CZECH HYDROMETEOROLOGICAL INSTITUTE

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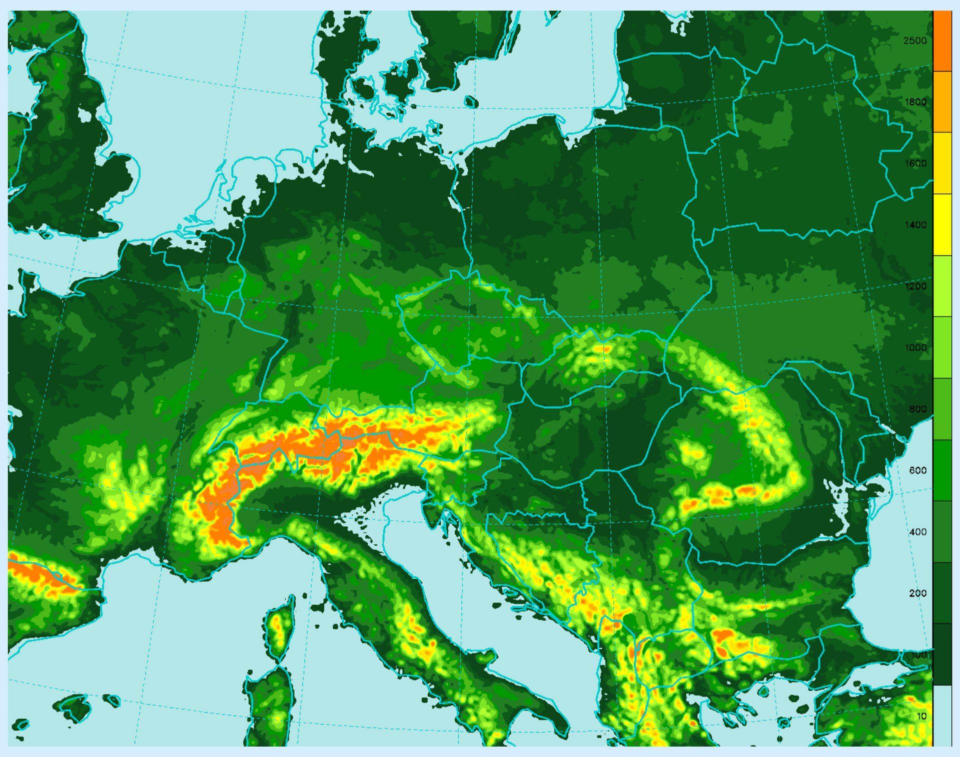
ALADIN/CE model set-up

- domain (529x421 grid points, linear truncation E269x215, Δx~4.7km)
- 87 vertical levels, mean orography
- time step 180 s
- OI surface analysis based on SYNOP (T2m, RH2m)
- digital filter spectral blending of the upper air fields, long cut-off cycle (6h cycle, filtering at truncation E87x69, no DFI in the next +6h guess integration)
- digital filter blending + incremental DFI initialization of short cut-off production analysis of the upper air fields
- 3h coupling interval
- 00, 06, 12 and 18 UTC forecast to +54h
- hourly DIAGPACK analysis



Orography of ALADIN/CE model domain

- **ALADIN cycle 38t1 (ALARO-0 baseline)**, surface analysis and verifpack still on cy36t1

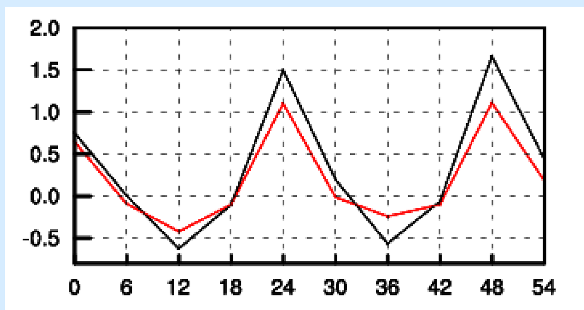
HPC system

- 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 (May 2013 – Apr 2014)

