TURKISH STATE METEOROLOGICAL SERVICE

Annual WWW Technical Progress Report on the GDPFS for the year 2003

1. Summary of highlights

New IBM computer systems and short-range forecasting system were implemented at Turkish State Meteorological Service during the second half of 2003. MM5V3 model is used for short-range forecasting with two nests (27 km. for coarse domain, 9 km for inner domain), 23 vertical levels. The required progress for running MM5 with ECMWF BC-Suite frame data was performed. At the moment, MM5 is run operationally four times a day (00, 06, 12, 18 UTC) with initial and boundary conditions from ECMWF BC-Suite frame data.

2. Equipment in use at Turkish State Meteorological Service

The implementation of new IBM computer systems was completed in the second half of 2003. The current computer systems are given below:

IBM pSeries 690 High Performance Computer

1 node with 16 CPUs (per 1.3 Ghz)
32 GB total memory size
16x36.4 GB hard disk capacity

IBM pSeries P630 (Data and Product Server)

4 CPUs (per 1.45 Ghz)
4 GB total memory size
25x36.4 GB hard disk capacity

IBM pSeries P630 (Post Processing and back-up to Data and Product Server)

2 CPUs (per 1.45 Ghz)
2 GB total memory size
11x36.4 GB hard disk capacity

IBM pSeries P630 (Test Server)

2 CPUs (per 1.45 Ghz)
2 GB total memory size
4x36.4 GB hard disk capacity

Intel P4 based workstations having SuSE Linux 8.2 and Windows XP operating systems.

3.0 Ghz CPU speed

72 GB SCSI hard disk capacity

2 GB RAM

SGI Onyx2 workstation (IRIX operating system)

2 CPUs (MIPS R10000 RISC, per 180 Mhz)

640 MB memory

25 GB hard disk capacity

SGI 2200 workstation (IRIX operating system)

2 CPUs (MIPS R12000 RISC, per 300 Mhz)

1 GB memory

60 GB hard disk capacity

3. Data and Products from GTS in use

ECMWF and Offenbach are two main connection points over GTS. Products such as TAFs, METARs, SYNOPs, TEMPs are operationally received.

4. Data input system

An automated system called MESSIR-COM (running on Intel based UNIX workstations) is used for data exchange over GTS and RMDCN.

5. Quality control system

Data quality system based on code controlling is performed by both MESSIR-COM and a software developed at Turkish State Meteorological Service. Observations are stored on SGI Origin 300 UNIX servers.

6. Monitoring of observing system

Surface and upper level observations are monitored for our observational network.

7. Forecasting system

7.1 System run schedule and forecast ranges

MM5V3 is running operationally four times a day at main synoptic hours (00, 06, 12, 18 UTC). The range of the each run is 48 hours.

7.2 Medium range forecasting system (4-10 days)

ECMWF Deterministic Model and Ensemble Prediction System (EPS) model outputs are used for medium range forecasting.

7.3 Short-range forecasting system (0-72 hours)

MM5V3 is run for short-range forecasting. Two domains are used for short-range forecasting. The resolution of coarse domain is 27 km and inner is 9 km. The forecasts produced by coarse domain are used as an input by inner domain.

7.3.1 Data assimilation, objective analysis and initialization

Implementation of 3DVAR system for MM5 is still in progress. National observations obtained from SYNOP, TEMP and AWOS (Automatic Weather Observation Stations) have been tested to improve forecast skill of MM5. These observations are given to MM5 as an input.

7.3.2 Model

A finite difference scheme and a time-split explicit method for the basis equations are used. Several physical parameterization schemes are available in the model for the boundary layer, the radiative transfer, the microphysics and the cumulus convection. Use of model at Turkish State Meteorological Service for the operational, 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
RRTM long wave radiation for radiation scheme

7.3.3 Numerical Weather prediction products

Meteorological fields are produced for forecasters at surface and pressure levels. These fields are temperature, relative humidity, wind, vertical velocity etc. at surface and pressure levels, precipitation (large scale and convective), snow mixing ratio, etc. at surface.

7.3.4 Operational Techniques for application of NWP products

ECMWF Deterministic model outputs are also used for short-range forecasting. One dimensional KALMAN filtering is applied to two meters maximum and minimum temperature for 70 domestic and 31 foreign stations from D+1 to D+4. Instability indicies are also calculated, based on parameters from ECMWF Deterministic model. It is also planned to apply KALMAN filtering to 2 meters maximum and minimum temperatures of MM5.

7.4 Specialized forecasts

Metu3 wave model which is originally developed at Middle East Technical University -Turkey is used to produce daily wave forecasts. ECMWF Deterministic model outputs are used as boundary and initial conditions for Metu3.

7.5 Extended range forecasts

ECMWF-EPS is used for extended range forecasting.

7.6 Long-range forecasts

ECMWF seasonal forecast is used for long range forecasting.

8. Verification of prognostic products

There were no changes in 2003 regarding the interpretation and verification of numerical weather prediction models at Turkish State Meteorological Service. 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. Suitable time steps of model outputs were used for this process. Operationally verified parameters and its periods are given in below for 60 Turkish stations:

- 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

9. Plans for the future

- Implementation of 3DVAR system for MM5.
- Running MM5 with higher resolution (3 km.) at inner domains for nowcasting purposes.
- Implementation of KALMAN FILTERING for MM5 outputs.

10. References

Dudhia, J., 1993: A non-hydrostatic version of the Penn State/NCAR mesoscale model: validation tests and simulation of an Atlantic cyclone and cold front. Mon. Wea. Rev. , 121, 1493-1513.

Kain, J.S., and J.M. Fritsch, 1993: Convective parameterization for mesoscale models: The Kain-Fritsch scheme. The Representation of Cumulus in numerical models, Meteor. Monogr., No 46, Amer. Met., Soc., 165-167.

Schultz, P., 1995: An explicit cloud physics parameterization for operational numerical weather prediction. Mon. Wea. Rev., 123, 3331-3343