Application and verification of ECMWF products 2009

RHMS of Serbia

1. Summary of major highlights

ECMWF products are operationally used in Hydrometeorological Service of Serbia from the beginning of 2003. Deterministic forecast products are received via RMDCN in GRIB and BUFR form for 10 days forecast at different horizontal resolutions and several domains. Products are represented using MetView and are available on local web site. In addition, forecasters consult ECMWF web site, priory for EPS products and monthly forecast. From September 2006 seasonal forecast products are also used.

Establishing of South East European Climate Change Centre started during the last year. In order to provide numerical background for Monthly forecast for the region, regional Eta model runs with 15 day EPS forecast as boundary conditions every day and for 32 days, weekly. On the other side, in June 2009 PRECIS model was installed and numerical tests using ERA products started.

2. Use and application of products

ECMWF products are used for short-range forecast for providing meteorological background for hail suppression activities, which is specialized part of Hydrometeorological Service of Serbia.

Medium range forecast is mainly based on ECMWF products from deterministic model as well as EPS products available on ECMWF web site.

Hydrometeorological Service of Serbia regularly issues monthly forecast for several places in Serbia. Statistical method by analogy is used together with EPS products from ECMWF.

RHMS of Serbia has continued to use ECMWF's monthly forecasts as well as seasonal forecasts of prediction System 3.

2.1 Post-processing of model output

2.1.1 Statistical adaptation

2.1.2 Physical adaptation

WRF-NMM, a non-hydrostatic limited-area model, has been running operationally since August 2007. Model uses ECMWF boundary conditions for 72 hours ahead. Some verification results compared with ECMWF forecast are presented in chapter 3.1.2.

2.1.3 Derived fields

2.2 Use of products

Some of ECMWF forecast products, like CAPE and EFI are widely used in every day work. Wind gusts and 2m minimum and maximum daily temperature forecast are especially important for road maintenance requirements.

Prediction of the heat waves started operationally in August 2008. Maximum temperature predicted in deterministic model run and distributed as BUFR weather parameters is used as a first guess. During winter minimum temperature is used for prediction of the cold waves.

3. Verification of products

3.1 Objective verification

3.1.1 Direct ECMWF model output (both deterministic and EPS)

The 00 UTC run of ECMWF deterministic forecast is verified against SYNOP observations. Forecast data were taken from 0.25° x 0.25° grid, using grid points closest to chosen synoptic stations. Statistical scores presented here are related to station Beograd - Karađorđev park (13274).

MAE and RMSE of 2m minimum (18-06 UTC) and maximum (06-18 UTC) temperature forecast (Fig. 1-2) do not differ significantly compared to previous year (2007). These scores for 2008 are slightly better from D+3 to D+8 for maximum temperature forecast.

Figures 3 and 4 show large positive 2m temperature forecast errors at midday (t+60h) and underestimation at midnight (t+72h). This underestimation of 2m temperature with strong diurnal cycle can be seen in figure 5.

10m wind speed forecast shows good agreement with observed data (Fig. 6).

3.1.2 ECMWF model output compared to other NWP models

ECMWF model forecast is compared to the regional non hydrostatic NMM model. NMM version 3.0 is running from June 2008 using ECMWF as BC. Horizontal resolution of the model is about 10 km and 00 UTC run is considered.

Comparison of the forecast quality of ECMWF model and NMM model is presented in figs. 7-20. Seasonal averaged values for 2m temperature, 10m wind speed and precipitation occurrence are taken in consideration. Values of ME and MAE show advantage of NMM forecast for 2m minimum temperature (Fig.7-8), while 2m maximum temperature forecast errors are comparable (Fig. 9-10). Evaluation of precipitation forecast is similar for both models (Fig. 11-12) regarding two presented scores. More comprehensive study is needed for reliable conclusion.

Analyzing figures 14-16 and 18-20 one can conclude that NMM is better in forecasting of 2m temperature and ECMWF is better in forecasting 10m wind speed. It has been noticed that temperature is lower at the beginning of NMM forecast. This is probably caused by colder temperature field in ECMWF analysis which is often the case during winter.

