CZECH HYDROMETEOROLOGICAL INSTITUTE

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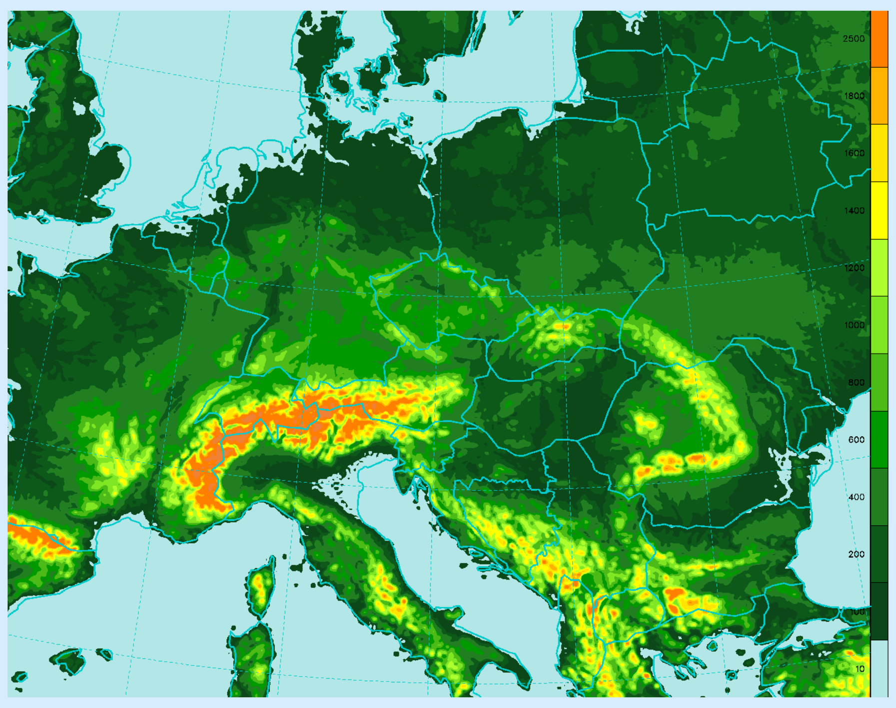
ALADIN/CE model set-up

- domain (529x421 grid points, linear truncation E269x215, Δx~4.7km)
- 87 vertical levels, mean orography
- time step 180 s
- surface analysis based on OI of SYNOP (T2m, RH2m)
- **BlendVar** for upper air fields (digital filter spectral blending followed by 3DVAR)
  - filtering at truncation E87x69
  - space consistent coupling
  - no DFI for long cut-off 6h cycle
  - incremental DFI initialization for short cut-off production analysis
- 3h coupling interval
- 00, 06, 12/18 UTC forecast to +72/54h
- hourly DIAGPACK analysis
- **ALADIN cycle 38t1tr_op4 (ALARO-1 baseline)**



Orography of ALADIN/CE model domain

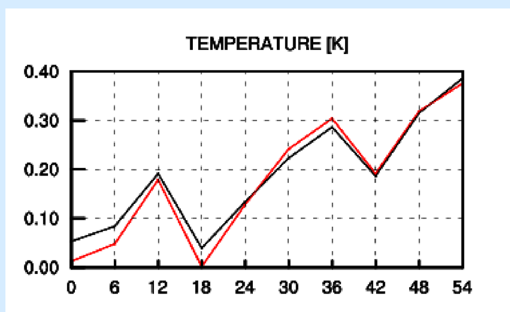
HPC system

- two full **NEC SX-9** nodes (1TB RAM and peak performance 1.6 TFLOPS provided by 16 vector CPUs each node)
- GFS with 118TB usable disk space
- operating system is SUPER-UX and NQSII scheduler
- two Linux **frontend servers** (4 Intel Xeon quad core CPUs, 2.93 GHz clock rate and 31 GB RAM each)

Major operational changes (April 2015 – April 2016)

20 Aug 2015 BlendVar implementation - digital filter spectral blending combined with 3DVAR assimilation of SYNOP, TEMP, AMDAR, AMV and SEVIRI data improved analysis and upper-air wind and temperature biases up to lead time of +24h

16 Jan 2016 prolongation of forecasts to +72h



T700hPa BIAS of **oper** and BlendVar suite for Jun–Aug 2016

Longwave ACRANEB2 developments

Ján Mašek

Shortwave part of ACRANEB2 radiation transfer scheme was published in QJRMS (DOI:10.1002/qj.2653), paper describing the longwave part is being finalized. Evaluating accuracy of the NER (Net Exchanged Rate) technique with bracketing required construction of independent narrowband reference with full inclusion of scattering. It confirmed that in the longwave part of spectrum grey treatment of aerosols and clouds is fully justified, and the only quantities whose broadband optical saturation must be parameterized are gaseous transmissions.

