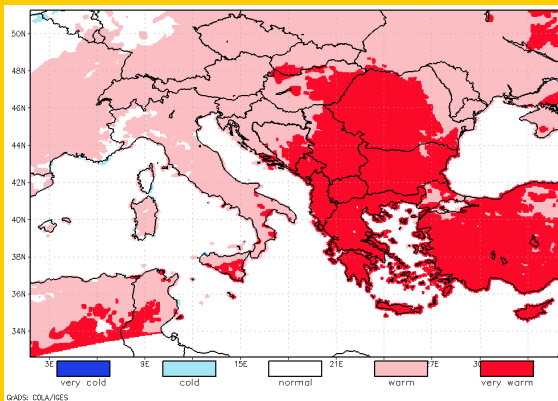


DROUGHT MONITORING BULLETIN

June 2024

HOT SPOT

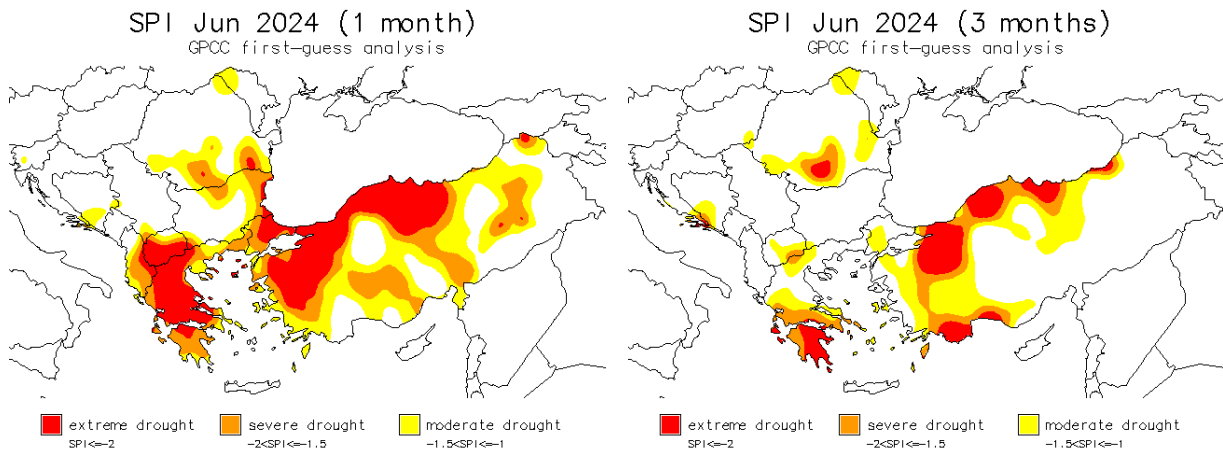


As seen on figure on the left showing **June mean air temperature in percentile classes**, in reference to 1991-2020, June was much warmer than normal across vast part of the region, especially over its southern half and the central-north. In that area, daily air temperature maximums rose above 30 °C in early days of June already, after which a warm spell with daily maximums between 30 °C and 40 °C lasted more or less throughout the rest of the month. Over much of the region, monthly mean air temperature marked this June among the hottest 5 % of local records.

STANDARDIZED PRECIPITATION INDEX

Drought situation with regard to 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.

