Application and verification of ECMWF products 2012

RHMS of Serbia

1. Summary of major highlights

ECMWF forecast products became the backbone in operational work during last several years. Starting from ten days deterministic forecast, amount of products in use is growing constantly including EPS, EFI, seasonal forecast etc. Available ECMWF software like MetView and GRIB_API are widely used.

Establishing of South East European Climate Change Centre started during 2008. In order to provide numerical background for monthly forecast for the region, regional Eta model runs with 6 months EPS forecast as a boundary conditions, every month. Also, WRF-NMM and NMM-B use ERA fields for case studies and numerical tests for different regions.

Demand for forecast archive and data base appeared during last year, so RHMSS requested MARS installation. ECMWF experts work in the cooperation with our staff, most of the job is already done.

2. Use and application of products

ECMWF products are used for short-range forecast for providing meteorological background for hail suppression activities, specialized service in Ministry of Internal Affairs.

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.

Some efforts in using ECMWF monthly forecast data as BC for NMM model were made.

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, 2m minimum and maximum daily temperature forecast as well as daily amount of precipitation are used as a background in the severe weather warnings.

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 - Kara?or?ev 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 the previous years. These scores for 2m minimum temperature are a bit smaller than during 2010. from D+7.

Scatterplots (Figures 3 and 4) for forecast of 2 meter temperature show that dispersion is bigger than it was previous years. At midday (60h) forecast temperature generally tends to be higher for temperature below 20oC and lower for temperature above 20oC. Most of the biggest errors are spotted in situations when observed value is about 0oC. There is still an underestimation for midnight (72h) 2 meter temperature.

Also, a slightly overestimation of 10 meter wind forecast can be seen in Fig. 5 and 6, at midday for wind speed lower than 5 m/s and at midnight when there is no wind.

Figures 7 and 8 show scores for 2 meter temperature and 10 meter wind speed forecast. Diurnal cycles in forecast errors can be seen, stronger for 2 meter temperature forecast. This diurnal cycle for wind speed forecast is weaker than in 2010.

Smaller amounts of precipitation are overestimated and larger are underestimated for both 54h and 78h precipitation forecast (Figures 9-10). Dispersion is significantly smaller compared to previous year. It should be emphasize that 2011 was very dry, there were only 100 rainy days in comparison with 150 observed in 2010.

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. 11-16. Seasonal averaged values for 2 meter temperature and 10 meter wind speed 60h(midday) and 72h(midnight) forecast and 24 hour precipitation occurrence are taken in consideration.

Values of ME and MAE show advantage of ECMWF forecast for 2 metre temperature at midday (especially during winters), while NMM 2 meter temperature forecast have better scores at midnight (Fig. 11-12).

ECMWF is better in 10 meter wind speed forecast for both midday and midnight forecast and during all seasons (Fig. 13-14).

Regarding two presented scores, evaluation of precipitation forecast is similar for both models with minimum skill in spring (Fig. 15-16).

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

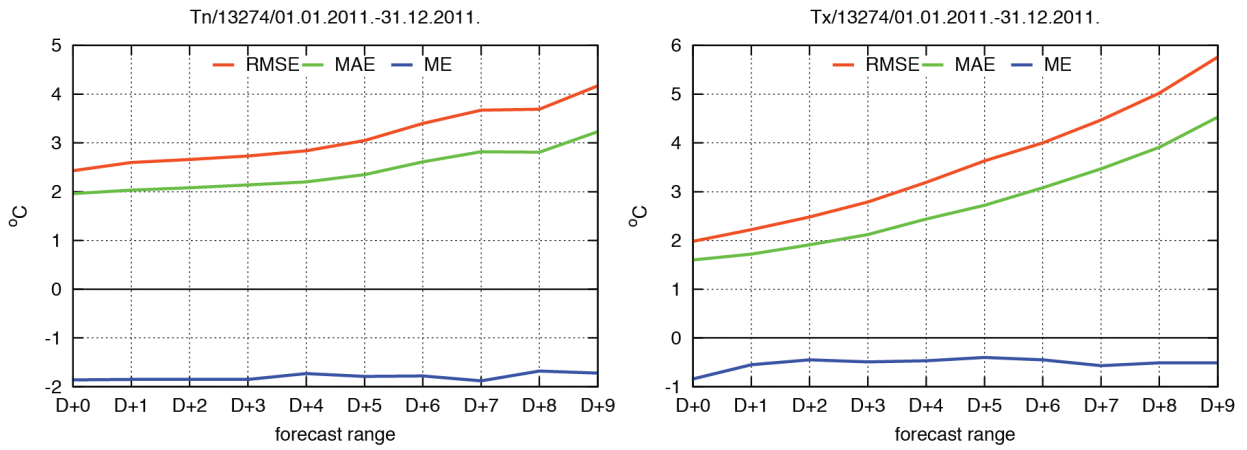http://www.ecmwf.int/newsevents/meetings/forecast_products_user/index.html

