Application and verification of ECMWF products in Serbia

Hydrometeorological Service 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.

2. Use and application of products

ECMWF products are used for short-range forecast and for providing meteorological background for hail suppression activities, which is specialized part of Hydrometeorological Service of Serbia.Service uses BC products for running regional Eta model for 72 hours forecast.Recently we have installed WRF-NMM non-hydrostatic model for short-range forecast (up to 48 hours) and we are doing efforts for adjusting and preparing ECMWF global fields as boundary conditions for future operational run.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.Completely new approach in our Service was implemented in interpretation of seasonal forecast.

2.1 Post-processing of model output

2.1.1 Statistical adaptation

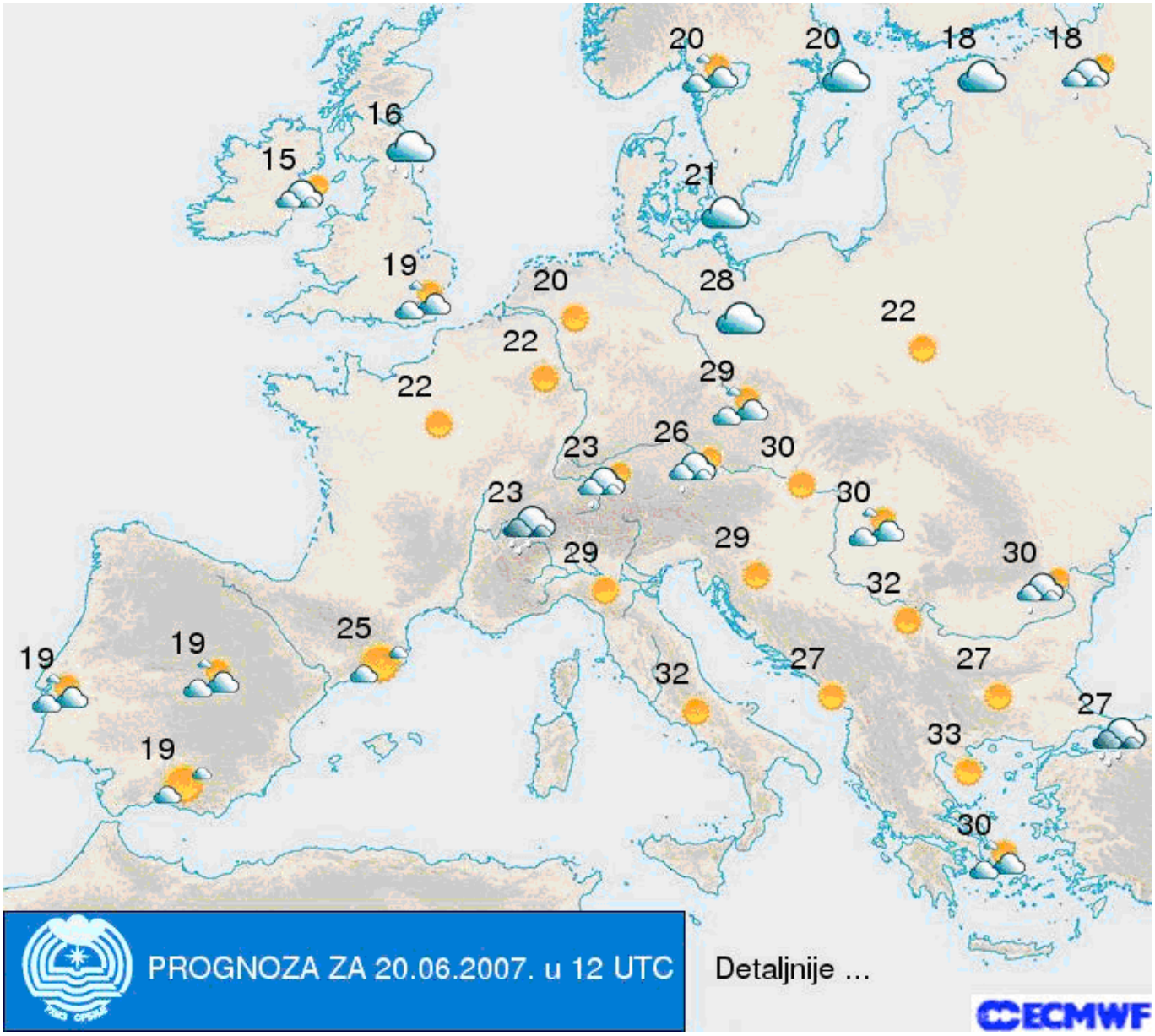
2.1.2 Physical adaptation

Only first steps were made in non-hydrostatic modelling. Regarding requirements that models have there are a lot of work in preparation and arrangement of input fields from ECMWF as well as the most suitable using of available finale products.

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 forecasted minimum and maximum daily temperature are especially important in forecast for road maintenance requirements.Hydrometeorological Service of Serbia