Limited Area Modeling Activities in Romania

1. ALADIN

(Alexandru S., Banciu D., Caian M., Ibanescu I., Radu R., Soci C., Stefanescu S.)

National Meteorological Administration of Romania is a partner in the international project ALADIN. The main research and development topics in this collaboration are going towards: coupling problems, data assimilation, physical parameterisations, validation and verification and ensemble prediction systems.

1.1 Operational ALADIN

Operational suite of ALADIN-Romania is integrated on a SUN E4500 platform (8-CPU 400GHz, 64 bytes architecture) twice per day over two different domains up to 48h forecast range.

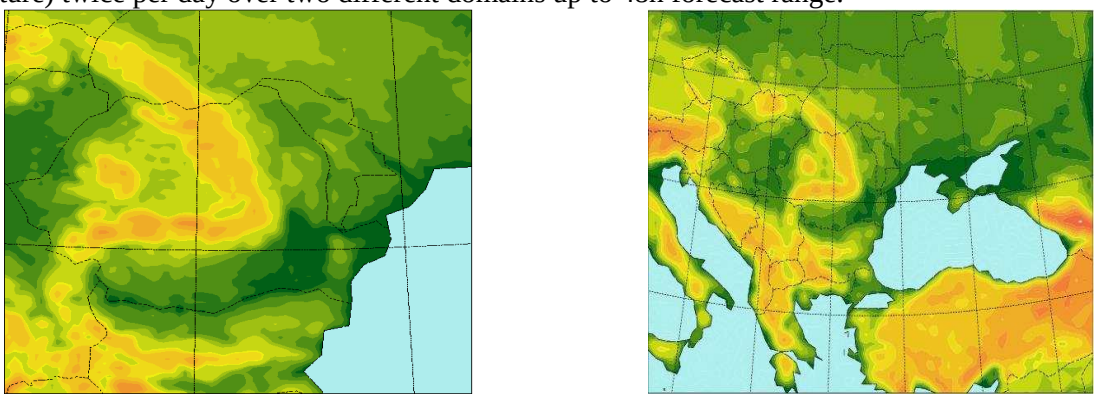

Figure 1. a) Integration domains and orography: Dx=10 km (left) and b) Dx =24 km (right)

The main characteristics of the model are : regular grid using Lambert projection, and resolution of 10km (100x100), soon (144x144)) (Fig.1c) and 24km (120x90), hybrid vertical coordinate , 41 vertical levels, dynamical adaptation mode, ARPEGE supplies initial and boundary conditions, 2TL Semilagrangian scheme with time step of 450s for 10km, 900s for 24 km, time integration for 48h : 40 min (10 km), 22 min (24km).

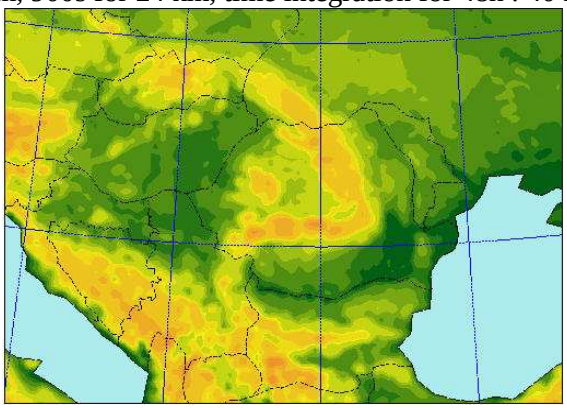

Figure 1. c) Integration domains and orography: Dx=10 km (144x144)

The operational suite includes: the post processing (every 3 hours), the generation of standard outputs (grib format routed towards the visualization systems in Bucharest and to the Regional Meteorological Centers), statistical adaptation (MOS, Kalman filter) of the direct model output and verification procedures. Additional graphical products (meteograms, pseudo – satellite images, hight of specific isotherms, stability indexes, etc) are automatically generated; they are available on the ALADIN- romanian web site. The ALADIN model results are used as input data for the wave models (WAM, VAGROM) and for the diffusion and transport of pollutants models (MEDIA). New is the operational implementation of Aladin-Diagpack - the optimum interpolation method used to obtain an Aladin analysis, using the SYNOP data from the Romanian stations (mean sea level pressure, 2m temperature and humidity, 10m wind and sea surface temperature).

