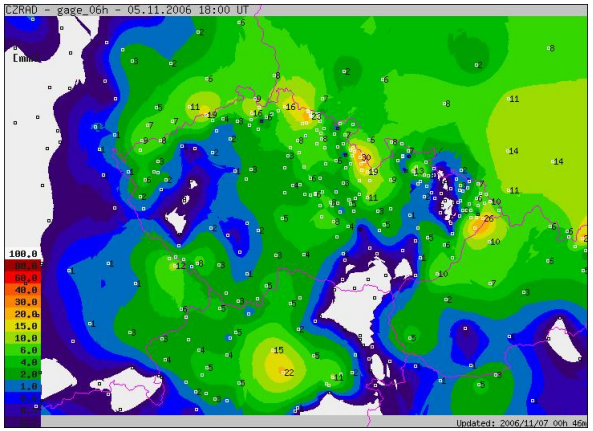
oper



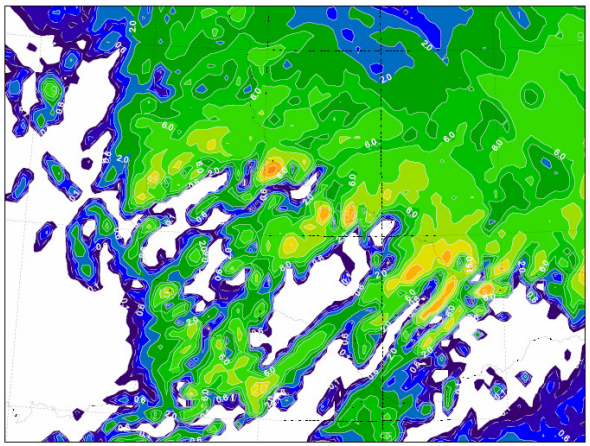
high
fall speed
of rain/snow



obs

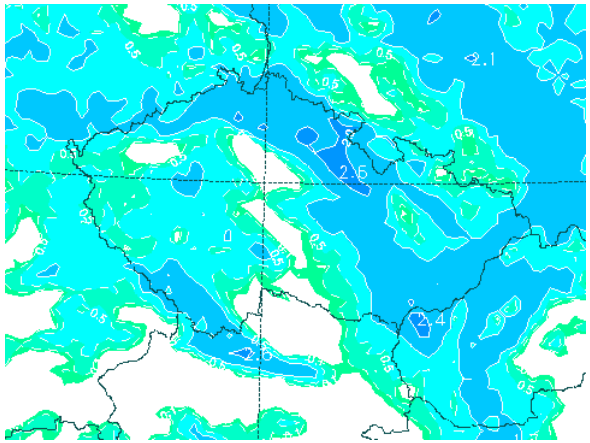


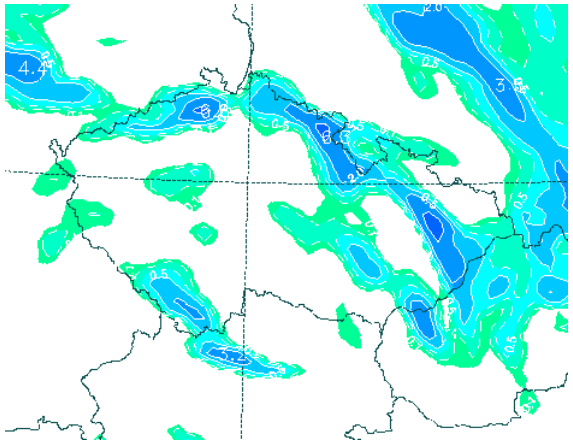
old

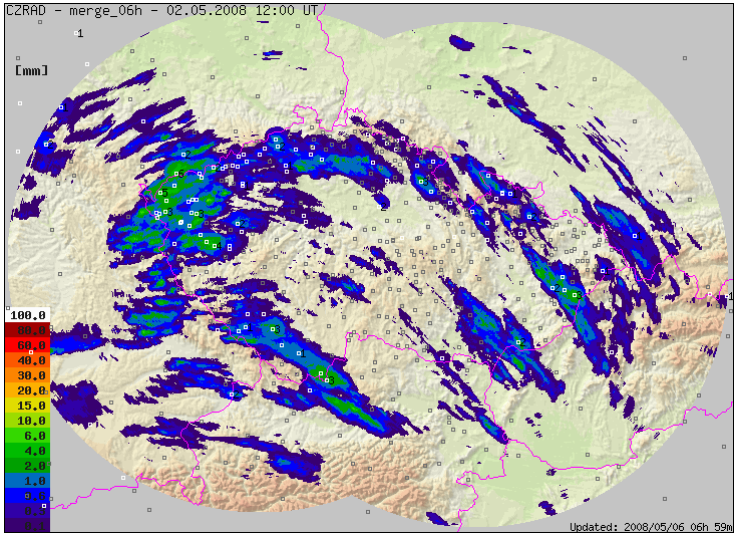


Forecast skills with ALARO-0 (2)

- Prognostic convection with 3MT – better structures.