6 Aug 2013 new tuning of low vegetation type thermic coefficient RCTVEG(3)=1.4E-05 to lower diurnal cycle bias of T2m

18 Feb 2014 implementation of cy38t1_bf3 except for data assimilation configurations



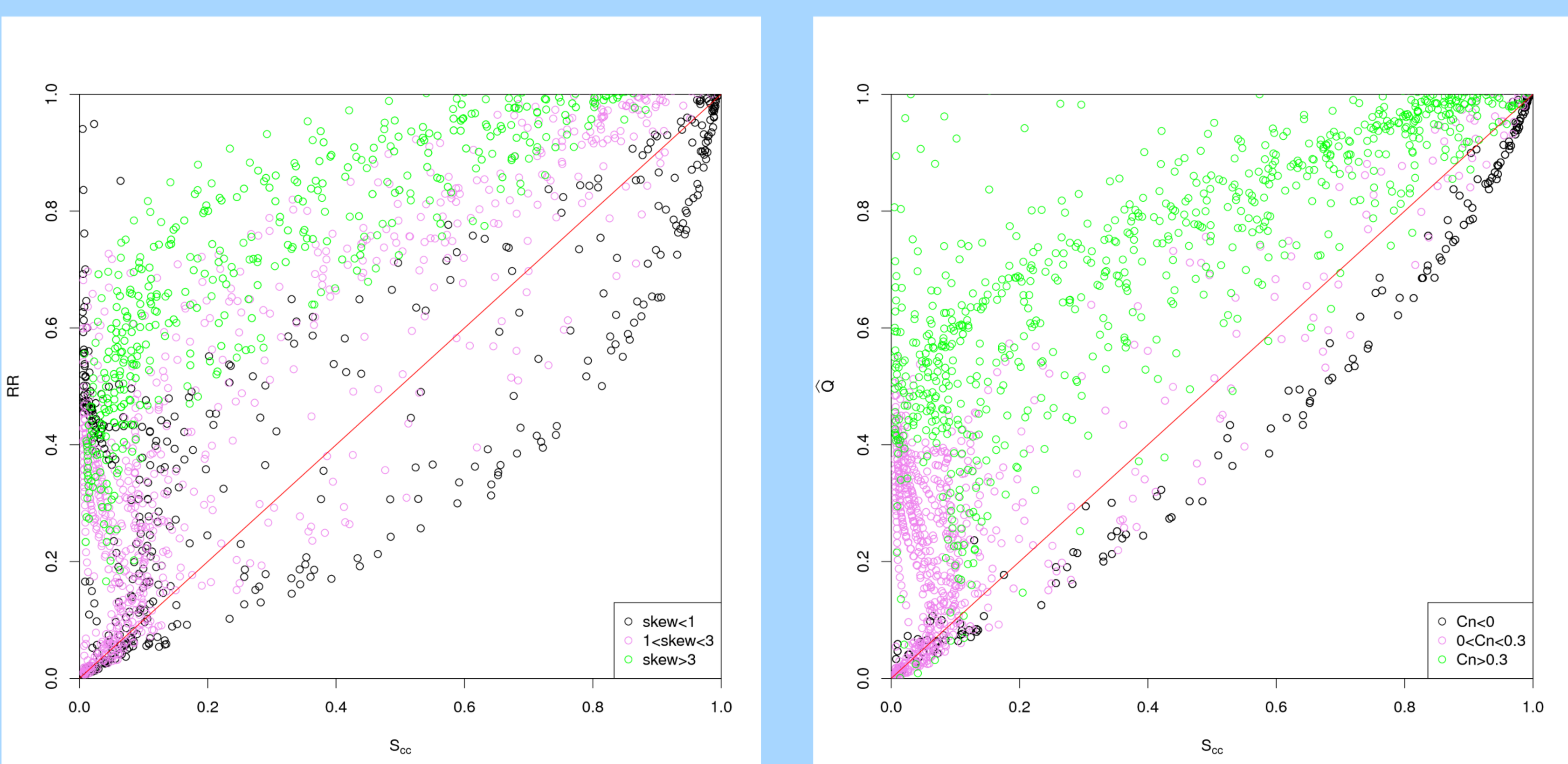
T2m BIAS of oper and test suite for July 23 2013 – August 7 2013

TOUCANS development

Ivan Bašták Ďurán, Jean-Francois Geleyn

There are several novelties in development of turbulent scheme TOUCANS:

- introduction of prognostic Turbulent Total Energy (following Zilitinkevich et al., 2013), which complements the already implemented prognostic Turbulent Kinetic Energy;
- possibility to emulate 5 turbulent schemes: RMC01, modified CCH02 (two versions), QNSE and EFB;
- introduction of prognostic mixing length;
- upgrade of Third Order Moments parameterization with separated non-local transport of heat and moisture;
- new parameterization of moisture influence:
  - separate representation of conservation (entropy) and conversion (energy) aspects following Marquet (2011) and Marquet and Geleyn (2013);
  - consideration of expansion and latent heat release according to Marquet and Geleyn (2013);
  - influence of skewness equivalent parameter – C_n;
  - separation of two effects of Shallow Convection Cloudiness (S_{CC}):
    - ✓ Q - specifically horizontal part of the deviation form Gaussianity for the influence of the partial cloudiness on the buoyancy flux;
    - ✓ $M(S_{CC})$ - transversal vertical aspect.



