

## NWP at Croatian Meteorological and Hydrological Service Alica Bajić, Kristian Horvath, Stjepan Ivatek-Šahdan, Tomislav Kovačić,

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## **Current status of the operational suite**

#### Computer

- SGI Altix LSB-3700 BX2 Server with 48 Intel Itanium2 1.6GHz/6MB
- 96 GB standard system memory
- 2x146 GB/10Krpm SCSI disk drive, 1.6 Tb scratch disk
- OS SUSE Linux Enterprise Server 9 for IPF with SGI Package
- Intel Fortran & C++ compilers version 9.0.031
- Queuing system (PBS Pro version 9.2.0.81361)
- Main users: NWP, Air-quality modelling & Climate modelling





#### LBC files and lines

- global model ARPEGE, coupling frequency 3 hours
- Internet and RMDCN through ecgate as backup from July 2006

#### **Products on Internet**

- http://prognoza.hr/karte\_e.php?id=aladin&param=&it=
- http://www.dhmz.htnet.hr/prognoza/karte\_e.php?id=aladin&param=&it=

#### **Domains, model set-ups and forecast range**





ALADIN HR domain (8km horizontal resolution)

HRDA domain (2km horizontal resolution)





Evolution of scores for 2m temperature and relative humidity. Red is production from assimilation cycle, black operational production. Long dashed lines represent BIAS and full lines RMSE.

Evolution of scores for upper air temperature, relative humidity, wind speed and wind direction. Red means that ASSIM is better.

**Near the surface:** results are rather neutral for wind speed and direction (not shown) while bigger impact is for temperature and relative humidity

- *spring*: BIAS and RMSE of temperature and relative humidity are clearly smaller for ASSIM
- summer: RMSE of temperature is smaller and RMSE of relative humidity is just slightly smaller for AS-SIM. But BIAS of temperature is bigger after first day of forecast for ASSIM and BIAS of relative humidity for afternoon hours is also bigger for ASSIM
- *autumn*: results for temperature are almost neutral while for relative humidity both BIAS and RMSE are smaller for ASSIM

**Upper air**: for all variables RMSE of ASSIM is mostly smaller than OPER for first 6 hour, mixed results later

- in all seasons biggest and positive impact of assimilation is on relative humidity
- most positive impact of assimilation is in spring period while smallest positive impact of assimilation is in summer period

## **Development and application activities**





- 8 km horizontal resolution: 37 levels, 229x205 (240x216) grid points
- AL32T3: ALARO0-3MT, old radiation scheme, DFI
- 72 hours forecast, 1-3 hourly output

#### HRDA domain:

- 2 km horizontal resolution: 439x439 (450x450) grid points @ 15 levels
- 10 m wind forecast
- full run for research studies @ 37 and 73 levels

## **Parallel suite**



New product: waterspout forecasting indices over the **Adriatic Sea computed from operational ALADIN model** data

• Kuiper and van der Haven theoretical index (KHS)

• Szilagyi waterspout nomogram (SWN)





- Cycling: 4 times per day
- Production: twice per day at 00 and 12 UTC, 72h forecast
- Data: SYNOP, TEMP, SEVIRI (ch. 2 and 3), AIREP, GEOWIND, NOAA (AMSU-A, AMSU-B)
- Data source: OPLACE
- B matrix: NMC method, ~100 days
- LBC: ARPEGE long cut off analysis and forecast
- VARBC implemented
- Verification: bias and root mean square error compared to observations
- Results of verification: mostly positive impact

## Verification of produciton from assimilation cycle

- Statistics calculated for period 02.03.2010.-04.12.2010. for production (run 00UTC) from assimilation cycle (ASSIM) and operational production (OPER)
- Statistics divided in 3 periods: *spring* (02.03.2010.-31.05.2010.), *summer* (01.06.2010.-31.08.2010.) and *autumn* (01.09.2010.-04.12.2010.)





Szilagyi waterspout nomogram (SWN). Values of the dots are calculated from operational ALADIN HR model

- inidicies computed for the 19 waterspout events observed in 2010 on the Croatian coast of the Adriatic Sea
- yes/no value for both indices is evaluated for all 19 cases
- KHS successfully forecasts the occurrence of waterspouts in 13 cases (hit rate of 68,4%)
- SWN successfully forecasts the occurrence of waterspouts in14 cases (73,7%)

=> SWN and KHS indices improve the waterspout forecast