

Assessment of the seasonal forecast for the winter season 2011/12 in Bulgaria

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1. Introduction

1.1 Regular seasonal forecast

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:

European center for medium range weather forecast, Reading, UK;

MetOffice, Exeter, UK;

National center for environmental prediction, USA;

International research institute, Columbia University, USA;















Beijing climate center, China;

Tokyo climate center, Japan;

and the statistical prediction models of the Italian institute of biometeorology Ibimet and the Tokyo climate center. All these materials are available on the websites of the centers.

1.2 Explanations

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 we now prefer to issue forecast for the traditional seasons. Winter therefore is the three-month period December-January-February. We give first forecast for an upcoming winter season at the end of the third month prior to the season and update it at the end of every month since. We also update the forecast as the season goes and thus the last forecast issued is given at the end of the second month of a given season. For example, the first forecast for the winter season is issued at the end of September and the last update – at the end of January. However we evaluate only the three forecast issues prior to the season.

The regular seasonal forecast is available to the public on the website of the institute (<http://info.meteo.bg/>) though only in Bulgarian language.

2. Verification of the seasonal forecast for season winter 2011/12

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 30 meteorological stations distributed evenly in the country. The data from each of those 30 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 30 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 beyond 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.

In Table 1 and 2 we give our regular seasonal forecast for the winter season December-January-February 2011/12 issued in September (Month-3), October (Month-2), and November (Month-1) 2011 and for the individual months of the winter season issued up to three months in advance of the forecast one. The column “Index” gives the assessment of the month or the season based on real data.

Regardless the reference period 1961-1990 (used for the maps in Figures 1, 2, and 3) or 1980-2009 (used for the index in Tables 1 and 2), the winter season 2011/12 in Bulgaria

was cold and wet (See Table 1 and 2 line “Winter”). The cold status of the winter season is thanks primarily to the very cold month of February (See Fig. 3 left) and partly January in South Bulgaria (See Fig. 2 left). The wet status of the winter season is thanks primarily to the wet month of January (See Fig.2 right) and partly February in South Bulgaria (See Fig. 3 right).

Table 1: Scores of the seasonal forecast of mean seasonal temperature for the winter season 2011/12 in Bulgaria. The reference period for the index is 1980-2009.

Temperature	Forecast			Category	Score		
	Month-1	Month-2	Month-3		Month-1	Month-2	Month-3
December	0	-1	0	1.02	2	0	2
January	0	-1	0	-0.84	3	4	3
February	-1	1	1	-2.00	3	0	0
Winter	0	0	0	-1.82	0	0	0

Table 2: Scores of the seasonal forecast of seasonal amount of precipitation for the winter season 2011/12 in Bulgaria. The reference period for the index is 1980-2009.

Precipitation	Forecast			Category	Score		
	Month-1	Month-2	Month-3		Month-1	Month-2	Month-3
December	0	0	0	-0.30	4	4	4
January	0	0	-1	2.00	0	0	0
February	0	-1	-1	0.72	3	0	0
Winter	-1	-1	-1	1.68	0	0	0

The forecast was based on the UK MetOffice forecast for positive winter NAO and the forecast of most of the global centers for continuing moderate La Nina for the winter season. The overall forecast of the numerical models was for cold and dry season which was taken into account too. The fact that most of the models were giving rather dry winter and that there was forecast for moderate La Nina and positive NAO made so that dry or normal winter was favored in the seasonal forecast from September until the latest one issued in November. The uncertainty associated with La Nina and positive NAO working in different ways in terms of thermal status of the winter season made so that neutral winter in terms of temperature was favored. We should have rather preferred to leave the winter season unpredictable though. The models however suggested cold season and with grate confidence. It was underestimated for our winter forecast.

As can be seen from Table 1 and 2 the average score of our latest winter forecast is 1.33 which is below the threshold for being good. The forecast for the winter season as a whole is unsuccessful. Only the precipitation forecast for December and the temperature forecast for January can be considered successful.

