Application and verification of ECMWF products in Turkey

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1. Summary of major highlights

There is no any major development in verification reports.

2. Use and Application of Products

2.2.2 Physical Adaptation

MM5 Model

A meso-scale MM5 model run operationally 4 times a day for 48 hours using the boundary and initial conditions obtained from ECMWF BC-Suite Project. MSL pressure, sea surface temperature, and upper level temperature, height, u-v wind components and relative humidity parameters are used as initial conditions for MM5.

METU-3 Wave Model

METU-3 is a wind-wave prediction model developed by Coastal and Harbor Engineering Research Center of Middle East Technical University. METU-3 is running operationally at TSMS for wind wave forecast around Turkey. METU-3 is running 2 times a day using 10 meter u-v wind components of ECMWF deterministic model outputs as initial conditions. METU Wave model outputs are significant wave height, mean wave periods and 10 meter wind speed.

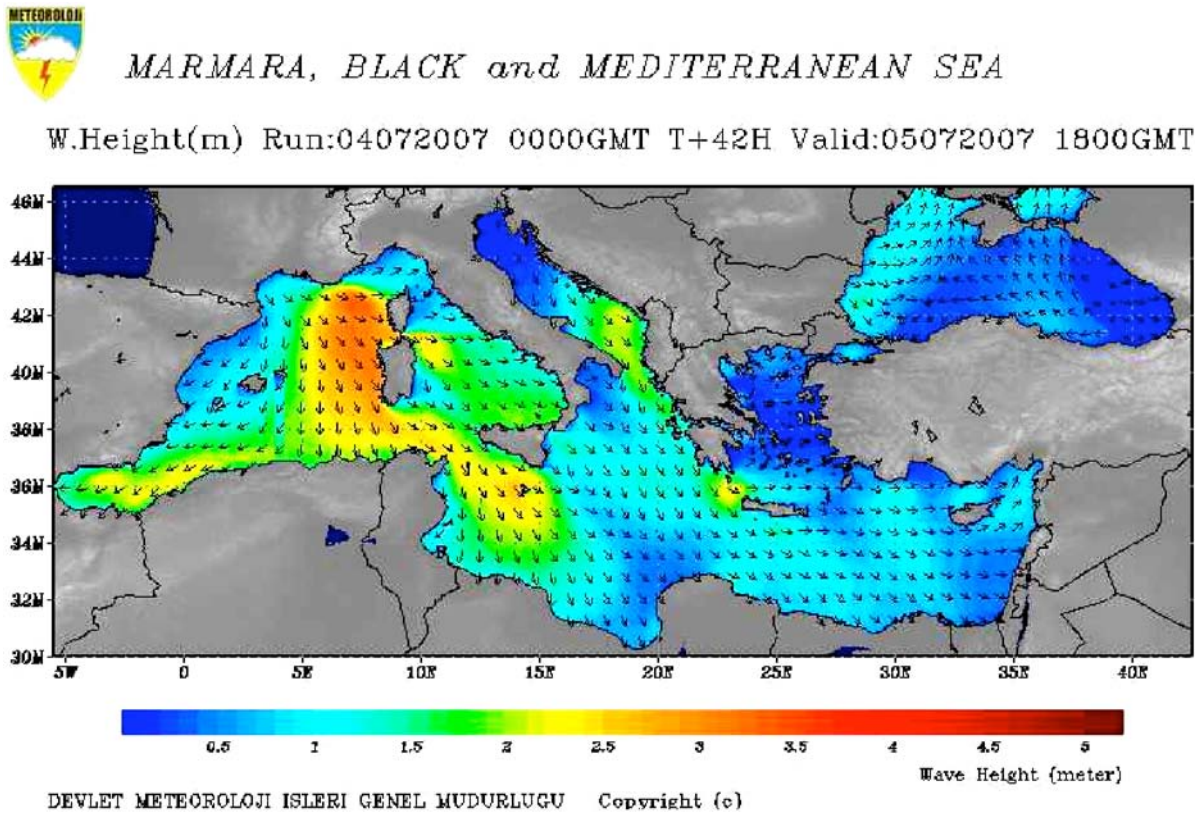

Fig. 2.2.2.1 METU-3 Wave Height Forecasts for T+42

3. Verification of Products

3.1 Objective Verification

3.1.1 Direct ECMWF Model Outputs

24 hourly forecasts between T+00 and T+144 of 12 UTC and 00 UTC deterministic model run are operationally verified with standard statistical scores (mean error, root mean square error and mean absolute error). For the verification of all parameters, 60 Turkish synoptic stations were used, covering the period from January to December 2005.

(i) In the free atmosphere

In the verification process of upper level parameters, observations of 7 our radio-sonde stations used for calculations. For other stations ECMWF analyses values were used.

