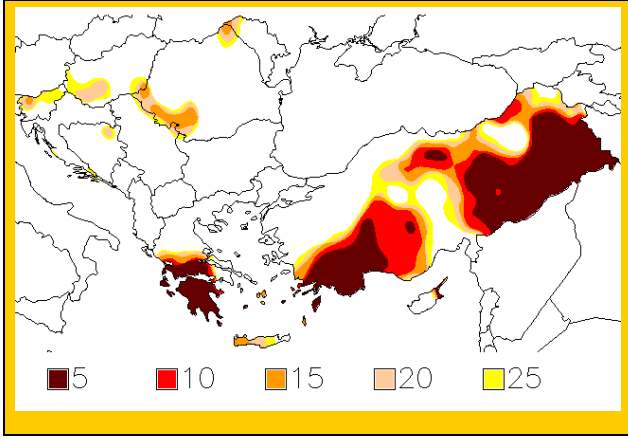
DROUGHT MONITORING BULLETIN

April 2021

HOT SPOT

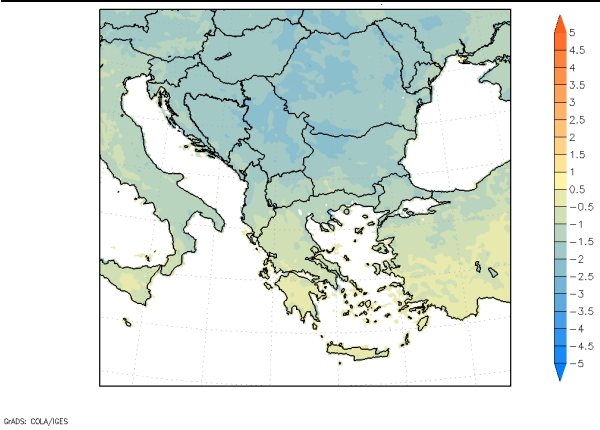


April brought considerable precipitation deficit to Turkey and southern Greece. In vast part of the area, including southern half of Greece, southwestern Turkey and across most of the eastern third of Turkey, the level of monthly precipitation classified among the lowest 5th percentile of local history. Precipitation level was noticeably lower than normal also in central Turkey and over its north-east, classified among the lowest 15th percentile of local historic records.

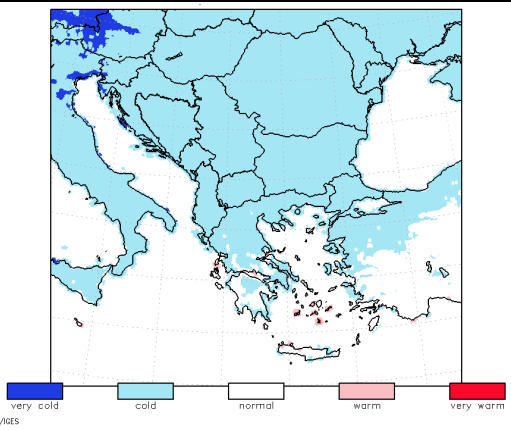
AIR TEMPERATURES AND SURFACE WATER BALANCE

*Figures in this section present anomalies of the average air temperature and accumulated surface water balance as well as classified values of the average **air temperature** and **surface water balance** in percentile classes for 60-day period **from 2 March to 30 April 2021**.*

AVERAGE AIR TEMPERATURE ANOMALY (°C)
2 MARCH – 30 APRIL 2021



AVERAGE AIR TEMPERATURE PERCENTILE CLASSES
2 MARCH – 30 APRIL 2021

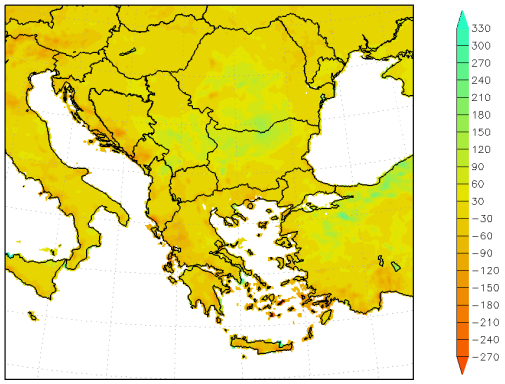


March to April period was in general colder than normal across the region. Average or under-average air temperatures of up to 2 °C prevailed most of the time, with negative anomalies of up to 4 °C and even some frost days occasionally present, and only a few shorter periods of average or warmer-than-normal air temperatures. The last dekad of March was unusually warm across the north-west of the region with mean air temperature up to 2 °C higher than normal

