DROUGHT MONITORING BULLETIN

June 2023

HOT SPOT

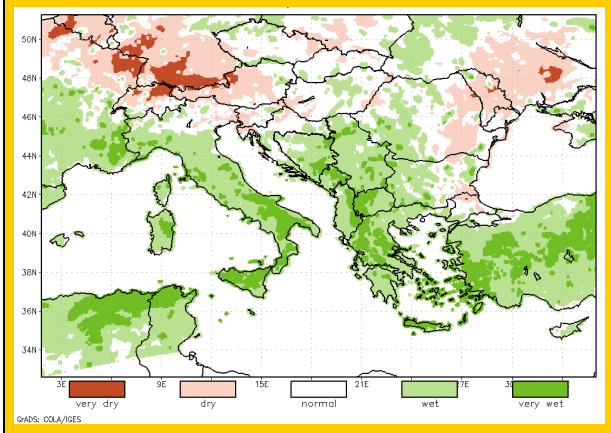
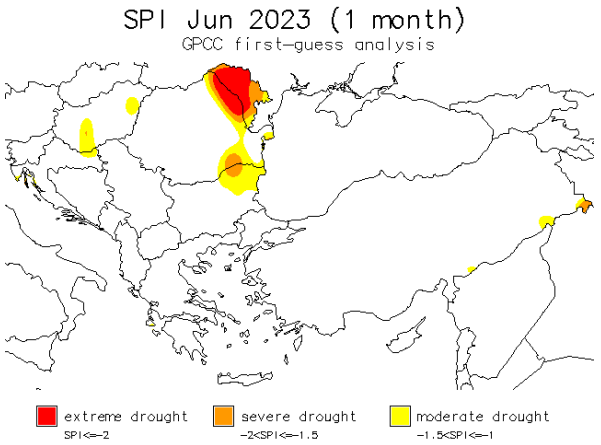


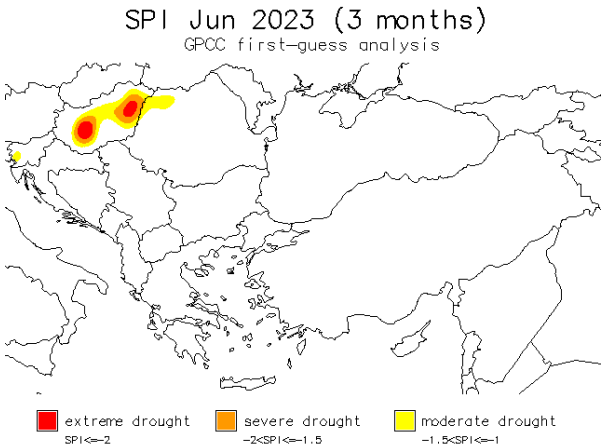
Figure on the left shows **June precipitation level in percentile classes** on the base of 1991–2020. It was another dry month for Moldova and eastern parts of Romania, which have been experiencing drier than normal months since Janurary and February respectively, with the exception of April when precipitation level was abundant. Precipitation level was in June noticeably lower than normal also in scattered areas across the northern parts of the region and along the western part of the Black Sea.

STANDARDIZED PRECIPITATION INDEX

Drought situation with regard to the precipitation level is presented by Standardized Precipitation Index (SPI). The SPI calculation is based on the distribution of precipitation over long time periods (at least 30 years) and can be calculated at various time scales that reflect the impact of drought on the availability of water resources. The long-term precipitation record is fit to a 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 and values less than zero indicate drier periods. Only the dry part of the extreme anomalies is presented on the maps.

Standardized precipitation index for **June 2023** is shown in figures below. SPI for a one-month period indicates possible drought conditions which can have impact on vegetation, while SPI for a three-month period can be indicative also for surface water status.





