

New operational configuration of ALADIN at CHMI

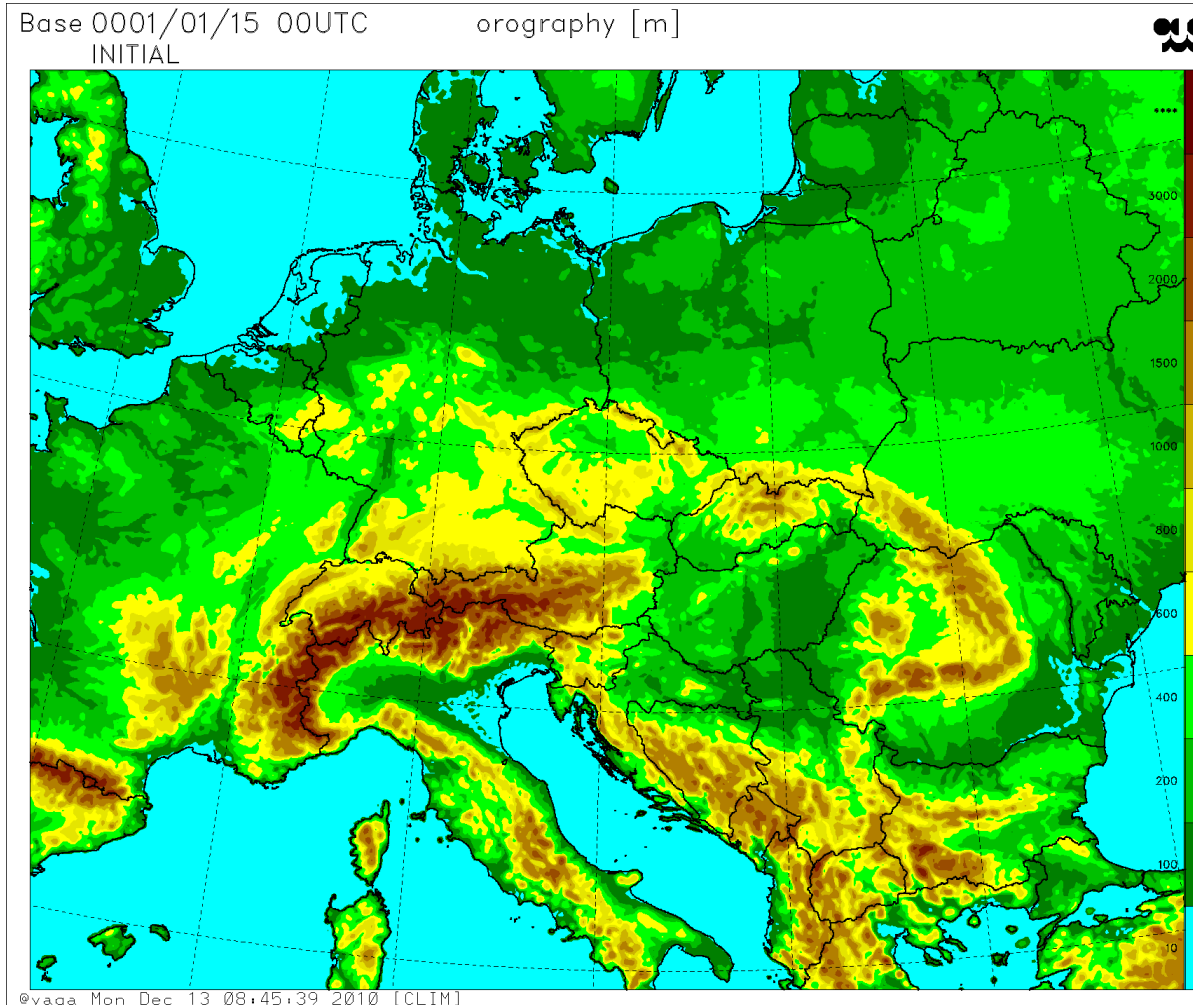
Radmila Brožková
Numerical Weather Prediction
Department



Operational Applications

- ALADIN is run operationally at CHMI since 1998.
- Currently we have two applications:
 - Main Central European domain - ALADIN/CE;
 - ALADIN/Afghanistan (since 2007).
- Both applications are at the same scientific complexity for the model; there are differences in the analysis (surface analysis done for ALADIN/CE).