uses BUFR weather parameters for ten days forecast for central heating system and agro meteorological purposes.We developed criteria for automatic weather forecast also on BUFR weather parameters basis. These products are available on local intranet (Fig 1 and 2).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Detaljnije ...
ECMWF

Fig. 1

BEOGRAD

DATUM I TERMIN	POJAVA	T(°C)	VETAR (m/s)
20/06/2007 12:00 UTC		32	E 2
20/06/2007 18:00 UTC		28	NE 3
21/06/2007 00:00 UTC		22	E 3
21/06/2007 06:00 UTC		26	SE 4
21/06/2007 12:00 UTC		35	SE 4
21/06/2007 18:00 UTC		30	SE 1
22/06/2007 00:00 UTC		27	W 5
22/06/2007 06:00 UTC		25	N 3
22/06/2007 12:00 UTC		32	W 1
22/06/2007 18:00 UTC		30	E 2
23/06/2007 00:00 UTC		25	NW 2
23/06/2007 06:00 UTC		24	S 3
23/06/2007 12:00 UTC		33	W 4
23/06/2007 18:00 UTC		30	NW 3
24/06/2007 00:00 UTC		23	NW 3
24/06/2007 06:00 UTC		23	N 2
24/06/2007 12:00 UTC		31	SW 1
24/06/2007 18:00 UTC		28	E 2
25/06/2007 00:00 UTC		23	NW 2

ECMWF

Fig. 2

3. Verification of products

3.1 Objective verification

3.1.1 Direct ECMWF model output (both deterministic and EPS)

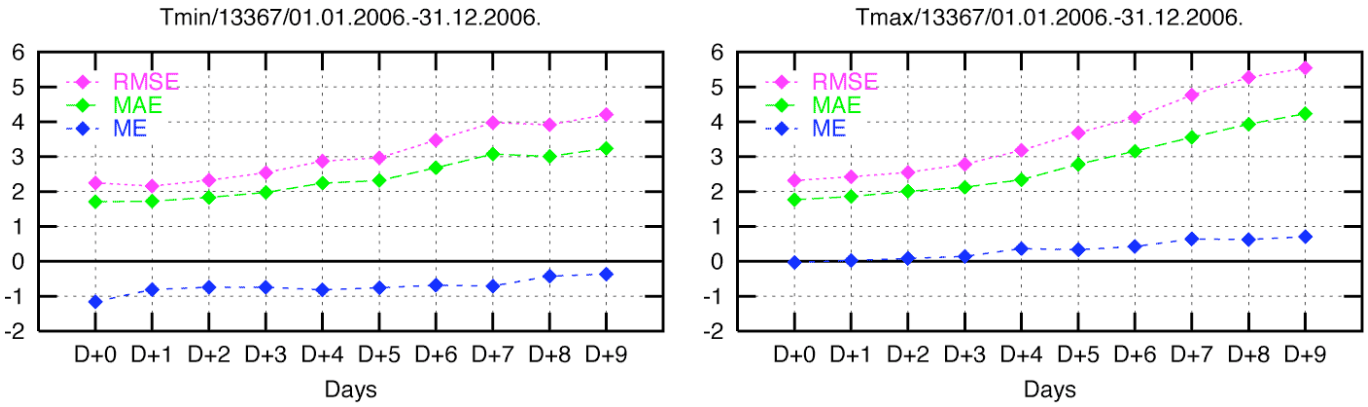
The verification has been made for several locations, including Belgrade, which are of interest to our forecasters. Input forecast values for ECMWF were taken from 0.5°x0.5° grid. The 00UTC model run outputs have been verified using grid points closest to chosen synoptic stations.