(ii) Local weather parameters

Interpolated model outputs of local weather parameters (maximum, minimum and 12 UTC of 2 meter temperature, mean sea level pressure, and total precipitation) verified with the corresponding observations. For this process, suitable time steps of model outputs were used. Verified parameters and its periods for the year 2005 are given in below:

- Daily Maximum and Minimum Temperature; D+1, D+2, ..., D+7;
  Scores: ME, RMSE, MAE.
- Mean Sea Level Pressure and 2 m Temperature : D+1, D+2, ..., D+7;
  Scores: ME, RMSE, MAE.
- Total Precipitation existence and contingency tables with 6 categories (0, 0.1-1, 1-5, 5-10,10-20, 20<mm) : D+1, D+2, D+3 ;
  Scores: BIAS, HIT, FAR, TS, POD.
- 1000, 850, 700, 500 and 300 hPa Height and Temperature: D+1, D+2, ..., D+7 ;
  Scores: ME, RMSE, MAE.

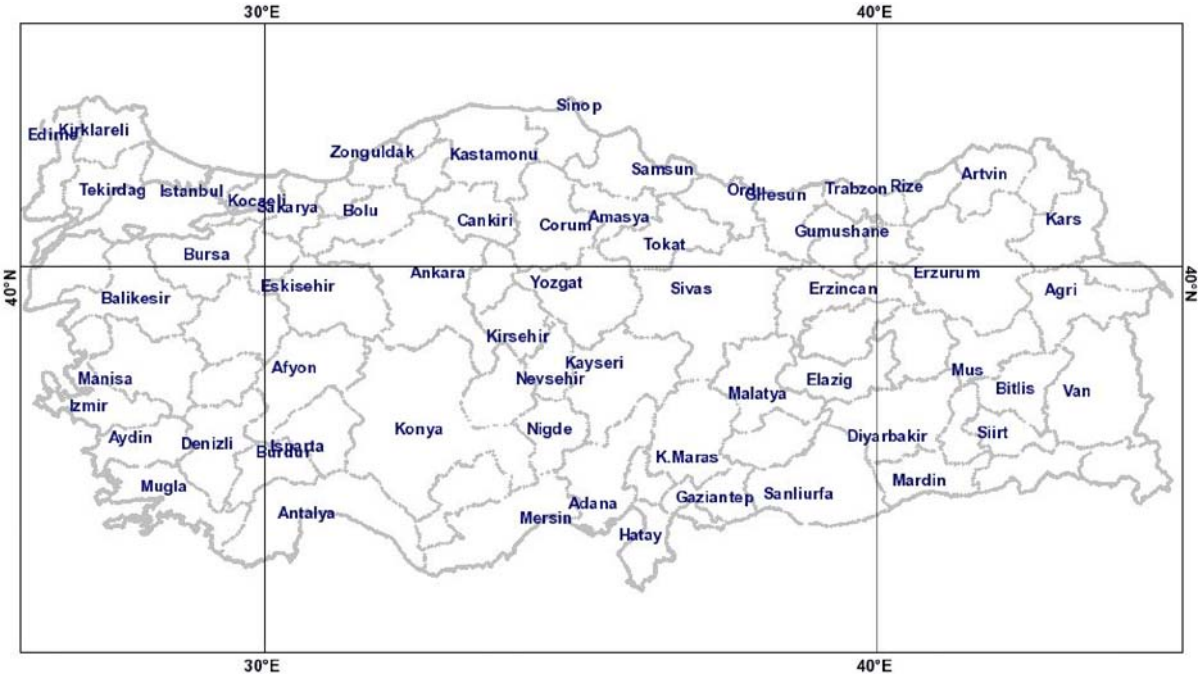

Fig. 3.1.1.1 Turkish synoptic and radio-sonde stations used in this study.

