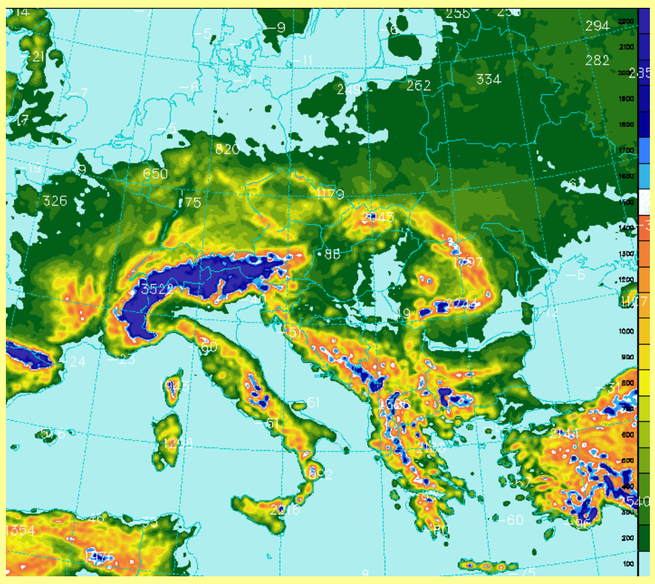
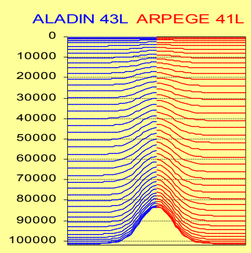
Czech Hydrometeorological Institute

ALADIN@CHMI

OPERATIONAL

• LACE domain (309x277 grid points, linear truncation E159x143, Δx=9km)
• 43 vertical levels, mean orography
• time step 360 s
• digital filter spectral blending long cut-off cycle (6h cycle, filtering at truncation E47x42, no DFI in the next +6h guess integration)
• digital filter blending + incremental DFI initialization of short cut-off production analysis
• 3h coupling interval
• ARPEGE/ALADIN cycle **29T2**
• **OpenMP** parallel execution
• 00 and 12 UTC forecast to **+54h**
• 06 and 18 UTC forecast to **+24h**
• hourly off-line fullpos
• post-processing of near-surface parameters into selected localities using obs-operators of OI





• hourly DIAGPACK analysis of T_{2m}, RH_{2m}, v_{10m}, KO-index, CAPE, MOCON (SYNOP observations)
• verification package based on cycle AL12 (AL28 in validation)
• monitoring of SYNOP and TEMP observation based on OI quality control

NEC SX-6/8A 64GB

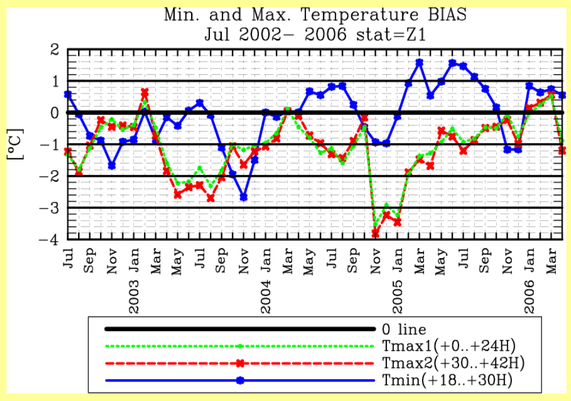
• **8 x 8 GFlops/s vector processors 11 GFlops/s sustained**
• **64 GB shared memory 128 GB/s**
• **SuperUX 15.1**
• **NQS batch processing**
• **OpenMP and MPI**

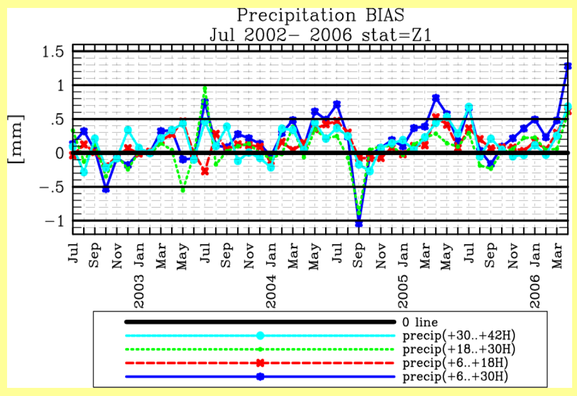
Model Operations

• **boxes:**
  • **NEC SX-6/8A 64 GB**
  • **Linux cluster (suite control & products)**
• **operational team:**
  • **4 NWPers (on-call support)**
  • **computer operators**
• **the suite operated under SMS 4**
• **mixed use of RMDCN and Internet**

