



Assessment of the prediction for the JJA 2017 Summer season for the Republic of Srpska, Bosnia and Herzegovina

1. SEECOF 18, MedCOF-9 Climate outlook for the 2017 Summer season:

Precipitation and Temperature

Over The Republika Srpska probabilistic consensus forecast was expected to be warmer (above upper tercile categories) with the chance of **50%** (figure 1 right-bottom). That prognosys had been in consistence with observed values. The observed temperatures are ranked as extremely warm in the entire state entity (fig1 top-right).

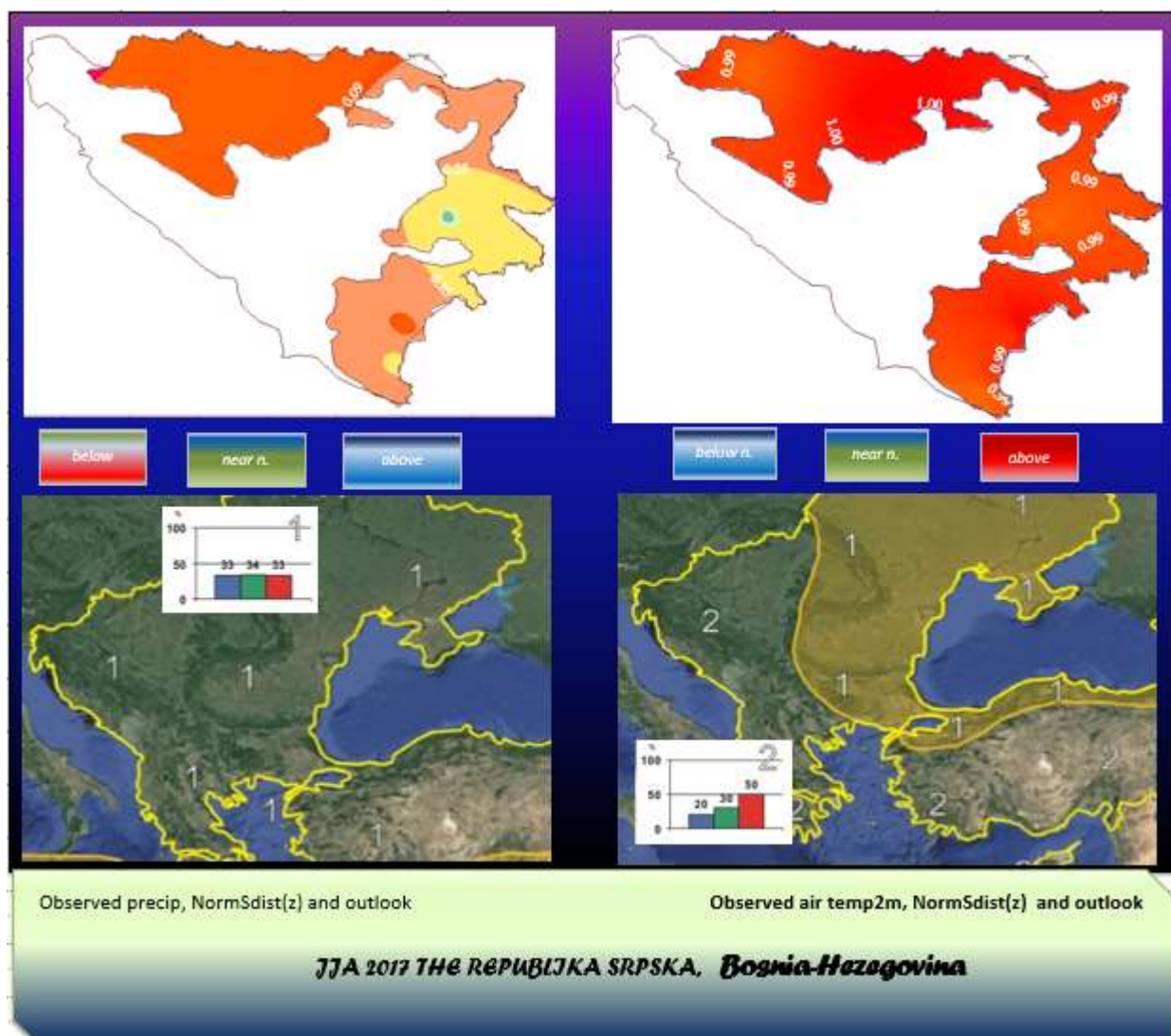


Figure 1. Spatial presentation of the 2017 summer season a) jja 17 precipitation and forecast (top and bottom, left-ref 1981/2010); b) JJA17 temperature and outlook (top and bottom, right)

The JJA outlook for the rainfall height suggested the same probabilities for all three terciles categories. Measured values was settled in very dry to extremely dry position over almost entire state entity of Srpska (fig 1, top and bottom-left).

