Long-term forecast in Croatia

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Weather Analysis and Forecast Department

Meteorological and Hydrological Service of Croatia

Courtesy of Zoran Vakula and Lovro Kalin

SEECOF IV, Belgrade, 22-26 November 2010

Outline

- Overview of the activities in Weather Analysis and Forecast Dept.
- Monthly Weather Forecasts before and after Jan 2010
- Seasonal Weather Forecasts, production
- Seasonal Weather Forecast, conclussion

Main activities of the Weather Analysis and Forecast Department

Duties and products:

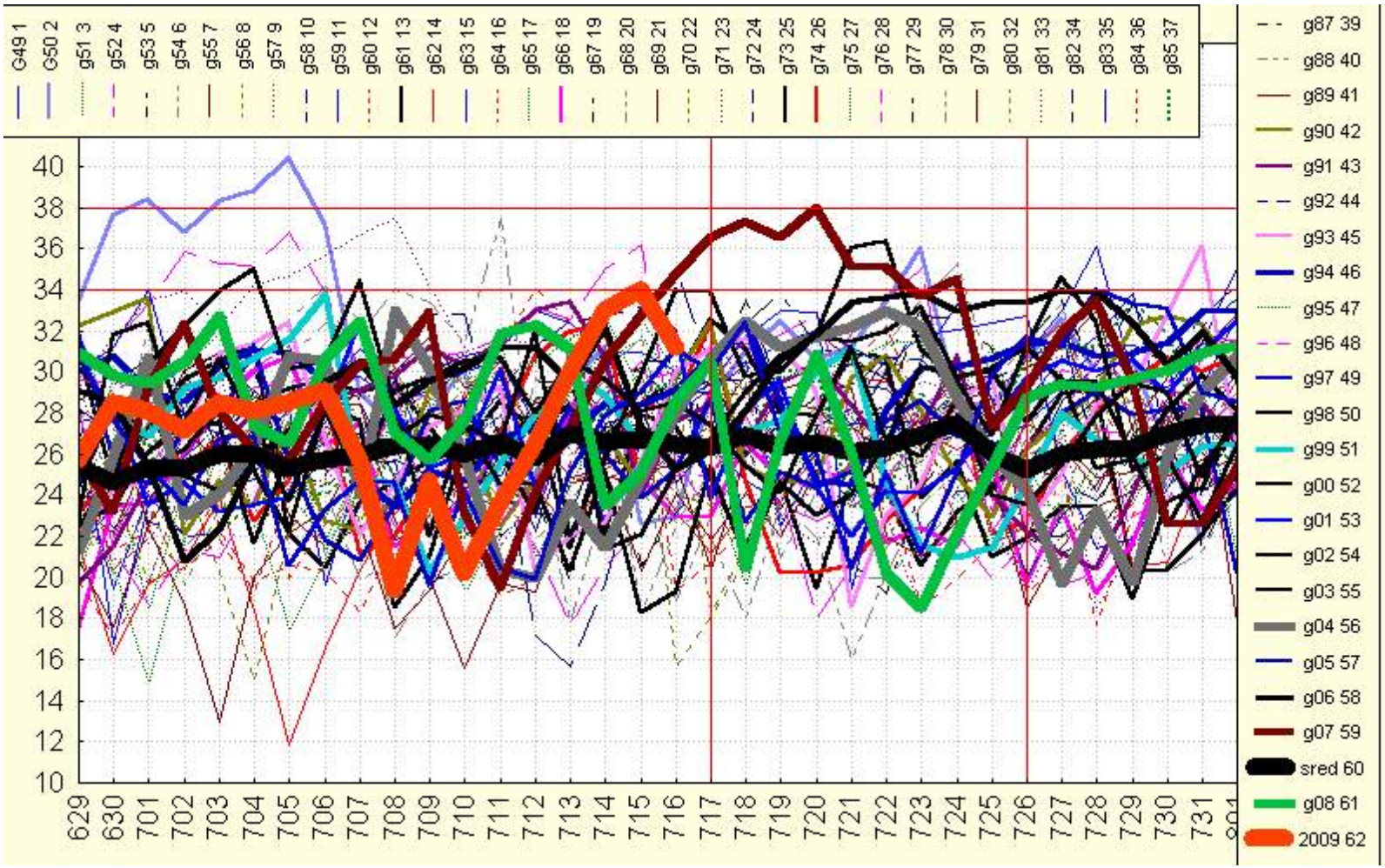
- Weather Alarms and Nowcasting (daily, twice or more)
- Short-range forecasts (daily, updated according to needs)
- Medium – range forecasts (daily)
- Monthly forecasts (twice per month, on Fridays)
- Seasonal forecasts (once per month, between 15th and 20th)

Users:

- General public
  - radio, tv, newspapers, web, sms, mms, telephone service…
- Special customers
  - civil services, fire department, agriculture, roads, engineering, mine-disposal, water and power management, tourism …

Monthly Weather Forecasts, before 2010

- Temperature and precipitation forecasts based ONLY on the analogy with respect to T2m



Monthly Weather Forecasts, before 2010

- End-product...

Departure of the analogy year from climatology

Forecaster's comment

Means of the analogy year compared to climatology 1961-90

Daily minimum and maximum temperatures from the analogy year with respect to climatology

5-days precipitation accumulationsfrom the analogy year with respect to climatology

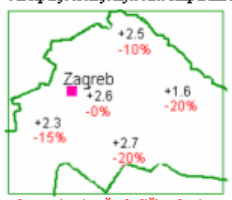
DHMZ, Odjel za vremenske analize i prognoze — Dinamičko-statistička dugoročna prognoza, Zagreb, 30. prosinca 2009.

PROGNOZA VREMENA ZA **SIJEČANJ 2010**. GODINE
(za razdoblje od 1. 1. do 5. 02. 2010.)

SREDIŠNJA HRVATSKA

Kopnenje za klimatologiju

odstupanje srednje mjesečne temperature



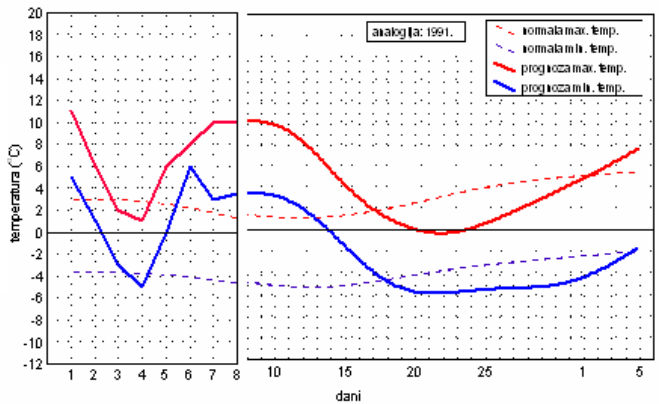
odstupanje mjesečne količine oborine

Srednja temperatura zraka očekuje se višom od prosječne. Prve dane nove godine obilježit će izrazito toplo vrijeme, a nakon kratkotrajnog zahlađenja očekuje se novi val toplog vremena. U drugoj polovici mjeseca izgledno je malo hladnije razdoblje.

Ukupna mjesečna količina oborine predviđa se oko višegodišnjeg prosjeka. Oborine će biti češće u prvoj polovici mjeseca, kada će nekratko i zasnježiti.

Na postaji Zagreb Maksimir od 1949. najhladniji siječanj bio je 1954. (srednja mjesečna temperatura zraka bila je −7.0 °C), a najtopliji 2007. (+1.7 °C). Najveće oborine bilo je 1964. (140 mm), a najmanje 1954. (1 mm).

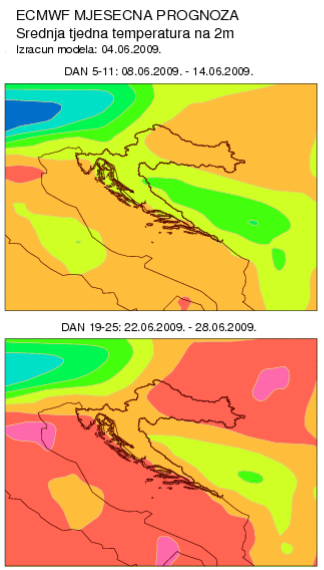
SIJEČANJ	srednja mjesečna temperatura (°C)		mjesečna količina oborine (mm)	
mjesto	normala	prognoza	normala	prognoza
BJELOVAR	-1.1	-0.7 do 1.8	50	30 do 50
KARLOVAC	-0.6	0.5 do 3.0	69	50 do 70
SISAK	-0.7	0.8 do 3.3	52	30 do 50
VARAŽDIN	-1.3	0 do 2.5	45	30 do 50
ZAGREB	-0.8	0.6 do 3.1	46	40 do 60

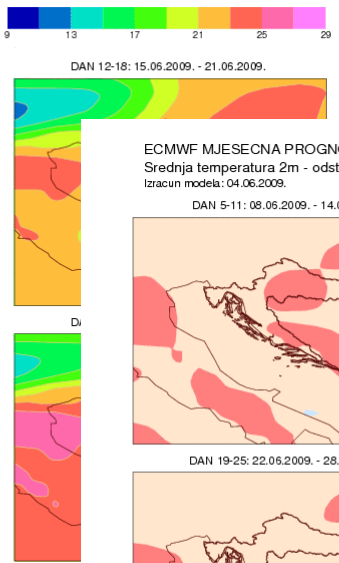


e-mail: prognoza@cirus.dhz.hr — ☎ +385 1 45 65 672, Fax: +385 1 45 65 757 — http://meteo.hr

Monthly Weather Forecasts, from Jan 2010

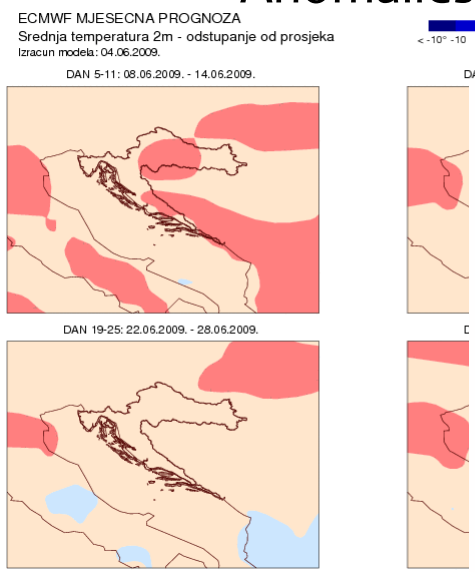
- after 1 year testing, ECMWF CM introduced in operational production

