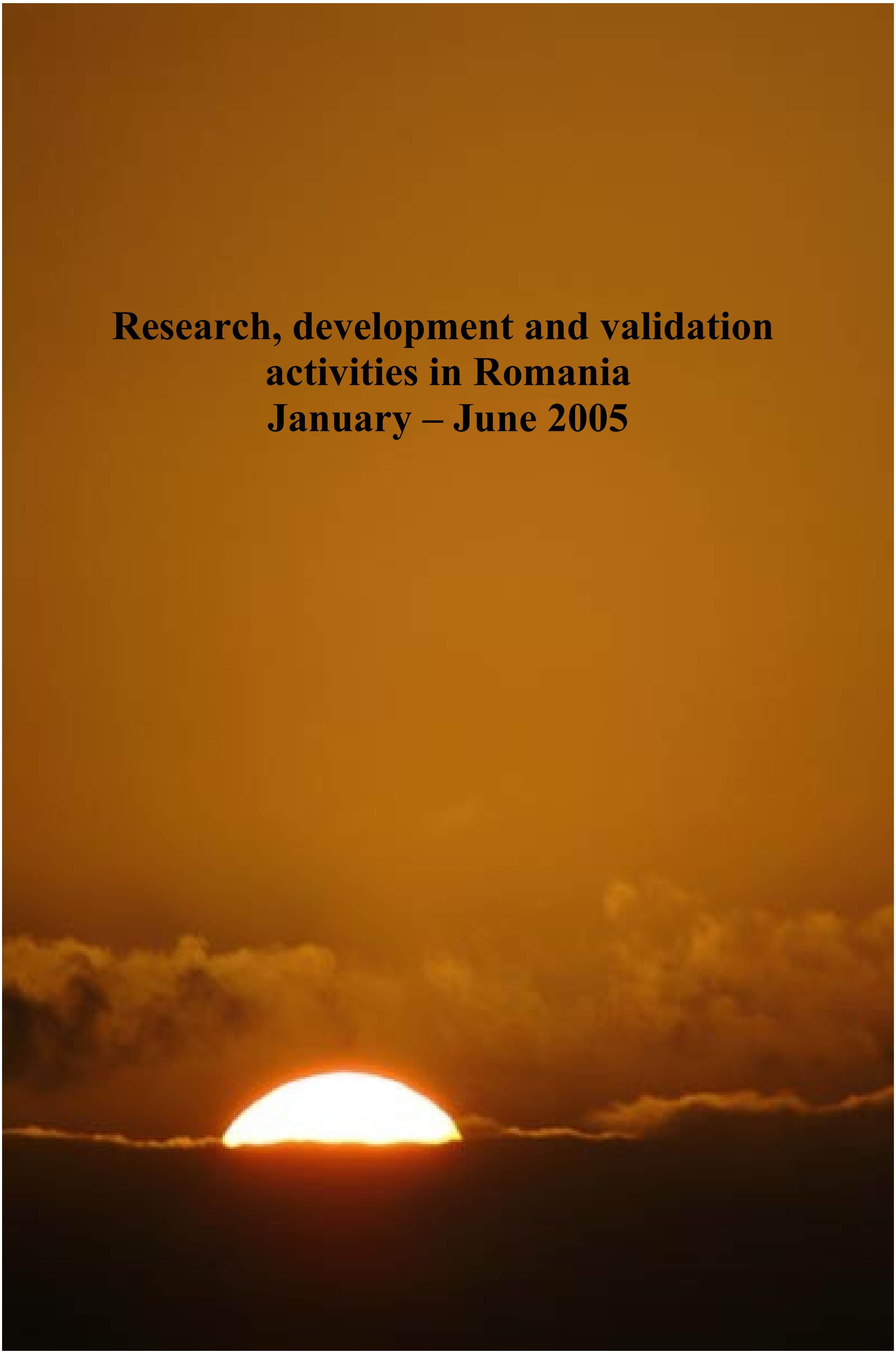
Research, development and validation activities in Romania
January – June 2005



1. Spectral coupling (Raluca Radu)

The impact of spectral coupling in ALADIN version 15_03 was studied against the operational one . A daily data base over almost a year was realized and the response of the forecast model to the proposed coupling method versus the classic grid-point coupling method was analysed.