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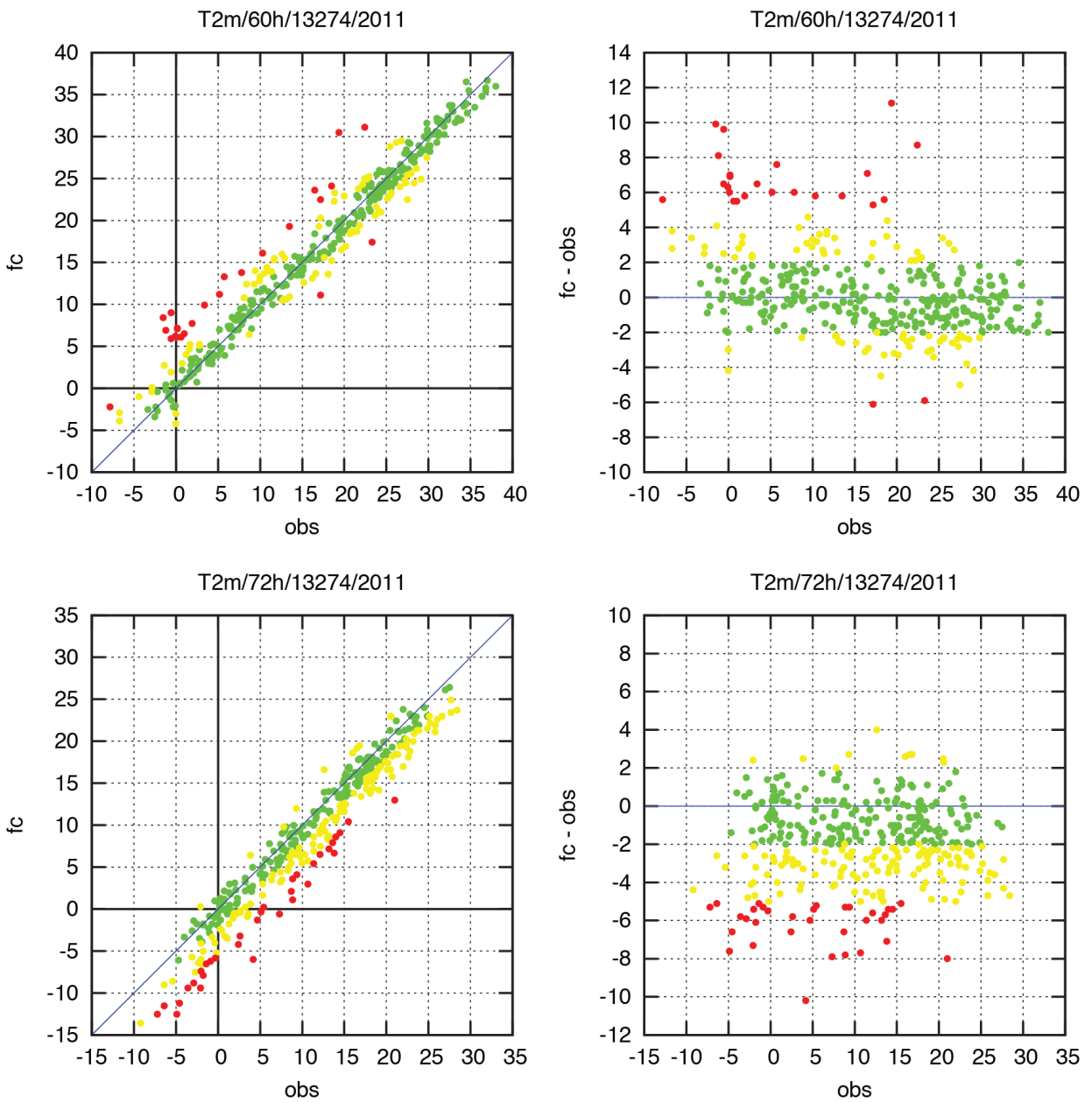