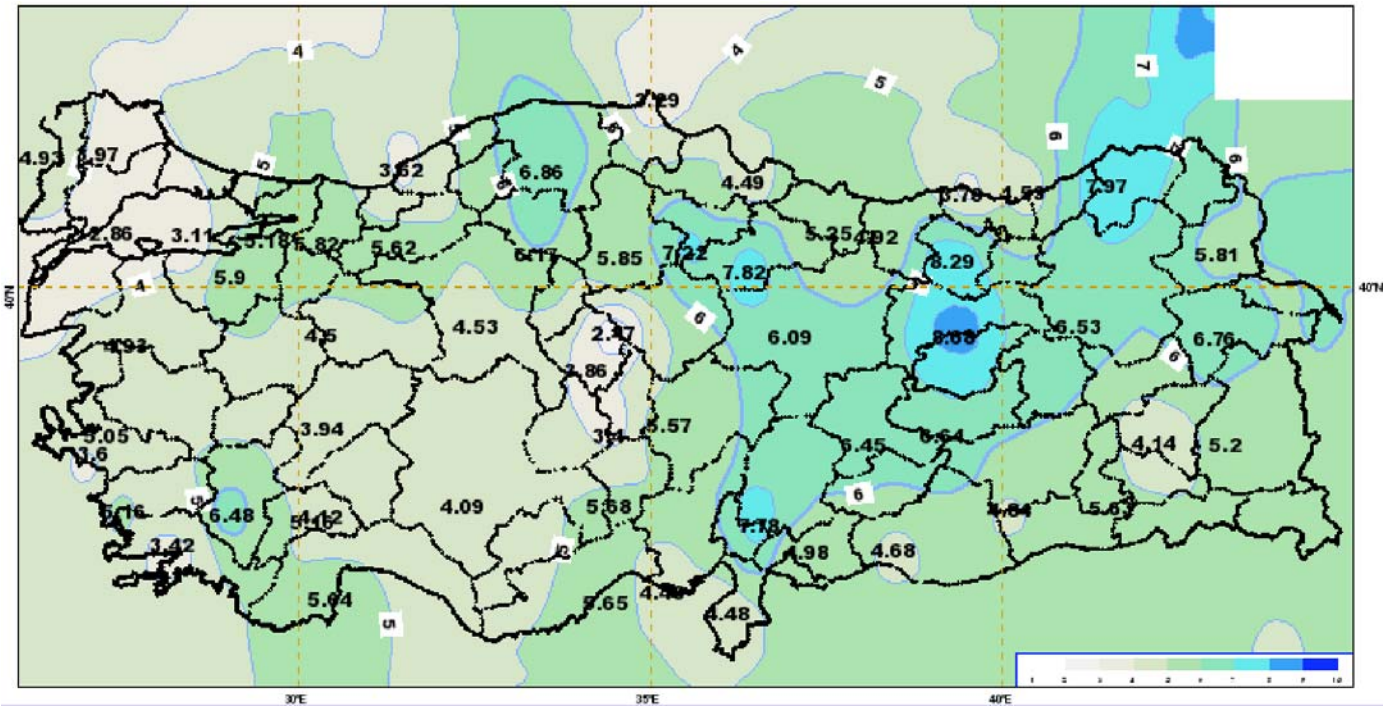

Fig. 3.1.1.2 00 UTC RMSE Values of Maximum Temperature D+1.

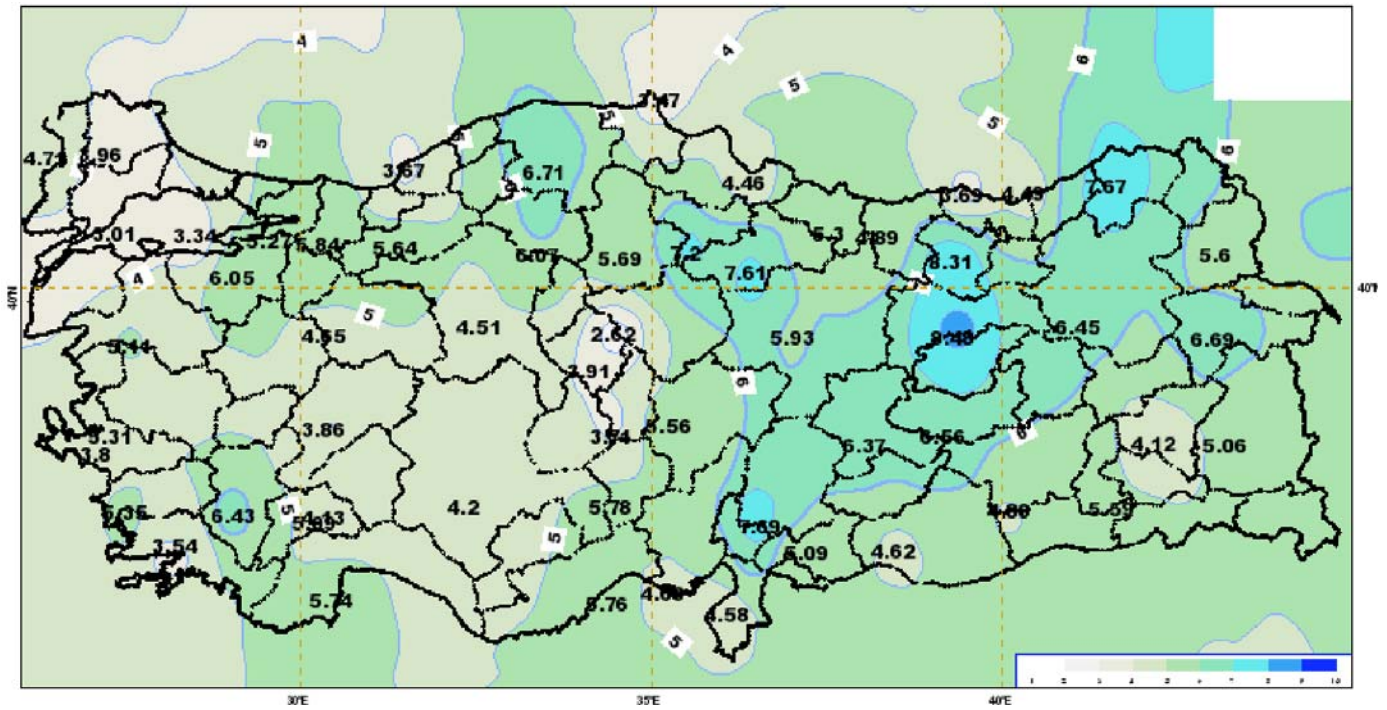

Fig. 3.1.1.3 00 UTC RMSE values of Maximum temperature for D+3.