Going further with the validation of the spectral coupling method for ALADIN, aspects concerning its behaviour at finer resolution are investigated on some cases. The aim is to determine the physical processes leading to the accurate representation of a fluid sub-domain at smaller scales through the spectral treatment of the lateral boundary forcing. Another objective treated here is to analyse how the proposed coupling scheme performs in the ALADIN-NH version.

Tornado case (7.05.2005)

Several experiments were conducted in order to study the coupling methods impact on a tornado event (around 11 UTC, May 7, 2005 at north-east of Bucharest, marked with a circle on the satellite image from figure 1).

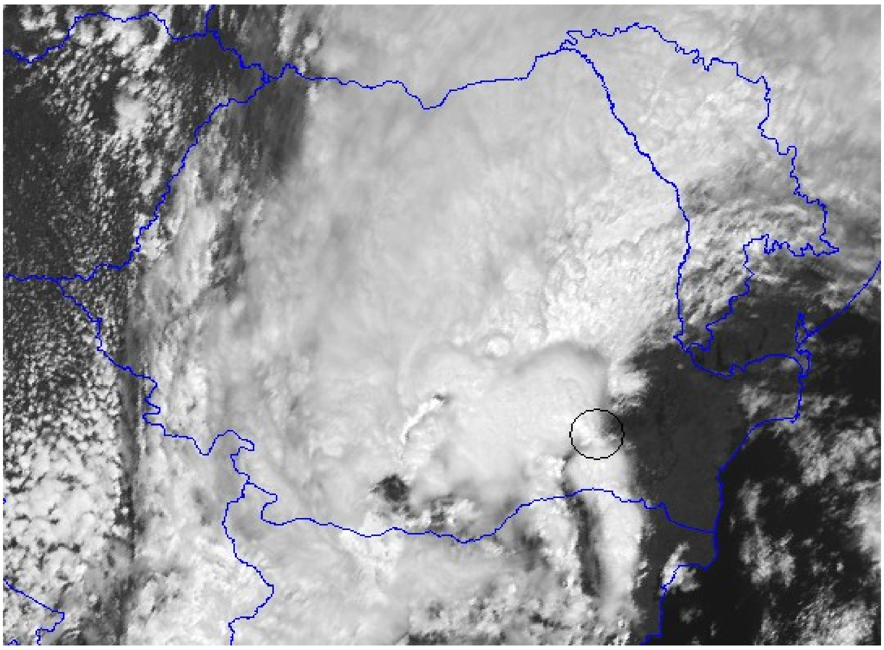


Fig. 1 : Satellite image (MSG, visible) – May 7, 2005, 11:00 GMT

The ALADIN (al15_03 version) model was integrated for two domains : operational one (100x100 points, 10 km resolution) and a smaller one (50x50 points, 3.5 km resolution), using the classic and spectral coupling methods. The initial time of the numerical simulations is 6th of May 2005, 00 UTC.

For the 3.5 km resolution domain, experiments, using both hydrostatic (HH) and non-hydrostatic (NH) version, were performed in order to study the impact of coupling schemes correlated with non-hydrostatic dynamics. The main differences among different simulations made are presented in Table 1.

It is remarkable the way all experiments showed a good qualitative capacity to create the correct larger scale environment, leading to the strong frontogenesis at the right moment, corresponding to 35 hour forecast range).

	3.5 km (Bucharest domain)	10 km (Romania domain)
ALADIN-NH	OP SP (k0=0,k1=7) SP (k0=1,k1=7)	
ALADIN-HH	OP SP (k0=1,k1=7)	OP SP (k0=2,k1=10)

Table 1. Experiments with ALADIN-NH and ALADIN-HH: OP (operational grid point coupling), SP (spectral coupling, extended to all coupled variables in NH experiments), k0, k1- parameters for spectral relaxation.

