

# Verification of the seasonal forecast for summer 2020 in Bulgaria

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## 1. Verification of the seasonal forecast for summer 2020

Tables 1 and 2 show the regular Bulgarian seasonal forecast for the winter season JJA 2020 issued in March (Month-3), April (Month-2), and May (Month-1) 2020 and for the individual months of the summer season issued back up to 3 months prior to the forecast one. The column “Category” gives the assessment of the month or the season based on real data.

**Table 1:** Scores of the seasonal forecast of mean seasonal temperature for summer 2020.

Temperature	Forecast			Category	Score		
	Month-1	Month-2	Month-3		Month-1	Month-2	Month-3
June	0	1	1	-0.16	4	2	2
July	0	1	1	1.27	2	4	4
August	1	1	1	1.51	3	3	3
Summer	1	1	1	1.24	4	4	4

**Table 2:** Scores of the seasonal forecast of seasonal amount of precipitation for summer 2020.

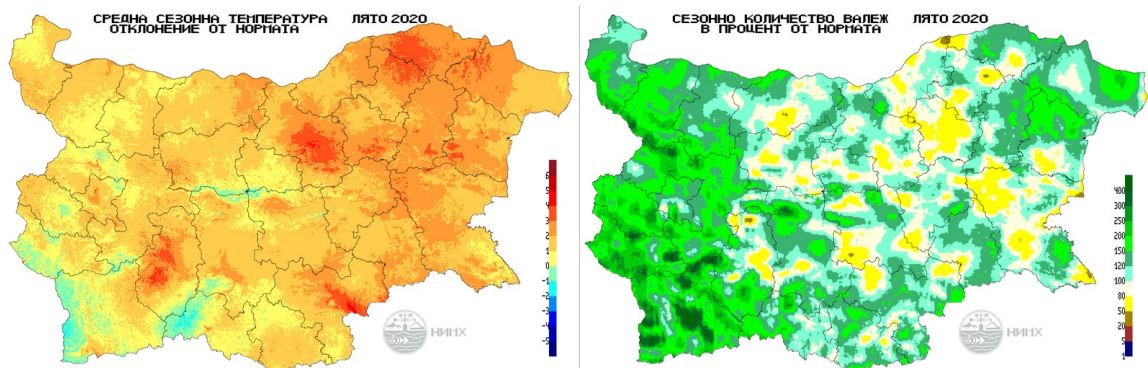
Precipitation	Forecast			Category	Score		
	Month-1	Month-2	Month-3		Month-1	Month-2	Month-3
June	0	-1	-1	0.69	3	0	0
July	0	-1	-1	-0.94	3	4	4
August	-1		-1	-0.44	3	1	3
Summer	-1	-1	-1	-0.05	3	3	3

In average the forecast for temperature scores 3.3 which is very good in the high end of the interval (almost excellent). In average the seasonal precipitation amount forecast scores 2.5 which is very good too but at the lower limit (bordering “good”).

The MedCOF/SEECOF forecast for summer 2020 was stating warm (60% chance for above normal) and dry (50% chance for below normal) or normal (30%) season in the region of Bulgaria. The national seasonal forecast was in the same direction but with weaker probabilities. The MedCOF-SEECOF temperature forecast for summer 2020, for the region of Bulgaria, was for near or above normal temperature and it scores “very

