SPECIAL PROJECT PROGRESS REPORT

Progress Reports should be 2 to 10 pages in length, depending on importance of the project. All the following mandatory information needs to be provided.

Reporting year	2012……………………………………………….……
Project Title:	Boundary conditions for ALADIN, ALARO and AROME based on IFS, ECMWF EPS and ERA-Interim data
Computer Project Account:	SPFRCOUP……………………………………..……
Principal Investigator(s):	Alex Deckmyn……………………………………..……
Affiliation:	Royal Meteorological Institute, Belgium
Name of ECMWF scientist(s) collaborating to the project (if applicable)	None
Start date of the project:	1/1/2012…………………………………….……
Expected end date:	31/12/2014………….……

Computer resources allocated/used for the current year and the previous one

(if applicable)
Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)			130000	29589
Data storage capacity	(Gbytes)			800	

Summary of project objectives

(10 lines max)

This project aims to study various aspects and issues concerning the coupling of the ALARO and AROME models to data from ECMWF (IFS, EPS, ERA-Interim). The main topics of interest are

- Surface issues (non-compatibility of surface parameterisations)
- LBC's for LAM-EPS systems
- Regional climate modelling

The intention of this project is to allow scientists from some selected (Cooperating and Non-Member) States access to resources on the HPCF to (1) develop and maintain a unified software environment for experimentation and preparing boundary conditions, (2) perform boundary condition file preparation at ECMWF before sending it to their own sites for running the LAMs, and (3) to test new approaches in IC and LBC preparation.

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Summary of problems encountered (if any)

(20 lines max)

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Summary of results of the current year (from July of previous year to June of current year)

This section should comprise 1 to 8 pages and can be replaced by a short summary plus an existing scientific report on the project

The current SPFRCOUP project started on January 1st, 2012.
1) In these first 6 months, the main activity has been conducted by the Hungarian team on comparing coupling strategies for the ALARO LAMEPS. A report of these activities is given at the end of this report.

2) The GLAMEPS multi-model EPS system has benefited from the original SPFRCOUP results for the coupling of the ALARO members to LBC's from EPS. Conversely, the new SPFRCOUP project that has just started, will profit from some recent developments in GLAMEPS.
At the Belgian RMI scripts are being prepared for extraction of boundary data from ERA-INTERIM. The main addition to previous experiments is that a CANARI surface data assimilation will be included. Part of the code for these experiments will be common with that developed for the GLAMEPS project (SPNOGEPS), where ALARO members of the LAM ensemble are coupled to EPS output, but with a separate surface assimilation to solve the incompatibilities of the surface parameterisations. Experimental runs and validation will start in the second half of 2012.

3) Also at RMI, a study has been done of the Coupling Update Frequency (CUF) monitoring. This is an approach that monitors the difference between a field (usually the pressure field) in the coupling model and the values that would be obtained by interpolation between subsequent coupling files. The purpose is to detect fast moving storms that may cross the coupling zone of the LAM without being correctly detected. In such cases, the coupled LAM may be restarted with the storm system inside the domain. A case study of this approach has been started using ERA-40 data for December 1999 (including the Lothar storm), that was downscaled using the ALARO model. A report of this work is attached at the end of this report.

List of publications/reports from the project with complete references

No publications yet.

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Summary of plans for the continuation of the project

(10 lines max)

The work at various participating countries is expected to proceed with some particular topics planned for the near future:

- Experimentation on ERA-Interim downscaling with special interest for surface fields. The use of surface data assimilation will be studied closely.
- Further experiments for LAMEPS coupling, including a longer experimentation period for detailed verification.

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Report on the contribution of Hungarian Meteorological Service in SPFRCOUP

In the first half of 2012 we concentrated on preparing LBC files from ECMWF EPS to our limited area EPS. The operational EPS at the Hungarian Meteorological Service (HMS) is using ALADIN model with ALARO physics and coupled to the PEARP (ARPEGE EPS). Model runs are started at 18UTC every day and LBCs are used from the global system started at the same time. Experiments aimed a comparison between the operational version of our limited area EPS and an experimental one coupled to ECMWF EPS.

In our experiments we used 12UTC ECMWF runs with 6 hour shift to start model runs at the same time than in our operational version. The preparation of the LBC files run on C1A and contained the following steps:

- Download files from MARS
- Execution of 901 configuration to get FA files
- Adding some surface variables to the FA files from the climate files
- Execution of e927 configuration to get a smaller domain
- Transfer of the files to the HMS

This process is similar to the one we use operationally at the downscaling of the single IFS forecast and it was used even before the start of this special project to have experiments with EPS. In the first half of this year only one technical modification have been introduced: the change of the climate file which is used in e927 on C1A. Previously we used the same as in the operational system which had 20.6km resolution in accordance with the PEARP resolution over Hungary. We started to use a climate file which was consistent with IFS EPS resolution and which made cheaper the data transfer as well.

