



Republic Hydrometeorological Service of Serbia

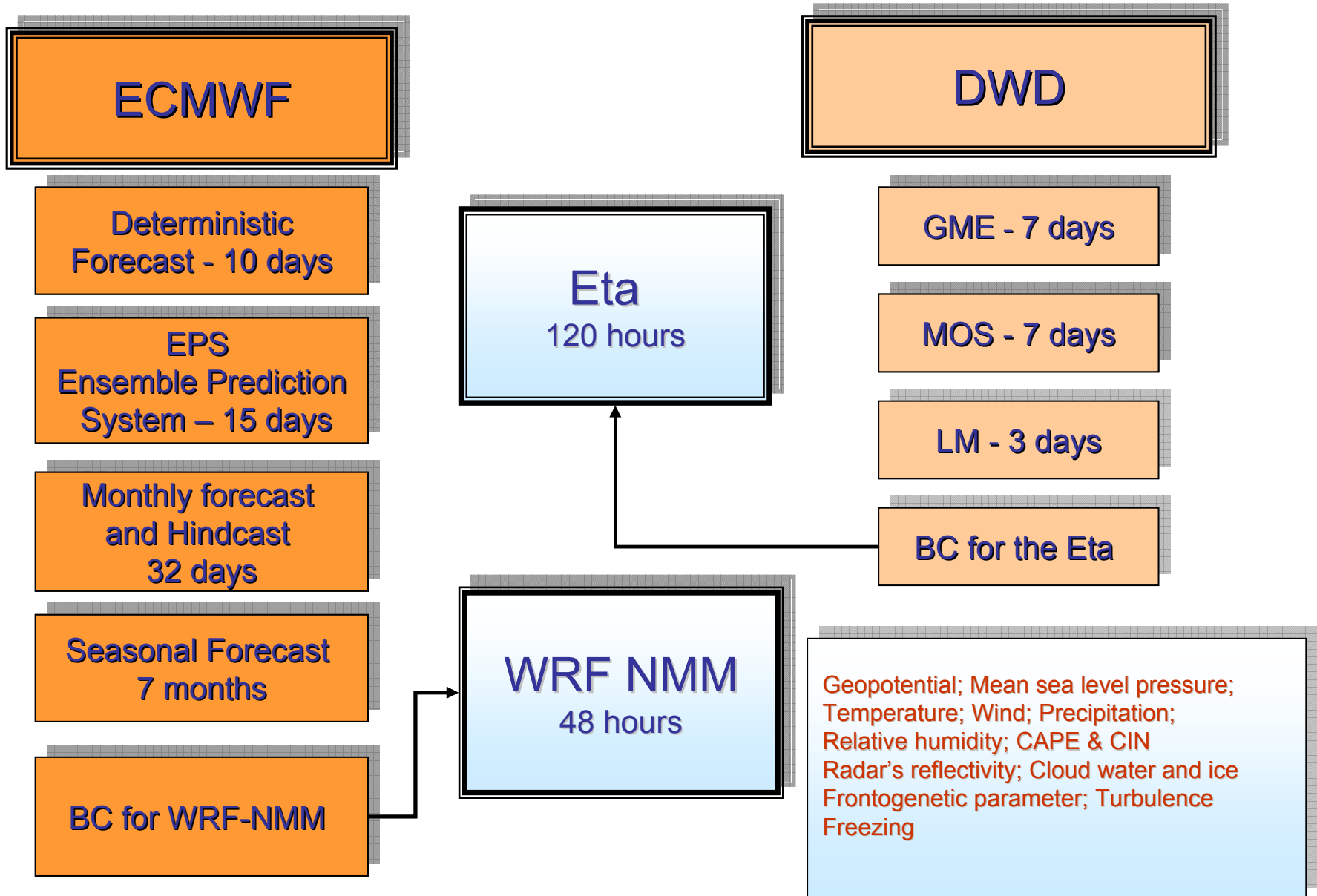
Use and verification of ECMWF products at the RHMS of Serbia

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ECMWF Forecast Products Users Meeting,
11-13 June 2008, ECMWF, Reading



Numerical Weather Models & Products in use





Use of ECMWF products

Name	Data type	No. of products	Volume
SZ	BC – regional Eta	1868	14.47MB
S1	Deterministic forecast Europe region	2220	91.97MB
S2	Hindcast, Monthly and Seasonal forecast	13172	3.58MB
S3	Experimental	594	2.92MB
S4	BC for WRF NMM	2656	7.49MB
S5	Deterministic forecast Balkan region	4514	5.77MB
SB	BUFR - Weather Parameters	3626	3.83MB



Use of ECMWF software

- BUFRDC
- GRIBEX
- GRIB API
- Magics
- Metview
- SMS
- MARS

The screenshot shows the ECMWF website page for GRIBEX encoding/decoding software. The page includes a navigation menu with categories like Home, Your Room, Login, Contact, Feedback, Site Map, and Search. Below the navigation, there are sections for 'About Us', 'Products', 'Services', 'Research', 'Publications', and 'News&Events'. The main content area is titled 'GRIBEX encoding/decoding software' and contains a description of the software, a list of links for 'Download', 'License', 'Description', 'Roadmap', 'Changes', 'Contact', 'Mailing list', 'Available versions', 'Main characteristics', 'GRIBEX manual', and 'ECMWF Table 2 versions'. A 'License' section at the bottom states that the software is licensed under the GNU Lesser General Public License.