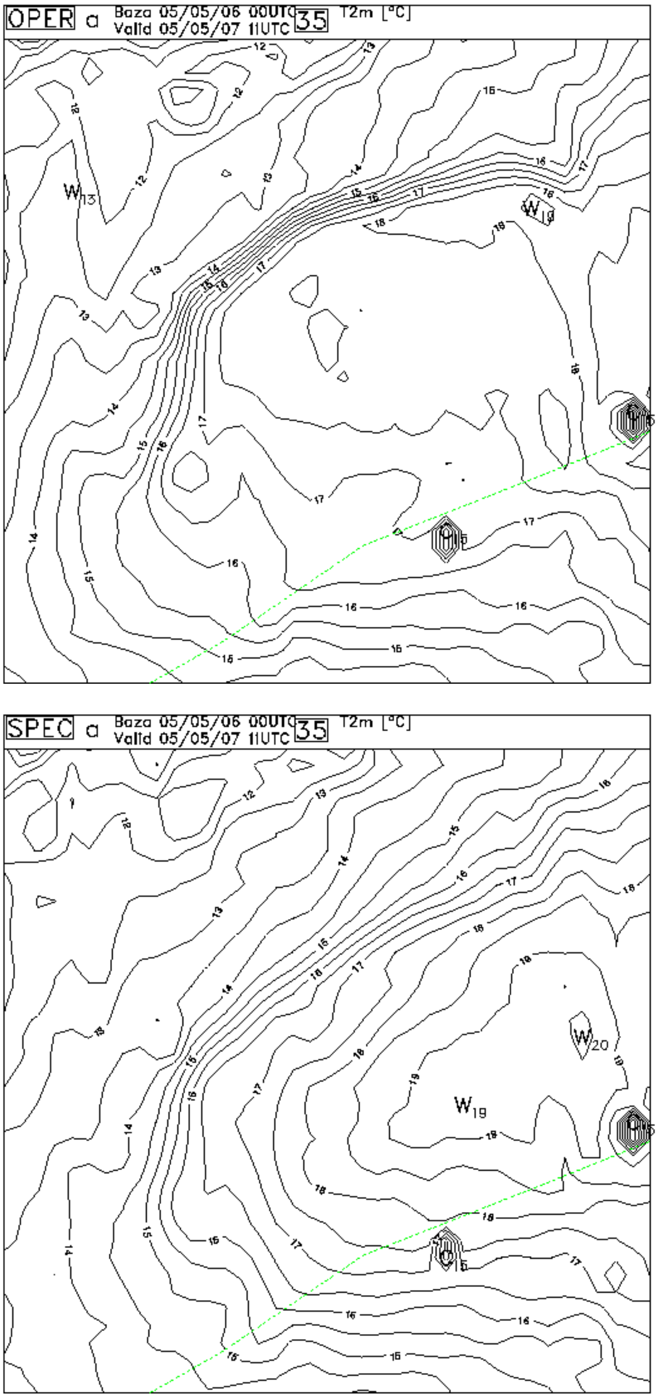


Fig. 2 : 2m temperature after 35 hours of integration : operational coupling (top) and spectral coupling (bottom)

The grid point coupling succeeds to better catch the local features (the strong temperature gradient see fig. 2; NB: the small cold nuclei correspond to some problems in the climatic file), while the spectral coupling seems to better represent the magnitude of the event.

