1. Research development and validation activities

1.1. A case study using spectral coupling method (Raluca Radu)

The impact of spectral coupling behavior at finer resolution in local phenomena such as a tornado event (Movilita, Romania, 07.05.2005) was studied (see previous Newsletter). The results correlated with the observations show the capacity of different coupling methods to simulate this event.

Different mechanisms were identified for the frontogenesis phases: first phase of diabatic nature which was generated in PBL at 35 (11 UTC) (Figure 1a, Figure2a) was characterized by a rapid development at small scale through topographic forcing and PBL nonstationarity (mechanism 1). This phase was better represented with the operational gridpoint coupling scheme. The second phase of the frontogenesis regeneration produced after 3h by the nonlinear interactions between the large and the small scales (mechanism 2) was represented more realistically with the spectral coupling method. The energy exchange here was sustained from the upper levels (Figure 1b, Figure 2b). Preliminary results support idea of spectral coupling application in the case of situations developed through scale interaction.

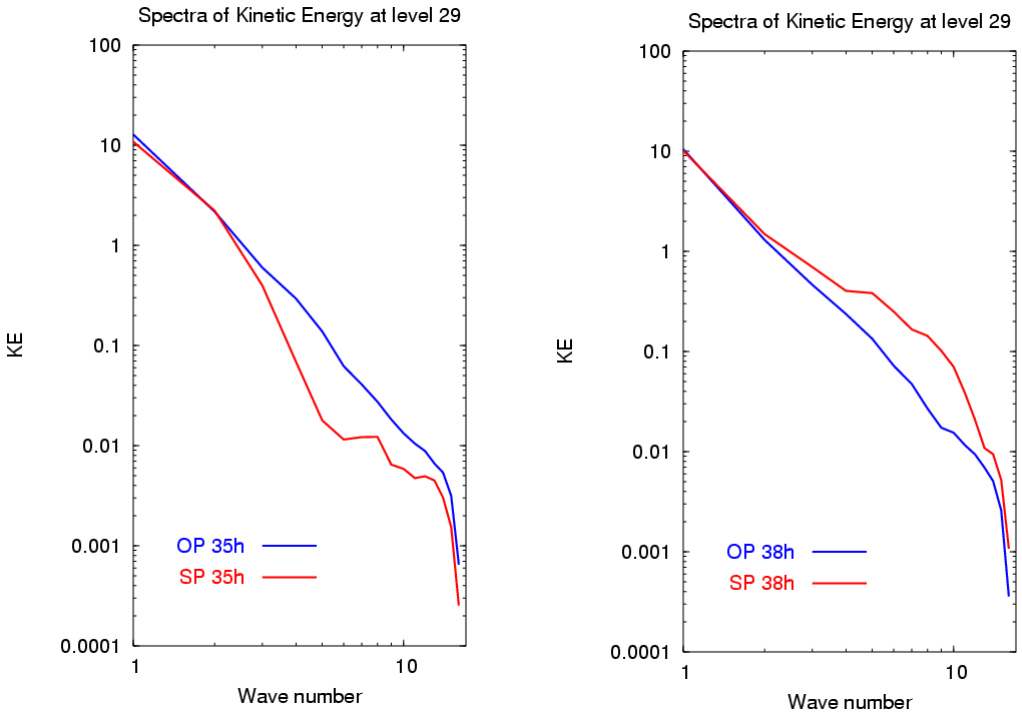

Figure 1: spectra of kinetic energy with gridpoint coupling (blue) and spectral coupling (red) left - a) first phase (mechanism 1), right - b) second phase (mechanism 2)