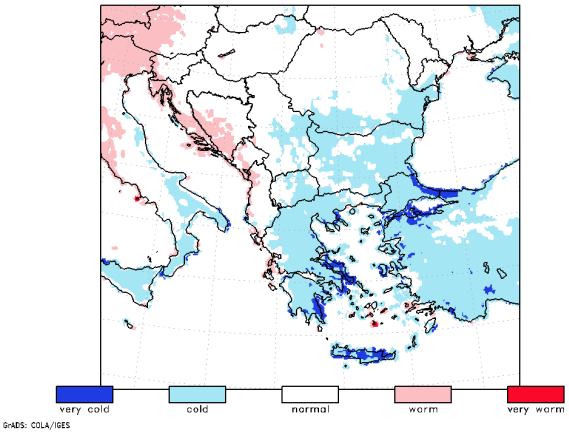
The region's north-east experienced noticeable lack of rain in June as the monthly deficit from the normal across Moldova and over to far eastern Romania ranked among the driest 5 % of long-term records for this time of year, according to SPI, and indicated severe to extreme drought conditions this June. Also localised areas across central Hungary and a wider border area between Romania and Bulgaria recorded considerable precipitation defict in June, indicating drought conditions of moderate to severe level.
Over the last three months from April to June, lack of rain was most profound over much of the Hungarian territory with severe to extreme lack of rain in April, followed by moderate to severe precipitation deficit in May but also in June, indicating severe to extreme drought conditions over its central and northeastern part.

AIR TEMPERATURE AND SURFACE WATER BALANCE

*Figures in this section present anomalies of the **average air temperature** and **accumulated surface water balance** as well as their classified values in percentile classes for a 60-day period **from 1 May to 29 June 2023**.*

AVERAGE AIR TEMPERATURE ANOMALY (°C)
1 MAY – 29 JUNE 2023

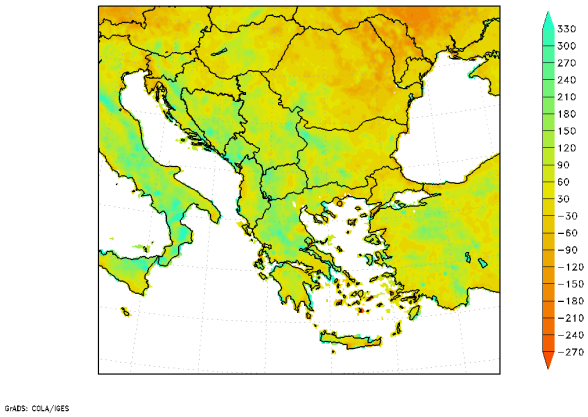
AVERAGE AIR TEMPERATURE PERCENTILE CLASSES
1 MAY – 29 JUNE 2023



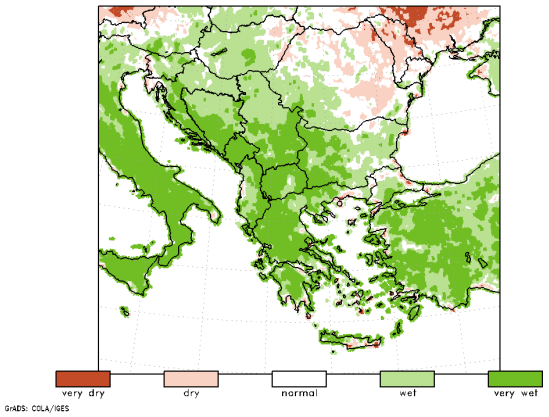
During its first two dekads, June air temperature were either average or colder than normal. Especially in the southern parts including wider Aegean Sea area and southwestern Turkey, mean air temperatures were up to 2 °C, locally up to 3 °C lower than normal. In mid-June, negative anomalies of up to 3 °C spread over all of Greece and southwestern Turkey, and anomalies of up to 2 °C colder reached also the entire central third of Balkan Peninsula, from Hungary to North Macedonia, covering also Montenegro, eastern Croatia and western parts of Romania, Bulgaria and Turkey. Last days of June saw warmer air temperature come in to the region from the north-west. Slovenia, most of Hungary and parts of countries along the Adriatic Sea experienced air temperatures almost 3 °C warmer than normal, a belt from western Romania to Albania up to 2 °C, while for southeastern half of the region from Moldova to central Greece and Turkey, the arrival of warmer air mass was felt in a form of expelling colder than normal air temperatures.
The 60-day period from May to June proved unusually cold for southeastern half of the region, including southern Romania, Bulgaria, parts of Serbia and North Maceodnia but mostly for Greece and western half of Turkey where localised areas about the coastal sides experienced among the coldest air temperatures of the local record with the 60-day mean air temperature up

to 2 °C below the long-term normal. Average May air temperature conditions combined with average or locally warmer air temperature conditions in June resulted in not much deviation from the long-term 60-day mean.