3.1.3 Post-processed products

3.1.4 End products delivered to users

3.2 Subjective verification

3.2.1 Subjective scores (including evaluation of confidence indices when available)

3.2.2 Synoptic studies

4. References to relevant publications

Nurmi, P., 2003: Recommendations on the verification of local weather forecasts, *ECMWF Technical Memorandum No. 430*

http://www.ecmwf.int/products/greenbook
http://www.ecmwf.int/newsevents/meetings/forecast_products_user/index.html

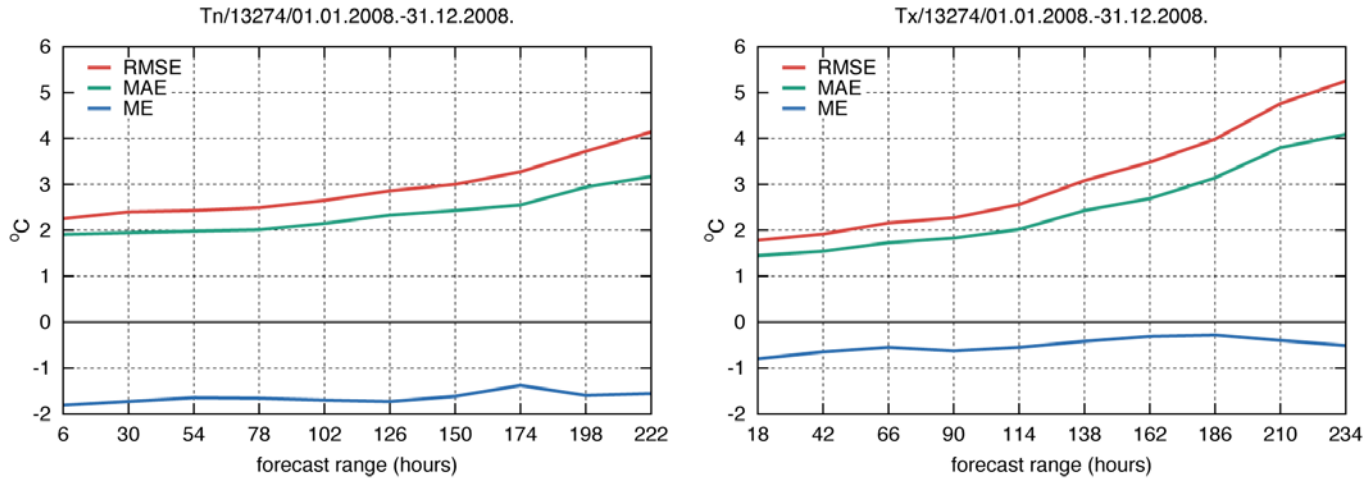

Fig.1-2 ME, MAE and RMSE of ECMWF 2m minimum and maximum temperature forecast (D+0 to D+9) as a function of forecast range (Beograd – Karađorđev park).

