NWP at Croatian Meteorological and Hydrological Service, 2013

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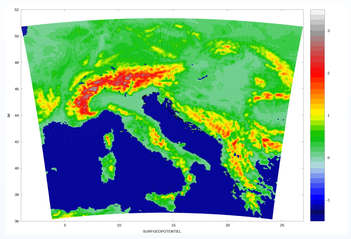
Model domains

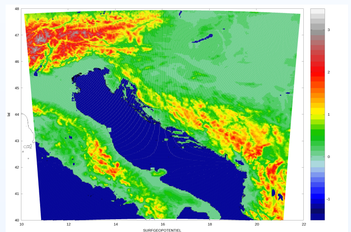


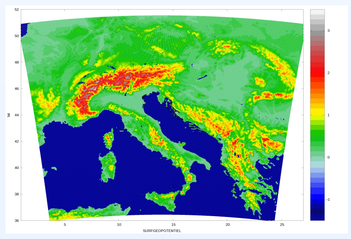
ALADIN HR domain

- 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 NH 24hr forecast @37 and 73 levels for research studies





Possible new domain domain

- 4 km horizontal resolution
- 469x421 (480x432) grid points
- ALARO with 3MT, NH
- covering the same area as current domain for ALARO with 8km horizontal resolution

New computer

SGI UV 2000 (shared memory system)

- Numalink 6 interconnect
- 28 Intel Xeon E5 6-core 2,9GHz 15MB cache CPUs with total **228 cores**
- 608 GB RAM
- working disks 6.6TB
- Intel compilers version 13.1.0 20130121
- PBSPro, SGI management software, Fibre Channel, Gigabit etherneth

Forecast postprocessing

Two EU IPA IIIC Regional Developement Component in Croatia projects are set up to improve using numerical forecasts in wind energy and solar energy usage. Both projects are implemented in cooperation with University of Zagreb Faculty of Eledctrical Engineeging and Computation. Improvement will be mostly through post-processing of wind and solar irradiance forecasts.

Post-processing tools that will be tested are: Kalman filter for bias correction, neural networks and analog method.

Weather Intelligence for Wind Energy WILL4WIND

Weather Intelligence for Wind Energy – WILL4WIND

Croatian wind energy sector lacks efficient wind energy management, and in particular a dedicated state-of-the-art wind and wind forecasting system designed for the specific and challenging wind climate in Croatia. The overall objective of the project is to increase the wind energy share in Croatia's electricity consumption through science and industry-business partnership resulting in improved Croatian wind energy management. To make an impact and contribute the main goal several specific objectives are designed:

- enhance the wind prediction capabilities to support the safe and efficient integration of wind power plants into electric power system
- assess the performance improvement of the advanced wind prediction system and predict the associated day-to-day forecast uncertainties
- integrate the improved wind prediction technology into the forecasting and wind energy management processes
- raise awareness on the weather-related research results and identify the key joint research and development priorities for the benefit of the Croatian industry in the wind energy sector.

Results of the project will be reached by synergy of research and business/industry partners through using the state-of-the art research results. Innovative wind forecast system will be developed by using measured data, numerical weather forecast models and neural networks. Performance improvement of the innovative prediction system will be evaluated for several wind power plant locations in the Šibenik-Knin county. Wind forecasts will be integrated in the wind energy management process by establishing on-line access to local wind forecasts through web and mobile applications, what will enhance management of the national electric grid as well as operation of individual wind power plants.

ENHEMS-BUILDINGS

ENHEMS-Buildings – Enhancement of Research, Development and Technology Transfer Capacities in Energy Management Systems for Buildings

The overall objective of the action is to establish a multiplicative transfer of engineering technology in Energy Management System for Buildings (BEMSs). Specific objectives contribute to the overall objective will be attained by achieving expected results as follows:

- Created set of tools for BEMS design tailored for the building at hand
- Created solar irradiance measurement network and solar irradiance modeling infrastructure for the entire Croatia,
- Developed weather forecast services tailored for BEMS and matched with appropriate data communication services,
- BEMS installed upon the existing building automation system,
- Established Technology Transfer Center for BEMSs (BEMS-TTC).