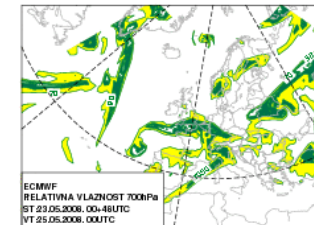
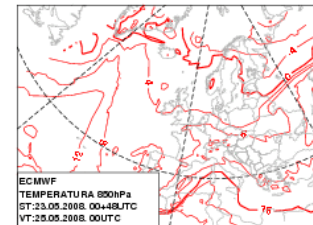
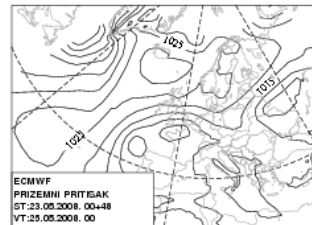
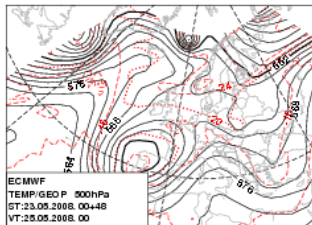
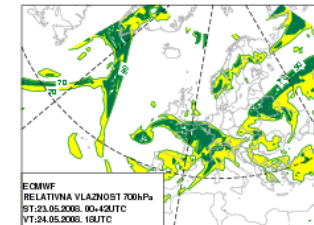
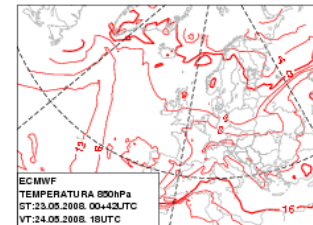
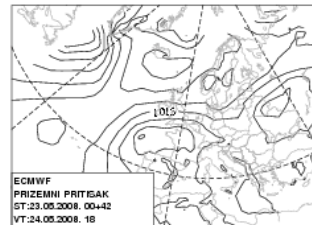
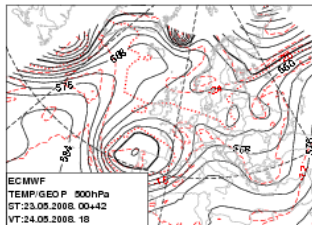
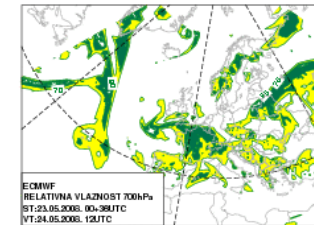
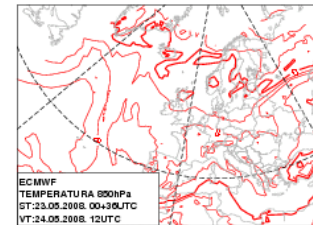
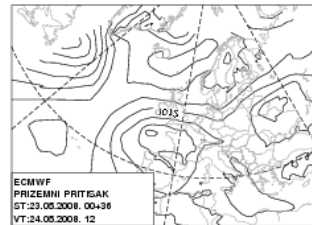
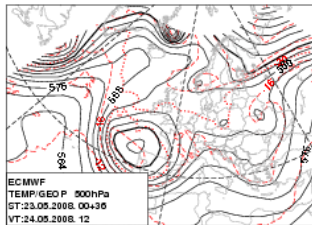
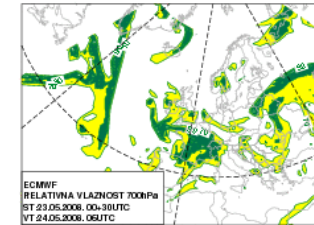
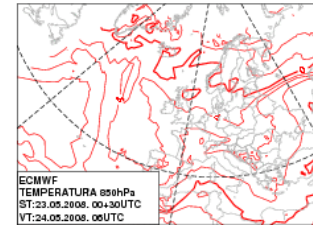
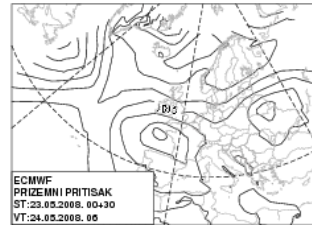
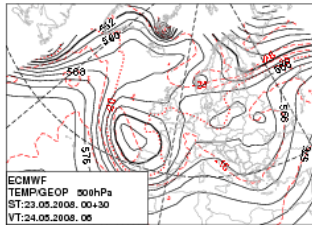
The screenshot shows the Metview/Macros interface. It features a menu bar with 'File', 'View', 'Tools', 'Folders', and 'Help'. The main area displays a file explorer view with several folders and files, including 'GEOPO', 'GEOPOTENCIJAL', 'ERATURA', 'TEMPERATURA na 2m', 'OBLACI', 'DAVINE', 'POT TEMP', 'VETAR N', 'VETAR', 'VERTIKALNI PRESEK', 'VERT BRZINA', and 'PREDLOZI'. A context menu is open over the 'ERATURA' folder, showing options like 'execute', 'visualise', 'examine', 'save', 'edit', 'duplicate', 'delete', 'output', and 'output'.

The screenshot shows the XCdp interface. It has a menu bar with 'File', 'Edit', 'Show', 'Servers', 'Windows', and 'Help'. The main area displays a list of data sources and their status, including 'COROBOR', 'UDCS', 'rmdcn', 'DWDsat', 'process', 'receive', 'smart', 'smog', 'SuperVision1', 'telsi', 'telsipro', 'rhmzdata', 'gateway', 'public', 'ftp', 'web', 'mail', 'ruterkosutnjak', 'ruterzelenobrd', 'Alpha1', 'Ornyx', 'novolab', 'linksurcin', 'CmaGora', and 'linkzemun'. Each entry includes a status icon and a timestamp.



Visualization of ECMWF products using Metview

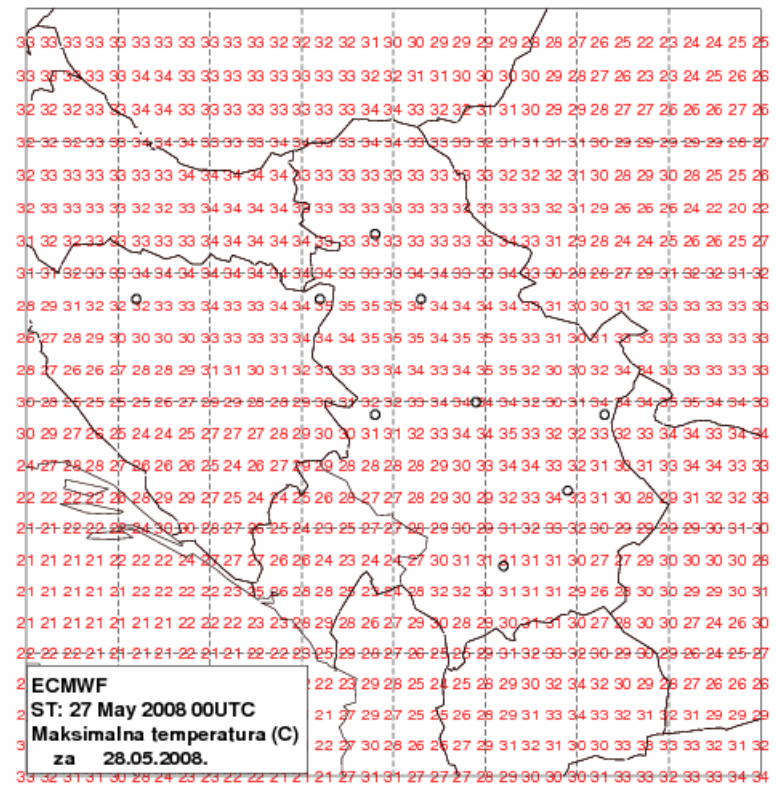
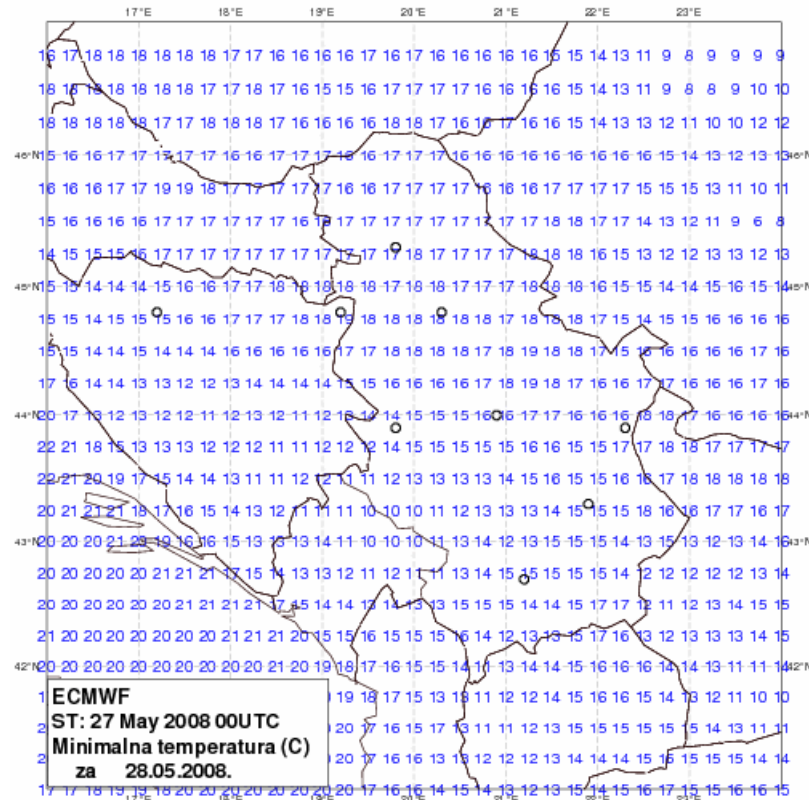
z500 hPa, MSLP, t850 hPa & RH700 hPa