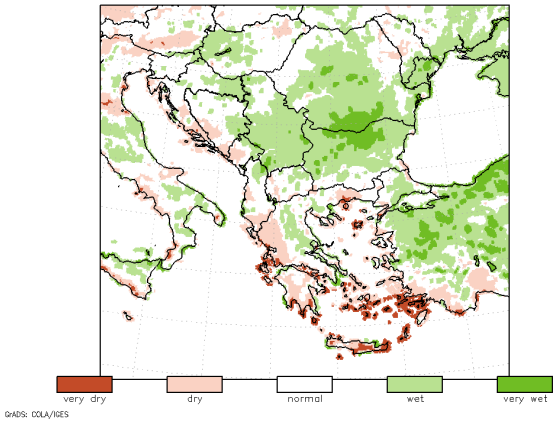
over northern Croatia, Slovenia and eastern Hungary, in mountainous areas up to 3 °C higher. During the same time, the anomalies stretched the opposite way over southern part of the region, air temperatures in Bulgaria and western Turkey were up to 4 °C colder than usual. Another such extreme conditions occurred in the last dekad of April. This time it was the southern parts of the region that experienced well above average air temperatures, up to 2 °C over southern half of Greece and up to 4 °C over southwestern Turkey, while unusually cold air temperatures spread across the far northern areas including Hungary, northern Romania and Moldova where a 10-day mean was up to 4 °C below the average, in northeastern Hungary and northern Moldova up to 5 °C lower.

However, despite the alternating air temperature conditions across the two poles of the region throughout March and April, the average or below-average conditions prevailed, thus resulting in the 60-day mean value up to 2 °C colder than normal over the entire northern half of Balkan Peninsula. In northwestern quarter of Romania, central Serbia and northwestern Bulgaria the anomalies were even lower, up to 2.5 °C below the average. Only southern Greece and southwestern Turkey ended the 60-day period with mean air temperature ranging about the long-term average for this time of year.