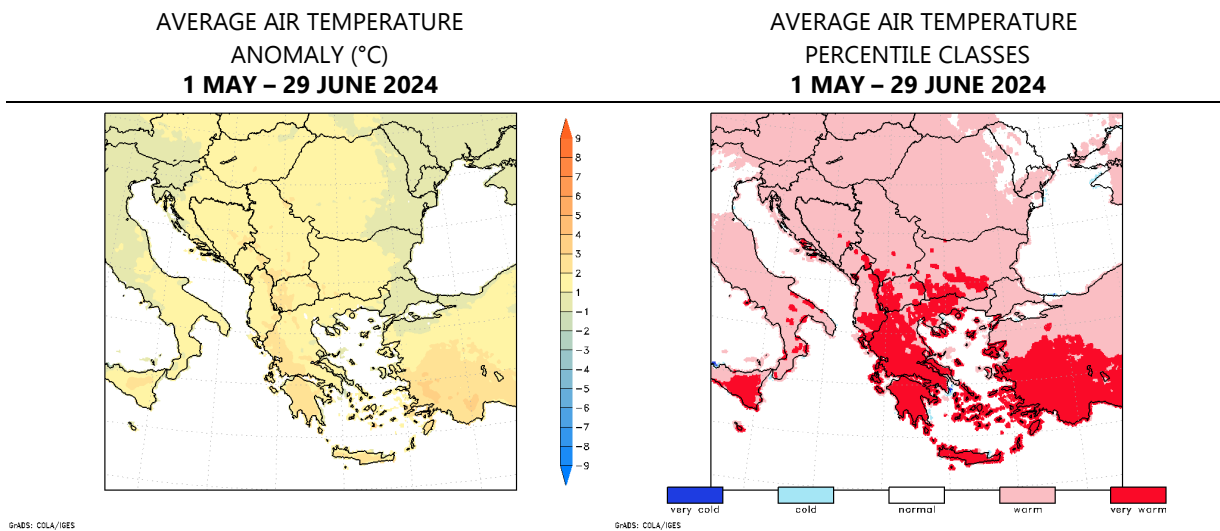
Standardized precipitation index for **June 2024** is shown in figures below. SPI for a one-month period indicates possible drought conditions which can have impact on vegetation, while SPI for a three-month period can be indicative also for surface water status.



June was very scarce with precipitation level across Greece, North Macedonia, Albania and much of Turkey, and according to the SPI, monthly deficit indicated noticeably dry conditions across most of the southern half of the region. Extremely dry conditions this June were present across central and northern Greece, southern part of North Macedonia and across much of northwestern quarter of Turkey, while a wider area – including Albania, the rest of Greece, along the central west-to-east belt over Turkey and over the Danube River lowlands – experienced moderate to severe drought. A 3-month overview of precipitation conditions also reveal that southern parts of the region recorded greatest lack of rain, especially southern half of Greece, western and northern Turkey and southern Romania where 3-monthly deficit indicates severely to extremely dry conditions, mostly on the account of severely to extremely dry April and June. Accumulated deficit between April and June indicated moderately dry conditions also locally across central and northeastern Balkan Peninsula, which comes as a result of moderate to severe precipitation deficit in May and June.

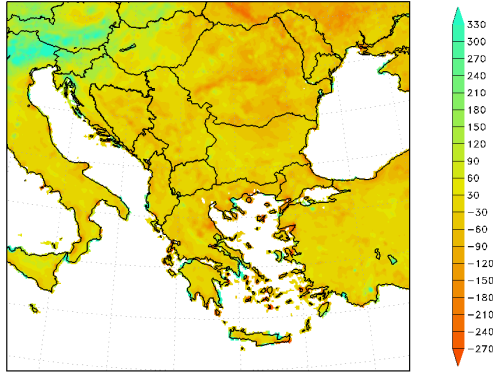
AIR TEMPERATURE AND SURFACE WATER BALANCE

Figures in this section show anomalies of the mean air temperature and accumulated surface water balance as well as their absolute values in percentile classes for the 60-day period between 1 May and 29 June 2024.



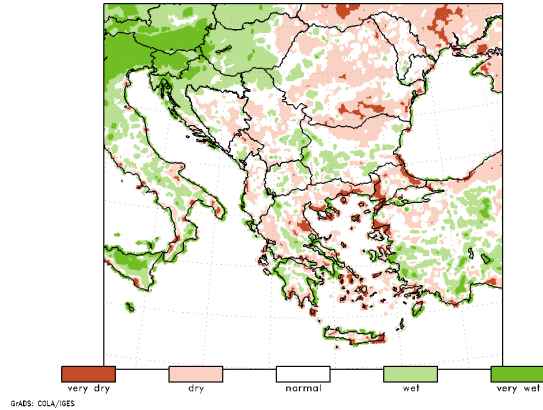
After an average end of May, June began with a warm spell that caught the region from the south. In Greece, Turkey, Bulgaria and southeastern Romania, air temperatures in first dekad of the month exceeded the long-term average for up to 5–6 °C, and in a wider belt from Montenegro to Moldova for up to 3–4 °C as the anomalies gradually decreased in northwestern direction. Mid-June brought a temporal relief to the northern parts of Balkan Peninsula, from Croatia to Moldova, while the warm spell continued across North Macedonia, Bulgaria, Greece and Turkey where dekadal mean air temperature remained up to 4–5 °C higher than normal. In final days of June, air temperatures on average 3–5 °C higher than normal spread over the rest of the Balkan Peninsula and southeastern Turkey, while the coastal areas between the Black Sea and the Aegean Sea recorded more or less average air temperatures. As June was on average warmer than normal over the entire region, while May was warmer than normal over the western half of Balkan Peninsula but on average colder than usual across wider Black Seas coastal area, the 60-day mean air temperature shows on average up to 2 °C warmer May-June period, in southern Greece and southwestern Turkey up to 3 °C.