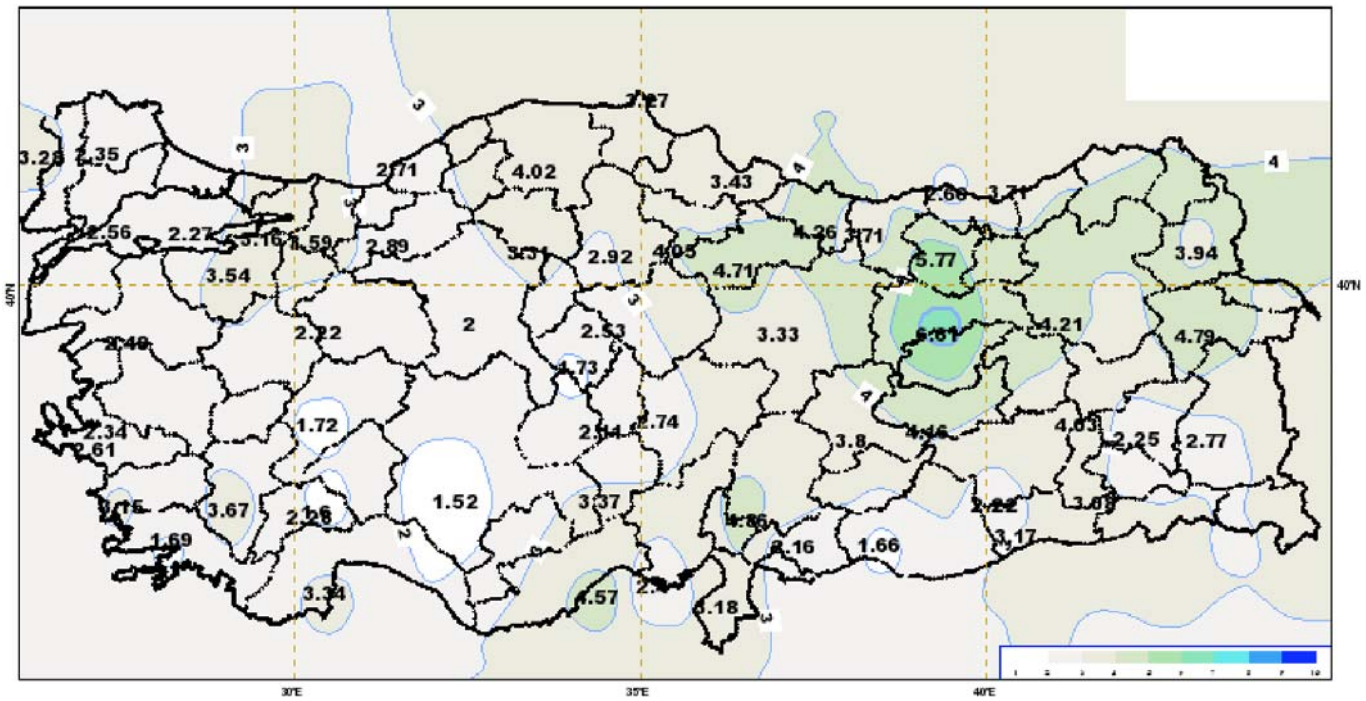

Fig. 3.1.1.4 12 UTC RMSE Values of 2m Temperature for D+1

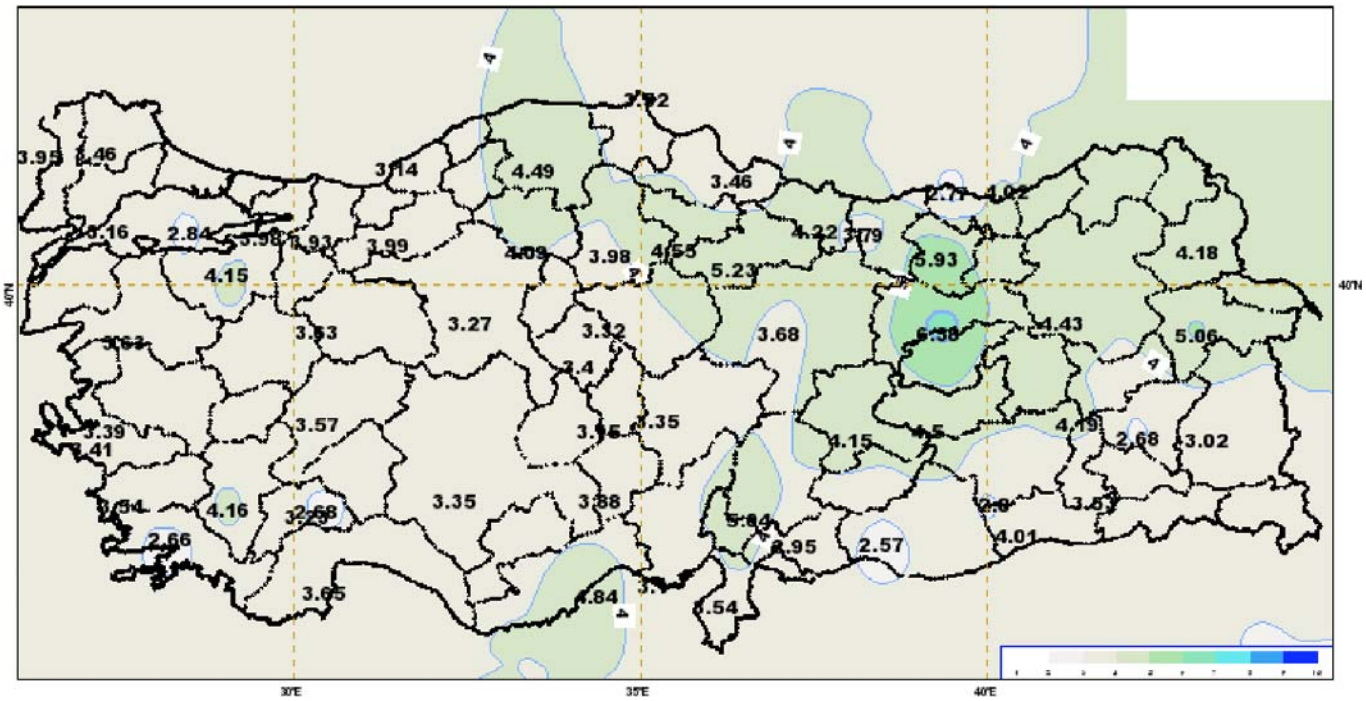

Fig. 3.1.1.5 12 UTC RMSE Values of 2m. Temperature for D+6

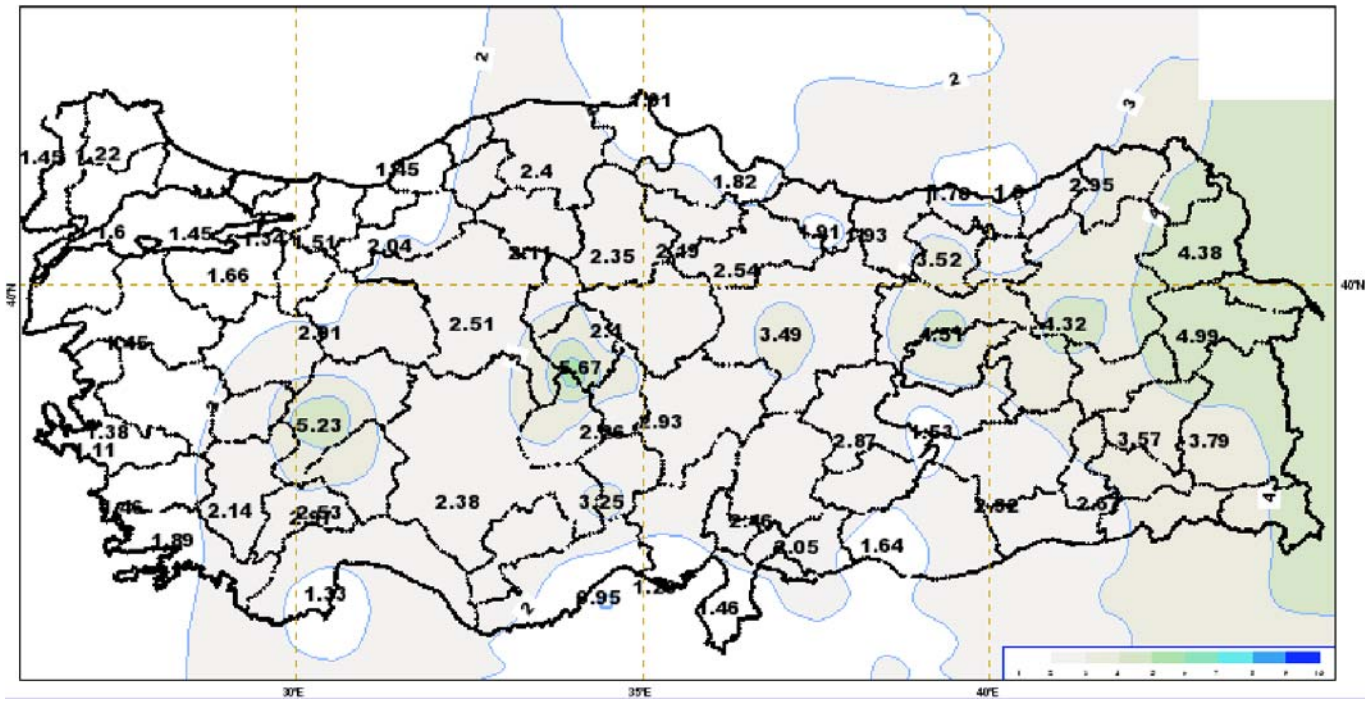

Fig. 3.1.1.6 00 UTC RMSE Values of Mean Sea Level Pressure for D+1

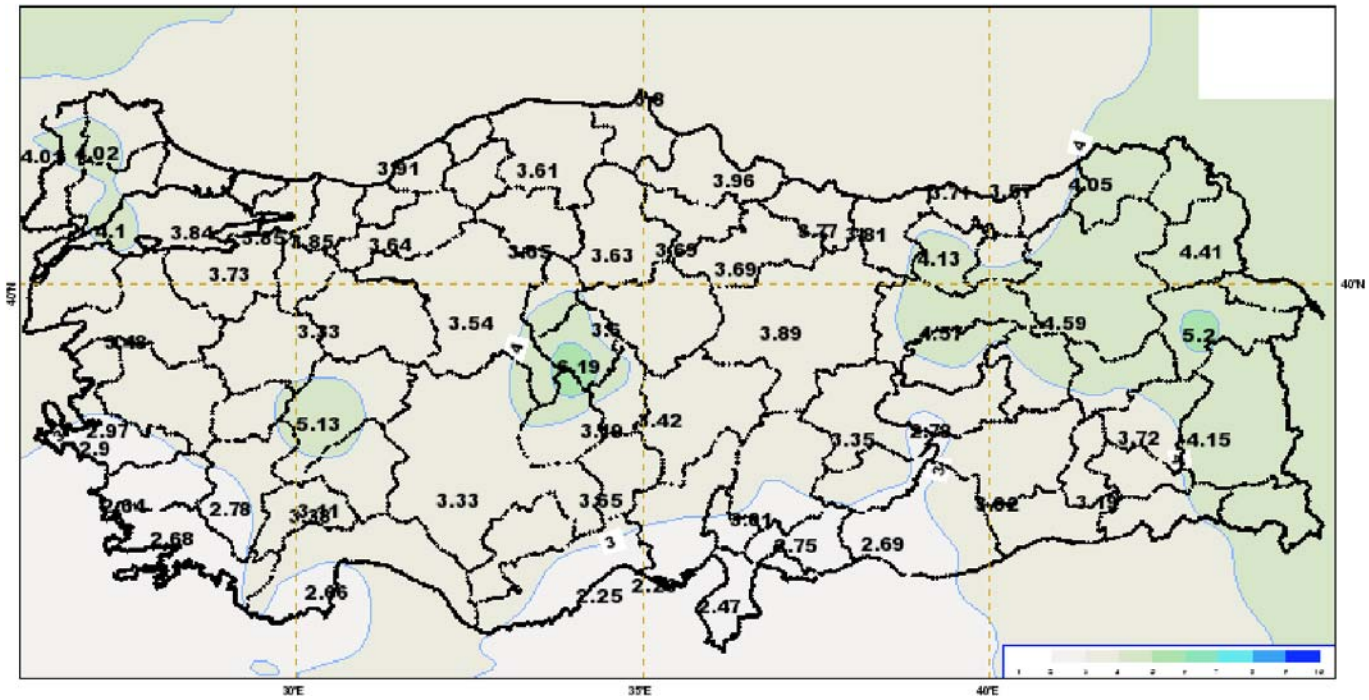

Fig. 3.1.1.7 00 UTC RMSE Values of Mean Sea Level Pressure for D+7

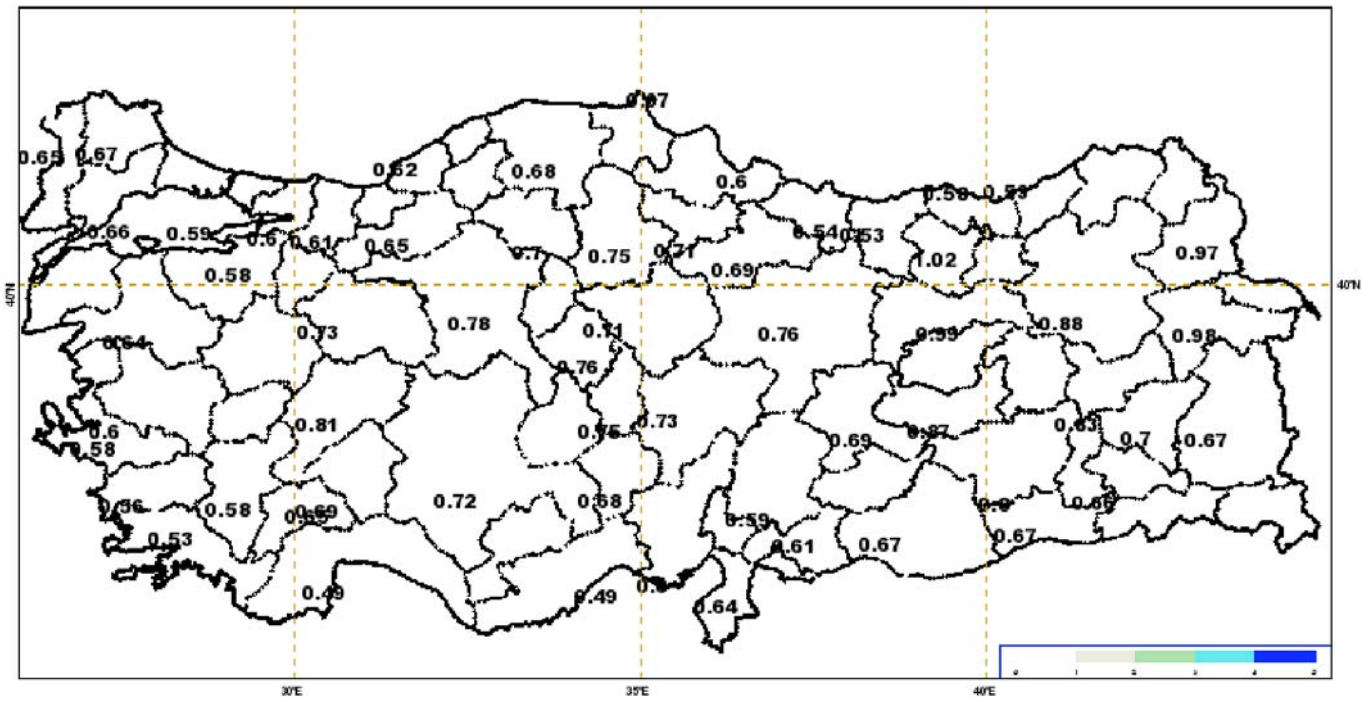

Fig. 3.1.1.8 12 UTC RMSE Values of 850 hPa Temp. for D+1

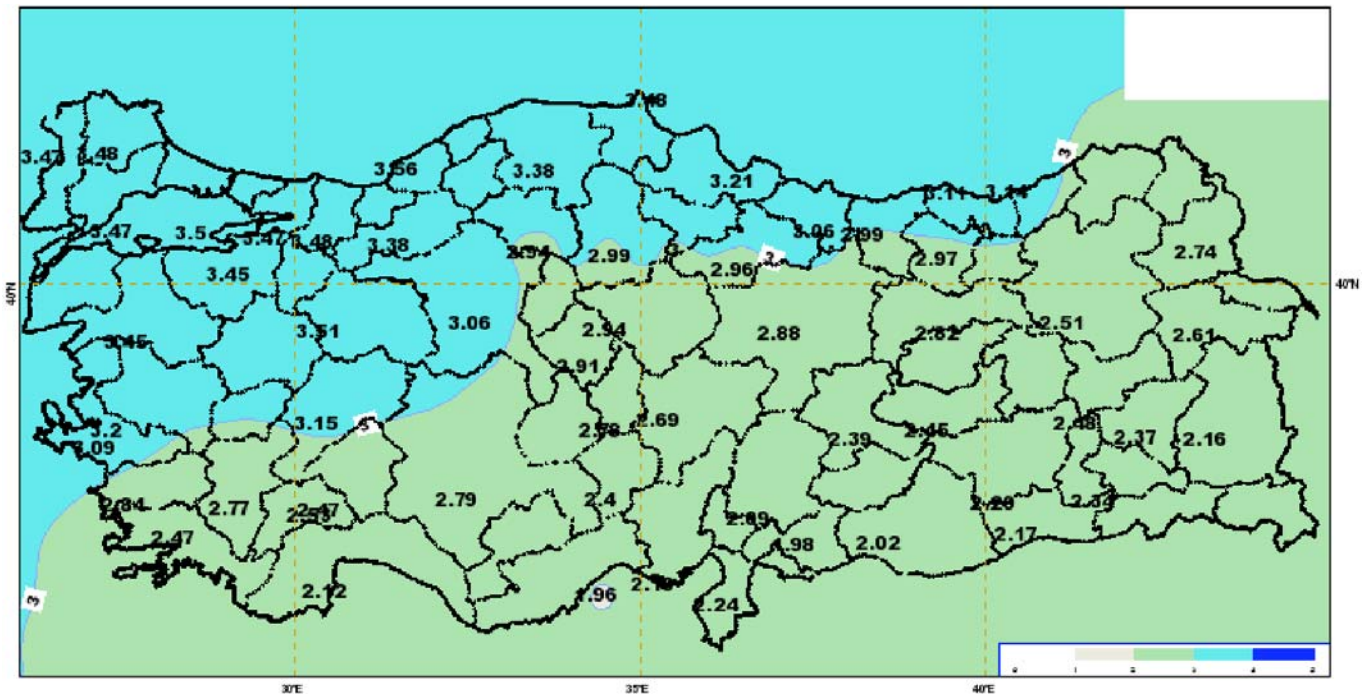

Fig. 3.1.1.9 12 UTC RMSE Values of 850 hPa Temp. for D+7

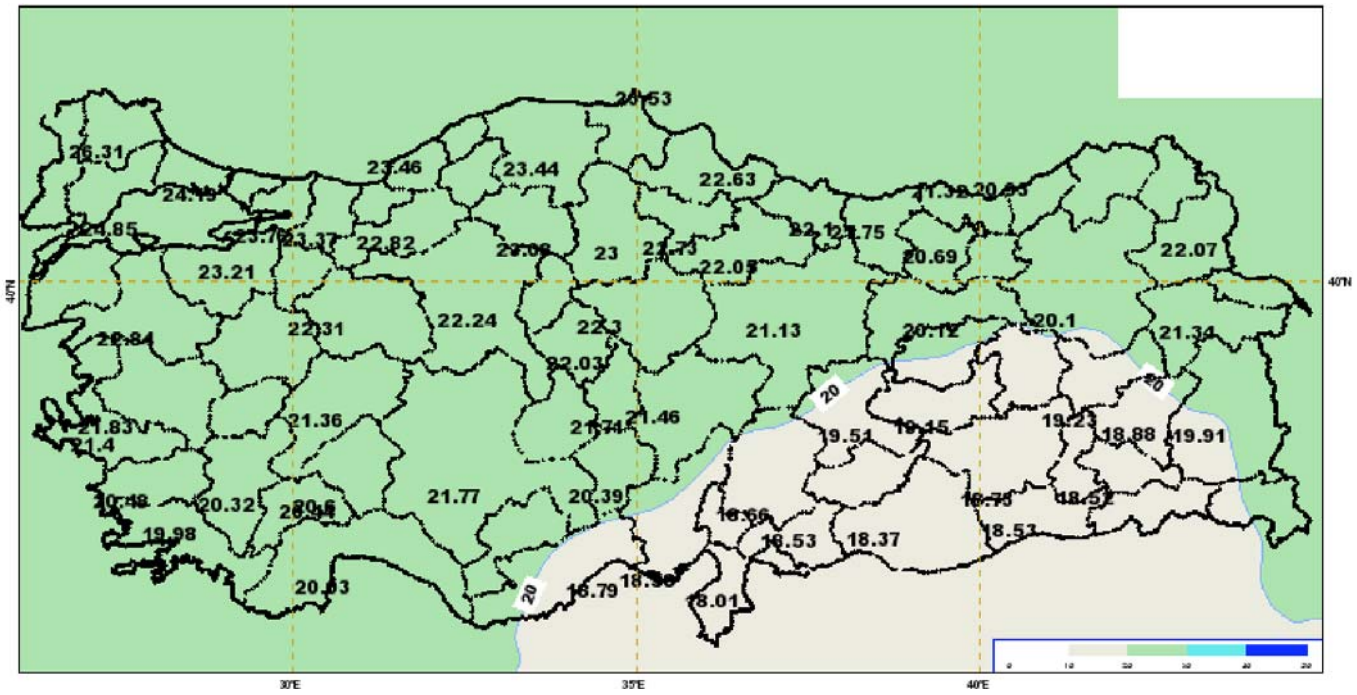

Fig. 3.1.1.10 12 UTC RMSE Values of 850 hPa Heights for D+5