Figure 1 demonstrates accuracy of bracketing technique, making the cost of EBL (Exchange Between Layers) computation linear in number of levels. Figures 2 and 3 show accuracy of ACRANEB2 and of narrowband reference, respectively. In NWP environment, broadband approach combined with selective intermittency leads to an optimal share between cost and accuracy, making ACRANEB2 outperforming traditional approach that compromises high accuracy of k-distribution method by using rather crude full intermittency in order to make the computational cost affordable.

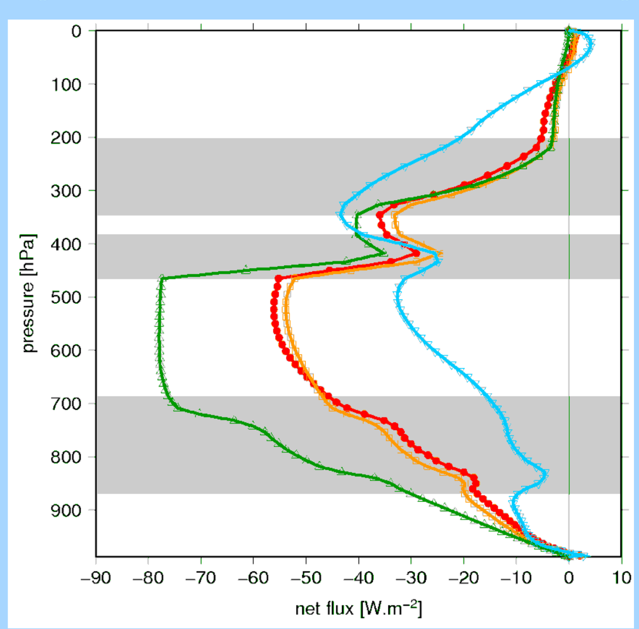


Figure 1: EBL flux calculated by narrowband reference (red) and by bracketing technique (yellow), interpolating between minimum (green) and maximum (blue) EBL estimates. The case shown is a waving cold front on 01-Jul-2012 at 18 UTC in Prague. Cloud layers are denoted by grey shading.

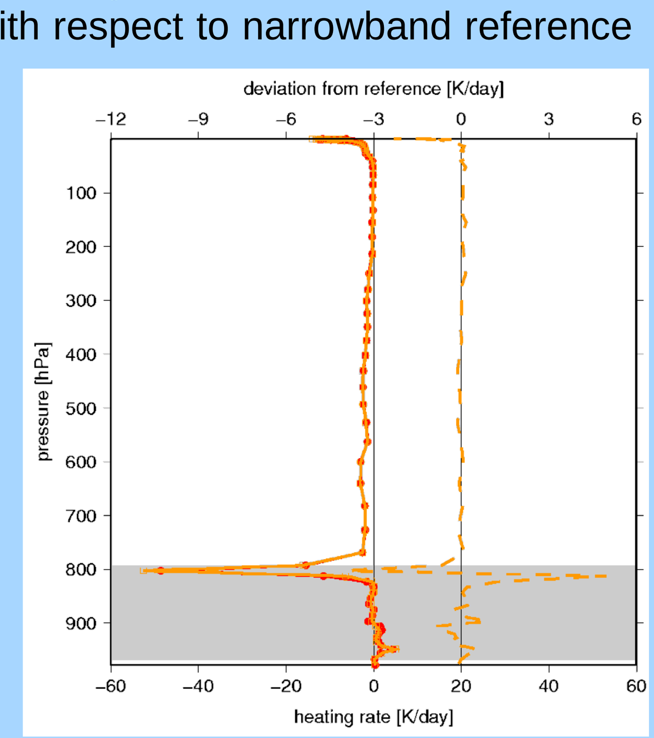


Figure 2: Longwave heating rate computed by narrowband reference (red) and by ACRANEB2 (yellow) for the same case as on figure 1. Dashed line denotes error of ACRANEB2 with respect to narrowband reference (upper scale).