Fig.3-4 Scatterplots and forecast errors vs. observations of one year ECMWF t+60h (midday) and t+72h (midnight) 2 meter temperature forecast for Beograd - Karađorđev park (13274).
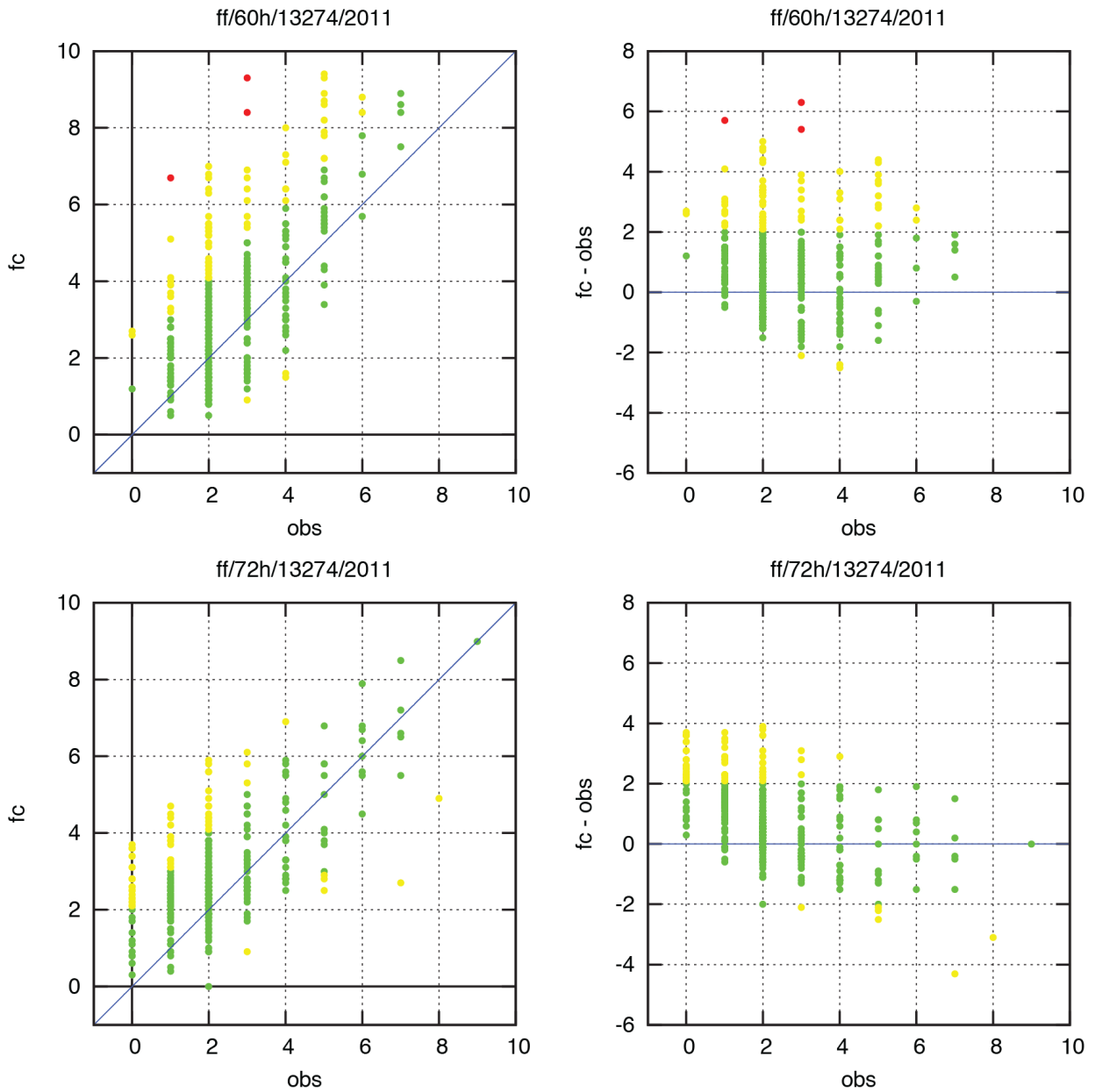