Visualization of ECMWF products using Metview

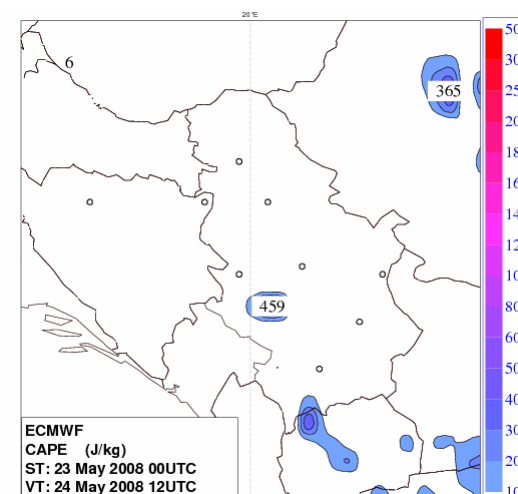
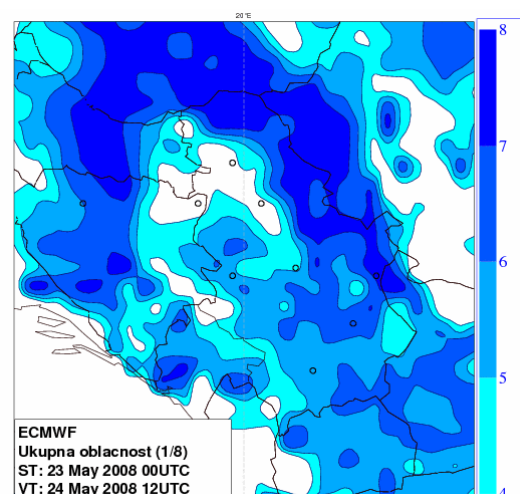
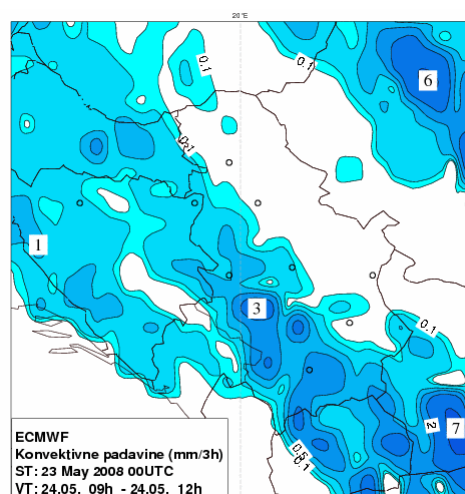
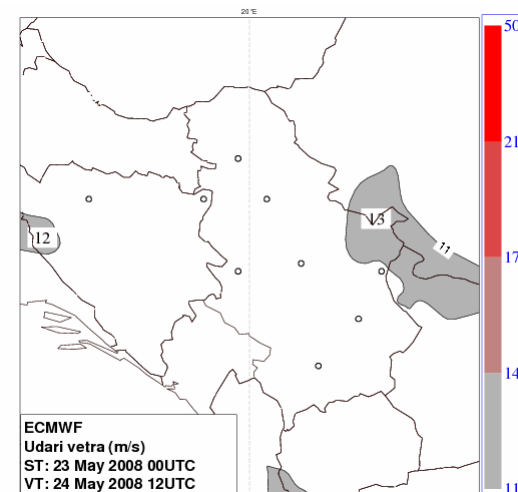
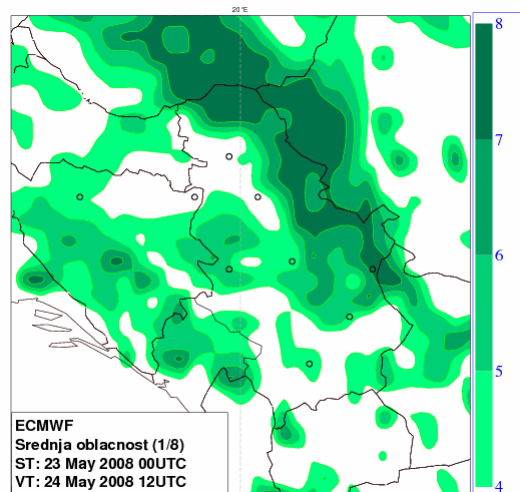
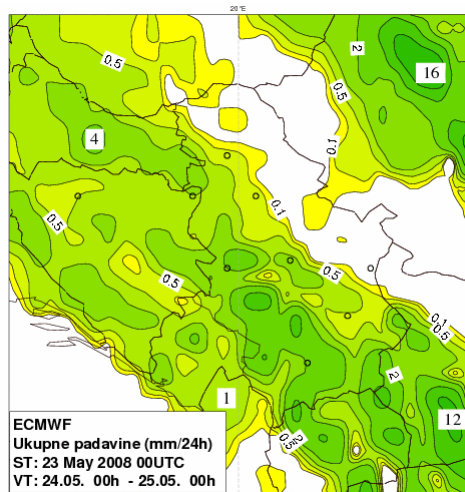
2m daily minimum and maximum temperature





Visualization of ECMWF products using Metview

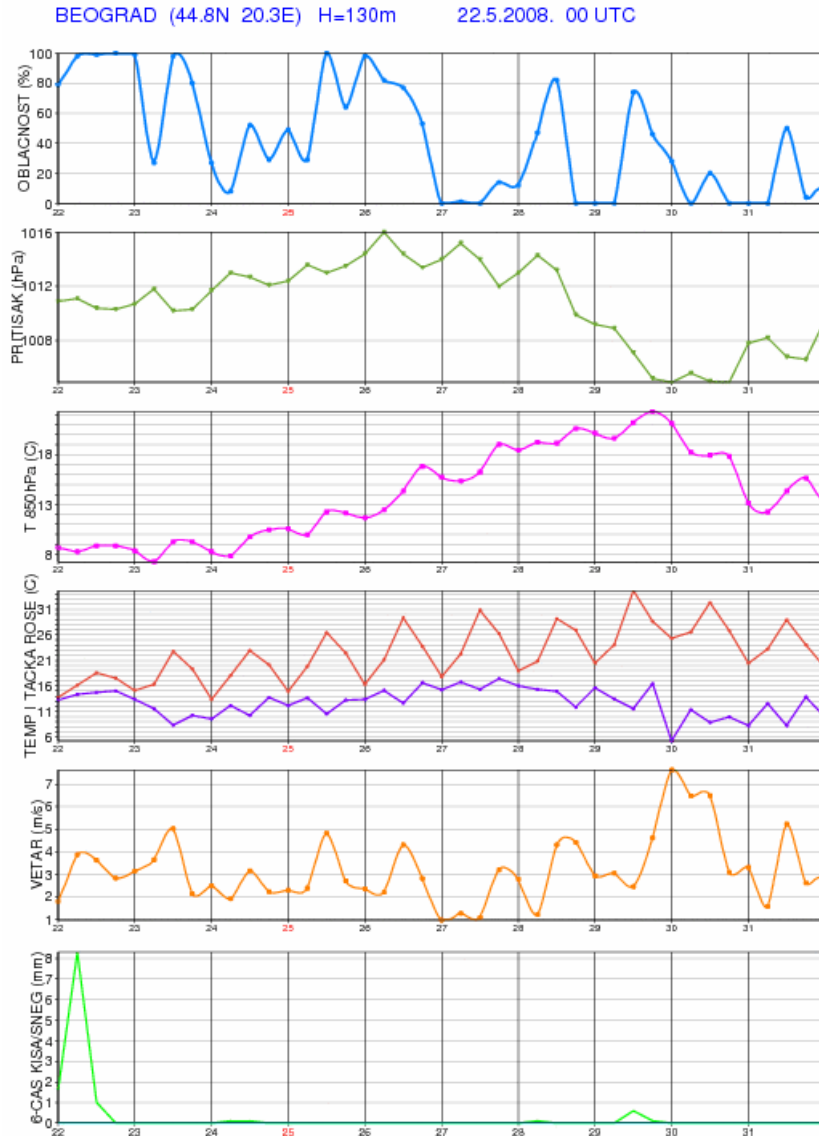
total prec/24h, conv. prec/3h, middle and total cloud cover, wind gust & CAPE