Romania has joint the common ALADIN verification program. The data extraction procedure, developed by the Slovenian colleagues has been installed on a SUN workstation, using the PALADIN package. The surface and upper-air parameters forecasted by the ALADIN-Romania model for the established list of stations are sent by e-mail to Ljubljana to be inserted into the central database.

2. High Resolution Regional Model and Lokal Modell

(Pescaru V. I., Velea L., Dumitrache R.)

2.1 Operational and simulations

HRM is integrated operationally on SUN BLADE 1000 workstation at 28 km resolution. The non-hydrostatic Lokal Modell, implemented firstly on Sgi Altix workstation and then running on Linux Cluster with: multi-processor optimization, pre-operational running procedures at 14 km together with simulations at 7 km and 2.8 km proved its functionality. The model is running twice per day up to 78 hour forecast for a domain covering Romania (16 –32° E, 42 – 51°N).

Tests with the Local Modell (LM) and HRM at 14 km shows that LM improves the forecast, as for instance by reducing the area and amount of precipitation closer to observations (Figure 2). The Lokal Modell was also implemented and tested for the 2.8 km horizontal resolution, using to that aim more representative domains over the Romanian territory. Analysis of the obtained results proved the LM's ability to detect fine scale phenomena.

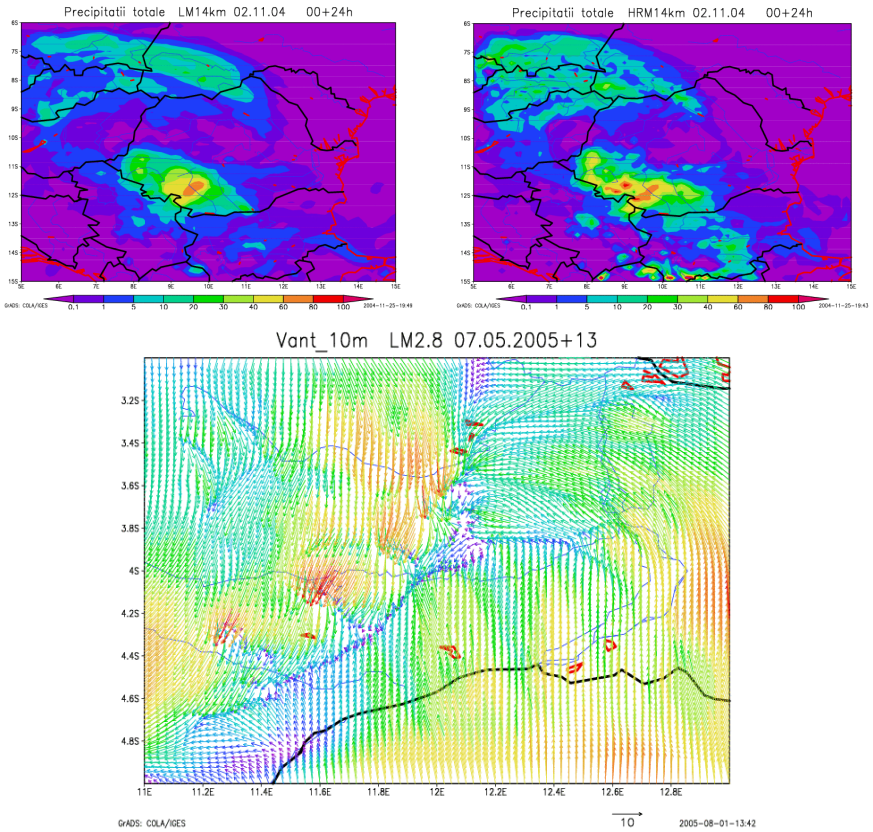

Figure 2 a): Total precipitation LM (left), b) total preciptation HRM (right) at 14 km, and c) 10m wind with LM at 2.8km (bottom).

3. Developments and other applications

The ALADIN research-developments activities (part of them in cooperation with others Aladin teams) were focused on the following topics: spectral coupling, data assimilation and high-resolution simulations (including comparison between ALADIN-NH and AROME) mainly for floods events studies.