ACCUMULATED WATER BALANCE ANOMALY (mm)
1 MAY – 29 JUNE 2023



ACCUMULATED WATER BALANCE PERCENTILE CLASSES
1 MAY – 29 JUNE 2023



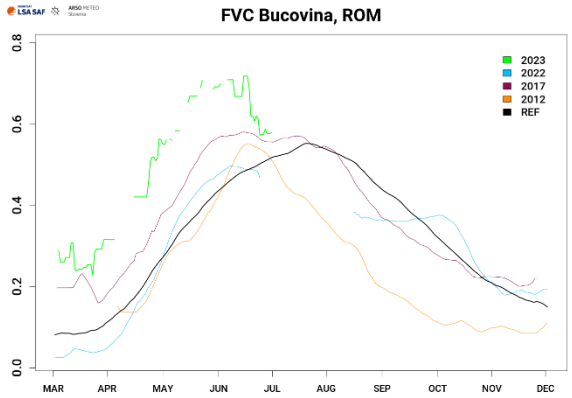
The 60-day surface water balance over May and June shows that several areas across the northern belt of the region accumulated considerable surface water balance deficit. For Moldova and eastern Romania, the deficit of up to 120 mm, locally in the north up to 150 mm accumulated over the course of dry both May and June. Northeastern Hungary and the region's far north-west too recorded dry surface water balance conditions, with deficit of 60–120 mm compared to the long-term mostly on the account of drier surface water balance conditions in June while May surface water balance levels were normal. Other parts of the region, especially its central part and central-western Turkey recorded wet to very wet surface water balance conditions throughout May and June. Surplus ranged from 120 to 180 mm across much of this part of the region, while localised areas in Bosnia and Herzegovina, Montenegro, Bulgaria, North Macedonia, Greece and Turkey recorded one of the wettest May-June periods, with surplus reaching up to 240 mm, isolated areas noticeably more.

REMOTE SENSING - FRACTION OF VEGETATION COVER

Fraction of vegetation cover (FVC) is a vegetation index based on multi-channel remote sensing measurements (data from EUMETSAT's LSA SAF data base 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 to the damages of possible natural disasters (including drought). FVC values are in general low at the beginning of the growth season, the highest at full vegetation development, then FVC slowly drops with vegetation senescence. Line shape depends on the sort of vegetation at the given location.

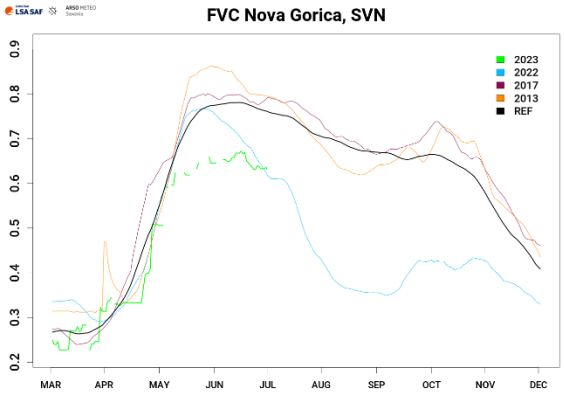
Graphs below present the **vegetation situation** as recorded **on 30 June 2023** at selected locations across Southeastern Europe. FVC values for year 2023 are presented as a green line. Graphs also include reference line (2004–2022) in black, and lines in light blue (year 2022), magenta (year 2017) and orange (year 2012, or 2013 for Slovenia) for comparison. Possible missing values or their sharp decline could be a result of a prolonged cloudy weather, extreme weather events, snow blanket or changes to product by the product provider.

