The operational version of the ALADIN model (ALADIN/HU) at the Hungarian Meteorological Service

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OMSZ
Hungarian Meteorological Service

Operational configuration

Main features of the operational ALADIN/HU model
- Model version: AL.26T3
- Initial conditions: 3D-VAR assimilation
- 48 hour production forecasts twice a day
- Boundary conditions from ARPEGE

The ALADIN/HU domain

Model geometry
- 8 km horizontal resolution (349*309 points)
- 49 vertical model levels
- Linear spectral truncation
- Lambert projection

Assimilation settings
- 6 hour assimilation cycle
- short cut-off analyses for the production runs
- NMC background error covariances
- Digital filter initialisation
- LBC coupling at every 3 hours

48h   48h   48h
12 UTC   00 UTC
00 ... 06 ... 12 ... 18 ... 00
DATA DATA DATA DATA DATA

The data assimilation cycle

Observation usage
- SYNOP (geopotential)
- TEMP (T, u, v, q on standard pressure levels)
- ATOVS/AMSU-A (radiances from NOAA 15 and 16) with 80 km thinning distance
- ATOVS/AMSU-B (radiances from NOAA 16 and 17) with 80 km thinning distance
- AMDAR (T, u, v) with 25 km thinning distance and 1 hour time-window, together with a special filter (that allows only one profile in one thinning-box)
- Web-based observation monitoring system

Different observations (SYNOP, TEMP, AMDAR, ATOVS) used in the operational system

Forecast settings
- Digital filter initialisation
- 300 s time-step (two-time-level SISL advection scheme)
- LBC coupling at every 3 hours
- Hourly post-processing in the first 36 hours and 3 hourly afterwards

Operational suite / technical aspects
- Transfer ARPEGE LBC files from Météo-France, Toulouse via Internet and satellite dissemination system (RETIM) as backup
- Model integration on 24 processors
- 3D-VAR on 26 processors
- Post-processing
- Continuous monitoring supported by a web-based system (see below)

The web interface of the 3D-VAR observation monitoring system

The computer system
- IBM p690 server (regatta) + IBM (p655) cluster server + SGI Altix 3700
- CPU: 32 + 32 + 144 processors (1.3 Ghz + 1.7 Ghz + 1.5 Ghz)
- 64 + 128 + 288 Gbyte internal memory
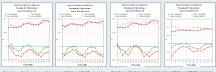- IBM TotalStorage 3584 Tape Library (capacity: ~30 Tbyte)
- Loadleveler job scheduler on IBM
- Totalview debugger (on Regatta)

Plans
- To extend the forecast range from 48 h to 54 h
- To run the model four times a day

The two IBM supercomputers: p690 (first picture) and p655 (second picture), the new SGI Altix 3700 supercomputer (third picture) and the IBM TotalStorage 3584 Tape Library (fourth picture) at HMS

The monitoring system of the operational and parallel suites

At HMS the operational and the test versions of the ALADIN model are running twice a day (00 and 12 UTC). Continuous (24 h) monitoring of these suites is needed. This is done by a group of nine people from the NWP group. To make this work easier it was decided to develop a monitoring system based on PHP scripts. This web-based system has three main components:
- Monitoring of the operational and the parallel suites
- Diary of errors
- Statistics about the runs of the operational suite

Monitoring of different model runs:

The basic idea of the system is to check the existence and size of different files (however, some applications are checked through logfiles). The possible statuses (which are indicated with different colours) of the files/applications are the following:

- **GREEN** File exists, its size is good and it is belonging to the given model run
- **ORANGE** File exists, it is belonging to the given model run, but its size is wrong
- **RED** File is not there (or it is not belonging to the given model run)
- **BLUE** File is there, it is belonging to the given model run, but nothing can be said about its size
- **GREY** No file is required for the given time step

Each suite (at the moment we have an operational and two parallel suites) has its own page. On every page it is possible to choose among different model runs (such as yesterday 00 UTC, yesterday 12 UTC, today 00 UTC, today 12 UTC). It is also possible to set a value for automatic refreshing of the webpage (no refresh, refresh in every 5 minutes and refresh in every 10 minutes are the possible values).

Each page is organized into tables. There are three big tables: for assimilation, for production and for verification. Through these tables information is obtained not only about the name of the machine and the directory where the system looks for the files, but also about the name and size of the files and the date of creation.

The system provides access to different files and directories:
- Cronfiles
- Logfiles, listing files
- Working directories (with err and out files)

The web page of the operational suite. The green colour indicates that all files are ready and the operational run finished successfully. (The pages for the parallel suites are nearly the same.)

Diary of errors

In case of an error in the run of the operational or the parallel suites, one might feel important to:
- Share the problem with the others
- Make a note about it

Therefore it became important to implement this feature in the monitoring system. Through a web page detailed description of the errors can be sent. These are stored and also sent automatically via email to the other members of the NWP group.

Web page for the diary of errors.

Statistics about the operational suite

Statistics are available through the system in different forms: diagrams and tables for a given model run or for a longer period.