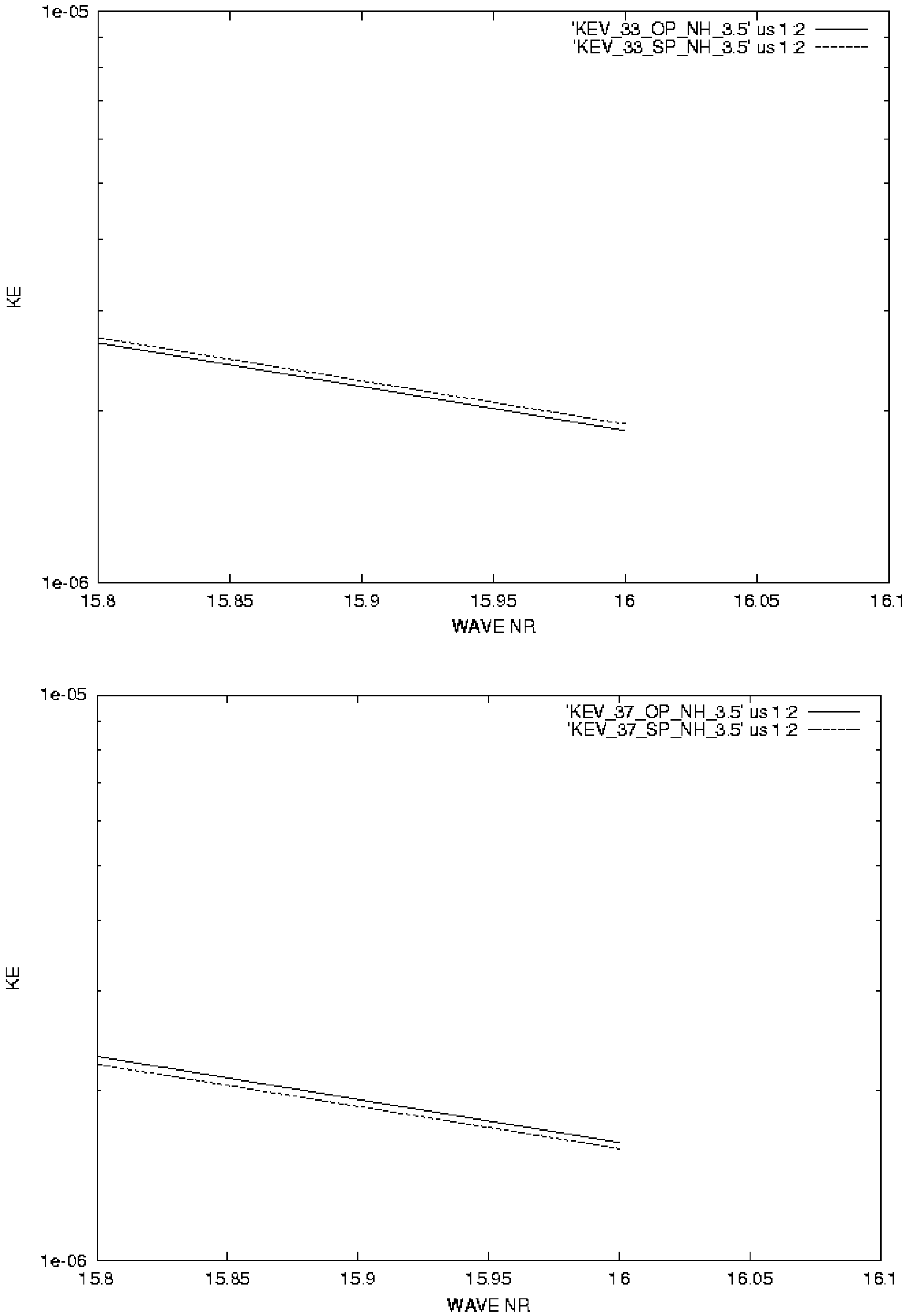


Fig. 3 : Kinetic energy spectra after 33 hours (top) and 37 hours (bottom);
full line for operational coupling, dash line for spectral coupling

Spectra analysis shows a growth of the kinetic energy and relative vorticity for short waves during the event time, when the spectral coupling is used for both domains. For the 3.5 km resolution, the growth appears even with 2 hours anticipation (fig.3, top part). In the next following hours, a sudden falling down of the kinetic energy was noticed (fig.3 bottom part).

Further work will continue with analysis of simulated instability conditions.

2. New experiments with the high-resolution dynamical adaptation of the surface wind forecast using the hydrostatic and non-hydrostatic versions of the ALADIN/Romania model (Steluta Alexandru)

A five months period of evaluation (in terms of statistical measures) was realized by comparison with the real measurements, for the surface wind forecast obtained by the operational model (at 10 km resolution) and using high-resolution dynamical adaptation method for the hydrostatic ALADIN/Romania model (at 2.5 km resolution). Also the forecasts of the 10 m wind field obtained with the hydrostatic and non-hydrostatic ALADIN/Romania models at high-resolution were illustrated during two snowstorms. All these results have been brought together into an article submitted to the "Romanian Journal of Meteorology", with the name “High-resolution dynamical adaptation of the ALADIN/Romania model’s surface wind forecast".

3. ALADIN/Romania meteograms (Steluta Alexandru)

The meteogram format has been changed, including new fields: 2m relative humidity, convective precipitation, relative humidity field in altitude, 1000-500 hPa thickness, 2m dew point temperature. Also new towns have been added, covering each county of Romania. A meteogram’s example for Resita city is presented below.