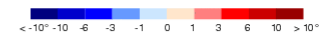




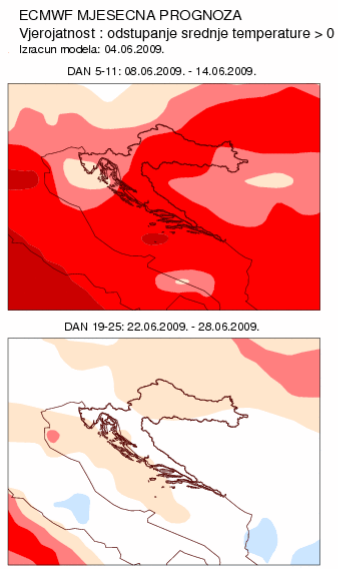
Temperature

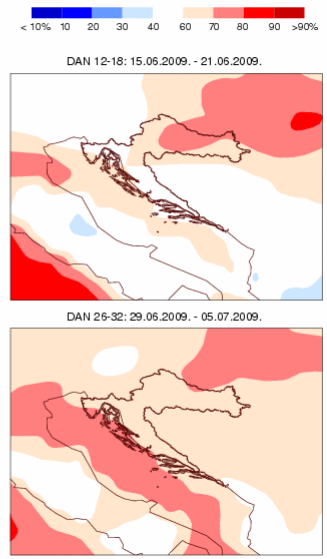
Anomalies





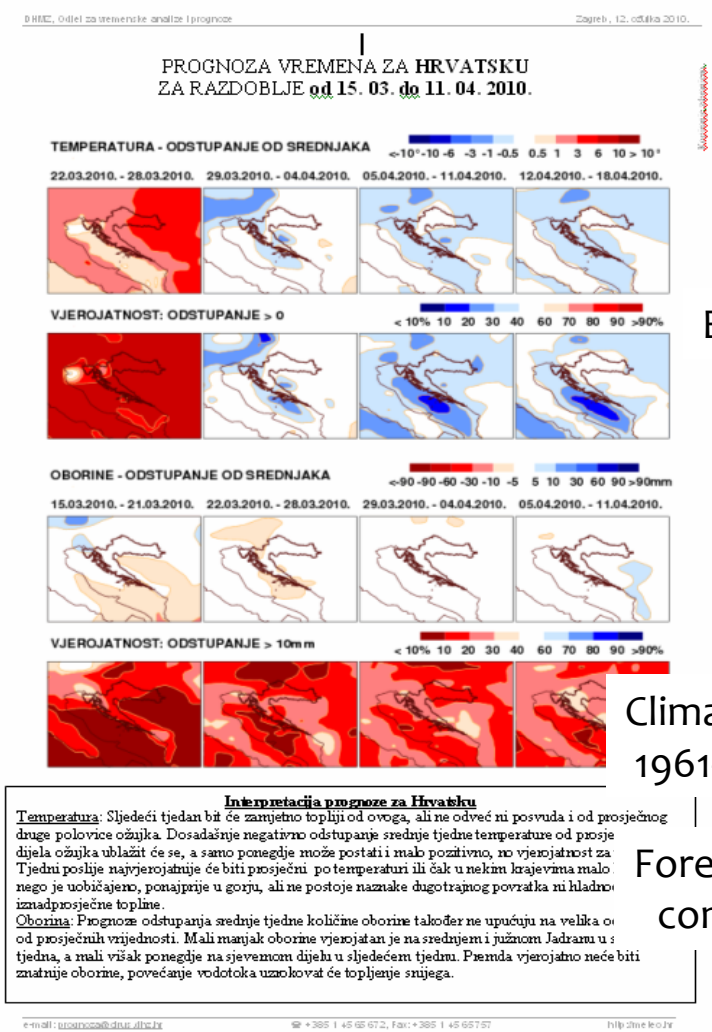
Probabilities



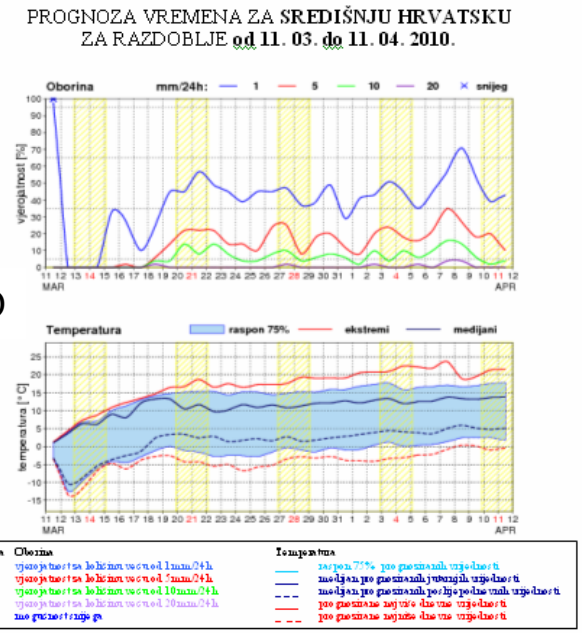


Monthly Weather Forecasts, from Jan 2010

- end-product changed accordingly



ECMWF DMO



Climatology 1961-90 →

Klimatološki srednjaci 1961.-1990.

ZAGREB	1. tjedan	2. tjedan	3. tjedan	4. tjedan
Tsre (°C)	4.9	7.8	9.5	10.5
Tmin (°C)	0.3	2.4	4.2	5.2
Tmax (°C)	11.6	13.9	15.0	16.0
oborina (mm)	10	16	15	15

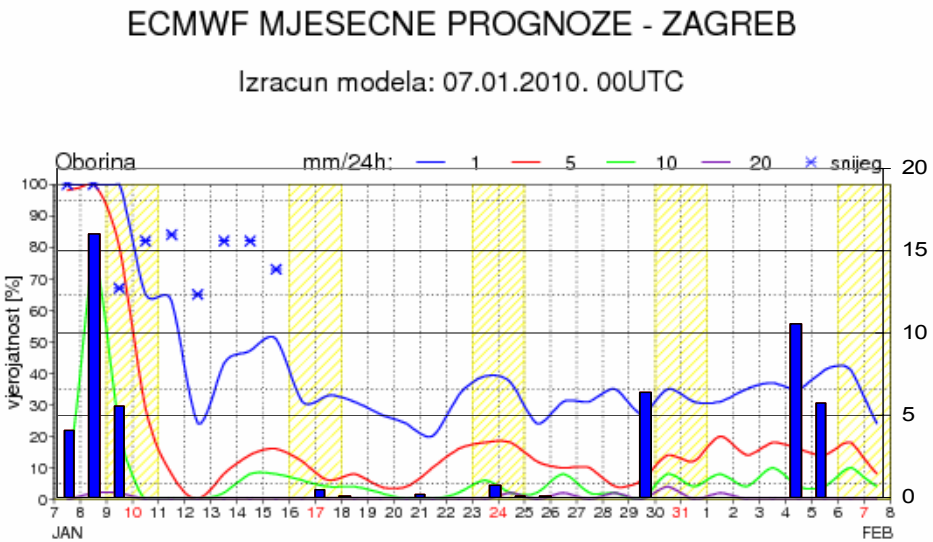
Forecaster's comment

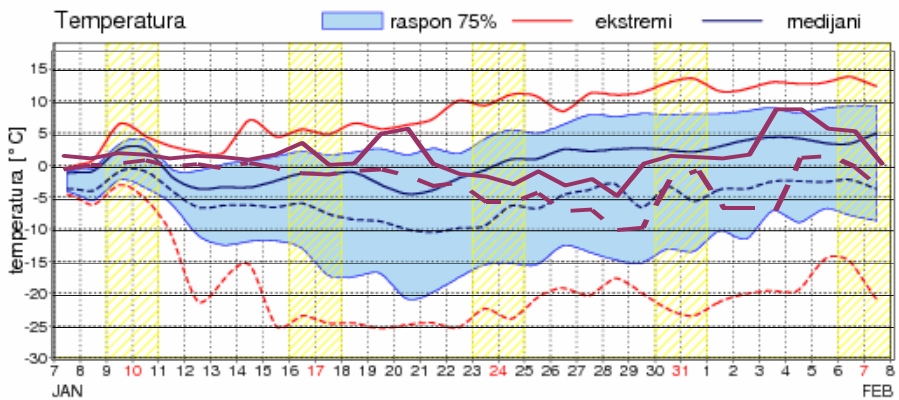
Interpretacija prognoze za središnju Hrvatsku

Temperatura: Potkraj ovoga i početkom sljedećega tjedna gotovo sigurno će još potrajati hladno razdoblje, možda čak i posljednje tako izraženo u prvoj polovici ove godine. Slijedi zamjetno zatopljenje u odnosu na srednju temperaturu u ovome tjednu, ali ne i na prosječnu druge polovice ožujka. Sami kraj mjeseca te prvih desetak dana travnja vjerojatno će biti uobičajeno topli ili tek malo hladniji nego što je uobičajeno.

Oborina: Sljedeći tjedan količina oborine bit će mala, no pritom još može pasti i vrlo malo snijega u prvoj polovici tjedna, vjerojatno potkraj ponedjeljka i u utorak. Vjerojatnost za više od 10 mm/24h povećava se oko 20. ožujka, od kada postoji sve veća mogućnost i češćih pljuskova.

Value of Monthly Weather Forecasts?





Due to complex Climatology - Graphs for 7 regions/points

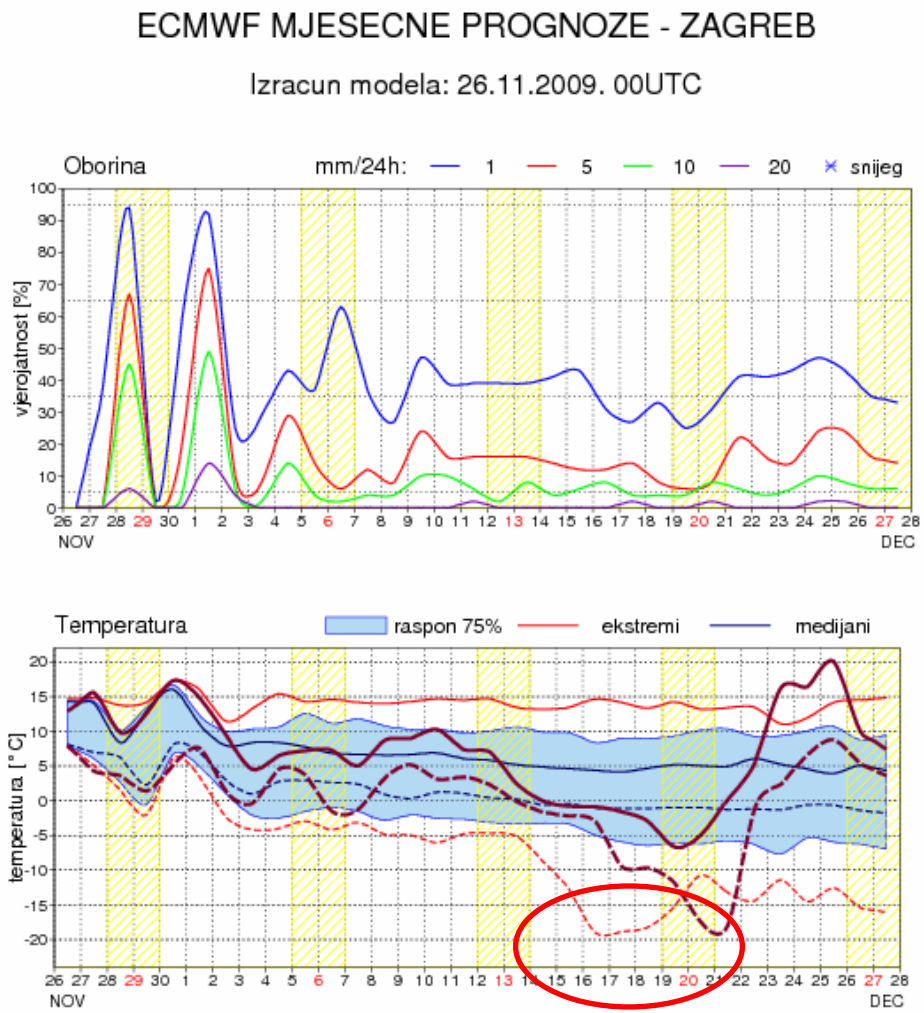
Precipitation:
1, 5, 10, 20 mm probabilities and snow day indicator

Temperature:
medians, extremes and 75% range

Value of Monthly Weather Forecasts?

Early warning
for 1st very cold period
last winter?

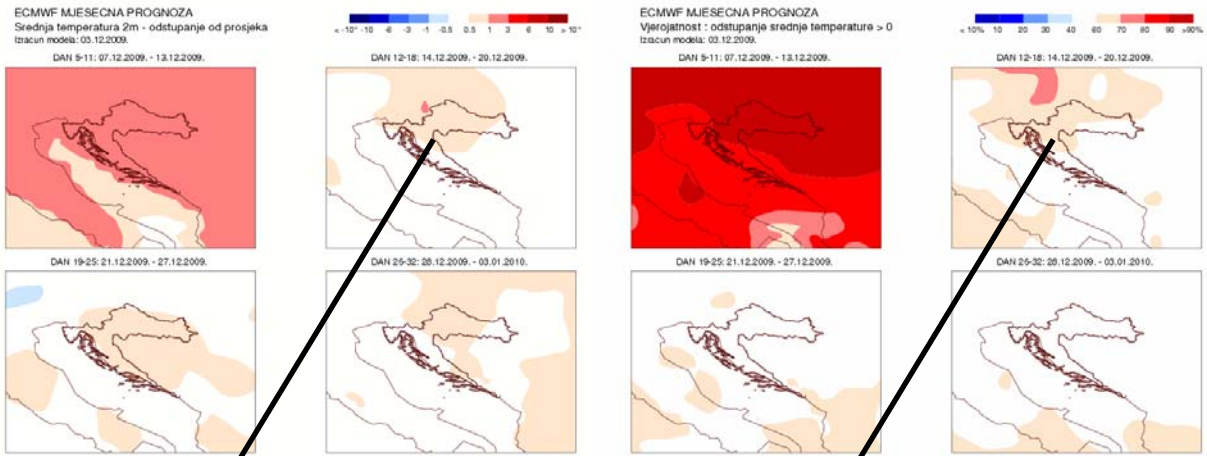
Skill or a random guess?



Value of Monthly Weather Forecasts?