Figures: Dependence of RR (the transition parameter influencing the buoyancy flux in case both effects of S_{CC} would be unseparated) and Q on S_{CC}. The diagram on the left is the equivalent of Fig. 9 of Lewellen and Lewellen (2004), computed from the same LES data (courtesy of D. Lewellen) but with different thermodynamic hypotheses and using the reinterpretation of Marquet and Geleyn (2013). The color scaling is based on skewness of the w subgrid-fluctuations. In the diagram on the right the color scaling is based on C_n. One clearly sees less dispersion and a more regular scaling in the second case.

QPF during the flood episode in June 2013

Radmila Brožková, Ján Mašek

The Czech Republic was affected by three flood events during June 2013. The first event with heavy precipitations falling from June 1 to June 3 - the most severe one with respect to the life lost and damage - will be further discussed. It was followed by two other important precipitation periods, from June 9 to June 11, and finally from June 23 to June 26, however with a smaller extent of the concerned area and ensuing problems.

The course of the flood and its intensity were strongly influenced by previous soil saturation caused by abnormally rainy May, see Fig 1 for illustration. Moreover, Czech Republic territory is crossed by the main European "water division" line between the North Sea and the Mediterranean Basin, and therefore the precipitation amounts and their location play here an even more important role than elsewhere. Both aspects made the response of surface water run-off to falling precipitation very quick and large. The 24h rainfall totals exceeded locally 100mm, see Fig 2, there were heavy precipitations in the mountain regions (North-West, North, South-West) and a relatively narrow band of extreme precipitation crossing the country from South-West to North-East, affecting central Bohemia and the capital of Prague. From the point of view of the hydrological response, this was likely the most devilish combination of the timing, location and precipitation amounts which could happen, since peaks of water discharge from several smaller catchments met at the same time together in Vltava and Elbe main rivers.

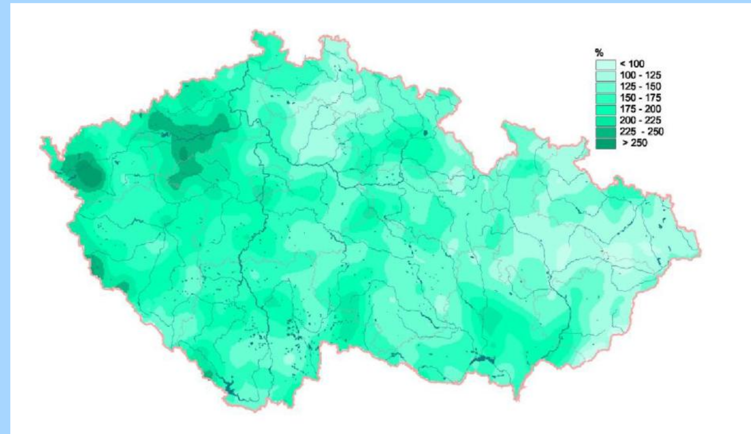


Figure 1: Percentage of the precipitation amount in May 2013 with respect to the monthly climatological mean (1961-1990).

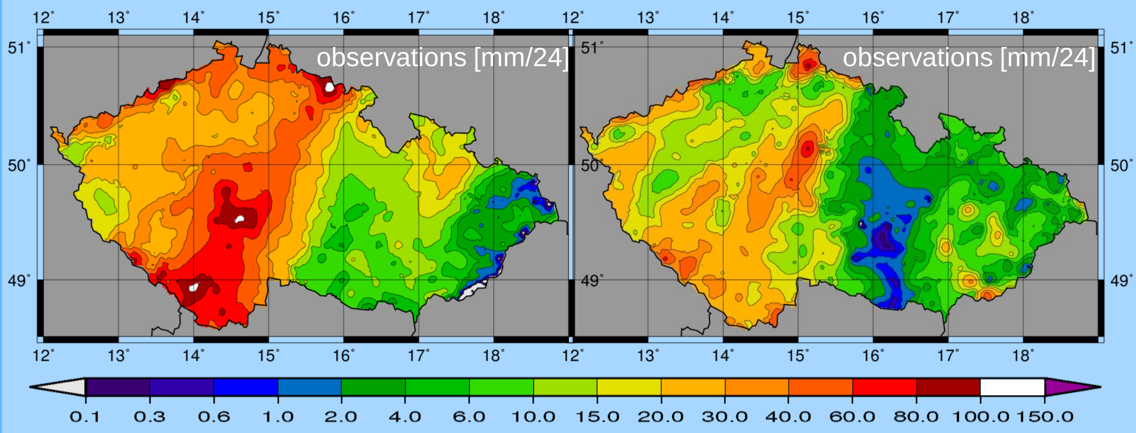


Figure 2: Precipitation amount observed from 6UTC June 1 to 6UTC June 2 (left) and from 6UTC June 2 to 6UTC June 3 (right).