Extremely hot and severe to extremely dry weather pattern was occurred in the whole territory (fig 1 and 2, top left and right). The prediction for the rainfall was not correct (no clear signal means that weather according climate type would prevailed).

2. Analysis of the 2017 Summer season:

Air temperature

Temperature, **Summer mean** for The Republika Srpska stations, in average over 24 stations was 21,3C and reached 0.98th-1.00P (*extremely hot* with respect to percentiles distribution). The hottest areas: southern, as usually (Trebinje 25,8C); eastern north of Semberia (Bijeljina 24,2C and western north (Banja Luka 23,8C).

The mean temperature anomalies varried from 2,1C (Sokolac) to 2,9C (Novi Grad) from the long term mean of the 1981-2010. Temperature, 2017 summer mean as well as long term tercile categories and anomalies, with respect to 1981-2010 climatology, are presented at the table 1 .

The table 1: Tmean, JJA 2017

Station in RS	NORMSDI ST (z) (1981- 2010)	jja 017 °C	jja017 anom °C	33,33	50,00	66,67	tercile anom. categ
Бања Лука Banja Luka	1,00	23,8	2,8	20,6	20,8	21,5	above
Приједор Prijedor	0,98	23,5	2,3	20,6	21,1	21,8	above
Нови Град Novi Grad	0,99	22,7	2,9	19,2	20,1	20,5	above
Добој Doboj	1,00	23,3	2,8	20,0	20,4	21,0	above
Бијељина Bijeljina	0,99	24,2	2,8	20,9	21,2	21,8	above
Соколац Sokolac	0,98	18,4	2,1	15,7	16,3	16,9	above
Билећа Bileća	0,99	23,8	2,5	20,6	21,2	21,6	above
Гацко Gacko	0,99	19,8	2,7	16,5	17,3	17,8	above
Чемерно Сетето	1,00	17,4	2,7	14,4	14,9	15,2	above
Требинје Trebinje	0,98	25,8	2,4	23,4	23,0	23,5	above

The JJA-2017 had been extremely sunny and extremely warm, in some places were measured the highest or the second highest of Tmax in August from 4th -10th (Banja Luka 41,8C; Višegrad 41,7C, Ribnik and Rudo 41,4C, Prijedor 41,2C).

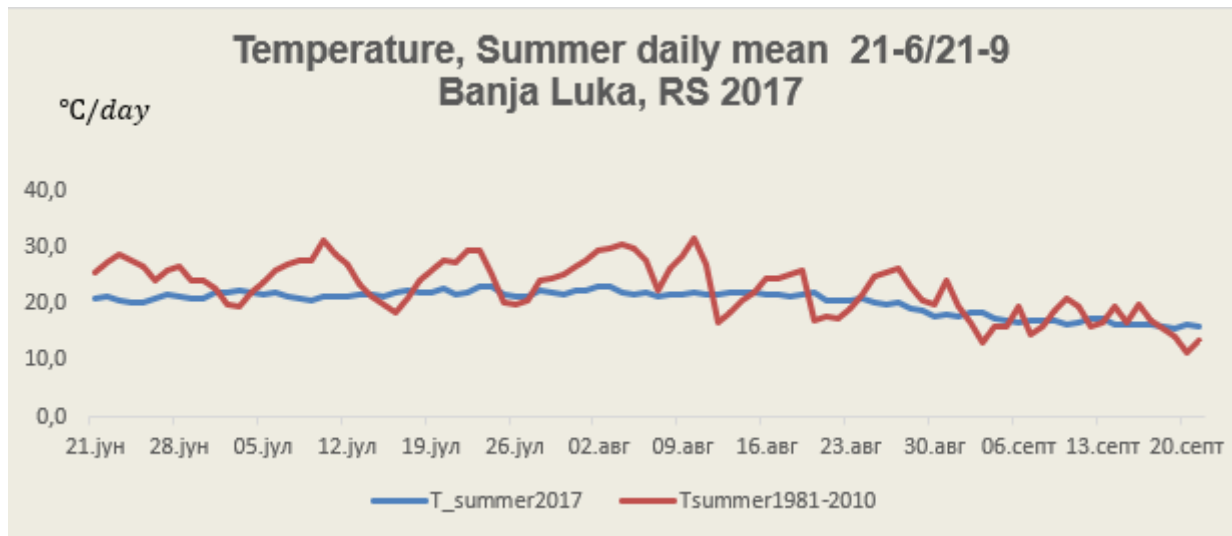


Figure 2. Temperature, daily mean during the summer time in Banja Luka

In Banja Luka July 10th was the hottest day of the analysed summer time. (fig 2.). It was occurred six heat waves.

