

# Application and verification of ECMWF products in Turkey 2008

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## 1. Summary of major highlights

## 2. Use and Application of Products

### 2.1.1 Statistical Adaptation

#### Kalman Filtering

Kalman Filtering is applied to 101 stations including 31 foreign stations from D+1 to D+4 for 2-meter maximum and minimum temperatures.

### 2.1.2 Physical Adaptation

#### MM5

MM5 is run operationally 4 times per day for 48 hours using the boundary and initial conditions 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 at Coastal and Harbor Engineering Research Center of Middle East Technical University. METU-3 is operationally running at TSMS for marine forecast for Mediterranean, Marmara, Caspian and Black Sea. METU-3 is running 2 times per day for 72 hours integration using 10 meter u-v wind components of ECMWF deterministic model outputs as initial conditions. METU Wave model outputs are significant wave height and directions, mean wave periods and interpolated 10 meter wind speed and directions.

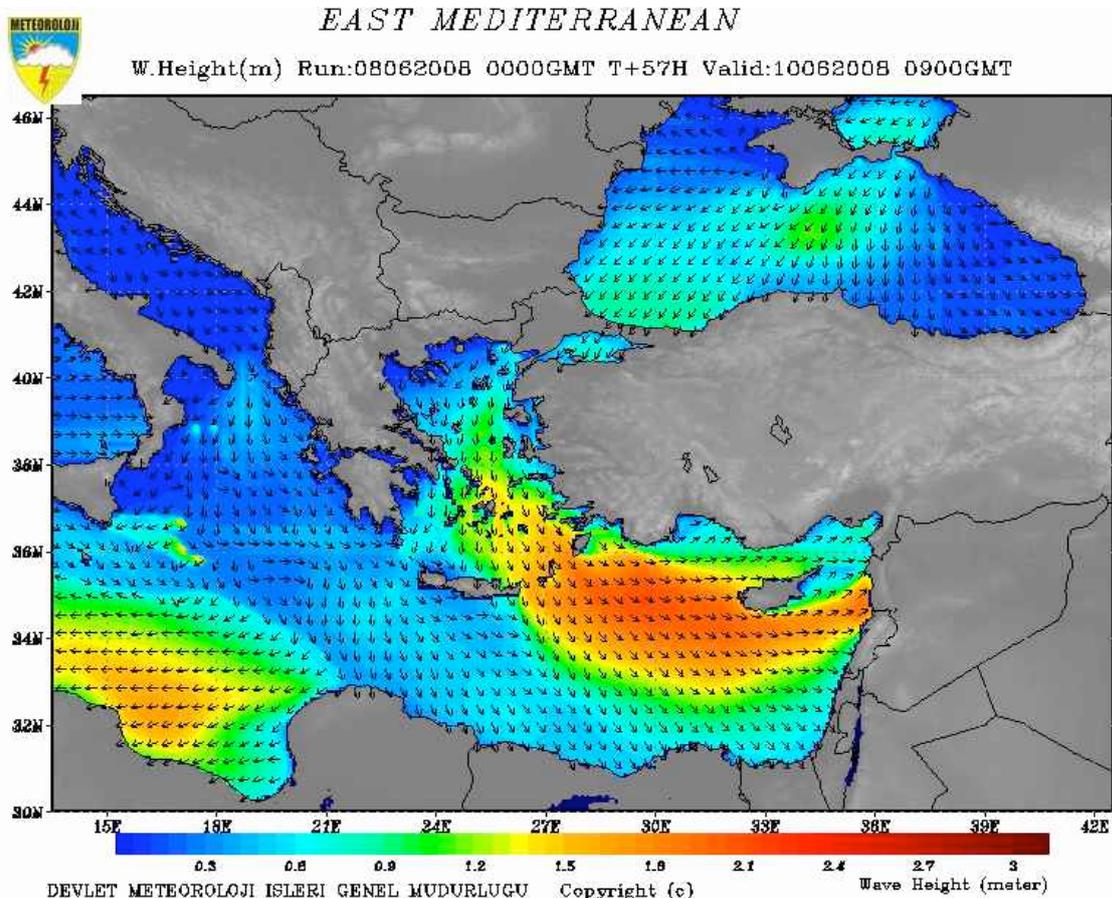


Fig. 2.1.2.1 METU-3 Wave Height Forecasts for T+57

### 3. Verification of Products

#### 3.1 Objective Verification

##### 3.1.1 Direct ECMWF Model Outputs

24 hourly forecast periods 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 2007.

(i) In the free atmosphere

For the verification process of pressure level parameters, observations from 7 radio-sonde stations were used. ECMWF analysis values were referenced for rest of stations.