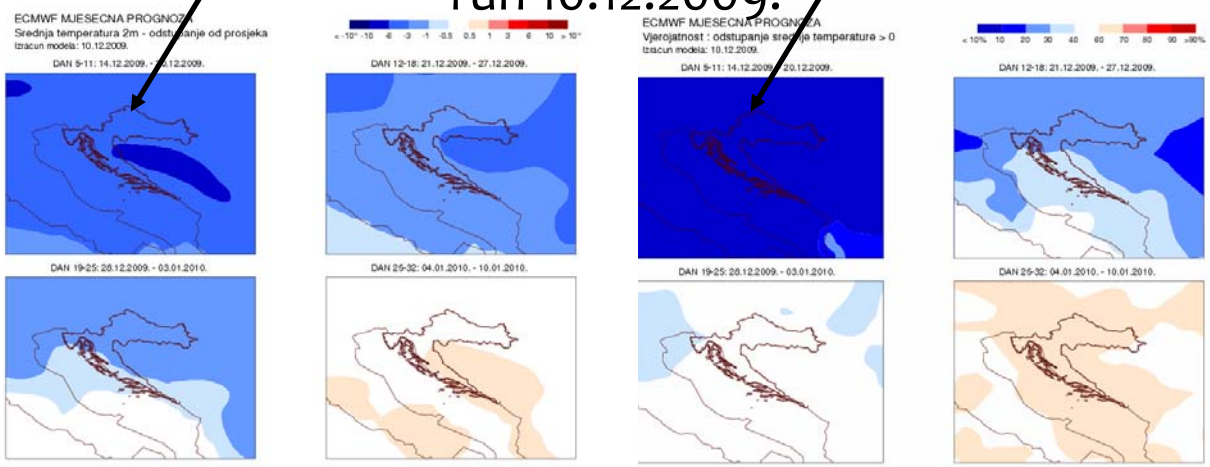
run 03.12.2009.

anomalies



Probabilities anomaly > 0

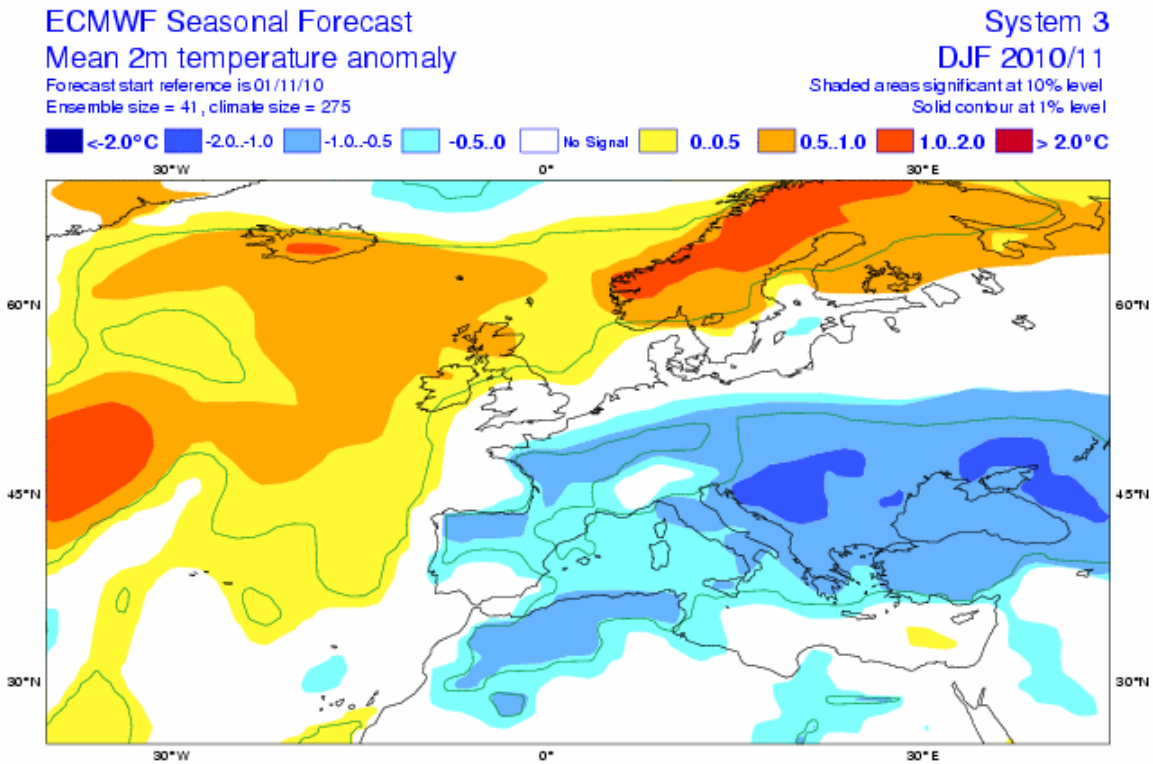
run 10.12.2009.



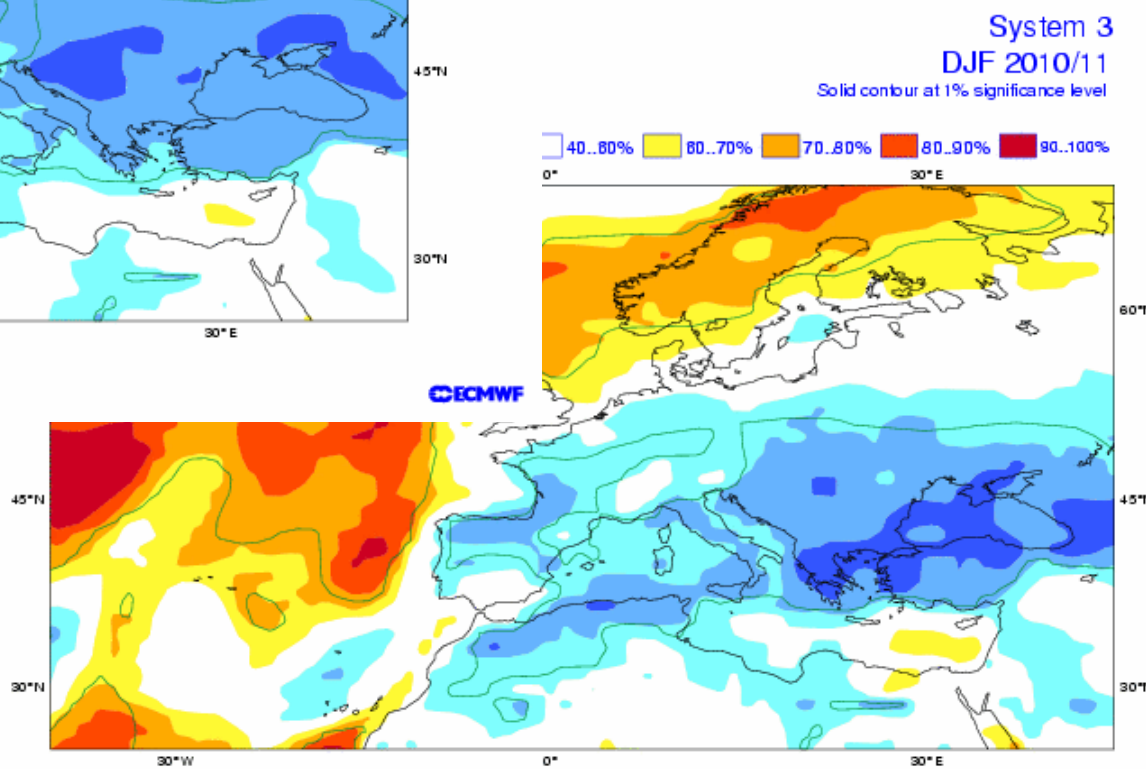
Seasonal Weather Forecasts

- Produced since 2005
- Based od ECMWF CM DMO
- Verified since 2006
- Published in media different manners, mainly to try to give the experts opinion, since all kinds of guesses and amateur interpretations appear anyhow
- Contracts since 2009, only one user at the moment