3.1 Spectral coupling (Radu R.)

The impact of spectral coupling (method for improving LBC treatment, based on spectral representation), on the forecasted fields in ALADIN was studied in comparison with the operational coupling. A daily data-basis over almost a year was realized in this sense. The validation of this method for ALADIN continued afterwards with aspects concerning its behaviour at finer resolution in extreme local phenomena as the tornado case of Movilita 07.05.2005. The results correlated with observations reveals the capacity of different coupling methods to simulate the both phases of frontogenesis. The conclusion was that the operational coupling was able to better detect the first phase developed by the non-stationarity of surface and PBL forcing, meanwhile only the spectral coupling catches the second phase of regeneration which was born through the interaction between the large and the small scales.

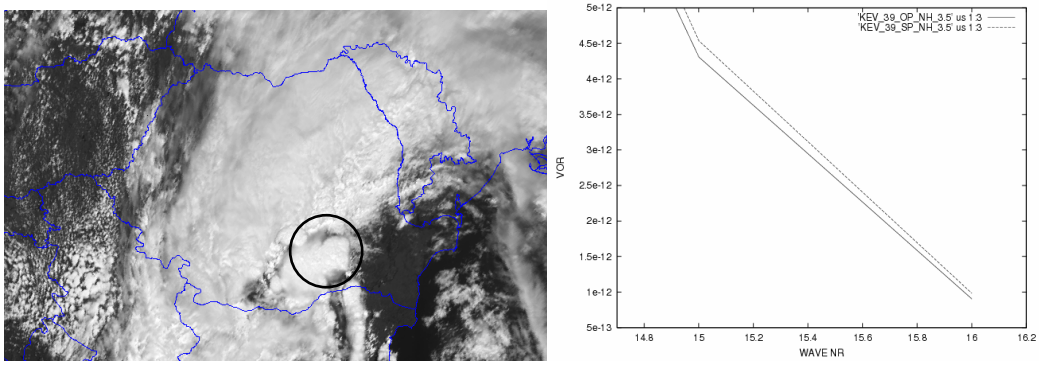

Figure 5: HRV Satellite image on 07.05.2005 (left) and vorticity spectra for ALADIN-NH (3.5km) using operational grid point coupling (contouring line) and spectral coupling (dashed line – right) when tornado produces.

3.2 CONVEX experiment application (11-12th of May 2005) (Barbu A., Banciu D., Pescaru V. I.)

Between 11 – 12th of May 2005 an international exercise named CONVEX-3, a simulation of a nuclear accident at the power plant in Cernavoda (Romania) took place. The coordination was done by IAEA, NEA/OECD (Nuclear Energy Agency/Organization for Economic Co-operation and Development), OCHA (United Nation Office for the Co-ordination of Humanitarian Affairs), WHO (World Health Organization) and WMO (World Meteorological Organization).

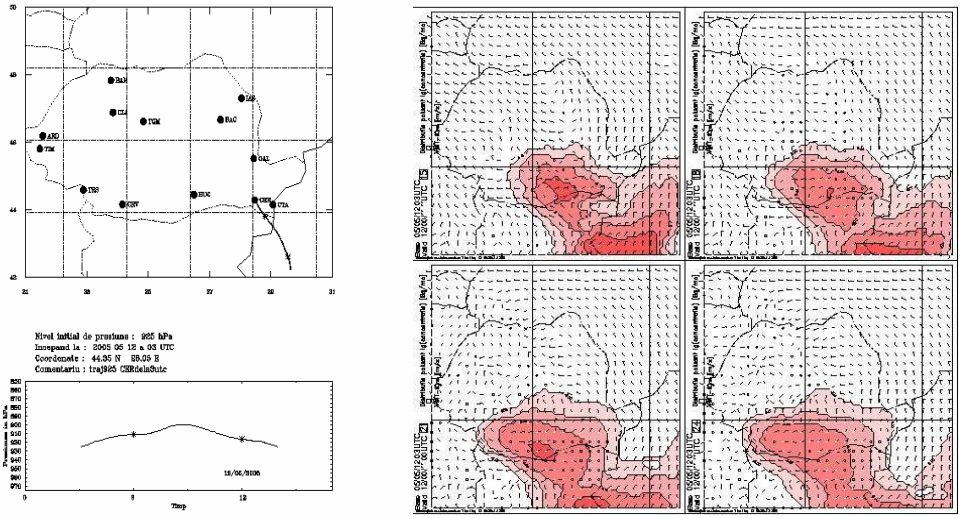

Figure 3: 48 h trajectory with the initial point at 925 hPa (left), and pollutant concentration for 15, 18, 21 and 24 hour forecast ranges (right).

