CZECH HYDROMETEOROLOGICAL INSTITUTE

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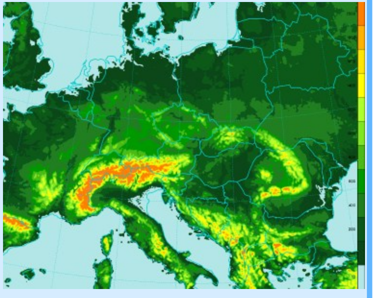
ALADIN/CE model set-up

- 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)**, 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 (April 2014 – April 2015)

11 Sep 2014 implementation of cy38t1_bf3 for surface analysis

22 Jan 2015 ALARO-1 prototype with new turbulence scheme TOUCANS, new radiation ACRANEB2, major changes in moist physics and improved diagnoses of temperature and moisture in 2m hight (implementation of 38t1tr_op3)

Blending-3DVAR assimilation e-suite

Antonín Bučánek, Patrik Benáček, Alena Trojáková

Combination of the blending technique with the 3DVAR data assimilation, denoted **BlendVar**, is used to improve the high resolution analysis. Here the performance is shown for the June 2013 flood case with respect to the use of the blending alone, which is the operational reference. BlendVar gives clearly better localization of precipitation, as shown below on the charts and by fraction skill scores.

The experiment setup is as follows:

- Step 1: Surface analysis (optimal interpolation; already in the reference)
- Step 2: Blending ARPEGE 4DVAR analysis with ALADIN guess (in the reference);
- Step 3: 3DVAR (new) with:
  - Background error covariance B matrix is obtained by dynamical adaptation of the ARPEGE 4DVAR Ensemble Data Assimilation members; the variances are multiplied by the factor of 1,7;
  - Observations in use: soundings, ground stations pressure, AMDAR; the σ_o were reduced by the factor of 0,67 after Desroziers et al., 2005.
- Cycling: 6h synchronous with ARPEGE 4DVAR.

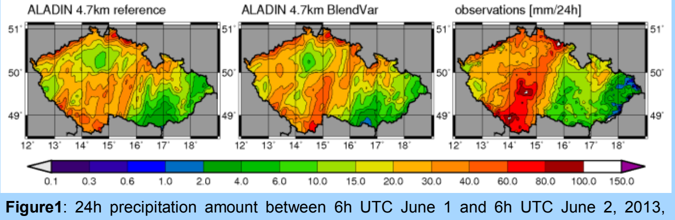


Figure1: 24h precipitation amount between 6h UTC June 1 and 6h UTC June 2, 2013, forecast by ALADIN model (left: operational version, middle: BlendVar) and observed (right panel). Forecast base is 1 June 2013 at 6h UTC. Horizontal resolution of ALADIN is 4.7km.

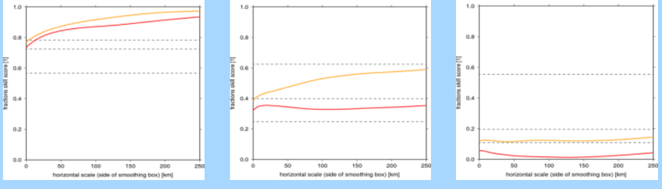


Figure2: Fraction skill score for precipitation thresholds of **20mm, 40mm and 60mm/24h** from left to right. Forecast base is 1 June 2013 at 6h UTC, forecast range 24h to capture the strongest precipitation event. Verification uses high density observations (760 rain gauge stations of combined networks in Czech Republic). BlendVar Experiment (yellow) outperforms the reference (red). Horizontal resolution of ALADIN is 4.7km.

