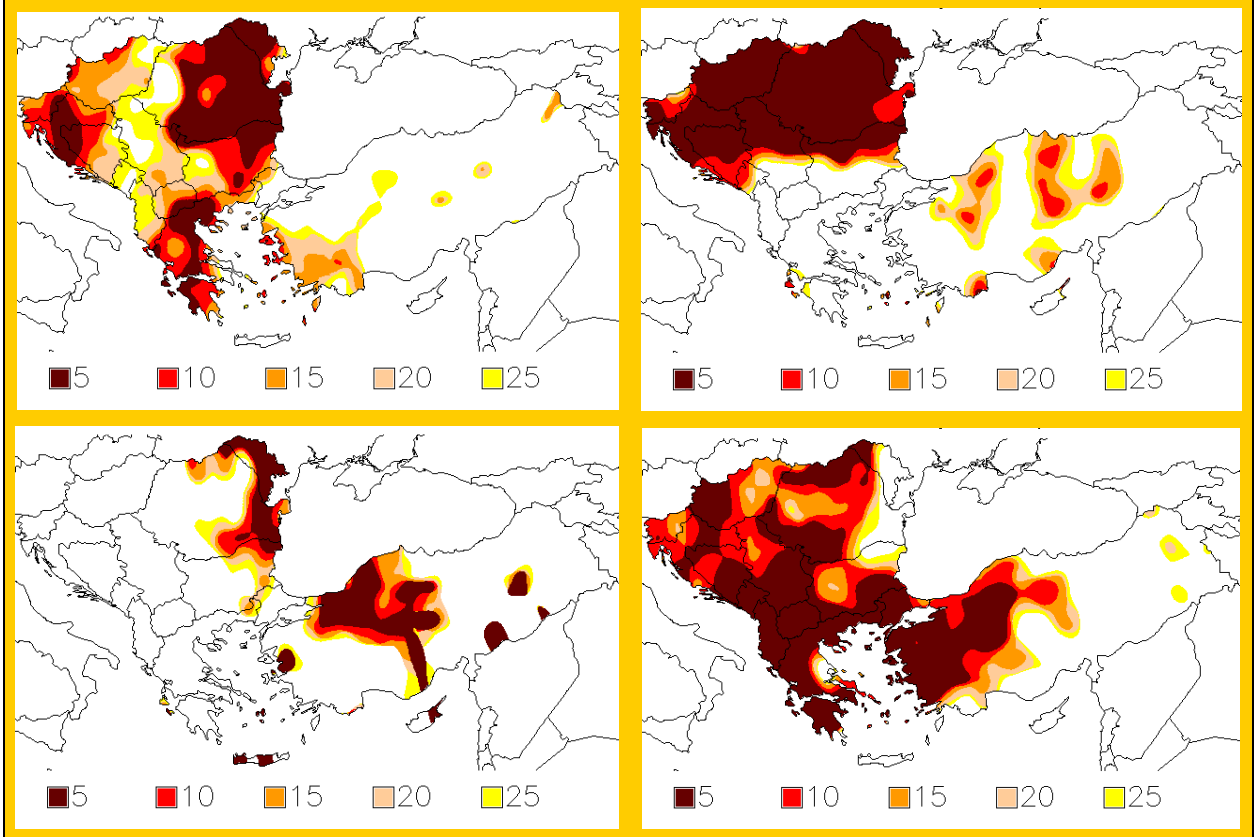
DROUGHT MONITORING BULLETIN

Overview from January to October 2020

HOT SPOT



Precipitation percentiles for January *(top left),* ***April*** *(top right),* ***August*** *(bottom left) and* ***November*** *(bottom right) in 2020.*

The figures above present the driest four months in 2020 in the region. January, April, August and November, a month in each season of the year, saw greatest rainfall deficits when compared to the multi-decadal local records. January brought widespread lack of rain all across the Balkan Peninsula, with highest relative deficits present in wider part of its north-east, also its north-west and south. In April, the entire northern half of Balkan Peninsula recorded extremely low rainfall rate, the monthly deficit ranked not more than within the driest 10th percentile but mostly within the driest 5th percentile. In August, very dry conditions were limited to central Turkey and the Peninsula's far north-east, including Bulgaria, Romania and Moldova. W ith the exception of some short periods of relief, the latter country experienced continuous monthly rainfall deficit since the beginning of 2020. November saw another widespread precipitation deficit all across the region, as most of it experienced the lack of rain as great as to classify in the driest 5th, some places in the driest 10th percentile.

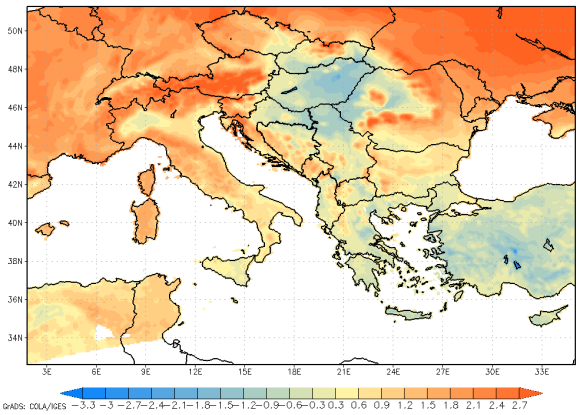
AIR TEMPERATURES AND SURFACE WATER BALANCE

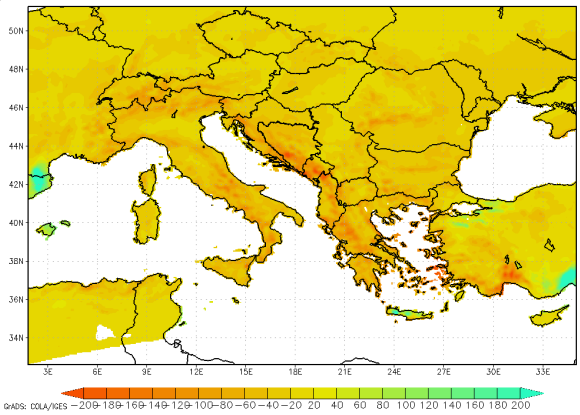
*Figures in this section present anomalies from the average of 1986-2015 period of monthly **air temperature** and accumulated **surface water balance** from **January to October 2020**.*

AVERAGE AIR TEMPERATURE ANOMALY [°C]

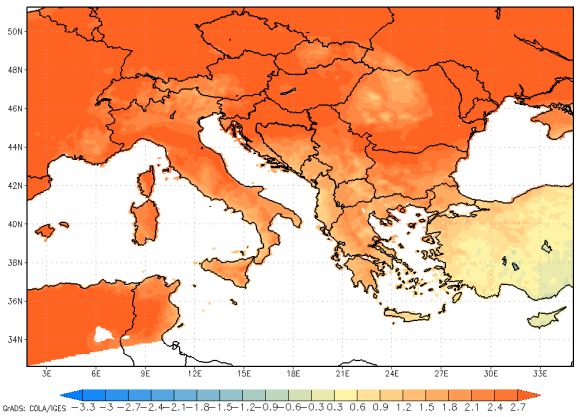
SURFACE WATER BALANCE ANOMALY [mm]