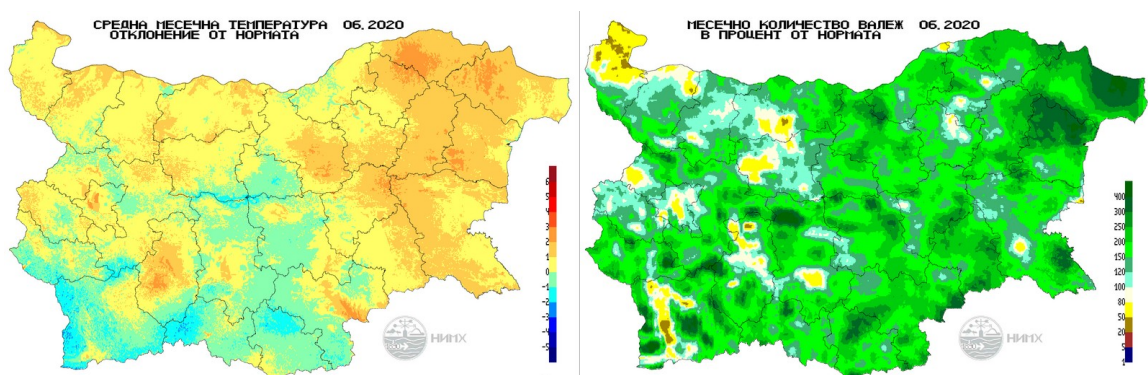
good”. The precipitation forecast was for near or below normal and it is very good as well.

Since 2012 the Bulgarian seasonal forecast contains an additional sentence that presents an attempt to predict how the upcoming season or month is expected to compare to the same one from the previous year. For this summer it was said that the season should be similar to summer 2019 or with less precipitation. The summer of 2019 was with temperatures above normal (1.73) and with precipitation near normal (0.47). Summer 2020 therefore was less warm (1.24) and with less precipitation (-0.05) than summer 2019.

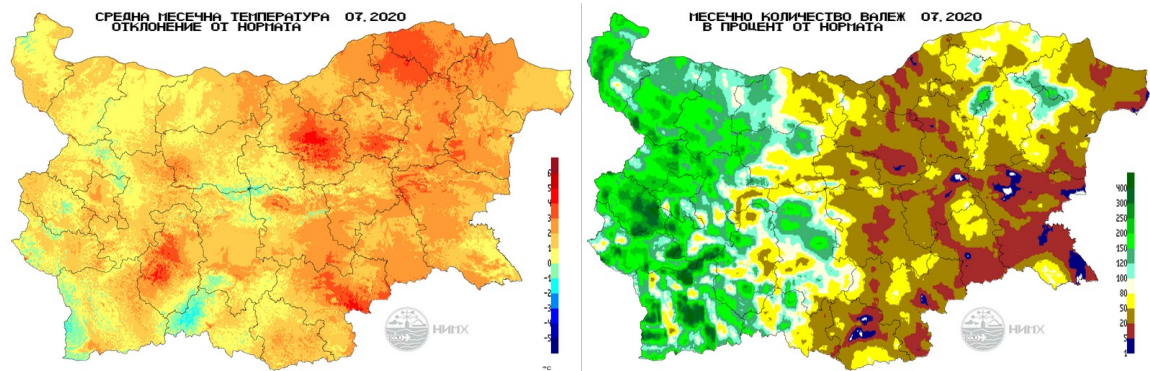


**Figure 1:** Departure of the seasonal mean temperature from normal (1961-1990) (left) and seasonal amount of precipitation in percent of normal (1961-1990) (right) for summer (June-July-August) 2020.

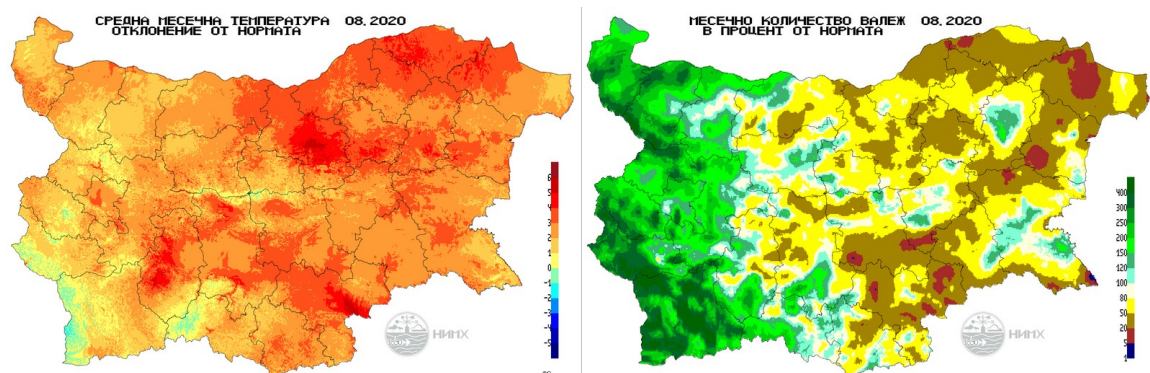
Figure 1, 2, 3, and 4 show maps of the departure from normal (1961-1990) of the seasonal/monthly mean temperature (left) and the seasonal/monthly amount of precipitation in percent of normal (1961-1990) (right) for the summer season as a whole (Fig. 1) and the individual months of June 2020 (Fig.2), July 2020 (Fig.3), and August 2020 (Fig.4). The maps are regular operational products of the Bulgarian weather service and are therefore given with reference to normal based on the period 1961-1990 as with the WMO recommendations.



