The Republika Srpska,
Bosnia and Herzegovina
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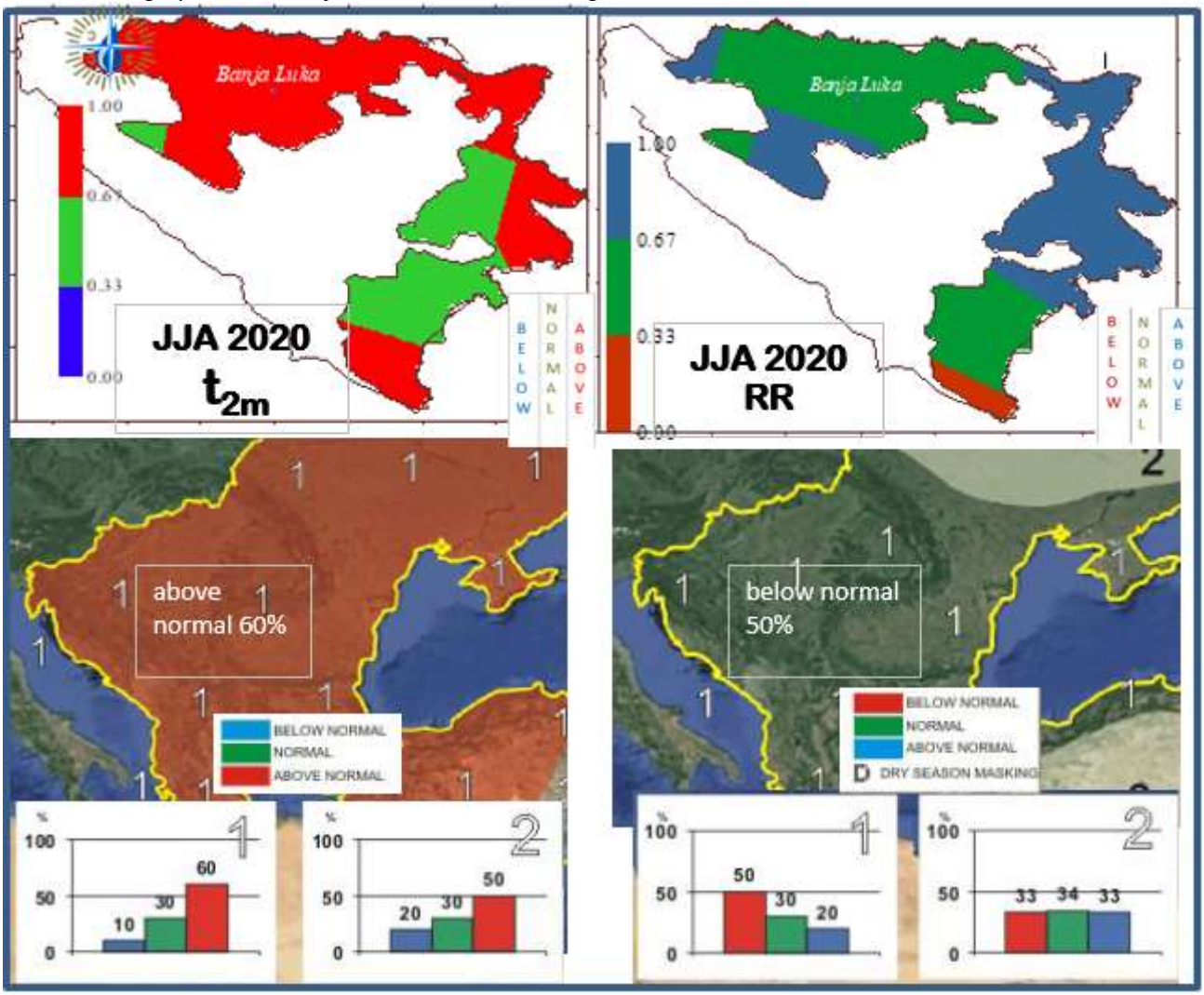
Verification of JJA 2020 outlook over

The Republika Srpska, Bosnia and Herzegovina

1. SEECOF-21, MedCOF-12 Climate outlook for the 2020 summer season:

Temperature and Precipitation

According to the seasonal forecast, based on tercille ranks and climate classification ratings, thermal conditions over the Republika Srpska for the climatological summer of 2020 had been described by the following categories: ***warmer than normal (****60% of probability) over the entire territory (the portion 1,down left).* ***According to RHMS observed values, this prognoses was partially correct.*** *Precipitation forecast was likely to experience a precipitation deficit (below normal, 50% probabilities). According to the observations made in Republic Hydro Meteorological Service of the RS, rainfall were in the range of* ***normal to above normal*** *category. The outlook for this element was wrong.*



Temp (left) and PRC tot (right) for jja2020- outlook (below) and observed values (above)