Verified local weather parameters

- Minimum temperature Tmin (minimum night time temperature between 18 and 06 UTC).
- Maximum temperature Tmax (maximum daytime temperature between 06 and 18 UTC).
- Precipitation occurrence R24 (accumulated precipitation between 06 and 06 UTC $\geq$ 0.3 mm/24h).

Some results for Beograd (13274), Negotin (13295) and Zlatibor (13367) are presented. Negotin is situated in the eastern part of the country, whose temperature is very dependent on synoptic situation. Sometimes, this location is very difficult for forecasting. Zlatibor is a mountain station in southwestern Serbia.

Considering whole forecast range (from D+0 to D+9) in most of the cases *Tmin* forecast is more accurate than *Tmax* forecast (Fig 3a and 3b for Zlatibor) with very good results in summer. If we compare some stations, MAE is less then 2°C even for D+9 (Fig 4a for Negotin) in summer and systematic underestimation of minimum temperature is noticed for Belgrade, especially in spring (Fig 4b). For most locations underestimation of maximum temperature is in autumn (Fig 5a, Belgrade), and for Negotin during whole year (Fig 5b, summer).



a) b)

Fig. 3

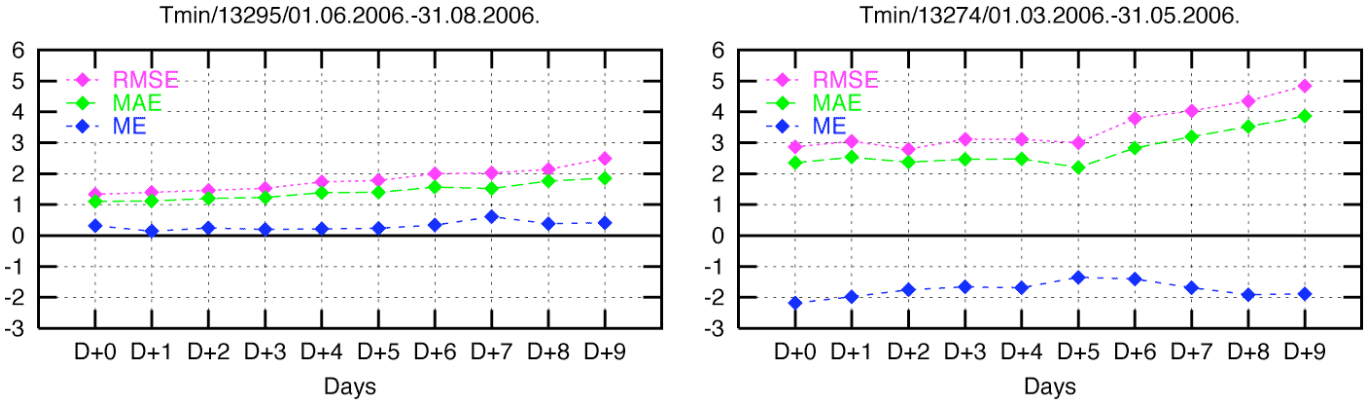


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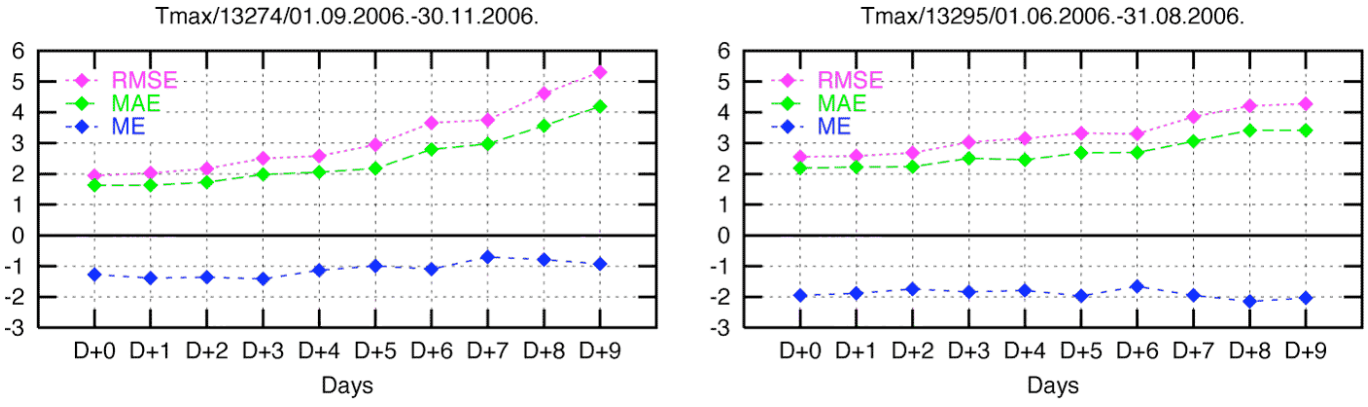
Fig. 4



a) b)

Fig. 5

First steps in verification of precipitation occurrence have been made this year. Presented results show overestimation of precipitation occurrence, what was already known from forecasters' experience. This overestimation is biggest in autumn (Fig 6, Belgrade). The best results are gained for southwestern mountain region (Fig 7, Zlatibor). Heidke Skill Score is presented in Fig.8, it gives very good results in prediction of precipitation occurrence for first 4 days of forecast.