**Figure 2:** Departure of the monthly mean temperature from normal (1961-1990) (left) and monthly amount of precipitation in percent of normal (1961-1990) (right) for June 2020.



**Figure 3:** Departure of the monthly mean temperature from normal (1961-1990) (left) and monthly amount of precipitation in percent of normal (1961-1990) (right) for July 2020.

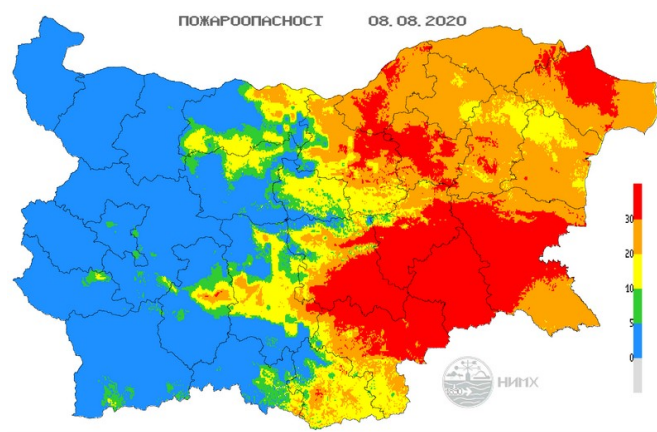


**Figure 4:** Departure of the monthly mean temperature from normal (1961-1990) (left) and monthly amount of precipitation in percent of normal (1961-1990) (right) for August 2020.

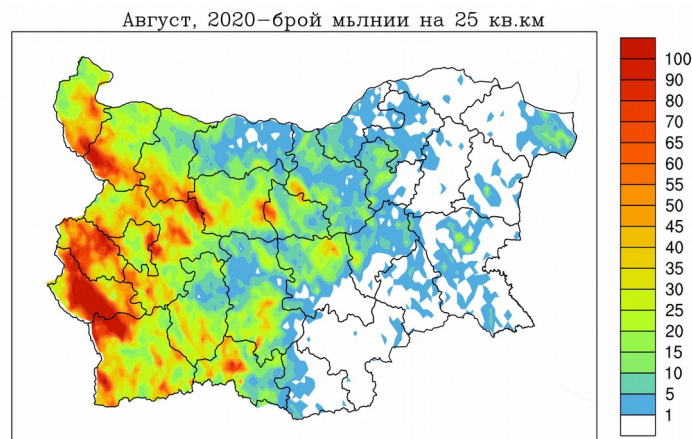
## 2. Extreme events

Drought conditions in East Bulgaria are the most prominent particularity of summer 2020. June was actually wetter month and there were days with big rain and land slides, thunderstorms and hailstorms (9-10 and 14-15 June). July however was wet in West Bulgaria and very dry in East Bulgaria. There was an undergoing drought since the summer of 2019 and in July it reemerged in East Bulgaria despite the rain in June. August was similar to July with rain in the west and rather dry conditions in the east of the country. Figure 6 shows the contrast between the thunder activity in West Bulgaria and the quieter August in East Bulgaria. The wild-fire season strengthened in east Bulgaria in August due to the drought. Figure 5 shows the extreme fire risk in Southeast Bulgaria where fires spread in the middle of the month.