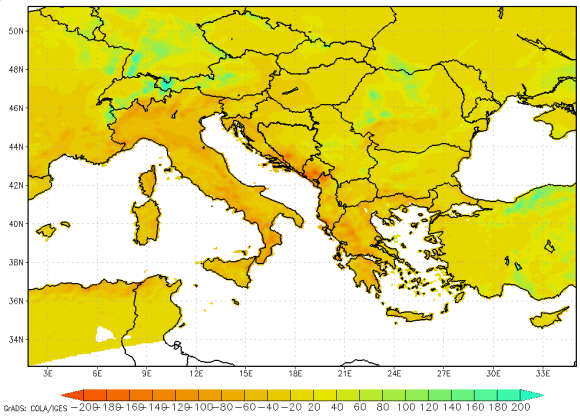
JANUARY 2020





FEBRUARY 2020

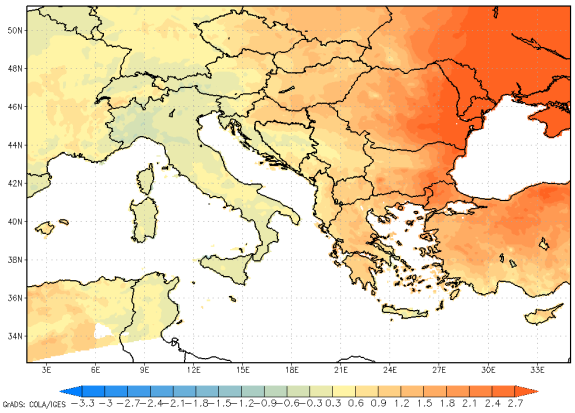
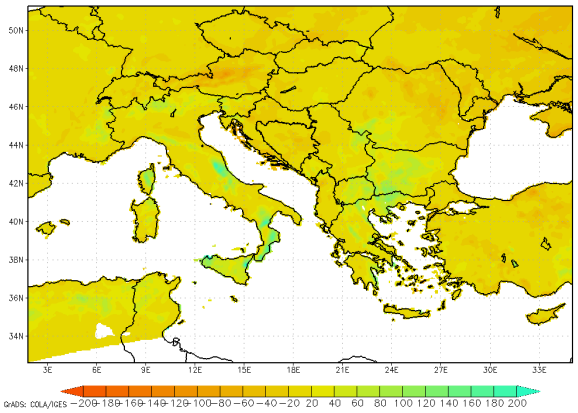
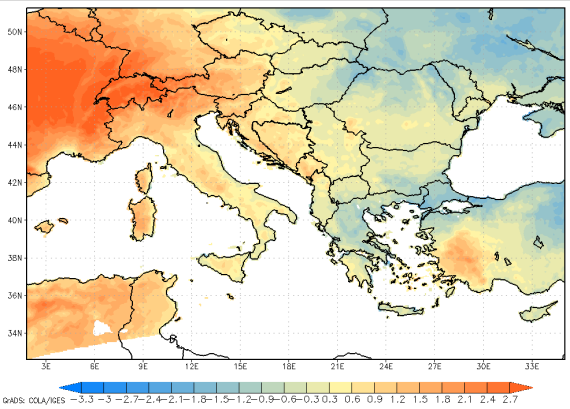
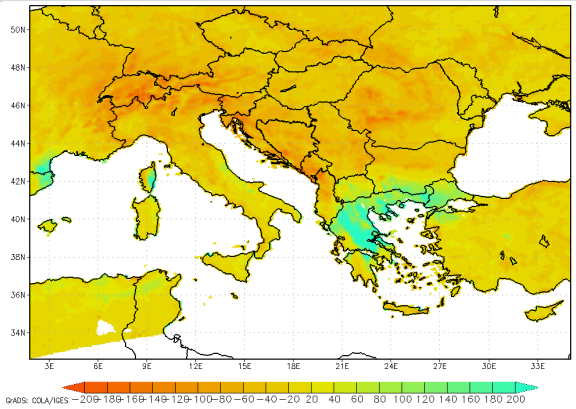




January was colder than usual over the Pannonia Plain, monthly average of the air temperature was up to 1.5 °C lower than normal. However, the surrounding areas toward the Adriatic Sea and the Black Sea experienced much warmer than usual January. Monthly mean exceeded the long-term January average for up to 2.5 °C in eastern and southern Romania, Moldova and coastal Croatia, even more in the Alpine area and the Carpathians. Elsewhere, January mean did mostly not exceed the long-term average for more than 1 °C in either extreme. Within the month, especially the last dekad was unusually warm across the region as air temperatures were up to 2 °C warmer than usual, in Moldova and eastern Romania up to 3 °C, with the exception of the Pannonia Plain where lower-than-usual air temperatures prevailed. In terms of surface water balance, January was a dry month all across the region, especially in the Aegean Sea area and in the central to northeastern Bulgaria where monthly deficit of surface water balance classified within the driest 5th percentile of local historic records. Monthly deficit accumulated mostly up to 60 mm, in areas along the western coastline in Balkan Peninsula it reached up to 140 mm, locally some more.

February brought well-above-average air temperatures to the entire region. The lowest anomalies, present over Albania and Montenegro, still exceeded the long-term average for up to 1.5 °C, while across the most of the region's northern half except in central and northwestern Romania, February

was up to 4 °C warmer than usual. The surface water balance situation in February shows a different picture: the belt from Hungary, along the entire western coastline, North Macedonia and all of Greece experienced dry water balance situation, monthly accumulations were from up to 60 mm below the average over the belt's north and to up to 120 mm below the average over the belt's south, in Montenegro up to 160 mm. February accumulation of surface water balance resulted in slightly positive anomalies from the usual values in central Serbia and Moldova, and in anomalies between 60-100 mm in limited areas in western and northern Romania.

AVERAGE AIR TEMPERATURE ANOMALY [°C]	SURFACE WATER BALANCE ANOMALY [mm]
MARCH 2020	
	
APRIL 2020	
	

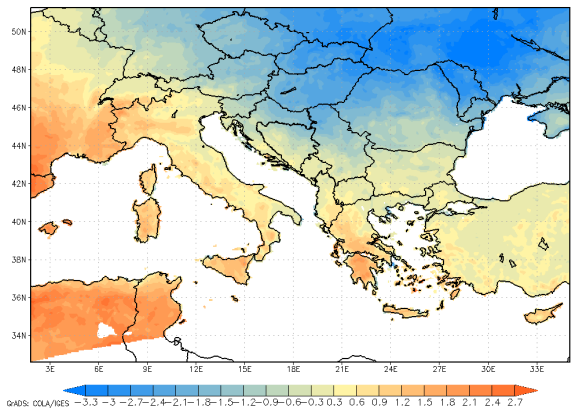
The far-eastern Balkan Peninsula continued to experience warmer-than-usual air temperatures also in **March**. Early days of the month were especially warm over that area as the10-day mean stretched between 6-8 °C above the long-term average. Air temperatures dropped noticeably by the end of the month, resulting in monthly mean exceeding the long-term average for 2.7 °C or more across Moldova, eastern Romania and northeastern Bulgaria. March was warmer than normal also across the central third of Balkan Peninsula, from Hungary, over western Bulgaria to Greece, where the long-term average was exceeded by up to 1.5 °C. Areas along the Adriatic Sea experienced more or less average March air temperatures, in Slovenia, coastal Croatia and central Bosnia and Herzegovina even slightly colder than usual. While surface water balance conditions were relatively normal or even wet in March across most of the region, the drier-than-usual surface water balance valus negatively coincided with the warm air temperatures over Moldova and eastern half of Romania where March brought additional deficit in surface water balance of up to 60 mm, locally up to 80 mm.

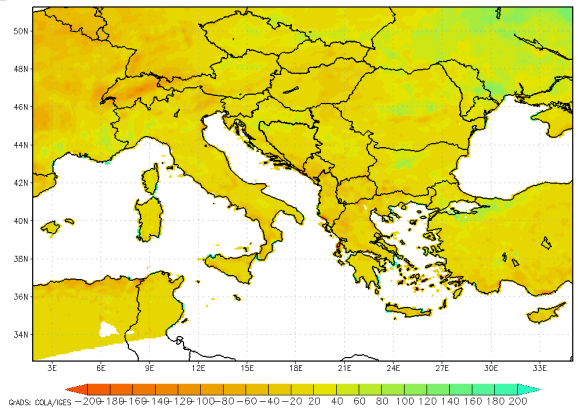
April saw both extremes present across the region in terms of surface water balance situation. While Greece experienced unusually high precipitation amount for this time of year, with monthly surplus of well above 200 mm across most of the country and up to 100 mm in areas north of its continental border, northern half of Balkan Peninsula experienced one of the driest April months in local history. Lack of rain throughout all month resulted in accumulated monthly deficit of mostly up to 100 mm, locally along the western parts from Slovenia to Montenegro and over the Carpathians of up to 140 mm. Combined with the air temperature conditions, April could be described as wet and cold over Greece as monthly mean air temperature stood up to 1.5 °C below the average. Elsewhere, April was drier and colder than usual, especially over the region's north-east, up to 1 °C colder, and over its far north, up to 1.5 °C colder, with the exception of the region's north-west where April was drier but also warmer than normal. Monthly mean revealed April was for up to 1.2 °C warmer over most of Slovenia, Croatia and Bosnia and Herzegovina, and up to 1.5 °C warmer in the Alpine area.

AVERAGE AIR TEMPERATURE ANOMALY [°C]

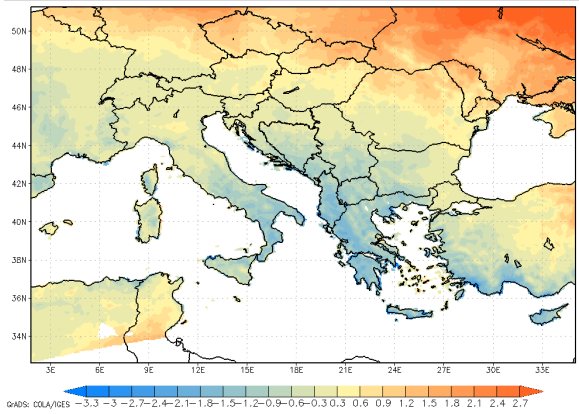
SURFACE WATER BALANCE ANOMALY [mm]