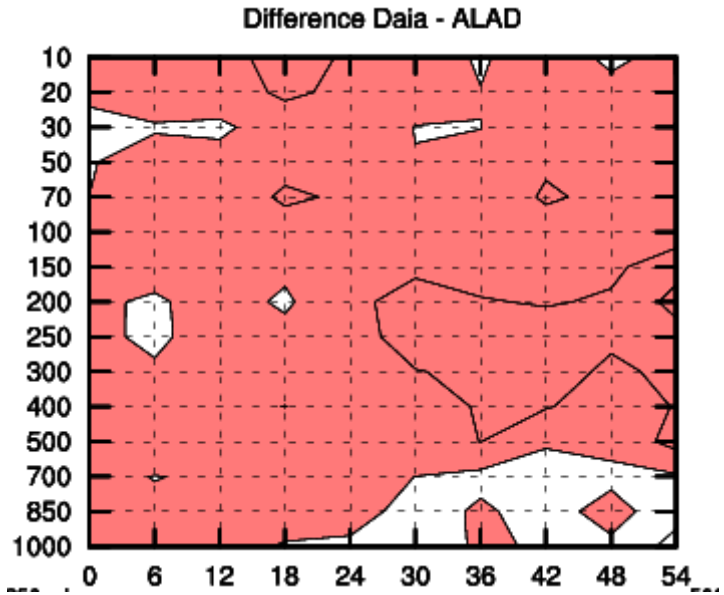




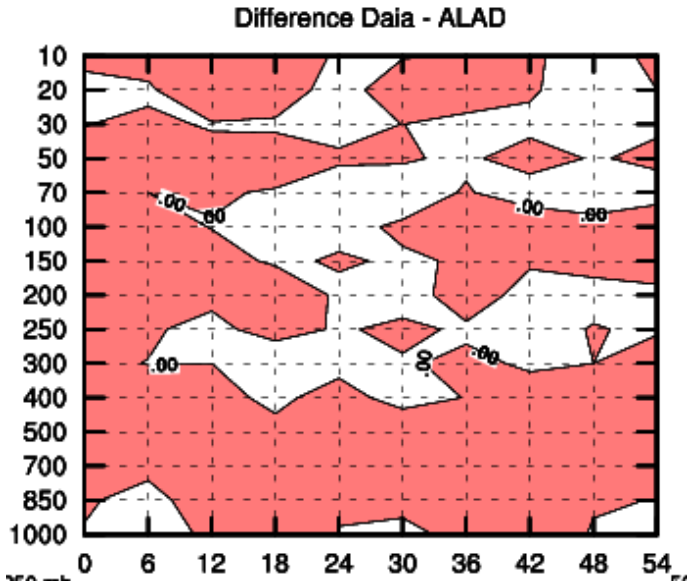


Forecast skills with ALARO-0 (3)