ACCUMULATED WATER BALANCE ANOMALY (mm)
2 MARCH – 30 APRIL 2021



ACCUMULATED WATER BALANCE PERCENTILE CLASSES
2 MARCH – 30 APRIL 2021

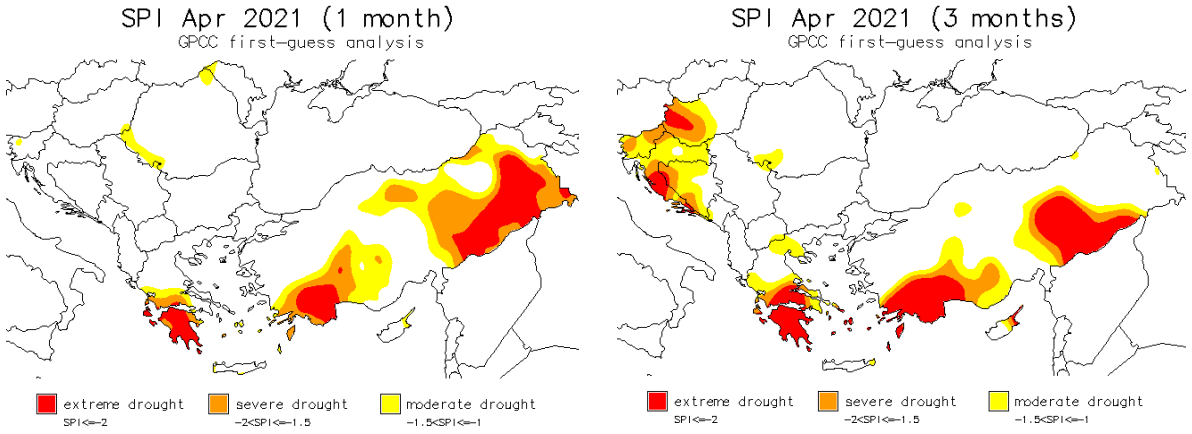


March to April period brought favourable precipitation conditions to areas in central Balkan Peninsula encircling southern half of Serbia, northern Bulgaria and central Romania, and to areas along the northern Turkey. Especially March but April as well brought precipitation level higher than normal, resulting in the 60-day surface water balance surplus between 60-120 mm, over the Bulgaria-Romania border area up to 150 mm, and along the Black Sea area in Turkey up to 180 mm. In Hungary, Slovenia and in along the Adriatic Sea, March was a dry month and although precipitation level was favourable again in April and conditions mainly normalized in that part of the region, it did not overcome the March precipitation deficit in far northeastern Hungary and the Alpine part of Slovenia, where surface water balance was up to 60 mm lower than normal, and along the southern Adriatic Sea where the deficit of up to -150 mm was present. On the other hand, a dry period throughout March as well as April was experienced along the western and far northeastern Greece, in April also along the country's south and in southwestern Turkey. Over that time, surface water balance deficit accumulated to 60-120 mm in that part of the region.

STANDARDIZED PRECIPITATION INDEX

The drought situation with regard to the precipitation accumulation is presented by Standardized Precipitation Index (SPI). The SPI calculation is based on the distribution of precipitation over long time periods (30 years, in our case long-term average 1961-1990 was used). The SPI can be calculated at various time scales which reflect the impact of the 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 **April 2021** 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.



According to SPI, April was a dry month especially in southern half of Greece and in the Turkey's south-west and across its eastern third. Precipitation level over these areas mostly classified in the lowest 5th percentile, indicating extreme drought conditions in April. The lack of precipitation was evident also in central Turkey as well as in a belt along western Romania and over the northernmost border area with Moldova, although to a lesser degree, where monthly accumulations ranked among the lowest 20th percentile and SPI values indicate moderate drought conditions.

A 3-month overview of precipitation conditions from February to April indicate drought conditions of various degree across a wider part of the region. Continuous precipitation deficit is noticed over southern Greece where SPI values indicate severe to extreme drought conditions in February and April and moderate to severe in March. Monthly precipitation level along southern and central Turkey was extremely low in February, then again over its southwest and east in April, while March saw no evident deficit. A 3-month overview reveals drought conditions of various degree also over the region's north-west, mostly as a result of moderate drought conditions in February, followed by severe to extreme drought conditions in March.

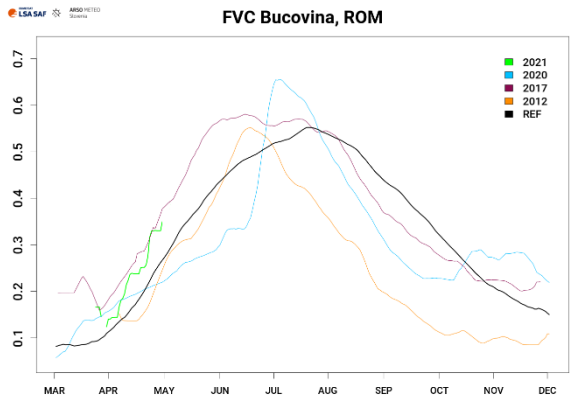
REMOTE SENSING - FRACTION OF VEGETATION COVER

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 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, then FVC slowly drops with vegetation senescence. Line shape depends on sort of the vegetation.