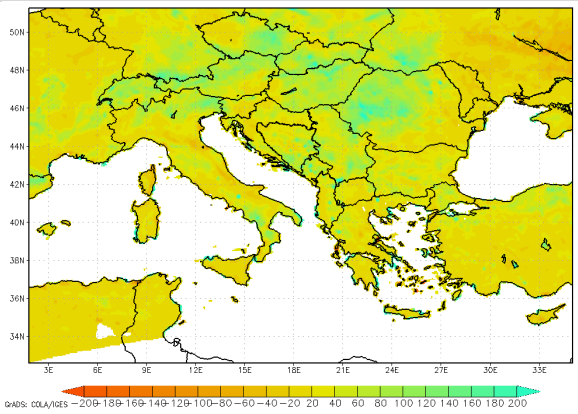
MAY 2020





JUNE 2020

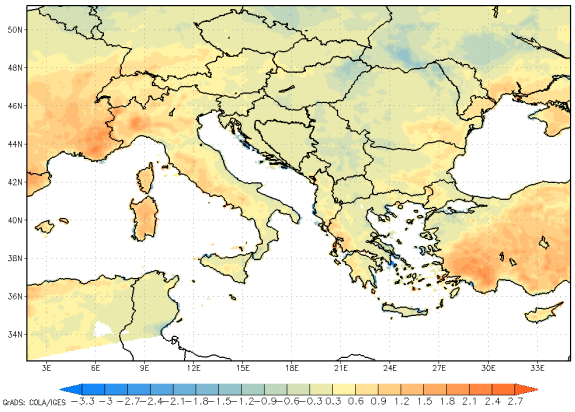
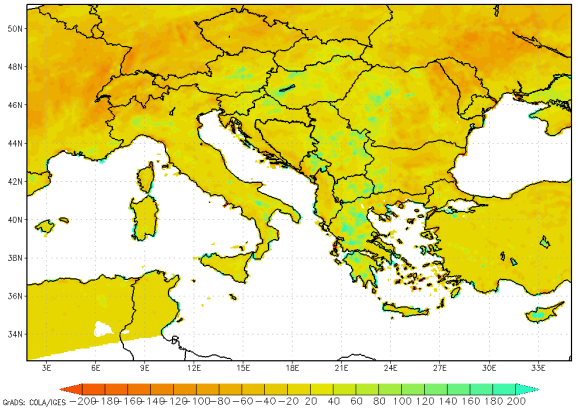
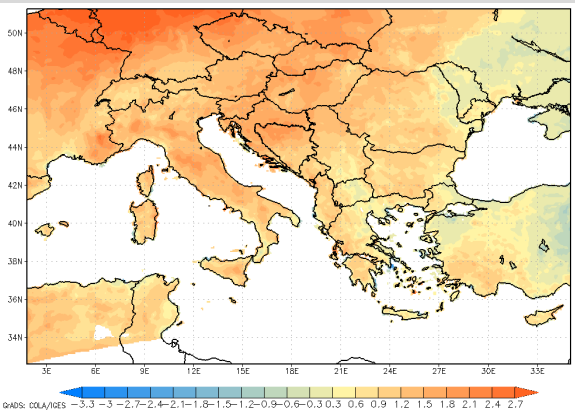
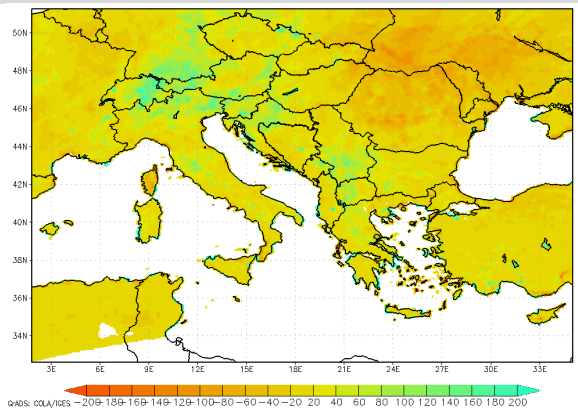




All across the northern area of Balkan Peninsula, from Slovenia to Moldova, **May** was colder than normal throughout all month. Continuously under-average air temperatures resulted in monthly mean up to 3 °C below the average over Hungary and Moldova, and between 1-2.5 °C colder than normal across the rest of the northern parts. Meanwhile, the rest of the Balkan Peninsula saw rapid changes from one extreme to another. It resulted in monthly mean of up to 1 °C colder than normal over Serbia and surrounding areas, and up to 1.8 °C warmer than normal over southern Greece, although anomalies within the month were greatly shifting: in mid-May, they ranged from up to 5 °C in central Serbia to over 8 °C above the average in southern Greece, while in late May they

dropped unusually, with anomalies mainly 3-5 °C below the average. In terms of surface water balance, May brought positive change to eastern parts of Balkan Peninsula, monthly accumulations produced surplus of up to 60 mm in central Romania and up to 100 mm over southern Moldova and central Bulgaria. Accumulations of about average values or slightly positive were present over the rest of the region, with the exception of Hungary as most of its territory was under a deficit of 40 mm, and area between Montenegro, southern Bulgaria and central Greece where under-average rainfall rate resulted in monthly surface water balance deficit of up to 80 mm.

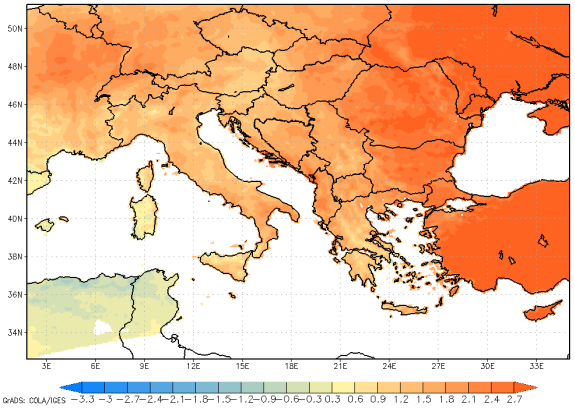
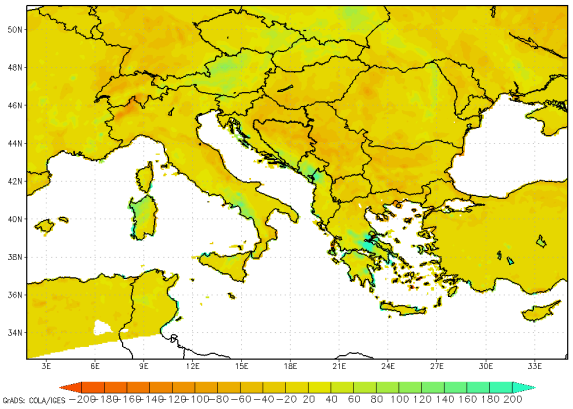
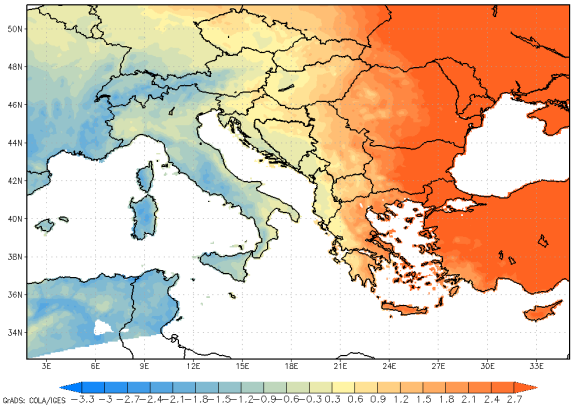
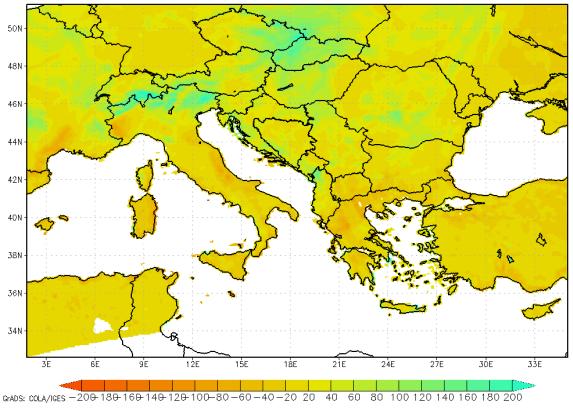
Over southern half of Balkan Peninsula, unusually cold air temperatures continued into **June**, especially in first two dekads of the month. In Montenegro, Albania, North Macedonia and especially Greece, June was up to 1.5 °C colder than normal, while central and northwestern part of the region experienced more or less average June in terms of air temperatures. On the other hand, after a spell of colder weather, June was warmer than normal over the region's north-east, where above-average air temperatures throughout all month resulted in monthly mean exceeding the usual air temperatures for 1-2 °C in northern half of Romania and Moldova. At the same time, all region experienced wet surface water balance conditions with the exception of Moldova. Due to high rainfall rate, surface water balance surplus was the highest in central Balkan Peninsula and over the Pannonian Plain, between 100-180 mm, locally more. Elsewhere, surplus did mostly not exceed 40 mm while Moldova experienced another month with a deficit, this time up to 40 mm.

AVERAGE AIR TEMPERATURE ANOMALY [°C]	SURFACE WATER BALANCE ANOMALY [mm]
JULY 2020	
	
AUGUST 2020	
	

July was more or less averagely warm for this time of year across the region. Slightly colder than usual, up to 0.6 °C, was in Serbia while isolated areas in northeastern Hungary and across far

northern Romania over to Moldova experienced July about 1 °C colder than normal. Only in limited areas across the region July was warmer than normal, this includes southeastern Romania and eastern and southern Bulgaria, up to 1 °C warmer, as well as western Greece where anomaly of monthly mean slightly exceeded 1 °C. Across the western half of Balkan Peninsula and western Romania, wet surface water balance conditions continued into July. Positive anomalies in monthly accumulations mostly reached up to 60 mm, while local intense precipitation amounts resulted in surplus of surface water balance of 180 mm or even more. The exception to this were areas along the Adriatic Sea coast, from Croatia to Albania, where July brought monthly accumulated deficit of up to 60 mm. Lack of rain was again evident over Moldova, Romania and Bulgaria where scarce precipitation resulted in additional surface water balance deficit of up to 100 mm.