- Some scores – effect of 3MT



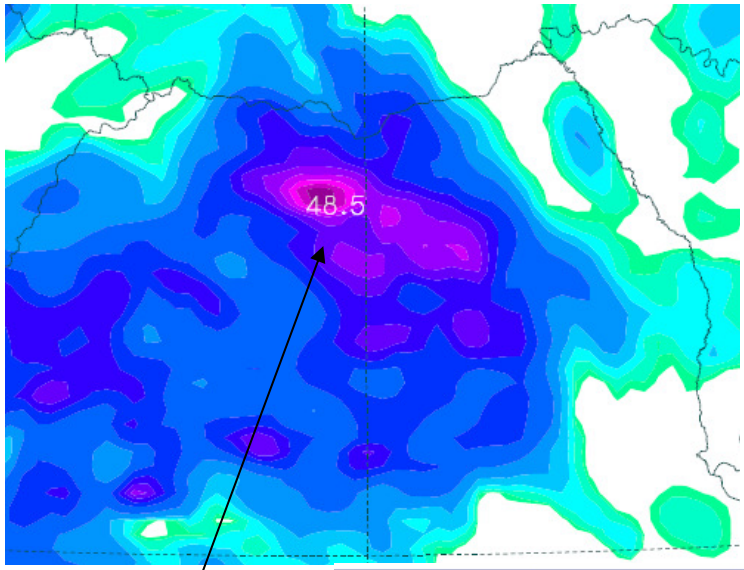
Geopotential

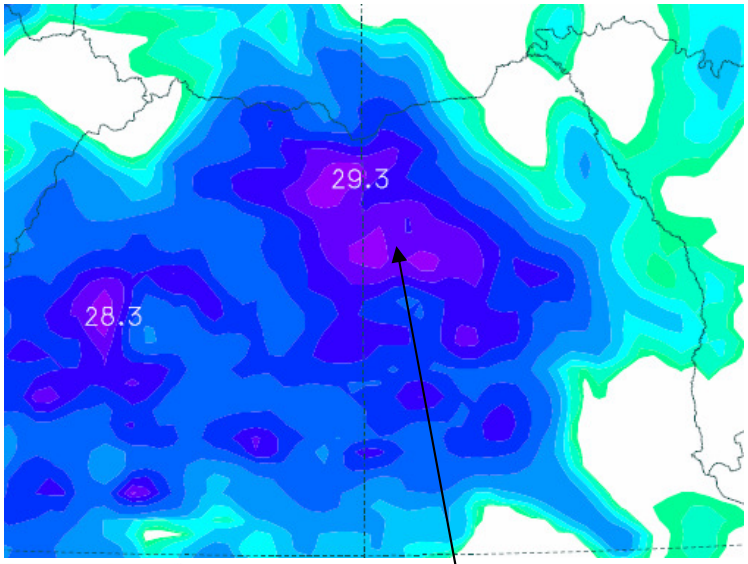


Temperature

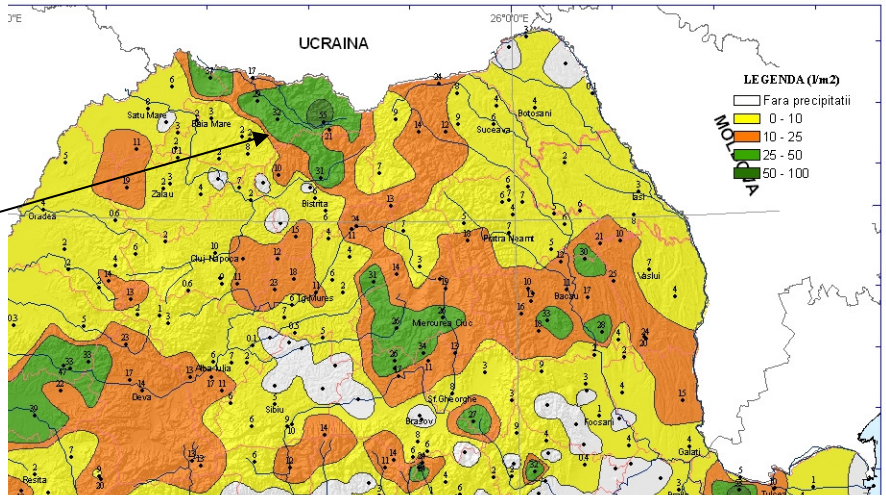
Difference of RMSE: red color = test is better. Small positive impact of 3MT