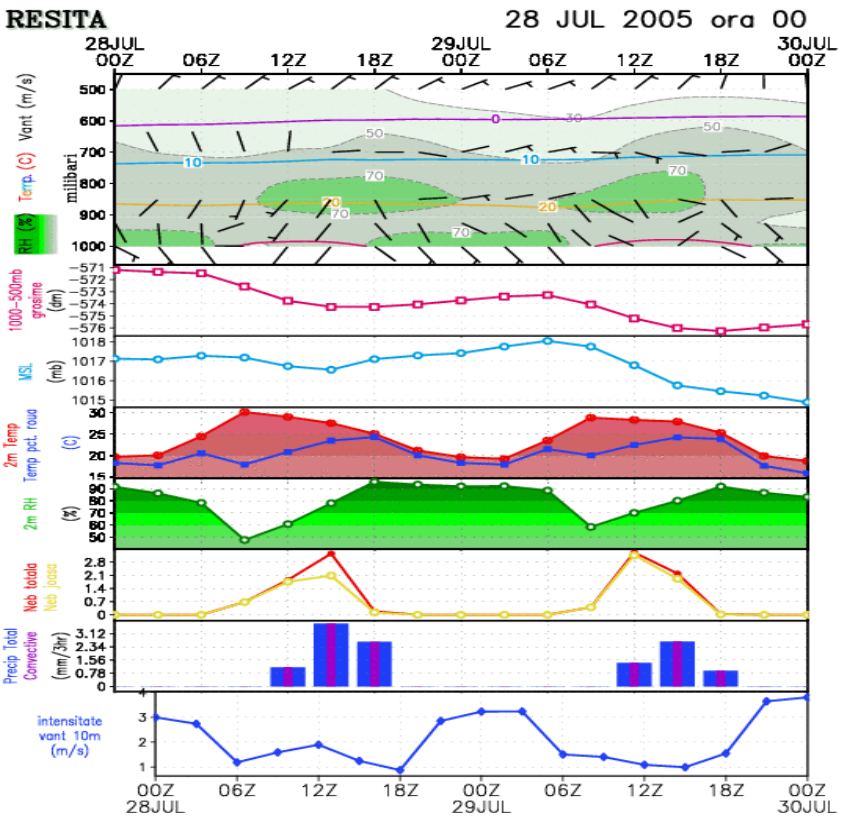


Fig. 4 : ALADIN meteogram

3. ALADIN diagnostic package (Simona Stefanescu)

The results of DIAGPACK, operationally implemented, are the basis of different diagnostics computations (CAPE, MOCON, stability indices) mainly used by the nowcasting department.