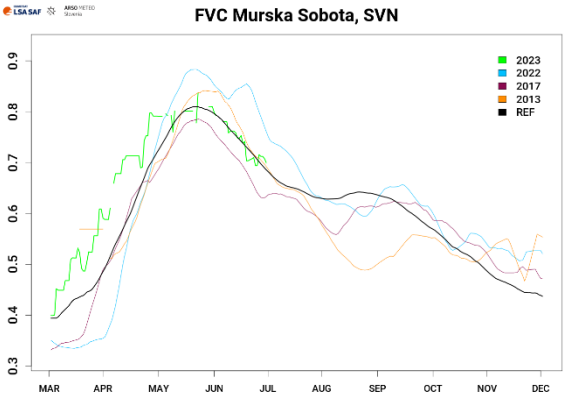
ROMANIA



In Bucovina, northern Romania, level of cover with green vegetation was more than twice its usual extent in early March. Spring weather conditions supported regular vegetation growth, thus FVC remained twice as high throughout spring. High rate of growth continued into first half of June when growing rate would normally begin to flatten, resulting in 25 % higher than normal FVC in mid-June. Afterwards, a rapid decline in vegetation cover can be observed in second half of June.

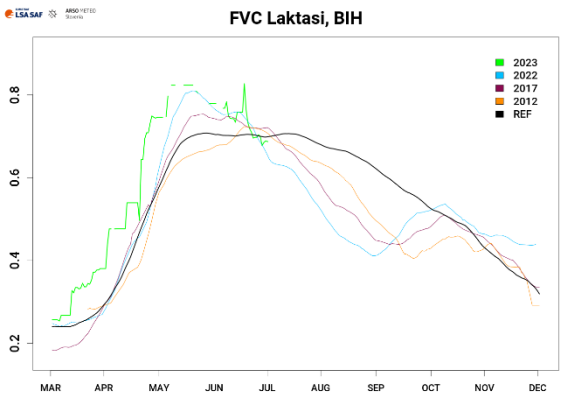
SLOVENIA

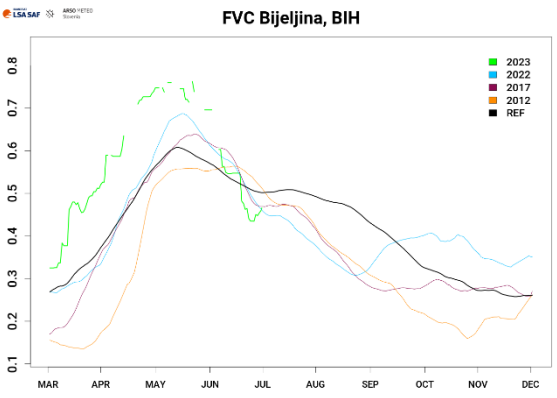


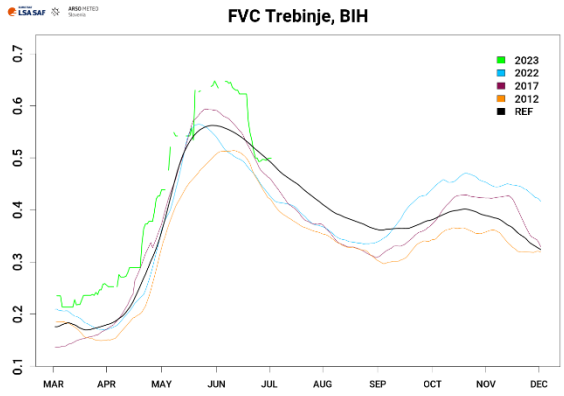


Vegetation development in Nova Gorica, western Slovenia followed its usual pattern more or less well in early spring. From mid-May onward, weather conditions did not support further growth to reach the expected level of cover at its peak time in early June, but instead the development stagnated at the level of cover reached in second half of May, resulting in 10-15 % lower than normal peak values at the end of June. In Murska Sobota, northeastern Slovenia, vegetation season began up to a month earlier than normal and progressed at the regular rate throughout spring, indicating higher than normal vegetation cover for that time of year. In early May, the ahead-of-time progress came to an end and its seasonal peak was reached at the regular time and level of cover, and senescence phase began as normal in June.