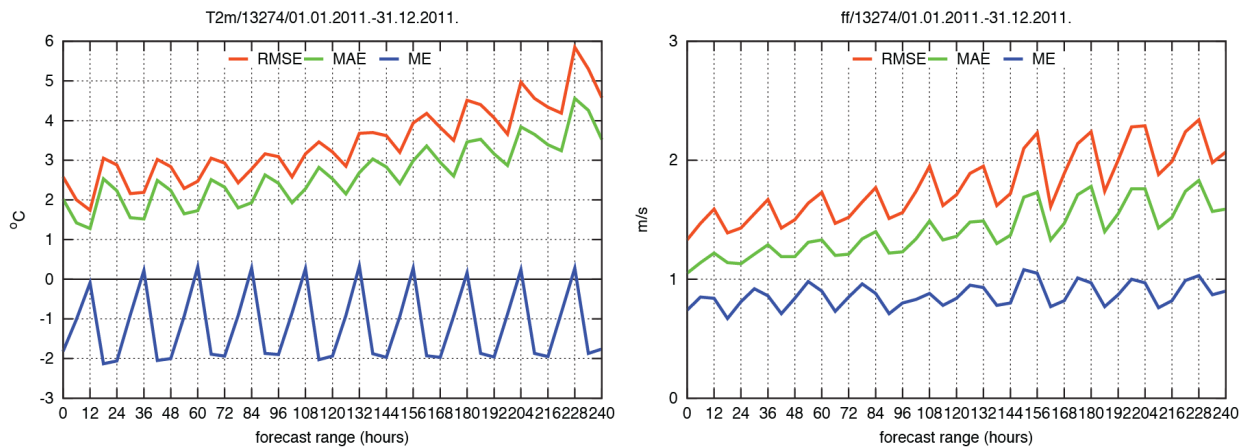
Fig.5-6 Scatterplots and forecast errors vs. observations of one year ECMWF t+60h (midday) and t+72h (midnight) 10 meter wind speed forecast for Beograd - Karađorđev park (13274).