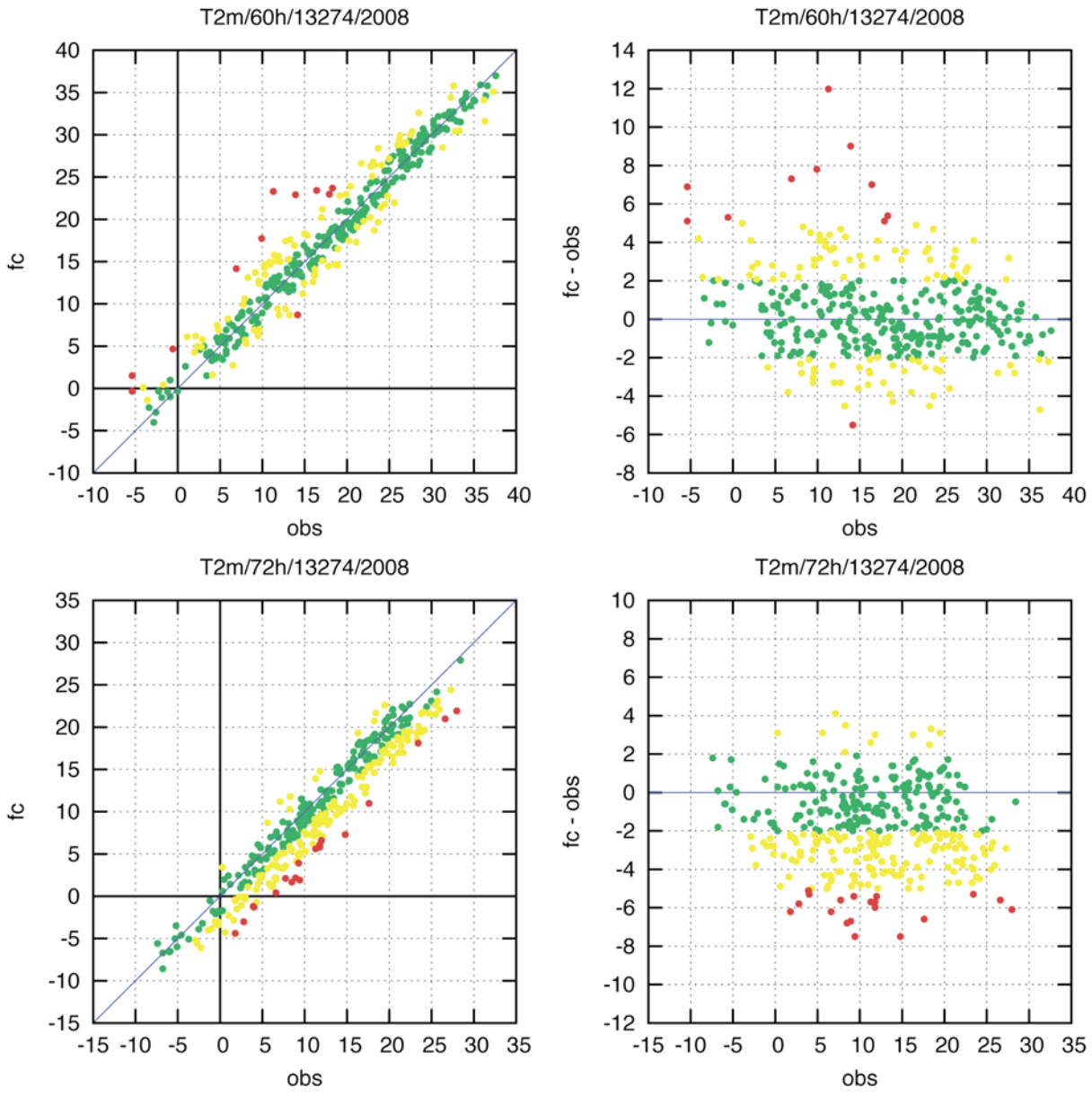

Fig.3-4 Scatterplots and forecast errors vs. observations of one year ECMWF t+60h (midday) and t+72h (midnight) 2m temperature forecast for Beograd – Karađorđev park (13274).