Seasonal Weather Forecasts



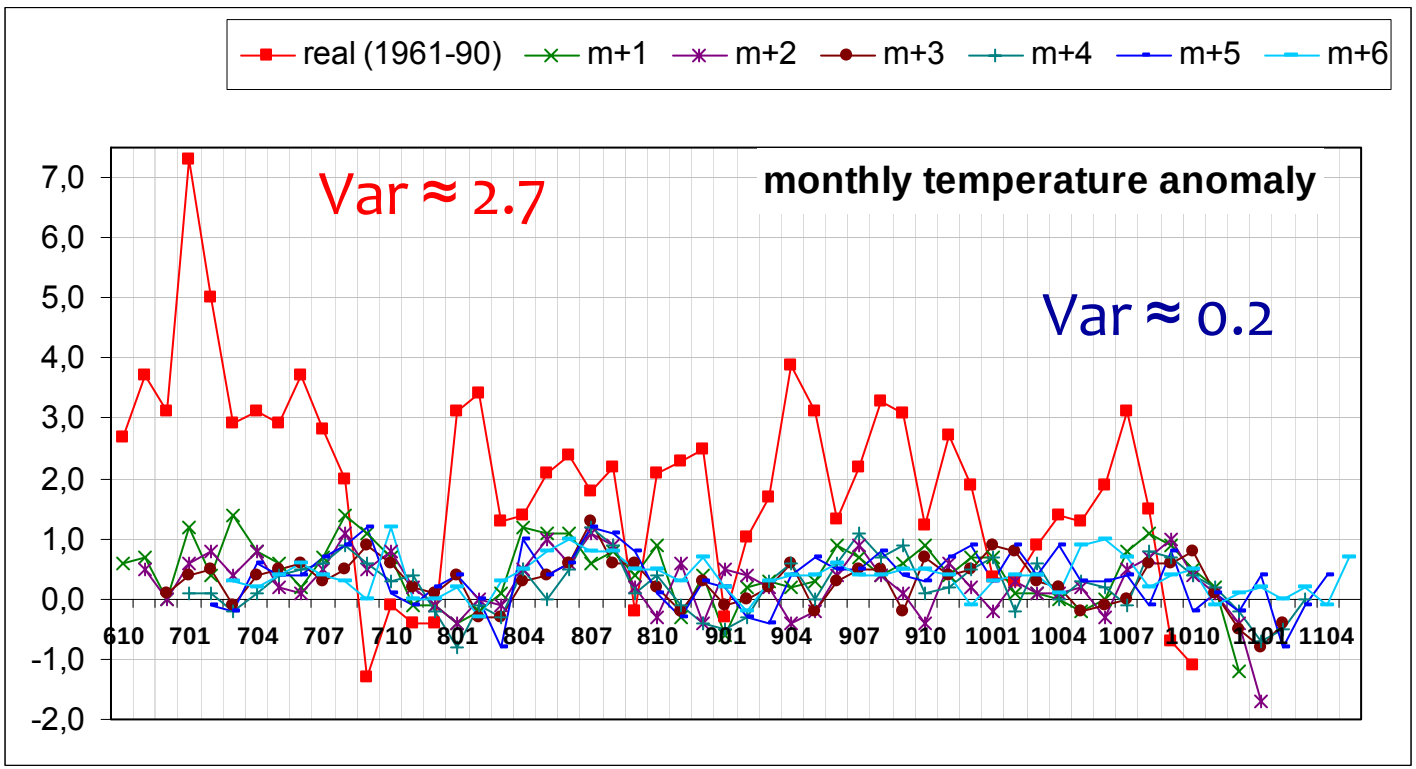
Forecast issue date: 15/11/2010



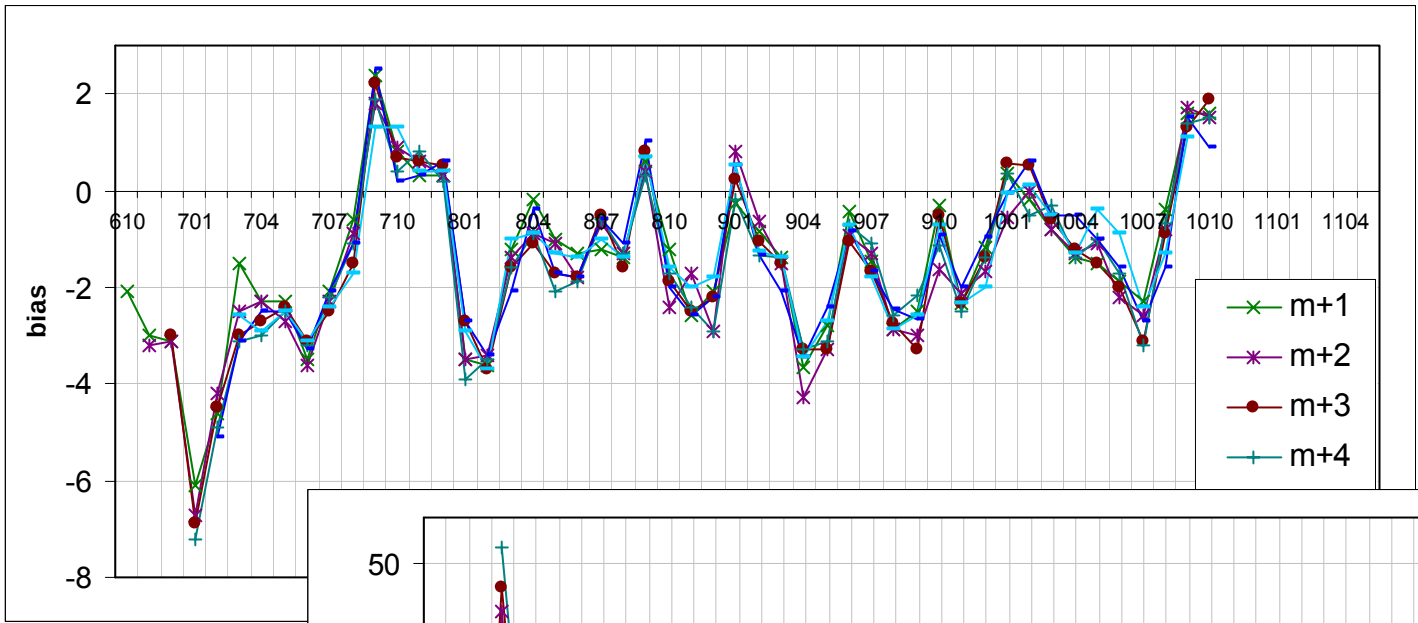
Forecast issue date: 15/11/2010

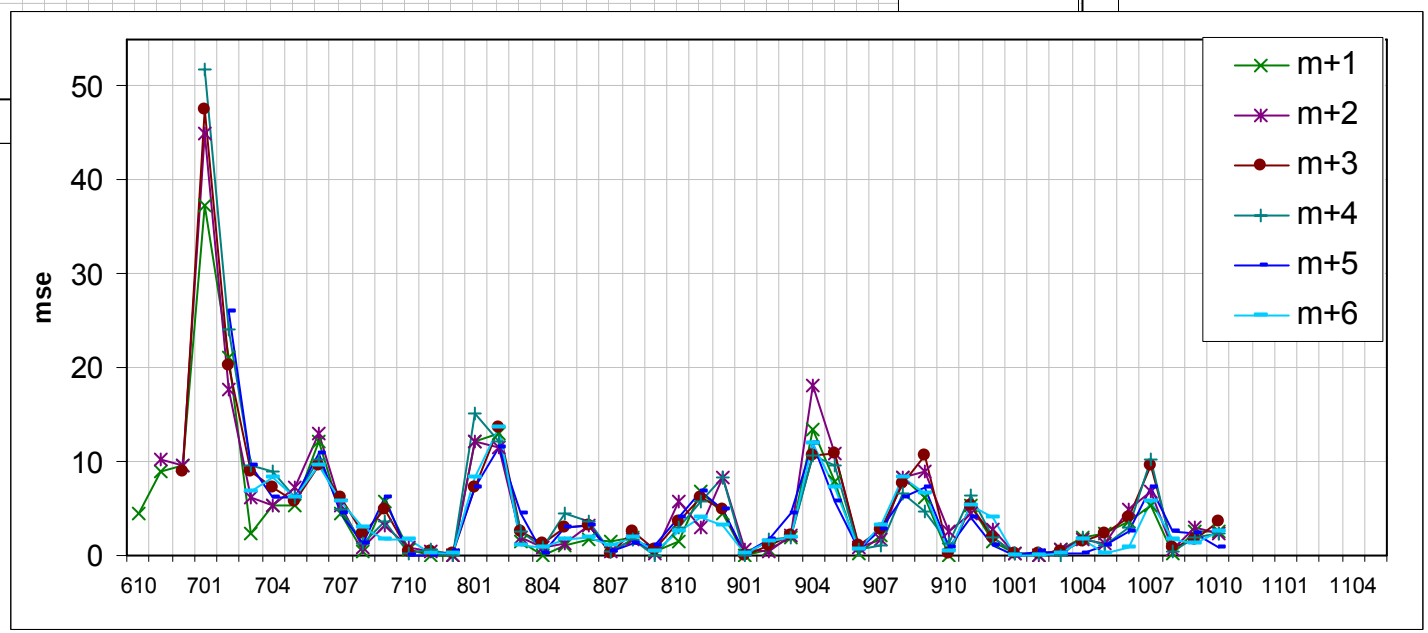
Value of Seasonal Weather Forecasts

- Verification in different manners since 2005
- Methodology?
- Preliminary results for seasonal forecasts (2m temperature anomaly in Zagreb, from September 2006)



Value of Seasonal Weather Forecasts





Value of Seasonal Weather Forecasts

- Another approach: search for different events
- Temperature anomaly above/under some threshold (median view)

step +1

2010	toplo	0.2+/-	hlad no
toplo	3	0	2
0.2+/-	5	0	0
hlad no	0	0	0

2009	toplo	0.2+/-	hlad no
toplo	9	0	0
0.2+/-	2	0	0
hlad no	0	0	1

2008	toplo	0.2+/-	hlad no
toplo	7	1	0

step +2

2010	toplo	0.2+/-	hlad no
toplo	3	0	2
0.2+/-	4	0	0
hlad no	1	0	0

2009	toplo	0.2+/-	hlad no
toplo	5	0	1
0.2+/-	4	0	0
hlad no	2	0	0

2008	toplo	0.2+/-	hlad no
toplo	6	0	0

step +3

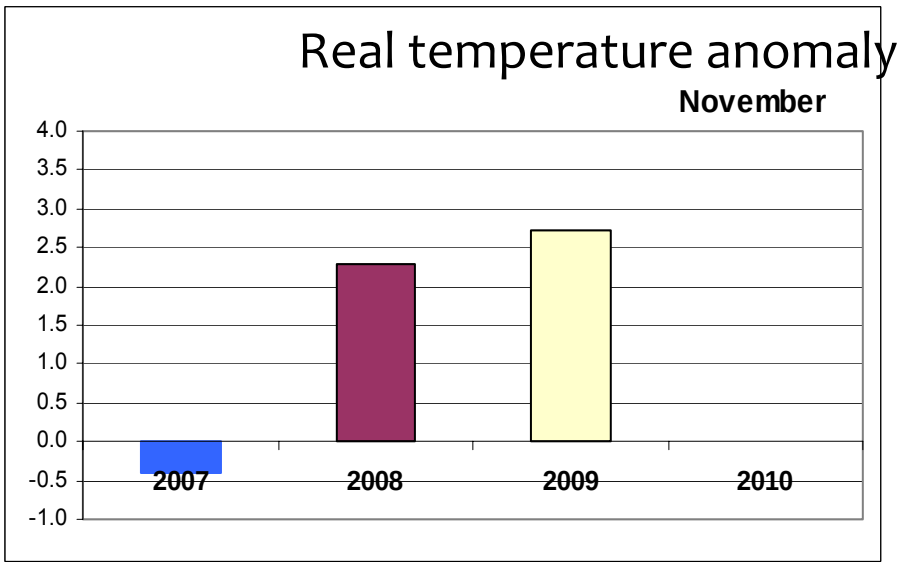
2010	toplo	0.2+/-	hlad no
toplo	4	0	2
0.2+/-	4	0	0
hlad no	0	0	0

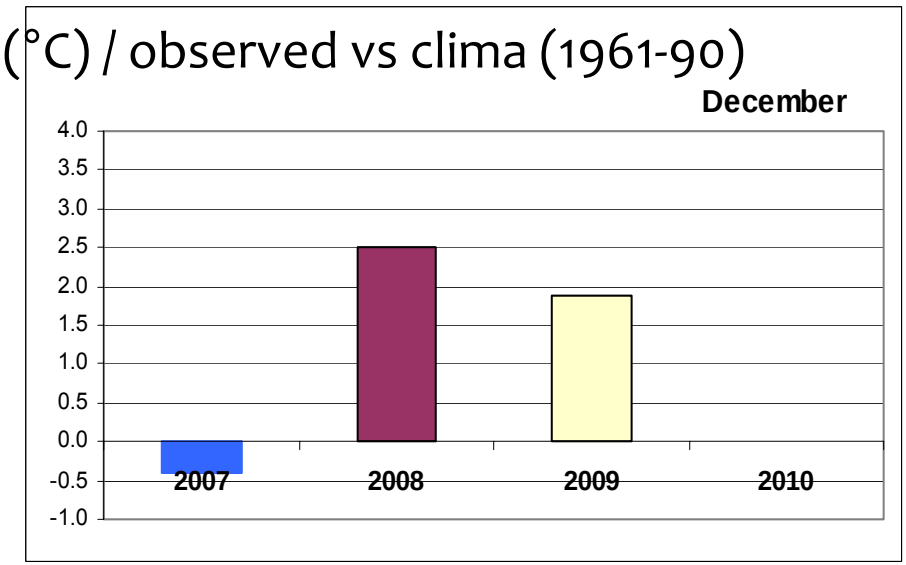
2009	toplo	0.2+/-	hlad no
toplo	7	0	0
0.2+/-	4	0	1
hlad no	0	0	0

2008	toplo	0.2+/-	hlad no
toplo	7	1	0

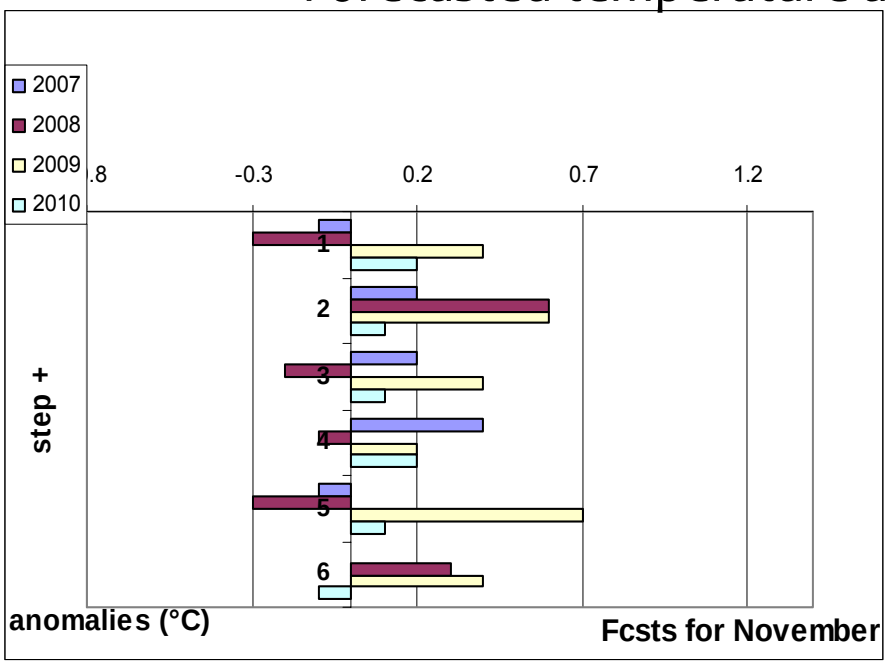
Analysis of long range forecasts 6 month ahead for last 4 years

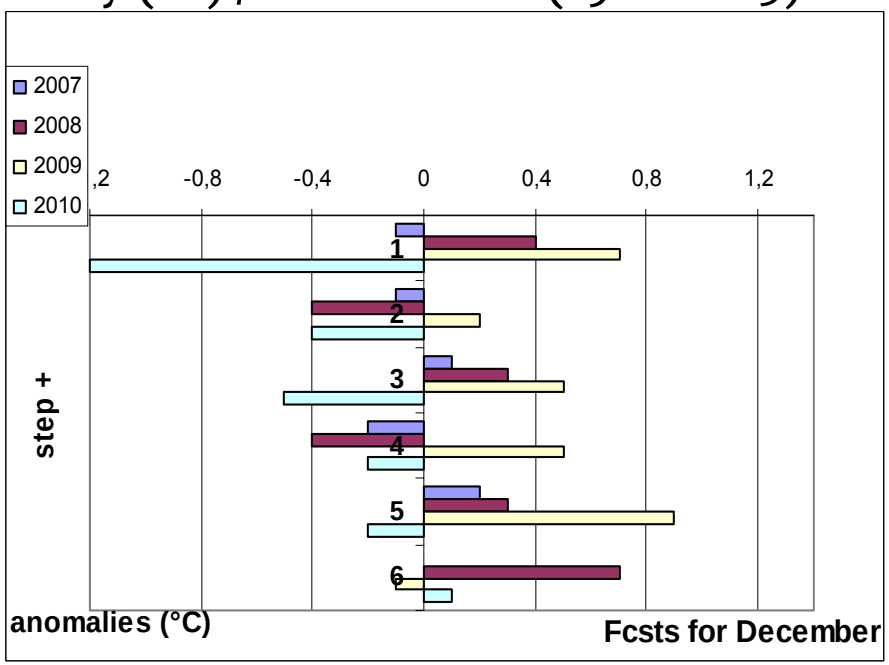
Real temperature anomaly (°C) / observed vs clima (1961-90)