Feedbacks: resolved condensation vs sub-grid condensates





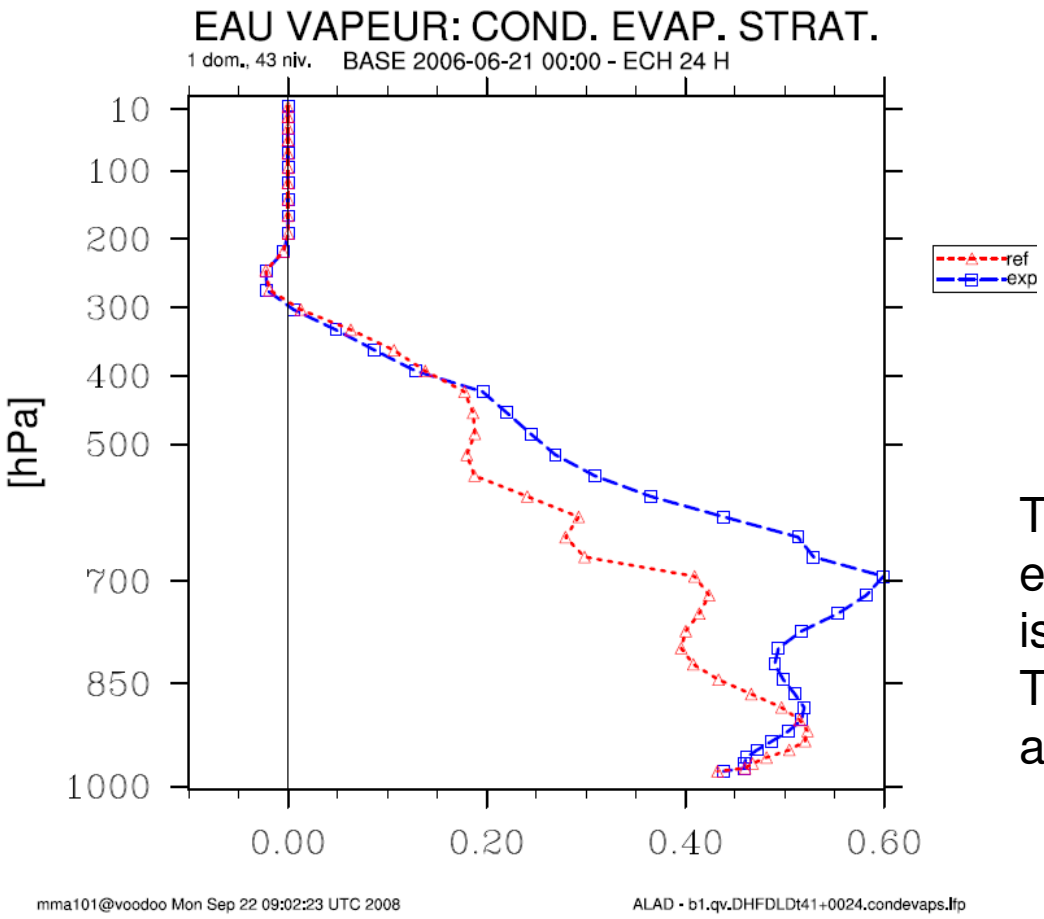
3MT standard



24h precipitation sum
Courtesy of INMH

3MT but existing convective condensates are treated as resolved in the new time-step: the squall line structure is smoothed out.

Feedbacks: geometry of clouds in microphysics



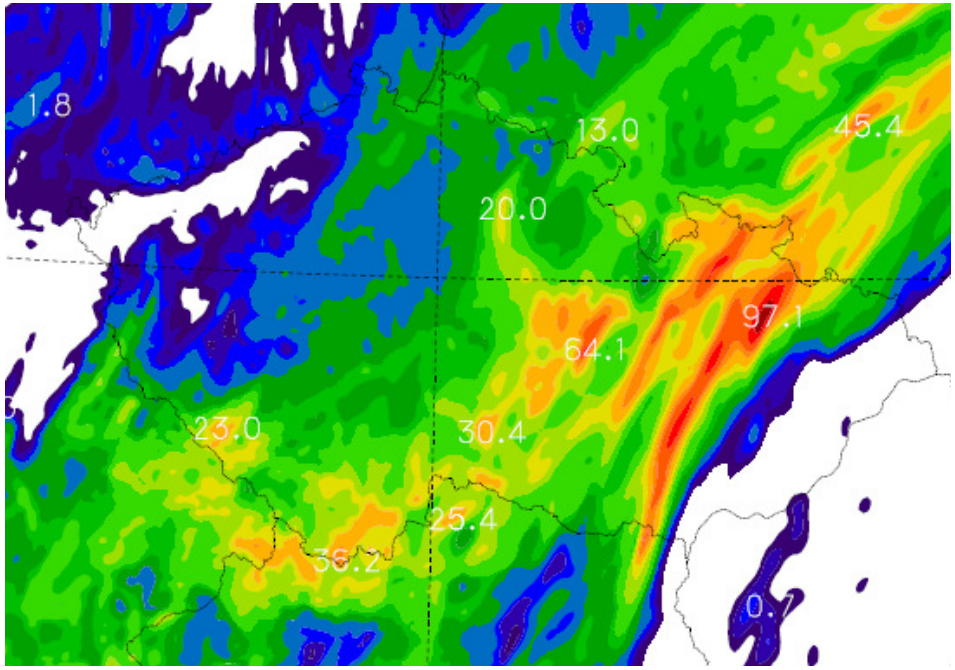
Two options are currently coded:

- Maximum overlap of clouds (more realistic) – reference;
-Random overlap of clouds – exp 1

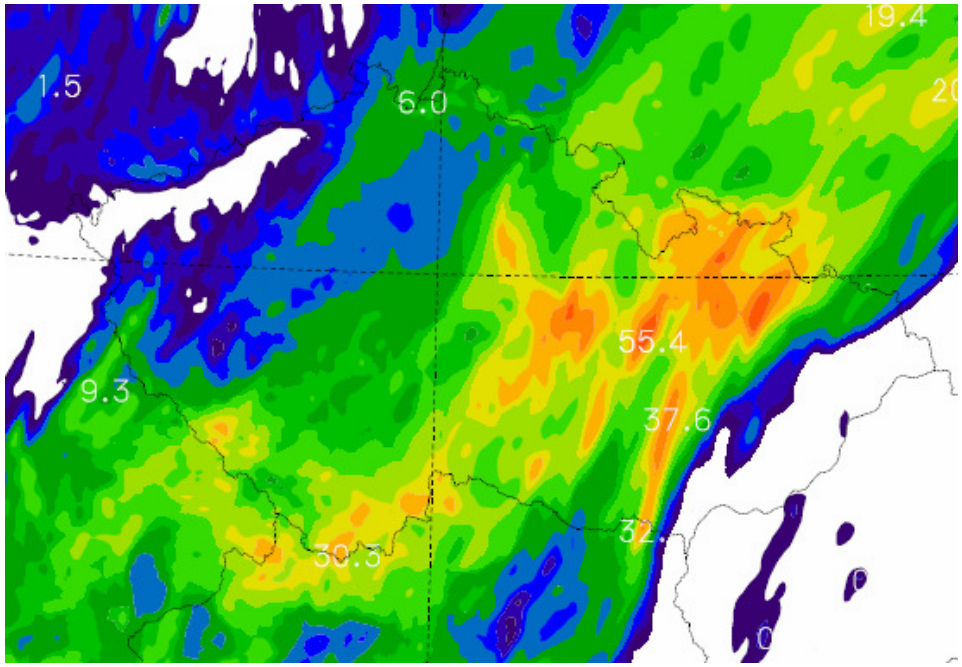
The impact (here shown for evaporation of falling species) is not negligible.
The problem cannot be treated as linear.