00 UTC model scores

monthly averages against 33 Czech SYNOP stations

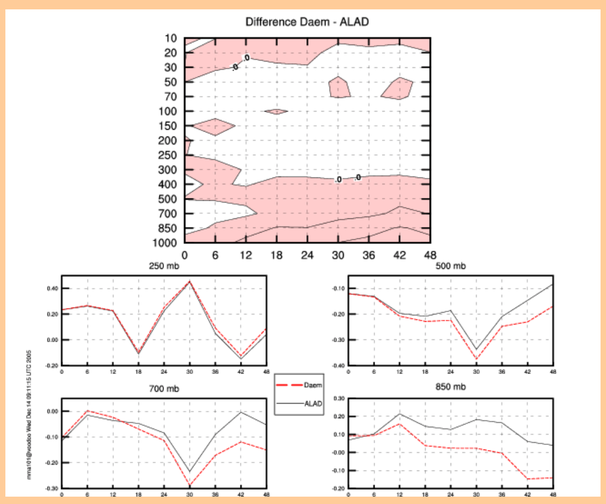




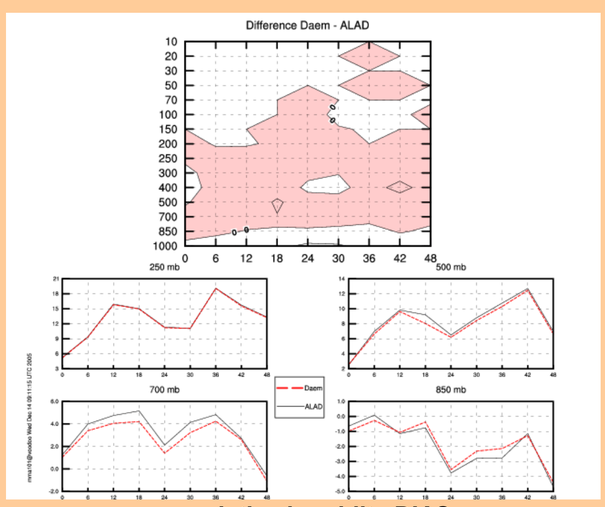
Major operational changes

• four runs per day (July 2005)
• new computation of momentum and heat mixing lengths based on the PBL height diagnosed by the **A**yotte-**T**udor-**P**iriou-**G**eleyn algorithm (work of J.Cedilnik), retuning of VZ0CM, VZIUSTAR0 (roughness terms over sea in Charnock's formula) and default tuning of SLHD & switch from MPI to OpenMP parallel execution (January 2006)
• new climatic files based on GTOPO30 database (January 2006)
• upgrade from NEC SX-6/4B 32GB to SX-6/8A 64GB (February 2006)

Interactive computation of mixing length based on PBL diagnostics by the A-T-P-G algorithm
→ neutral impacts in general, but an important impact on the scores of parameters at the 850 hPa (nearby top of PBL). It is especially true for temperature bias (by almost 0.2 K), but wind speed and humidity scores are improved as well.
→ On the other hand the MSLP bias keeps more or less its value from the initial state during the forecast; nevertheless its RMSE remains OK. The bias of geopotential is also slightly worse, but not significantly (0.5m at 250hPa).
See also case study GABLS II (simulation of diurnal cycle in dry and stable atmosphere) below.