Figures 1, 2, and 3 show maps of the departure of the monthly mean temperature from the norm (1961-1990) (left) and monthly amount of precipitation in percent of normal (1961-1990) (right) for the winter months December 2011 (Fig.1), January 2012 (Fig.2), and February 2012 (Fig.3). The maps are regular operational products of the Bulgarian

weather service and are therefore given with reference to norms based on the period 1961-1990 as with the WMO recommendations.

Figure 1: Departure of the monthly mean temperature from the norm (1961-1990) (left) and monthly amount of precipitation in percent of normal (1961-1990) (right) for December 2011.

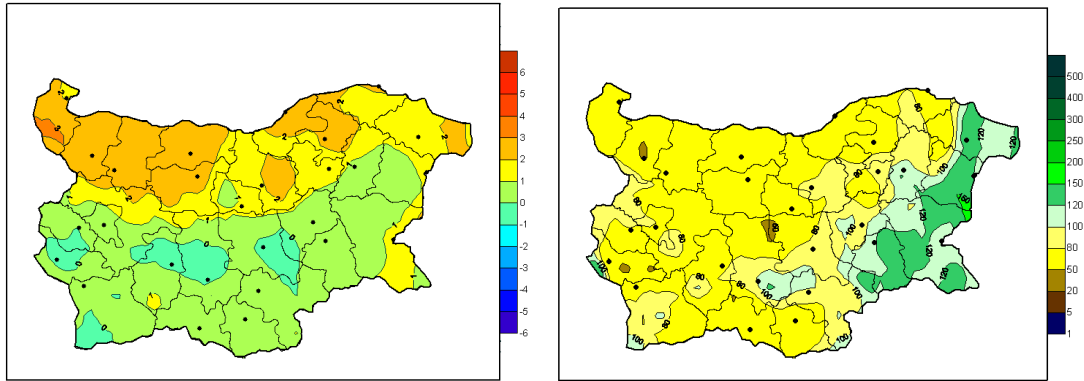
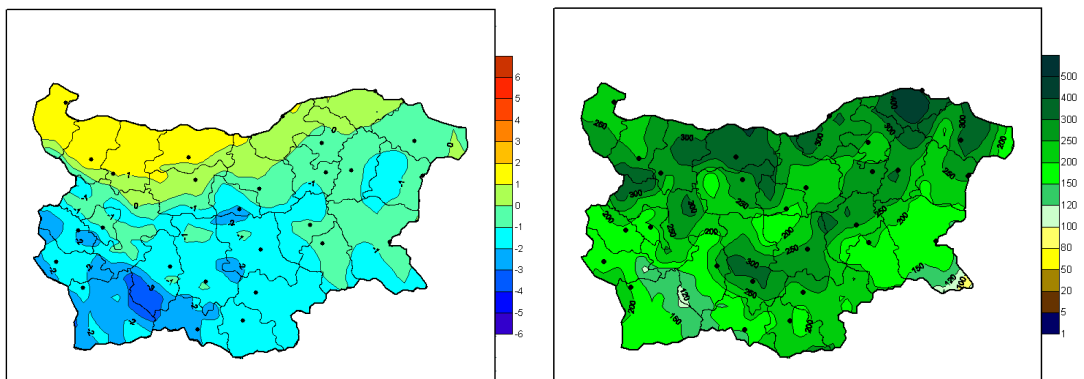


Figure 2: Departure of the monthly mean temperature from the norm (1961-1990) (left) and monthly amount of precipitation in percent of normal (1961-1990) (right) for January 2012.



3. Extreme events

The month of February 2012 was extremely cold with mean monthly temperatures in North Bulgaria up to 6-7°C below average (See Fig. 3 left). The lowest temperature measured last winter is -31.4°C in Sevlievo, North-central Bulgaria, on 1 February 2012 (See Fig. 4). There was continuous snow cover almost everywhere in the country from late January to late February which is rather exceptional (See Fig. 5). In Sofia, the capital city, there was continuous snow cover from late December to the beginning of March which is also rare. The maximum snow depth in the mountain stations reached levels above 200 cm which is also rather rare. There was a strong precipitation event around 5-6 February 2012 mostly in the southeast part of the country. In the Eastern Rhodope Mountains in the south the reported 24h-precipitation amounts were up to 179 mm and

above 100 mm in numerous stations in the region (See Fig. 6). This event was also associated with a sudden warming in the region. The combined rapid snow melt due to the warming and the abundant rain triggered the collapse of the wall of a small local water reservoir in the Eastern Rhodope Mountains. This caused sudden flood of villages along the river below. There were casualties and property loss.