Average to wet conditions continued in **August** over western half of the region, this time over western and central Bulgaria as well. Monthly surplus of surface water balance reached mostly up to 40 mm, while in Slovenia, Croatia, Serbia and North Macedonia high precipitation amount greatly contributed to monthly surplus in surface water balance of up to 100 mm, locally more. Meanwhile, eastern Hungary and entire Romania and Moldova continued to experience dry conditions as August lack of rain extended the period of surface water balance deficit, monthly up to 60 mm, in far northern parts up to 100 mm. Air temperature wise, August was warmer than usual across the region, only Moldova, North Macedonia and local areas in eastern Greece experienced more or less average August air temperatures. While anomalies exceeded the long-term average for mostly up to 1 °C, in northern parts of the region from Bosnia and Herzegovina, to Slovenia and over to northwestern Romania August was up to 2 °C warmer than normal.

AVERAGE AIR TEMPERATURE ANOMALY [°C]	SURFACE WATER BALANCE ANOMALY [mm]
SEPTEMBER 2020	
	
OCTOBER 2020	
	

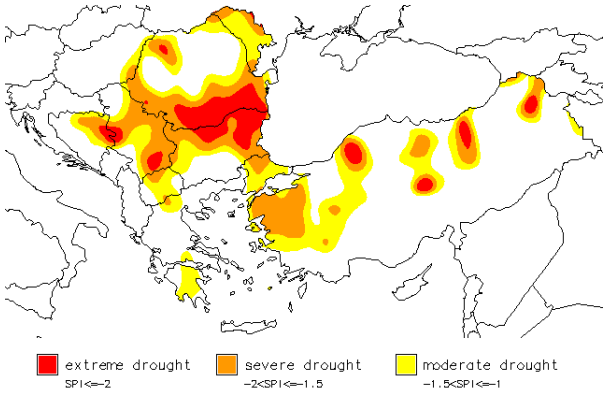
Especially in the first half of **September** air temperatures well warmer than normal spread across the region. Anomalies of 3-5 °C above the average, first present over Moldova, Romania and Bulgaria, stretched across most of Balkan Peninsula by mid-September. Average air temperatures came at the end of the month only to western half of the region, while air temperatures of up to 3 °C warmer than normal persisted across Moldova, Romania and Bulgaria. For this reason, monthly mean across the latter countries exceeded the average September temperatures for 2.5-3 °C, locally even more. September was noticeably warmer than normal also across the areas along the southern Adriatic Sea, for up to 2.5 °C, while only in Slovenia and southern half of Greece experienced September mean air temperature ranged about the normal values. In terms of surface water balance, most of the region, especially its wider central area and Moldova, experienced dry conditions. Monthly accumulations classified as wet only across northeastern Romania with surplus of up to 80 mm, and along the western coastline and over to southern half of Greece where surplus ranged mostly up to 40 mm, only locally up to 180 mm or more. The rest of the region ended a month with accumulated surface water balance of mostly up to 60 mm.
Well-above-average air temperatures persisted over eastern half of Balkan Peninsula, in mid-**October** they were as high as 5 °C above the local average, especially in Moldova. The air temperature conditions appeared in northwestern Balkan Peninsula where October went from average, to up to 3 °C colder than normal in mid-October, to average air temperatures again. This west-to-east bi-polar air temperature conditions in October are reflected in monthly mean as well: while anomalies stood mostly up to 0.5 °C below the long-term average northwestern areas, in the Alpine area and central Croatia up to 1 °C lower than normal, in the eastern half of Balkan Peninsula, especially in Moldova, Romania and eastern half of Bulgaria, October as more than 2.7 °C warmer than usual. Precipitation events in October brought slight but welcome relief to surface water balance conditions to the latter countries as they ended a month with accumulated surplus of up to 40 mm, locally in central Romania and northern Moldova up to 100 mm. Also the rest of the region experienced a wet month, accumulated surface water balance exceeded the long-term average for mostly up to 60 mm, along the Adriatic Sea, in northern Serbia and Hungary the anomalies reached between 80-120 mm. On the other hand, October proved dry to North Macedonia and Greece as deficit reached up to 40 mm and 60 mm, respectively.

STANDARDIZED PRECIPITATION INDEX

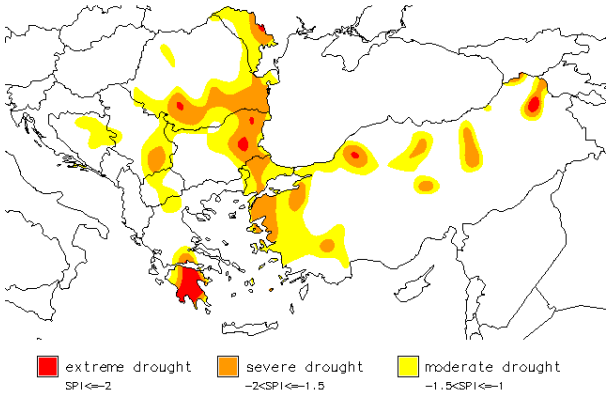
Drought situation with regard to precipitation accumulation is presented by Standardized Precipitation Index (SPI). The SPI calculation is based on distribution of precipitation over long–time period (30 years, in our case long–term average 1961–1990 was used). SPI can be calculated at various time scales which reflect impact of drought on availability of water resources. The long–term precipitation record is fit to probability distribution which is then normalised so that the mean (average) SPI for any place and time period is zero. SPI values above zero indicate wetter periods while values below zero indicate drier periods. Only the dry part of the extreme anomalies is presented on the maps.

Maps of SPI for one and three months, which can be used for estimation of meteorological and agricultural drought respectively, have already been published in monthly bulletins during vegetation season 2020. Maps below present SPI for 6 months which tells us more about hydrological conditions throughout the year.

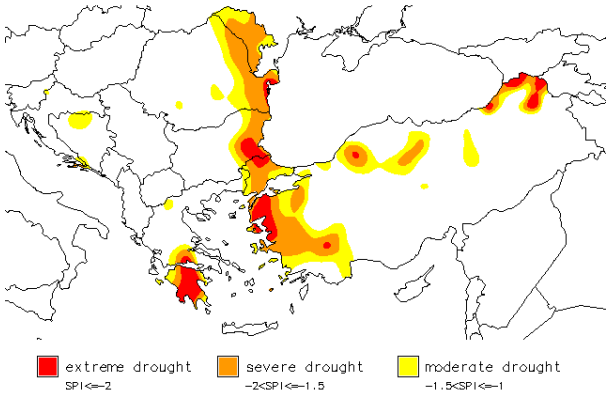
SPI Jan 2020 (6 months)
GPCC first-guess analysis



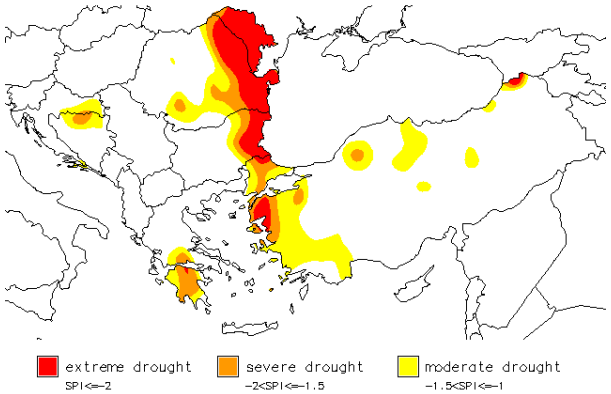
SPI Feb 2020 (6 months)
GPCC first-guess analysis



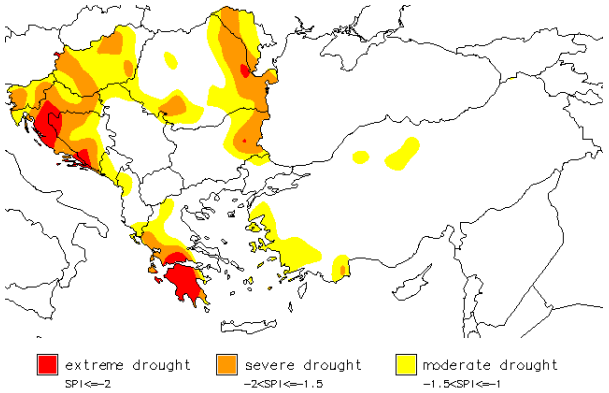
SPI Mar 2020 (6 months)
GPCC first-guess analysis



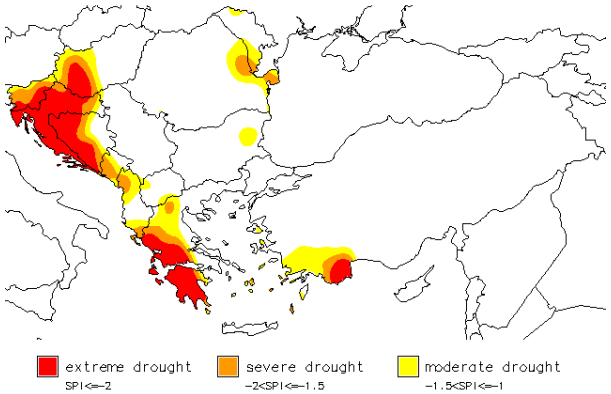
SPI Apr 2020 (6 months)
GPCC first-guess analysis