ALADIN Central Europe computational domain





Recent R&D Milestones Already Operational in 2008-2009

- First ever application of the 3MT scheme aimed at model resolutions where convection is only partly resolved;
- New set of generic model thermodynamic equations applied in physics-dynamics interface;
- New method for computing processes linked with the fall of drops and flakes - statistical sedimentation;
- Robust Semi-Lagrangian Horizontal Resolution tuning and new S-L interpolators.

Delivered HPC Configuration: 2009/2010

- SX9: two nodes, 32 CPU, 2TB memory;
- Two front-end machines: NEC Express 5800/140Rf4 with quad-core Intel Xeon;
- Fast Storage: NEC gStorageFS of 118 TB usable space.
- Both SX9 nodes are devoted to shared operational and research works.
- One of the front-end servers is devoted to the operational suite. In case of failure the operational suite may be swapped to the second one.
- The second front-end is a work-group server.

HPC system

Operational work in 2010

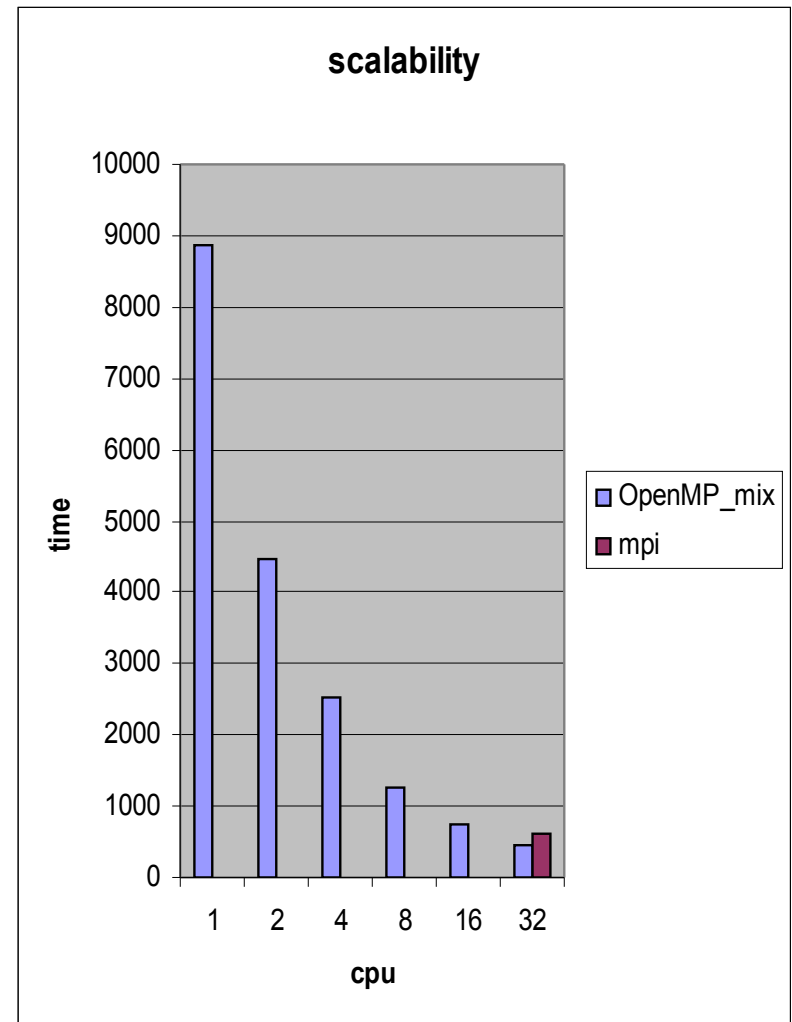
- Migration of the ALADIN operational suite to the new system phase A: 5th May
- Delivery of the SX9 second node: second half of May
- Acceptance of the whole system: 29th June
- Start of new high-resolution ALADIN e-suite: 25th June
- Scientific tunings and operational optimisations - summer 2010
- Switch to high-resolution ALADIN: 26th October.