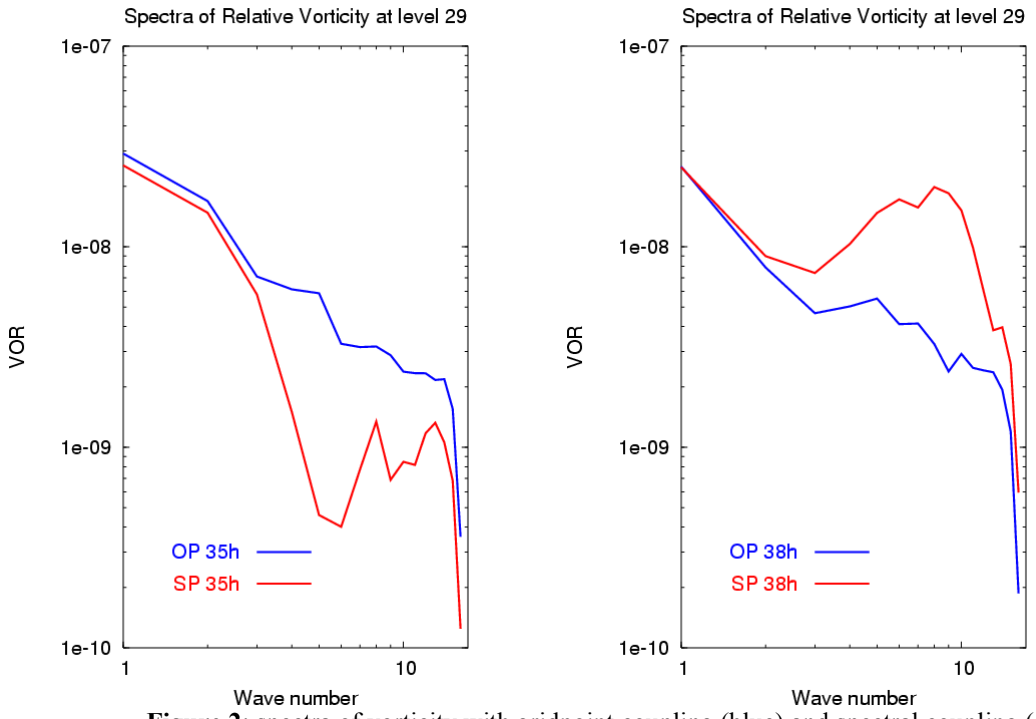

Figure 2: spectra of vorticity with gridpoint coupling (blue) and spectral coupling (red) left - a) first phase (mechanism 1), right - b) second phase (mechanism 2)

1.2. Flow-dependent background standard deviations for Arpege 4D-Var (Simona Stefanescu)

During a 2 month stay at Meteo-France, a study related to the flow-dependent background standard deviations has been started. Using perturbed observations in Arpege 4D-Var scheme, a 6-member ensemble of analyses and 6h forecasts has been generated for a one month period (18 January 2005 – 18 February 2005). The daily standard deviations for vorticity have been computed and a filter (of type cos^2) has been applied in order to remove the noise related to the use of a small-size ensemble. The filtered vorticity standard deviation at model level 26 (around 500 hPa) have been compared with the geopotential height field at 500 hPa. Large values of vorticity standard deviations associated with low geopotential areas have been observed. The computation of vorticity standard deviation for January period has been done at Meteo-France and then the continuation of work for February period has been done in Romania.

1.3. Formulation of the closure assumption and entrainment rate within the deep convection parameterization scheme (Doina Banciu)

New ideas based on Jean-Marcel Piriou PhD thesis and Dimitri Mironov (Proceedings HIRLAM/NetFAM Workshop on Convection an Clouds, Tartu, January 2005), which could be used in the ALARO frame, were introduced in the present Aladin/Arpege convection scheme under the supervision of Jean-Francois Geleyn. They concern the closure assumption and the formulation of the entrainment rate. The specific implementation followed the suggestions of Jean-Francois:

- the closure assumption is a continuous combination between CAPE and humidity convergence formulations
- the historical formulation of the entrainment rate is based on vertical integral buoyancy
- the entrainment rate was completed by a turbulent part depending on the derivative of the CAPE integral

The modifications were tested within the frame of the 1D version, for TOGA-COARE and EUROCS cases, for which a first tuning of the free parameters was carried out.

Many thanks to Jean-Marcel Piriou who made available to us the last version of the 1D model and the data for the specific cases. The advice of Jean-Francois and Jean-Marcel are acknowledged as well.