ALARO-1 first version

Ján Mašek, Ivan Bašták-Ďurán, Radmila Brožková

ALARO-1 is the next generation of the model physics developed according to the concept of ALARO. Among other developments, there are conceptually new schemes of radiation and turbulence suited for high resolution NWP models, entering the operational setting at CHMI. The ingredients are as follows:

ACRANEB 2 radiation scheme:
- Net Exchange Rate (NER) algorithm used for thermal band – no need to go for fine spectral granularity;
- Computation savings are met by a double intermittency for NER terms with respect to the needed precision.
- NER allows for a separated computation of cloudy optical effects: ***cloud-radiation interaction is kept at every model time-step***.
- Using double intermittency, accuracy/ computing time ratio is nice compared to other state-of-the-art solutions.

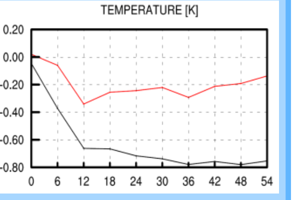


Figure 1: 2m temperature bias, 2015/01/03 to 2015/01/23, 0h UTC runs, solid black: **reference**, solid red: **ALARO-1**.

TOUCANS – new turbulence and shallow convection scheme:
- Prognostic **T**urbulent **K**inetic **E**nergy and **T**urbulent **T**otal **E**nergy (sum of kinetic and ***moist*** potential energy);
- Prognostic handling of length scale;
- ***Moist*** Third Order Moments;
- Turbulent diffusion of cloud condensates.

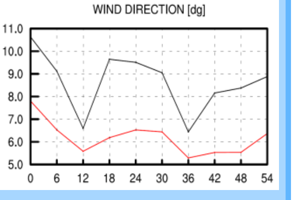


Figure 2: 10m wind direction bias, 2015/01/03 to 2015/01/23, 0h UTC runs, solid black: **reference**, solid red: **ALARO-1**.

Microphysics
- More realistic vertical geometry of clouds and precipitation (Shonk et al., 2010)
- Better rain-drop size distribution after Abel and Boutle, 2012.

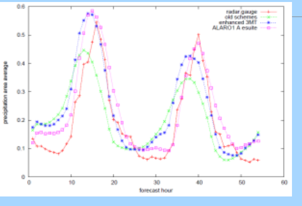


Figure 3: Precipitation diurnal cycle, average of 11 realizations in June-July 2009. ALARO-1 improves moist deep convection diurnal cycle.

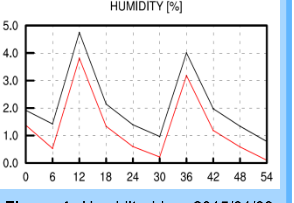


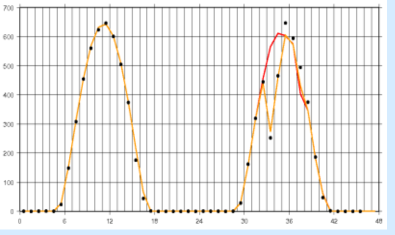
Figure 4: Humidity bias, 2015/01/03 to 2015/01/23, 0h UTC runs, solid black: **reference**, solid red: **ALARO-1**.

Solar eclipsis on 20 March 2015

Ján Mašek

The influence of the partial solar eclipsis on 20 March 2015 at Prague - Libus station (Lat: 50.008, Lon: 14.447) on the ALADIN forecast from 19 March 2015 0h UTC with 48 hours range.

Figure 1: Total shortwave radiation [W.m^{-2}] of the ALADIN forecast. **Red**: without taking into account the solar eclipsis; yellow: with solar eclipsis considered; **black dots**: observations.



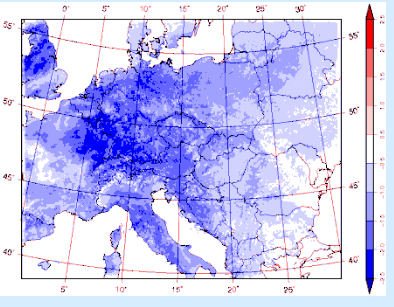


Figure 2: The forecasted influence of the solar eclipsis on 2m temperature [K] over Europe compared with the reference run without solar eclipsis taken into account, valid for 20 March 2015 10UTC.