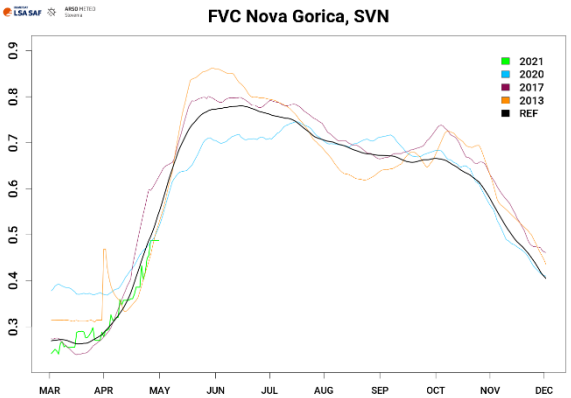
Graphs below present the **vegetation situation** as recorded **on 30 April 2021** in some regions of Southeastern Europe. FVC values for year 2021 are presented as a green line. Graphs also include reference line (2004–2020) in black, and lines in light blue (year 2020), magenta (year 2017) and orange (year 2012, or 2013 for Slovenia) for comparison. Possible missing values or sharp decline of values could be a result of prolonged cloudy weather, extreme weather events or snow blanket.

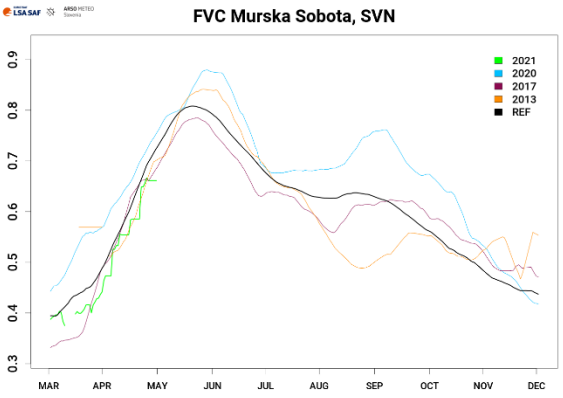
ROMANIA



In Bucovina, northern Romania, vegetation growth progressed well these spring months. No unusual decline is observed in April, moreover, continuous run of FVC values above the long-term average line indicates favourable weather conditions for vegetation development. FVC values at the show that vegetation cover was about 10 % higher than normal.

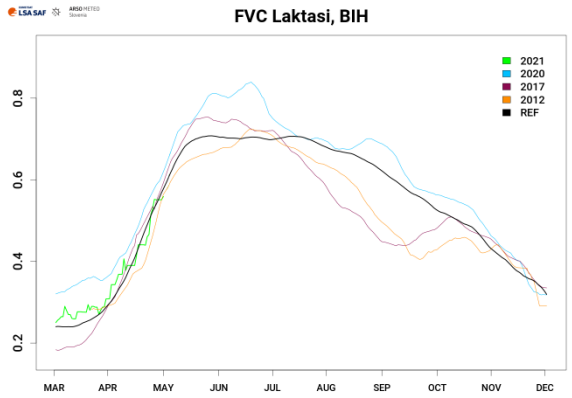
SLOVENIA

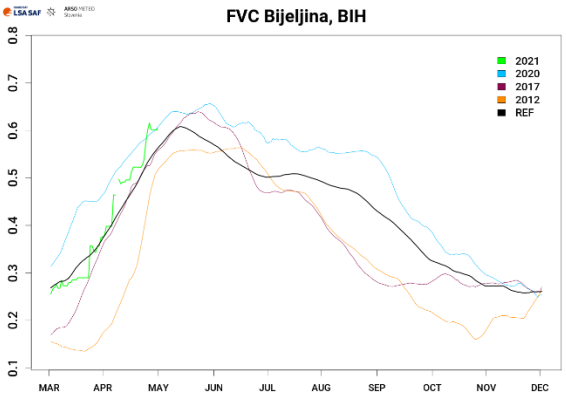


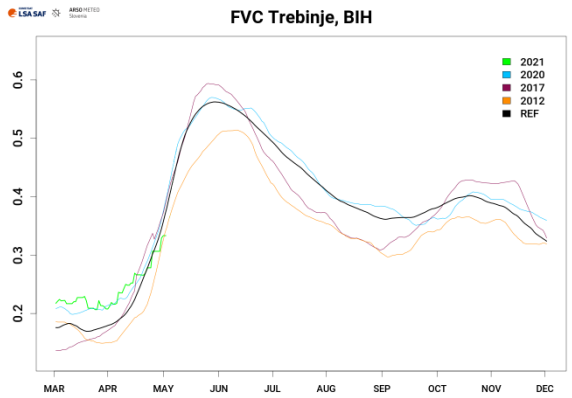


Vegetation development in Nova Gorica, western Slovenia progressed as expected throughout spring months, while in Murska Sobota, northeastern Slovenia, a delay of vegetation growth in March can be seen from the FVC graph as values indicate vegetation growth began less than a month later than normally. Since then, it continued to develop at its usual rate.