BOSNIA AND HERZEGOVINA (REPUBLIC OF SRPSKA)

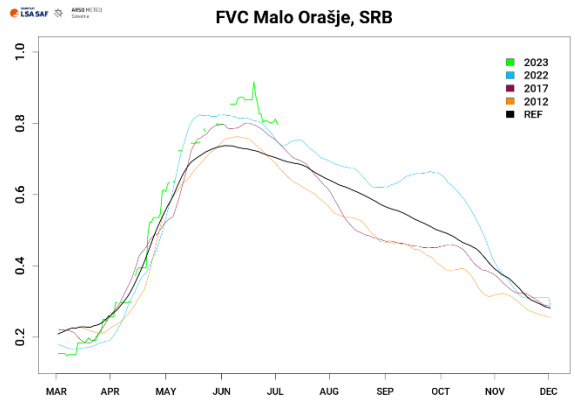


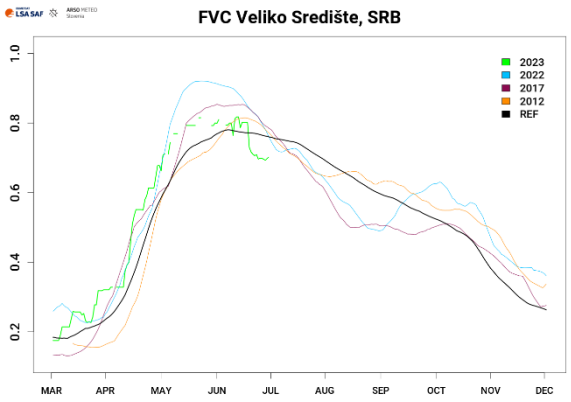




Vegetation season in Laktasi and Bijeljina along the northern Bosnia and Herzegovina began few weeks earlier than normal and for much of the spring developed at its usual growing rate, resulting in continuously above-average level of cover with green vegetation, for up to 15 %. Favourable weather conditions for vegetation growth also in late April resulted in exceeding the usual fraction of cover during seasonal peak in mid-May for 10-20 %. Senescence phase occurred at the rate much higher than normal at both location, meaning the fraction of cover with vegetation dropped for almost 20 % in Laktasi between mid-May and end of June, down to the average level, and for up to 30 % in Bijeljina, to below-average at end of June. In Trebinje, southern Bosnia and Herzegovina, vegetation season began earlier too, and after a slow development in its initial month of the season the rate of growth increased in second half of April, resulting in level of vegetation cover catching up to its usual or even slightly increased FVC values for the given time. According to FVC index, seasonal peak in mid-June was exceeded for up to 10 %, followed by a sharp decline in second half of June.

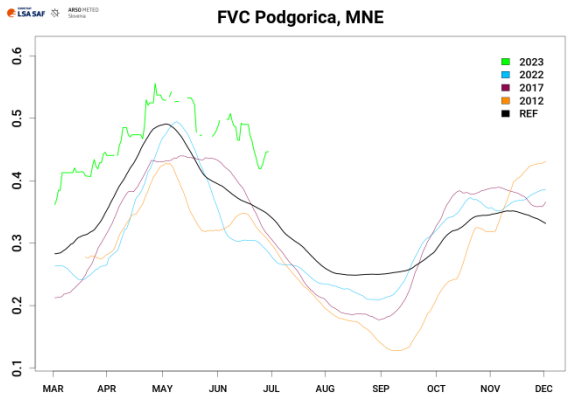
SERBIA





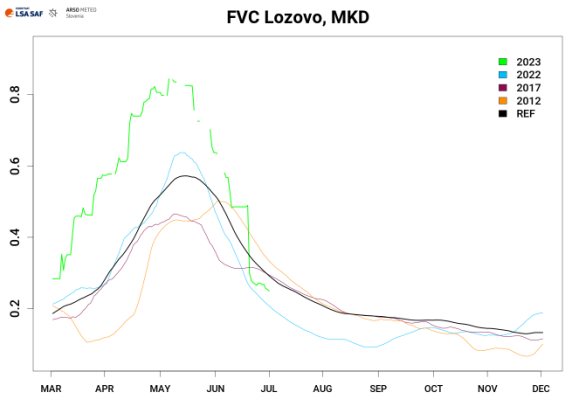
Vegetation season slightly earlier than normal in Veliko Srediste, northeastern Serbia and progressed well throughout spring months, reaching seasonal peak up to a month ahead of time and peak vegetation cover remained levelled throughout all May and early June. Sharp decline in FVC values can be observed in mid-June, suggesting sudden damage to the vegetation. Also in Malo Orasje, vegetation season progressed as usual this spring. Weather conditions seemed to support vegetation growth even beyond its usual peak time in May, as FVC values kept rising until mid-June, exceeding the peak vegetation cover for approximately 15-20 %. At that location too, a sudden drop in FVC values can be observed in mid-June, indicating sudden reduction in cover with green vegetation.