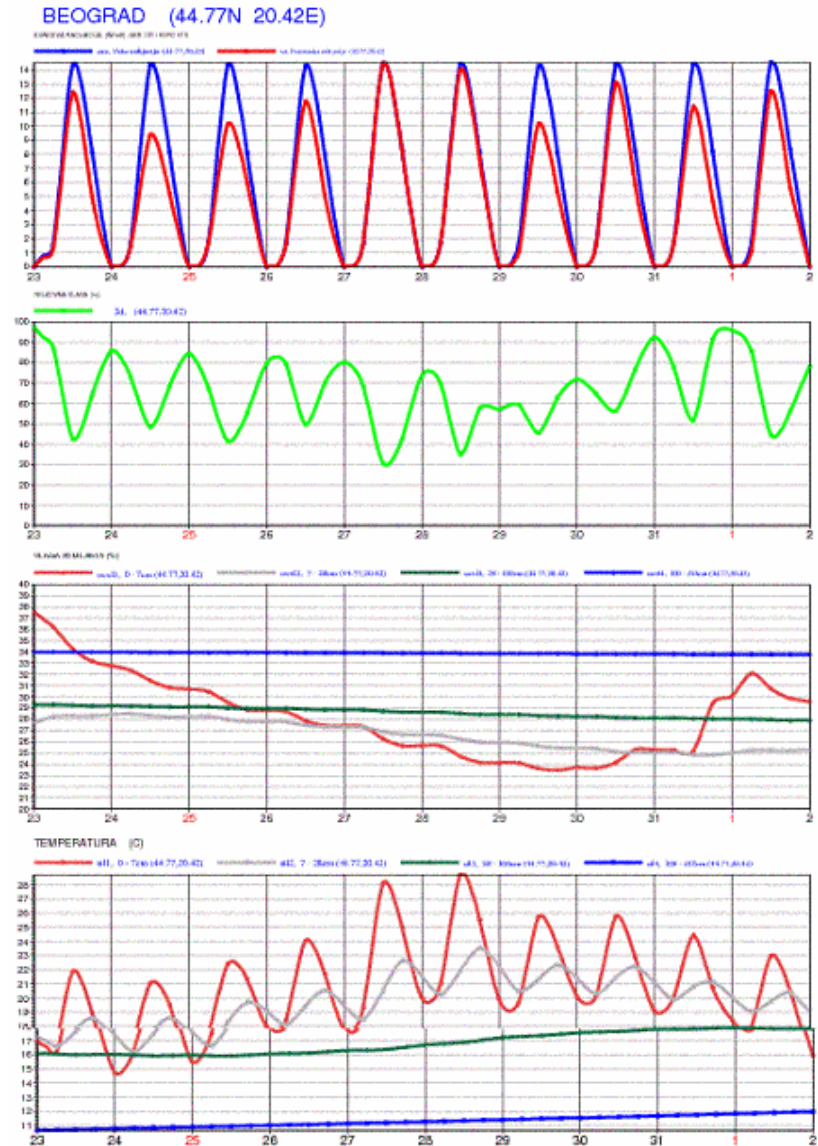


Visualization of ECMWF products using Metview

meteograms



radiation, 2mRH, soil t and moisture content at four ground levels for agro meteorology





Use of ECMWF BUFR products

daily and 6-hourly forecast for road maintenance and remote heating systems

RHMZ SRBIJE - PROGNOZA ZA BEOGRAD

START PROGNOZE 27. 5.2008. 00UTC

DATUM	MIN(°C)	MAX(°C)	SRED(°C)	PAD(mm)
27. 5.2008.	16	32	25.9	-
28. 5.2008.	18	34	26.0	-
29. 5.2008.	17	28	22.1	-
30. 5.2008.	17	30	23.3	-
31. 5.2008.	18	30	23.9	0
01. 6.2008.	18	30	24.5	-
02. 6.2008.	17	32	26.2	-
03. 6.2008.	20	30	24.4	1
04. 6.2008.	18	33	26.1	-
05. 6.2008.	19	28	23.0	0

RHMZ SRBIJE - PROGNOZA ZA BEOGRAD

START PROGNOZE 27. 5.2008. 00UTC

h(LOC)	T(C)	PRAV	BRZ(m/s)	MX(m/s)	PAD(mm)
27. 5.2008.					
2	17	JI	2	0	-
8	23	J	3	6	-
14	32	Z	3	6	-
20	30	Z	2	5	-
28. 5.2008.					
2	19	JZ	3	4	-
8	24	JZ	2	5	-
14	34	Z	4	9	-
20	26	SZ	4	7	-
29. 5.2008.					
2	20	SI	3	8	-
8	20	SI	3	6	-
14	28	I	5	10	-
20	22	I	6	12	-
30. 5.2008.					
2	18	JI	6	10	-
8	20	JI	6	10	-
14	29	JI	3	9	-
20	25	I	4	7	-



Verification of medium range forecast

- the 00UTC run
- nine synoptic stations
- grid points closest to chosen synoptic stations
- still under development

Verified parameters:

- 2m minimum (night time 18-06UTC) temperature
- 2m maximum (day time 06-18UTC) temperature
- 24 hour accumulated precipitation (06UTC) with various rainfall thresholds

Computed scores:

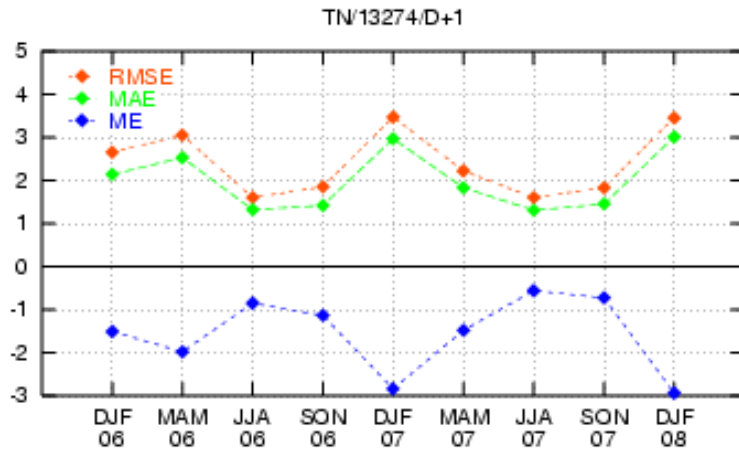
- continuous (ME, MAE, RMSE, ...)
- categorical (FBI, POD, FAR, PC, TS, KSS, ...)