Fig.7-8 ME, MAE and RMSE of ECMWF 2 meter temperature and 10 meter wind speed forecast as a function of forecast range (Beograd - Karađorđev park).
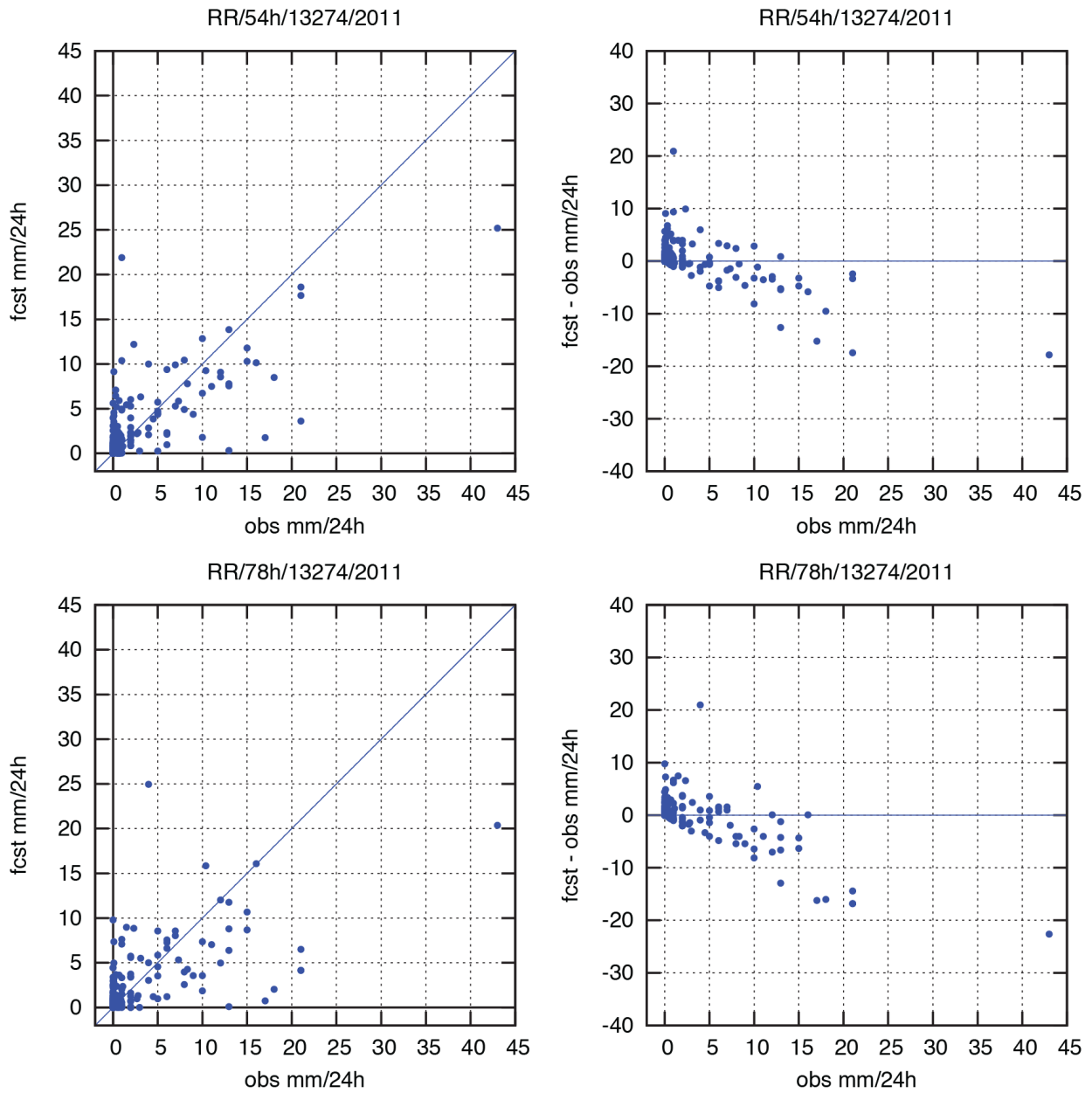
Fig.9-10 Scatterplots and forecast errors vs. observations of one year ECMWF 54h and 78h 24h precipitation forecast for Beograd - Karađorđev park (13274).
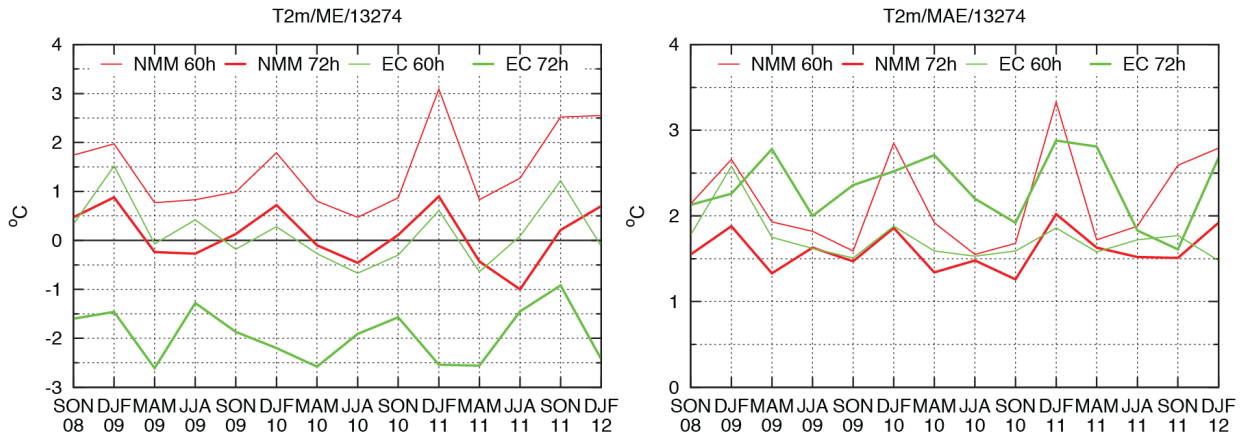