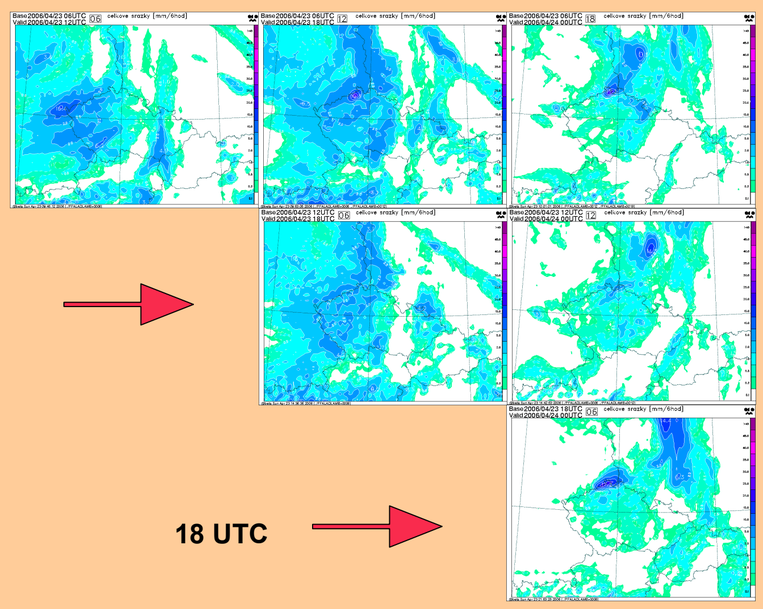
temperature BIAS
test (red) versus oper (black)



relative humidity BIAS
test (red) versus oper (black)

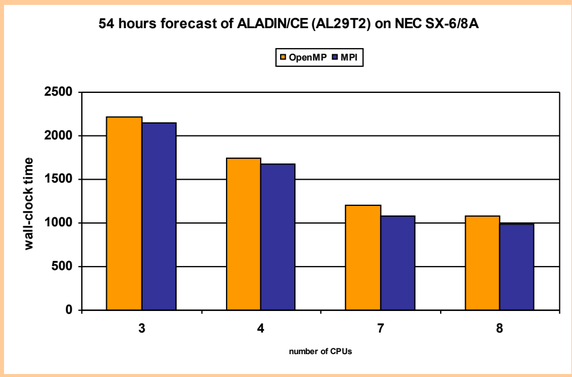
Four runs per day

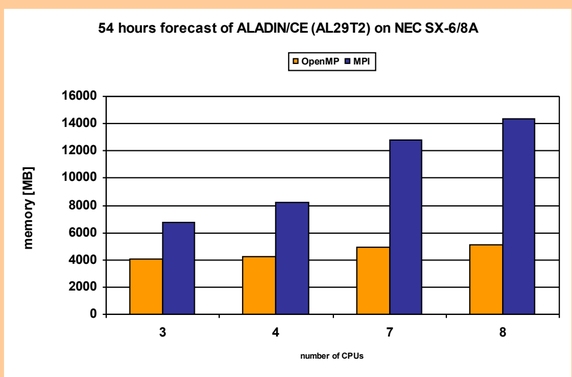
06 UTC →
12 UTC →
18 UTC →



In case of consistency gives more confidence with the forecast

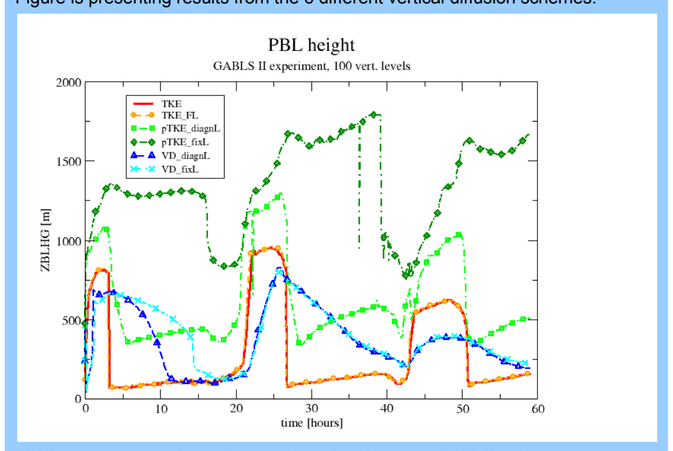
MPI and OpenMP performance
on shared memory NEC SX-6/8A





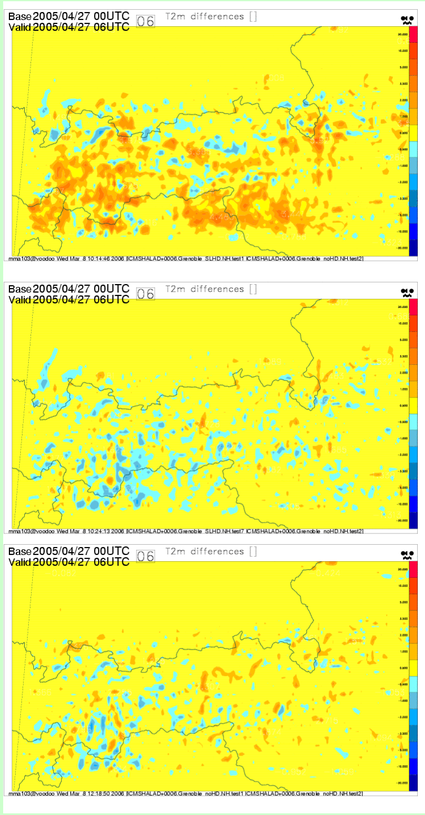
GABLS II experiment with 1D model

This study is focused to diurnal cycle of turbulence in dry stable atmosphere. Figure is presenting results from the 6 different vertical diffusion schemes.