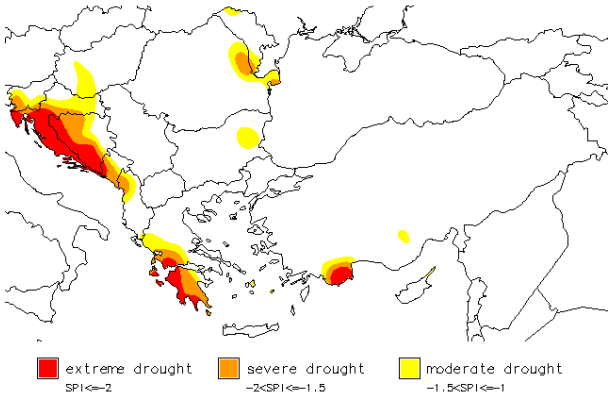
SPI May 2020 (6 months)
GPCC first-guess analysis



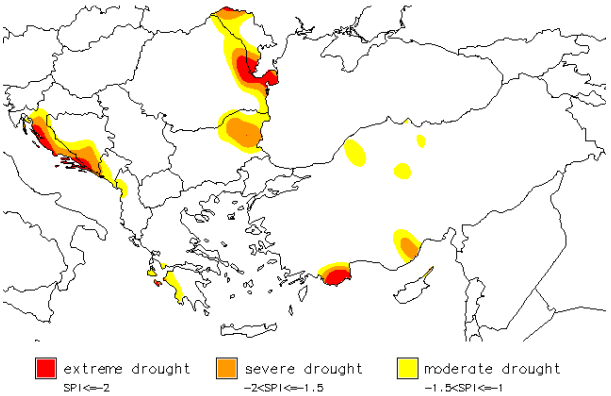
SPI Jun 2020 (6 months)
GPCC first-guess analysis

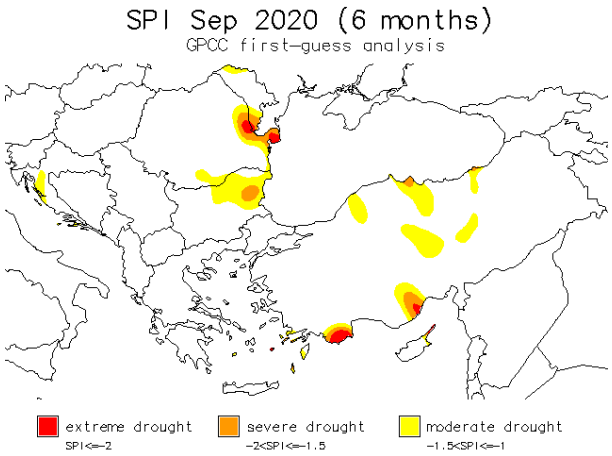


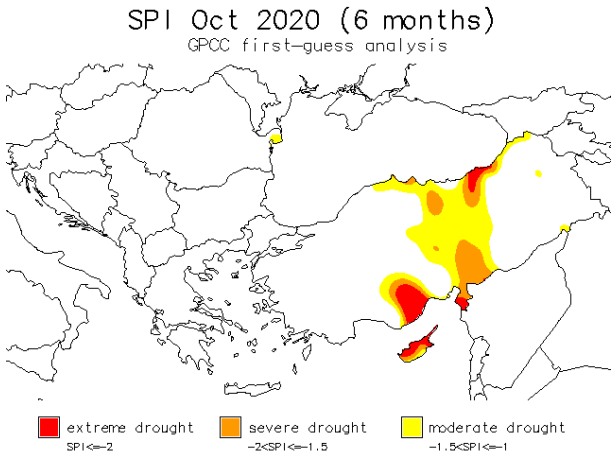
SPI Jul 2020 (6 months)
GPCC first-guess analysis



SPI Aug 2020 (6 months)
GPCC first-guess analysis





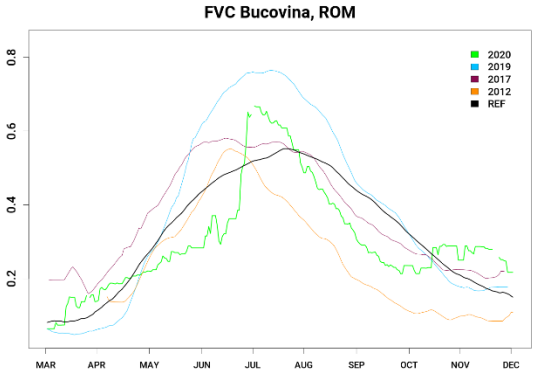


According to SPI6 for January, severe to extreme hydrological drought conditions were present over a wider part of the region. They were spread across Turkey where dry conditions of moderate to severe level persisted throughout all autumn 2019, as well as across central and eastern Europe where lack of rain was most evident in August 2019 – locally in southern Romania and southern Serbia also in autumn months –, but especially again in January. Although severely dry conditions over far eastern part of the region gradually weakened throughout winter months, they intensified again in April upon lasting lack of rain, which worsened again the not-yet-recovered hydrological conditions there. By June, hydrological conditions mainly restored across that area while at the same time they gradually intensified along the far western parts of Balkan Peninsula, mainly across its north-west and along the western and southern Greece. In that part of the region, they remained extreme throughout June and July, then gradually weakened and restored to normal by August, along Croatia and southern Bosnia and Herzegovina by September. Meanwhile, another period of dry conditions, experienced from Moldova to Bulgaria in July and August, reflected in intensifying of severe to extreme hydrological drought conditions again in August and September over localized areas in that part of the region. While in hydrological sense, drought conditions restored to normal across the entire Balkan Peninsula by October, autumn months saw progressive worsening of hydrological drought conditions across most of Turkey, mainly as a result of locally dry July and August but mostly due to severe lack of rain in October over the entire eastern half of Turkey.

REMOTE SENSING – FRACTION OF VEGETATION COVER

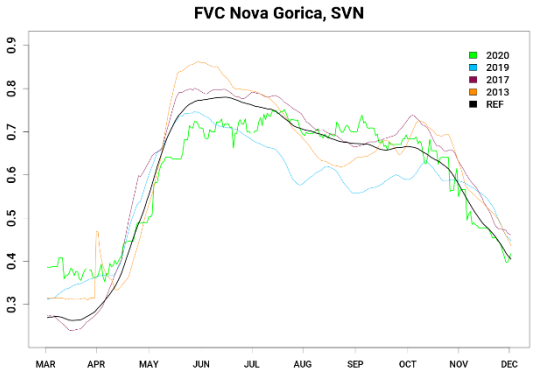
Fraction of vegetation cover (FVC) is vegetation index, based on multi–channel remote sensing measurements (data from Eumetsat's LSA SAF database is used for products in this bulletin). FVC shows fraction of the total pixel area that is covered by green vegetation, which is relevant for applications in agriculture, forestry, environmental management and land use, it has also proved to be useful for drought monitoring. Values vary according to the vegetation stage and of course to the damages of possible natural disasters (including drought). FVC values are lower at the beginning of the growth season, the highest at the full vegetation development and then FVC slowly drops with vegetation senescence. Line shape depends on sort of the vegetation.

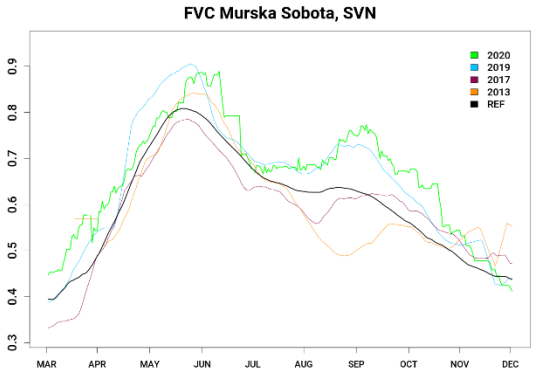
Graphs below present **vegetation development** from **March to December 2020** at 13 locations across Southeastern Europe, as indicated by FVC index. FVC values for year 2020 are presented as green line. Graphs also include reference line (2004–2019) in black, and lines in light blue (year 2019), magenta (year 2017, or 2013 for Slovenia) and orange (year 2012) for comparison. Possible missing values or sharp decline of values could be a result of a prolonged cloudy weather, extreme weather events or snow blanket.

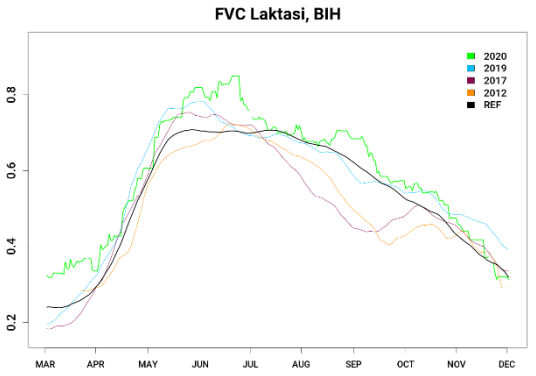


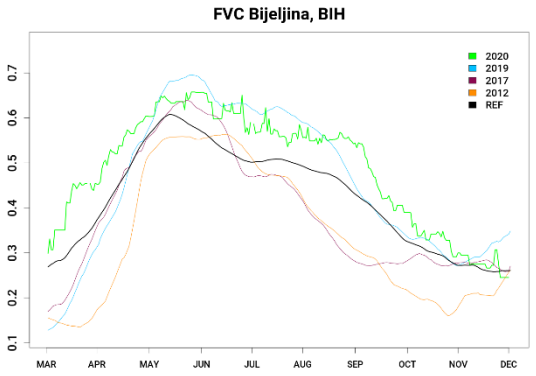
Graphs of FVC at the following locations (from top left to bottom right):

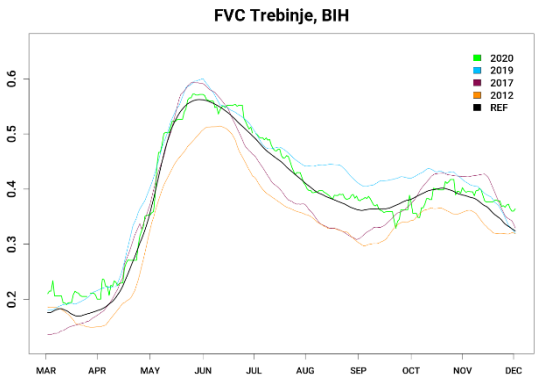
Romania – Bucovina;
Slovenia – Nova Gorica, Murska Sobota;
Bosnia and Herzegovina – Laktasi, Bijeljina, Trebinje;
Serbia – Vrsacko vinogorje, Smederevsko vinogorje;
Montenegro – Podgorica;
North Macedonia – Lozovo, Kavadarci;
Greece – Larisa, Kalamata.