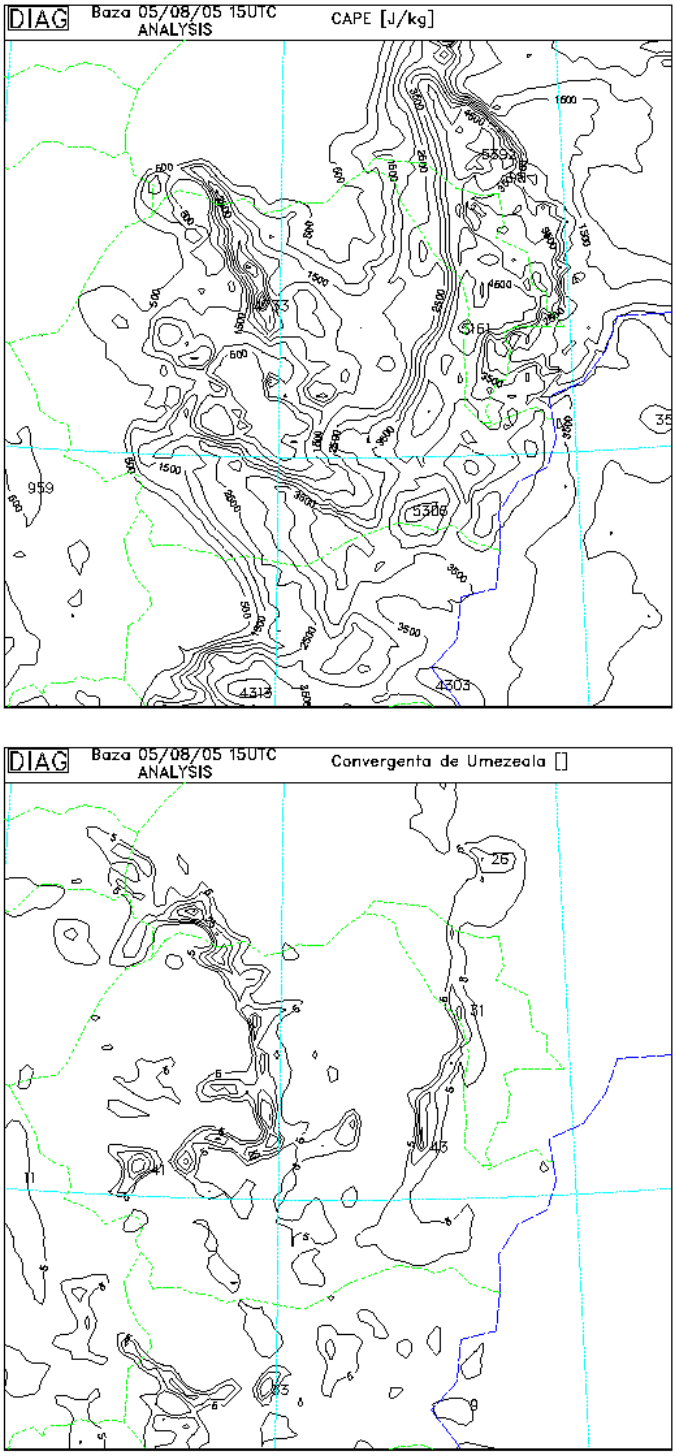


Fig. 5 : CAPE (top) and MOCON obtained by using DIAGPACK

4. A heavy precipitation case generated by short tropospheric waves (Forinela Popa, Doina Banciu, Viorica Dima)

The large amounts of precipitation registered in Romania in the last half of April were mainly generated by the fast evolution of short tropospheric waves, which evolved in the upper and medium levels of the troposphere. Between 13th and 27th of April, four such tropospheric waves crossed the Romanian territory, the second one (17th to 19th of April) being the most severe one and therefore being chosen for a detailed analysis. During this period, in the Banat area heavy rains have fallen in a relatively short time, inducing floods. The water-vapour satellite imagery and the outputs of the ALADIN model (especially the potential vorticity field), were extensively used. A special attention was paid to the evolution in the upper half of the troposphere, at the tropopause level and in the low stratosphere.