(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 against corresponding observations. For this process, suitable time steps of model outputs were used. Verified parameters and its periods for the year 2007 are given in below:

- Daily Maximum and Minimum Temperature; D+1, D+2, ..., D+6; Scores: ME, RMSE, MAE.
- Mean Sea Level Pressure and 2 m Temperature : D+1, D+2, ..., D+6; 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,F,KSS,ETS,HSS,OR,ORSS
- 1000, 850, 700, 500 and 300 hPa Height and Temperature: D+1, D+2, ..., D+6 ; Scores: ME, RMSE, MAE.

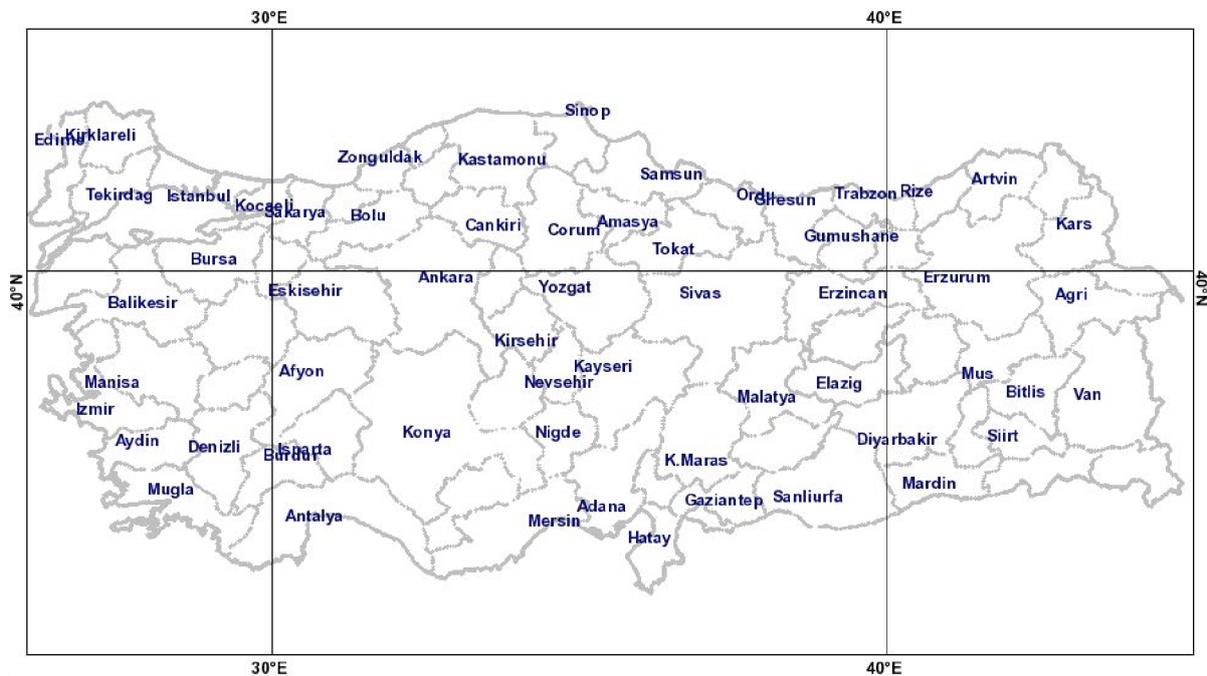


Fig. 3.1.1.1 Turkish synoptic and radio-sonde stations used in this study.

