

## VERIFICATION OF THE SEECOF -15 SUMMER 2016 CLIMATE OUTLOOK FOR REPUBLIC OF REPUBLIC OF MACEDONIA COMPARED TO THE 1981-2010 BASE PERIOD

Hydrometeorological Service of Republic of Macedonia prepares regular seasonal climate analysis, based on the products of SEECOF seasonal forecasts and the forecast products from the SEVCCC. The present analysis is for the summer 2016, June, July and August, and it is based on the means of the climatological period 1981-2010.

### ➤ SUMMER 2016

The mean seasonal air temperature during summer 2016 ranged between 16.7°C in Lazaropole to 26.2°C in Gevgelija. Spatial distribution of the mean seasonal air temperature is shown on Figure1. The mean air temperatures anomaly was slightly above normal at all main meteorological stations, from 0.4°C in Skopje and Ohrid to 1.2°C in Mavrovo (Figure2).

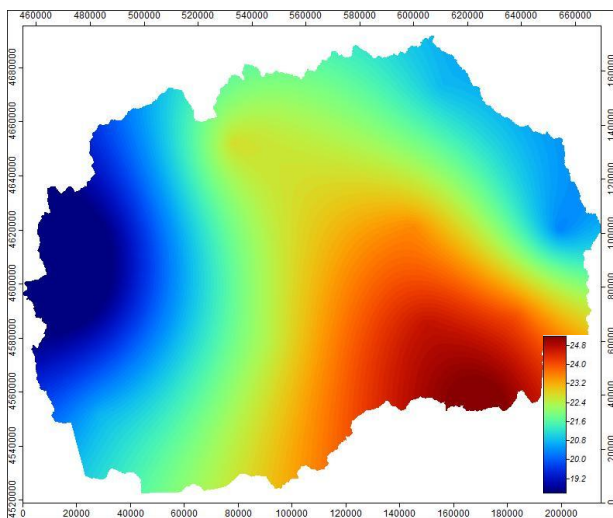


Figure 1: Spatial distribution of the mean seasonal air temperature (°C) during summer 2016

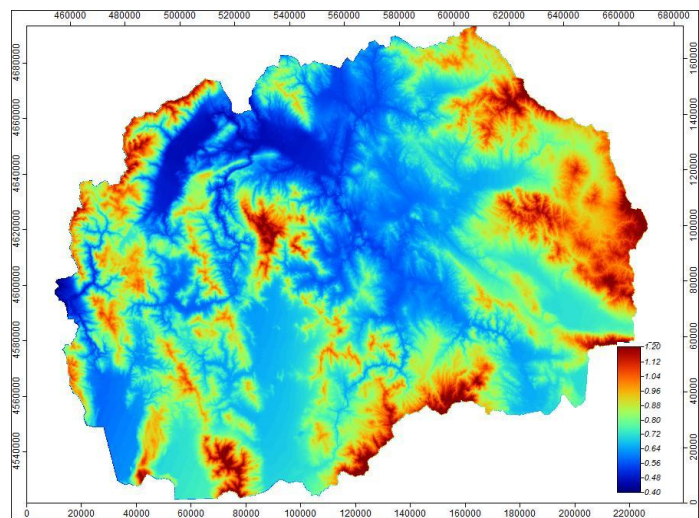


Figure 2: Mean seasonal air temperature anomaly (°C) compared to the period 1981-2010 during summer 2016

The mean maximum seasonal air temperature was also slightly above normal, with positive anomaly from 0.4°C in Ohrid to 1.2°C in Lazaropole. The mean minimum seasonal air temperature was above normal reaching positive anomaly of 1.9°C in Mavrovo. The highest daily air temperature during summer 2016 was measured 39.1°C observed on 21<sup>st</sup> of June in Gevgelija. The lowest air temperature during summer 2016 was measured 3.4°C observed on 13<sup>th</sup> of August in Lazaropole.

According to percentile calculation method, the central part of the territory was classified in normal boundaries, the west and the east Macedonia was classified as warm (Table1).

Rainfall totals were variable for this summer season. Spatial distribution of the precipitation sums is shown on Figure 3 and the anomaly compared to 1981-2010 base period on Figure 4. The anomaly is evident and it explains the difficulty to predict.