Feedback from pressure gradient computation

Grad (RT) with qv only; dx = 2.3km



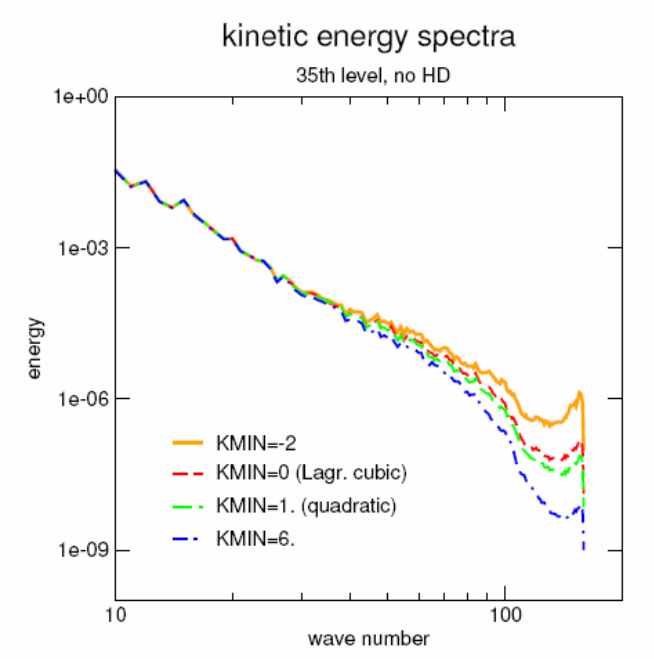
Grad (RT) with all species



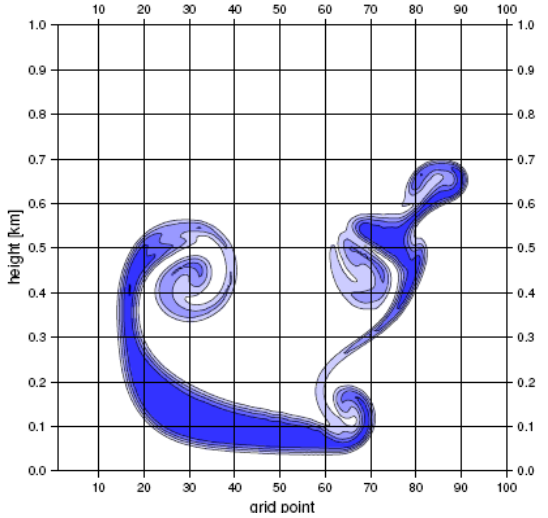
Associated questions:
Any other similar omission will likely cause similar feed-backs;
Initialization: filtering RT is detrimental.

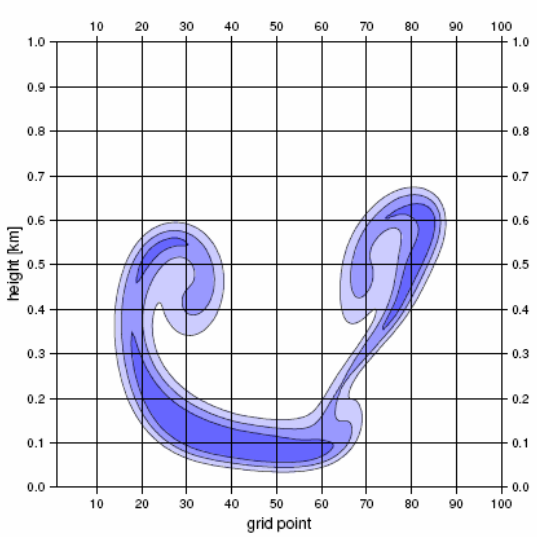
Contributors: S. Malardel & Y. Bouteloup (sensitivity),
R. Brožková & P. Smolíková (DFI problem)