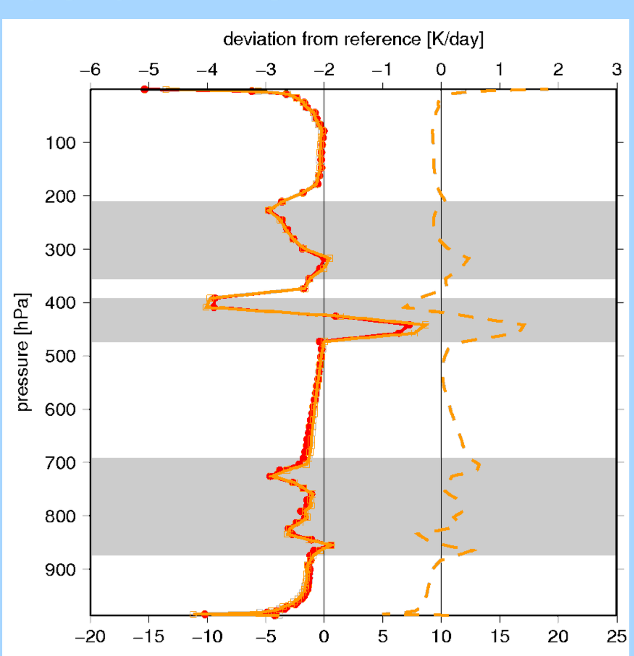


Figure 3: Longwave heating rate delivered by line by line calculation (red) and by narrowband reference (yellow) for CIRC (Continual Intercomparison of Radiation Codes) benchmark case 6. Dashed line denotes error of narrowband reference with respect to line by line calculation (upper scale).