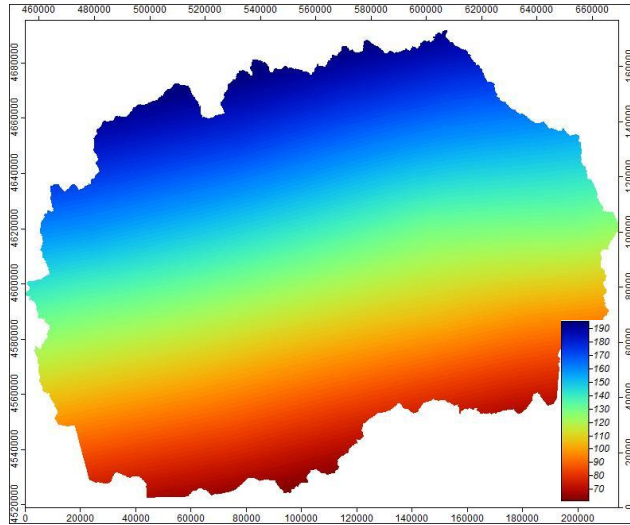


Figure 3: Spatial distribution of the precipitation sums (mm) during summer 2016

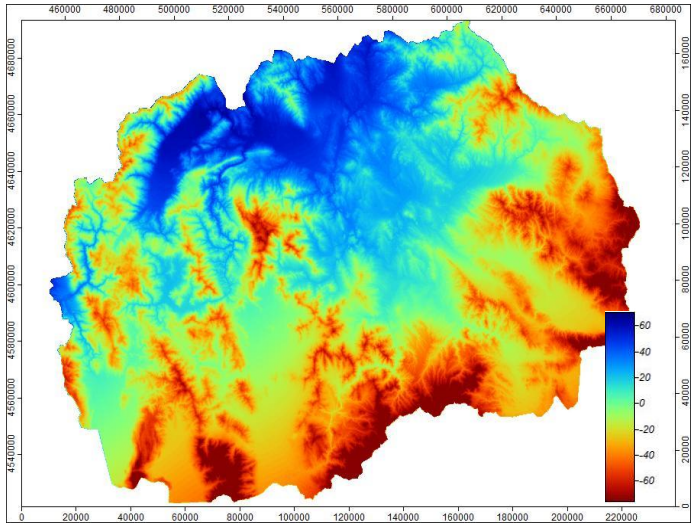


Figure 4: Spatial distribution of the precipitation sums anomaly (mm) during summer 2016

The wettest day was 7<sup>th</sup> of August with 114.0mm which was measured on the Precipitation station Butel in Skopje. Skopje valley evidenced devastating intensive rainfall causing flash floods on 6<sup>th</sup> of August. According to the analysis for the region of the Skopje valley, there was extreme 5 hours precipitation intensity with probability of appearing 0.1% or once in a thousand years.

According to percentile calculation method the precipitation regime was variable (Table1).

Meteorological station	Temperature	Precipitation
Berovo	warm	normal
Kriva Palanka	warm	normal
Stip	normal	normal
Strumica	warm	dry
Demir Kapija	normal	wet
Gevgelija	normal	normal
Skopje	normal	very wet
Prilep	normal	normal
Bitola	warm	normal
Ohrid	normal	normal
Mavrovo	very warm	normal
Lazaropole	warm	dry

Table1: Air temperature and precipitation classification in Republic of Macedonia for summer 2016 using percentile method compared to 1981-2010 base period

The values of distribution of tercile for the air temperature and the precipitation sums are shown in table 2 and 3, respectively.

Air Temperature (°C)	summer	1981-2010	
		33	67
Berovo	18.9	17.8	18.6
Kriva Palanka	20.4	19.3	20.0
Stip	24.0	23.0	24.0
Strumica	24.4	23.0	23.8
Demir Kapija	25.0	24.1	24.9
Gevgelija	26.2	25.0	26.0
Skopje	23.7	23.0	23.8
Prilep	22.2	21.3	22.1
Bitola	22.3	21.4	22.0
Ohrid	21.1	20.4	21.0
Lazaropole	16.7	15.7	16.2
Mavrovo	17.5	15.9	16.7

Table 2: Values of distribution of tercile for temperature for period 1981-2010

Precipitation sums (mm)	summer	1981-2010	
		33	67
Berovo	177.2	138.8	162.8
Kriva Palanka	158.8	132.4	142.2
Stip	82.1	87.6	104.1
Strumica	75.7	85.1	180.3
Demir Kapija	127.3	75.0	210.3
Gevgelija	59.7	61.9	269.5
Skopje	193.2	86.8	110.6
Prilep	95.5	75.3	128.5
Bitola	100.7	77.6	200.8
Ohrid	93	65.6	238.3
Lazaropole	108.7	138.8	162.8
Mavrovo	181.4	103.2	329.8

Table 3: Values of distribution of tercile for precipitation for period 1981-2010

The SEECOF-15 forecast product for the mean temperatures for summer season puts Republic of Macedonia in a zone 3, which is likely to experience above or near-normal summer temperatures (Figure 5). Forecast for the precipitation for JJA 2016 categorized our country in zone 2 (Figure6). Zone 2 is with high uncertainties, probabilities for below-, near-, or above-average conditions are approximately equal.