### RMSE VALUES OF 2m.Min.Temp for D+1 (12 gmt)

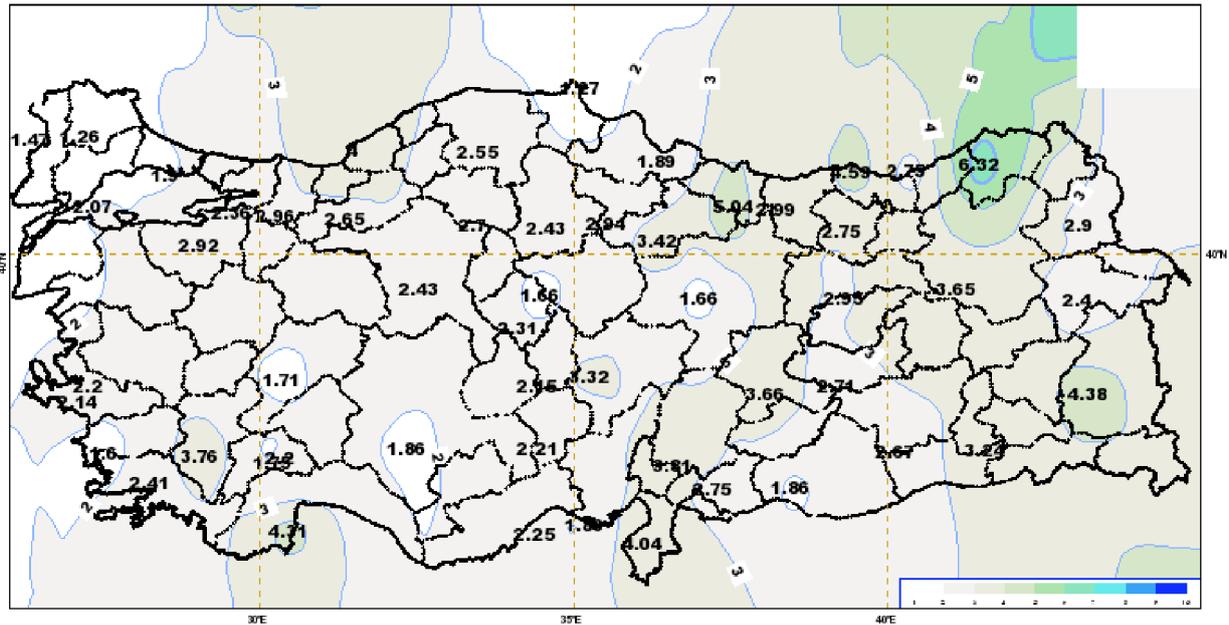


Fig. 3.1.1.2 12 UTC RMSE Values of Minimum Temperature for D+1.

### RMSE VALUES OF 2m.Min.Temp for D+6 (12 gmt)

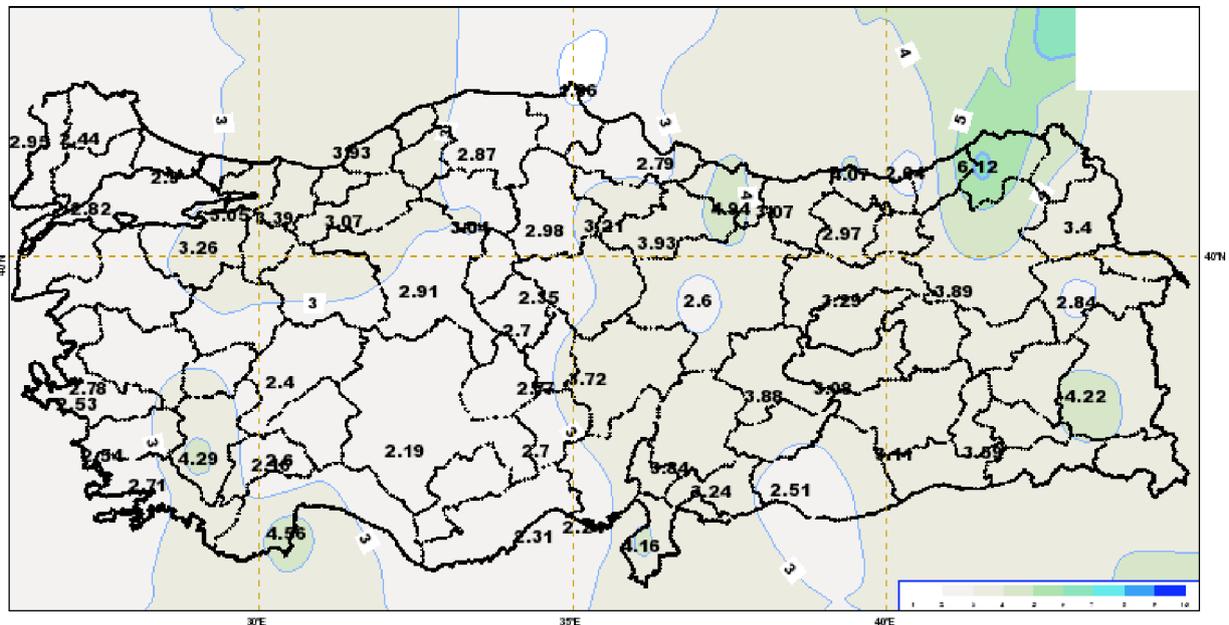


Fig. 3.1.1.3 12 UTC RMSE values of Minimum temperature for D+6.