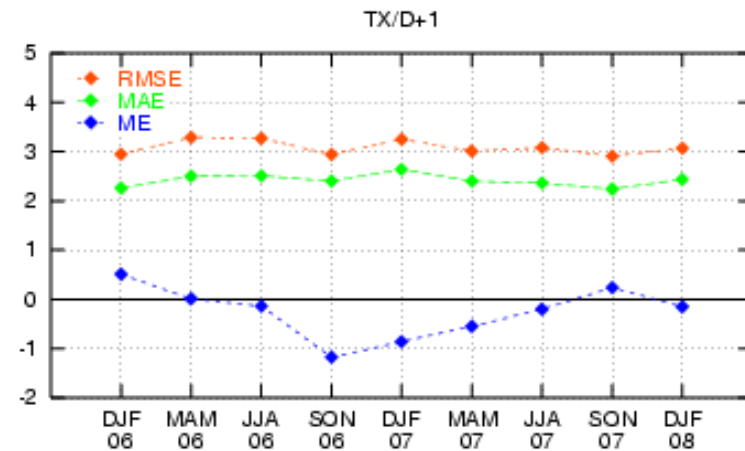
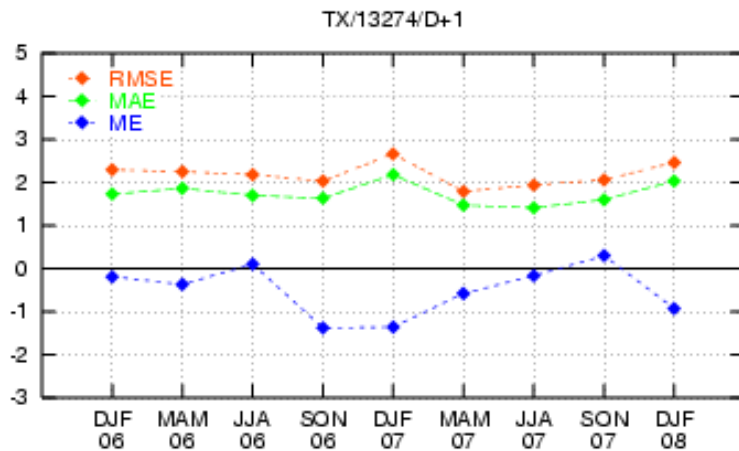
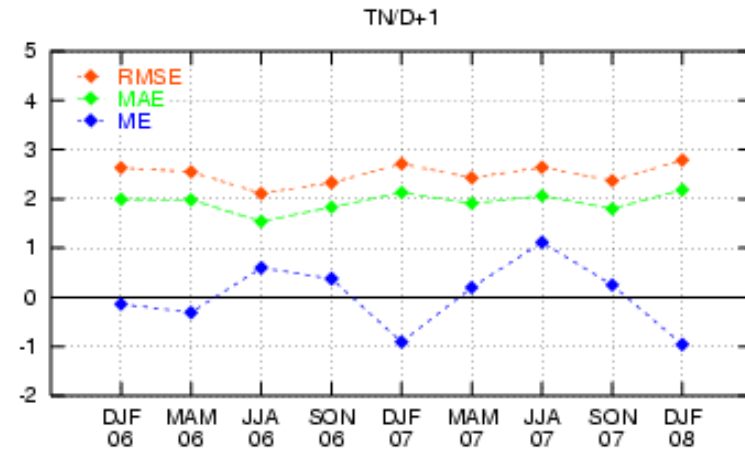


Verification of medium range forecast

2m minimum and maximum temperature, D+1, Beograd



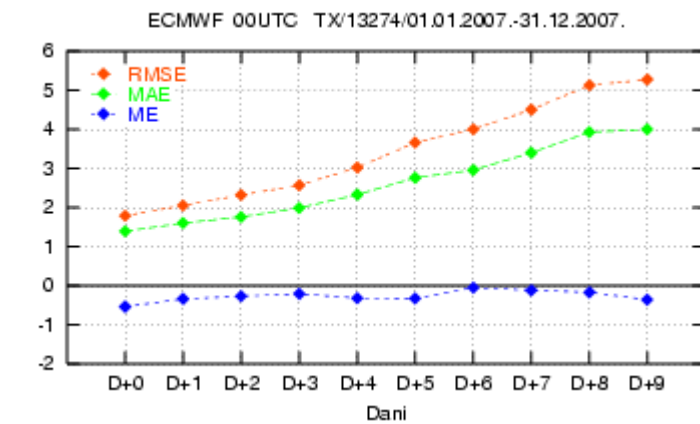
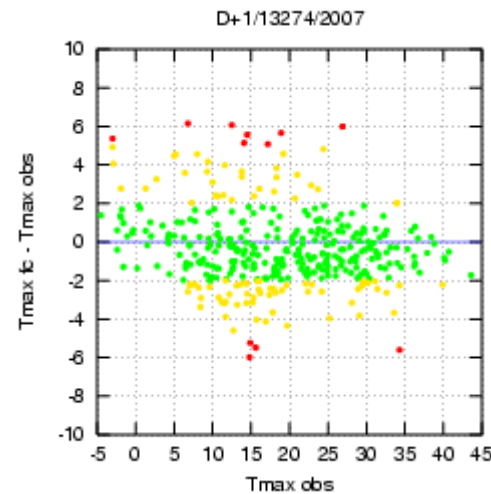
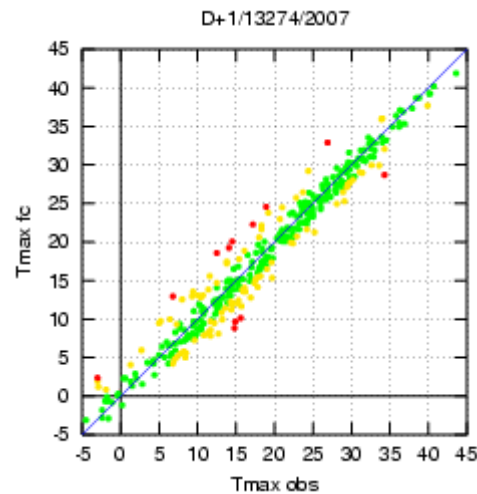
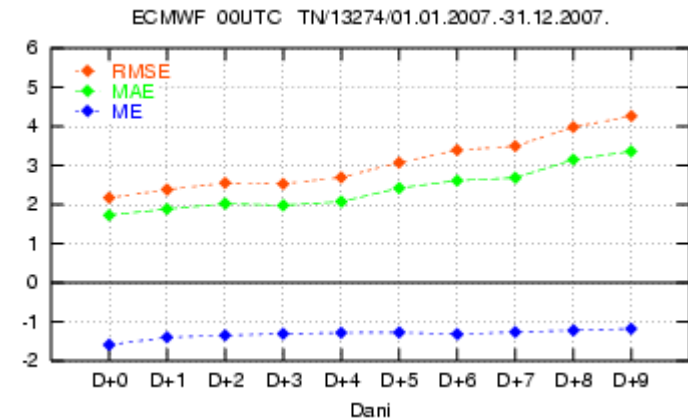
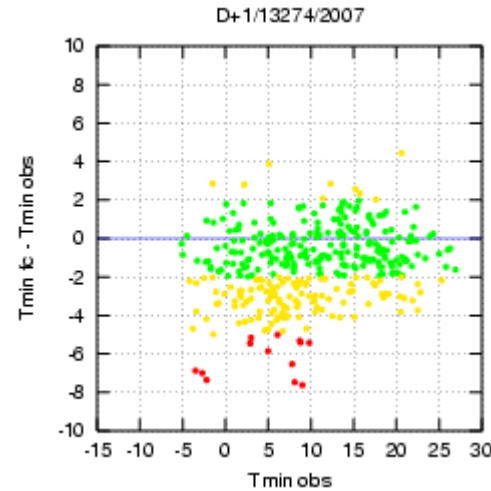
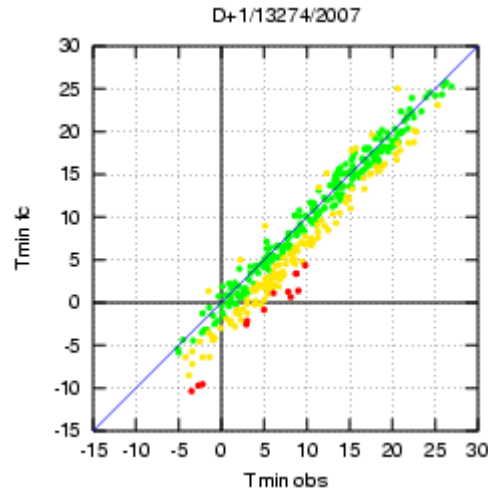
2m minimum and maximum temperature, D+1, 9 stations





