

Verification of the seasonal forecast for summer 2021 in Bulgaria

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1. Verification of the seasonal forecast for summer 2021

Tables 1 and 2 show the regular Bulgarian seasonal forecast for the summer season JJA 2021 issued in March (Month-3), April (Month-2), and May (Month-1) 2021 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 2021.

		Forecast			Score			
2021	Month Season	-1	-2	-3	Index	-1	-2	-3
Temperature	June	-1	1		-0.33	3	2	1
	July	1	1	1	1.96	3	3	3
	August	1	1	1	1.91	3	3	3
	Summer	1	1		1.91	3	3	1

Table 2: Scores of the seasonal forecast of seasonal amount of precipitation for summer 2021.

		Forecast			Score			
2021	Month Season	-1	-2	-3	Index	-1	-2	-3
Precipitation	June	0	-1		0.81	3	0	1
	July	-1	-1	-1	-0.81	4	4	4
	August	-1	-1	-1	-0.47	3	3	3
	Summer	-1	-1		-0.05	3	3	1

In average the forecast for temperature scores 2.6 which is very good but in the lower end of the interval (bordering “good”). In average the seasonal precipitation amount forecast scores 2.7 which is very good near the lower limit.

The MedCOF/SEECOF forecast for summer 2021 was stating warm (50% chance for above normal) season with no signal for precipitation for the region of Bulgaria. The national seasonal forecast for temperature was in the same direction. The precipitation forecast however was giving more weight to the dry (40%). The MedCOF-SEECOF

temperature forecast for summer 2021, for the region of Bulgaria, is “very good”. The precipitation forecast is good too having in mind that the seasonal outcome for precipitation is indifferent.

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 have been similar to summer 2020. The summer of 2020 was with temperatures near or above normal (1.24) and with precipitation near normal (-0.05). Summer 2021 therefore was even warmer (1.91) and with similar precipitation (-0.05).

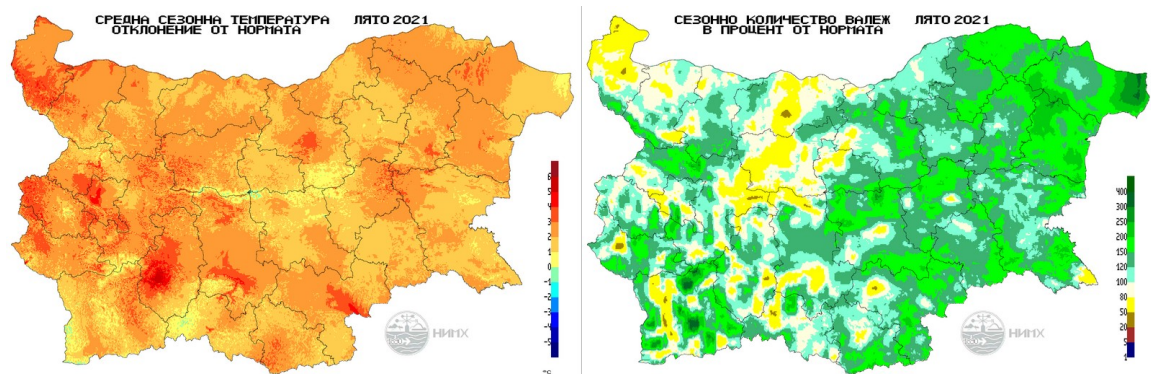


Figure 1: Departure of the seasonal mean temperature from normal (1961-1990) (left) and seasonal amount of precipitation in percent of normal (1961-1990) (right) for summer (June-July-August) 2021

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 2021 (Fig.2), July 2021 (Fig.3), and August 2021 (Fig.4). The maps are regular operational products of the Bulgarian weather service and are still given with reference to normal based on the period 1961-1990.