ACCUMULATED WATER BALANCE
ANOMALY (mm)
1 MAY – 29 JUNE 2024



35: COLA/IGES

ACCUMULATED WATER BALANCE
PERCENTILE CLASSES
1 MAY – 29 JUNE 2024



34aES: COLA/IGES

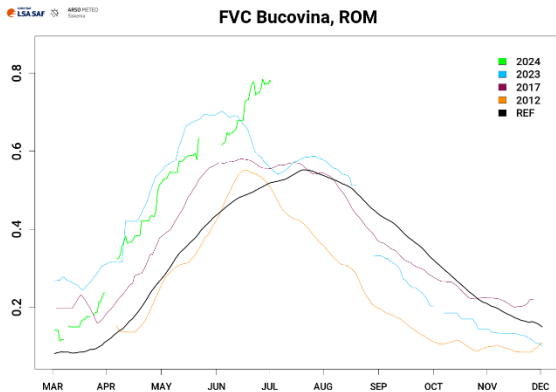
Warmer than normal air temperatures combined with noticeable lack of rain created considerable surface water balance deficit across most of the region this June, especially across southern half of Balkan Peninsula. As this came opposite to the wet and very wet surface water balance levels in that part of the region experienced in May, the 60-day accumulated surface water balance over the May-June period thus summer up to mostly not more than 90 mm of accumulated deficit, locally in central-eastern Greece up to 150 mm. Some higher was the 60-day accumulated surface water balance deficit across eastern Hungary, most of Romania and Moldova, between 90 and 150 mm, as a result of consecutive months of average to lower than usual surface water balance. On the other hand, northwestern quarter of the region recorded wet to very wet surface water balance levels in June as well as May, altogether resulting in the accumulated surplus of 150–270 mm.

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.

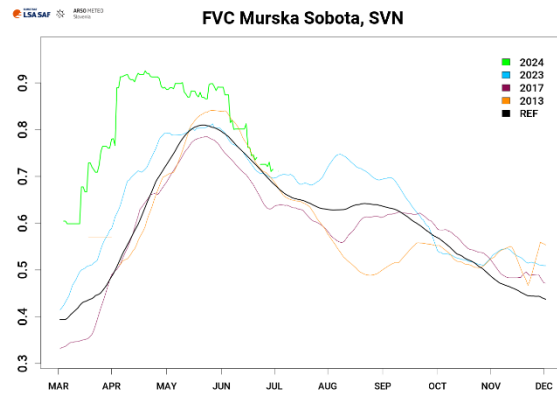
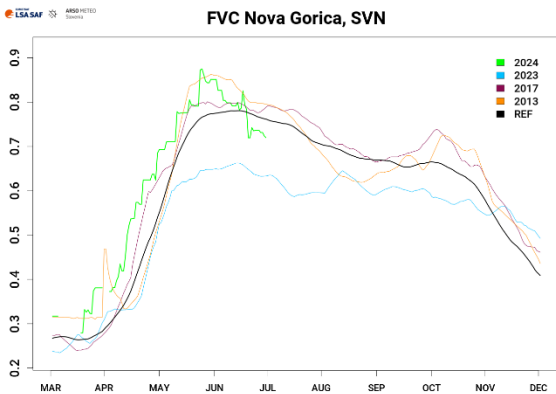
Graphs below present the **vegetation situation** as recorded **on 30 June 2024** at selected locations across southeastern Europe. FVC values for year 2024 are presented in green line. Graphs also include reference line (2004–2023) in black, and lines in light blue (year 2023), magenta (year 2017) and orange (year 2012, or 2013 for Slovenia) for comparison. Missing values or their sharp decline can be linked to prolonged cloudy weather, extreme weather events, snow blanket, human intervention or changes to product by the product provider.