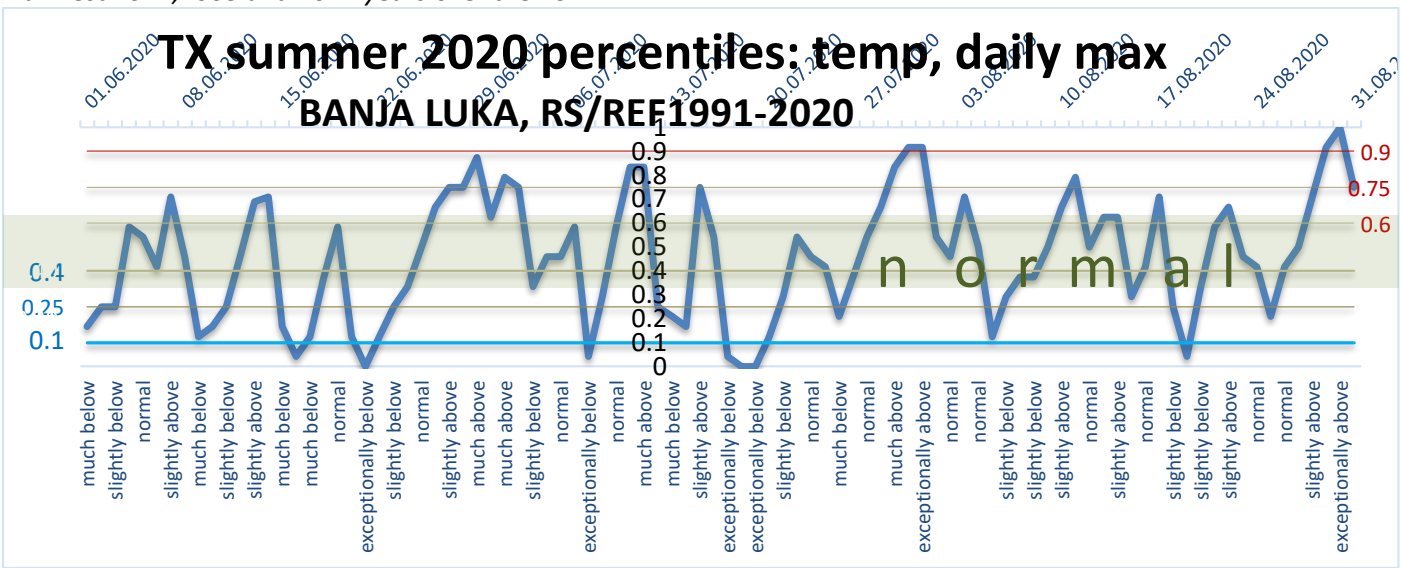
- *The Republika Srpska (RS) registered above normal, warm weather pattern, over the most of areas with reference to standard climatological normal values; Normal summer temperature recorded over middle area of RS; the previous record of the coldest day is broken down, in many places of RS (July, 17-19th, exceptionally below)*
- *Averaged over whole territory of RS, rainfall stated around normal to above pattern; below normal over the Southern; Romania in Republic of Srpska encountered historical maximum of rainfall total in August*

1. Analysis of the 2020 Summer season

JJA-2020 t_{mean} - statistics with reference to (ref 1981-2010) in The Republika Srpska