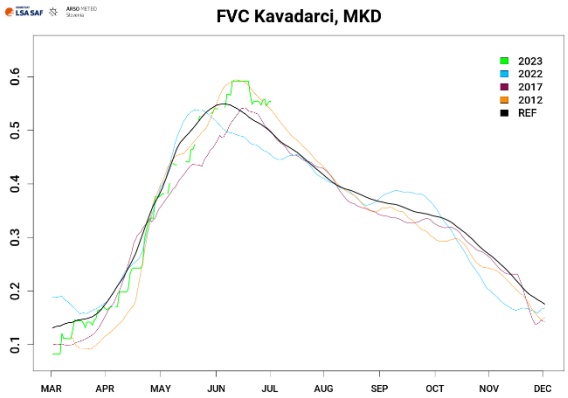
MONTENEGRO



It has so far been a good year for vegetation growth in Podgorica, southern Montenegro. It began on the base of up to 10 % higher level of cover with green vegetation, and despite a lower growing rate throughout March and April, the boost in vegetation growth in early May resulted in exceeding the seasonal peak for up to 10 %. Weather proved favourable even afterwards, slowering the senescence rate and keeping the fraction of vegetation cover 10-15 % above the average.

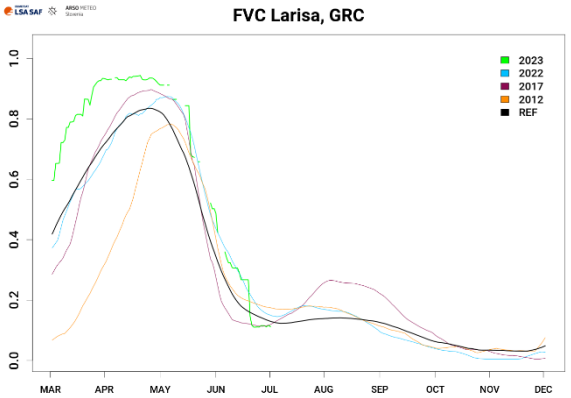
NORTH MACEDONIA

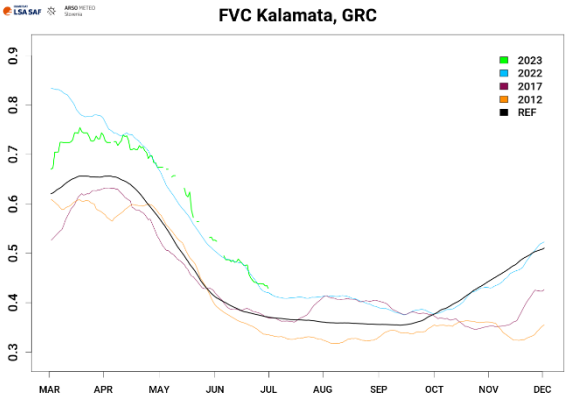




Vegetation growth in Lozovo, central North Macedonia was abundant for most of the season, beginning a month earlier than normal and progressing well above the average peak cover in mid-May, exceeding it for up to 25 %. Senescence phase began at the higher-than-normal rate, bringing FVC values down to average by mid-June already, followed by a sharp drop to below the average. In Kavadarci, southern North Macedonia, vegetation growth followed well its regular development this year with a slight setback experienced in second half of May, according to FVC. Seasonal peak was reached up to 2 week later than normal but the level of cover remained stagnant until the end of June, not showing signs of senescence yet.