ROMANIA



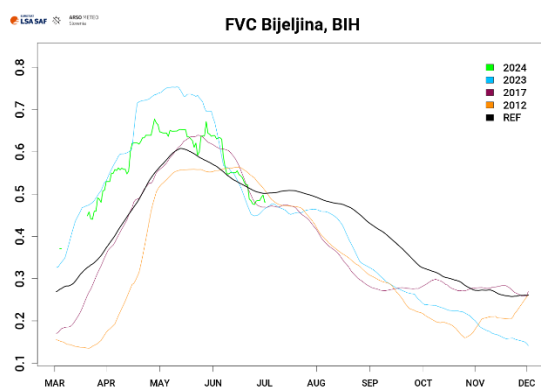
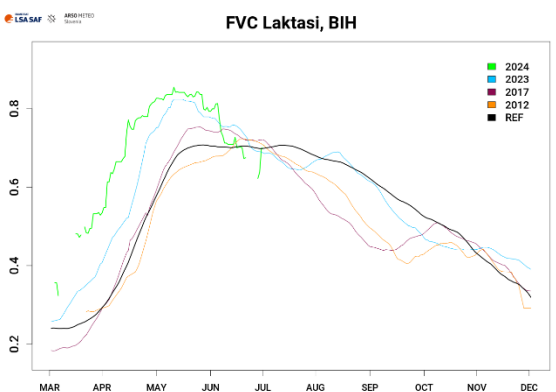
Vegetation development in Bucovina, northern Romania began on the base of slightly higher than normal vegetation cover in early spring, and, supported by favourable weather conditions, progressed well, at the higher than normal rate throughout the entire growing season. Level of cover with green vegetation progressively exceeded the average, from initial 10 % in April to approximately 30 % by the end of June, as it approaches its seasonal peak.

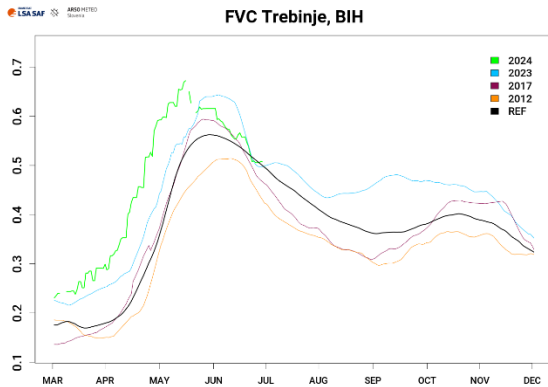
SLOVENIA



Vegetation growth began earlier than normal this spring in Nova Gorica, western Slovenia and progressed at its usual rate, meaning level of cover remained more or less two weeks ahead of its regular time throughout spring. Seasonal peak in late May was slightly exceeded, although June weather conditions appeared to have sped up senescence, with FVC values dropping faster than normal throughout June to below-average by the end of it. In Murska Sobota, northeastern Slovenia, vegetation had an abundant growing phase, as level of cover exceeded the average by 30 % by mid-April already. Total fraction of cover remained at 85–90 % until its seasonal peak, then June weather conditions soon brought it down to the average level of the end of the month.

BOSNIA AND HERZEGOVINA (REPUBLIC OF SRPSKA)

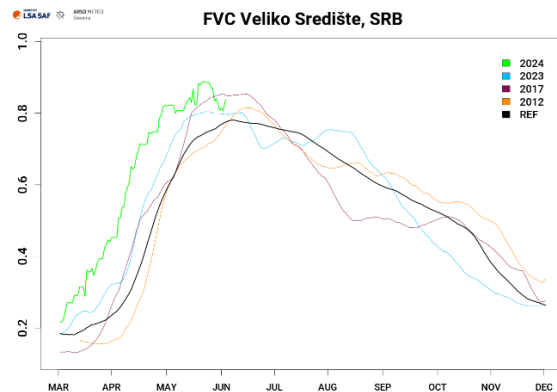
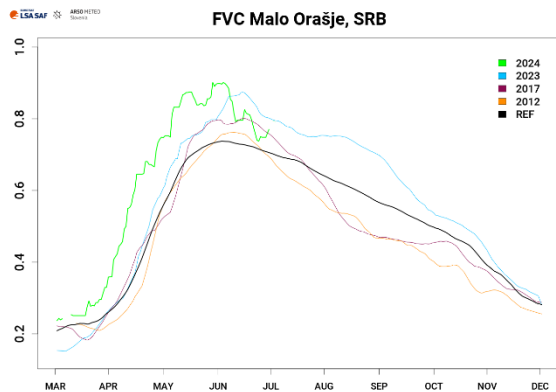