Numerical models had difficulty to forecast this key spatial distribution of rain, namely the narrow belt and its amplitude. Operational ALADIN/CE version indicated this belt from +36h lead time, before the rain was located more to the East, see Figure 3.

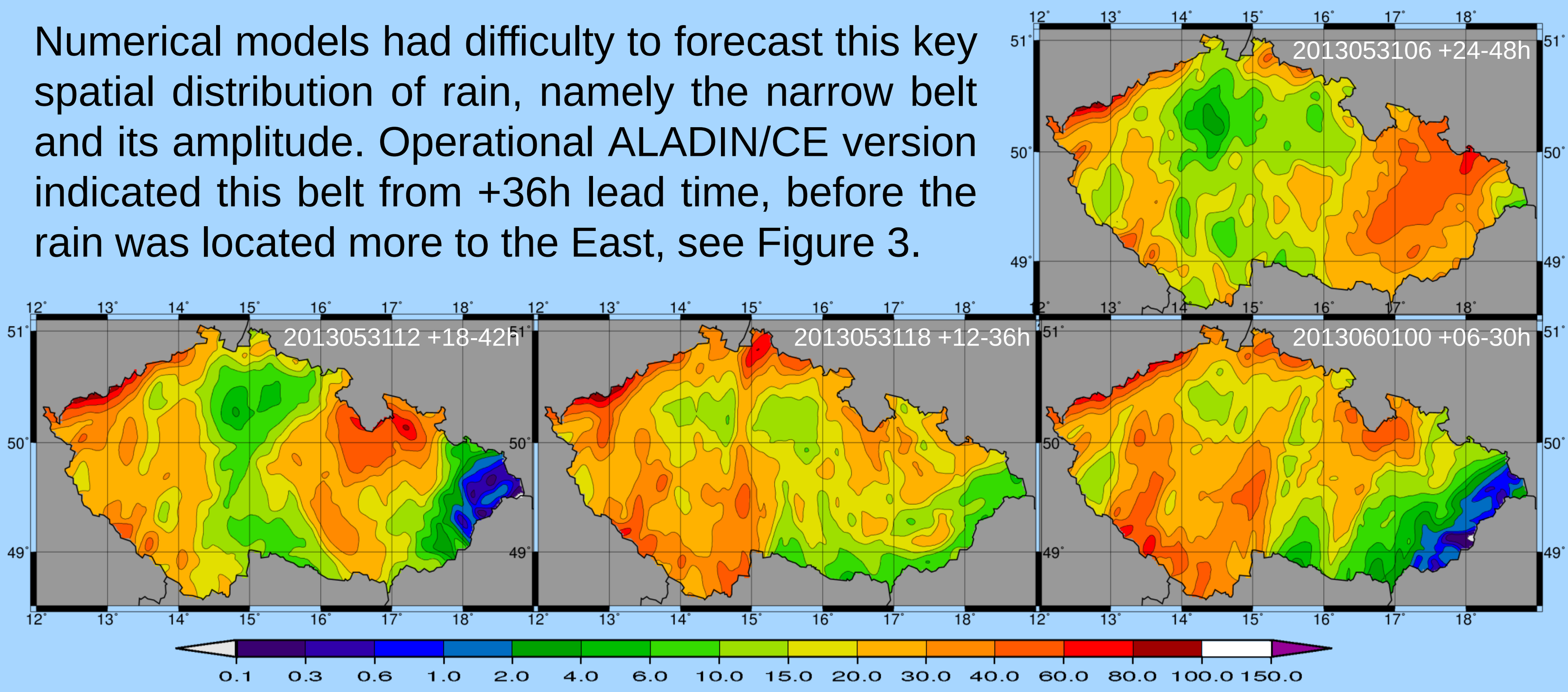


Figure 3: ALADIN/CE 24h precipitation forecast for 6UTC June 1 to 6UTC June 2 and for lead times going from +48h to +30h.