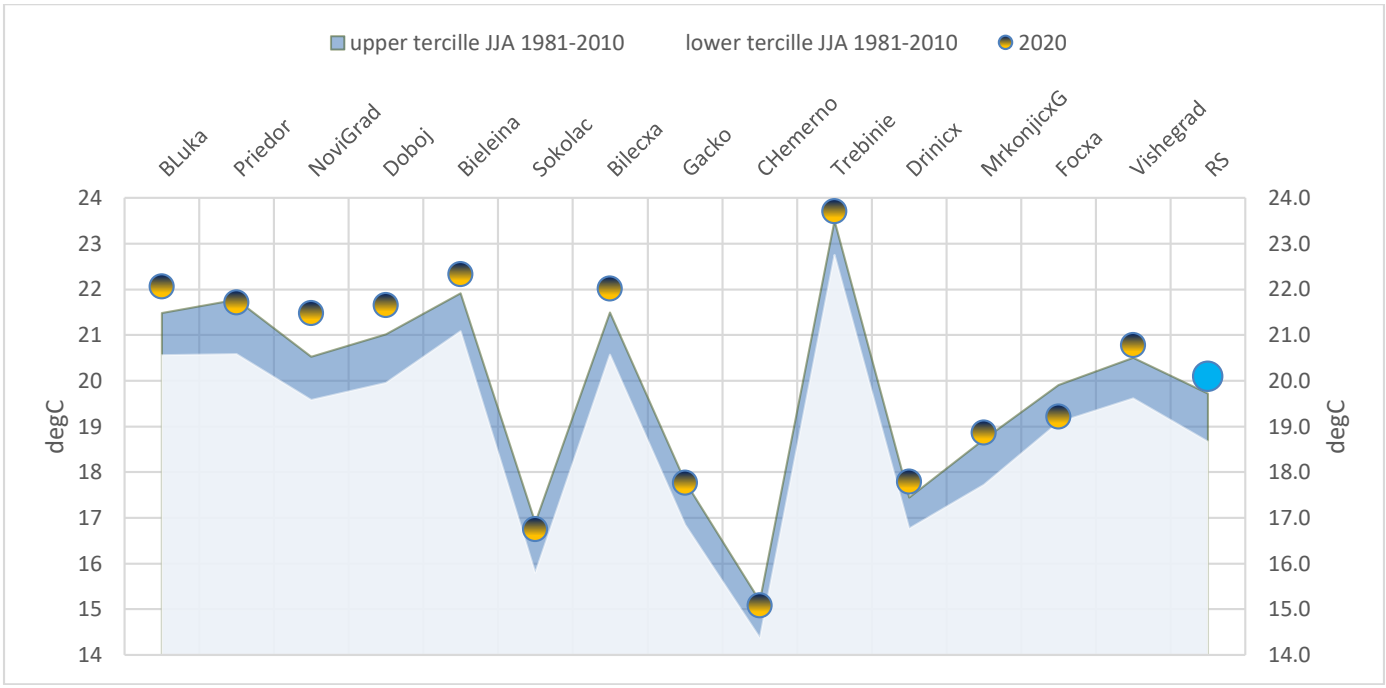
Station	*tmean 1981-2010*	*STD*	*z (STI)*	*Percentile (NORMSDIST)*	*PercRank 2020*	***JJA 2020 (mm)***	***lower tercille***	***upper tercille***	***median***	*tercille category*
Бања Лука *Banja Luka*	21.0	1.05	1.00	**0.84**	0.83	**22.1**	20.6	21.5	20.8	*above*
Приједор *Prijedor*	21.2	1.08	0.49	**0.69**	0.69	**21.7**	20.6	21.8	21.1	*above*
Нови Град *NoviGrad*	20.2	1.13	1.17	**0.88**	0.88	**21.5**	19.6	20.5	20.1	*above*
Добој *Doboj*	20.5	1.00	1.15	**0.88**	0.86	**21.7**	20.0	21.0	20.4	*above*
Бијељина *Bijeljina*	21.5	1.17	0.75	**0.77**	0.75	**22.3**	21.1	21.9	21.4	*above*
Соколац *Sokolac*	16.3	1.02	0.44	**0.67**	0.66	**16.8**	15.8	16.9	16.3	***normal***
Билећа *Bileća*	18.4	7.31	0.49	**0.69**	0.78	**22.0**	20.6	21.5	21.0	*above*
Гацко *Gacko*	17.3	0.90	0.56	**0.71**	0.66	**17.8**	16.8	17.8	17.3	***normal***
Чемерно *Čemerno*	14.8	0.92	0.28	**0.61**	0.64	**15.1**	14.4	15.2	14.9	***normal***
Требиње *Trebinje*	23.3	1.13	0.37	**0.64**	0.71	**23.7**	22.8	23.5	23.0	*above*
Дринић *Drinić*	17.1	1.12	0.61	**0.73**	0.80	**17.8**	16.8	17.4	17.2	*above*
Фоча *Foča*	19.4	1.00	-0.22	**0.41**	0.49	**19.2**	19.1	19.9	19.4	***normal***
МркГрад *Mrkonić G.*	18.3	1.12	0.49	**0.69**	0.75	**18.9**	17.7	18.7	18.2	*above*

Thermal pattern was significantly above standard WMO normal values of the 1981-2010 but not like during the warmest 2012,2003 and 2017 years over the RS.



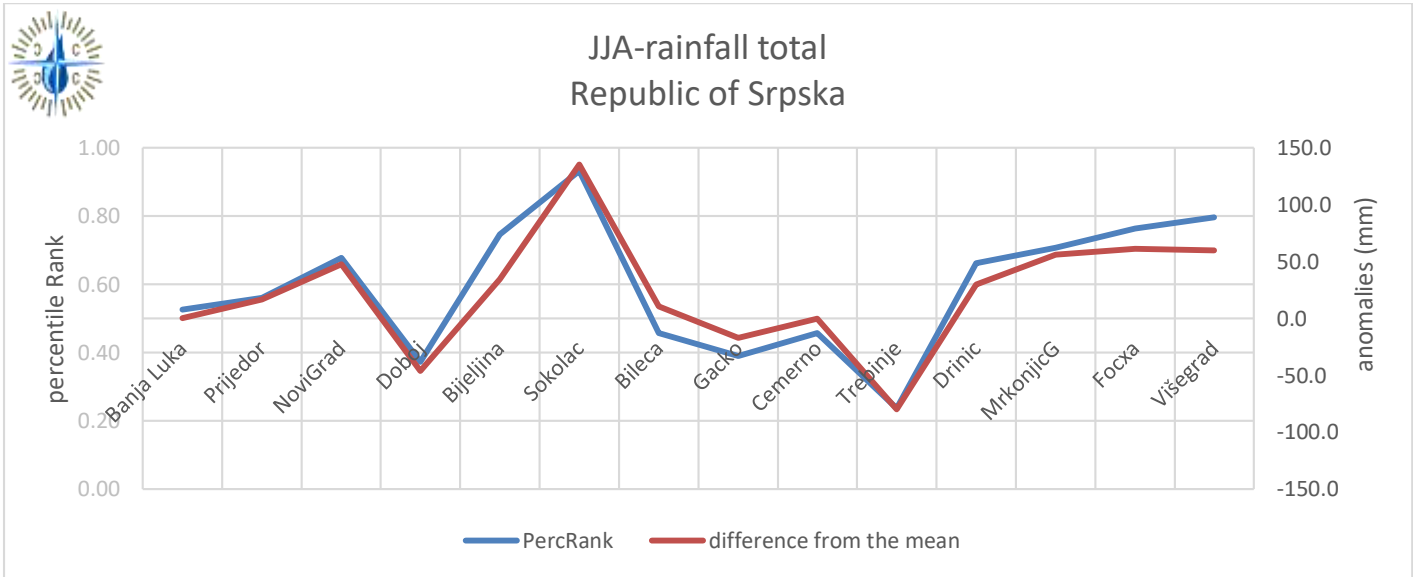
SUMMER DAYS OF THE EXCEPTIONALLY BELOW CATEGORY MEASURED MORE FREQUENT THAN *INSIDE CATHEGORY EXCEPTIONALY ABOVE*