Vegetation season began earlier than normal at all three locations in Bosnia and Herzegovina, and on the base of slightly higher than usual level of cover. Favourable weather conditions throughout spring months supported regular growth, resulting in advanced level of cover throughout spring and exceeded seasonal peak cover in mid-May by 10–15 % at all three locations. Soon afterwards, the level of cover with green vegetation began declining faster than normal. In Bijeljina, northeastern Bosnia and

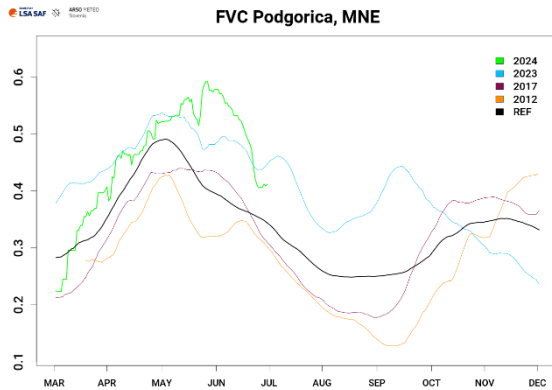
Herzegovina, the slightly exceeded vegetation cover was brought down to the average before the end of May, followed by a temporal recovery in early June, which ended as quickly as it came. Final days of June saw further drop of FVC to just below the average. Also in Laktasi, northern Herzegovina and in Trebinje in the south, FVC values declined faster than normal after the seasonal peak, dropping to more or less the average extent before the end of June.

SERBIA



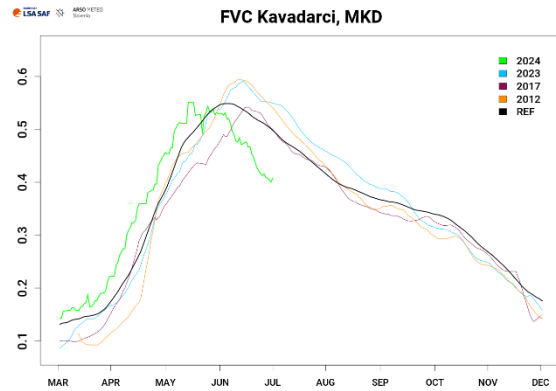
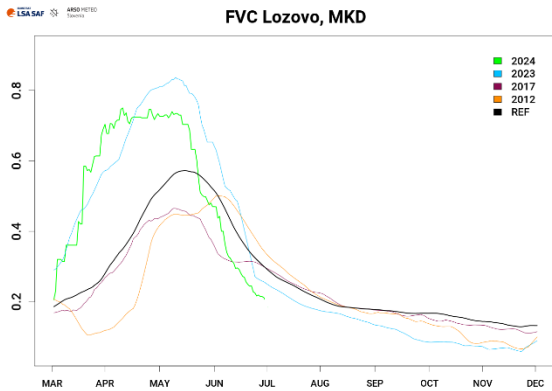
Vegetation season in Veliko Srediste, northeastern Serbia began in early March, almost a month earlier than normal, and as it progressed at its usual rate it reached its seasonal peak in late May at the level of cover up to 15 % higher than normal. FVC values for June are unfortunately missing. Vegetation season in Malo Orasje, central Serbia began in late March, which is still a week or two earlier than normal. Spring weather conditions supported its regular growth throughout April and continued into May, resulting in well exceeding the seasonal peak cover in mid-May, for up to 20 %. Throughout June, level of cover with green vegetation fell rapidly with occasional temporal boost, and dropped to just above average level by the end of June.