Seasonal Rainfall

The 2017seasonal rainfall total belong to "below" tercile anomaly category in the entire state entity of the Republika Srpska. To be more precisely, according to percentiles and SPI-index, the occured drought was qualified like "very dry" ie "severe drought". Regarding the difference of precipitation from evaporation (measured values) it is qualified as an extremely dry over the most places (the second highest negative difference in Banja Luka -the driest pattern was only in 2003. from 1961 onwards.

The example of Banja Luka has shown the relativity of ranking according to rainfall: both summers ranked as extremely warm, 2003 and 2017 differ, so that Return Period of extremely warm weather pattern in 2003 is 145yrs but in 2017 it is 126yrs (. In 2003 beside the driest summer season, was the driest vegetative period (April September) too.

According to precipitation only , it is spected to be drier in 2017 (116mm/JJA) cause of less precipitation amount than in 2003 (135mm/JJA) but in 2003 it was warmer with larger evaporation.

April-September of the 2017 is the fifth driest vegetation season over more than 50 years.

Table 2: Rainfall 30. May -31. Aug-2017; relevant statistics

The Republika Srpska Station	NORMSDIS T (z) (Percentile 1981-2010)	PercRank (1960-2017)	jja 017 mm	rainfall jja-017 % from normal	33P (mm/JJA)	67P (mm/JJA)	50P (mm/JJA)	tercile anom.rank
Бања Лука Banja Luka	0,03	0,02	116	43	221	313	265	below
Приједор Prijedor	0,07	0,05	131	54	198	271	219	below
Нови Град Novi Grad	0,05	0,02	119	48	210	274	245	below
Добој Doboj	0,09	0,09	143	50	215	321	272	below
Бијељина Bijeljina	0,06	0,12	123	50	216	278	255	below
Сокоци Sokolac	0,31	0,35	204	86	206	260	241	below
Билећа Bileća	0,34	0,35	150	84	144	196	175	near norm
Гацко Gacko	0,03	0,02	50	26	158	222	184	below
Чемерно Čemerno	0,29	0,19	163	75	172	246	198	below
Требње Trebinje	0,14	0,12	77	42	133	229	161	below

Among the hottest and driest summers are also those in 1950 (93mm), 1946 (99mm) , 1933, but also in the distant past of 1894, 1895, 1905 (at the end of 19.century sunshine duration showed max). Each severe to extreme drought over here was connected with the similar weather pattern (sunny to extremely sunny-warm to extremely warm) and have had the return period of about 50-60yrs.