Graphical presentation of JJA 2020 mean temp percentile categories for Banja Luka (above) and over the Republika Srpska stations (below) have showed cooling trend for summer 2020.



8 exceptionally cool days (< 0.10percentile) occurred, in some places 0.00percentile (abs min of T_{MEAN}, T_{MAX}); 4 exceptionally warm days with no one of the max percentile (abs max of temp) regarding to the newest standard WMO normal 1991-2020)

Precipitation



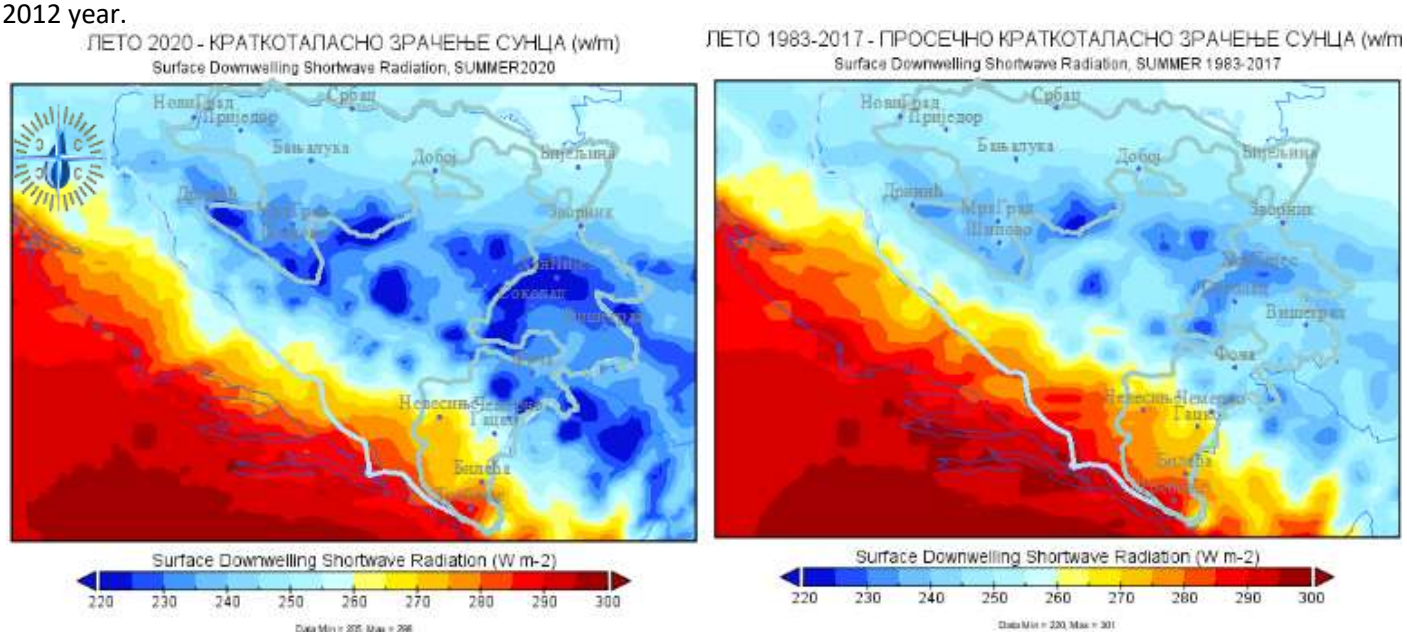
RHMS RS data source

JJA-2020 precipitation statistics over the RS, regarding to the time period of the 1981-2010:

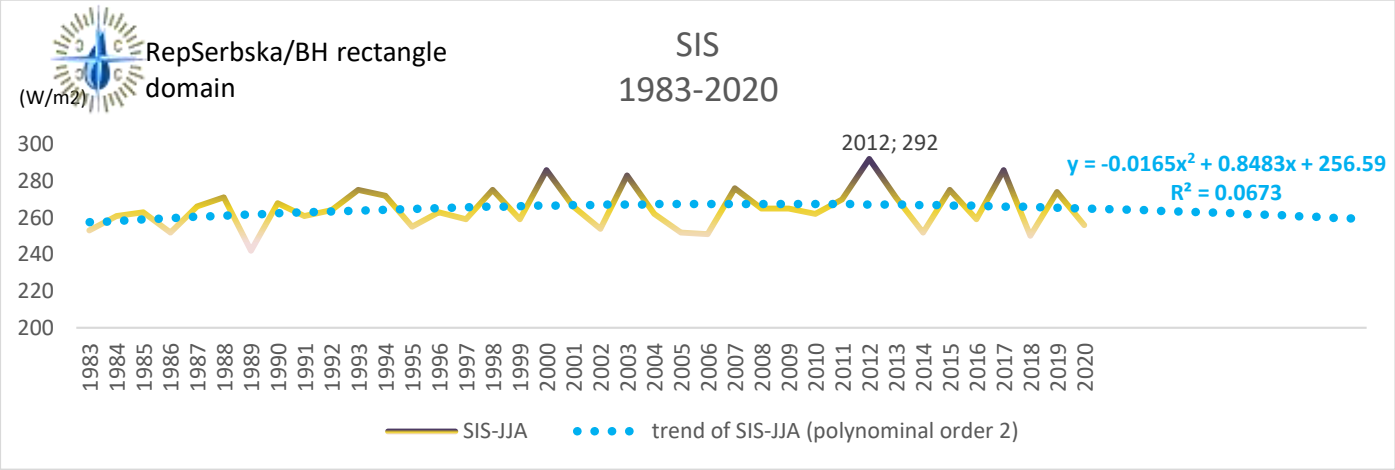
Station	*jja1981 -2010*	*STD*	*z (SPI)*	*NORMSDIST (z) (percentile)*	*PercRank 2020*	***JJA 2020 (mm)***	*% jja2020 (ref1981-2010)*	*trend %*	***lower tercille***	***upper tercille***	***median***	*tercille category*
Бања Лука *Bana Luka*	276	81	0.00	**0.50**	0.53	**276**	100	0.1	235	313	273	***normal***
Приједор *Priedor*	243	76	0.22	**0.59**	0.56	**260**	107	6.9	198	271	219	***normal***
Нови Град *NoviGrad*	247	71	0.67	**0.75**	0.68	**295**	119	19.3	216	279	246	*above*
Добој *Doboy*	284	104	-0.45	**0.33**	0.37	**238**	84	-16.2	218	321	272	***normal***
Бијељина *Bijeljina*	243	78	0.44	**0.67**	0.75	**278**	114	14.2	216	278	255	*above*
Соколац *Sokolac*	238	64	2.13	**0.98**	0.93	**373**	157	57.0	207	259	239	*above*
Билећа *Bileca*	179	71	0.15	**0.56**	0.46	**190**	106	5.8	144	196	175	***normal***
Гацко *Gacko*	200	84	-0.20	**0.42**	0.39	**183**	91	-8.6	158	226	198	***normal***
Чемерно *Cxemerno*	224	98	0.00	**0.50**	0.46	**224**	100	-0.2	186	254	203	***normal***
Требиње *Trebine*	179	97	-0.82	**0.21**	0.24	**99**	55	-44.8	133	229	161	***below***
Дринић *Drinic*	272	87	0.34	**0.63**	0.66	**302**	111	10.9	243	309	251	***normal***
Фоча *Focxa*	215	81	0.76	**0.78**	0.76	**276**	129	28.5	175	225	204	*above*
МркГрад *MrkonicG*	264	102	0.63	**0.74**	0.71	**329**	125	24.7	227	291	265	*above*

<u>Surface down-welling Shortwave Fluks in Air</u>

using satellite data application in climate monitoring of RHMS RS (CMSAF) it is obvious coolong trend over BH from 2012 year.