MONTENEGRO



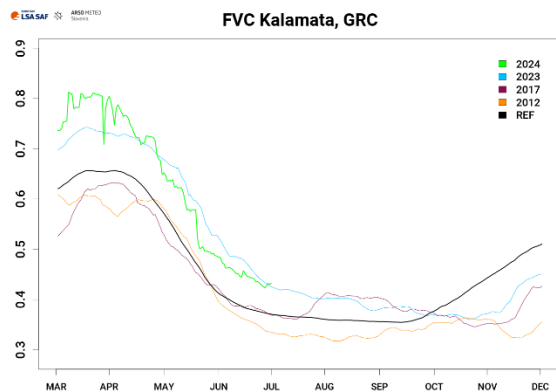
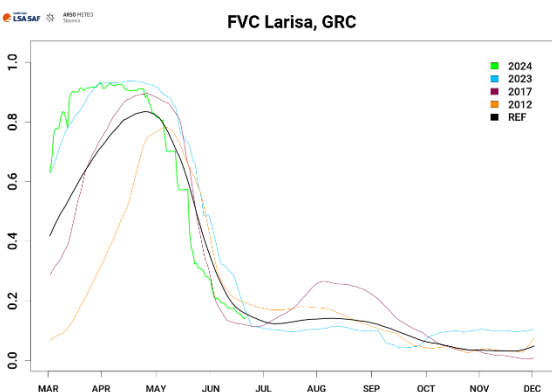
Vegetation development in Podgorica, southern Montenegro began in early March, up to a month earlier than normal. Spring weather conditions proved favourable for growth, as it lasted beyond the usual peak time, meaning the peak cover with green vegetation was this season reached a month later and at the extend approximately 10 % greater than normal. It then gradually fell throughout June to just above the average level before the end of the month.

NORTH MACEDONIA



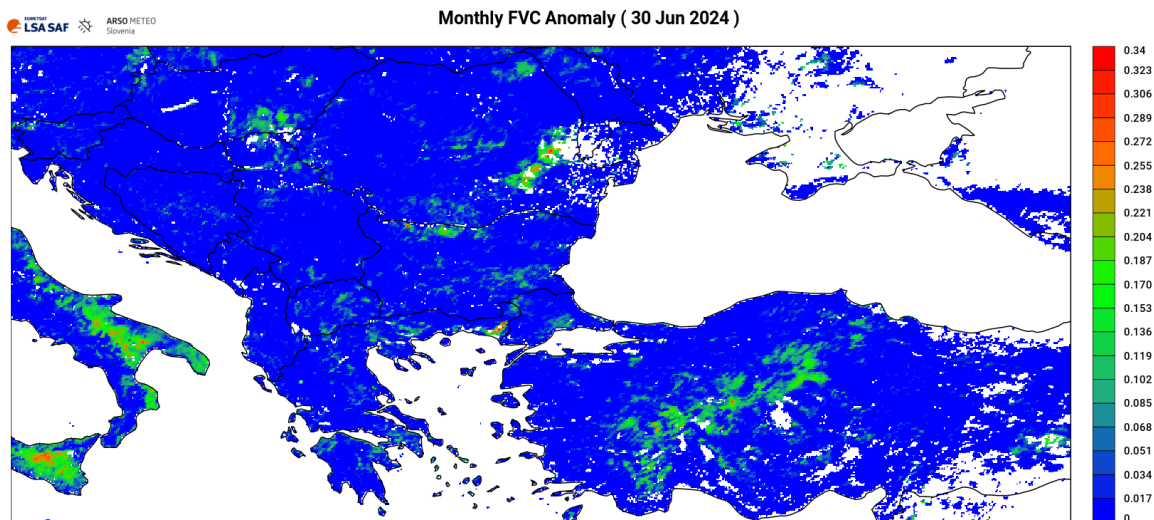
Vegetation development in Lozovo, central North Macedonia was this season boosted into growth a month earlier than normal. At the growing rate much higher than normal vegetation cover expanded to the level about 20 % greater than what is normally a seasonal high before mid-April already, and remained at this level until mid-May. The high cover was rapidly brought down to the average, and has been steadily declining since then. In Kavadarci, vegetation growth began only slightly earlier than normal and progressed at the usual rate although later weather conditions cut short the seasonal peak in mid-May and caused advanced decline of vegetation cover. With a steady decline since then, FVC stood 10 % below the average by the end of June.

GREECE



Vegetation at both locations in Greece experienced abundant growing part of the season. In Larisa, central Greece, vegetation development reached its seasonal peak in mid-March already, a month and a half earlier, and at the extent of 90 % of the area covered in green vegetation, which is 10 % more than at its average seasonal peak usually reached in early May. The extent of vegetation cover remained at this high level throughout the rest of March and April, however, later weather conditions brought it down to the average before mid-May, after which the decline of level of cover continued slightly ahead of its regular time. In Kalamata, southern Greece, the above-average level of vegetation cover continued into senescence phase, as despite the decline from April onward, FVC values remained about 10 % above the reference also by the end of June.

Figure below shows negative anomaly of **accumulated 30-day FVC values** as recorded **on 30 June 2024** in comparison to the past 20 years (2004–2023), and is used experimentally.



