LIMITED AREA MODELLING ACTIVITIES AT THE HUNGARIAN METEOROLOGICAL SERVICE (2001/2002)

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INTRODUCTION

The numerical weather prediction (NWP) group of the Hungarian Meteorological Service (HMS) belongs to the Department of Research and Development. Due to some reorganisation now the Satellite Research Laboratory is also part of the NWP team, so the enlargement of the team had been continued. The main topics of interest are as follows: limited area modelling, ALADIN (5 persons), nowcasting (5 persons), visualisation (3 persons), interpretation of medium-range and seasonal forecasts, ECMWF (2 persons) and automatic forecast generation (1 person). The main topics to be discussed in this report are the achievements related to the ALADIN model. A new homepage of the Department of Research and Development was created, where important information can be read about our activities (for instance also verification results). Please visit http://omsz.met.hu/english/kfo/neo_en.html for more details about numerical weather prediction.

ALADIN EXPLOITATION: ALADIN/LACE and ALADIN/HU

Two versions of the ALADIN model are available in Budapest: ALADIN/LACE regional model (nested in the French ARPEGE global model) version (see more details at the RC LACE international status report) exploited in Prague and ALADIN/HU local version (nested in the ALADIN/LACE model) running in Budapest. The main changes in the ALADIN operational suite were related to the migration of the model to our new computer (IBM Regatta p690 server, more details see below) and to the fact that the number of vertical model levels had been increased from 31 to 37 (for the other features see the Hungarian status report of 1999/2000). Several new configurations are tested with the help of our new computer and going to be introduced operationally in the near future. The SGI ORIGIN 2000 machine is now used entirely for nowcasting purposes (having already 16 500 MHz processors with further memory and disk increase). The ALADIN related research and development work is carried out in Toulouse, Prague and Budapest and detailed later in this report.

MAIN CHARACTERISTICS OF THE REGATTA P690 SERVER

Hereafter the main characteristics of our new IBM server is detailed:

- The machine is the small brother of the machine to be delivered at ECMWF,
- CPU: 32 processors (1,3 GHz),
- Peak performance: 5.2 Gflops/processor,
- 64 Gbyte internal memory,
- 364 Gbyte disk space,
- Loadleveler job scheduler is installed and used for the safe exploitation of the operational model.

RESEARCH AND DEVELOPMENT ACTIVITIES: 3D-VAR

The main research and development topic for the Hungarian Meteorological Service in the ALADIN project is the further development of the three-dimensional variational (3d-var) data assimilation scheme. The main contributions are related to the background error statistics, installation of observational data base (ODB), starting developments for the application of satellite data in the course of 3d-var, search for the best strategy for the cycling, initialisation, coupling of the scheme, assessment of the double nested versus simple nested strategy (see the report of Steluta Alexandru at the same volume).

The new observational data base (ODB) was installed in Toulouse and then at different ALADIN member states. We have actively participated in this action and the new data base system was installed and tested successfully in Budapest.

The discussions inside the ALADIN community had been continued regarding the computation of background error statistics for the ALADIN model. From our side the investigations had been continued for the potential use of constant coupling lagged background error statistics (a variant of the NMC method, when the two forecasts taking part in the computation of the difference fields have exactly the same lateral boundary conditions, thus substracting the large scale effects from the statistics). The main result of the last year that the lagged method can be used only with some limitations for the double-nested domain. The reason behind is that the resolution and domain size difference between the coupling and coupled model is small, which means too strong error variance reduction in the lagged scheme.

Regarding new data sources for 3d-var one of the major development was related to the possible local application of satellite (ATOVS) data in the 3d-var process. The positive impact of ATOVS data in the global model (ARPEGE) was proven, so the activities were related to the mostly technical (until now)

pre-processing and quality control of the data for the limited area. The AAPP software package is used for the pre-prcessing of the HRPT data.

RESEARCH AND DEVELOPMENT ACTIVITIES: LATERAL BOUNDARY CONDITIONS

Important topic of interest for our Service is the lateral boundary (coupling) problem. Our efforts were joined in the framework of the ALATNET project together with the Slovenian, Belgian and Romanian ALADIN team. The main direction of research is to find an alternative method to the Davies relaxation scheme and/or to improve the time interpolation between the available boundary information, especially, when fast propagating small scale weather phenomena are concerned. One candidate for complementing the Davies scheme in a spectral model is the spectral coupling, where the relevant scales are coupled in addition to the physical fields. This investigation is in its early stage, without new original results. As far as the time interpolation problem is concerned first the phase-amplitude decomposition was proposed (see last year's report), however the promising barotropic results were not reproduced in the 3D framework. This year Piet Termonia (from Belgium), while spending 2 months in Budapest gave new inertia to the investigations. His new approach is firstly to find an alternative description for the fast propagating waves based on the experiments for the 1999 Xmas storms, secondly generalise its results and thirdly to propose some a priori diagnostics tool, when one can decide what is the sufficient lateral boundary frequency, which is needed for the given meteorological situation. The cornerstone of the idea is the decomposition of the model state variables into moving and growing parts. Then this decomposition is transformed into spectral space (Fourier transformation) and then using the data of the Xmas storm a functional is derived and minimised in order to ensure the best fit to the real data. Using the traditional linear time interpolation the "dipole problem" appears, while it disappears using the proposed new formulation.

FUTURE PLANS

Very ambitious plans are considered for the future. The main planned changes in the operational ALADIN model version are due to the changes in the LACE project (the centralised model version will disappear). The new ALADIN/HU domain will cover entire Europe with a 6,5 km resolution and will be directly coupled by the ARPEGE global model (the lateral boundary frequency is anticipated for 3 hours). The introduction of the 3d-var data assimilation scheme for the determination of the initial conditions of the model is also in the plans and should be realised in the first half of 2003.