

JOINT WMO TECHNICAL PROGRESS REPORT ON THE GLOBAL DATA PROCESSING AND FORECASTING SYSTEM AND NUMERICAL WEATHER PREDICTION RESEARCH ACTIVITIES FOR 2007

[TURKEY/Turkish State Meteorological Service]

1. Summary of highlights

TSMS has become a full member of ALADIN project starting from 01.01.2008.

2. Equipment in use

IBM P690 is used for running MM5 model. IBM P630 servers are used for post-processing and intranet purposes.

- One IBM P690 Power4 High Performance Computer
 - ✓ 1 node with 16 CPUs (each 1.3 Ghz)
 - ✓ 32 GB total memory size
 - ✓ 16x36.4 GB hard disk capacity
- One IBM pseries P630 (Data and Product Server)
 - ✓ 4 CPUs (each 1.45 Ghz)
 - ✓ 4 GB total memory size
 - ✓ 25x36.4 GB hard disk capacity
- One IBM pseries P630 (Test Server)
 - ✓ 2 CPUs (each 1.45 Ghz)
 - ✓ 2 GB total memory size
 - ✓ 11x36.4 GB hard disk capacity
- 10 Intel P4 based workstations having Linux and Windows 2000 operating systems.
 - ✓ 3.0 Ghz CPU speed
 - ✓ 72 GB SCSI hard disk capacity
 - ✓ 2 GB RAM

Since 1998, the following systems have been in operation;

- SGI Onyx2 workstation (IRIX operating system)
 - ✓ 2 CPUs (MIPS R10000 RISC, each 180 Mhz)
 - ✓ 640 MB memory
 - ✓ 25 GB hard disk capacity
- SGI 2200 workstation (IRIX operating system)
 - ✓ 2 CPUs (MIPS R12000 RISC, each 300 Mhz)
 - ✓ 1 GB memory
 - ✓ 60 GB hard disk capacity

MSS Hardware Details:

Cluster & Archiving Servers

- 2x Intel Xeon MP 3.66 Ghz, 1 MB , 667 MHz (Up to 4x CPU)
- 4 GB DDR' 400 MHz ECC SDRAM (Up to 64 GB)
- 2x 146 GB SCSI U320 HDD
- DVD-RW/DVD-RAM
- 4x Gigabit Ethernet NIC (2 inbuilt, 2 extra)
- Tape Kit VXA-2 80 GB

Sadis 2G

- Sadis 2G Receiver /Decoder
- Satellite Modem
- Vad EDGE 4200 decoder

3. Data and Products from GTS in use

- SYNOP-500 (please modify according to your situation)
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Synop and upper air observations are ready to disseminate BUFR.

4. Forecasting system

4.1 System run schedule and forecast ranges

MM5 is used for short-range forecast at Turkish State Meteorological Service (TSMS). Forecast integration time is 48 hours and it takes 75 minutes to run. It is run four times in a day.

ALADIN is also used for short-range forecast at TSMS. Forecast integration time is 48 hours.

4.2 Medium range forecasting system (4-10 days)

ECMWF's IFS and EPS products are used for medium-range forecast.

4.2.1 Data assimilation, objective analysis and initialization

4.2.1.1 In operation

"[information on Data assimilation, objective analysis and initialization]"

4.2.1.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.2.2 Model

4.2.2.1 In operation

"[Model in operational use, (*resolution, number of levels, time range, hydrostatic?, physics used*)] "

4.2.2.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.2.3 Operationally available Numerical Weather Prediction Products

Ten days forecasts are retrieved 2 times in a day from ECMWF. Those data are processed by a program called as metview which is freely available to member states by ECMWF.

Some of the products are MSLP, precipitation, pressure level charts, 10 meters wind, snowfall, snowdepth etc.

4.2.4 Operational techniques for application of NWP products (*MOS, PPM, KF, Expert Systems, etc..*)

4.2.4.1 In operation

"[brief description of automated (formalized) procedures in use for interpretation of NWP output]"

Kalman Filter has been applied for 2 meter maximum and minimum temperature of the direct model output of ECMWF since 2001.