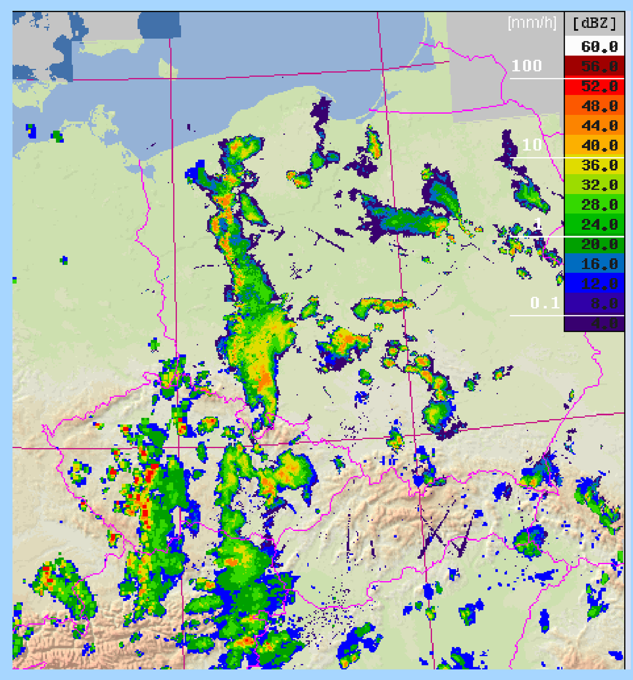
Non-precipitating convection in TOUCANS

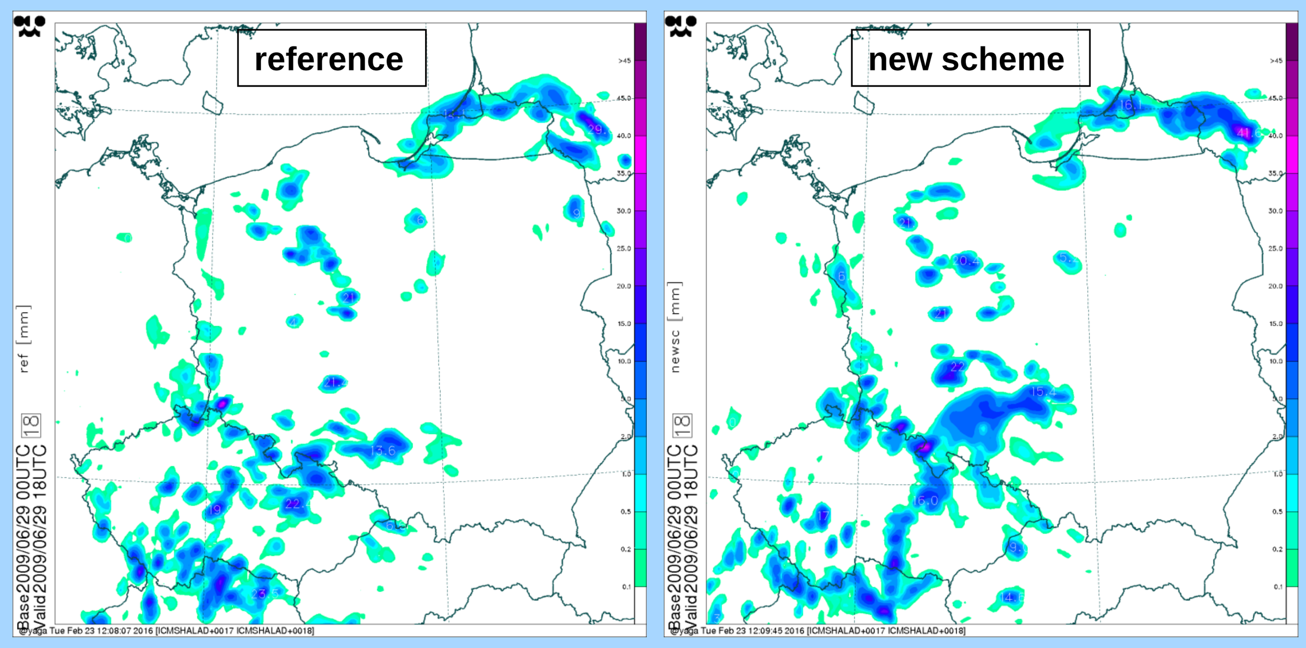
Radmila Brožková

A new scheme of the non-precipitating cumulus convection based on

- mass-flux type approach,
- recent works on moist Brunt-Väisälä frequency formulation,
- fit to LES data,

is being tested in ALARO-1 within the turbulence scheme TOUCANS. In summer season it helps to get a better transition from the shallow to deep convection leading to more realistic organization of the latter one.





Figures: 1h precipitation forecast for 29 June 2009 00UTC for lead time of +18h for reference (left) and the new scheme (right). Top: Instantaneous reflectivities at 17UTC, not directly comparable with precipitation sums, indicates quite well the convection position and organization over Poland.

Testing parameters of iterative time schemes

Petra Smolíková

When setting the iterative time scheme (PC scheme) we may choose the time discretization used in the research of SL trajectory (SETTLS or NESC) and the time discretization of non-linear terms used in the predictor step, while in all corrector steps the non-extrapolating (NESC) scheme is used. Furthermore, we decide if the SL trajectories will be recalculated in corrector steps or not. The trajectories are kept for corrector steps unchanged in case the "CHEAP" version of the iterative scheme is used.

An orographic wave over the mountainous Czech western boundary on 27 January 2008 has been simulated using 1km horizontal resolution and 87 vertical levels with integration for 24 hours from 00UTC. Tests have been performed with ALARO-1 physics and various configurations of the iterative time scheme with one iteration. An enhanced time step of 50s was used to see the difference in the stability and accuracy of distinct configurations. The appropriate choice would rather be 40s, but differences in results are then less pronounced.

The results were compared to the reference experiment with short time step of 20s (not shown). We may conclude from the experiments performed that SETTLS scheme may be beneficial in the trajectory calculations while the calculation of SL trajectories through NESC could be dangerous since serious oscillations in the prognostic fields may occur (compare **EXP3** with **EXP2**) with big impact on the precipitation field (40mm in 6 hours of spurious precipitation). Best results are obtained if SL trajectories are calculated in the predictor step only and through SETTLS (see **EXP1**). Regarding calculation of non-linear terms, the combination of SETTLS in the predictor and NESC in the corrector steps gives extremely noisy results (see **EXP4**), while pure SETTLS without corrector step is unstable.