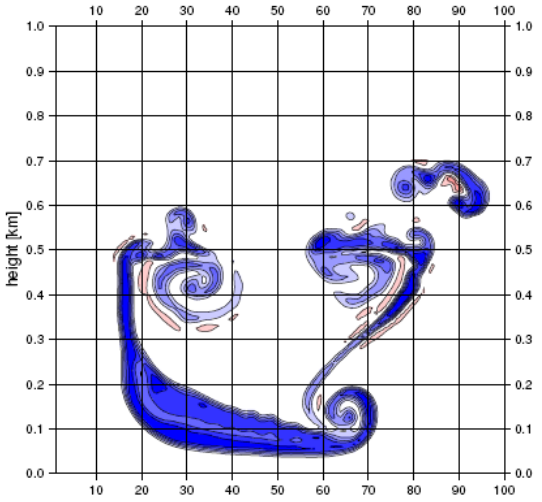
Impact of interpolator diffusivity (1)



Bubble tests:
- normal
- smoothed
- overshoots

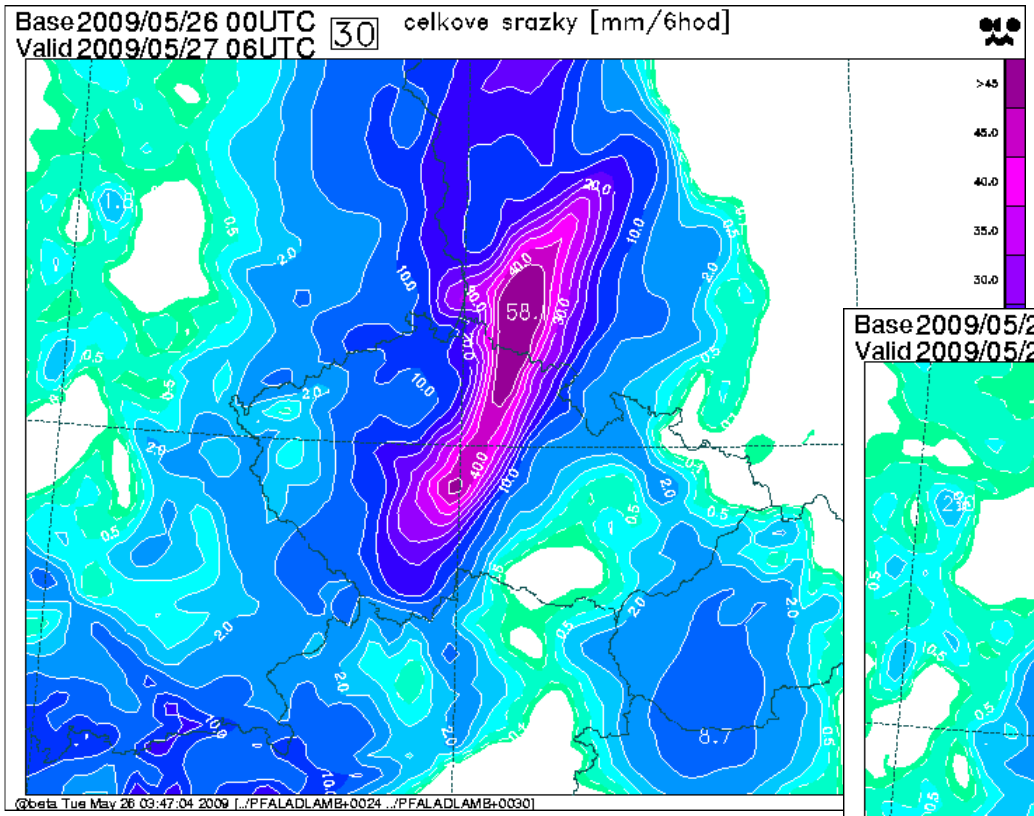


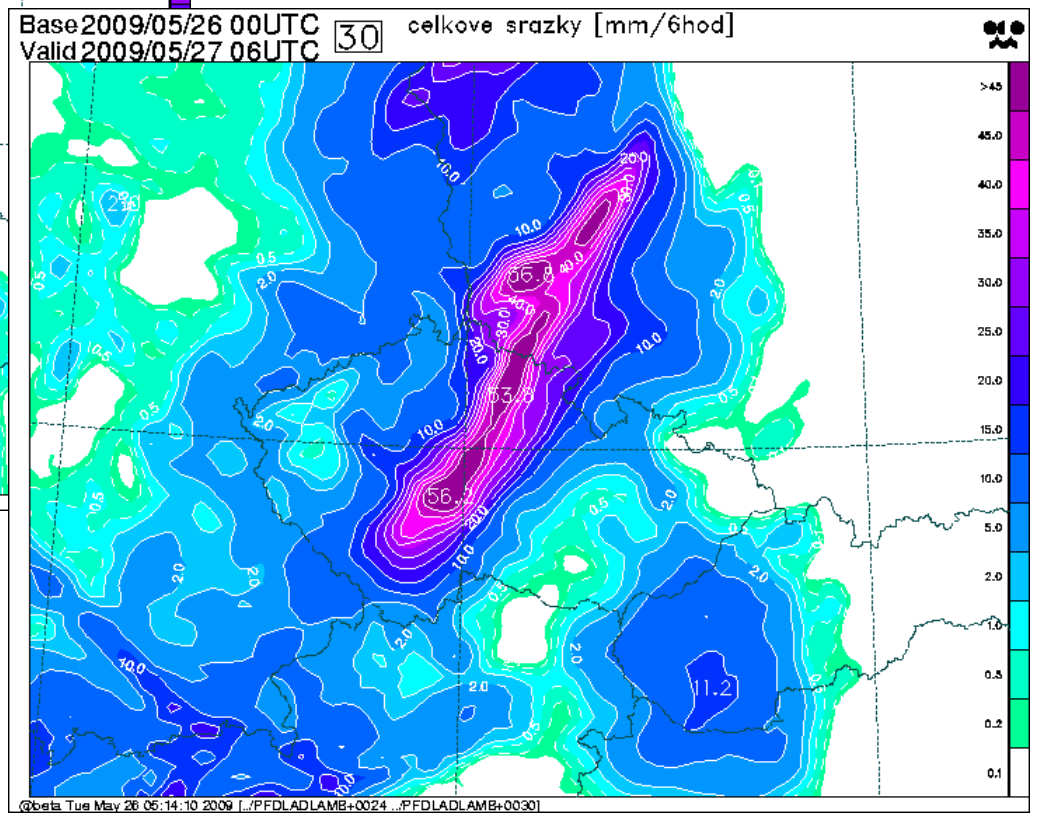




Small waves
kinetic energy spectrum
- measure of diffusivity.

Impact of interpolator diffusivity(2)