4.2.4.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.2.5 Ensemble Prediction System (EPS)

4.2.5.1 In operation

"[Number of runs, initial state perturbation method, perturbation of physics?]" (*Describe also: time range, number of members and number of models used: their resolution, number of levels, main physics used*)

4.2.5.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.2.5.3 Operationally available EPS Products

"[brief description of variables which are outputs from the EPS]"

EPS products for 15 days forecasts are retrieved from ECMWF. These data is processed by metview and TSMS's forecasters can use EPS charts via TSMS NWP's intranet page. Products are as follows;

- Total Precipitation
- 850 hPa temperature anomaly
- 500 hPa geopotential and temperature
- 1000 hPa geopotential and 850 hPa temperature
- Ten meters wind speed
- EPSgrams

4.3 Short-range forecasting system (0-72 hrs)

MM5-V3 model is run four times in a day on the TSMS's servers. Boundary data called as BC suite is retrieved from ECMWF to run MM5 operationally.

ALADIN model is run twice in a day and boundary conditions are retrieved from Meteo-France.

4.3.1 Data assimilation, objective analysis and initialization

4.3.1.1 In operation

"[information on Data assimilation (*if any*), objective analysis and initialization,]" (*Indicate boundary conditions used*)

There is no data assimilation progress for short-range forecasting system at the moment but it is planned to run ALADIN model with 3DVar.

4.3.1.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.3.2 Model

4.3.2.1 In operation

"[Model in operational use, (*domain, resolution, number levels, range, hydrostatic?, physics used*)] "

MM5 which is a non-hydrostatic model is run 4 times in a day. Mesh-size is 7 km for inner domain and 21 km for outer domain. Number of vertical levels are 32. Time interval is 69 seconds. Forecast period is 48 hours.

For the operational use of model at Turkish State Meteorological Service the following schemes are selected:

- The Kain-Fritsch scheme for the convective parameterization
- Reisner schemes (mixed-phase) for microphysical parameterization
- MRF PBL for the planetary boundary layer

ALADIN which is a hydrostatic model is run twice in a day. Mesh-size is 10 km. number of vertical levels 60. Forecast period is 48 hours.

4.3.2.2 Research performed in this field

"[Summary of research and development efforts in the area]"

A library has been developed for MM5 by TSMS NWP team. That library makes easier to read MM5 model outputs and get the values of parameters from the MM5 output.

4.3.3 Operationally available NWP products

"[brief description of variables which are outputs from the model integration]"

Grads, RIP and NCL programs are used to process MM5 model output. Some of the products are given as follows;

- Convective and Total precipitation
- Pressure level charts (850, 700, 500, 300, 200 hPa etc)
- MSLP
- Thickness chart
- Vorticity
- Streamlines
- Divergence
- Meteograms
- Skew-T – Log P charts

4.3.4 Operational techniques for application of NWP products

4.3.4.1 In operation

"[brief description of automated (formalized) procedures in use for interpretation of NWP output]"
(MOS, PPM, KF, Expert Systems, etc..)

Kalman Filter is applied for 2 meter temperatures of MM5 outputs.

4.3.4.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.3.5 Ensemble Prediction System

There is no activities performed in that area.

4.3.5.1 In operation

"[Number of runs, initial state perturbation method, perturbation of physics?]" (Describe also: time range, number of members and number of models used: their domain, resolution, number of levels, main physics used)

4.3.5.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.3.5.3 Operationally available EPS Products

"[brief description of variables which are outputs from the EPS]"

4.4 Nowcasting and Very Short-range Forecasting Systems (0-6 hrs)

There are four radars in Turkey. These radars are located in the western part of Turkey.

4.4.1 Nowcasting system

4.4.1.1 In operation

"[information on processes in operational use, as appropriate related to 4.4]"

Radars, satellite images and NWP model outputs are used for nowcasting purposes.