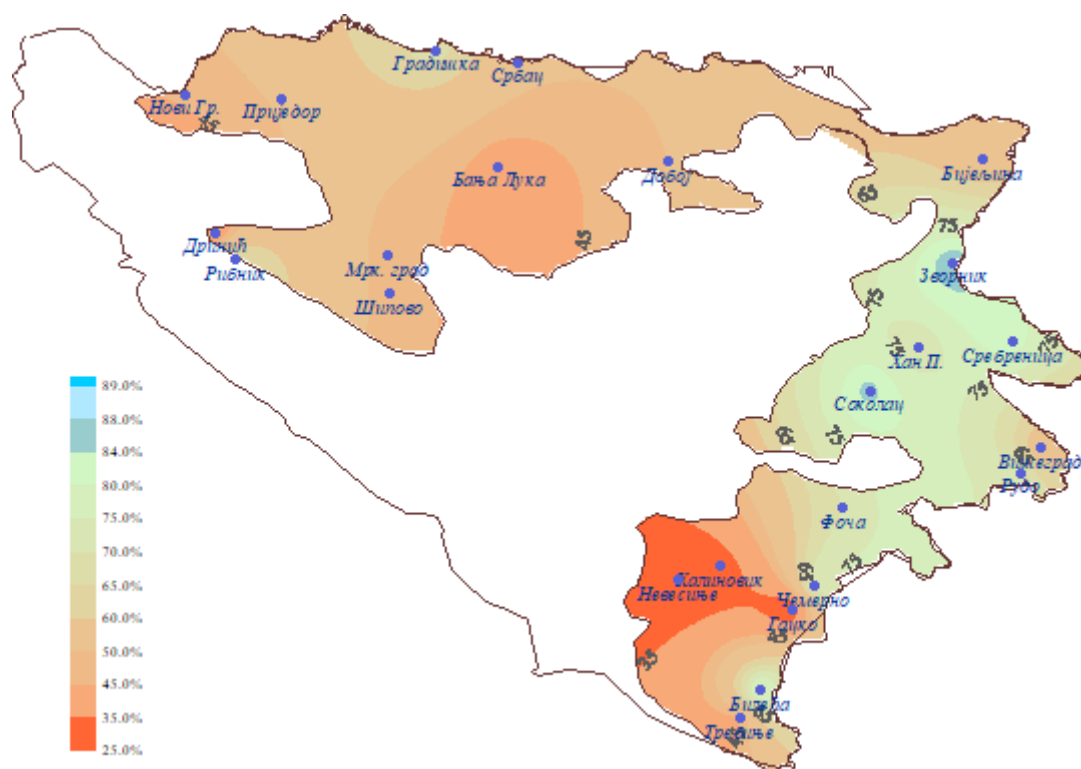


Fig 3 Spatial distribution of Relative anomaly of Precipitation in (% from normal), ref 1981-2010) The Republika Srpska, Bosnia and Herzegovina

Rainfall total for the summer varied from 50 mm (Gacko) to 260 mm (Zvornik), on average, over RS 24 stations, that was 138mm (238mm multi-annual mean). Regarding higher temperature in eastern places, even somewhat larger amount of precipitation (Bijeljina for example), evaporation was larger than in Banja Luka, so drought was also more intense then precipitation showed.

Calculated potential evapotranspiration over different places suggested more than three times larger potential evapotranspiration than the rainfall total. According to modified Mediterranean type of climate, southern places each summer have occurred significant deficit of precipitation but it is unusual over the northern and central areas where the month of Jun is remarkable as the primary or secondary max of precipitation.

The driest summers from 1954: 2003, 2017, 2015, 2012, 2013, 2007, 2011, 2008 with more than 180mm larger evaporation than summer rainfall. Over the farer past, the similar years were 1950 and 1946, aswell as 1933 and 1954 even with less rainfall total, but similar extremely hot and sunny to extremely sunny meteorological phenomena. In 1950s were occured absolute daily max in many places over the Bosnia and Herzegovina and were not overreached through the newest warming.