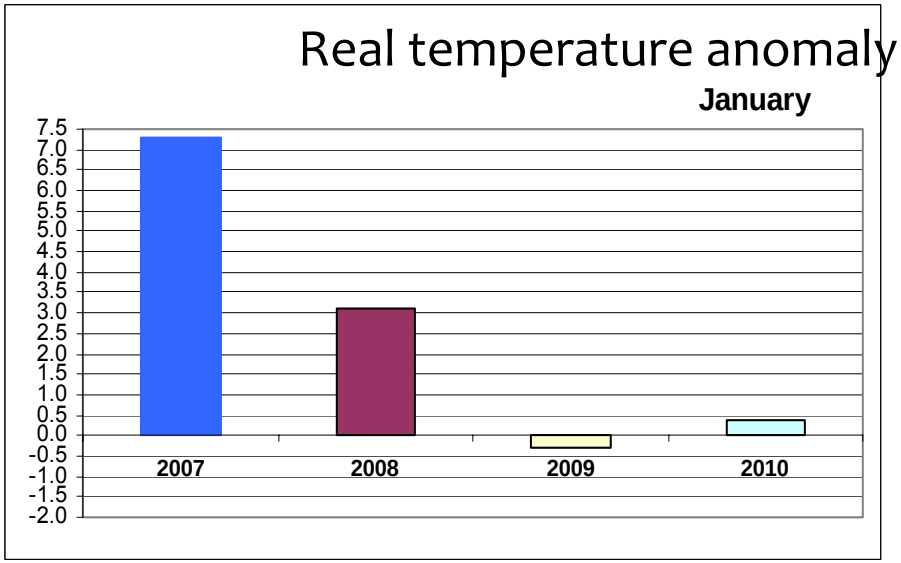
Forecasted temperature anomaly (°C) / model clima (1981-2005)

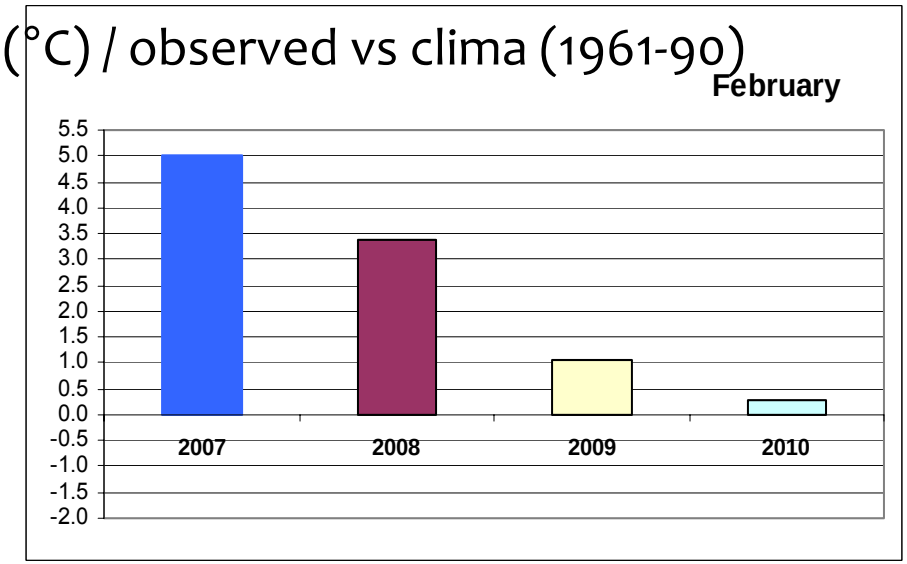




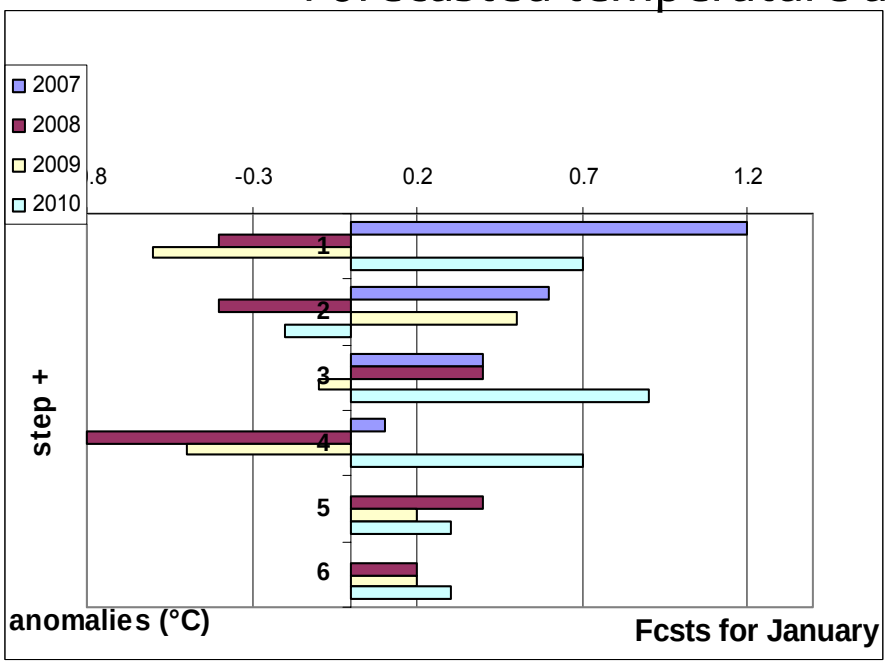
Analysis of long range forecasts 6 month ahead for last 4 years

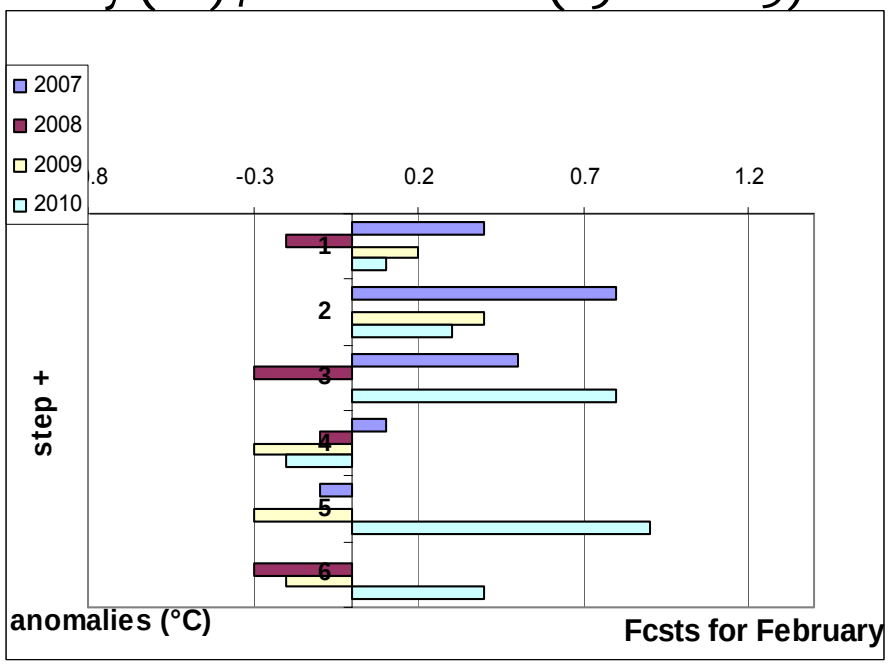
Real temperature anomaly (°C) / observed vs clima (1961-90)