In June, various parts of the region recorded under-average level of cover with green vegetation. The greatest is the area stretching from southwestern, across central to northern Turkey where the fraction of vegetation cover was up to 20 % lower than it normally is at this time of year. Also up to 20 % lower was fraction of cover in southern Hungary, bordering over to Serbia and Romania, across northern Moldova and over scattered localised areas across vast area stretching from southern and eastern Greece, North Macedonia and over southern Bulgaria. Noticeably below the average are FVC values for southeastern Romania, where the fraction of vegetation cover was for this time of year 20–30 % lower than usual.

DROUGHT IMPACT REPORTS

GREECE

Many Greek islands, such as Gavdos, are facing the risk of **water scarcity** due to the mild winter and drought, which have resulted in insufficient replenishment of water reserves ^[1]. Given the increased demand during the tourist season, the risk of water supply interruptions is evident. The General Secretariat for Civil Protection has declared a state of emergency for Leros, Sifnos, and the municipality of Phaistos in Crete ^[2, 3, 4].

Agricultural production is also facing significant problems. In Crete, drought is affecting olive tree, vineyard, and greenhouse crops, and in several areas, restrictions on water consumption for irrigation per acre have been imposed, depending on the type of crop ^[4].

The reduced rainfalls over the past two years, the lack of snowfall, and the ongoing drought have resulted in decreased water quantities in **reservoirs** across the country. There has also been a significant drop in the water level of boreholes, and **salinization** is observed in many areas. The water reserves in Attica, which hosts half of the country's population, are on yellow alert ^[4, 5].

[1] <https://www.skai.gr/news/greece/gaydos-ekklisi-tou-dimarxou-se-katoikous-kai-touristes-gia-to-nero>

[2] <https://www.tanea.gr/2024/06/28/economy/economy-greece/leros-se-katastasi-ektaktis-anagkis-logo-leipsydrias/>

[3] <https://www.naftemporiki.gr/green/climate/1703104/se-katastasi-ektaktis-anagkis-kai-i-sifnos-logo-leipsydrias/>

[4] <https://www.skai.gr/news/environment/ereyna-skai-meionontai-oi-posotites-nerou-stous-apatamieytires-kampanaki-gia-leipsydria>

[5] <https://www.ethnos.gr/greece/article/322691/oefialthsthsleipsydriasepanerxetaisekitrinosynagermohattikhadeiazoynoitamieythrestosxediopoye xetazetai>

TURKEY

Due to the drought experienced in Yozgat, one of the important grain centers of the Central Anatolia Region, central Turkey, this year's **barley** harvest started two weeks early. Producers expressed yield concerns due to insufficient rainfall and drought ^[1]. Similar reports came from the region of Konya, central-southern Turkey, where despite an increase in planting areas compared to the previous year, there could be a 10 % decrease in barley yield due to drought ^[2].

Serious increase in temperature and insufficient rainfall in Izmir, northwestern Turkey affected the **water level in Tahtali Dam** that meets the city's drinking water needs. It was observed that the water level in the dam, the occupancy of which fell to 28 %, had receded completely and settlements had become more visible ^[3].

Prolonged lack of rain in Edirne, northwestern Turkey has caused the **flow of the Tunca River**, one of the city's important water resources that used to be a hot topic due to floods, to fall to its lowest level in recent years. Some sections of the river, where citizens normally swim and fish, completely dried up and could be crossed on foot ^[4]. Water drop in Tunca River left impact on **natural life** and cycles. Many other sections of the river still holding water turned green due to plants and algae forming on its surface, and the living space of the fish in Tunca also shrunk. It is observed that some heron birds could easily hunt in the river for this reason ^[5].