Example of statistics for a longer period in a box plot form. The different applications of the operational run are on the x axis, while the time when they finished is on the y axis.

Example of statistics for a longer period. The application is the downloading of the coupling files. On the x axis are the days, on the y axis is the time when the last file arrived.

Verification

Objective verification
An interactive web-based verification system (called OVISYS: Objective Verification System) has been developed. It provides the verification of NWP forecasts used at HMS against SYNOP observations, including: scatterplots, contingency tables, maps and temporal evolution diagrams (ME, MSE, MAE, BIAS, RMSE), probability distributions and wind-direction pie charts. The extension of the system to use TEMP and AMDAR observations is also under development.

In the following the objective and subjective scores will be presented for the time period 2005/12/01-2006/03/01. As objective scores the BIAS and RMSE values of ECMWF and ALADIN/HU and also of MM5 and ALADIN/HU are compared for the area of Hungary. From the results of the subjective verification a comparison between ALADIN/HU and ECMWF is presented.

Subjective verification
The main motivation of this kind of activity was to get a complex view about the forecast quality over Hungary, especially for variables that are hard to evaluate in an objective way (e.g. cloudiness, precipitation). The present system includes the comparison of the 0-48 h forecasts of 3 different ALADIN model versions and ECMWF. The 5-degree qualification (the higher the better) indices together with some additional data (e.g. synoptic situation) are fed into a database that can be accessed through a web interface.

Total cloudiness

Objective verification scores. Comparison of BIAS and RMSE values for total cloudiness between ECMWF and ALADIN/HU for Hungary for the 00 (left) and 12 UTC (right) runs.

Objective verification scores. Comparison of BIAS and RMSE values for total cloudiness between MM5 and ALADIN/HU for Hungary for the 00 (left) and 12 UTC (right) runs.

Subjective verification scores for total cloudiness. Comparison of ECMWF (ECM) and ALADIN/HU (AL_OPER) for Hungary for the time period covering the first (left) and the second (right) day of the ALADIN forecast. Scores are computed for the period covering December 2005-February 2006.

2 meter temperature

Objective verification scores. Comparison of BIAS and RMSE values for 2 meter temperature between ECMWF and ALADIN/HU for Hungary for the 00 (left) and 12 UTC (right) runs.

Objective verification scores. Comparison of BIAS and RMSE values for 2 meter temperature between MM5 and ALADIN/HU for Hungary for the 00 (left) and 12 UTC (right) runs.

Subjective verification scores for 2 meter temperature. Comparison of ECMWF (ECM) and ALADIN/HU (AL_OPER) for Hungary for the time period covering the first (left) and the second (right) day of the ALADIN forecast. Scores are computed for the period covering December 2005-February 2006.

Subjective verification scores for 2 meter temperature. Comparison of ECMWF (ECM) and ALADIN/HU (AL_OPER) for Hungary for the time period covering the first (left) and the second (right) day of the ALADIN forecast. Scores are computed separately for the all three month of the period December 2005-February 2006.
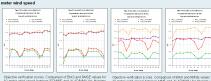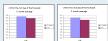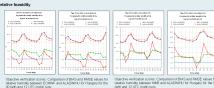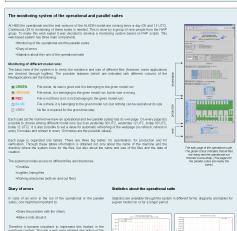
10 meter wind speed

Objective verification scores. Comparison of BIAS and RMSE values for 10 meter wind speed between ECMWF and ALADIN/HU for Hungary for the 00 (left) and 12 UTC (right) runs.

Objective verification scores. Comparison of BIAS and RMSE values for 10 meter wind speed between MM5 and ALADIN/HU for Hungary for the 00 (left) and 12 UTC (right) runs.

Subjective verification scores for the 10 meter wind speed. Comparison of ECMWF (ECM) and ALADIN/HU (AL_OPER) for Hungary for the time period covering the first (left) and the second (right) day of the ALADIN forecast. Scores are computed for the period covering December 2005-February 2006.

Relative humidity

Objective verification scores. Comparison of BIAS and RMSE values for relative humidity between ECMWF and ALADIN/HU for Hungary for the 00 (left) and 12 UTC (right) runs.

Objective verification scores. Comparison of BIAS and RMSE values for relative humidity between MM5 and ALADIN/HU for Hungary for the 00 (left) and 12 UTC (right) runs.

Summary of the verification results

It can be concluded that for the examined 3 month period, all models (ECMWF, ALADIN/HU, MM5) overestimated the 10 meter wind speed (positive BIAS in every time step), and in the ALADIN model the relative humidity was also overestimated. On the other hand the total cloudiness had negative BIAS.

Comparing the scores of ECMWF and ALADIN/HU it can be realized that the RMSE values are quite similar. This holds for both the 00 and the 12 UTC runs. There was more difference in the case of BIAS. (There is a slight advantage to the ALADIN/HU model except for relative humidity.)

Comparing ALADIN/HU and MM5, ALADIN was better for all parameters in nearly every time steps. The most significant difference occured in the case of 10 meter wind speed.

In case of any question ask:

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