Parameters of new high-resolution version

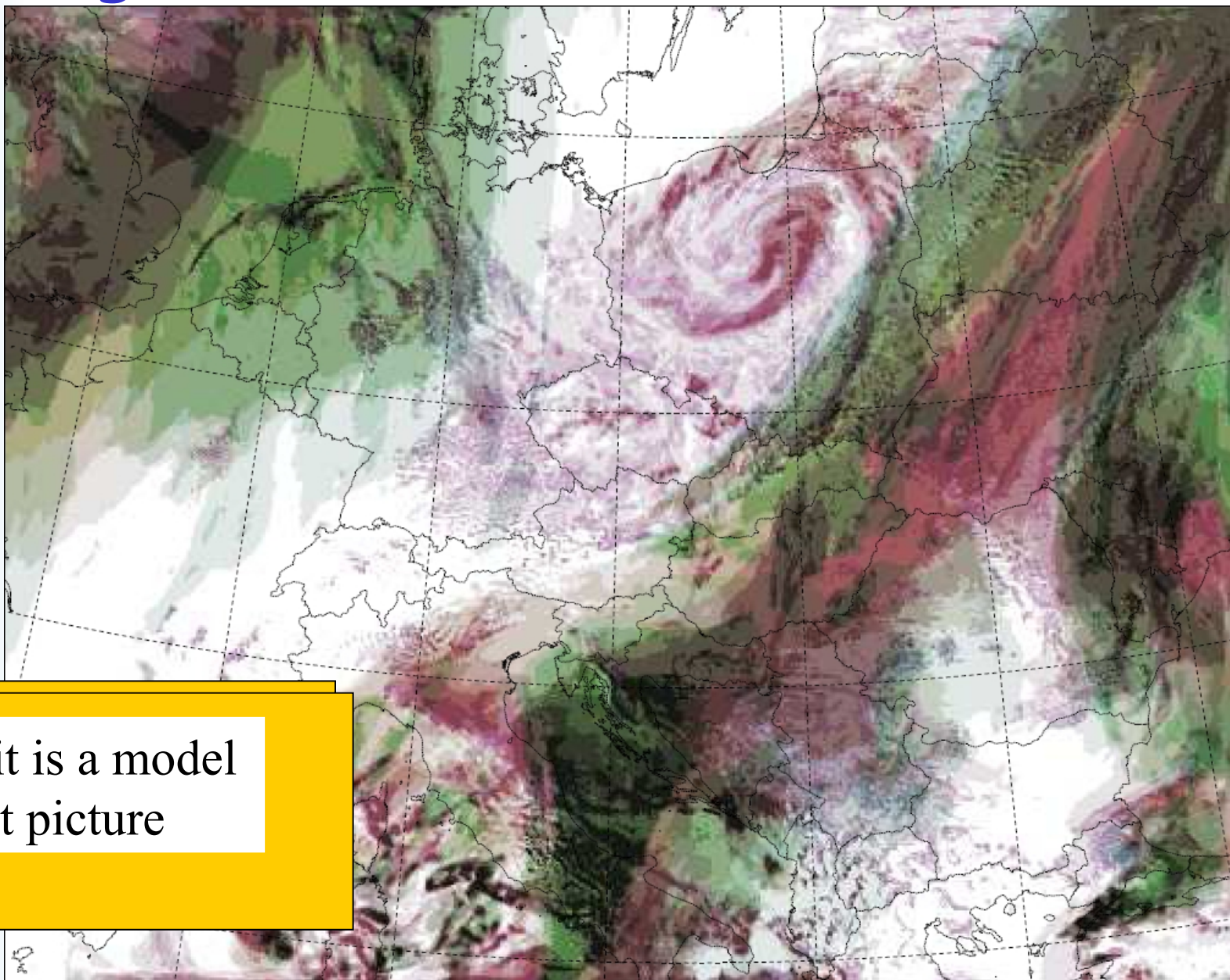
- Horizontal resolution of **4.7km** with **529x421** grid points (540x432 FFT linear truncation 269x215);
- Vertical resolution of **87 levels**;
- HPE dynamical kernel with 2 time-level Semi-Lagrangian Semi-Implicit scheme with **180s** time-step.
- **ALARO-0 physics** with prognostic moist-deep convection scheme **3MT**: in total we have **10** 3D prognostic variables in the moist physics.
- Physics - the same like at 9km, but: corrected downdraft, tuning of entrainment for updraft (consequence), removal of 4dz wave in the source term for precipitation (got apparent at 87 levels).