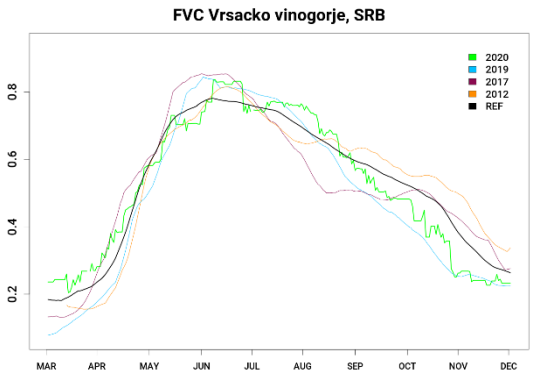


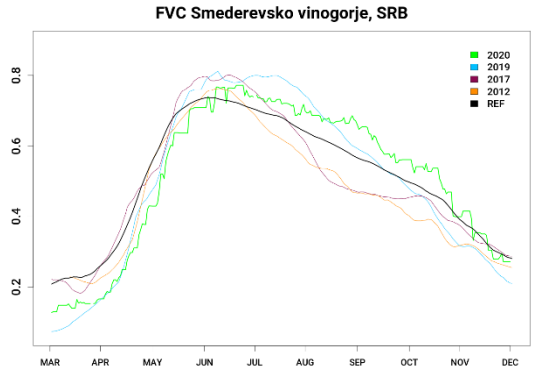


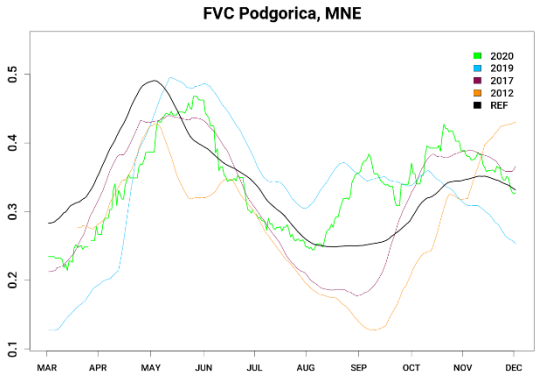


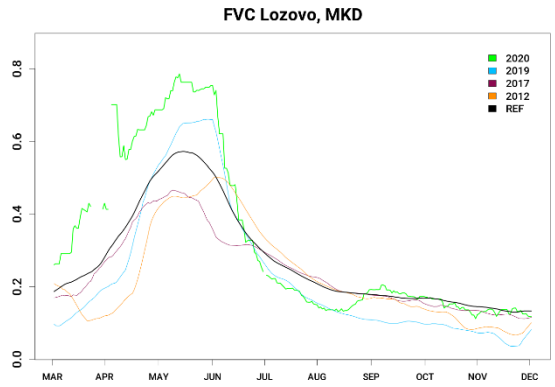


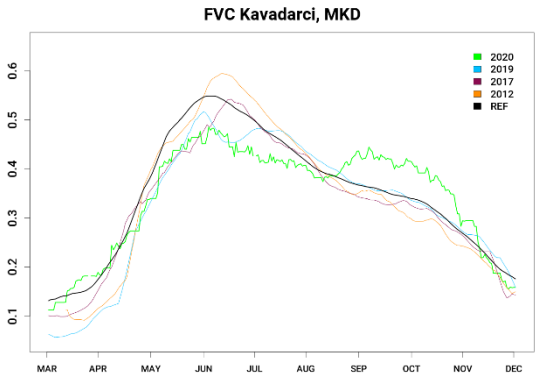


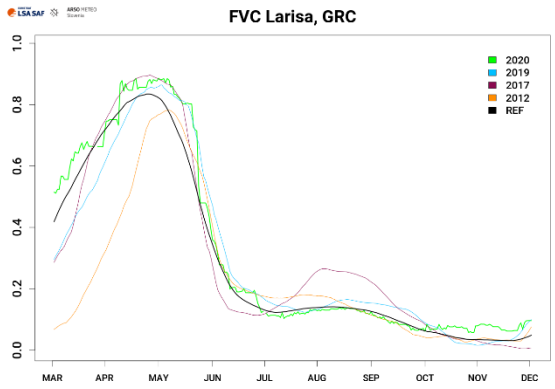


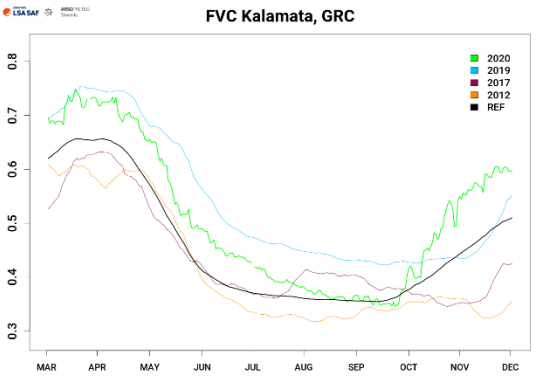












IMPACT REPORTS

SLOVENIA

In early spring months, the negative impact was reported mostly in western and southwestern Slovenia where rainless conditions were aggravated by strong winds, especially the bora wind, which further dried out the soil. The drought damage was seen in spring-planted cereals and clover crops, with significant damages on oilseed rape and winter cereals [1, 2]. Crops of sown vegetables without irrigation and early potatoes did not sprouted or sprouted very slowly, and asparagus yield was noticeably lower than usual due to drought. Affected by prolonged drought were also orchards, especially apples [3]. Hops was lagging behind in growth, with first-year plantations being

particularly affected. Cereals were most affected in Vipava valley in western Slovenia where arable land was so drained that fertilization and tillage were prevented [1, 2, 3]. At the same time, there was no water available for irrigation where the latter was possible, neither in dedicated reservoirs [2]. Prolonged drought conditions lasting throughout winter months and spring caused hydrological drought. Before the end of April, low water content was noted on as many as 80 % of water measuring stations. Individual streams and small rivers dried out [4]. Very low groundwater levels were recorded in several aquifers in northwestern Slovenia, with a declining trend toward extremely low values were monitored in eastern Slovenia since the beginning of the year [4, 5]. Firefighter units had to be activated in parts of western Slovenia and hilly areas without water supply. The number of water supplying increased considerably in April, with almost twice as many shipments by mid-April than in the whole month in the previous year [3].

[1] https://www.rtvslo.si/okolje/novice/ce-v-kratkem-ne-bo-dezja-bo-susa-za-kmete-katastrofalna/521653
[2] https://www.rtvslo.si/radiokoper/prispevki/novice/po-pozebi-zdaj-se-susa-vogrscek-ne-pomaga/520183
[3] https://www.rtvslo.si/okolje/novice/dolgotrajna-susa-ze-povzroca-resne-tezave-primorskim-kmetovalcem/521331
[4] http://meteo.arso.gov.si/uploads/probase/www/agromet/product/document/sl/HidrometeoroloskeRazmere_2020_04_23.pdf
[5] http://meteo.arso.gov.si/uploads/probase/www/agromet/product/document/sl/HidrometeoroloskeRazmere_2020_04_16.pdf

MOLDOVA

Very dry autumn 2019, warm and snowless winter and dry first months of the year 2020 caused hydrological drought and paved the way for agricultural sector in Moldova to become seriously affected in spring months already. By the end of April, water flow in the rivers and water basins in the country was at 50 % or lower of the multi-annual average, and the accessible water reserve in the soil layer of 0-200 cm was three times lower than the multi-annual average [6, 7, 8, 9]. As a result, many winter crops were affected, mostly in southern and central regions, less so in northern parts of the country [6, 7, 10]. In May, also apricot, plum and cherry plantations were reported affected due to the prolonged water stress [11]. In June, the preliminary local data collected by the Ministry of Agriculture, Regional Development and Environment in Moldova showed that spring drought affected about 60 % of the field sown with winter crops. The assessments also revealed that about 2,000 hectares were re-cultivated [12, 13]. As drought hit the agriculture sector also in summer months, a sharp jump in prices was recorded for almost all types of greens in Moldova, with an acute shortage of domestic and imported products [14]. Most drastic decrease in production per hectare was noted in wheat. According to the national authorities, the year's harvest of wheat was about 600 thousand tons at the country level, which results in estimated losses of over 50 % [15, 16]. While this amount was enough to cover the domestic needs of the country, there was significantly less wheat for the export [15]. Drought affected not only cereals but all crops, especially peas, autumn barley, spring barley and potato, while corn, fruit and sunflower harvest were believed to be at the limit of national consumption [17, 18, 19].