Verification of medium range forecast

2m minimum and maximum temperature, Beograd, 2007





Verification of medium range forecast

Beograd,
t+54, 2007

0.3mm/24h

F\O	yes	no	Σ
yes	87	65	152
no	15	197	212
Σ	102	262	364

2mm/24h

F\O	yes	no	Σ
yes	52	27	79
no	26	259	285
Σ	78	286	364

10mm/24h

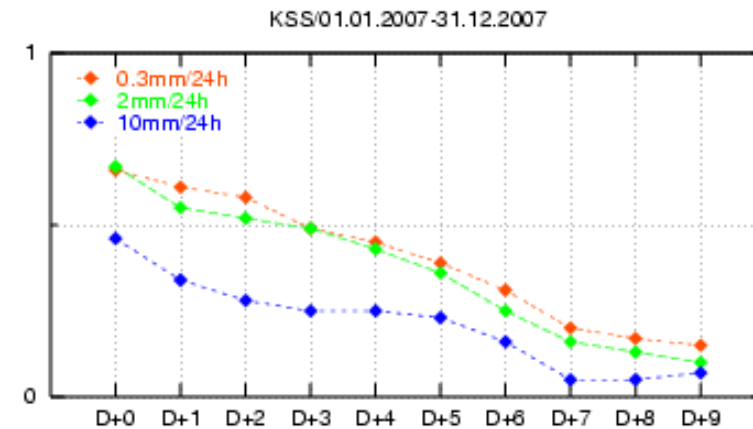
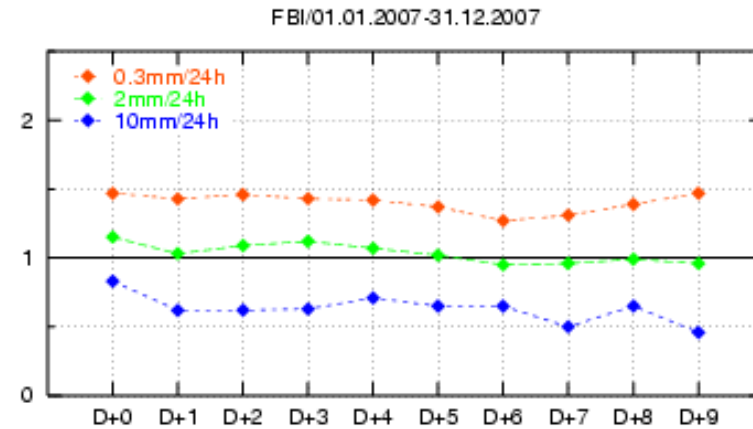
F\O	yes	no	Σ
yes	10	5	15
no	17	332	349
Σ	27	337	364

FBI=1.49
POD=0.85
FAR=0.43
PC=0.78
F=0.25
KSS=0.60
TS=0.52
ETS=0.36
HSS=0.53

FBI=1.01
POD=0.67
FAR=0.34
PC=0.85
F=0.09
KSS=0.57
TS=0.50
ETS=0.40
HSS=0.57

FBI=0.56
POD=0.37
FAR=0.33
PC=0.94
F=0.01
KSS=0.36
TS=0.31
ETS=0.29
HSS=0.45

FBI & KSS, 9 stations, 2007





Combined monthly forecast method

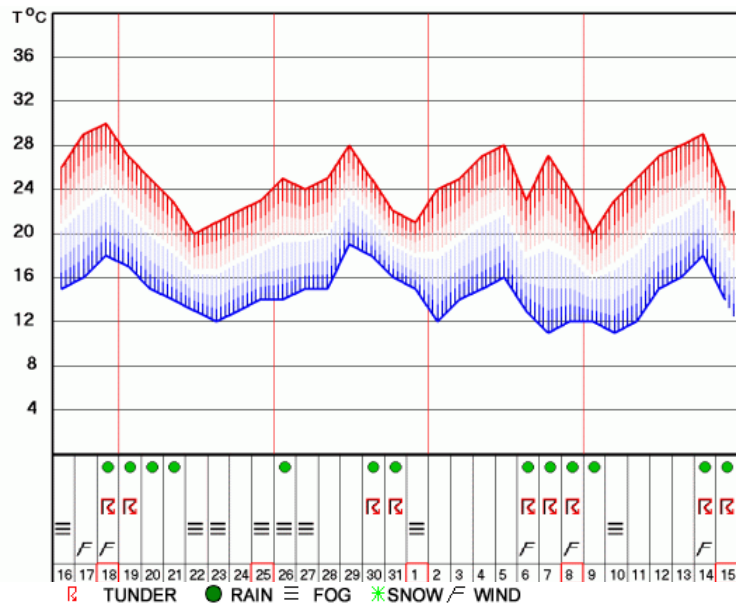
Combined method based on analogue method of RT500/1000hPa anomalies, ECMWF, DWD and NCEP products

Introduced in 2005

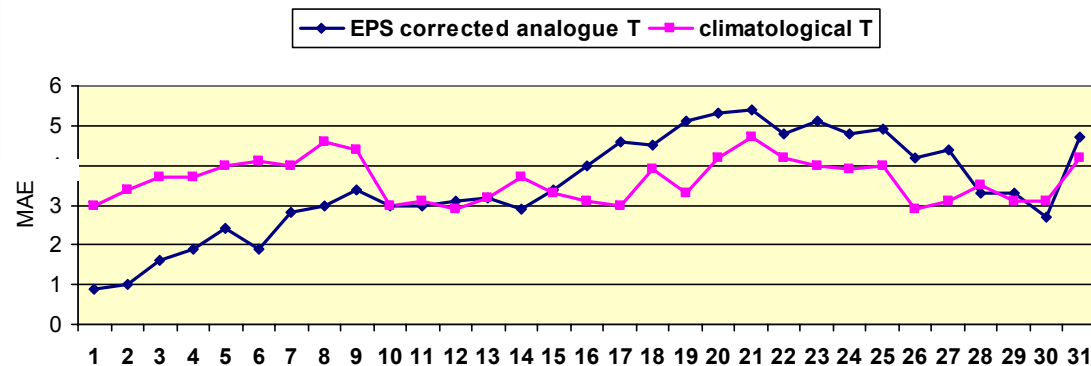
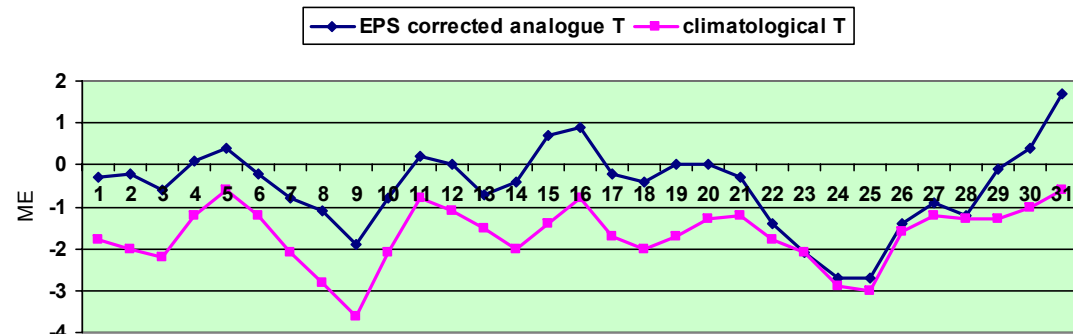
Verification of combined method for 2006 and 2007 has shown an improvement in reliability of monthly forecast.

Monthly forecast for Belgrade
16.05.-15.06.2008.

ME and MAE of mean daily temperature for Belgrade for year 2007:



Twice a month for several places in Serbia.