Scalability issues

- It depends on the size of the problem.
- With CHMI benchmark and/or future operational configuration (540 x 432 x 87) the ALADIN model scales quite well.
- Even on 32 cores of SX9 the hybrid parallelization is faster - it avoids memory conflicts.



High Resolution - more details



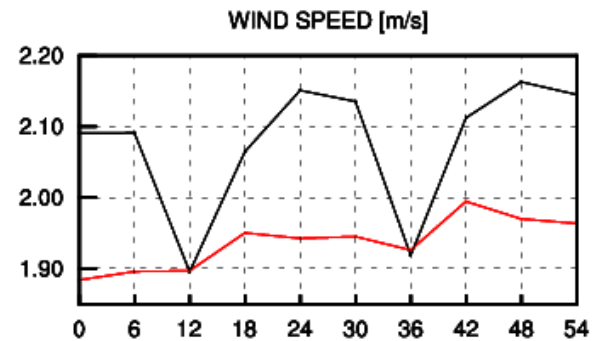
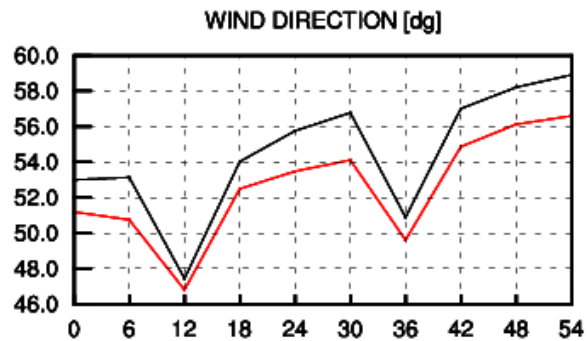
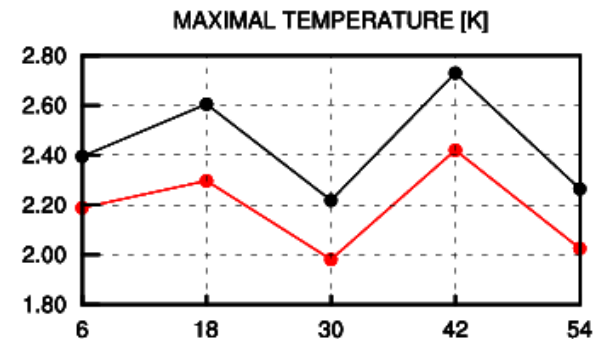
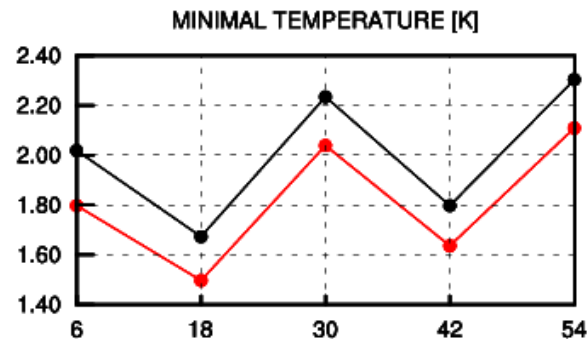
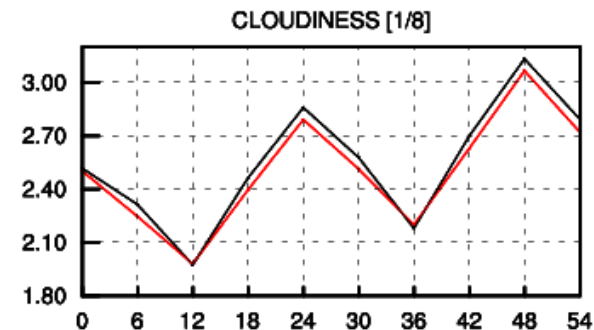
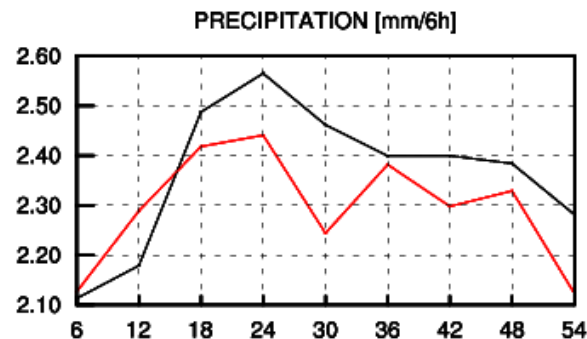
Sorry, it is a model
forecast picture