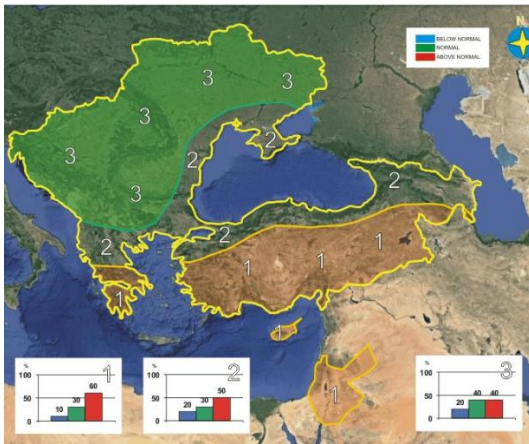


Figure 5: Graphical presentation of the 2016 summer temperature outlook

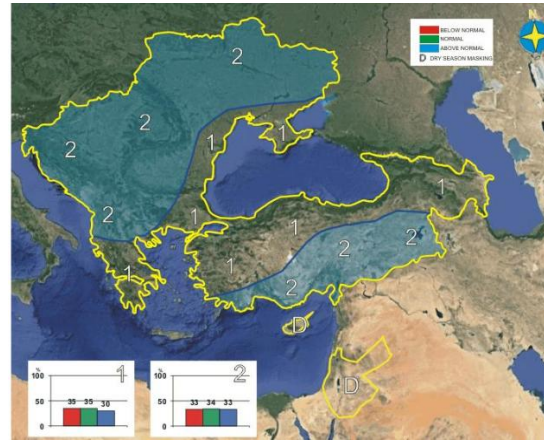


Figure 6: Graphical presentation of the 2016 summer precipitation outlook

A general judgment for the models evaluation for summer season is that the model performed good both qualitatively and quantitatively concerning the temperature. Concerning the precipitation, evaluation of the model is difficult because of the variable regime.

## ➤ JUNE 2016

June is characterized with positive difference from the long term average for mean, maximum and minimum monthly temperatures. The absolute temperature range was from 5.1°C in Lazaropole to 39.1°C in Gevgelija. Mean monthly temperature and mean maximum monthly temperature was above normal 1-2°C. The anomaly from the mean monthly minimum temperature ranged from 0.6° in Demir Kapija to 2.2°C in Strumica and Mavrovo. The upper limit of the minimal temperature was exceeded in Ohrid 21.0°C at 24<sup>th</sup>, in Prilep 22.4°C at 24<sup>th</sup> and in Skopje 23.6°C at 23<sup>th</sup>.

Precipitations for June were below long term average 1981-2010. Berovo had 48mm on 6<sup>th</sup> of June, with total monthly sum precipitation 69.0mm.

The forecast from the Southeast Europe Virtual Center for Climate Change in Serbia for the month of June was partly efficient for temperature (in the view of the positive anomaly, but not for the degrees), but not for precipitation (Figure 7 and 8).

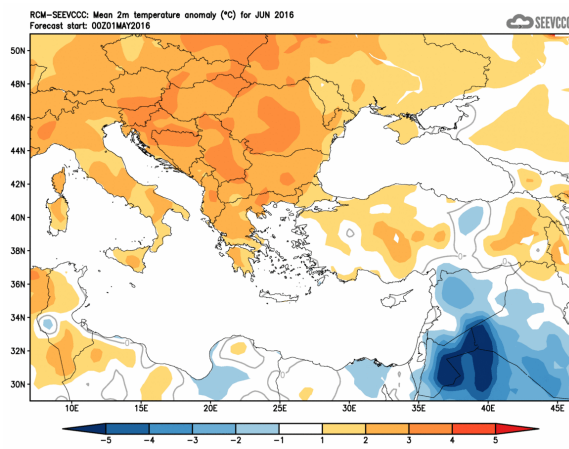


Figure 7: Divergence of the mean monthly temperature (°C) from the normal 1981-2010 in June 2016