Main activities planned for the Meteorological and hydrological service of Croatia are:

- Upgrade of the Croatian solar irradiance measurement equipment at the the main meteorological stations of Rijeka, Zadar, Dubrovnik, Gospić, Osijek, Zagreb and Split and computer/software resources for the Croatian Solar Irradiation Data Base,
- Develope weather forecast services for BEMS which include: a) assessment of the required weather data inputs for BEMS, b) assessment of the appropriate time and space resolution of the weather forecast for BEMS, c) assessment of the appropriate forecast accuracy for different data inputs.

Radar data assimilation

We are testing radar data assimilation method developed at Meteo France. Radar data assimilation goes through two steps; the first one is 1DVAR retrieval of humidity profiles that are than used in 3DVAR as pseudo observations. At Meteo France the method is implemented for AROME, a nonhydrostatic version of ALADIN with Meso-NH physics parameterizations. Operationally AROME is used on horizontal resolution of 2.5 km that makes it a convection permitting model and should be well suited for assimilation of radar data. Our tests are done with hydrostatic version of ALARO, which is another version of ALADIN but with different parameterizations. Horizontal resolution of the model used was 8 km with 37 vertical levels. To the contrary to AROME our model is not a convection permitting one.

Until the end of the year it is planed to run model at 4 km horizontal resolution and much more vertical levels and model on 8 km will be switched off but we still decided to do some test of radar data assimilation with it.

The radar data assimilation is tested on two weeks period starting with 2 June 2013. Only radar data were assimilated and forecasts with assimilation are compared with forecasts without assimilation. The B matrix was calculated with standard NMC method on three month period starting on 15 February 2008.

Validation of radar data assimilation is ongoing and there are no statistical scores available yet. Here, the effect of radar data assimilation is shown on the 2 June 2013 non-convective case. Analysis time was at 2 June 2013 00H. At the analysis time precipitation in the range of Croatian radars was from the processes resolved by the model. Radar image and simulated reflectivity at the analysis time are shown on Fig. 1. Analysis increments on three vertical levels are on the Fig. 2 and accumulated precipitation forecasts are on the Fig. 3.

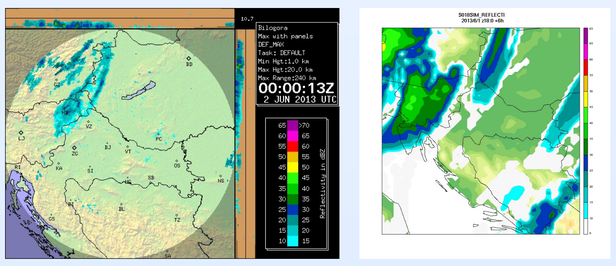


Figure 1. Radar image at the analysis time (left) and radar reflectivity simulated with ALARO model at level 18 (5372 m).