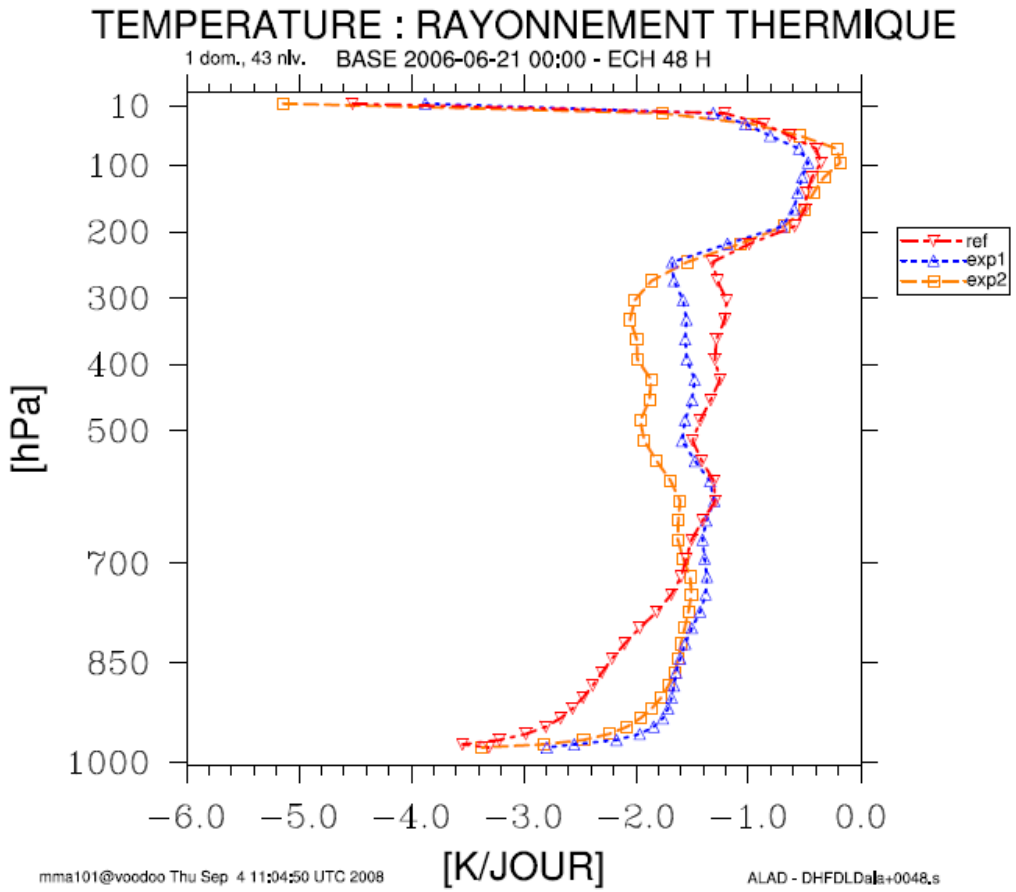


Feedbacks and tuning problems

- Radiation: new transmission functions in thermal band

DDH diagnostics:
Reference: old acraneb
Exp 1: new acraneb
Exp 2: RRTM

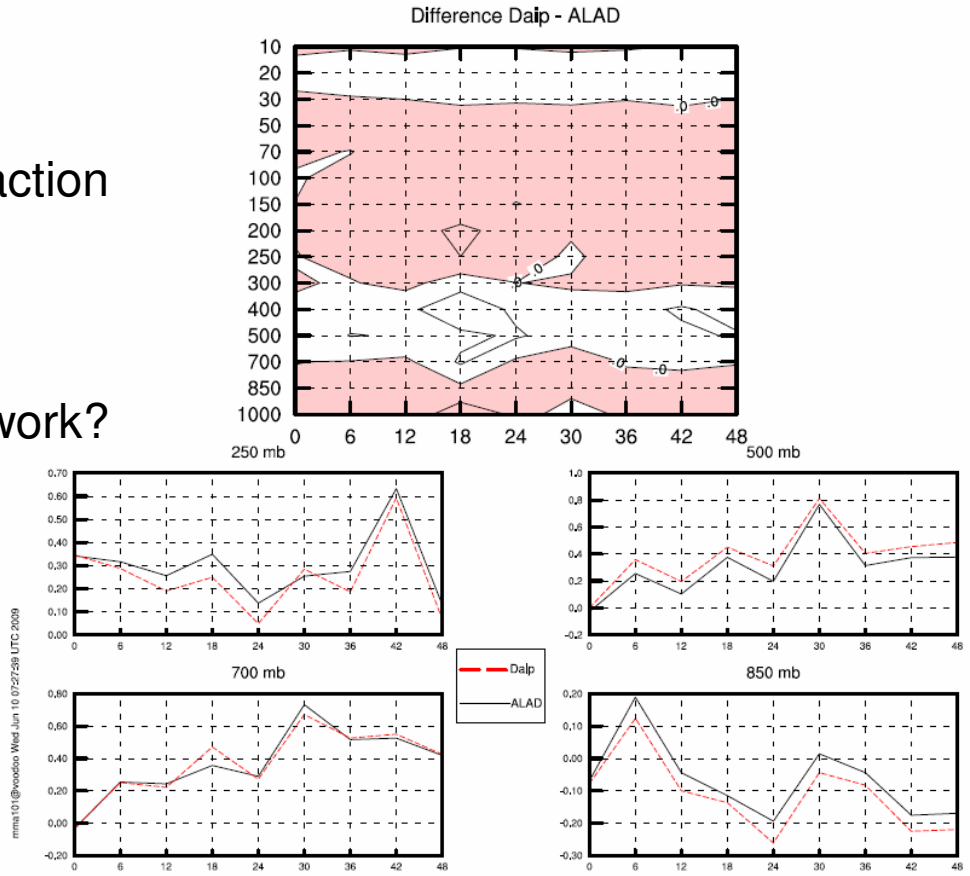
This should improve results, but …



Feedbacks and tuning problems

Too much warming in layer between 400 – 700 hPa – interaction with cloudiness?

This score does not fit to image of DDH picture – feedbacks at work?