Extended Range Forecast

Extended range forecasts based on ECMWF EPS products since October 2006

Forecasts based on probability distribution

Users of probabilistic extended range forecasts

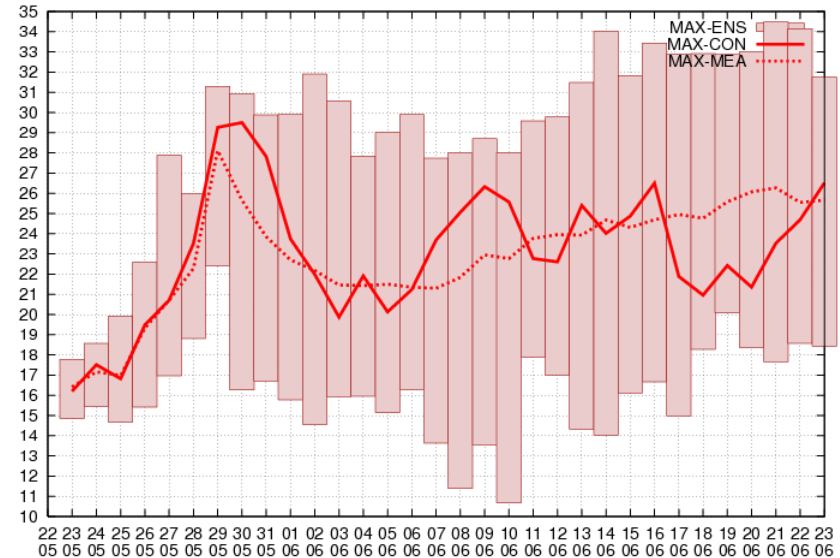
- Ministry of energy
- Ministry of agriculture
- Belgrade road maintenance and remote heating system
- Hydrology and Agriculture departments of HMS of Serbia



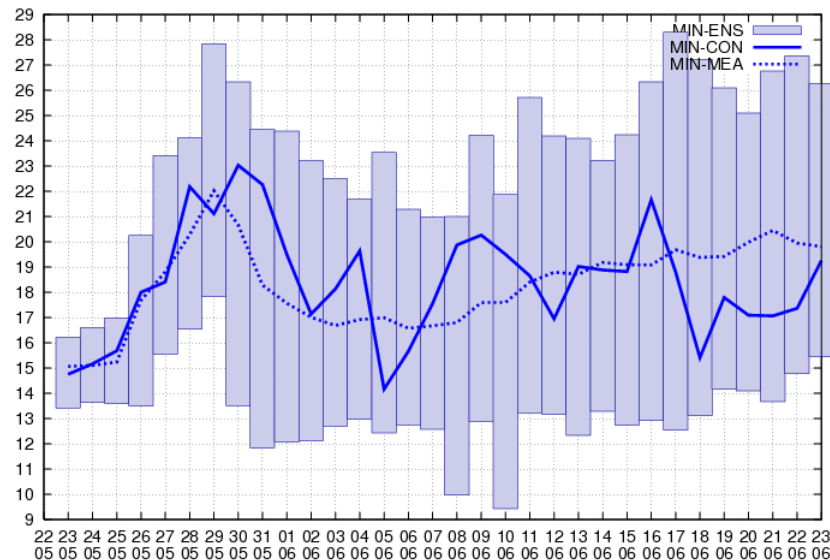
Monthly forecast

- Monthly forecast and hindcast data for minimum, maximum temperature and precipitation amount
- Statistical analyses of both ensemble members
- 5 locations in Serbia

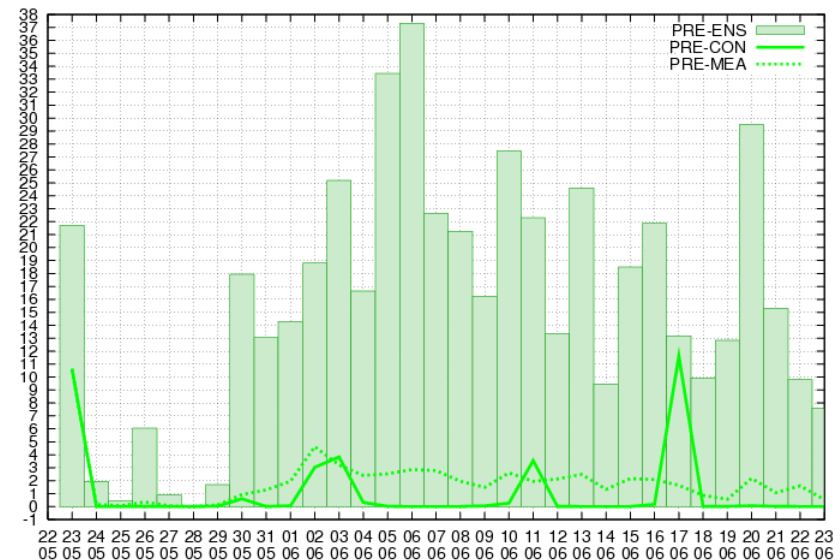
ECMWF Ansambl max dnevne temperature za 50km NE od Beograda 22.05.2008. - 23.06.2008.



ECMWF Ansambl min dnevne temperature za 50km NE od Beograda 22.05.2008. - 23.06.2008.



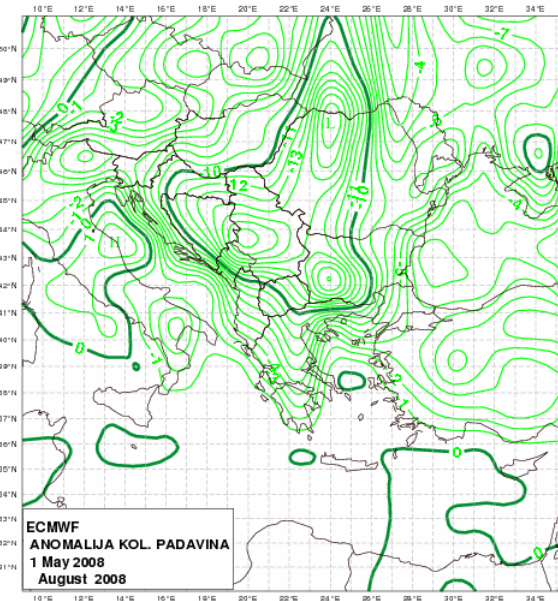
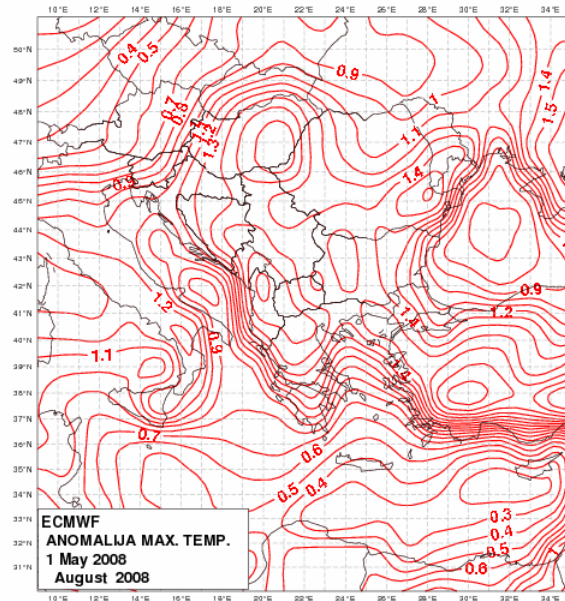
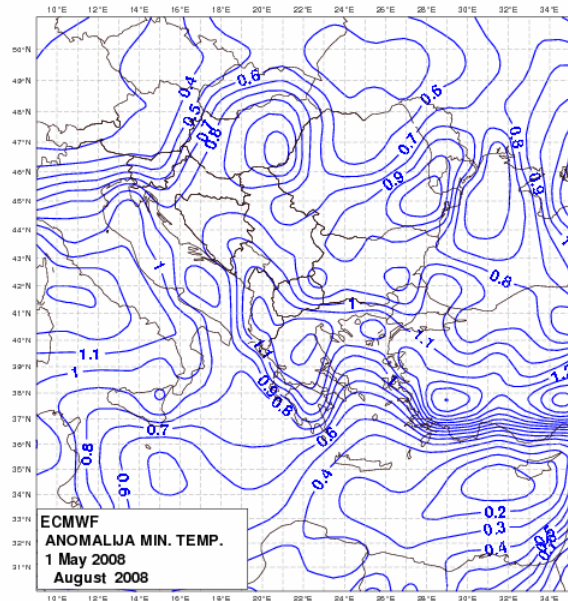
ECMWF Ansambl dnevne kol padavina za 50km NE od Beograda 22.05.2008. - 23.06.2008.