Figure 3: Departure of the monthly mean temperature from the norm (1961-1990) (left) and monthly amount of precipitation in percent of normal (1961-1990) (right) for February 2012.

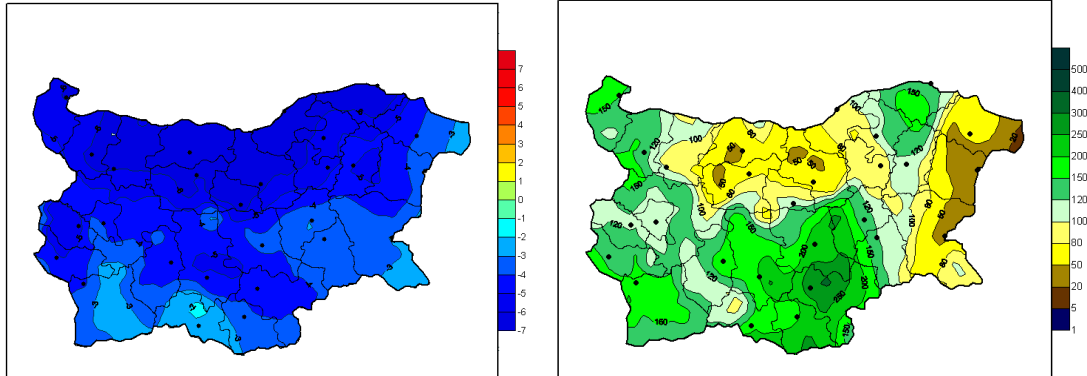


Figure 4: Minimum temperature (°C) 1 February 2012.

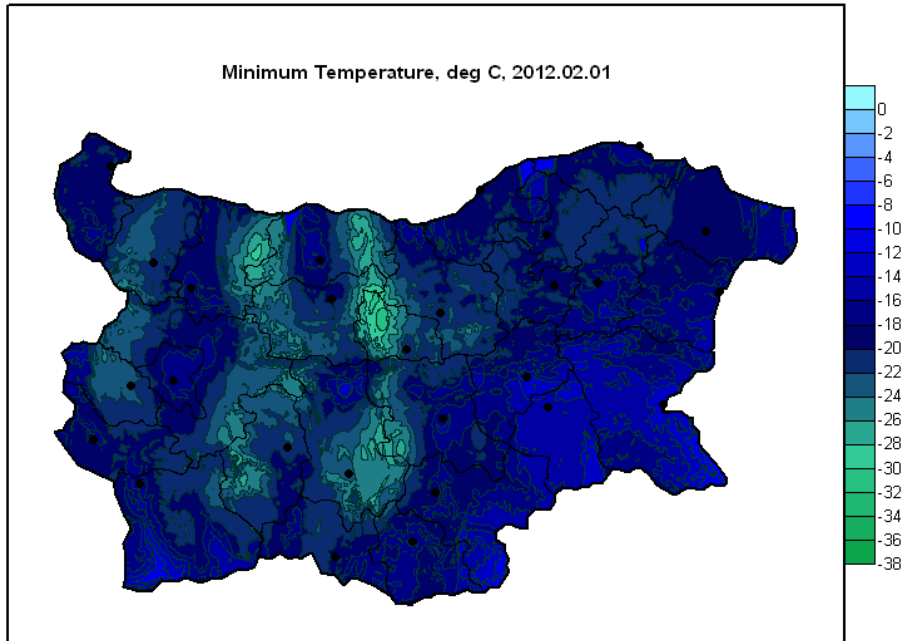


Figure 5: Snow depth (cm), 13-14 February 2012.