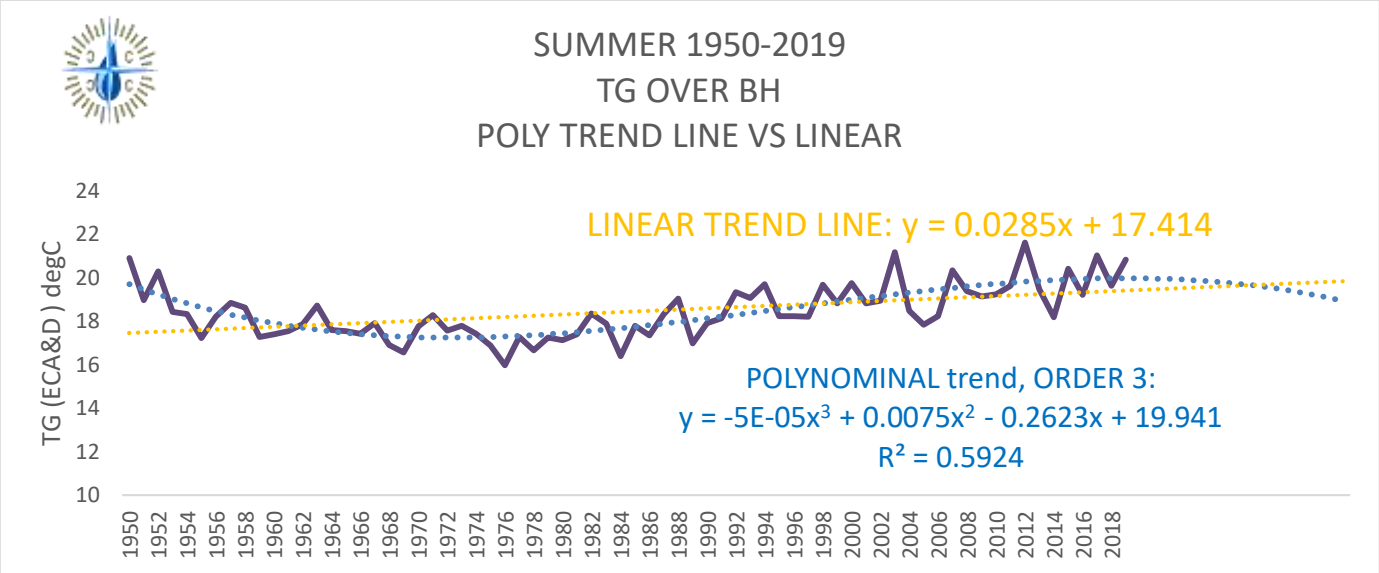


SIS-Surface downwelling Shortwave Fluks in Air for summer 2020 (spatial distibution showd above, left) and averaged over the 1983-2017 time period (above, right) (ICDR SEVIRI RADIATION BASED ON SARAH-2 METHOD



According to the **SIS-CMSAF product of EUMETSAT** for the climatological summer season and polynominal trend line, as well as a few another climate indices calculated from ground measurements, it is likely to be cooler over the Serbska and Bosnia and Herzegovina over the next summers, due to more frequent convective instability (which was normal during the summer before) and upcoming cooling climate variation, with more convective rainfall during the summer months. The continuosly 7-year summer drought is broken two years before.

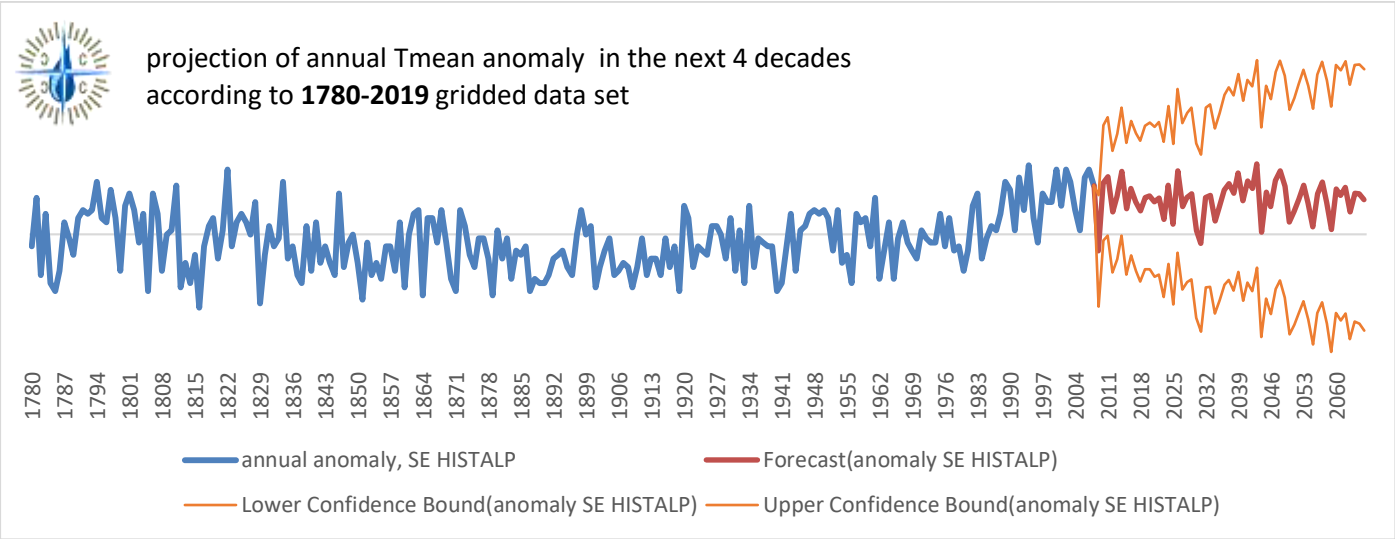
This parameter belongs to the most important climate elements for describing variation of thermal conditions over the summer time.