Seasonal forecast

Mean monthly anomaly charts for minimum and maximum temperature and precipitation





Seasonal forecast

August 2008 : Warmer and drier August.

Mean minimum air temperature in August will be above or within multiannual average with its value in average 0.7°C higher in the east and 1.2°C in the north, west and southwest of the country. In Belgrade and its wide vicinity forecasted value of August mean minimum air temperature will be around 17.9°C.

Mean maximum air temperature in August will be above multiannual average with the values in average 1.3°C higher. In Belgrade and its wide vicinity mean maximum air temperature during August will be around 29.4°C.

Mean precipitation quantity during August will be below or in the range of multiannual average with values in average around 11mm lower in most parts of the country to 8mm in the far southwest of Serbia than the multiannual average. In Belgrade and its wide vicinity, mean August precipitation quantity will amount to around 45mm.

		below 18.1	5	extremely below normal	extreme cold
June- July- August	21.8	18.1 - 20.2	15	below normal	cold
		20.3 - 23.2	20	normal	normal
(JJA)		23.3 - 25.5	20	above normal	warm
		above 25.5	40	extremely above normal	very warm



WRF NMM based on ECMWF's I & LBC

A state-of-the-art non-hydrostatic, pressure-sigma hybrid vertical coordinate mesoscale model.

Current characteristics

- horizontal resolution about 10km
- number of numerical points 92x118
- 38 vertical levels

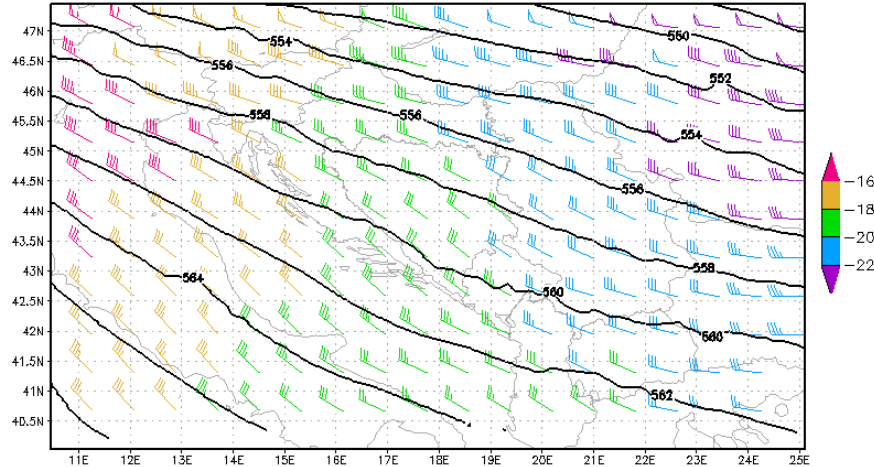
Domain covers the Balkans and the Adriatic Sea.

Model is running twice a day on ECMWF boundary conditions for 48 hours ahead.

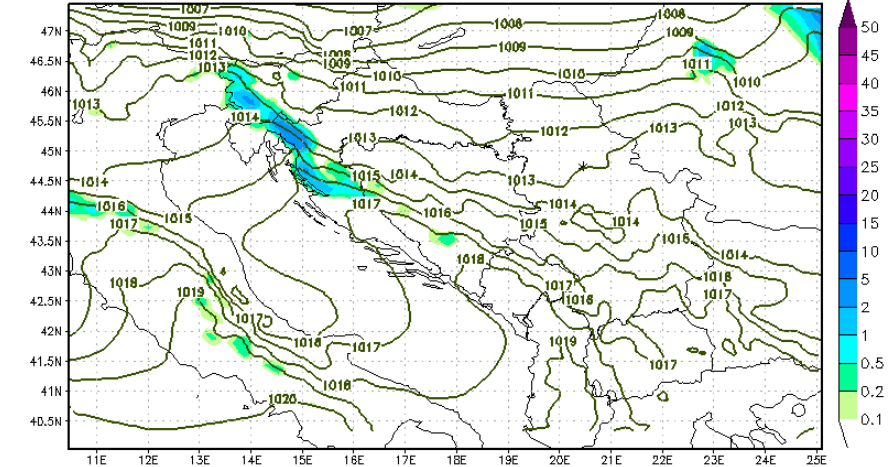


WRF NMM Products based on ECMWF's I & LBC

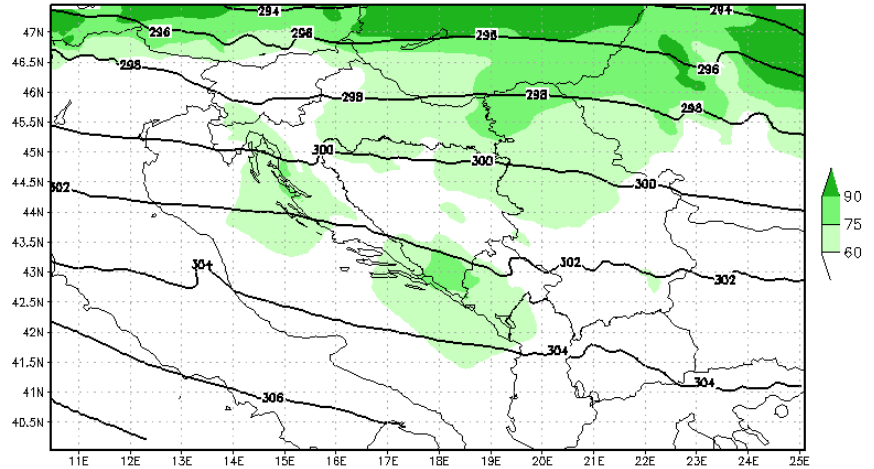
WRF-NMM 500hPa Geopotencijal (gpm), vetar i temperatura (C)
Start:01.03.2008 00 UTC Valid:01.03.2008 03 UTC



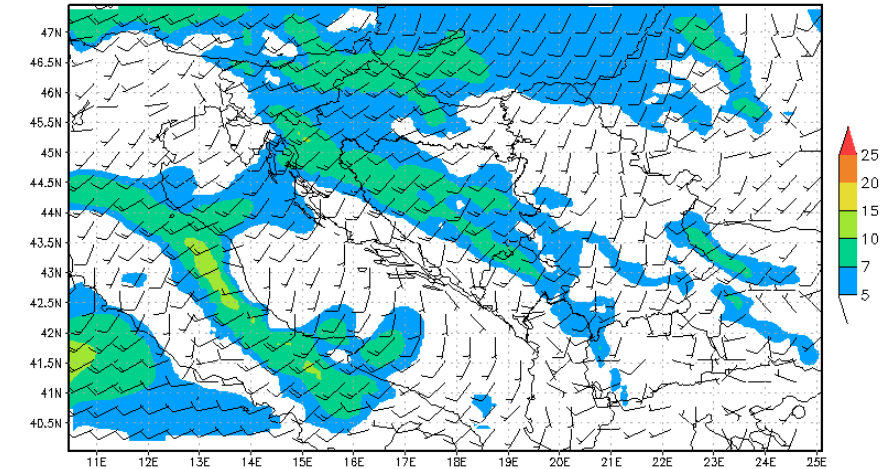
WRF-NMM Ukupne 3h padavine (mm) & prizemni pritisak (hPa)
Start:01.03.2008 00 UTC Valid:01.03.2008 03 UTC



WRF-NMM 700hPa Geopotencijal (gpm) i rel. vlaga (%)
Start:01.03.2008 00 UTC Valid:01.03.2008 03 UTC



WRF-NMM Vetar na 10m (m/s)
Start:01.03.2008 00 UTC Valid:01.03.2008 03 UTC



Republic Hydrometeorological Service of Serbia



www.hidmet.gov.rs

www.meteoalarm.rs