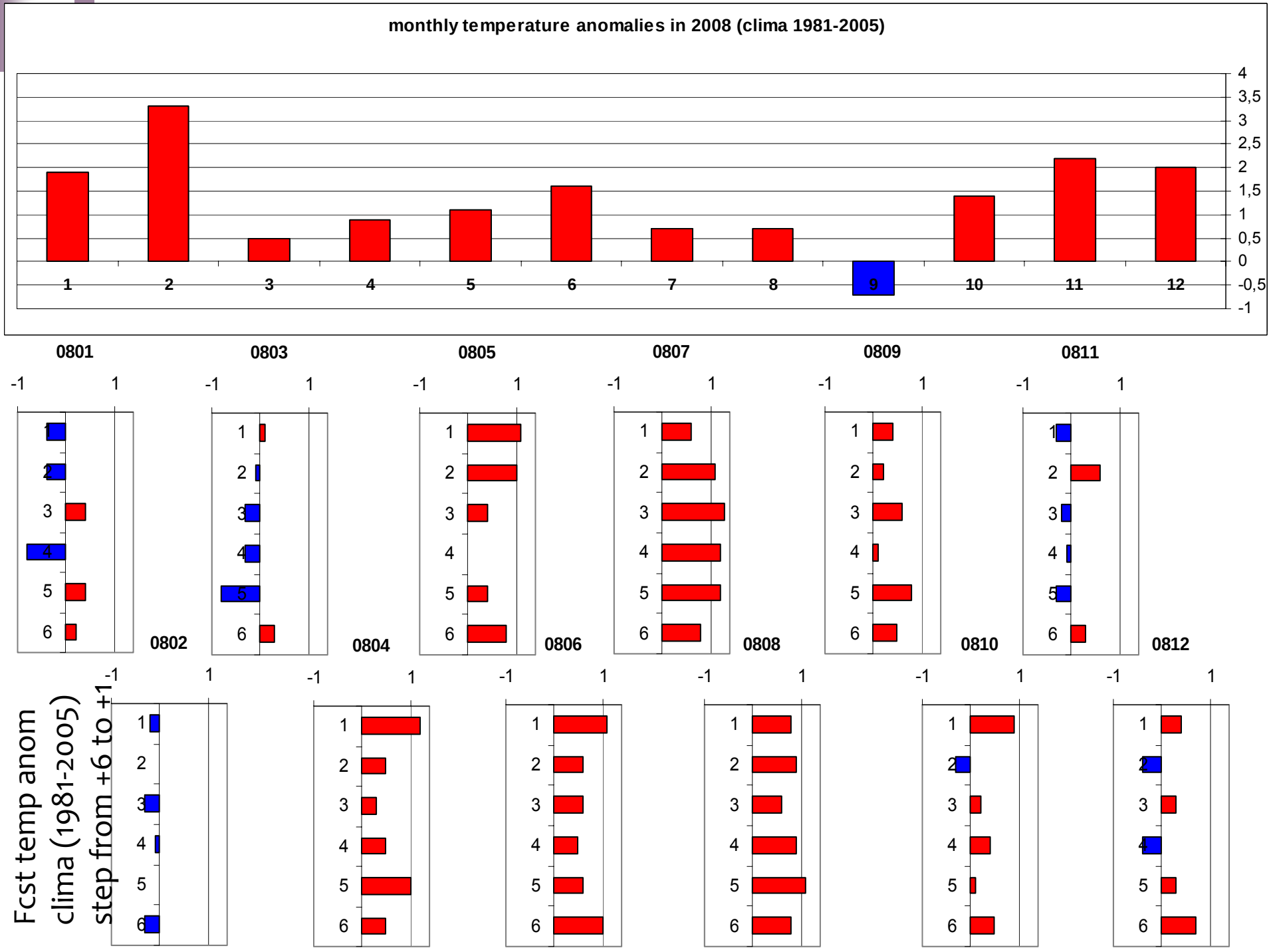


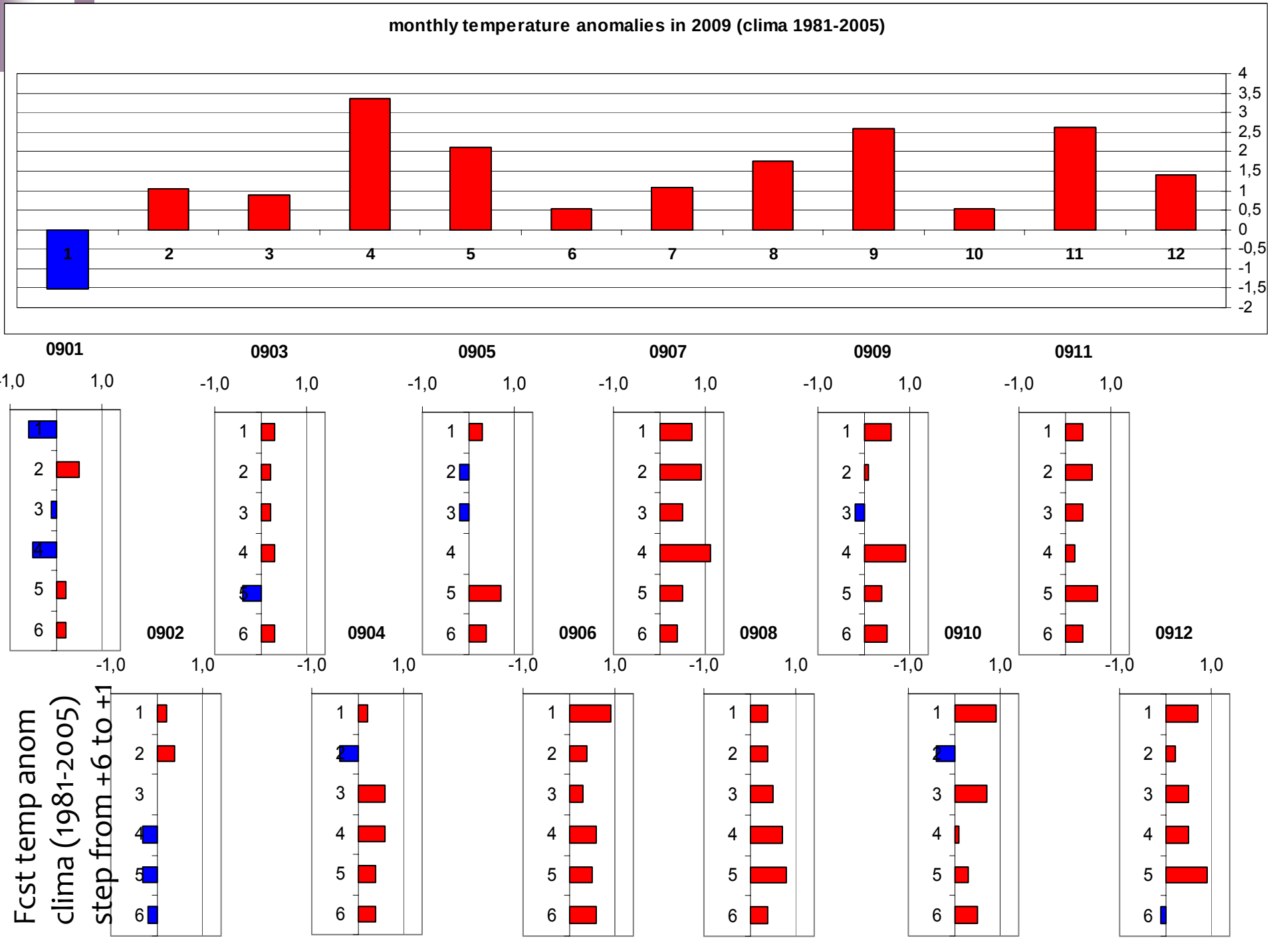


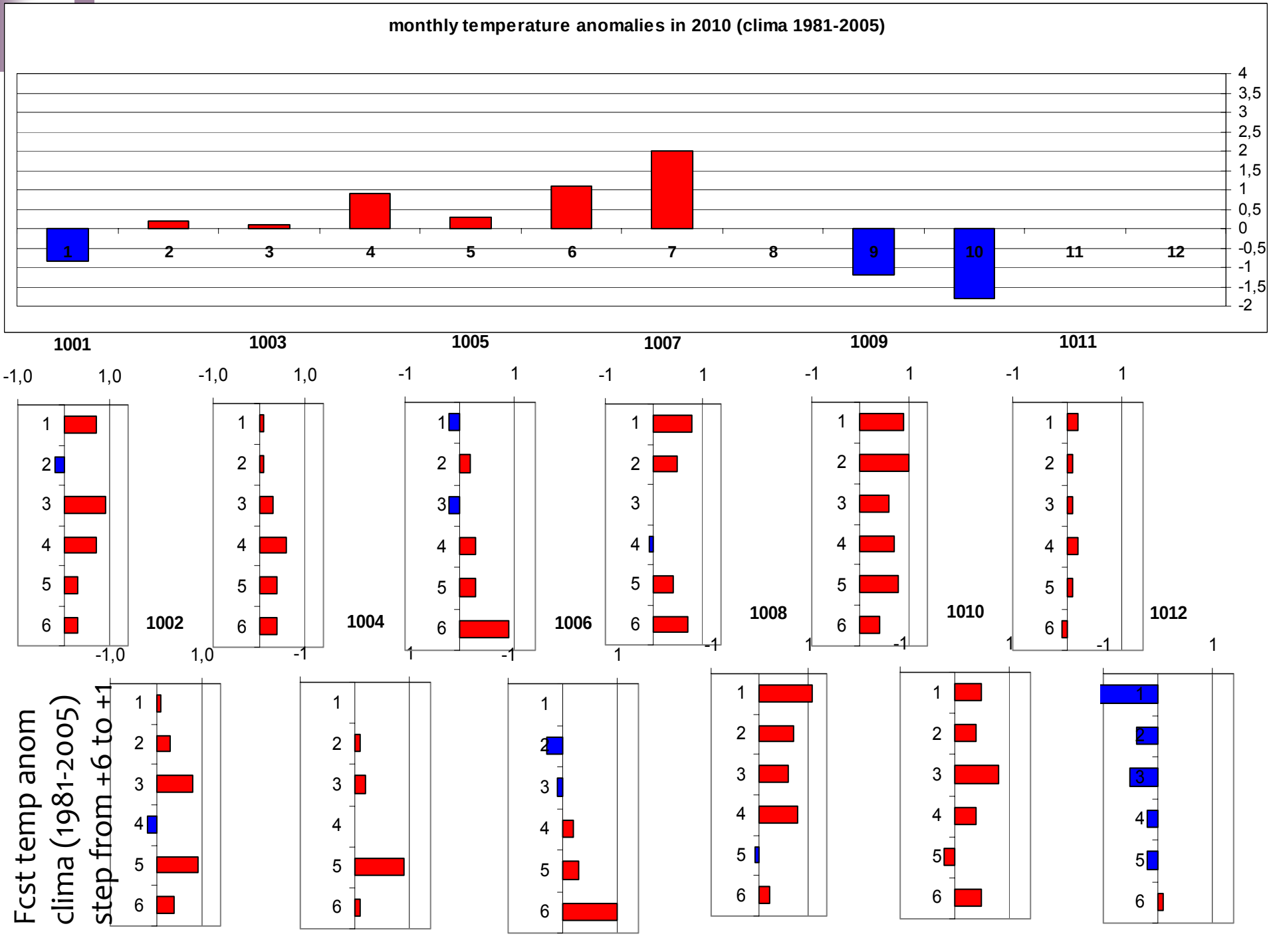
Forecasted temperature anomaly (°C) / model clima (1981-2005)





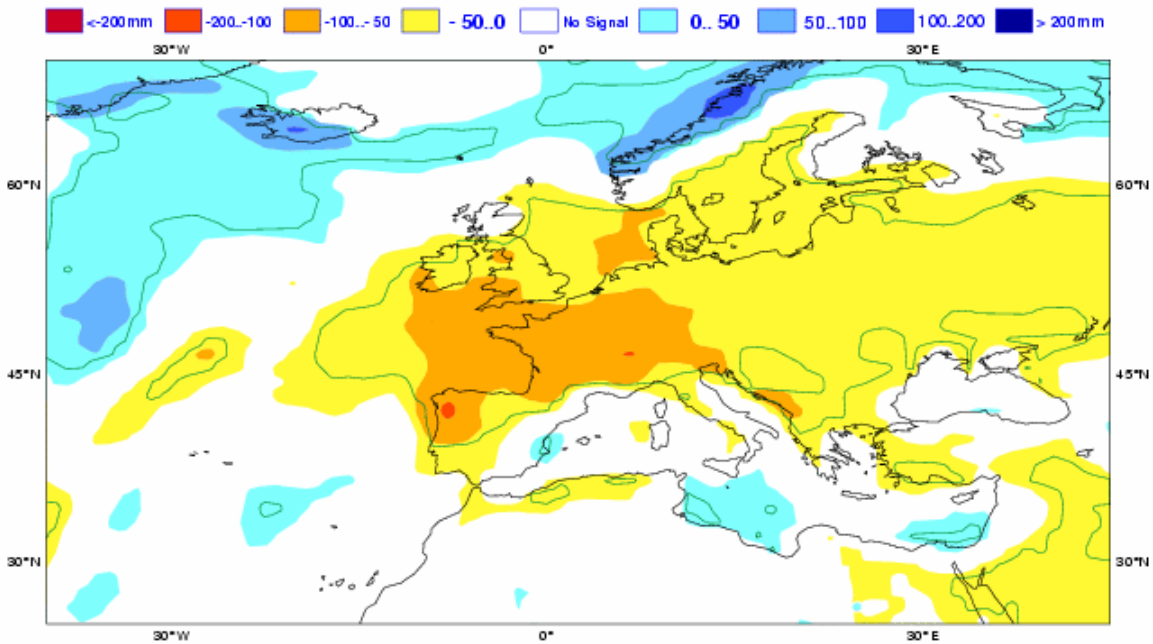

monthly temperature anomalies in 2008 (clima 1981-2005)
4
3,5
3
2,5
2
1,5
1
0,5
0
-0,5
-1
1
2
3
4
5
6
7
8
9
10
11
12
0801
0803
0805
0807
0809
0811
0802
0804
0806
0808
0810
0812
-1
1
Fcst temp anom
clima (1981-2005)
step from +6 to +1


monthly temperature anomalies in 2009 (clima 1981-2005)
4
3,5
3
2,5
2
1,5
1
0,5
0
-0,5
-1
-1,5
-2
1
2
3
4
5
6
7
8
9
10
11
12
0901
0902
0903
0904
0905
0906
0907
0908
0909
0910
0911
0912
-1,0
1,0
Fcst temp anom
clima (1981-2005)
step from +6 to +1


monthly temperature anomalies in 2010 (clima 1981-2005)
4
3,5
3
2,5
2
1,5
1
0,5
0
-0,5
-1
-1,5
-2
1
2
3
4
5
6
7
8
9
10
11
12
1001
1003
1005
1007
1009
1011
-1,0
1,0
-1
1
1002
1004
1006
1008
1010
1012
Fcst temp anom
clima (1981-2005)
step from +6 to +1

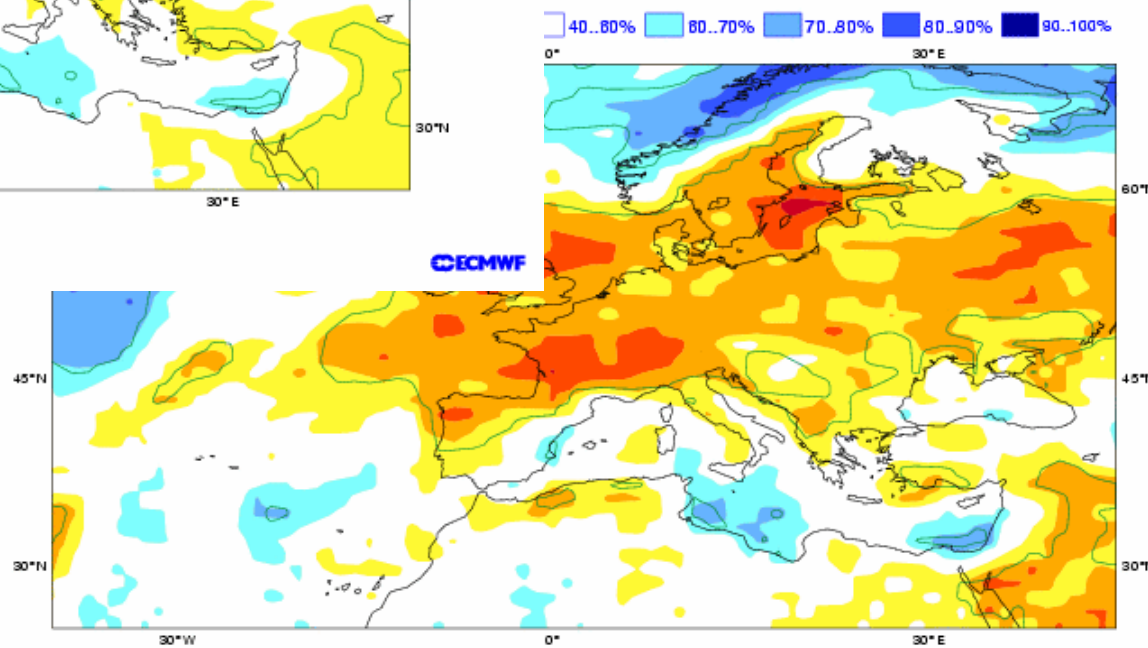
ECMWF Seasonal Forecast
Mean precipitation anomaly
Forecast start reference is 01/11/10
Ensemble size = 41, climate size = 275

System 3
DJF 2010/11
Shaded areas significant at 10% level
Solid contour at 1% level