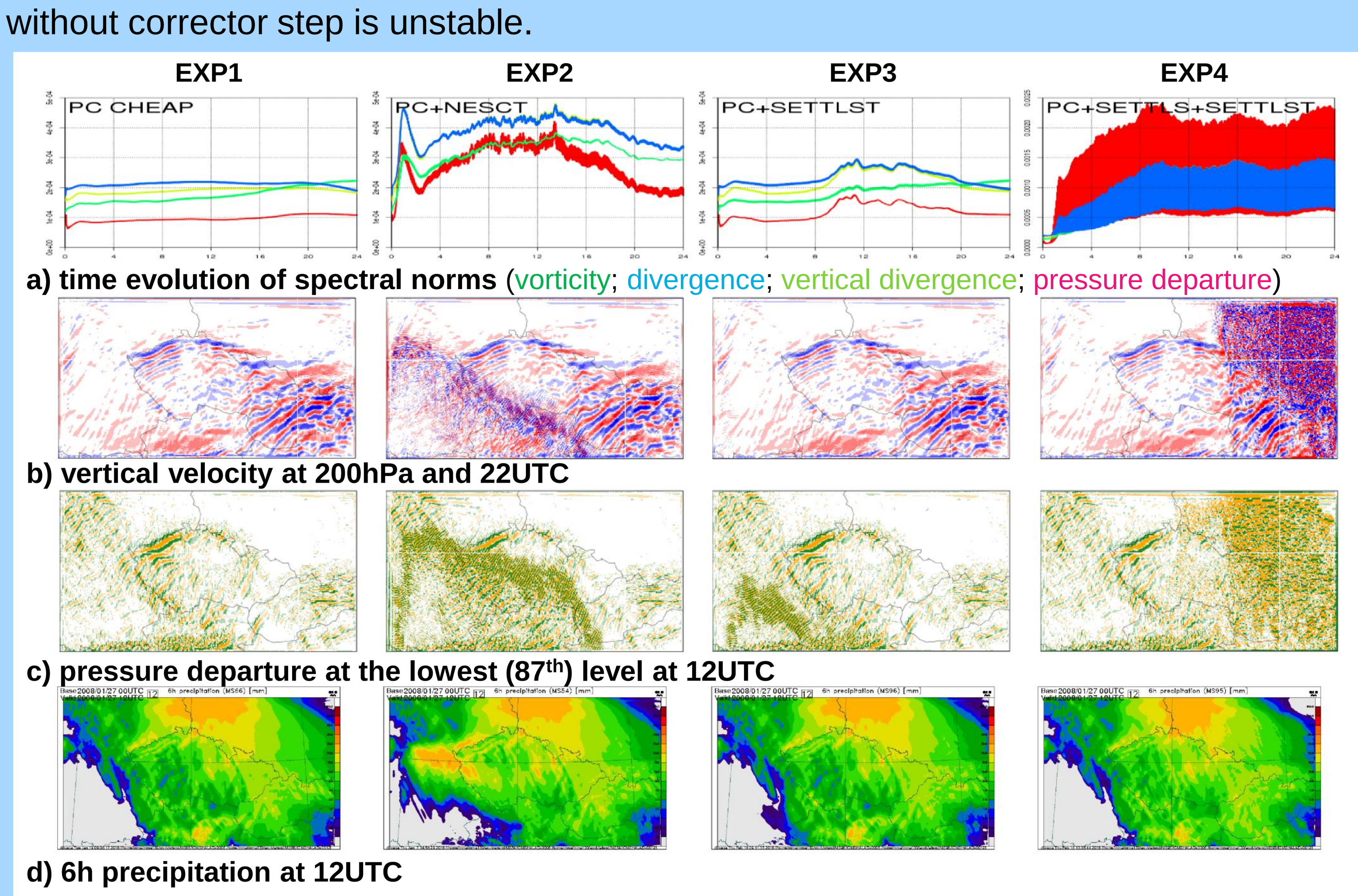


Figure: The choices in the iterative time scheme – **EXP1**: cheap version of PC scheme - SL trajectories calculated only in the predictor step (LSETTLST=true); **EXP2**: SL trajectories calculated in all steps with NESC (NESCT=true); **EXP3**: SL trajectories calculated in all steps with SETTLS (LSETTLST=true); **EXP4**: SETTLS used in the predictor step for non-linear terms, while NESC is used in corrector step and SL trajectories are calculated with SETTLS (LSETTLST=true) - notice 5 times larger scale for spectral norms.