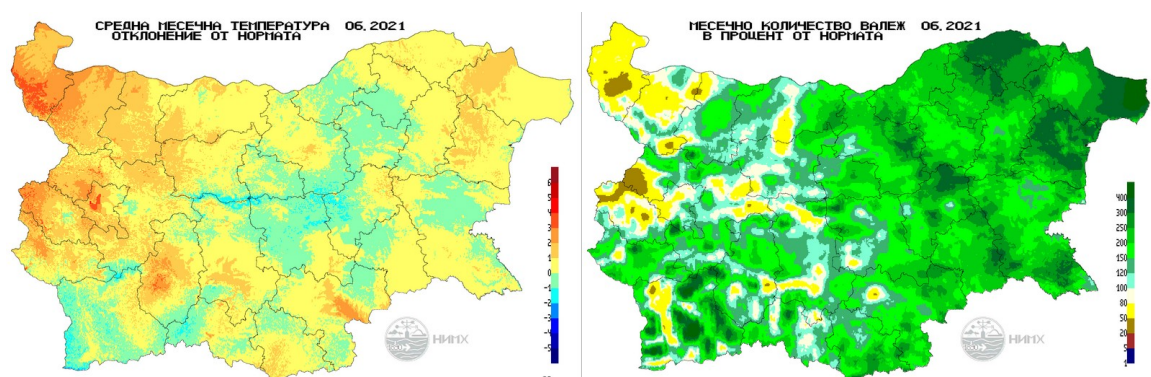


Figure 2: Departure of the monthly mean temperature from normal (1961-1990) (left) and monthly amount of precipitation in percent of normal (1961-1990) (right) for June 2021

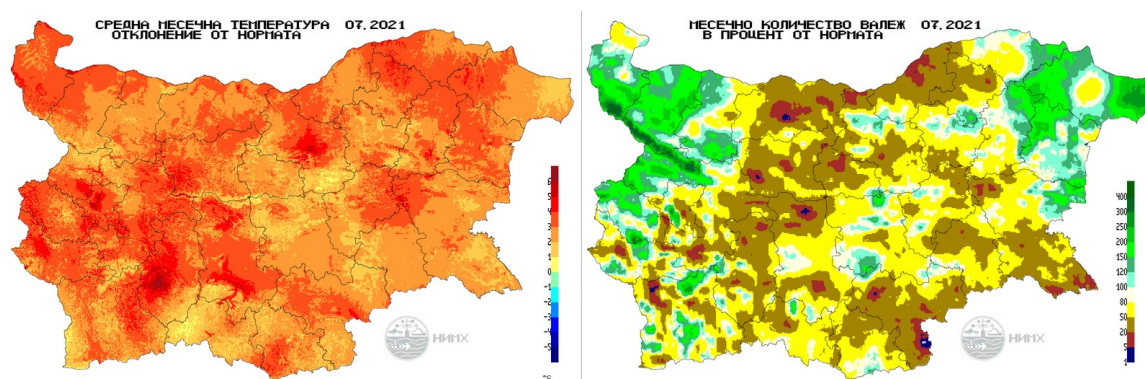


Figure 3: Departure of the monthly mean temperature from normal (1961-1990) (left) and monthly amount of precipitation in percent of normal (1961-1990) (right) for July 2021