Verification of Precipitation

Precipitation forecasts of the ECMWF are interpolated to the station points. Actual values (observed) and interpolated forecast values are compared. 24 hourly total precipitation classified as follows;

		Observation	
		Yes	**No**
Forecast	**Yes**	a	b
	No	c	d

FAR = b/(a+b)
Hit Rate= (a+d)/(a+b+c+d)
BIAS = (a+b)/(a+c)
POD = a/(a+c)
TS = a/(a+b+c)

Also contingency tables of total precipitation are preparing operationally with 6 categories (0, 0.1-1, 1-5, 5-10,10-20, 20<mm) for D+1, D+2 and D+3 forecasts for 60 stations.

3.1.2 ECMWF model output compared to other NWP models

A meso-scale MM5 model is running 4 times a day for a range of 48 hours. We perform verification for MSL pressure, 2m temperature, 10 meter u-v wind components and total precipitation parameters of MM5 model (12 UTC run). However, no objective scores of comparison have been computed at ECMWF and MM5 model. In the subjective verification, 2m temperature values of ECMWF give more accurate result than those of MM5. Whereas, MM5 model forecasts for the total precipitation are better than ECMWF.

3.1.3 Post-processed products

Kalman Filtering

Kalman Filtering applied to 101 stations including 31 foreign stations from D+1 to D+4 for

2-meter maximum and minimum temperatures. Kalman Filterıng outputs are %5-20 better then direct model outputs.