On our computer we run forecasts from the prepared LBCs. Surface fields were changed for the ones we had in our operational deterministic assimilation system. This process can mean some inconsistency but results showed its benefit against keeping original fields coming from IFS or changing fields from ARPEGE. In our experiments we used the first 11 members of ECMWF EPS because we do the same with PEARP in our operational system.
With the above described configuration we run 67 experiments in the first half of this year. The individual experiments were frequently checked in Visualization System of HMS (Fig.1.) especially from probabilistic point of view.
For the second half of the year more similar runs are planned on C1A. We do not plan any modification in our process and settings. We are aiming to create a detailed verification from the results we already got and we will get in the second half of the year.

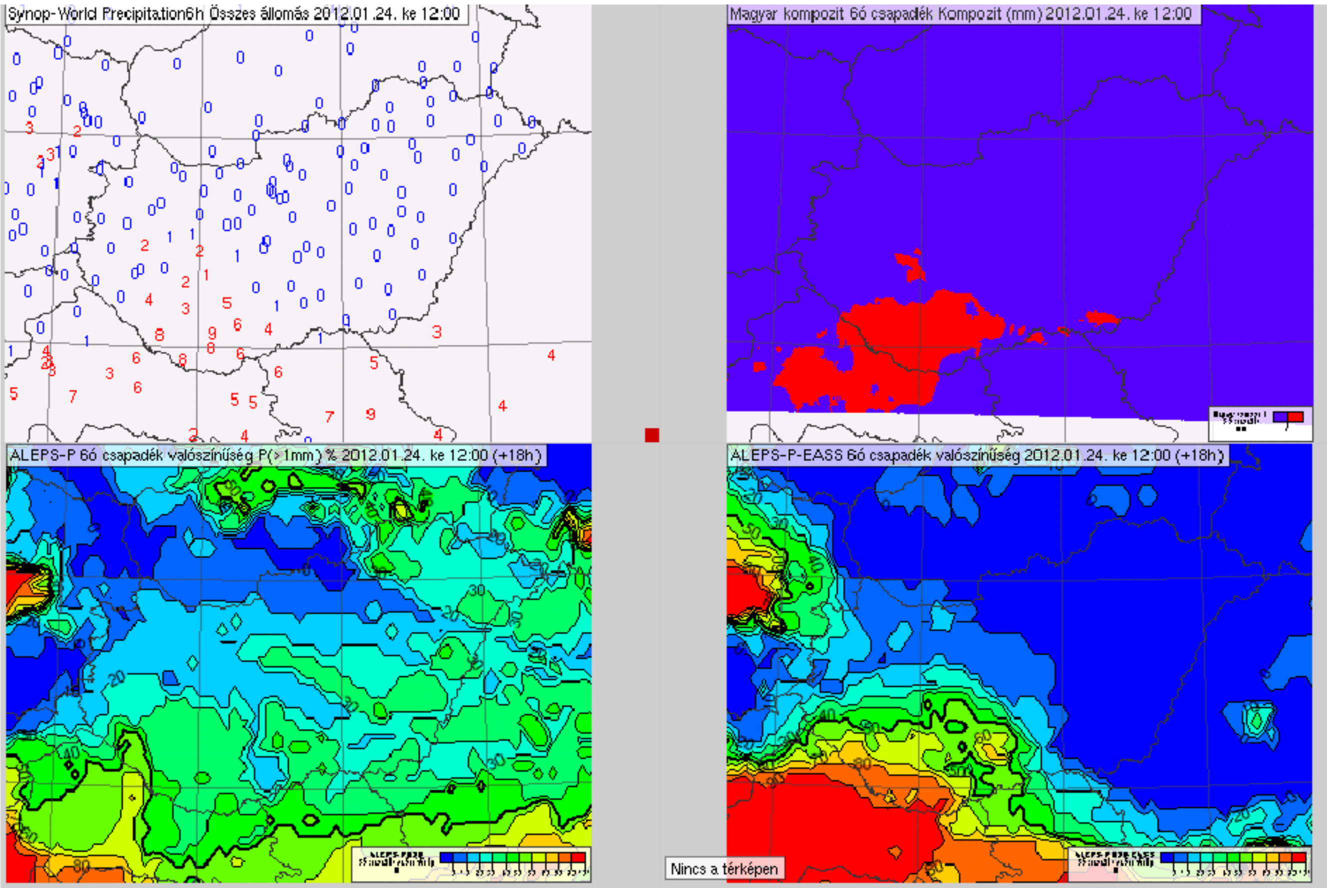

Fig.1.: The observed 6h-precipitation (above left) and radar composite picture (above right) at 12UTC on 24th of January 2012. Red colour indicates the area of precipitation more than 1mm. The probability of passing this threshold in our operational limited area EPS (below left) and in ECMWF EPS coupled experiment (below right). Blue belongs to the 0% and red to the 100% probability values.