Fig.11-12 ME and MAE of ECMWF midday and midnight (60h, 72h) 2 meter temperature forecast for seasons SON08 to DJF12. Comparison to WRF-NMM forecast (Beograd - Karađorđev park).
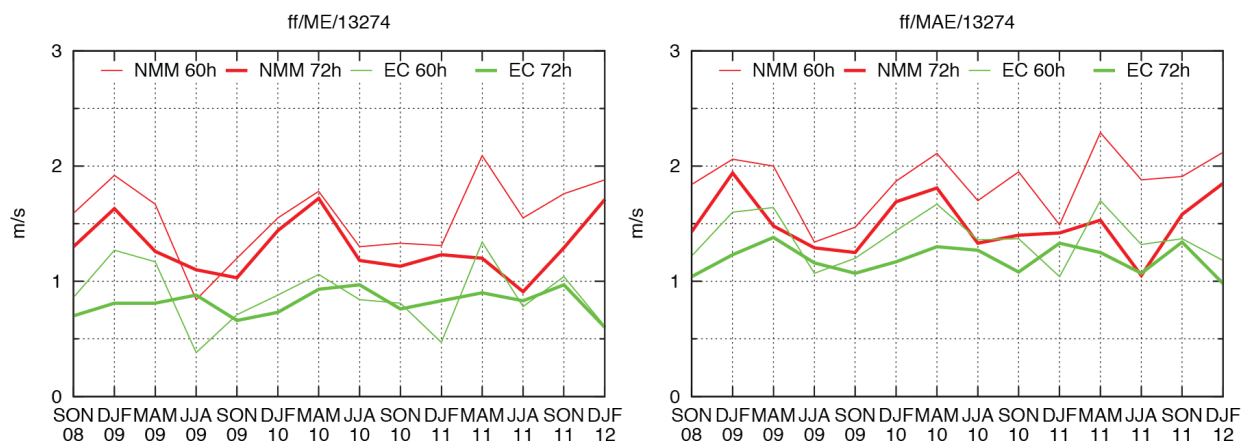
Fig.13-14   ME and MAE of ECMWF midday and midnight (60h, 72h) 10 meter wind speed forecast for seasons SON08 to DJF12. Comparison to WRF-NMM forecast (Beograd - Karađorđev park).
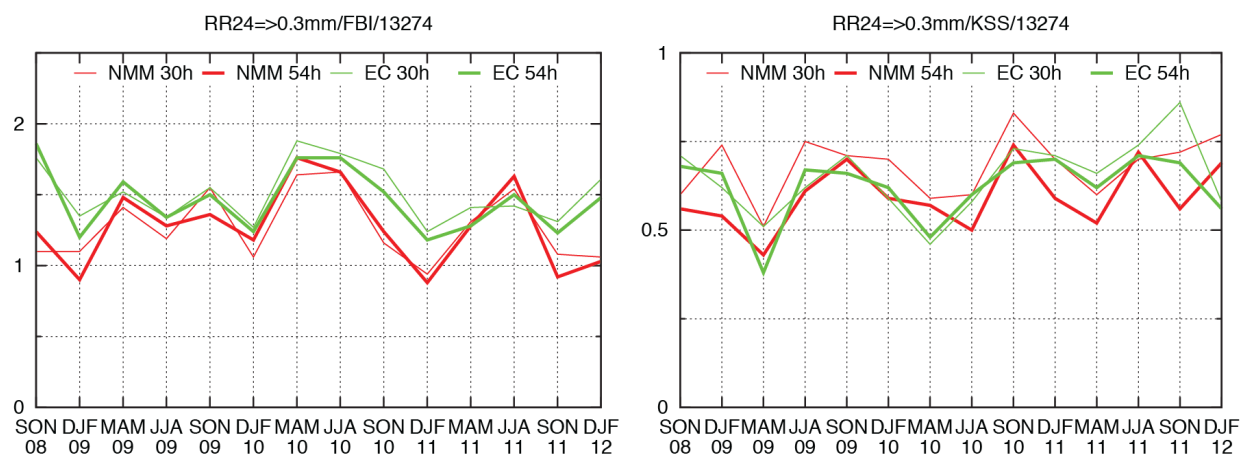

Fig.15-16   FBI and KSS of ECMWF 24h precipitation forecast (30h, 54h) for seasons DJF08 to DJF12. Threshold is 0.3mm/24h. Comparison to WRF-NMM forecast (Beograd - Karađorđev park).