The estimates of the Ministry of Agriculture, Regional Development and Environment showed that most agricultural crops were compromised by more than 60 %, causing a total damage of 1.2 billion lei to farmers [20]. The harvested corn was dry and of poor quality, thus left to be processed for animal feed [16, 21]. Some fields in southern Moldova were nearly entirely affected which left some households unable to harvest enough to feed the animals, or forced to clear their crops [16, 17, 21]. With the harvest significantly lower than last year, not all farmers were able to meet their contractual quota obligations [17]. Drought conditions lasting into autumn caused problems in land cultivation to sow winter cereals [22]. The acute drought left significant impact also on grasslands, forcing farmers to use winter stock of fodder, to send their animals to slaughterhouses as they no longer had anything to feed them or, although risking being fined, put their flocks in the forests so that the animals can graze at least on the falling leaves [23]. Long-lasting lack of significant

precipitation deepened hydrological drought by August for most part of the country. Critically low was also the water pumping station Cosernita in central Moldova, while several lakes have completely dried up across the country [24, 25, 26]. The level of the largest tributary of the Dniester River, the Raut River in northern Moldova, dropped considerably [27]. In response to the lack of water, some households have built illegal dams [28].

[6] https://unimedia.info/ro/news/d7073a72ee15782f/situatia-din-agricultura-fara-precedent-potrivit-ministrului-perjupremierul-anunta-o-scadere-a-roadei-de-grau-cu-50.html
[7] http://24h.md/guvernul-va-elabora-un-set-de-masuri-de-diminuare-a-impactului-secetei-asupra-agriculturii/
[8] https://unimedia.info/ro/news/022bff8066e87aba/toate-terenurile-agricole-semanate-cu-culturi-cerealiere-de-toamna-siprimavara-vor-fi-inventariate.html
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[13] https://www.moldpres.md/en/news/2020/06/11/20004714
[14] https://press.try.md/item.php?id=1042837075
[15] https://mybusiness.md/ru/novosti-biznesa/item/14850-v-moldove-neurozhaj-pshenitsy-podorozhaet-li-muka
[16] http://www.trm.md/ro/economic/fermierii-din-sudul-tarii-grav-afectati-de-seceta
[17] http://trm.md/ro/social/agricultorii-estimeaza-pierderi-de-peste-50-din-cauza-secetei
[18] http://www.hotnews.md/articles/view.hot?id=64658
[19] https://unimedia.info/ro/news/4db02fecfe3e9b2c/video-roada-de-porumb-si-seminte-de-floarea-soarelui-la-limitaconsumului-national-ion-chicu-despre-exportul-productiei.html https://www.ipn.md/ro/ion-chicu-roada-din-acest-an-permite-satisfacerea-necesitatilor-7966_1076123.html
[20] http://www.interlic.md/2020-08-19/executivul-va-repartiza-300-milioane-de-lei-pentru-compensarea-par-iala-apierderilor-la-culturile-de-grupa-i-64155.html?highlight=secet%C4%83
[21] http://www.trm.md/ro/economic/agricultorii-inregistreaza-pierderi-din-cauza-secetei
[22] https://www.jurnal.md/ro/news/af53e25d99000849/seceta-afecteaza-rm-guvernul-initiaza-un-program-de-asigurare-asecuritatii-alimentare.html
[23] https://www.jurnal.md/ro/news/83bd088ef03fbaba/fotoreportaj-de-pe-dealurile-dogorite-ale-moldovei-oamenii-auinceput-sa-si-sacrifice-animalele.html?fb_comment_id=4984890954869591_4985430574815629
[24] http://www.meteo.md/index.php/en/news/detail/aspectele-24-31-08-2020
[25] http://www.meteo.md/index.php/en/news/detail/aspectele-hi
[26] http://stiri.tvr.ro/seceta-seaca-lacurile-din-republica-moldova--ecologi--tii-spun-ca-este-unul-dintre-cei-mai-secetosiani-din-ultimii-70-de-ani_868352.html#view
[27] https://protv.md/social/rauri-dar-si-lacuri-intregi-din-partea-de-nord-a-tarii-au-secat-cu-totul-iar-fantanile-din-sateintregi-nu-mai-au-apa-ecologistii-spun-ca-seceta-dar-si-faptul-ca-ramanem-cu-tot-mai-putine-paduri-duc-la-aceastasituatie-grava-video---2540290.html
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ROMANIA

Due to the winter/spring and summer droughts, more than half of the 2.9 million hectares sown with agricultural crops in Romania were affected to the various extent, mostly along the eastern and southern Romania, presenting 4 % of the country's territory [29, 30]. In spring in the south of the country, drought nearly reached the level of natural disaster. Most affected were wheat, corn and sunflower, and also newly sown corn and sunflower crops were at risk of drying out. While water demand for irrigation increased during that time, some of the functional stations were unable to be used due to the low flows of the Danube and the Siret rivers [31]. The drought affected also the water supply across that part of the country. In Gorj County in southwestern Romania, water supply regime was introduced, making tap water available only at certain times. While some used it also for agricultural activities, water was scarce to run the household and personal hygiene. Due to continuous decrease of water level, the authorities decided to divide the locality of Smardan in southeastern Romania in two, north and south, with each part receiving water every alternate day [32, 33]. Later in May, impacts of winter and spring drought became a concern also for livestock breeders in Buzau County in southeastern Romania through heavily affected grassland, which also stopped in growth. Dried fodder left over from winter was already used up by animal breeders. The support of the Buzau firefighters was required to supply water to their livestock herds [34]. In the Vrancea area in southwestern Romania, the rain was scare to a point the first as well as second scythe are zero. In the absence of vegetation to feed their livestock with, animal breeders had to rely on food supplies since April. Some were seriously considering selling their animals or take them to the slaughterhouse [35]. Throughout summer months, the negative impacts were vivid also

through increased market prices for cereals [36]. According to the National Institute of Statistics, the price of milling and bakery products increased by more than 3% over the first half of the year [37]. In Dobrogea in the south-east, drought has completely compensated wheat crops and farmers had barely anything to harvest [38]. Similarly goes for some farmer in Vaslui in eastern Romania who, due to negligible amount of rain since August 2019 that destroyed both autumn and spring crops, was forced to abandon their agricultural business [39]. In Moldova County in eastern Romania, some farmers were on the verge of bankruptcy as a result of having more than 70 % of cultivated land completely compromised [40]. Corn yield was down to 40 % in comparison to the previous year [41]. In the view of heavily affected wheat production, authorities decided to temporally ban the export of wheat to destinations other than the EU [42]. The lack of rainfall this year has significantly reduced the grape harvest as the fruits are far from satisfactory, regardless of the variety. In the absence of rain, the grapes are as sweet as honey and bunches were few [43].

The agricultural drought affected wheat and rapeseed crops the most, especially in southeastern Romania, where yields reached only 10 % of average production. According to the Ministry of Agriculture, drought throughout 2020 caused a reduction of the year's overall cereal production by between 35 % and 40 % at the country level. There was an estimated 30 % decrease in national production of sunflower due to the drought in spring across all of the country and summer drought in certain regions of the country [44, 45]. Great losses were experienced also across other parts of southern Romania, as agricultural yield was reduced by more than 50 % compared to the year before, and many farmers were unable to cover even their investments. The lack of rainfall at the end of summer put at risk also autumn crops [46]. The Groupama Asigurari insurance company registered highest negative drought impacts across the south and the east of the country, areas that represent 75% of Romania's arable land [47]. The Alliance for Agriculture and Cooperation claimed that the agricultural year 2019-2020 was the hardest in the last 50 years, being for the first time when both autumn and spring crops were affected by severe agricultural drought [48]. In addition to crop cultivating, also livestock sector was negatively affected, including sheep sector, pig and poultry farmers as well as beekeepers [49]. In southeastern Romania, farmers who no longer had money to pay the salaries of their employees took to the streets to demand aid from the authorities [50]. In areas with prolonged lack of rain, even agricultural lands with irrigation systems did not prove economically viable due to the high amount of water required to save the crops, and farmers were considered giving up the agricultural area [49]. Significant lack of rain reflected in hydrological drought as well. 95 % of the surface of Lake Nuntasi in Danube Delta area, which normally stretches over 850 hectares, dried up over the course of two months at the end of summer. Consequently, the flora and fauna of the area were put under great stress, posing an ecological disaster in the biosphere sector [51]. Also the level of the Lake Solesti dropped by 60 %, and consumption in Negresti in eastern Romania was restricted due to the drastic decrease in the volume of water in the Cazanesti reservoir [52]. Fisheries were required to manage the existing volumes of water with great care in order to ensure the necessary living conditions for the fish stock [53]. The number of villages where water supply schedule was introduced grew alarmingly over this summer [54]. Critical water situation was reported also for Techirghiol Lake in the coastal area, the largest salt lake in Romania, as prolonged drought threatened its existence and the water level dropped by more than a meter. Specialists pointed out the increasing salt concentration, potentially threatening the lake's flora and fauna. The lake has not had such a low water level since the 1970's [55].