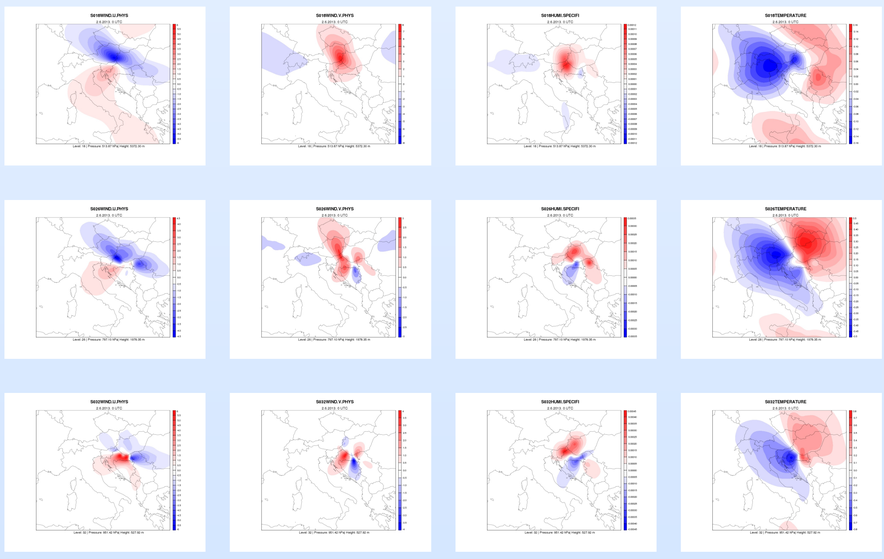


Figure 2. Analysis increments after assimilation of reflectivity and radial wind data from two Croatian radars. From left to the right increments are for U and V wind components, specific humidity and temperature. From top to the bottom are increments on three model levels: level 18 (5372 m), level 26 (1978 m) and level 32 (527 m).

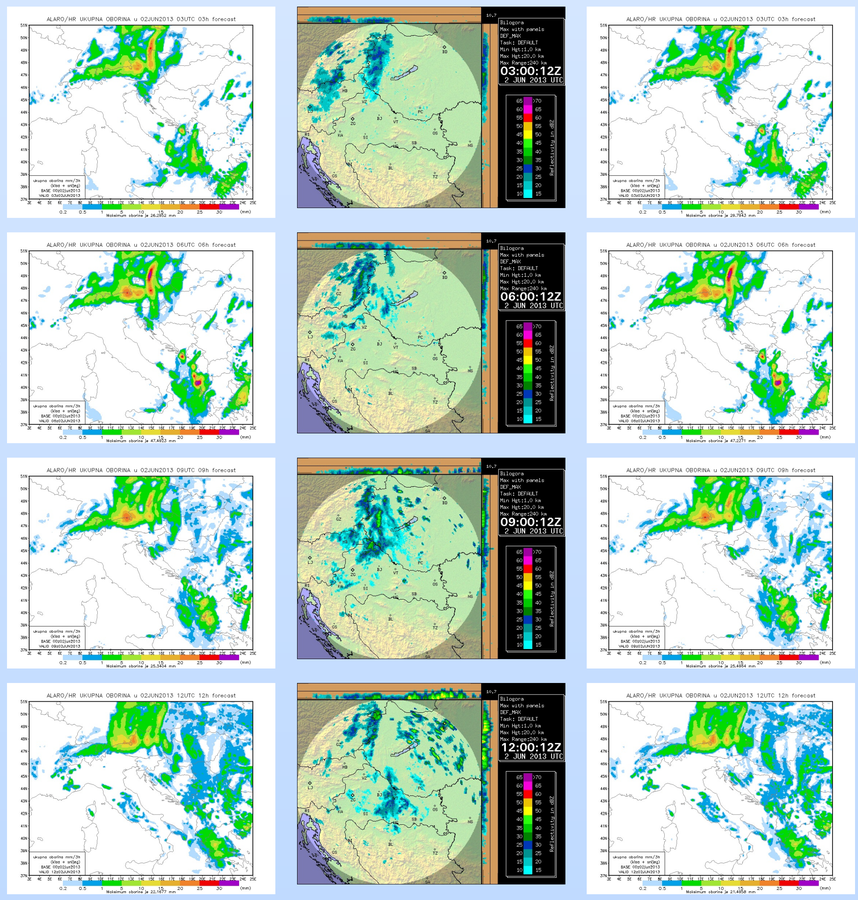


Figure 3. Forecasted 3h accumulated precipitation at +03H, +06H, +09H and +12H and radar reflectivity at the corresponding times. Left: forecast without assimilation, right: forecast with assimilation, middle: radar reflectivity. In the observed 12 hour period the main difference between forecasts with and without assimilation can be seen over northern Croatia. Radar assimilation has removed or reduced precipitation there. If radar image (max product) is used for visual verification we can say that in this case assimilation of radar data had negative impact on forecast. To reach final decision we must study this case in more details. From some other cases we have seen that radial wind can have greater impact on analysis than reflectivity. Assimilation of only radial wind and only reflectivity must be checked.