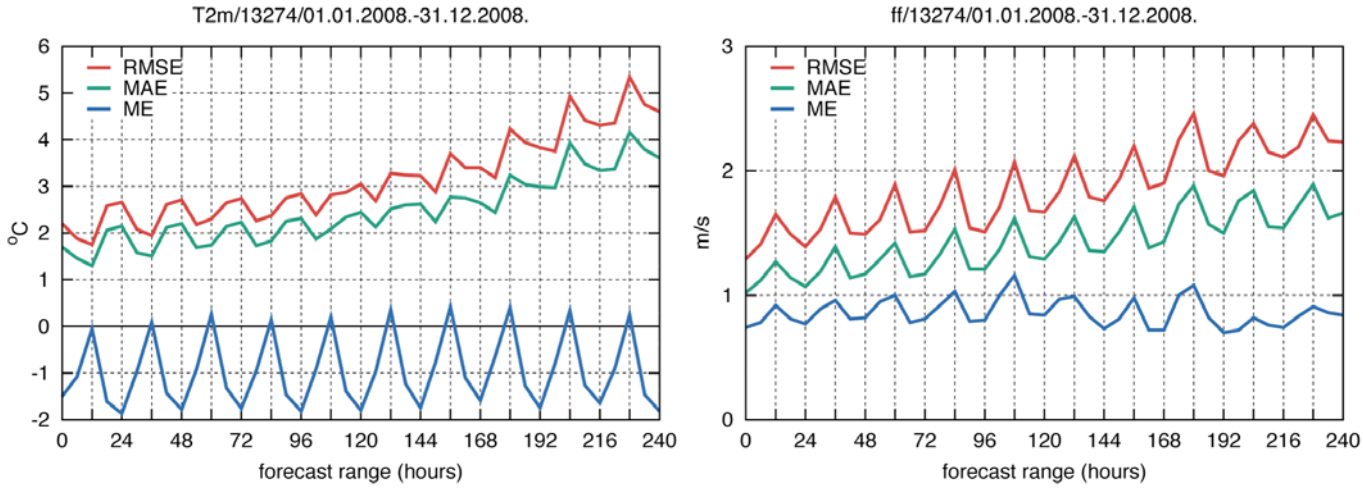

Fig.5-6 ME, MAE and RMSE of ECMWF 2m temperature and 10m wind speed forecast as a function of forecast range (Beograd – Karađorđev park).