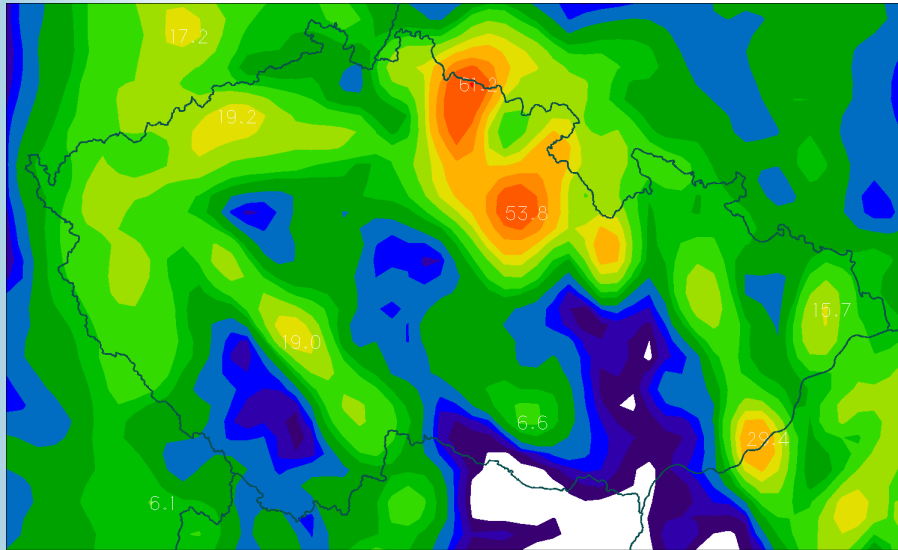
High Resolution - some scores

Standard deviation

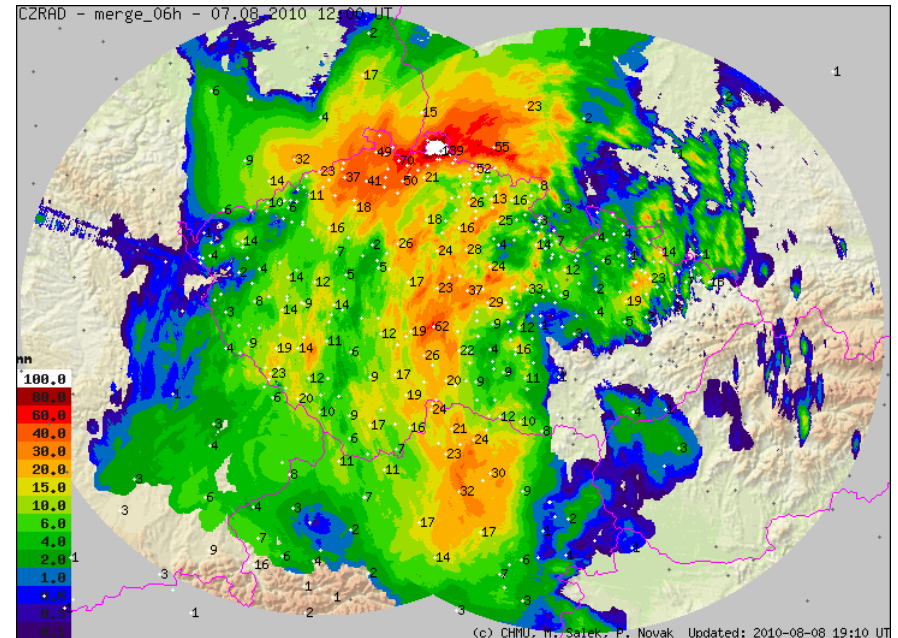
26/8 – 20/09
LACE domain



Example: CZ flood case of 7th August 2010

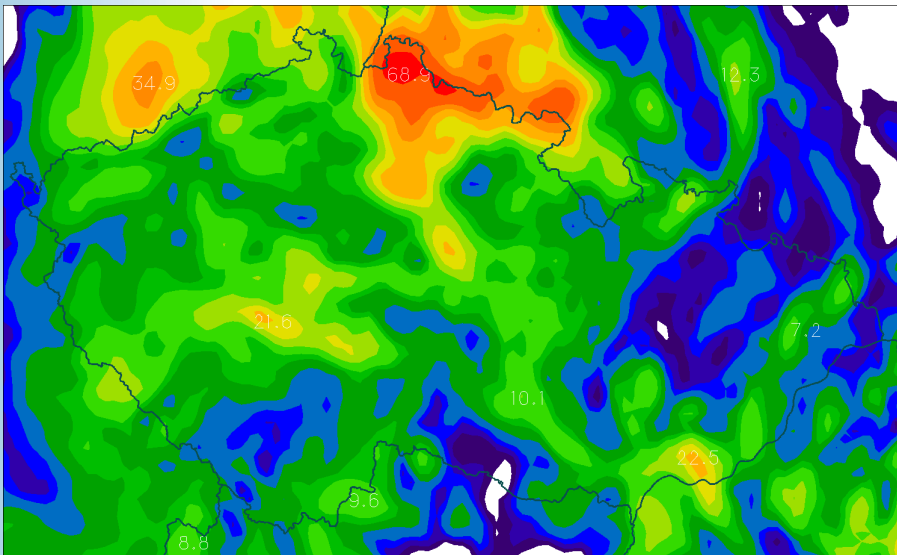


9km, 43L, 24h forecast

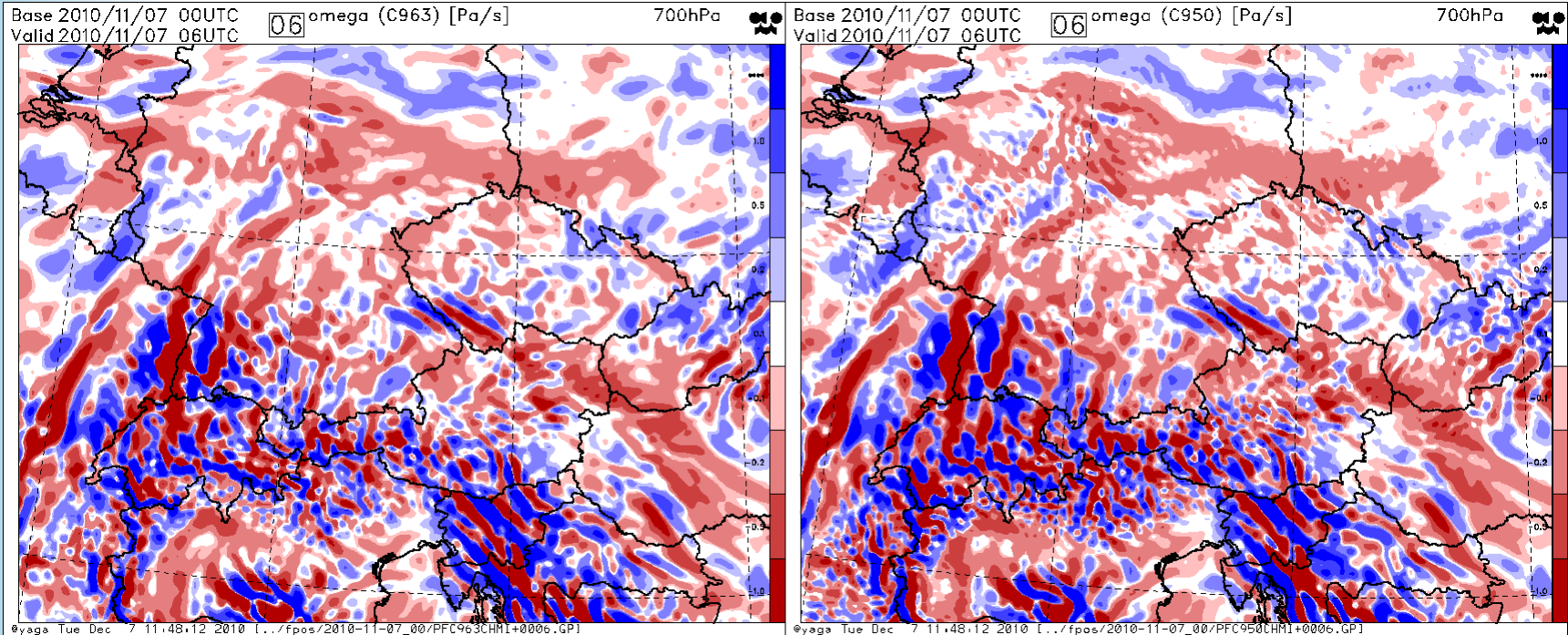


observations: radar & gauges

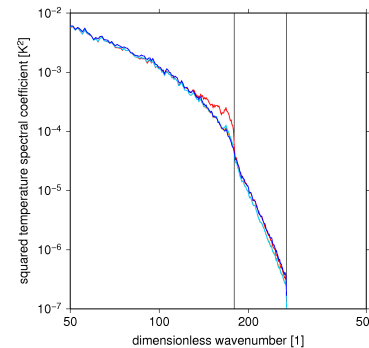
4,7km, 87L, 24h forecast =>
better location



Example of phys-dyn interaction



Spectrum of temperature
 (+0006 hour forecast, model level 085)



Vertical velocity as measure
 of noise: effect of diffusion and
 stationary forcing

Aims for 2011 and beyond

- Improving the description of the precipitating processes in the framework of the COST ES0905 project.
- Making operational the new scheme describing turbulence (in clear sky as well as in clouds) and its influence on precipitating processes. Name=TOUCANS
- Work on accuracy versus frequency for the radiation computations.
- Improving the use of measurements within the process of atmospheric data assimilation.