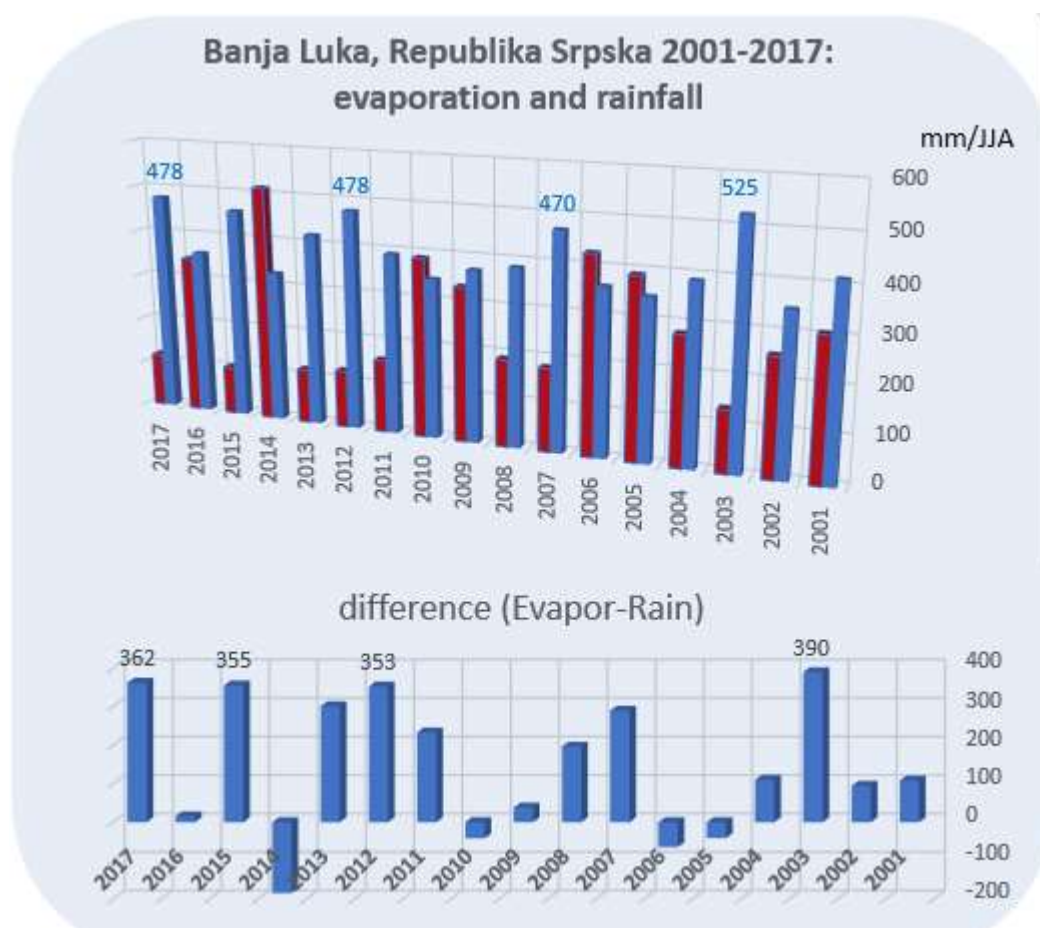


Figure 4: **JJA2017** values of Evaporation (blue) and Rainfall total (red; both measured values) have shown more precisely the intense of droughts over the hottest period 2001-2017in new history. The example of Banja Luka, RS, BH

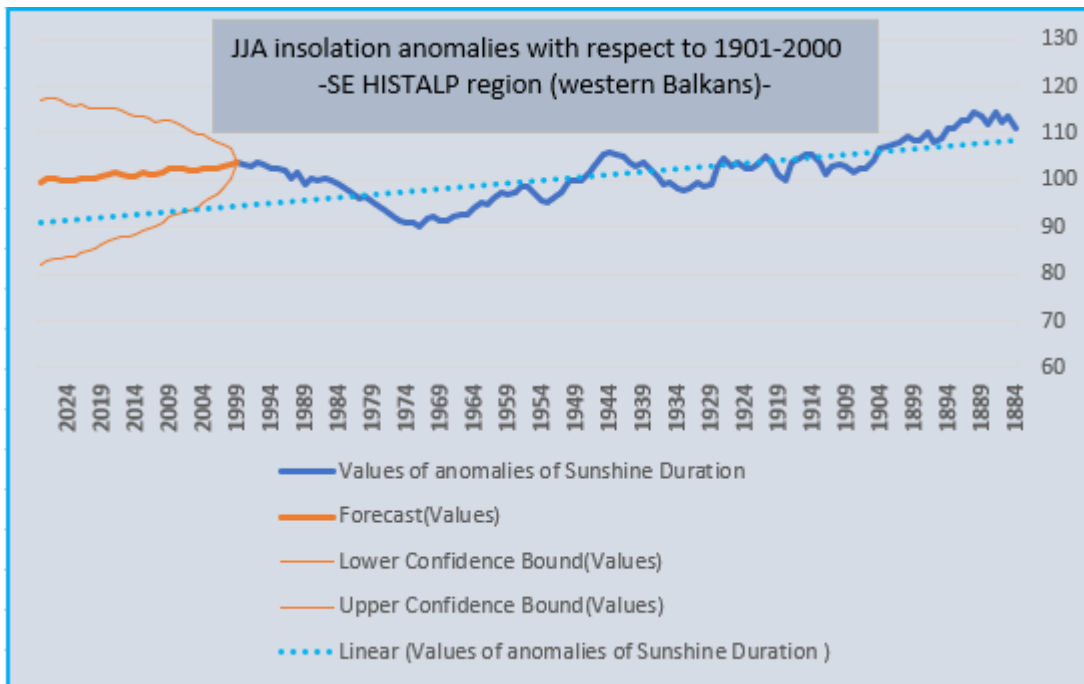


Figure 5: Diagram shows increasing insolation over the recent past as the primarily cause of heating.