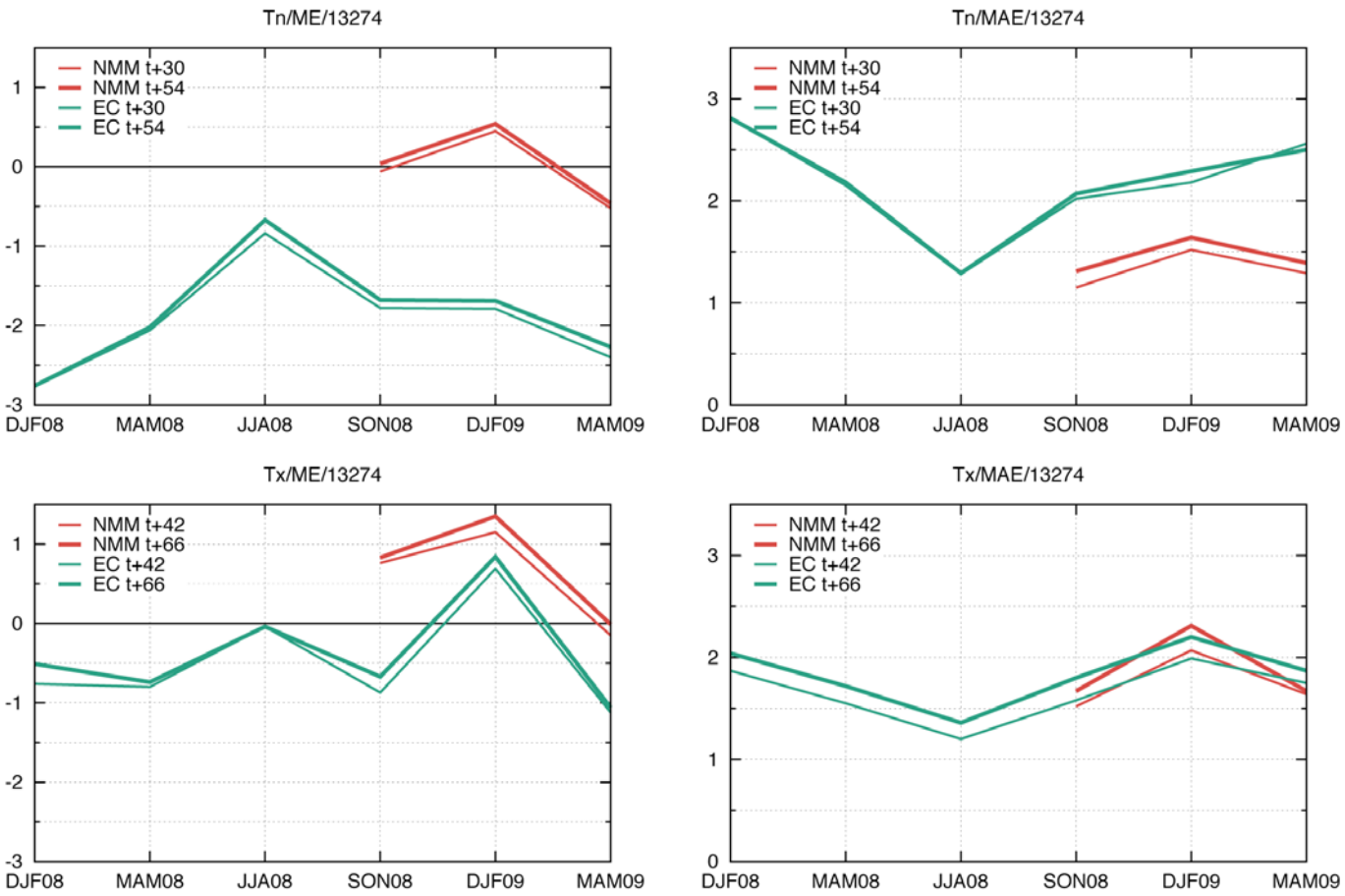

Fig.7-10 ME and MAE of ECMWF 2m minimum (t+30 for D+1 and t+54 for D+2) and maximum (t+42 for D+1 and t+66 for D+2) temperature forecast for seasons DJF08 to MAM09. Comparison to WRF-NMM forecast for three last seasons (Beograd – Karađorđev park).

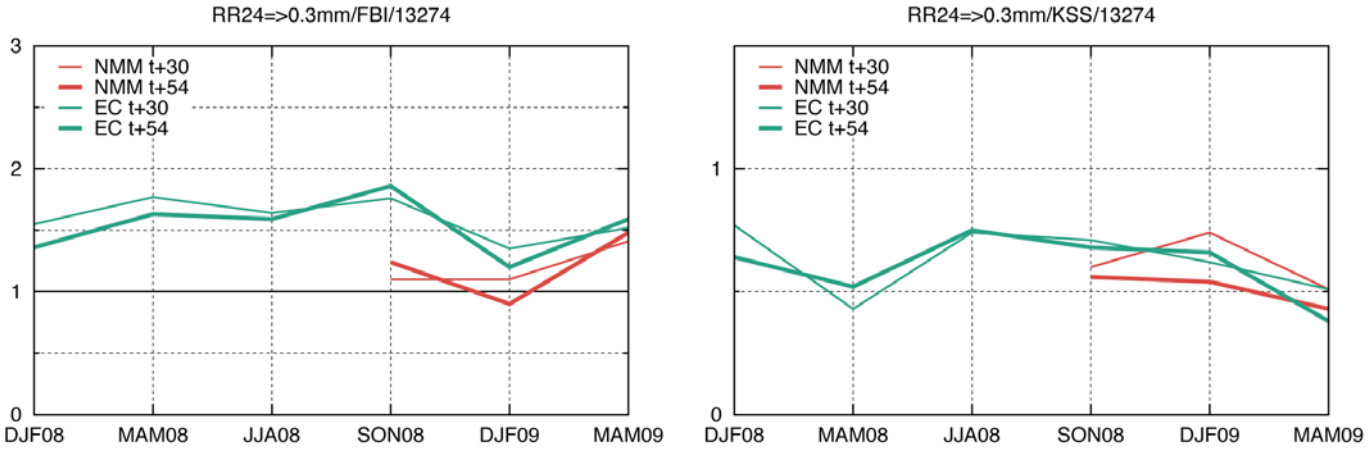

Fig.11-12 FBI and KSS of ECMWF 24h precipitation forecast (t+30h and t+54h) for seasons DJF08 to MAM09. Threshold is 0.3mm/24h. Comparison to WRF-NMM forecast for three last seasons (Beograd – Karađorđev park).