For this exercise the National Meteorological Administration of Romania provided different products as: meteorological forecast by ALADIN model, pollutant concentration forecast obtained by the coupled systems ALADIN model – MEDIA, HRM model-INPUFF, 48 hours trajectories (issued from the trajectory model by using ALADIN forecasted wind).

The maps containing the distribution of the pollutant cloud and trajectories have been communicated to the decision factors and stored on the NMA web page. The outputs were in accordance with those provided by Meteo-France and MetOffice.

3.3 Circulation models (Stefanescu S., Banciu D.)
ALADIN model was integrated over the Black Sea domain at 24 km resolution for 60 h, twice per day. The ALADIN fields: 2m temperature and specific humidity, 10m wind speed and precipitation, evaporation and heat fluxes are used to couple the basin scales and coastal circulation models.
During 22-26 July 2005 a pre-operational forecasting experiment took place in ARENA project framework. The results of the POM model (Princeton Ocean wave Model) were integrated for the Romanian coastal zone.

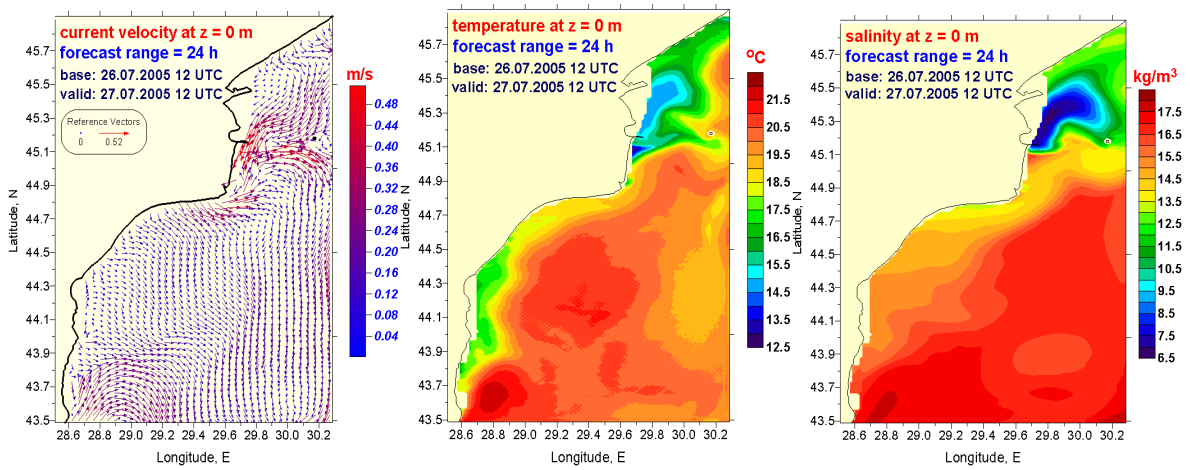

Figure 4: The current velocity (a), sea temperature (b) and salinity (c) 24h forecast of the POM circulation model for the Romanian coastal zone valid on 27.07.2005 12 UTC

3.4 New machine
New Linux cluster platform for research purposes was realized with the following characteristics: 14 nodesX2 processors Intel Xeon, 2,66MHz per node, RAM 30GB, computing power~155Gflops, processors being connected through HP Gigabit Ethernet. As compilers it uses: Intel Fortran 8.2 and C, Portland Group.

Event
First **AROME Training Course** organized by Meteo-France and National Meteorological Administration of Romania will take place in Poiana Brasov between the 21- 25th of November 2005. Around 53 participants will attend lectures on Méso-NH physics, ALADIN-NH dynamics and AROME prototype, including the externalized surface module.