Forecast issue date: 15/11/2010

System 3
DJF 2010/11
Solid contour at 1% significance level

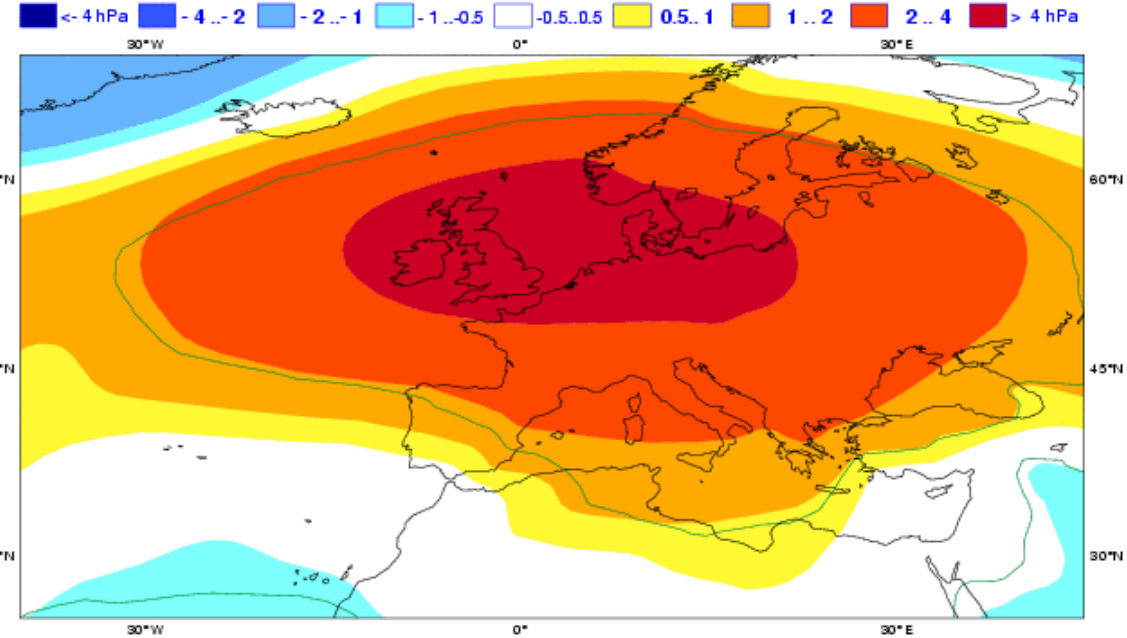


ECMWF

Forecast issue date: 15/11/2010

ECMWF Seasonal Forecast
Mean MSLP anomaly
Forecast start reference is 01/11/10
Ensemble size = 41 , climate size = 275

System 3
DJF 2010/11
Solid contour at 1% significance level



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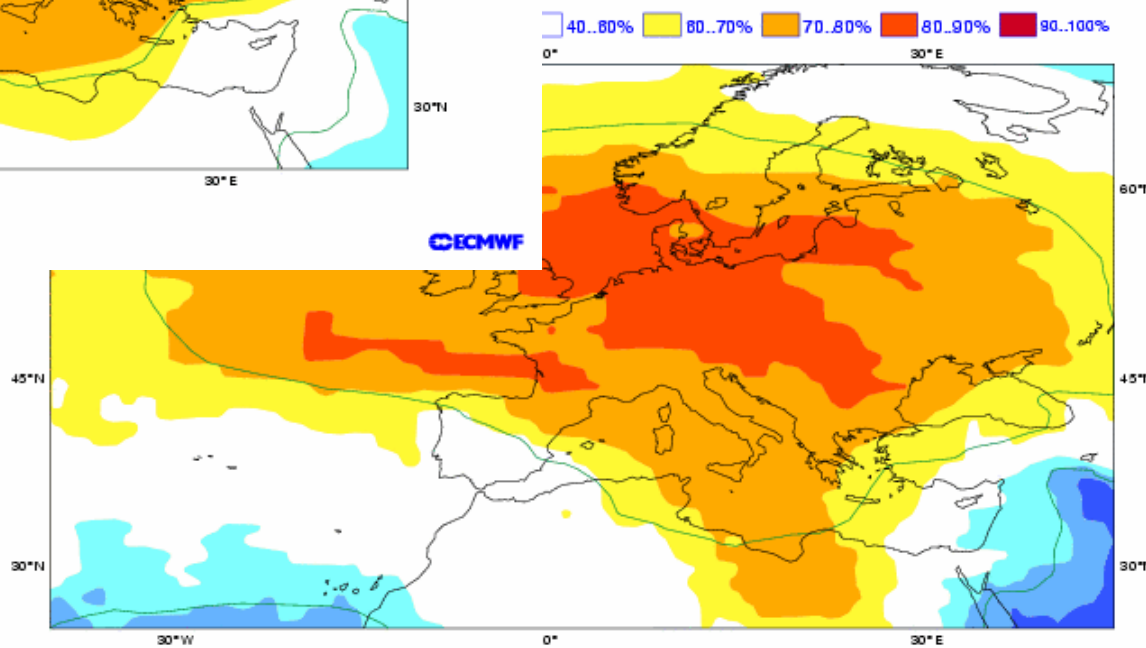
System 3
DJF 2010/11
Solid contour at 1% significance level



ECMWF

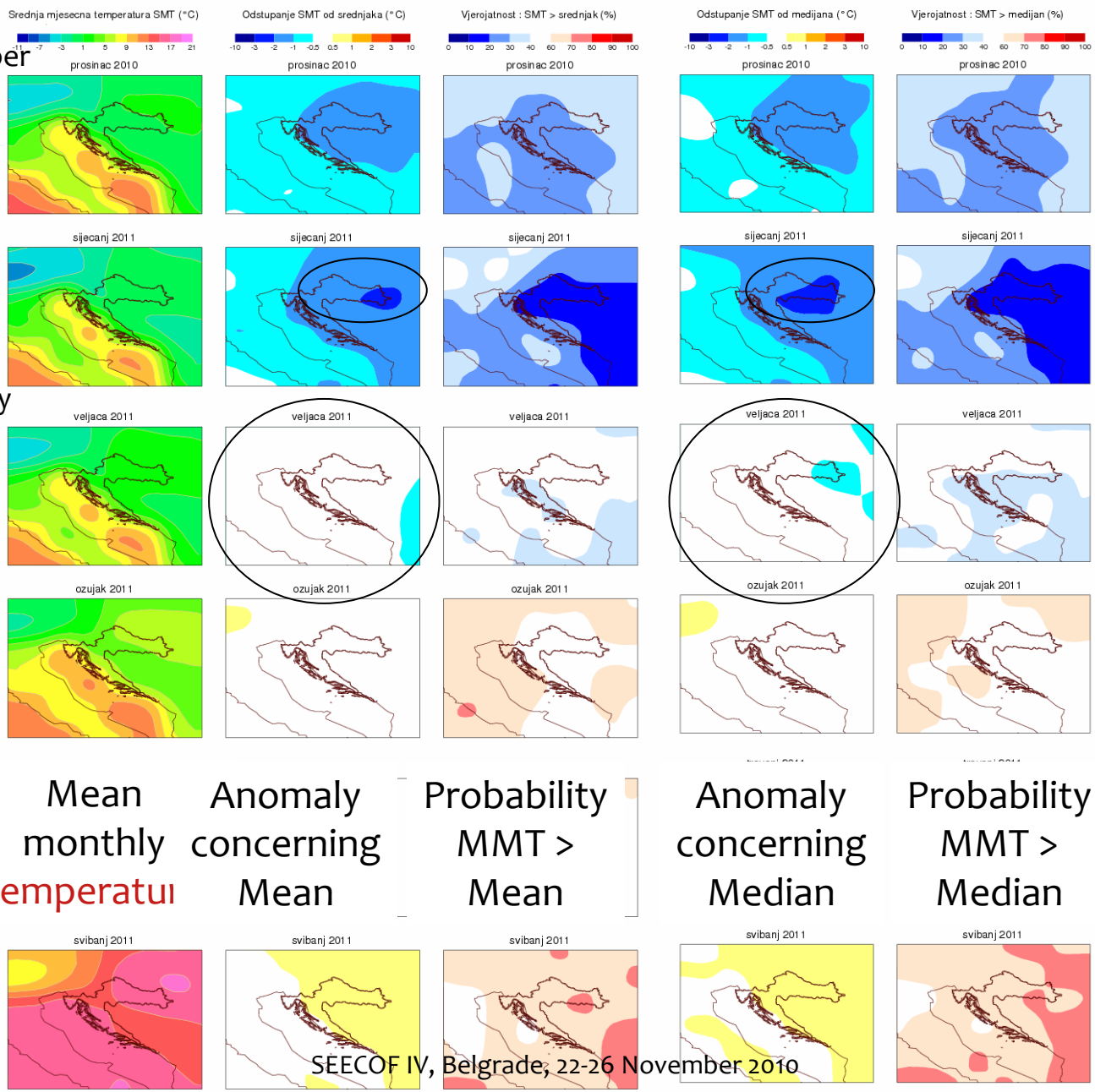
Forecast issue date: 15/11/2010

December

January

February

March



ECMWF SEZONSKA PROGNOZA PO MJESECIMA

IOZA PO MJESECIMA

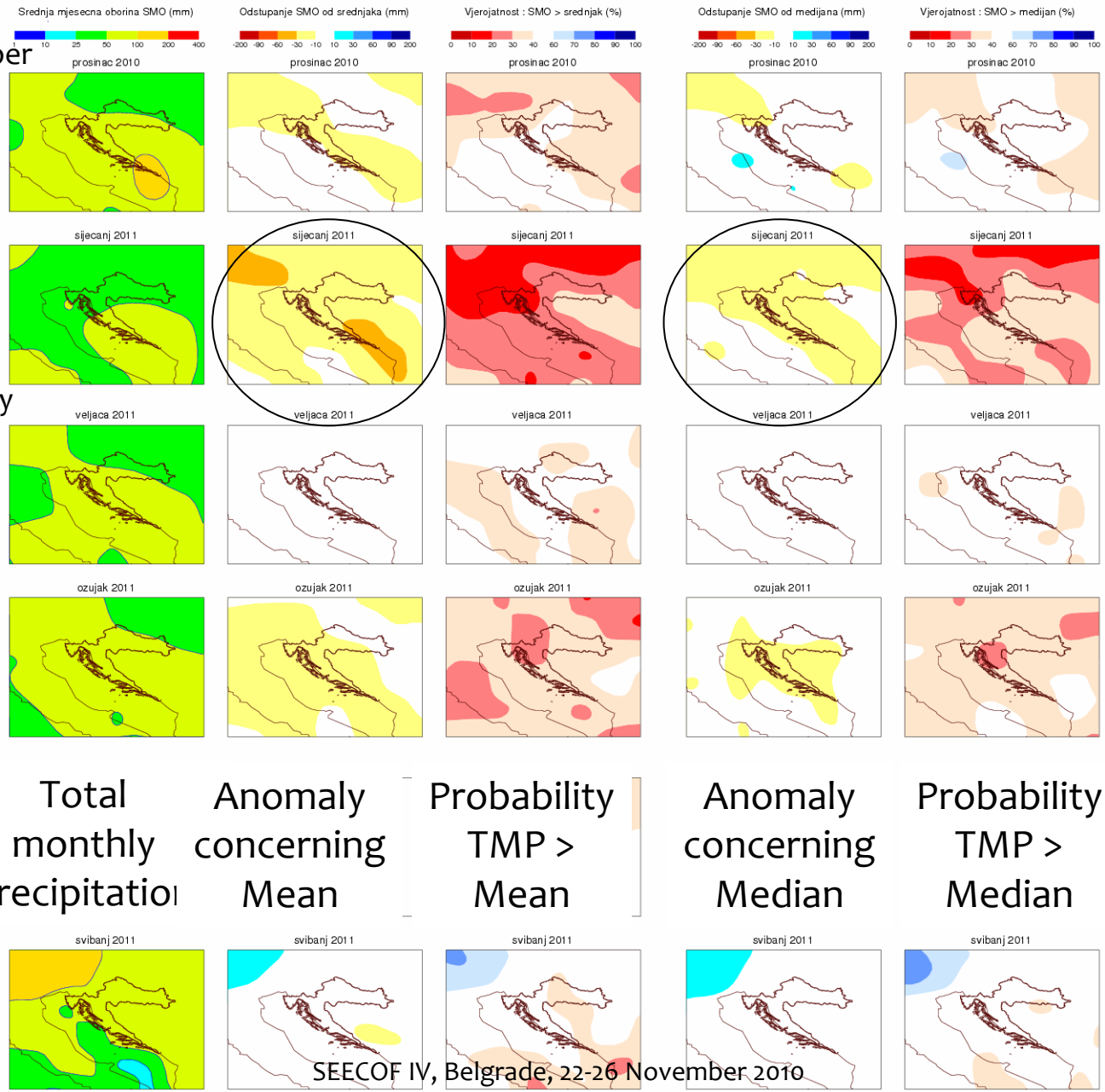
Izracun modela: 15.11.2010.

December

January

February

March



Total monthly precipitatio

Anomaly concerning Mean

Probability TMP > Mean

Anomaly concerning Median

Probability TMP > Median

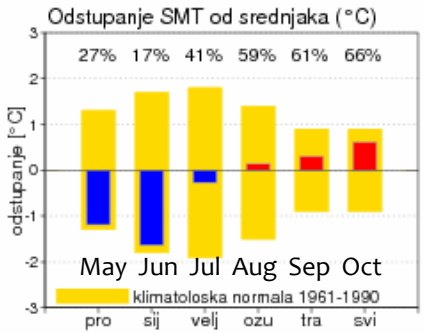
Anomalies
mean vs. median:
-temperature
-precipitation
-MSLP

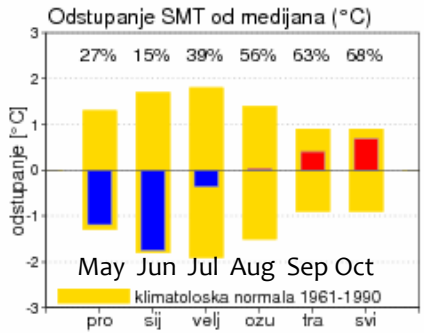
ECMWF sezonska prognoza za Sredisnju Hrvatsku

Odstupanja prognoza od klimatologije modela po mjesecima

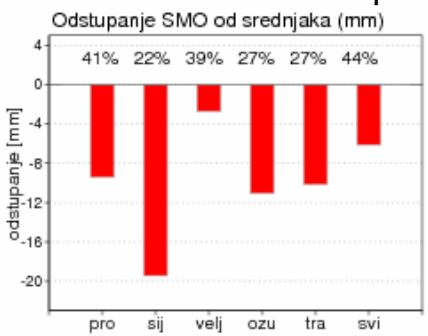
Izracun modela: 15.11.2010.

