

TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA PROCESSING SYSTEM 2001

HUNGARIAN METEOROLOGICAL SERVICE, BUDAPEST

1. SUMMARY OF HIGHLIGHTS

In 2001 a procurement was launched for replacing the mainframe computer of the Hungarian Meteorological Service. For the end of the year the IBM company had been chosen with a p690 Regatta server having altogether 32 processors (peak performance: 5,2 Gflop/s each processor), 32 Gbyte memory and 364 Gbyte disk space. The old mainframe computer of the Service, the SGI Origin 2000 machine is going to be upgraded to 16 processors. The ALADIN limited area model is running in this SGI machine.

2. EQUIPMENTS IN USE AT THE CENTRE

Ethernet network: SGI Origin 2000 machine with 16 processors, HP L2000, HP K-250, K-200, C-200, D-280 servers and HP B-180, HP J-210, HP755, HP715, HP710, DEC 600 Au Personal Workstation and SUN workstations, NETSYS telecommunication computer, CISCO routers.

3. DATA AND PRODUCTS FROM GTS IN USE

The daily statistics of raw information:

SYNOP:	00/06/12/18 UTC	1123 - 1237
TEMP:	00/12 UTC	112 - 124
	06/18 UTC	19 - 28

The daily statistics of products:

GRID (EGRR):	00/12 UTC	600
(EDZW):	00/12 UTC	100
GRIB (EDZW):	00/12 UTC	750
FAX (EDZW)	00/12 UTC	73
	06 UTC	4
	18 UTC	32

4. DATA INPUT SYSTEM

Automated

5. QUALITY CONTROL SYSTEM

Horizontal consistency check (for SYNOP messages) and hydrostatic vertical quality control (TEMP messages).

6. MONITORING OF THE OBSERVING SYSTEM

Surface and upper-air observations are monitored on the national level.

7. FORECASTING SYSTEM

The workstation version of the ALADIN limited area model (ALADIN/HU) is operationally launched twice a day providing 48 hour forecasts.

7.1 SYSTEM RUN SCHEDULE

The ALADIN short range forecasting model is launched on the SGI Origin 2000 machine, the data processing and visualisation are made on HP servers and workstations.

7.2 MEDIUM-RANGE FORECASTING SYSTEM (4-10 DAYS)

There isn't any own medium range forecasting model.

7.2.4 OPERATIONAL TECHNIQUES FOR APPLICATION OF NWP PRODUCTS

10 day forecasts of deterministic model and ensemble prediction system of ECMWF is operationally used. Meteorological fields are displayed on workstations by the HAWK (Hungarian Advanced Workstation) visualisation software. Automatic forecast generation is carried out based on the outputs of the ECMWF model until 6 days. The Kalman filter procedure was developed and put into operations for the 2m temperature forecasts of the ECMWF model (see also ALADIN/HU model).

7.3 SHORT-RANGE FORECASTING SYSTEM (0-72 HRS)

7.3.1 DATA ASSIMILATION, OBJECTIVE ANALYSIS AND INITIALIZATION

The operational numerical weather prediction model ALADIN/HU is applied in dynamical adaptation mode, i.e. the initial and lateral boundary conditions of the model are gained by interpolation from the larger scale ALADIN/LACE limited area model. The model integration is preceded by digital filter initialisation.

On the other hand there is an optimal interpolation procedure (executed on an hourly basis), which serves as input for the nowcasting-type applications and procedures. It can be mentioned here that steady efforts were carried out in order to develop a three-dimensional variational (3D-VAR) data assimilation scheme for the ALADIN model.

7.3.2 MODEL

The operational ALADIN/HU limited area NWP model is a version of the ALADIN model for the region around Hungary. The main characteristics of the ALADIN model are as follows:

- Hydrostatic primitive equations;
- The equations are solved using the spectral method having elliptical truncation of bi-Fourier series;
- Hybrid vertical co-ordinates;
- Two-time level semi-lagrangian advection scheme;
- Semi-implicit timestepping;
- 4th order horizontal diffusion,
- Davies-Kallberg coupling (relaxation) scheme;
- The physical parametrization package (simple radiation scheme, Bougeault deep convection scheme etc.) is rather the same than it is for the ARPEGE French global model.

The main characteristics of the ALADIN/HU application are the following:

- Extended domain stretching from the Alps to the Carpathian mountains;
- Integration twice a day (at 00 and 12 UTC) for 48 hours;
- 200*144 points in horizontal and 31 vertical model levels,
- Approximately 8 km of horizontal resolution;
- Coupling by the ALADIN/LACE model every 6 hours;
- Post-processed products every hour for the first 18 hours and 3 hourly afterwards on 32 pressure and 9 height levels.

7.3.3 NUMERICAL WEATHER PREDICTION PRODUCTS

Two-dimensional fields: mean sea level pressure, surface temperature, convective and frontal precipitation (including snow), total cloudiness (including low, medium and high level clouds), surface pressure, snow thickness, 10m wind, 2m temperature and relative humidity, 2m minimum and maximum temperature, pressure and temperature of the ICAO jet, surface pressure tendency, total precipitable water, short wave radiation arriving to the surface..

Three-dimensional fields: These fields are obtained on 9 height levels (on 20, 100, 300, 500, 600, 750, 900, 1250, 1500 metres) in the planetary boundary layer and on 32 pressure levels (on 1000, 990, 980, 970, 960, 950, 940, 925, 900, 880, 860, 850, 840, 820, 800, 780, 760, 740, 720, 700, 650, 600, 550, 500, 450, 400, 350, 300, 250, 200, 150, 100 hPa). The variables are as follows: geopotential (only on pressure levels), pressure (only on height levels), temperature, wind field, relative humidity, pseudo-potential temperature, vertical velocity (only on pressure levels), divergence (only on pressure levels), potential temperature (only on pressure levels), potential vorticity (only on pressure levels) and absolute vorticity (only on pressure levels).

7.3.4 OPERATIONAL TECHNIQUES FOR APPLICATION OF NWP PRODUCTS

Automated forecast generation based on the outputs of the ALADIN models giving 48 hours forecasts. Kalman filter statistical adaptation algorithm was adapted and put into operations for improving the 2m temperature forecasts of the ALADIN/HU model.

8. VERIFICATIONS OF PROGNOSTIC PRODUCTS

ECMWF, ALADIN/LACE and ALADIN/HU products are verified and compared operationally computing simple statistical measures (bias and RMSE) using all the SYNOP and TEMP observations inside the domain of the ALADIN/HU domain. The verification is performed along the EWGLAM (European Working Group for Limited Area Modelling) standards. The automatically generated forecasts are also verified and compared with the forecasts issued by the forecasters.

9. PLANS FOR THE FUTURE

The main plans are listed below:

- Operational implementation of the three-dimensional variational (3D-VAR) data assimilation scheme for the ALADIN model.
- Migration of the ALADIN model and related applications to new IBM p690 (Regatta) server.
- Feasibility study for using the non-hydrostatic version of ALADIN.

10. REFERENCES

Horányi, A., I. Ihász, and G. Radnóti, 1996: ARPEGE/ALADIN: A numerical weather prediction model for Central-Europe with the participation of the Hungarian Meteorological Service. *Időjárás*, 100., 277-300.