[29] http://stiri.tvr.ro/ministrul-agricultorii--adrian-oros--mai-mult-de-jumatate-din-culturile-insaman--ate-in-toamna-suntafectate-de-seceta_859652.html
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[31] http://stiri.tvr.ro/culturile-sunt-in-pericol--canalele-de-iriga--ii-sunt-goale--debitele-raurilor-sunt-scazute_860837.html
[32] http://stiri.tvr.ro/seceta-a-dus-la-ra--ionalizarea-apei-in-jude--ul-gorj_860676.html
[33] http://stiri.tvr.ro/furnizarea-apei-restric-ionata-in-mai-multe-jude-e_860650.html
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[35] https://agrointel.ro/132734/despagubiri-seceta-pasuni-nutret-decizie/
[36] http://stiri.tvr.ro/covid-19---i-seceta-scumpesc-alimentele--producatorii-au-pierderi-de-milioane-de-euro-din-cauza-crizeisanitare_861562.html#view
[37] http://stiri.tvr.ro/produc--ia-de-grau-se-anun--a-cu-50prc--mai-mica-decat-in-2019--romania-a-fost-anul-trecut-al-doileacel-mai-mare-exportator-din-ue_865661.html#view
[38] http://stiri.tvr.ro/cereale-mai-pu--ine--paine-mai-scumpa--dupa-ce-seceta-a-distrus-culturile_865158.html#view
[39] https://agrointel.ro/149430/tanar-fermier-probleme-mari-culturi-afectate-seceta/
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[41] https://www.agerpres.ro/economic-intern/2020/08/21/ministrul-agriculturii-va-fi-suficient-grau-pentru-panificatiechiar-daca-productia-este-diminuata-de-seceta--560350
[42] http://stiri.tvr.ro/cea-mai-grava-seceta-din-ultimul-secol-afecteaza-europa-de-est_862138.html#view
[43] http://stiri.tvr.ro/produc--ia-de-struguri-din-acest-an--afectata-de-seceta_870446.html#view
[44] http://stiri.tvr.ro/seceta-face-ravagii-in---ara--este-un-an-catastrofa--noi--fermierii--suntem-termina--i_867907.html#view
[45] http://stiri.tvr.ro/anul-agricol-afectat-de-seceta-productia-de-floarea-soarelui-scade-cu-30prc_870225.html#view
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[54] http://stiri.tvr.ro/seceta-a-dus-la-ra--ionalizarea-apei-in-multe-comune-vrancene--sunt-sate-care-nu-au-primit-apa-larobinet-de-saptamani_867738.html#view
[55] http://stiri.tvr.ro/lacul-techirghiol--cel-mai-mare-lac-sarat-din-romania--afectat-de-seceta_870158.html#view

BULGARIA

According to the Ministry of Agriculture, Food and Forestry, Bulgaria have not recorded such high impacts of drought to the agricultural sector as in 2020. The snowless winter and spring-to-summer drought greatly affected the growth and development of cereal crops, which resulted in drastic decrease of yield in summer months across northern and eastern Bulgaria, with most affected by drought being the eastern third of the country, especially the districts of Burgas, Dobrich, Varna, Silven and Shumen. The collapse of cereal crops was reported on nearly 1 million decares, which has never happened before. This includes areas that were sown but were not harvested due to complete loss of yield due to drought. The highest damage was left in production of wheat, barley and rapeseed, while in Silven and Dobrich districts along the eastern third of Bulgaria, lower yields due to drought were reported also for sunflower and corn [56, 57, 58, 59]. According to the Ministry of Agriculture, the overall wheat harvest was lower by more than 22 %, while in eastern third of Bulgaria significantly lower yields have been observed for barley and oilseed rape, on average about 40 % lower than a year before. The Dobrich region in northeastern Bulgaria, traditionally the leader in the production of grain, also recorded one of the most intense droughts in the last 20 years, with wheat harvest of only 32 % compared to the year before [58, 60, 61, 62, 63, 64]. Wheat was completely destroyed on 0.7 % of the total area of the country, barely on 0.33 % and rapeseed on 1.5 % of the total area [58]. The poor harvest triggered higher market prices during summer months compared to the start of the harvest [64]. Large bankruptcies in small farmers and small grain producers were expected, as they were not able to cope with such yield losses [65]. Significant summer drought that destroyed the pastures reportedly left negligible harvest also among beekeepers who describe this year's honey production as tragic. Many beekeepers reported zero yield and the fortunate ones fortunate managed to yield honey that reaches only 60-70% of the yield the year before [66, 67]. Among the affected are also livestock farmers, while the State support is also being considered for vegetable growers and fruit growers [68]. The ongoing drought prevents the pre-sowing treatments of the arable areas intended for sowing with winter oilseed rape and winter cereals, creating conditions for serious delays in autumn sowing [69]. Continuous lack of rain to moisturize the soil and consequent drying up of the topsoil greatly increased fire risk. Hundreds of acres of grain have been burned in summertime in the Haskovo region, southern Bulgaria, and firefighters had to intervene several times to save the harvests of citizens [70]. Due to

the lack of snow in winter, followed by extreme drought and a new type of pest, unusual drying of the forests was observed over nearly 100 km from the protection belts in Dobrogea, northeastern Bulgaria. The trees in the belts were reported drying out en-masse. In response, planting of more drought- resistant trees began [71].

Due to the prolonged period of unfavourable precipitation conditions in Bulgaria, hydrological drought developed in the country, the negative impacts of which were the greatest across the eastern half of the country. The long-lasting drought throughout the year led to critical levels of the dams and to serious problems in water supply to the population. Several dams were experiencing critical conditions, already in August, with Ticha, Kamchia, Yastrebino and Asenovets dams were among the most affected by the dry winter-to-summer half of the year [72, 73, 74]. In Yastrebino in northeastern Bulgaria, drought during summer months forced surrounding agricultural producers to use the dam water for irrigation, which further reduced water level in Yastrebino Dam. Low water levels in dams have been reported alarmed also by the fishermen, pointing out the acute problem for the fish in it and the aquaculture. At the end of July, the flow of the Yastrebino Dam in northeastern Bulgaria was at only 20 %, which presented a threat for water shortage to the municipality of Antonovo and its inhabitants. Altogether, drought aggravated the dispute over the supply of water for irrigation, ecosystems and public demand [74]. The Ticha dam in central-eastern Bulgaria bore only half of its total water volume at the end of August. The volume of Kamchia dam, which supplies the two major seaside cities Burgas and Varna with water, drastically decreased throughout summer months and the supplied water amount to the two cities was reduced, threatening the Black Sea coast and tourism, according to the Minister of Ecology [72, 73]. According to the Minister of the Environment and Water, 30 % of the outflow of Koprinka Dam in central Bulgaria was directed along the Tundzha River to Zhrebchevo Dam in order to ensure the normal water supply of the boreholes used by the residents of Stara Zagora, Sliven and Yambol districts in central and central-eastern Bulgaria [75]. In Targovishte region in eastern Bulgaria, prolonged drought led to a sharp reduction in the flow of existing water sources and shortage of water for drinking and household needs, resulting also in irregular water supply [76]. In Smyadovo municipality in eastern Bulgaria, a partial state of emergency was declared in the frame of which the water was released every seventh day and the collected amount of water in the reservoirs ended within 12 hours. The state of emergency was in place until the end of August and prohibited the supply of drinking water for irrigation and industrial needs [77]. In September, a state of emergency was declared also for the municipality of Nedelino, southern Bulgaria, due to the lack of water. According to the mayor, most of the reservoirs in the region were only up to 10-15 % full with the exception of Dedelaynska Barchina Reservoir that held approximately 40 % of its total volume. Even the water schedule regime introduced at the beginning of September did not save enough water for drinking and household needs, and additional water was requested to be diverted from neighbouring municipalities [78, 79]. The water regime in Matnitsa district, in the frame of which water was available for only a few hours a day, had been in place for almost 4 months while water amount was still scarce for the higher parts of the district [80]. At the beginning of October, the available water volume of Kamchia Dam presented less than 28 % of its total volume, Zhrebchevo Dam at nearly 21 % of its total volume, and the water levels in dams of Ticha, Yastrebino and Aheloy remained below 50 % [81, 82, 83]. Since the end of September, the water supply through the irrigation canals of the agricultural areas in the area of Zhrebchevo dam were stopped [81].

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Methodology

DMCSEE Drought monitoring bulletin is based on numerical weather prediction (NWP) model simulations over SE Europe, SPI index calculations and remote sensing. Precipitation data is provided by Global Precipitation data Centre (GPCC; see: https://www.dwd.de/EN/ourservices/gpcc/gpcc.html). NWP simulations are performed with Non-hydrostatical Mesoscale Model with cca. 7 km spatial resolution (NMM; see: http://www.dtcenter.org/wrf-nmm/users/). Historical DMCSEE model climatology was computed with NMM model for time period between 1 January 1990 and 31 December 2019. European Centre for Medium Range Weather Forecast (ECMWF) ERA5 data set (see: http://www.ecmwf.int/en/forecasts/datasets/reanalyses-datasets/era5) was used as input for simulations. Long term averages (1990-2019), used for comparison of current weather conditions, are obtained from simulated data set. Comparison of current values to long-term averages provides signal on potential ongoing drought severity.