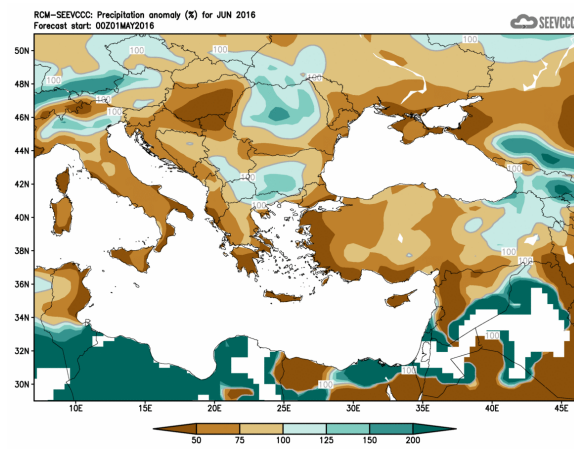


Figure 8: Percentage of the mean monthly precipitation (%) from the normal 1981-2010 in June 2016

## ➤ JULY 2016

July was similar as June, with positive anomaly concerning the temperatures. Mean maximum monthly temperature anomaly ranged from 0.7°C in Prilep to 1.6°C in Bitola. Mean minimum monthly air temperature ranged from 0.4° in Kriva Palanka to 2.3°C in Mavrovo. The mean monthly air temperature anomaly ranged from 0.6°C Stip, Prilep and Lazaropole to 1.5°C in Mavrovo. Absolute minimum air temperature in July was 6.7°C on 8<sup>th</sup> measured in Lazaropole and absolute maximum air temperature was 38.9°C measured on 24<sup>th</sup> of July in Demir Kapija. The precipitation regime was generally below the normal 1981-2010, but Skopje and Berovo had positive anomaly. Extreme daily precipitation sum was measured in Skopje on 16<sup>th</sup> of July with 34.4mm.

The forecast from the Southeast Europe Virtual Center for Climate Change in Serbia for the month of July was partly efficient for temperature (in the view of the positive anomaly, but not for the degrees), and concerning the precipitation regime it was perfect (Figure 9 and 10).

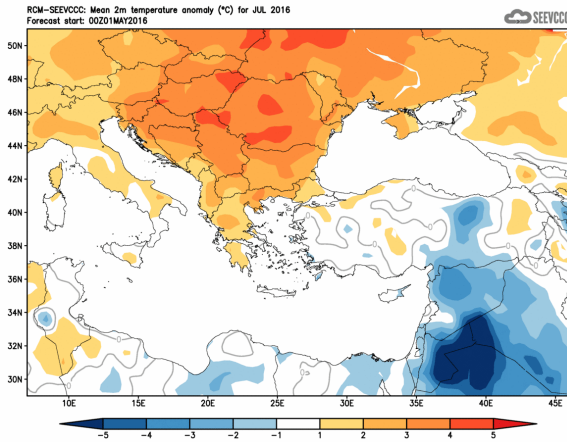


Figure 9: Divergence of the mean monthly temperature (°C) from the normal 1981-2010 in July 2016

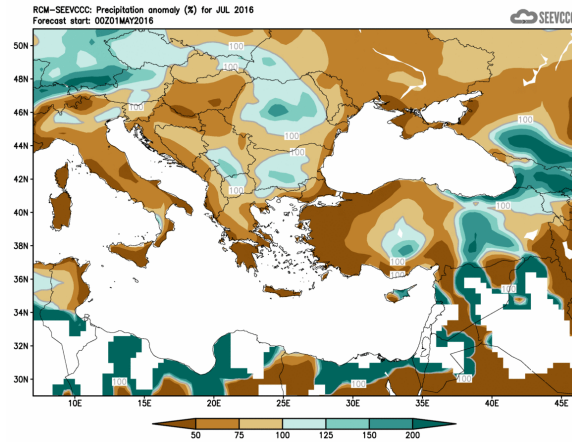


Figure 10: Percentage of the mean monthly precipitation (%) from the normal 1981-2010 in July 2016