3.1.4 End Products delivered to users

None.

3.2 Subjective verification

3.2.1 Subjective scores

Our Weather Analysis and Forecasting Division (WAFD) uses ECMWF outputs for wide range of purposes from short-range forecasts to the special reports. We compared ECMWF forecasts and those of WAFD forecasts (based on bench forecasters' experience) with observed values. The verification results were based on the observed values received from 41 stations throughout Turkey and ECMWF's D+1, D+2, D+3 and D+4 corresponding forecasts. When "yes-no" type of verification applied for ECMWF precipitation forecasts, little improvements were noted. Most of the figures show a continuing upward trend over the past few years. Based on ECMWF's upward trend, with combining their experiences and ECMWF model outputs, WAFD made better precipitation forecasts than previous years.

3.2.2 Synoptic Studies

None

4. References

ECMWF, (2005): Verification of ECMWF products in Member States and Co-operating States, Report 2004.

Güser, A. (2004): (in Turkish) "Kalman Filtresi ve Türkiye Üzerine Uygulamaları", Turkish State Meteorological Service, Ankara, p17-40.

Güser, A. (2002): (in Turkish) "Verifikasyon ve Türkiye Üzerine Uygulamaları", Turkish State Meteorological Service, Ankara, p13-23.

Kocaman, F. (2002): (in Turkish) "Kalman Filter ve Türkiye Üzerine Uygulamaları", Turkish State Meteorological Service, Ankara, p9-12.