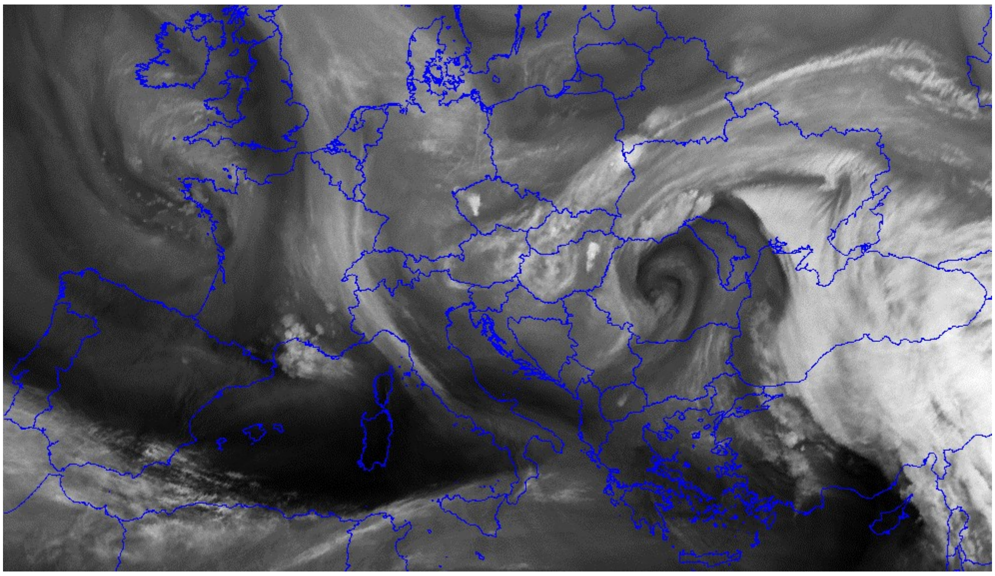


Fig. 6 : Water vapor MSG image, April 18, 18:00 UTC

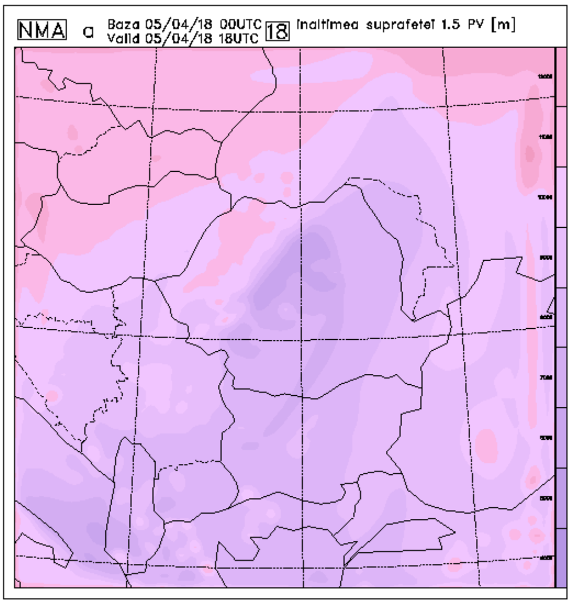


Fig. 7 : 1.5 PV height forecasted by the ALADIN model: April 18, 2005, 00 + 18 UTC

5. <u>CONVEX experiment (Anca Barbu, Doina Banciu)</u>

Between the 11–12-th of May 2005 in Romania took place an international exercise, CONVEX-3, when a nuclear accident at the power plant in Cernavoda has been simulated. The exercise has been coordinated by a Committee members from: 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).

National Meteorological Administration (NMA) of Romania participated in the exercise with meteorological forecast provided by the ALADIN model, pollutant concentration forecast obtained by the coupled system ALADIN model – MEDIA model, 48 hours trajectories (issued from the trajectory model using ALADIN forecasted wind).The results – maps containing the distribution of the pollutant cloud and trajectories have been communicated to the decision factors and also stored on the web page of the NMA.

The outputs of the models were, generally, in accordance with those provided from Météo-France and the Met Office. However, there were some differences with respect to the vertical and horizontal particle displacement.

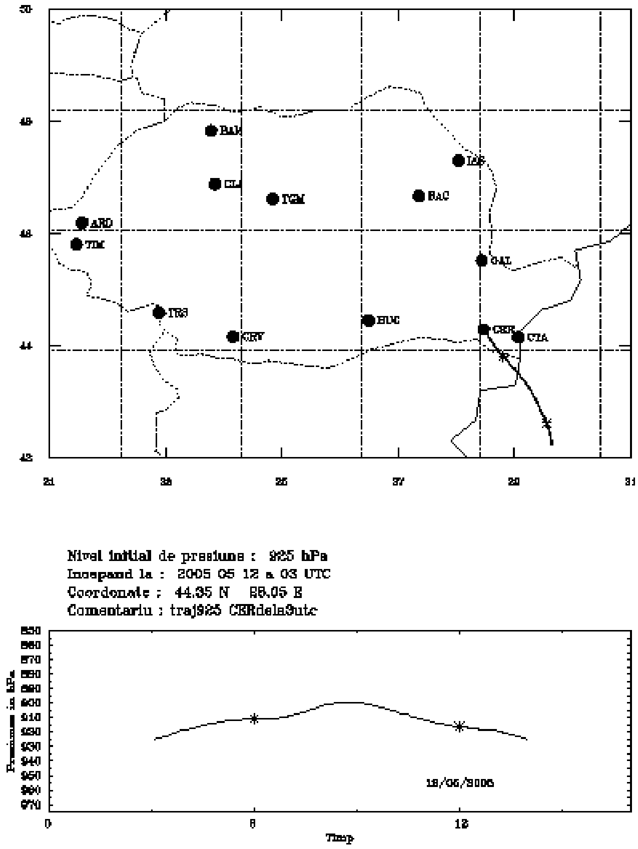


Fig. 8 : 48 hours trajectory with the initial point at 925 hPa

Some differences appear also in the position of the pollutant cloud. In ARPEGE forecast, the highest concentration nucleus is focused in the area of the source while ALADIN splits this nucleus in two parts, equal in intensity, one, West of the source, and the other one, South of the source.