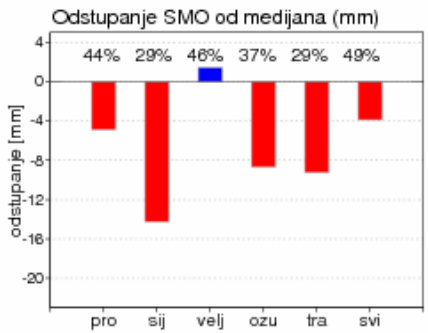
mean temperature median



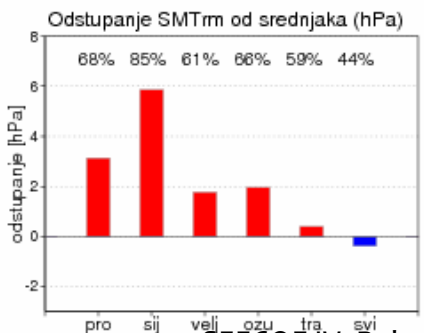


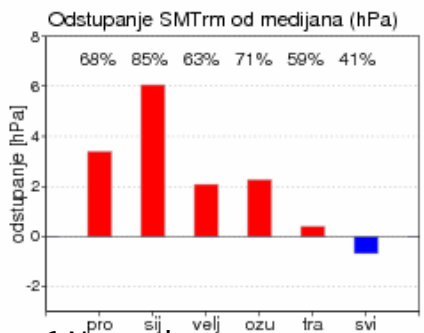
precipitation





MSLP



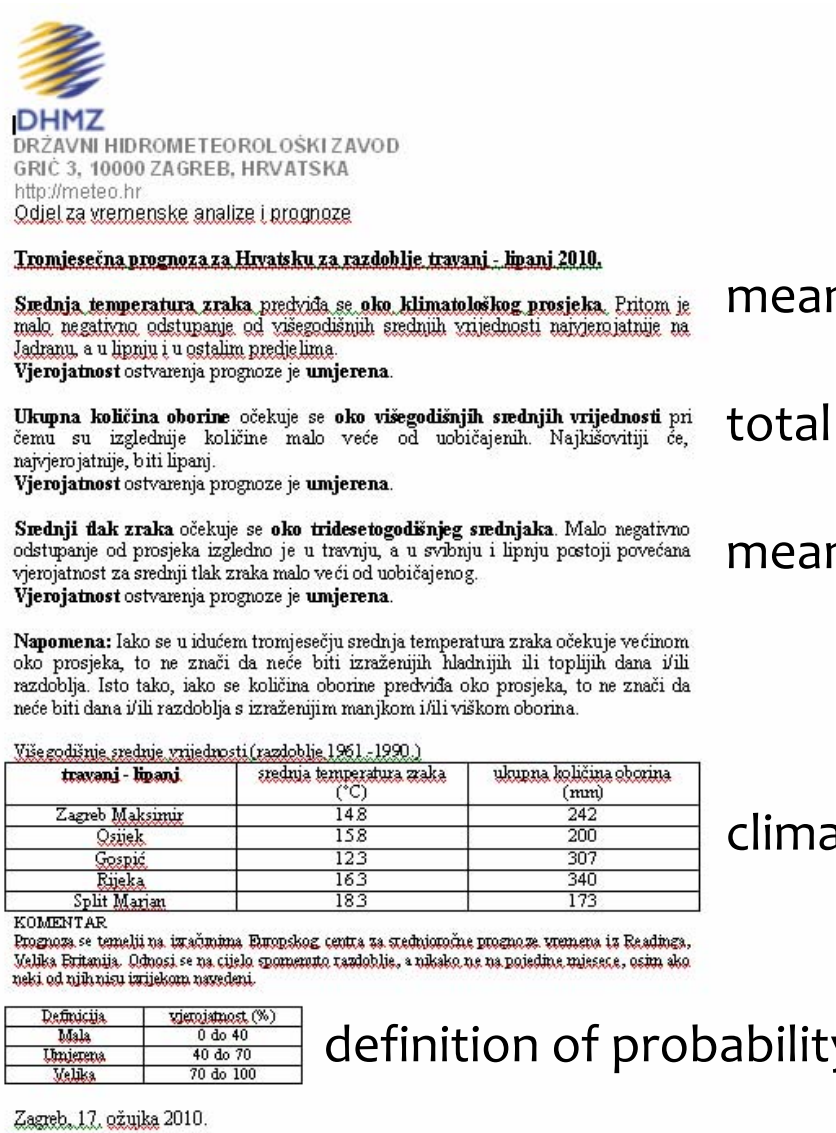


Seasonal forecast
for months

Due to complex
Climatology -
Graphs
for 5 regions
(points)

Seasonal Weather Forecasts

- End-product...



DHMZ
DRŽAVNI HIDROMETEOROLOŠKI ZAVOD
GRIČ 3, 10000 ZAGREB, HRVATSKA
http://meteo.hr
Odjel za vremenske analize i prognoze

Tromjesečna prognoza za Hrvatsku za razdoblje travanj - lipanj 2010.

Srednja temperatura zraka predviđa se **oko klimatološkog prosjeka**. Pritom je malo negativno odstupanje od višegodišnjih srednjih vrijednosti najvjerojatnije na Jadranu, a u lipnju i u ostalim predjelima.
Vjerojatnost ostvarenja prognoze je **umjerena**.

Ukupna količina oborine očekuje se **oko višegodišnjih srednjih vrijednosti** pri čemu su izglednije količine malo veće od uobičajenih. Najkišovitiji će, najvjerojatnije, biti lipanj.
Vjerojatnost ostvarenja prognoze je **umjerena**.

Srednji tlak zraka očekuje se **oko tridesetogodišnjeg srednjaka**. Malo negativno odstupanje od prosjeka izgledno je u travnju, a u svibnju i lipnju postoji povećana vjerojatnost za srednji tlak zraka malo veći od uobičajenog.
Vjerojatnost ostvarenja prognoze je **umjerena**.

Napomena: Iako se u idućem tromjesečju srednja temperatura zraka očekuje većinom oko prosjeka, to ne znači da neće biti izraženijih hladnijih ili toplijih dana i/ili razdoblja. Isto tako, iako se količina oborine predviđa oko prosjeka, to ne znači da neće biti dana i/ili razdoblja s izraženijim manjkom i/ili viškom oborina.

Višegodišnje srednje vrijednosti (razdoblje 1961.-1990.)

travanj - lipanj	srednja temperatura zraka (°C)	ukupna količina oborina (mm)
Zagreb Maksimir	14.8	242
Osijek	15.8	200
Gospić	12.3	307
Rijeka	16.3	340
Split Marjan	18.3	173

KOMENTAR
Prognoza se temelji na izračunima Europskog centra za srednjoročne prognoze vremena iz Readinga, Velika Britanija. Odnosi se na cijelo spomenuto razdoblje, a nikako ne na pojedine mjesece, osim ako neki od njih nisu izrijekom navedeni.

Definicija	vjerojatnost (%)
Mala	0 do 40
Umjerena	40 do 70
Velika	70 do 100

Zagreb, 17. ožujka 2010.

mean temperature

total precipitation

mean MSLP

short remark about the meaning of seasonal forecast

climatology 1961-90

commentary about the source

definition of probability classes

Official seasonal forecast for winter 2010/11 in Croatia

DHMZ
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http://meteo.hr
Odjel za vremenske analize i prognoze

Tromjesečna prognoza za Hrvatsku za razdoblje prosinac 2010. - veljača 2011.

Srednja temperatura zraka očekuje se **nižom od klimatološkog prosjeka uz veliku vjerojatnost** ostvarenja prognoze. Pritom će, također vrlo vjerojatno, diljem Hrvatske srednja mjesečna temperatura i prosinca i siječnja biti niža od prosjeka, osobito siječnja, a u veljači se predviđa oko prosjeka.

Ukupna količina oborine očekuje se **većinom manjom ili najviše oko klimatološkog srednjaka** uz **umjerenu vjerojatnost** ostvarenja prognoze u mnogim krajevima, a na sjevernom je Jadranu čak i velika vjerojatnost za manjak uobičajene količine oborine. Najveće odstupanje od prosjeka očekuje se u siječnju, a najmanje u veljači.

Srednji tlak zraka vrlo će **vjerojatno** biti **viši od prosjeka,** pa se očekuje dugotrajnije djelovanje anticiklone, ne samo u Hrvatskoj i okolici nego gotovo diljem Europe, posebice u središnjim dijelovima kontinenta. Pozitivno odstupanje od prosjeka vjerojatno će najviše biti izraženo u siječnju, a najmanje u veljači.

Napomena: Iako se u idućem tromjesečju srednja temperatura zraka očekuje većinom nižom od prosjeka, to ne znači da neće biti izraženijih toplijih dana i/ili razdoblja. Isto tako, iako se količina oborine predviđa uglavnom manjom od prosjeka, to ne znači da neće biti dana i/ili razdoblja s izraženijim viškom oborina.

Višegodišnje srednje vrijednosti (razdoblje 1961.-1990.)

prosinac - veljača	Srednja temperatura zraka (°C)	ukupna količina oborina (mm)
Zagreb Maksimir	0.7	147
Osijek	0.4	138
Gospić	-0.6	360
Rijeka	6.0	399
Split Marjan	8.3	253

KOMENTAR
Prognoza se temelji na izračunima Europskog centra za srednjoročne prognoze vremena iz Readinga, Velika Britanija. Odnosi se na cijelo spomenuto razdoblje, a nikako ne na pojedine mjesece, osim ako neki od njih nisu izrijekom navedeni.

Definicija	vjerojatnost (%)
Mala	0 do 40
Umjerena	40 do 70
Velika	70 do 100

Zagreb, 16. studenoga 2010.

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METEOROLOGICAL AND HYDROLOGICAL SERVICE
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http://meteo.hr
Weather analysis and forecasting department

Seasonal forecast for Croatia for the period December 2010. - February 2011.

The average temperature is expected to be lower than the climatological average with high probability of achieving forecasts. The will also very likely, across the Croatian, average monthly temperature of December and January will be lower than average, especially January. In February expected around the average.

Total precipitation is expected to be mostly minor or around the climatological mean at moderate likelihood of achieving forecasts in many regions, and in the northern Adriatic is even a high probability for the lack of normal rainfall. The maximum deviation from the average expected in January, a minimum in February.

Mean air pressure is likely to be higher than average, so it is expected long-term effect of high pressure, not only in Croatia and the surrounding area but almost all over Europe, especially in central parts of the continent. Positive deviation from the average will likely be most pronounced in January, a minimum in February.

Note: Although in the next quarter of the average air temperature is expected mostly lower than average, this does not mean that there will be more pronounced the warmer days and / or periods. Also, although the precipitation provides generally less than average, this does not mean that there will be days and / or periods are clearly identified with excess rainfall.

Long term mean value (period 1961st – 1990th)

December – February	The average temperature (° C)	total rainfall (mm)
Zagreb Maksimir	0.7	147
Osijek	0.4	138
Gospić	-0.6	360
Rijeka	6.0	399
Split Marjan	8.3	253

COMMENT
Forecast is based on calculations of the European Centre for Medium-Range Weather Forecasts in Reading, UK. Applies to all the time in question, and never in any month, unless some of them are not explicitly mentioned.

Definition	probability (%)
Small	0 do 40
Moderate	40 do 70
High	70 do 100

Zagreb, November 16th 2010.

Value of Seasonal Weather Forecasts

- Signal very low
- Forecasts do not catch extreme events
- Skill of forecast relatively constant through the whole forecast range?
- Significant seasonal variation (more cold in colder season, less cold in warmer season)
- Methods are to be improved (scores, climatology, use of forecast probabilities etc.)

Seasonal Weather Forecasts, conclussion

- Operational production of the forecast and approach to the users, as well as the verification, in the framework of Weather Analysis and Forecasting Department
- Research performed in the Climatology Department using REGCM
- Hopefully some progress in collaboration between the two will arise after SEECOF 4

Value of Seasonal Weather Forecasts

Thank you for your attention!