## ➤ **AUGUST 2016**

The month of August did not continue in the same rhythm as the months before. The temperature regime was variable with negative and positive anomaly. The mean maximum monthly air temperature anomaly ranged from  $-0.8^{\circ}\text{C}$  in Skopje to  $0.7^{\circ}\text{C}$  in Lazaropole. The mean minimum monthly temperature ranged from  $-0.3^{\circ}\text{C}$  in Stip to  $1.2^{\circ}\text{C}$  in Mavrovo and Strumica. The mean monthly air temperature was also variable, the anomaly ranged from  $-0.8^{\circ}\text{C}$  in Skopje to  $0.4^{\circ}\text{C}$  in Strumica. Absolute minimum temperature was measured in Lazaropole  $3.4^{\circ}\text{C}$  on 13<sup>th</sup> of August and absolute maximum temperature was measured in Demir Kapija on 1<sup>st</sup> of August  $38.4^{\circ}\text{C}$ . The upper limit of the minimal temperature was exceeded in Berovo  $17.6^{\circ}$  at 7<sup>th</sup> of August.

The precipitation regime was variable. Rainfall totals were lower with negative difference in the east part of Republic of Macedonia. Skopje valley was heat by a flash flood on 6<sup>th</sup> of August. There were human victims and a lot of damages on the local houses and fields. Extreme daily precipitation sum was measured in Skopje at Precipitation station Butel on 7<sup>th</sup> of August with 114.0mm. Daily precipitation sum was exceeded in Main meteorological station Skopje reaching 96.5mm on 7<sup>th</sup> of August.

The forecast from the SEEVCCC for the month of August was not efficient for temperature and for precipitation (Figure 11 and 12).

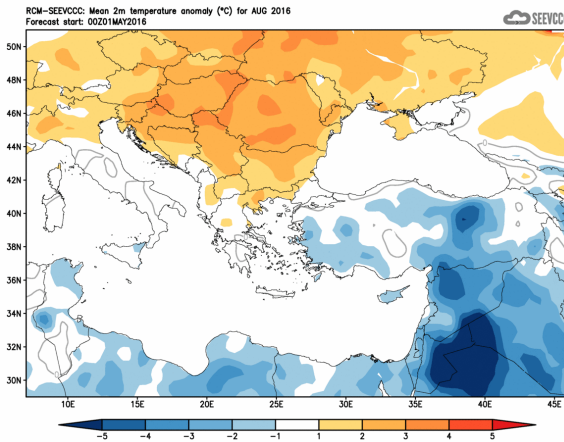


Figure 11: Divergence of the mean monthly temperature (°C) from the normal 1981-2010 in August 2016

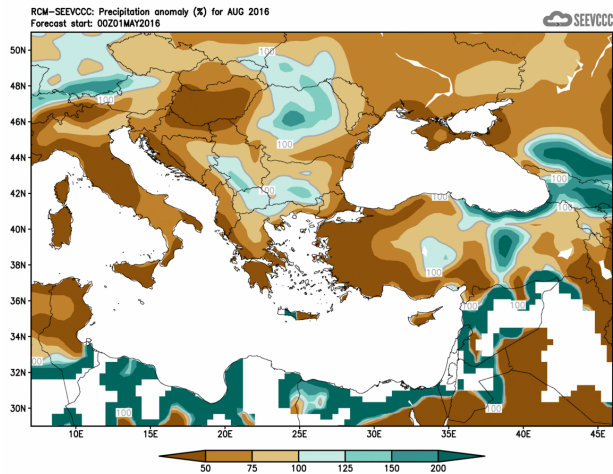


Figure 12: Percentage of the mean monthly precipitation (%) from the normal 1981-2010 in August 2016

Find also below a table presenting the general anomalies of SEECOF products and extreme events of the recorded summer weather.

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)		High Impact Events
	Observed	SEEVCCC climate outlook for temperature	Observed	SEEVCCC climate outlook for precipitation	
<b>REPUBLIC OF MACEDONIA</b>	Slightly above normal	Above to near normal (20, 40, 40)	Very variable precipitation regime	No predictive signal (33, 34, 33)	<p><b>June</b></p> <ul style="list-style-type: none"> <li>-Exceeded upper limit of minimal air temperature 21.0°C on 24<sup>th</sup> in Ohrid</li> <li>22.4°C on 24<sup>th</sup> in Prilep</li> <li>23.6°C on 23<sup>th</sup> in Skopje</li> </ul> <p><b>August</b></p> <ul style="list-style-type: none"> <li>-extreme 5 hours precipitation intensity with probability of appearing 0.1% or once in a thousand years.</li> <li>-Daily sum of precipitation 96.5mm in Skopje.</li> <li>-Exceeded upper limit of minimal air temperature 17.6°C on 7<sup>th</sup> in Berovo.</li> </ul>