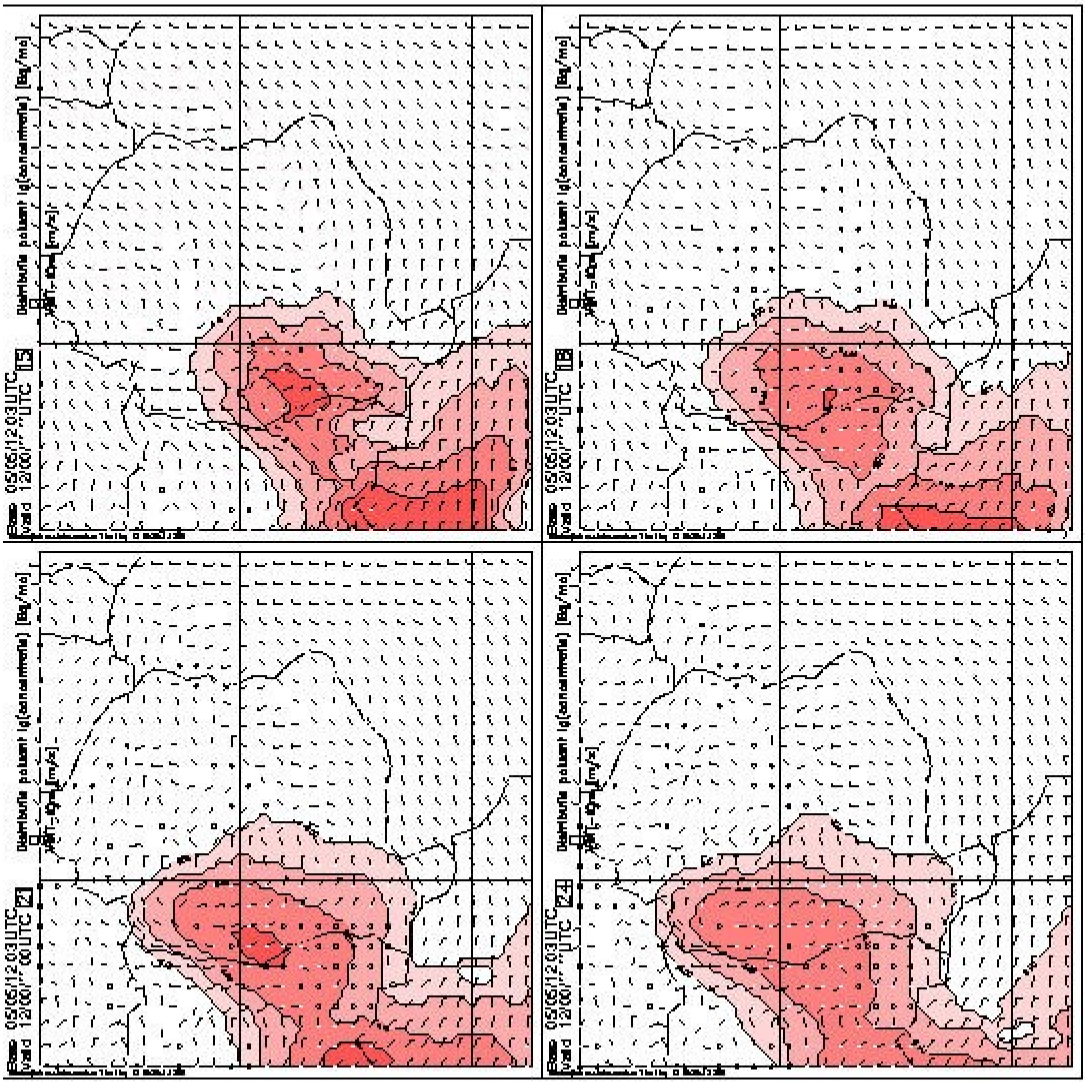


Fig. 9 : Pollutant concentration for 15, 18,21 and 24 hour forecast ranges

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