4.4.1.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.4.2 Models for Very Short-range Forecasting Systems

4.4.2.1 In operation

"[information on models in operational use, as appropriate related to 4.4]"

4.4.2.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.5 Specialized numerical predictions

[Specialized NP on sea waves, sea ice, tropical cyclones, pollution transport and dispersion, solar ultraviolet (UV) radiation and air quality forecasting etc.]

METU-3 (Middle East Technical University-Version 3) wave model is used marine forecast. It has 9 km resolution over Mediterranean Sea, 1 km resolution over Marmara Sea and 3 km resolution over Black Sea. Forecast range is 72 hours.

ECMWF or MM5 model outputs are used for running METU-3 model.

4.5.1 Assimilation of specific data, analysis and initialization (where applicable)

4.5.1.1 In operation

"[information on the major data processing steps, where applicable]"

4.5.1.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.5.2 Specific Models

4.5.2.1 In operation

"[information on models in operational use, as appropriate related to 4.5]"

4.5.2.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.5.3 Specific products operationally available

"[brief description of variables which are outputs from the model integration]"

Inversion forecast is available by using MM5 model outputs.

ECMWF monthly forecast is used for extended range forecast. So there is no extended range forecast running on TSMS's servers.

4.6 Extended range forecasts (ERF) (10 days to 30 days)

4.6.1 Models

4.6.1.1 In operation

"[information on Models and Ensemble System in operational use, as appropriate related to 4.6]"

4.6.1.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.6.2 Operationally available NWP model and EPS ERF products

"[brief description of variables which are outputs from the model integration]"

- Precipitation
- 2 meters temperature
- Temperature
- MSLP

4.7 Long range forecasts (LRF) (30 days up to two years)

4.7.1 In operation

"[Describe: Models, Coupled? (1 tier, 2 tiers), Ensemble Systems, Methodology and Products]"

4.7.2 Research performed in this field

"[Summary of research and development efforts in the area]"

4.7.2 Operationally available EPS LRF products

"[brief description of variables which are outputs from the model integration]"

- Precipitation
- 2 meters temperature
- Temperature
- MSLP

5. Verification of prognostic products

5.1 "[annual verification summary to be inserted here]"

The simple statistics (bias, mean error, mean absolute error and root mean square error) are computed on a basis for ECMWF dissemination fields. Interpolated model outputs of local weather parameters (maximum temperature, minimum temperature and 12 UTC of 2 meter temperature, mean sea level pressure and total precipitation) verified with corresponding observations. For this process, suitable time steps of model outputs were used. For 60 Turkish stations, operationally verified parameters and its periods are given in below:

- Daily Maximum and Minimum Temperature; D+1;
- Scores: ME, MAE, RMSE.
- Mean Sea Level Pressure and 2m. Temperature at 12.00 UTC: D+1,..., D+6;
- Scores: ME, MAE, RMSE.
- Total Precipitation existence: D+1, D+2, D+3;
- Scores: BIAS, HIT, FAR, TS, POD.
- 1000, 850, 700, 500 and 300 hPa Height and Temperature;
- Scores: ME, MAE, RMSE.

5.2 Research performed in this field
"[Summary of research and development efforts in the area]"

6. Plans for the future (*next 4 years*)

6.1 Development of the GDPFS

6.1.1 "[major changes in the Operational DPFS which are expected in the next year]"

A new HPC system is planning to install in 2008. MM5 and ALADIN model characteristics will be changed especially on horizontal and vertical resolution, domain size and forecast period.

6.1.2 "[major changes in the Operational DPFS which are envisaged within the next 4 years]"

6.2 Planned research Activities in NWP, Nowcasting and Long-range Forecasting

"[Summary of planned research and development efforts in NWP, Nowcasting and LRF for the next 4 years]"

6.2.1 Planned Research Activities in NWP

6.2.2 Planned Research Activities in Nowcasting

6.2.3 Planned Research Activities in Long-range Forecasting

7. References

"[information on where more detailed descriptions of different components of the DPFS can be found]"
(Indicate related Internet Web sites also)