## RMSE VALUES OF 850 hPa Height for D+6 (12 gmt)

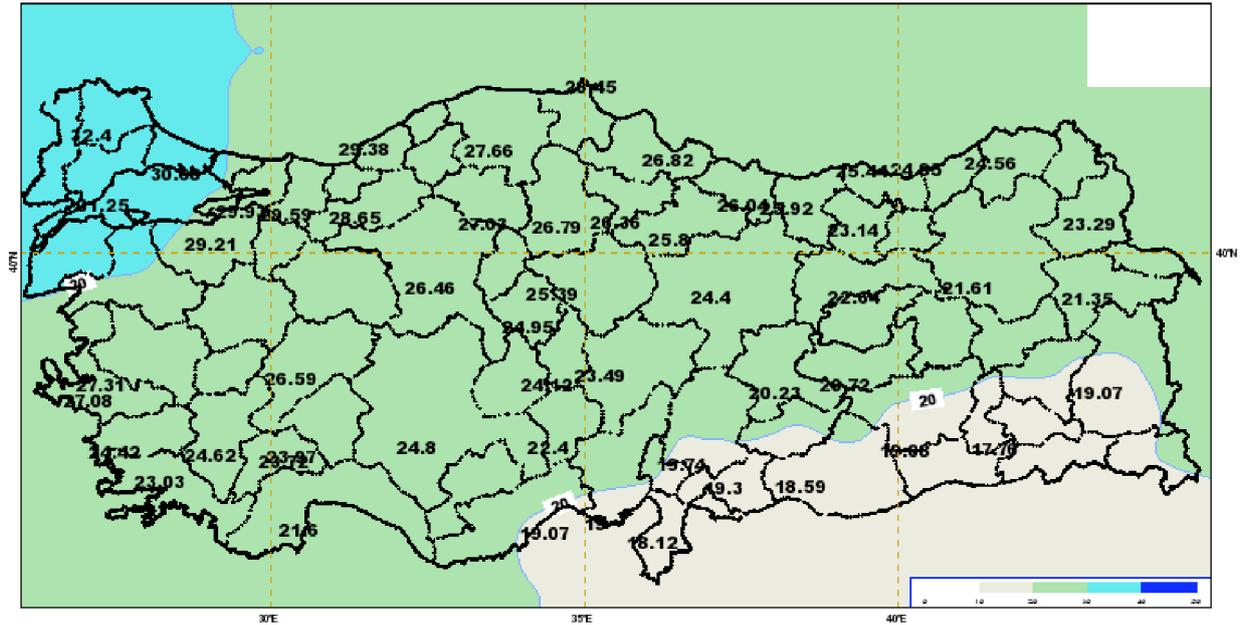


Fig. 3.1.1.8 12 UTC RMSE Values of 850 hPa Heights for D+6

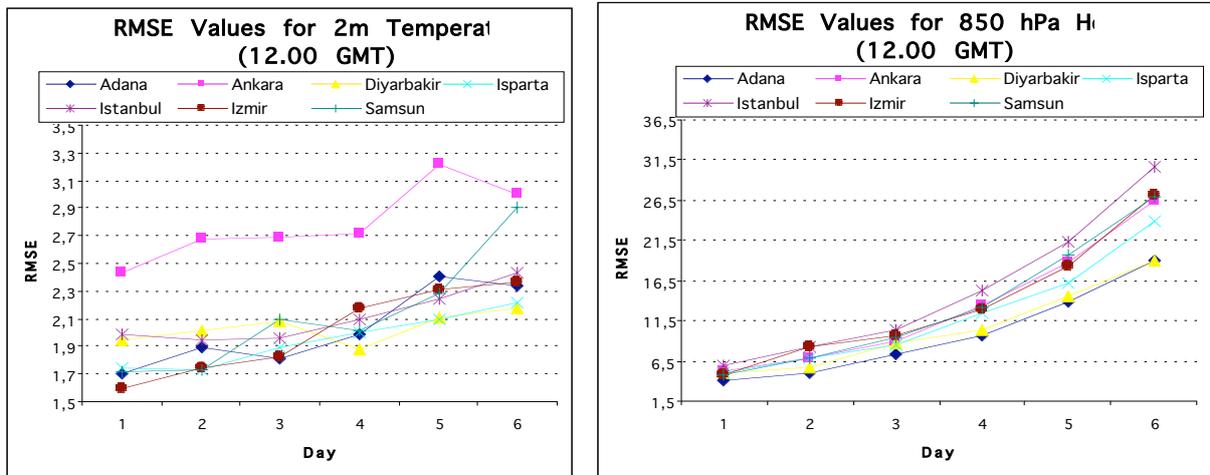


Fig. 3.1.1.9 RMS Errors of 12.00 GMT 2m Temperature and 850 hPa Height forecast as a function of forecast range for 7 Turkish radio-sonde stations.

### 3.1.2 ECMWF model output compared to other NWP models

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 between 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+5 for 2-meter maximum and minimum temperatures. Generally, Kalman Filtering outputs are %5-20 better than direct model outputs.



### 3.2.2 Synoptic Studies

None

## 4. References

**Abdalla,S. and Özhan,E.** (1994):METU Model for Wind-Wave Prediction,Ankara,p1-10.

**ECMWF,** (2006): Verification of ECMWF products in Member States and Co-operating States, Report 2006.

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

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