TKE	- used as reference (results of prognostic TKE scheme formulated on half-levels, adapted by P.Marquet and E.Bazile for ARPEGE/ARPGE-Climate)
TKE_FL	- TKE on full levels, simple reformulation of previous to full levels
pTKE_diagnL	- pseudoTKE scheme with operational mixing length computation, very promising result with nice diurnal cycle, although shifted
pTKE_fixL	- pseudoTKE with constant profile of mixing length, the worst result, illustrating of importance of mixing length computation
VD_diagnL	- current operational vertical diffusion scheme, there are some skills but with slow reaction in the first hours of an experiment
VD_fixL	- vertical diffusion scheme with constant profile of mixing length, impact of mixing length computation is not so important as for pseudoTKE scheme, but reaction time is even slower than previously

SLHD tuning for NH BBC



The aim was to see whether there is a chance for better tuning for the SLHD with respect to the diffusive chimney problem. All the test were done with the NH dynamics (same namelist as used for AROME) dx=2.2 km and dt=60 s and with the ALADIN physics (as physics was not assumed that important for this kind of tests).

Knowing that the supporting diffusion for vertical divergence causes a chimney, there should be an interest to use it as weak as necessary. On the other hand from AROME results we have learned that some diffusion is necessary.

The main task was to see:
1/ Whether RDAMPVDS (supporting diffusion of vertical divergence (VD)) can be tuned independently to RDAMPVORS and RDAMPDIVS (supporting diffusions of vorticity and divergence).
2/ What is the minimum supporting diffusion of VD to avoid the AROME diagnosed problems in low atmosphere.

The results were quite promising:
1/ RDAMPVDS can be tuned independently to the RDAMPVORS and RDAMPDIVS. (Not presented hereafter here.)
2/ Even very week supporting diffusion is enough to cure the strange behaviour of the low-level orography induced noise.

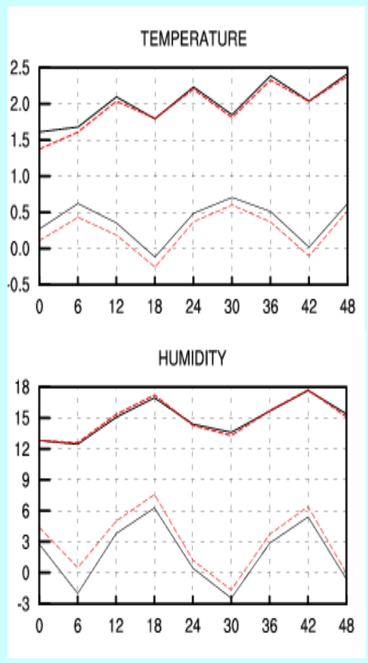
To illustrate it figures of T2m differences between different SLHD runs and the run without any horizontal diffusion, which is considered as reference, are presented. Ideally horizontal diffusion should not introduce too much changes in T2m field. In presence of normal temperature stratification (no inversion) HD typically bring some cooling to low levels temperature in mountainous areas.

The figure on the top corresponds to the run SLHD + RDAMPVDS=0 provides almost no chimney, but problem in low level vertical divergence. The warmer areas (on figures in red) of T2m signals the problem. In the middle the run SLHD with the new SLHD tuning (RDAMPVDS=15.) provides almost no chimney and also VD is ok. And at the bottom just for illustration the same figure obtained with spectral diffusion.

Future plans and planned changes

OI surface analysis based on SYNOP data replacing the surface blending

since June to December 2005 in parallel test. Improvement of T2m and HU2m scores



Next parallel suite with

3. Retuned pTKE and new cloud model with small retuning planned
4. OI surface analysis based on SYNOP data replacing the surface blending – continuation
5. zero version of new convection & microphysics scheme (3MT)