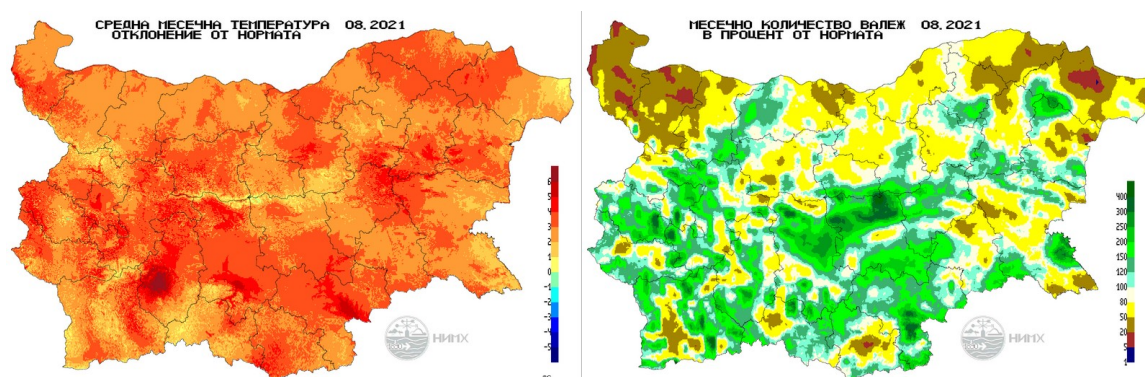


Figure 4: Departure of the monthly mean temperature from normal (1961-1990) (left) and monthly amount of precipitation in percent of normal (1961-1990) (right) for August 2021

2. Extreme events

The drought conditions in the height of the summer worsened the fire weather conditions. The fire weather index was at extreme levels at the end of July and the beginning of August. Fire fighters were dealing simultaneously with several major fires. Figure 5 shows the extreme fire risk for 3 August 2021.

Cooler and moist air came at the end of August to ease the drought but also brought thunderstorms and hailstorms. Lightnings stroke two people and hails devastated crop fields in South Bulgaria. Figure 6 shows the lightnings in Bulgaria on 25 August.

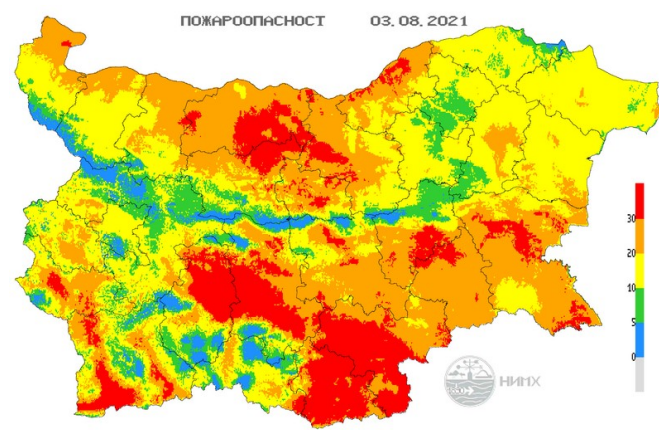


Figure 5: Fire weather index on 3 August 2021.

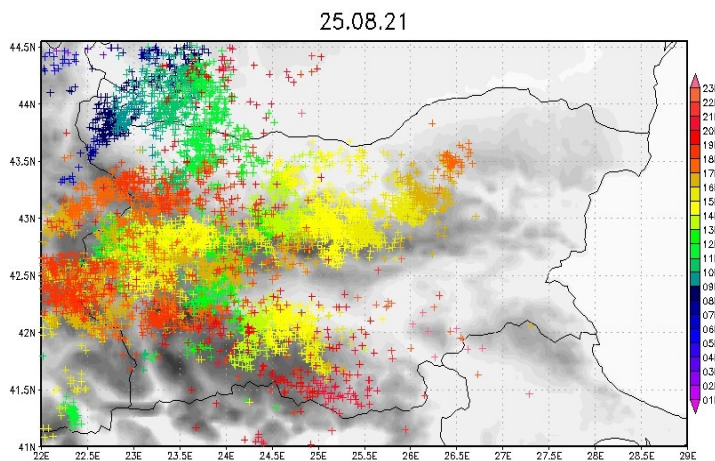


Figure 6: Lightning strokes on 25 August 2021 (from ATDNet, G. Anderson and D. Klugmann, 2014).

3. Explanations





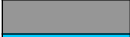
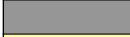








3.1 Regular seasonal forecasting in Bulgaria

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 ± 0.5 we consider that the forecast is excellent (4), within ± 1.0 – very good (3), within ± 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>).