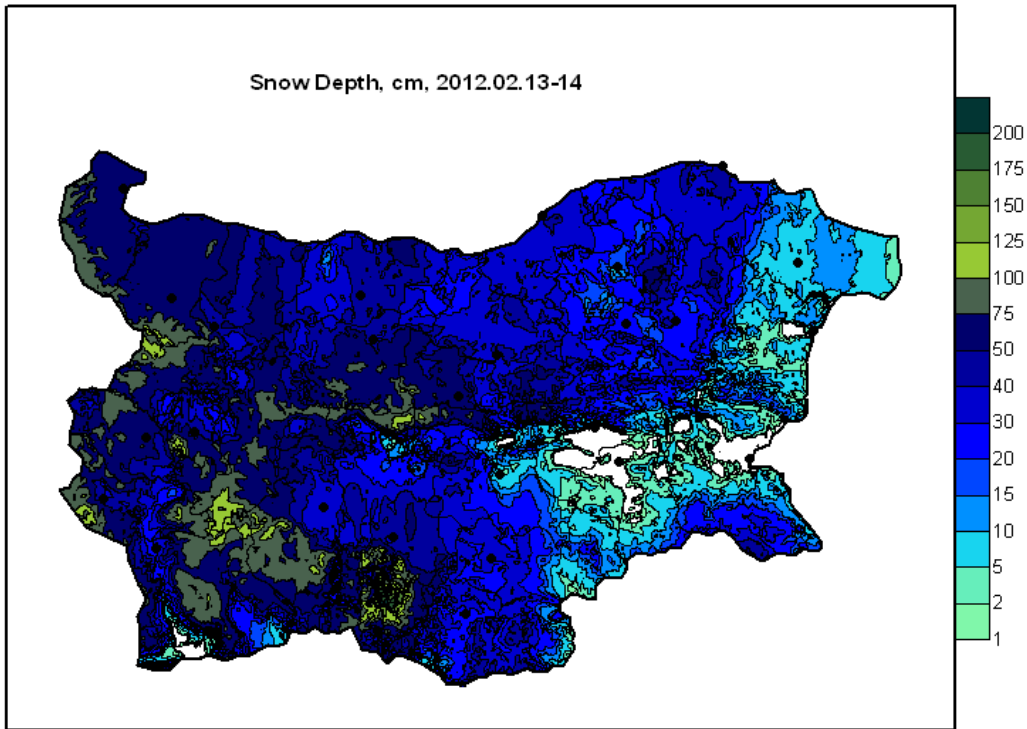
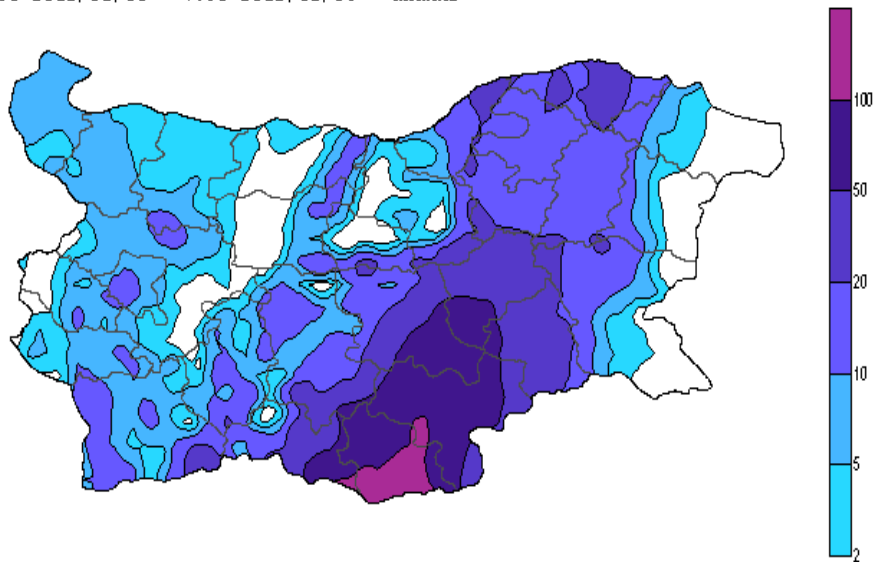


Figure 6: 24-h precipitation amount (mm), 5-6 February 2012.

7:30 2012/02/05 - 7:30 2012/02/06 - анализ



References:

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