BOSNIA AND HERZEGOVINA (REPUBLIC OF SRPSKA)

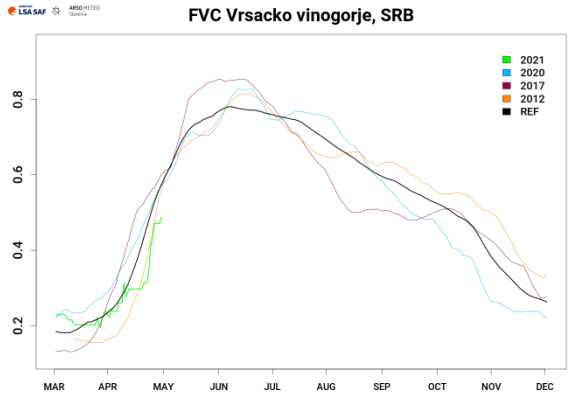


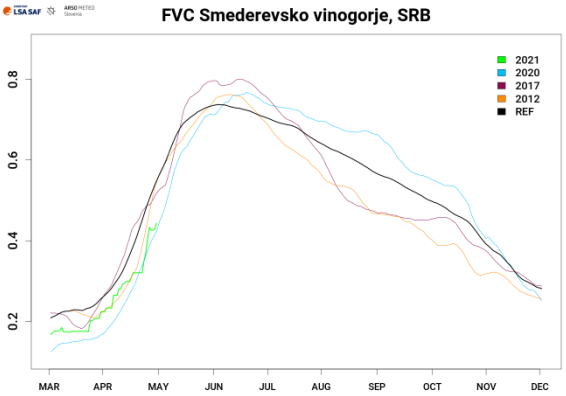




Vegetation season started as expected in Laktasi, northern Bosnia and Herzegovina as no major deviation from its average growth pattern can be observed throughout March and April. According to FVC values, there seemed to be a short delay in vegetation growth in Bijeljina, northeastern part of the country, while it recovered well before the end of March and continued to progress at a slightly higher rate than usual, exceeding the average values from mid-April onward. The opposite trend can be observed for Trebinje, southern Bosnia and Herzegovina where vegetation season started well with above-average fraction of cover with green vegetation throughout March and first half of April but weather conditions did not allow this positive trend to continue. Instead, a slower rate of progress in vegetation development can be observed from mid-April onward.