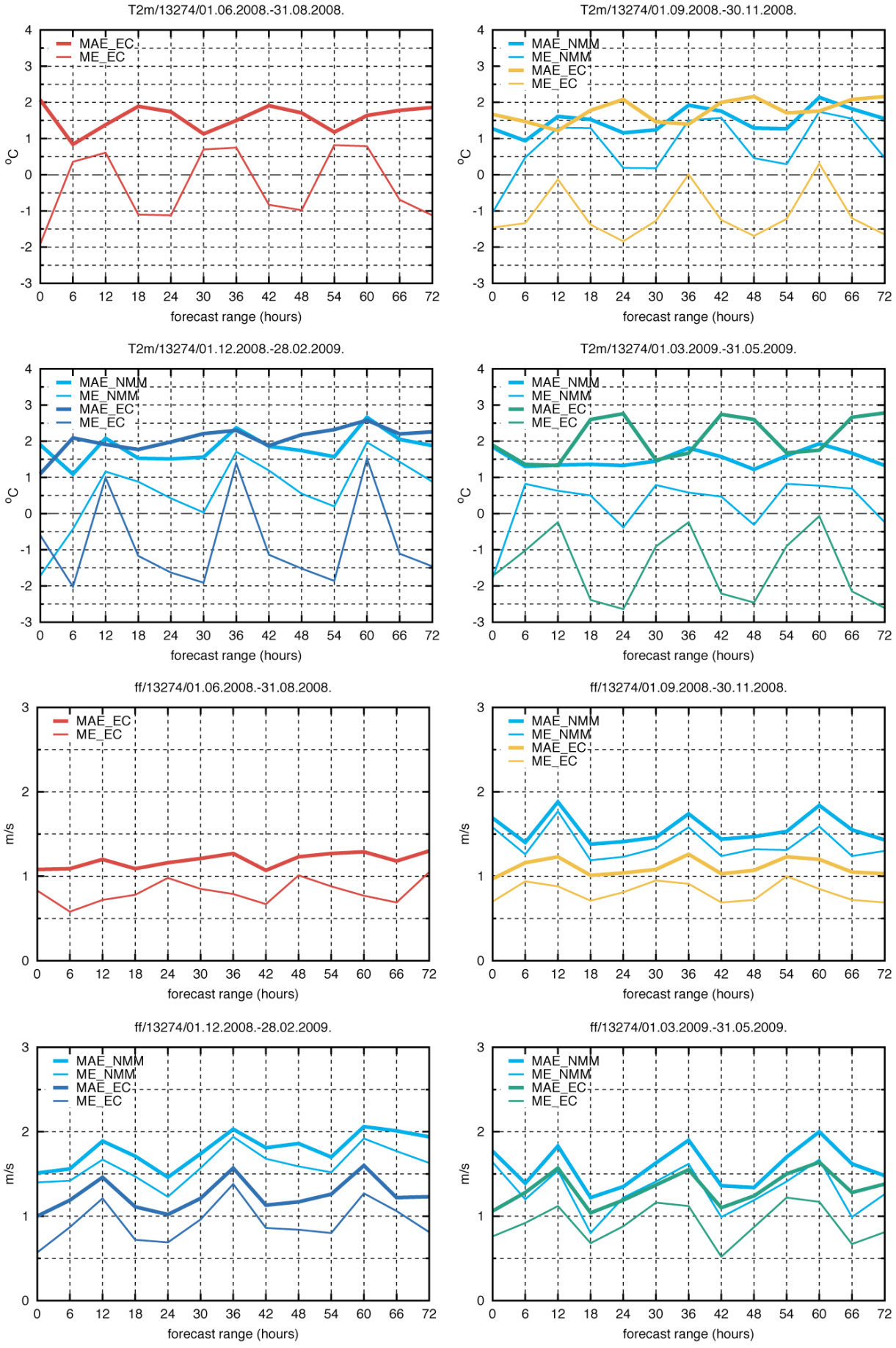

Fig.13-20 ME and MAE of 2m temperature and 10m wind speed forecast as a function of forecast range. Comparison of ECMWF to WRF-NMM forecasts for seasons SON08 to MAM09 (Beograd - Karađorđev park).