According to **ECA&D/E-OBS** gridded data set and observation of the RHMS of the RS, there is decreasing trend line for Bosnia and Herzegovina over the near future; polynominal trend line is consistent with meteorological satellite data, regarding to CMSAF product of Surface downwelling Shortwave Fluks in Air (SIS). Too simple Linear trend line is not appropriate function to describe changing temperature trend over more than 70 years; mean temperature, Tmean as TG is calculated by WMO standard formula (t07+t14+2*t21)/4). TG is not involved in climate projection models, but Tmean calculated as averaged extreme temperatures [(Tmax+Tmin)/2] which might differ from TG more than 3 degrees at daily level.

Also, Regarding to the longest regional *regridded monthly data set of* ***ZAMG/HISTALP*** for South Eastern part of, where Bosnia and Herzegovina belongs, positive anomalies will be slightle decreasing in the next decades, and mean temperature is likely to be near normal values over the 1900-2000 climatology or slightly below over far future (graph below).

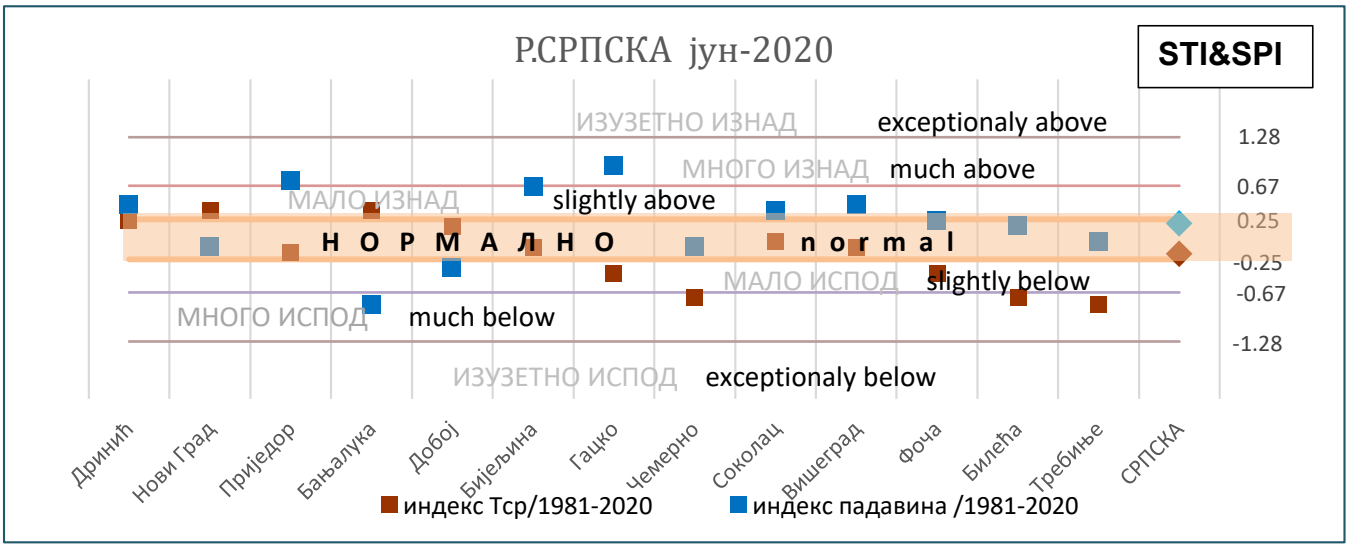
For the *thermal* Climate projection over the middle and far future, it is very needed for analyse to be done over several climate elements over as long as possible historical time period. All elements are in the relationships and some signal is revailed analysing another ones (precipitation, sunshine duration or cloudiness...). Return period of extreem thermal conditions is >70 years and 30 years period is insuficient for far prediction. Return period of two sided extrem weather pattern over which the extrem event would be happened at least once, is not the same.