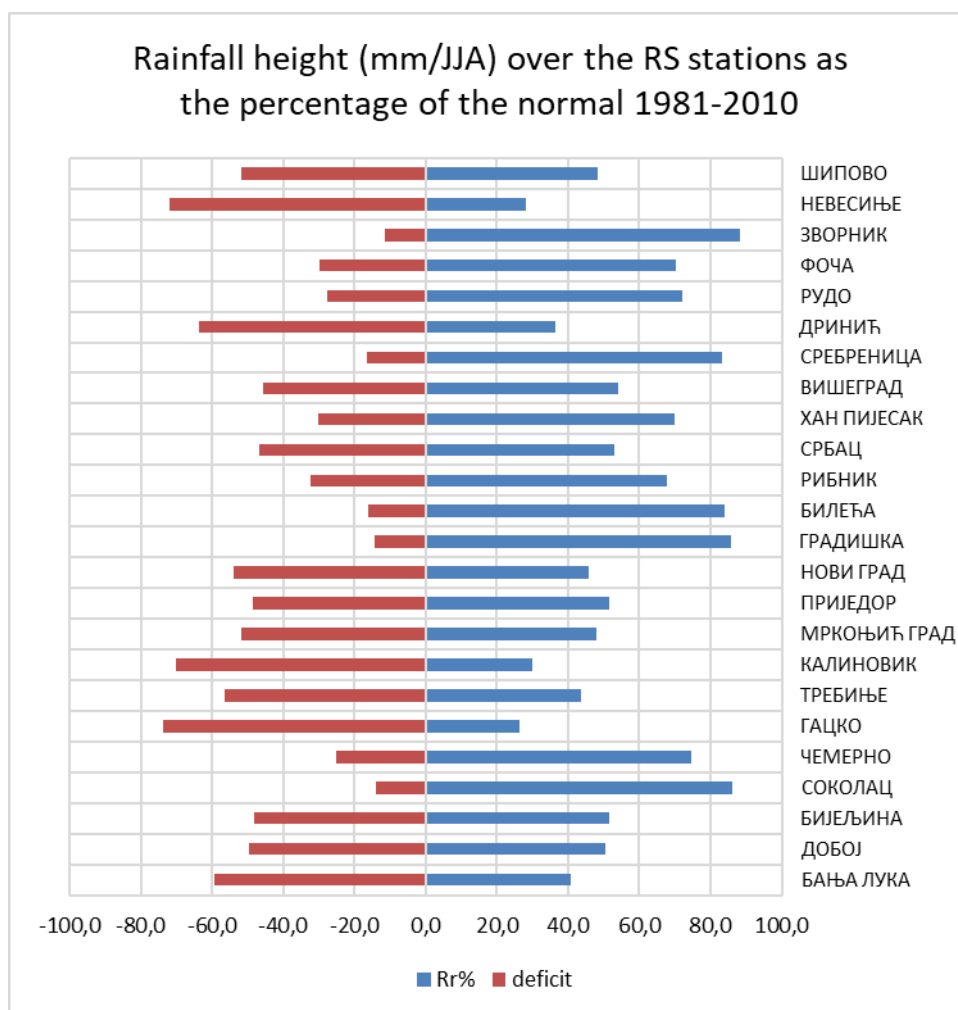


Figure 6: JJA-2017 Precipitation index as the percentage of normal value (blue) and the deficit of (red) over the RS stations.

High impact events:

- ❖ *Extremely sunny, warm and dry* in the most places of RS : according to the difference evaporation-rainfall the drought is more intense than relevant indexes of precipitation (SPI, Percentiles) had shown cause of very sunny to extremely sunny and windy (of southern directions) weather patterns;
 - ❖ six heat waves;
 - the yields of soybean, corn and others are less for 50% ; fruits are also halved for 80% with regard to *late spring frost* and *second driest summer* in the last 60 years
 - wild forest fires
- Estimated damage is more than 100 millions of KM.

3. Verification of the Medcof6, Seecof15 climate outlook for the 2017 summer season

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)	
	Observed	SEECOF, MedCOF <i>climate outlook</i>	Observed	SEECOF, MedCOF <i>climate outlook</i>
The Republika Srpska, BH	Extremely warm +2,1-2,9°C (0.98P-1,00P r1981-2010)	(20,30,50) <i>above upper tercile</i>	extremely dry in most places (The RS rainfall deficit: northern & central 41%, southern 55%)	<i>no clear signal</i> 33,34,33