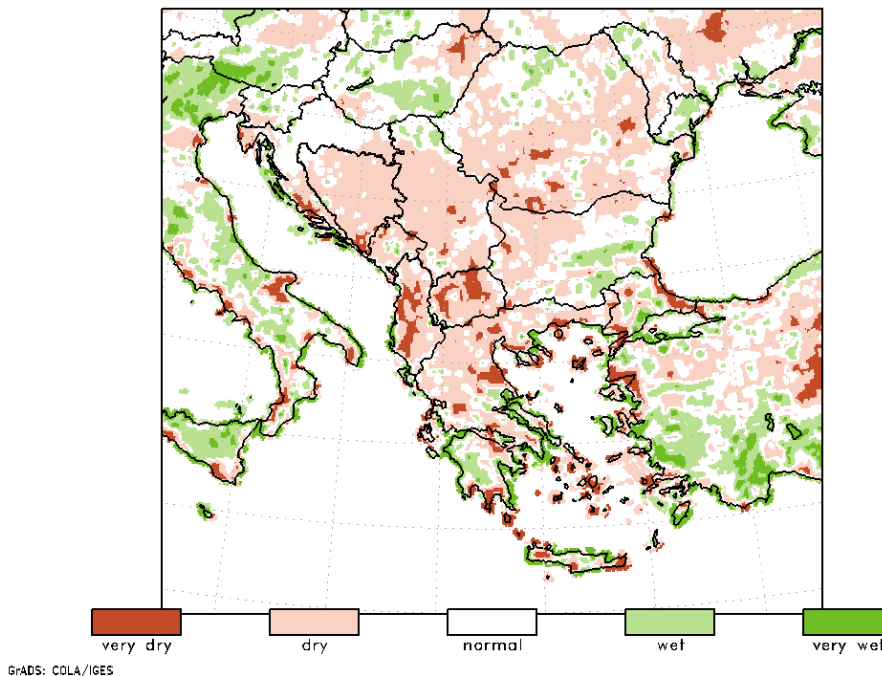
At the end of June, Tunca's flow rate was recorded as 2 cubic meters per second. The low water level in the river became source of concern also for **agriculture** producers in the region. Edirne

meets 50 % of Turkey's rice needs. Approximately 20 thousand acres of rice land benefit from the river. Along with rice, corn, clover, and the gardens that meet the city's vegetable and fruit needs are also irrigated from the river. As Tunca's flow rate has not increased also due to drought upstream in Bulgaria where the river springs, there have been **water conflict pressure** on Bulgaria to open the dams and release water ^[6, 7]. Due to the slowdown in flow and falling water levels, **controlled and rotational irrigation** has been implemented on the river. The Edirne Governorship decided that the irrigation in the upper villages close to the Bulgarian border be temporarily suspended, and gradual power cuts to be made across the downstream areas ^[8, 9].

- [1] <https://www.milliyet.com.tr/ekonomi/arpa-hasadi-erken-basladi-7140554>
- [2] <https://www.milliyet.com.tr/ekonomi/hububat-hasadinda-kuraklik-alarmi-7149753>
- [3] <https://www.milliyet.com.tr/gundem/izmir-barajlarinda-yaklasan-tehlike-7144378>
- [4] <https://www.posta.com.tr/gundem/kurakligi-en-net-anlatan-fotograf-balik-tuttuklari-nehir-kumsala-donustu-2727981>
- [5] <https://www.aa.com.tr/tr/yasam/tunca-nehrinin-yuzeyi-yosun-ve-su-mercimekleriyle-yesile-burundu/3258552>
- [6] <https://www.sabah.com.tr/yasam/tunca-nehri-kurudu-bulgaristanin-baraj-kapaklarini-acmasi-bekleniyor-6991732>
- [7] <https://www.sabah.com.tr/yasam/bulgaristana-suyu-sal-cagrisi-6993748>
- [8] <https://www.aa.com.tr/tr/gundem/tunca-nehrinde-kuraklik-nedeniyle-kontrollu-sulamaya-gecildi/3261674>
- [9] <https://www.aksam.com.tr/guncel/tunca-nehri-alarm-seviyelerine-geldi/haber-1486344>

OUTLOOK

Figure below shows model simulations of the **60-day accumulated surface water balance** in historical percentile classes for the time period **between 10 June to 8 August 2024**.



In comparison to the May-June situation, surface water balance conditions are in general expected to intensify across the region. Previously wet to very wet north-west is now foreseen to record surface water balance surplus only over localised areas while much of it will now experience normal or dry conditions. Similar change is expected over western Bulgaria, central Greece and central

Turkey where drier than normal conditions are now expected to prevail. Across much of the central Balkan Peninsula, surface water balance deficit is foreseen to last, with intensification to very dry conditions over local areas in Albania, North Macedonia, central Turkey and eastern Hungary.

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-hydrostatic 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 have a 5-percent range, and each of the middle three classes has 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 2023). Information on drought impacts are obtained from freely available online reports of national authorities and media newspapers.