A case study of CUF monitoring and Boundary Error Restarts using downscaled ERA40 data (RMI, Belgium)

The present case study was based on ideas and results published in

Termonia, P, A. Deckmyn and R. Hamdi: *Study of the Lateral Boundary Condition Temporal Resolution Problem and a Proposed Solution by Means of Boundary Error Restarts,*
Monthly Weather Review **137** (2009) 3551-3566

Termonia, P: *Monitoring of the Coupling-Update Frequency of a Limited-Area Model by means of a Recursive Digital Filter*,
Monthly Weather Review **132** (2004) 2130-2141

The main purpose is to monitor, inside the coupling model, the difference between the original pressure field and that which will be obtained in the coupling zone of the coupled model when interpolating between subsequent LBC's.

In the present case study we looked at results for December 1999, a month that included the Lothar storm.

Step 1

As existing boundary data for this period does not include the CUF monitoring field, we first had to run a coupling model. Rather than run a global model, we opted to ***downscale ERA-40*** data. Thus, the coupling model is a ALADIN run at 40km resolution over a domain covering most of Europe (fig 1)

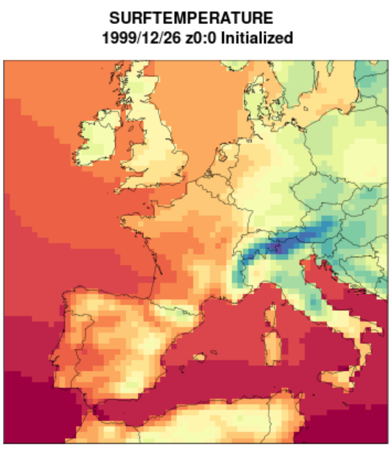

Figure 1: The 40km coupling domain

Step 2

The model output of these 40km runs were then used as coupling data for a smaller 7km domain. Also in the 40km run, the CUF field was calculated. We then calculated the maximum of the CUF inside the coupling region. The location of the storm is then searched within a region around the CUF maximum, by searching for a local maximum in 850hPa vorticity. When the storm system is inside the coupled LAM model domain, the run may be restarted.

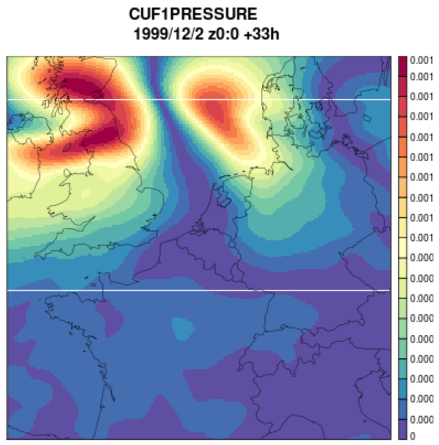

Figure 2: Example of CUF field, with maximum top left.

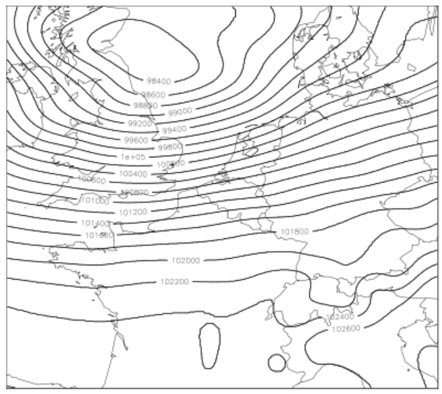

Figure 3: MSLP from the 40km run, with storm depression top left.

Figure 4 shows the values of the CUF maxima over the period 1/12/1999 – 6/1/2000. Setting a theshold at .0017, we get a total of 10 exceedences.

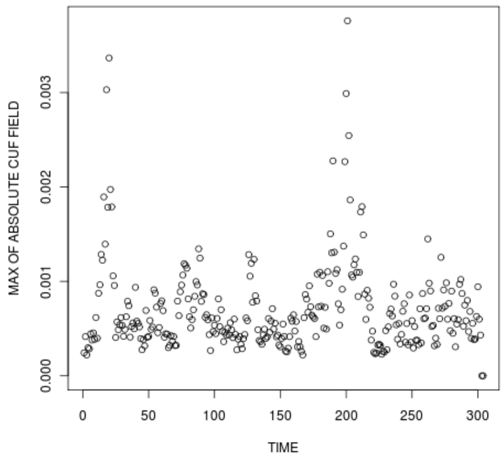

Figure 4: Maximum of absolute CUF field (at 3h intervals over 1 month

In Figure 4 one can see that there are two main events, at the beginning and end of December. This last event is the Lothar storm.

First Conclusions

In the case of the Lothar storm, the CUF method gives a clear warning of a storm entering the 7km forecast domain. However, the storm system in the 40km coupling model was already far less developed than in the original ERA40 data. Running the coupling model (40km) at a smaller timestep or on a larger domain improved this somewhat, but we still did not reproduce the full strength of the storm.

The CUF restart method is now operational at RMI, with LBC's from the ARPEGE model including the CUF field (which is calculated inside ARPEGE and added to LBC's). However, case studies such as the present one require reruns for older data, and in such cases use of ERA-40 (and ERA-Interim) downscaling remains very interesting.