This case was further examined with respect to increase of horizontal resolution and suppress of the deep convection parameterization. A dedicated high resolution domain (Δx~2.2km, 709x589 grid points, 87L) was prepared and following tests were performed:

- P1 - ALADIN/CE on 2.2km initialized from ARPEGE;
- P2 - ALADIN/CE on 2.2km initialized from operational DF blending on 4.7km;
- P3 - ALADIN/CE on 2.2km initialized from operational DF blending on 4.7km with switched-off parameterization of deep convection scheme.

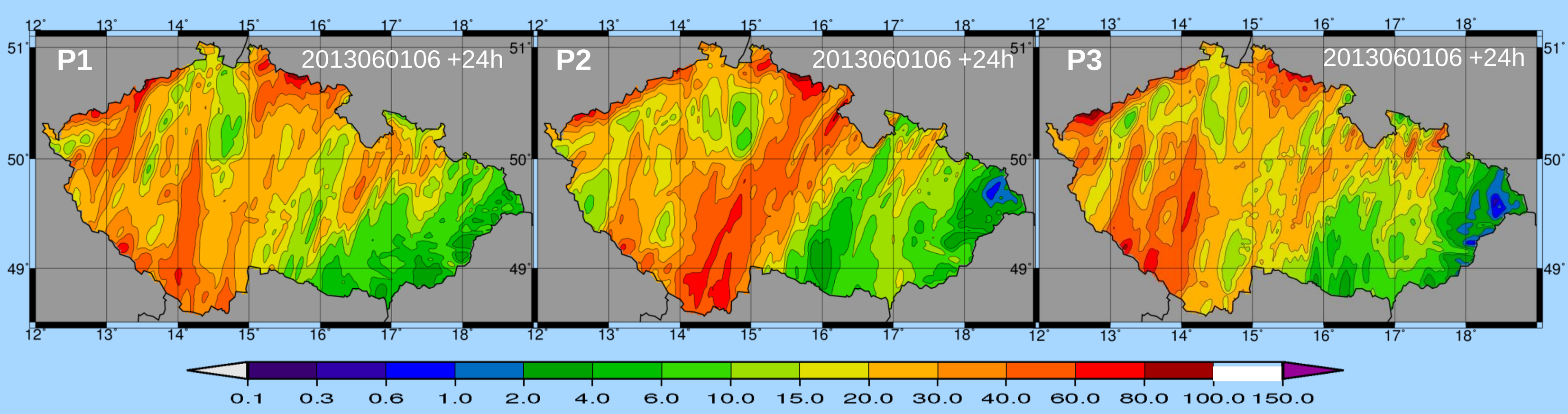


Figure 4: 24h precipitation forecast for 6UTC June 1 to 6UTC June 2 on resolution of 2.2km.

Comparison P1 and P2 shows the importance of the initial condition – both the structure and the amplitude of the narrow band over Bohemia improved. Experiment P3 indicates that the deep convection parameterization is still needed on the resolution of 2.2km for realistic description of unresolved updrafts and downdrafts.

The sensitivity tests showed that success of the QPF is not driven by a single factor, but progress can be achieved by combination of the increase in the models resolution, more complex description of physical processes and better analysis of the initial condition.

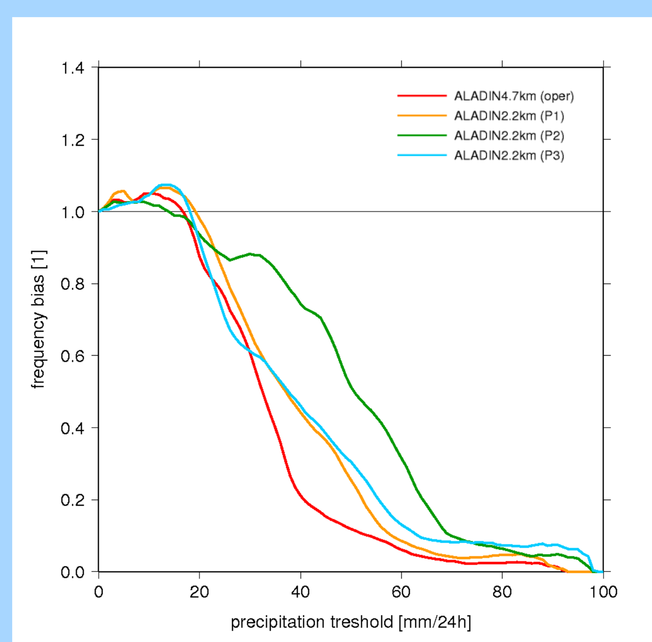


Figure 5: Frequency bias computed for 24h precipitation forecasts on 2.2km for 6UTC June 1 to 6UTC June 2.