

# NWP at Meteorological and Hydrological Service of Croatia in autumn 2017

Martina Tudor (tudor@cirus.dhz.hr), Stjepan Ivatek-Šahdan, Antonio Stanešić, Tomislav Kovačić, Mario Hrastinski, Suzana Panežić, Iris Odak Plenković, Alica Bajić, Kristian Horvath Meteorological and Hydrological Service of Croatia, Grič 3, HR10000 Zagreb, Croatia

#### INTRODUCTION

The operational model version used is AL38T1 with ALARO0 physics for 8, 4 and 2 km resolution forecasts. Operational forecasts run for:

- 8 km res, 360 sec, 4 times per day, 3D-Var and surface OI, 3h cycling, to 72 hours, LBCs: IFS, 37 levs.

- 4 km res, 180 sec, hydrostatic, 4 times per day, up to 72 hours, 3D-Var and surface OI, 3h cycling, LBCs: IFS, 73 levs.

- 2 km dynamical adaptation, 60 sec time-step, hourly, up to 72 hours,

- 2 km non-hydrostatic run, 60 sec time-step, using AL36T1 with available ALARO0 developments, from 06 UTC up to 24 hours.

#### Hardware upgrade

**Verification on LBC files** 

Standard verification scores (BIAS, RMSE) were computed for the LBC files. The results are intriguing: scores deteriorate with forecast range much faster for LBCs from IFS than for ARPEGE.





RMSE (full line) bias (dashed) and SDE (dotted) for IFS (red) and ARPEGE (black) LBC files during the forecast range computed for the whole LBC domain.



RMSE difference between IFS and ARPEGE LBC files in the vertical during the forecast

range computed for the whole LBC domain (blue means RMSE is larger for IFS LBCs).

**Ensemble method for estimation of background error** covariance matrix

New B matrix was calculated and diagnostic comparison of B matrix properties was made. Three B matrices were computed with following methods/characteristics:

- NMC (standard, 12-36h fcst. differences, 4 runs per day) -NMC
- Ensemble (local ALADIN-HR4 ensemble, 6 members, 6h cycle, upper air observation perturbation)
- Operational ECMWF LBC same for all members ENS
- LBC from ECMWF global ensemble ENS-LBC
- Time period: 20161210 20170228
- Number of differences:
- NMC 316
- ENS/ENS-LBC 972

Goal: compare NMC vs. ENS diagnostics, evaluate influence on forecast scores, evaluate impact of LBC error on ENS statistics

## The mainframe computer was upgraded by 10 nodes (60 cores)

reaching 48 nodes (288 cores). 5 slots empty +5 drawers

- Before
- And + lot more new cables



Final hardvare	
vinor: # Supplagy System type: UV2000 System name: vihor Serial number: UV2-00000082 Partition number: 0 24 Blades 288 CPUS 48 Nodes 1665.76 GB Memory Total 124.00 GB Max Memory on any N 1 BASE I/O Riser 4 PCIe Slots 2 Fibre Channel Controll 4 Network Controllers 3 Storage Controllers 2 USB Controllers 1 VGA GPU	ł

### Nowcasting using INCA in Croatia

Results of nowcasting 10 m wind and 2 m relative humidity using INCA with ALADIN-HR4 forecast as first guess.

#### Wind speed





#### Storm not forecast

Just after midnight on 9 July 2017, a storm developed over the western coast of Istria with a short episode of strong wind. It was not forecast by any operational configuration and there was no warning issued. Users were not happy.



Wind speed at stations Sv. Ivan na Pučini and Porer and wind direction at Porer measured by automatic station (black), operational forecasts using ALADIN in 8 km resolution starting from different analyses are shown in different colours (full lines for speed, squares for direction), the analyses times are plotted in the same colour on the left, 4 km resolution forecasts (dashed), dynamic adaptation of wind field (dotted lines for speed, circles for direction) and 2 km resolution NH forecast (red lines).

#### Results

- Largest horizontally averaged standard deviation for NMC method, smalles for ENS; similar shape
- Shorter length scales for ensemble B matrix than NMC; Shape similar for ENS and ENS-LBC
- Smallest energy for ENS on almost all scales especially on long scales (no LBC perturbations)
- A bit higher contribution of smaller scales for ENS-LBC method compared to NMC
- Narrower vertical correlations for ENS and ENS-LBC compared to NMC

#### Vertical profiles of standard deviation



Relative humidity



#### **Foggy issues**

100

95

90

80

70

60

50

Forecast of low level clouds and fog could use improvement. Below is one forecast where there is cloud in the initial conditions, but it dissipates during the forecast.



Cloud type from NWC SAF, ALADIN System 8 km 37 levs and 4 km 73 levs for 00 UTC on 12.11.2015.



#### Verification:

- Verification was done for May and June 2017; tuning of B matrix performed over one month period (Desrozier et al; REDNMC: NMC  $\rightarrow$  1.3; ENS\_LBC  $\rightarrow$  1.4; ENS  $\rightarrow$  1.7) - Small differences in surface scores, mainly visible in first 24 hour

- Bigger differences for upper-air better visible for June









