

TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA PROCESSING SYSTEM 2003

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1. SUMMARY OF HIGHLIGHTS

At the end of 2002 the Hungarian Meteorological Service received the certificate about the introduction of the quality management system ISO 9001:2000. From that time our data policy is determined strictly according to this standard.

In 2003 basically the same computers were available at the Hungarian Meteorological Service as was the case in 2002: IBM Regatta server and SGI Origin 2000 computer. The ALADIN limited area model is running on the IBM machine and the nowcasting programme package together with the MM5 model is on the SGI machine. The three-dimensional variational data assimilation system (3d-var) of the ALADIN model was intensively developed and tested during 2003.

2. EQUIPMENTS IN USE AT THE CENTRE

IBM Regatta p690 server with 32 processors (1,3 GHz processors), SGI Origin 2000 machine with 16 processors (500 MHz processors), HP L3000 cluster server with 4 CPU, different workstations (HP, DEC, SUN), EMC Clariion FC4700 disk storage system (3 Tbyte native capacity), several LINUX computers (used for: Message Switching System, FTP, mail server, and other special meteorological purposes), CISCO routers and switches.

3. DATA AND PRODUCTS FROM GTS IN USE

The daily statistics of raw information:

SYNOP: 00/06/12/18 UTC	1900
TEMP: 00/12 UTC	100
06/18 UTC	30

The daily statistics of products:

GRID (EGRR): 00/12 UTC	500
(EDZW): 00/12 UTC	70
GRIB (EDZW): 00/12 UTC	650
FAX (EDZW): 00/12 UTC	75
06 UTC	5
18 UTC	30

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 ALADIN limited area model (ALADIN/HU) is operationally launched twice a day providing 48 hour forecasts, the MM5 model is executed several times a day for providing ultra-short range forecasts.

7.1 SYSTEM RUN SCHEDULE

The ALADIN short range forecasting model is launched on the IBM p690 Regatta machine, the data processing and visualisation are made on HP servers and workstations and also on linux PC-s. The three-dimensional variational data assimilation scheme of the ALADIN model is intensively tested and verified in a continuous parallel suite.

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 models until 10 days. The Kalman filter procedure is operational for the 2m temperature forecasts of the ECMWF model (see also ALADIN/HU model). The products of the ensemble prediction system is clustered with a clustering algorithm targeted to the Carpathian Basin.

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 ARPEGE global model. The model integration is preceded by digital filter initialisation.

There is also an optimal interpolation procedure (executed on an hourly basis), which serves as input for the nowcasting-type applications and procedures (so it is not used as initial condition for any NWP model).

Intensive developments were devoted to the application of the three-dimensional variational (3D-VAR) data assimilation scheme for the ALADIN model. The 3D-VAR model version is running in parallel suite in order to test the performance of the data assimilation scheme with respect to the reference (operational) one. Some algorithmic choices (background error statistics, first guesses, etc.) and new data types (local satellite data, aircraft data) were intensively tested.

7.3.2 MODEL

The operational ALADIN/HU limited area NWP model is a version of the ALADIN model for the region over Europe. 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:

- Domain covering continental Europe;
- Integration twice a day (at 00 and 12 UTC) for 48 hours;
- 432*384 points in horizontal and 37 vertical model levels,
- Approximately 6,5 km of horizontal resolution;
- Coupling by the ARPEGE global model every 3 hours;
- Post-processed products every hour for the first 36 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 is operationally running 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 to the forecasts issued by the forecasters.

9. PLANS FOR THE FUTURE

The main plans are listed below:

- Further enhancement of the three-dimensional variational (3D-VAR) data assimilation scheme for the ALADIN model.
- Development and first tests of a limited area ensemble prediction system based on the ALADIN model.

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.