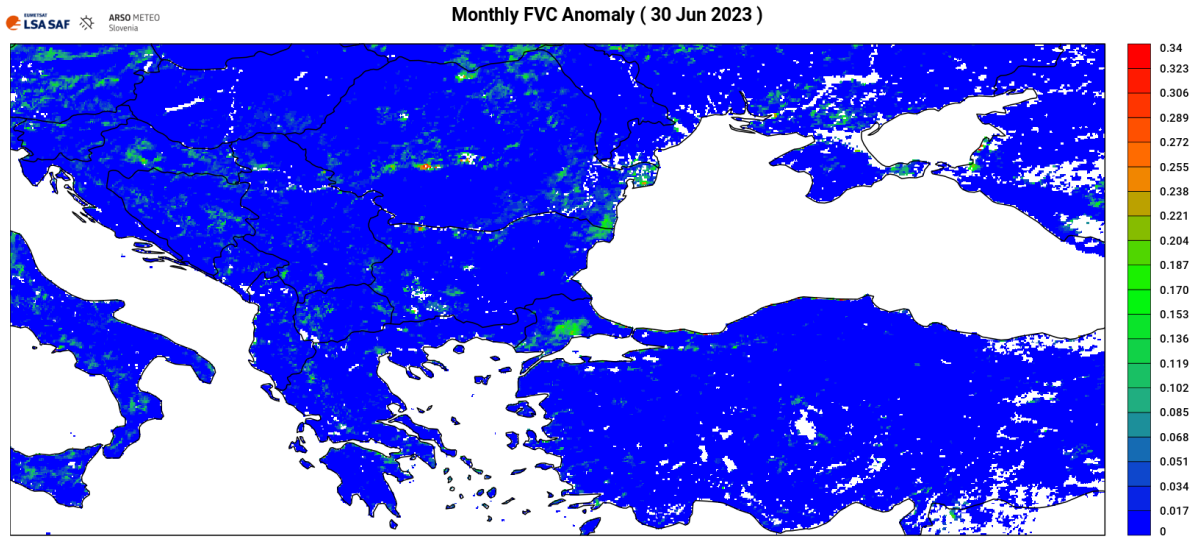
GREECE





Weather conditions were favourable for abundant vegetation growth this year in Larisa, central Greece. Fraction of vegetation cover was continuously about 20 % higher than normal between March and May, exceeding its peak coverage by 10 %. Senescence phase progressed at the regular rate, resulting in FVC values continuing to be above-average at the given time up until mid-June when vegetation appeared to experience a sharp drop in vegetation cover, down to less than average level by the enf of the month. In Kalamata too, weather conditions supported abundant vegetation growth this year. At its seasonal peak, fraction of vegetation cover was up to 15 % greater than normal, and as senescence phase progressed as usual the level of cover with green vegetation remained similarly above-average also throughout May and June, resembling the growing conditions of the previous year.

Figure below shows negative anomaly of **accumulated 30-day FVC values** as recorded **on 30 June 2023** in comparison to the past 19 years (2004-2022), and is used experimentally.



Fraction of vegetation cover was by the end of June more or less about the average levels across most of the region. Most noticeable was up 10-20 % lower than normal vegetation cover across continental Croatia, over central and northern Romania, coastal area along the western part of the Black Sea and over the Bosporian Turkey, while localised areas in the Carpathians recorded fraction of cover up to 30 % lower than it normally would be at this time of year.

DROUGHT IMPACT REPORTS

MOLDOVA

Several areas in the north of the country reported of very scarce or even no precipitation since April, leading to drying up of the crops as well as the ground which at some places already began forming cracks of more than 5 cm. Corn, sunflower and sugar beet were at the beginning of the growing season, thus further lack of rain could considerably affect the later yield [1].

[1] https://www.publika.md/video-nordul-moldovei-este-afectat-de-seceta-locuitorii-se-plang-pe-lipsa-precipitatiilor_3137434.html