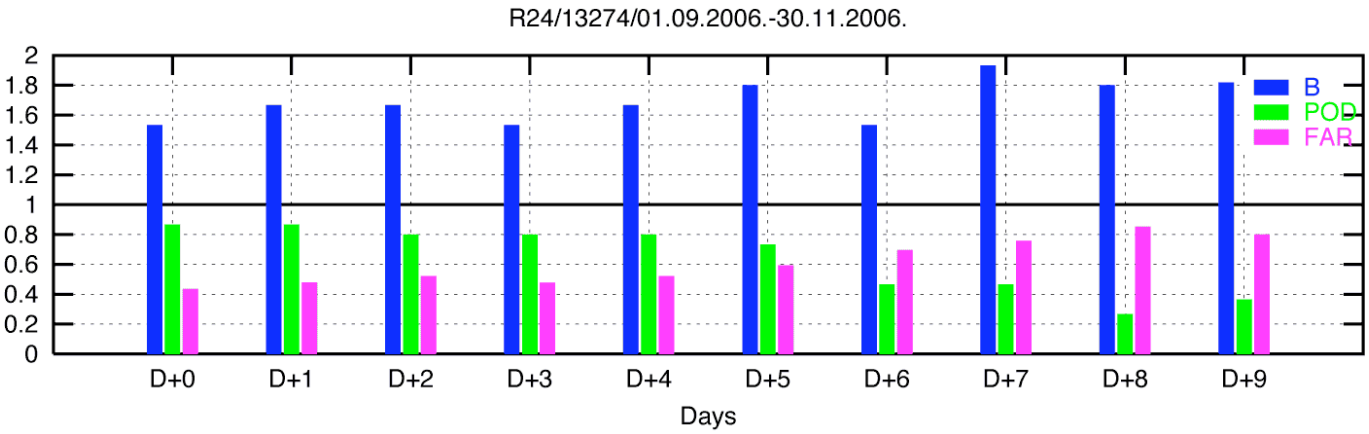


Fig. 6

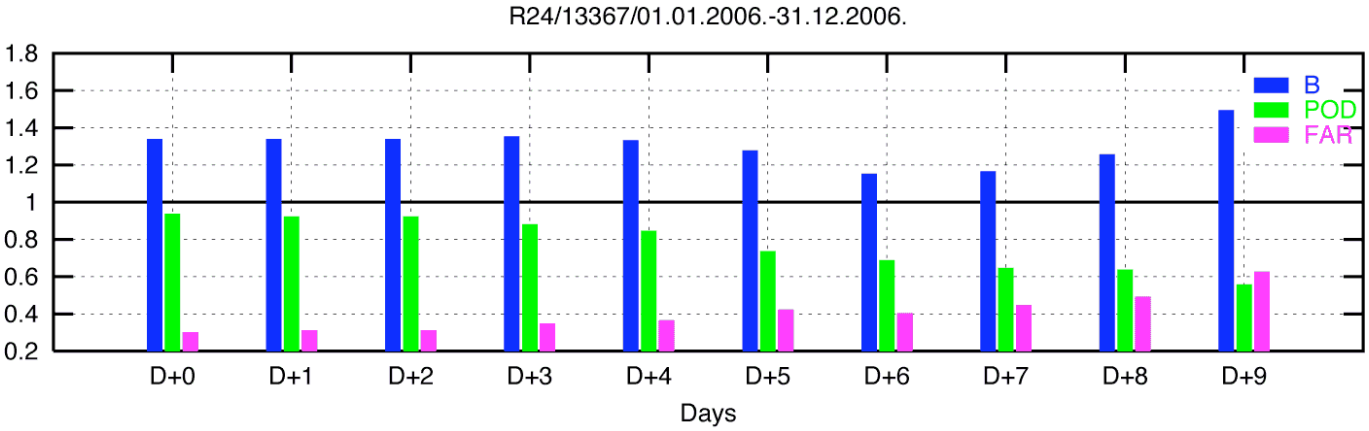


Fig. 7

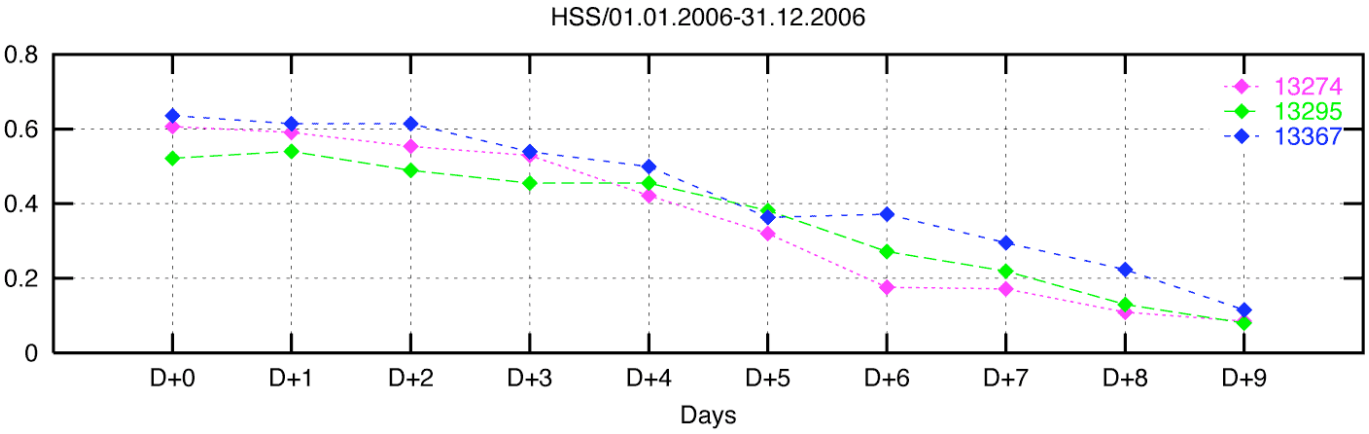


Fig. 8

From 2005 EPS GRIB products and statistical method are used for corrections in method by analogy, traditionally used for monthly forecast. As in 2005, plots of MAE (Fig 9) and ME (Fig 10) of mean daily temperature for Belgrade show noticeable improving in reliability of monthly forecast for 2006.