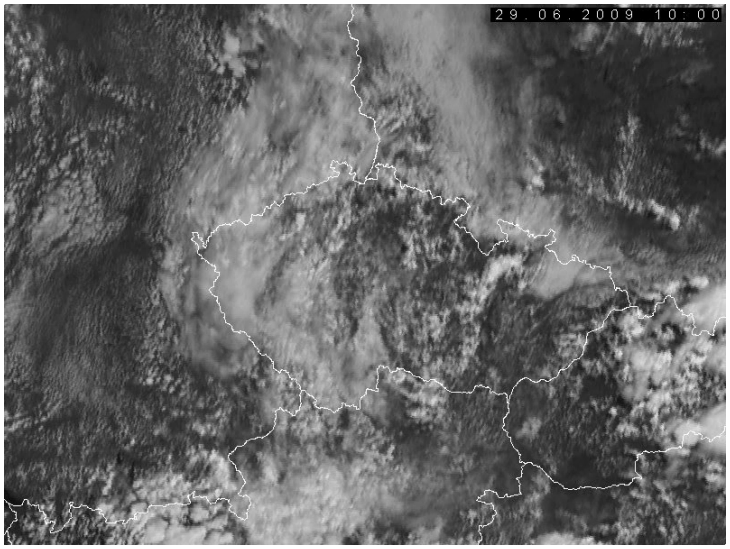


Temperature bias vs soundings

Current problems

- Find feedbacks with the radiation scheme;
- Improve turbulence and PBL;
- Probably both points above are also linked to overestimation of T2M under calm, clear sky winter conditions (minima -15 deg instead -20 deg, for example);
- Deep convection onset – still too early;
- Challenges of convection – turbulence feedbacks.

2010-: Harmonise turbulence & convection



COST

Action number
ES 0905

TOUCANS