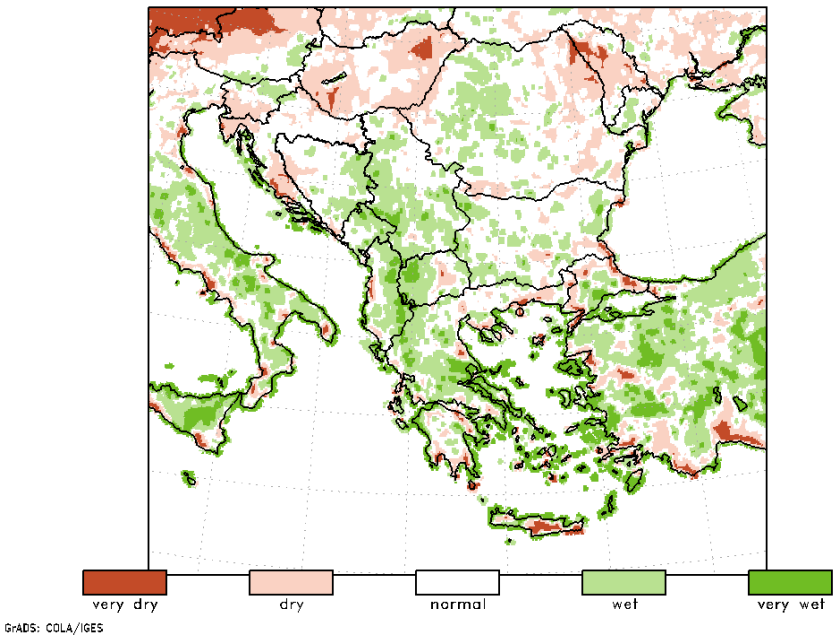
ROMANIA

Farmers from several counties complained of drought impacts on both autumn and spring crops, which were in June in greatest need for water while precipitation was scarce. According to the National Meteorological Administration, moisture content of the soil showed in mid-June low and particularly low values (moderate and strong pedological drought) in regions of Dobrogea, on extensive areas of Moldova and Muntenia, locally in the south and center of Transylvania, and isolated in the northwest of Banat [1].

[1] https://agrointel.ro/262750/romania-maturata-de-ploi-judete-intregi-raman-insa-afectate-de-seceta-harta-anm/

OUTLOOK

Figure below shows model simulations of the **60-day accumulated surface water balance anomaly** in historical percentile classes for the time period **from 31 May to 29 July 2023**.



A 10-day forcast of the 60-day surface water balance indicates surface water balance conditions are in general going to get drier, meaning the deficit is expected to become greater where already existing and extreme surplus would mostly diminish. Drier than normal conditions are expected to continue over Moldova and eastern half of Romania as well as over eastern Hungary where the surface water balance deficit is expected to become greater, indicating dry to very dry conditions over that part of Hungary. Also across much of the northern parts of the region, including the rest of the Hungary, parts of Slovenia and Croatia, surface water balance will come underaverage for this time of year indicating dry conditions over the 60-day period. In central and southern parts of Balkan Peninsula, previously dominanting very wet conditions are expected to lessen in intensity or even drop to normal values, locally even dry conditions are expected. Similarly, the forecast surface water balance will locally indicate normal or even dry conditions although much of the western half of the country will remain in above-average wet conditions.

Methodology

DMCSEE Drought monitoring bulletin is based on numerical weather prediction (NWP) model simulations over SE Europe, SPI index calculations, remote sensing product and public media drought impact reports. Precipitation data is provided by Global Precipitation Climatology Centre (GPCC; https://www.dwd.de/EN/ourservices/gpcc/gpcc.html) shown against the average of the 1961-1990 time period. NWP simulations are performed with Non-hydrostatical Mesoscale Model at ~7 km spatial resolution (NMM; http://www.dtcenter.org/wrf-nmm/users/). Historical model climatology in terms of air temperature and surface water balance is computed with NMM on the base of 1 January 1991 to 31 December 2020 time period, using European Centre for Medium Range Weather Forecast (ECMWF) ERA5 dataset (http://www.ecmwf.int/en/forecasts/datasets/reanalyses-datasets/era5) as input for simulations. Long-term averages (1991-2020), used for comparison of current weather conditions, are obtained from simulated dataset. Comparison of current values against long-term average or in percentile classes (the two extreme classes with a 5-percent range and each of the middle three classes with a 30-percent range) provides a signal on potentially ongoing drought. Remote-sensing product in the bulletin is based on the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Land SAF MSG Daily Fraction of Vegetation Cover product (https://landsaf.ipma.pt/en/products/vegetation/fvc/), presented for the checked and confirmed locations and using long-term averages from 2004 to the last full year (currently to 2022). Information on drought impacts are obtained from freely available online reports of national authorities and media newspapers.