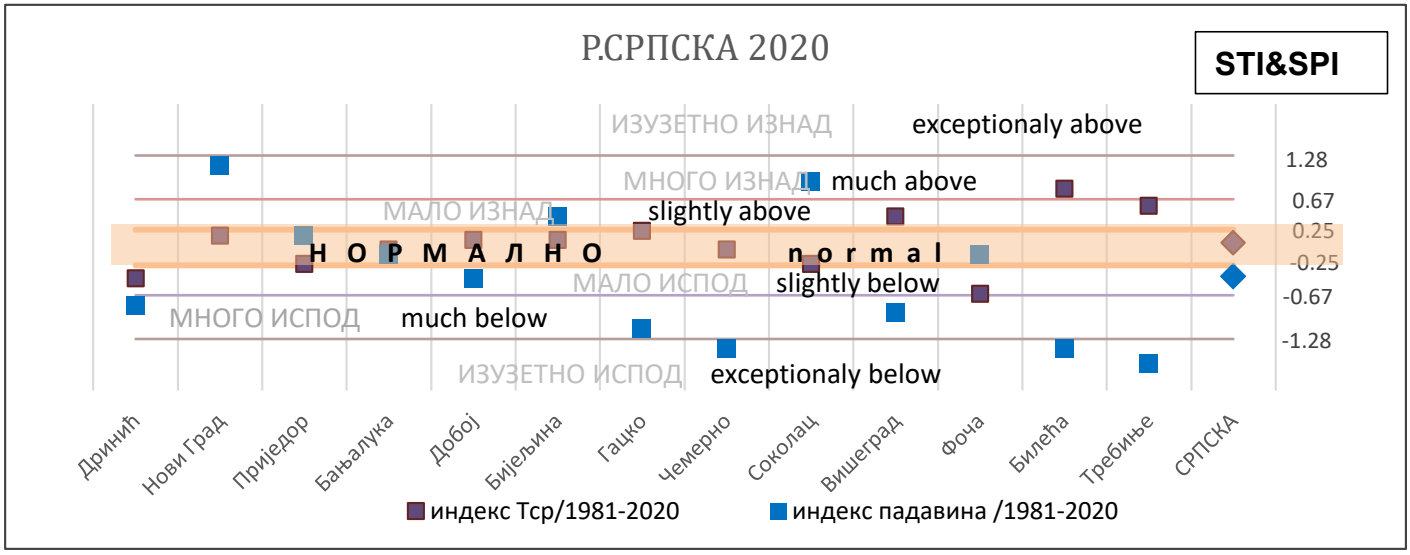
Aritmetical means of temperatures for the latest WMO normal (1991-2020) for Bosnia and Herzegovina are settled at higher percentiles (0.6th, 0.7th) instead of around 0.5th, but with less probabilites. That means that that latest 30 years period would not be relevant to be named as referent for calculating standard normals towards which will be calcualted all important statistics and indices, including the trend and clasification towards their categories, calculated by aritmetical means and standard deviations.

Next graphics present Standardised rainfall index SPI (blue) & standardised temp STI (red) indexes over the RS, for the particular summer months

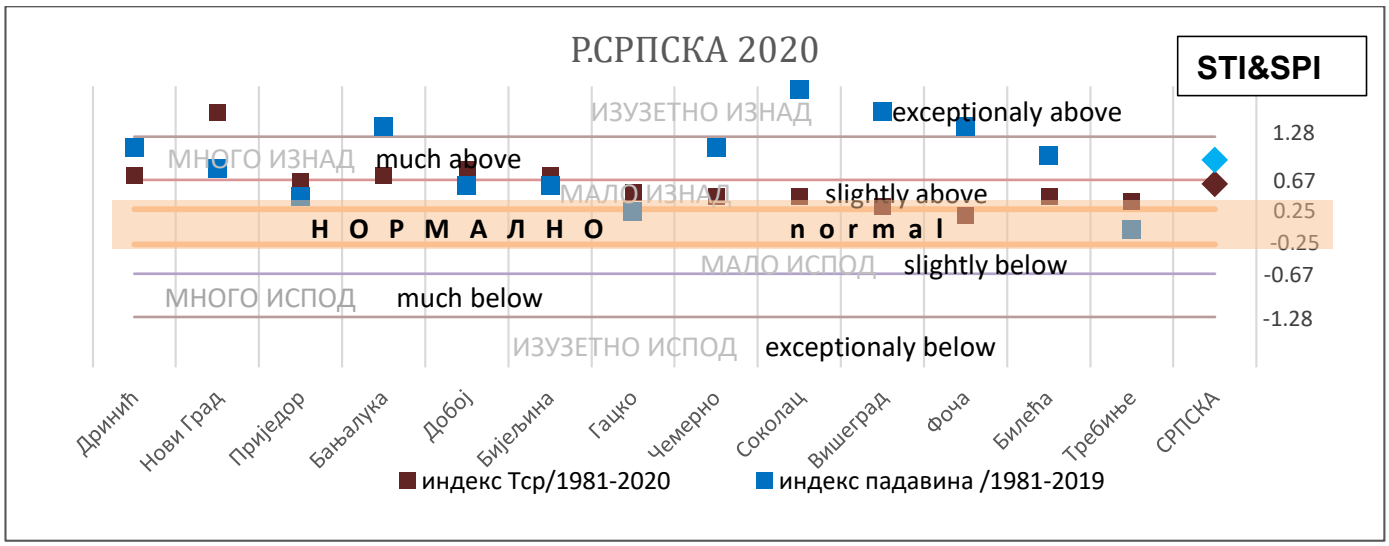
Jun: extremely wet (exceptionally above) observed in Zvornik, Han Pijesak; very wet (much above) Bijeljina, Srebrenica, Višegrad, Gacko



July: extremely dry (exceptionally below) observed in Trebinje, Bileća, Čemerno; very dry (much below) Višegrad, Gacko; wet (much above) Novi Grad, Sokolac



August: Places around Romania in Republic of Srpska encountered historical maximum of rainfall total in August



Verification of the climate outlook for the 2020 summer (JJA)

Country	Seasonal temperature (JJA)		Seasonal precipitation (JJA)	
	Observed	SEECOF, MedCOF *climate outlook*	Observed	SEECOF, MedCOF *climate outlook*
The Republika Srpska, Bosnia and Herzegovina	***normal to above***	*above*	**normal to above**	*Below*