**Figure 5:** Fire weather index on 8 August 2020.



**Figure 6:** Monthly flash density for August 2020 (from ATDNet, G. Anderson and D. Klugmann, 2014).

### 3. Explanations

#### 3.1 Regular seasonal forecasting in Bulgaria






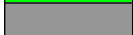
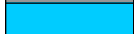
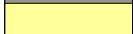






The National institute of meteorology and hydrology (NIMH) is the national weather service of Bulgaria. We have been producing regular seasonal forecast for our country since 2005. It is updated once a month at the end of the month as soon as all forecast materials become available. It is based on subjective analysis of the map products from the numerical climate prediction models of the following centers or multi-model systems:

ECMWF, EUROSIP, C3S, NMME, MetOffice, Meteo-France, NCEP

#### 3.2 Notation rules

The categories “above normal”, “around normal”, and “below normal” by definition have an equal probability of occurrence of 33.3%. The aim of the seasonal

forecast is to favor one or two of the three categories based on the analysis of all available forecast materials and assessment of the evolution of large climate structures for the upcoming months. We consider Bulgaria as a region that is relatively small compared to the spatial uncertainties of the modern seasonal forecasting materials. That is why we give a unique forecast valid for the entire country without detailing for different regions except occasionally and only for the first month based on analysis of the medium range weather forecast. The forecast is summarized in tables with the favored categories in color as follows:

	warm		wet
	warm to normal		wet to normal
	normal		normal
	cold to normal		dry to normal
	cold		dry
	not available		not available
	all categories are likely		all categories are likely

We call “season” any three-month period which corresponds to the way the numerical seasonal forecast products are provided by the centers. However since 2011 the seasonal forecast is published only for the calendar season winter, spring, summer, and autumn.

The regular seasonal forecast is available to the public on the website of the institute though only in Bulgarian language.

### 3.3 Verification rules

In order to quantify the seasonal forecast in terms of categories below, around, and above normal we do the following. Since we give a unique forecast for the expected category for the entire country we need to have a unique assessment of the category of a given month or season. The assessment of the category is based on data from 20 meteorological stations distributed evenly in the country. The data from each of those 20 stations are analyzed. These are records of mean monthly temperature and monthly amount of precipitation from 1950 to present. The percentiles for below, around, and above normal are found for each station based on the latest possible 30-year period 1980-2009. This period is chosen in order to match the base periods of some if not all of the climate centers producing probability map. This reference period is also more suitable to give monthly or seasonal category that would correspond better to the perception of the public. This should be especially true for the thermal category because of the recent overall warming trend. The months and seasons therefore can be attributed a certain category numbered from -2 (below normal) to +2 (above normal). These numbers for all 20 stations and for each individual month or season are then averaged in order to produce a unique category number for the entire country. The forecast itself is also attributed a number that reflects the forecast category. The numbers are -2 (below normal), -1 (below or around normal), 0 (around normal), +1 (above or around normal), and +2 (above normal). In order to assess the skill of our forecast we find the difference between the forecast and the real category. If it is within  $\pm 0.5$  we consider that the forecast is excellent

(4), within  $\pm 1.0$  – very good (3), within  $\pm 1.5$  – good (2), and above it is considered to be poor (0). If there is no given preference to any of the three categories we attribute score (1) reasonable, because at least the forecast is not misleading.

### References:

G. Anderson and D. Klugmann, 2014: A European lightning density analysis using 5 years of ATDnet data. *Nat. Hazards Earth Syst. Sci.*, 14, 815–829.

Monthly bulletin of the National institute of meteorology and hydrology, Sofia, Bulgaria. Latest issue available online ( <http://www.meteo.bg/meteo7/sites/storm.cfd.meteo.bg/meteo7/files/Bulletin.pdf> ) and older issues available on demand.

Seasonal forecast for Bulgaria. Latest issue available online ( <http://www.meteo.bg/en/forecasts/seasonal> ).