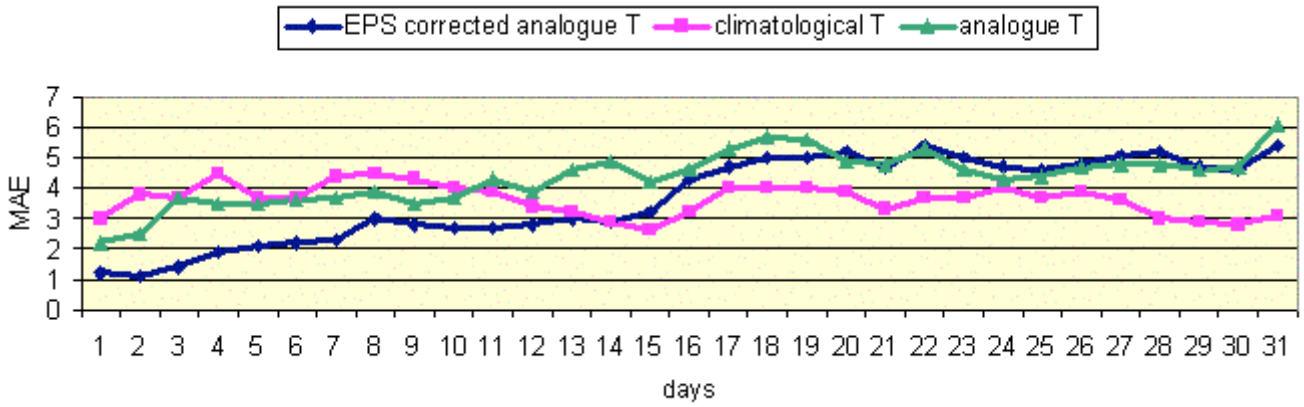


Fig. 9

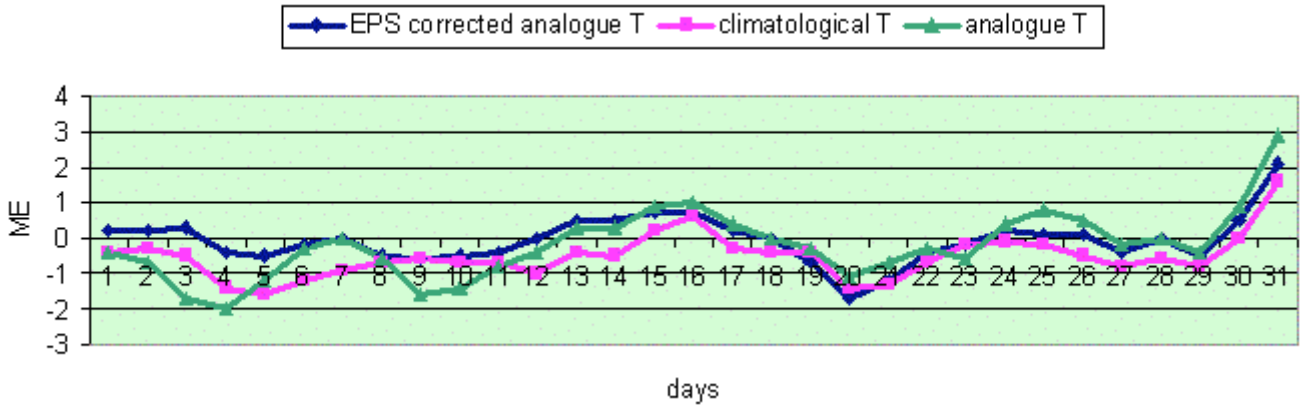


Fig. 10

RHMS of Serbia made first steps in using of the ECMWF Seasonal Forecast products (System2) from September 2006. We are using Web available products – spatial maps of model probabilities stratified by terciles for T2m temperature and precipitation and climagram for southeast Europe for preparation of first seasonal forecast bulletins for final users (Belgrade remote heating system, Ministry of Agriculture).

At the end of 2006 regular dissemination of the monthly mean anomalies of minimum and maximum temperature and for precipitation is activated.There is no systematic verification of seasonal forecast yet.

3.1.2 ECMWF model output compared to other NWP models

3.1.3 Post-processed products

3.1.4 End products delivered to users

3.2 Subjective verification

There is no subjective verification.

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

3.2.2 Synoptic studies