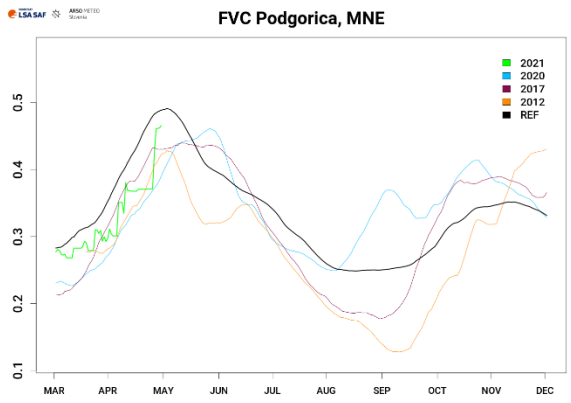
REPUBLIC OF SERBIA





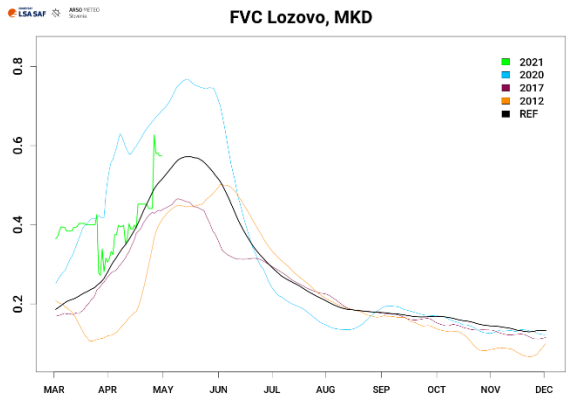
In Vrsacko vinogorje, northeastern Serbia, vegetation development progressed in its usual pattern up until mid-April when a period of stagnation of growth is observed via FVC index. It recovered by the end of the month and continued to progress at its usual rate, although the stagnation period resulted in FVC values at the end of April standing approximately 10 % lower than normal. In Smederevsko vinogorje in central Serbia, vegetation development began few weeks later than normal, as can be seen from FVC values. When growth boosted in early April, it continued to develop at the usual rate for early spring except a short delay is noticed.

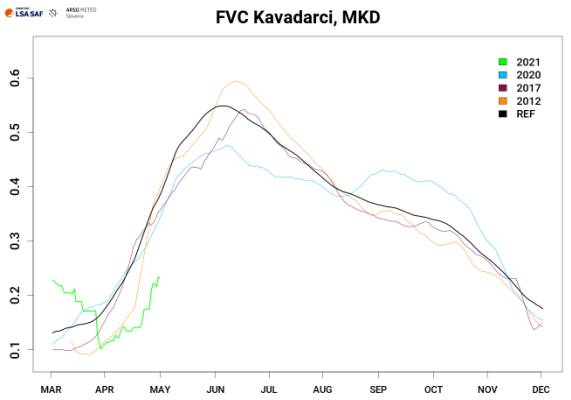
MONTENEGRO



Vegetation in Podgorica, southern Montenegro experienced a set of boosts and declines in March and April. Weather conditions did not prove to be favourable to vegetation development in March as it progressed at a rate much slower than normal. Early April seemed to encourage the vegetation development, although FVC values for mid-April show a clear stagnation in vegetation growth, followed by a boost in late April. Despite its unusual pattern of development, vegetation cover did not leg behind its average values at the end of April.

NORTH MACEDONIA

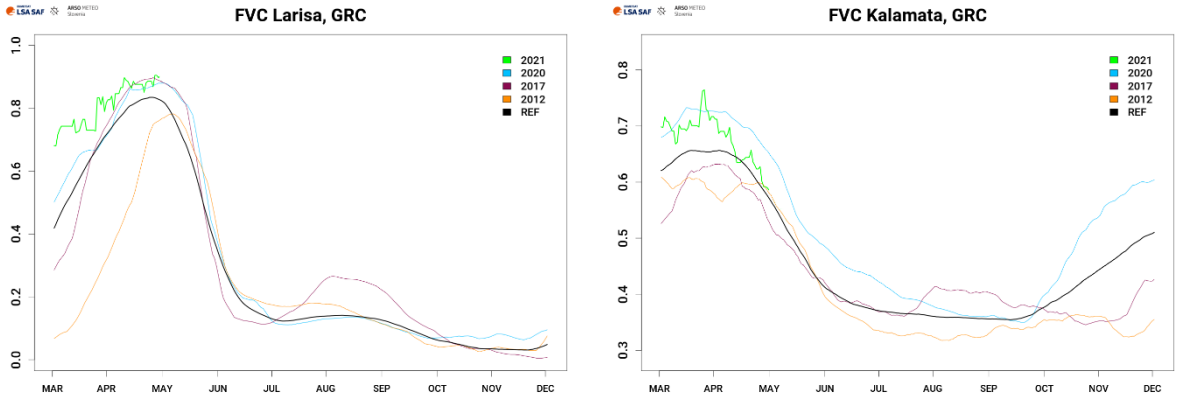




Vegetation season started well in Lozovo, central North Macedonia. The development of vegetation started earlier than normal, resulting in almost twice as high vegetation cover than usual by the beginning of March. FVC values then reveal a sudden decline of vegetation cover in last days of March, likely due to reason other than drought. Despite the sharp loss in fraction of vegetation cover, vegetation growth continued as usual for this time of year and saw a great boost in its development in final days of April, again exceeding the level of cover usual for the late April. In Kavadarci, southern part of North Macedonia, favourable weather conditions boosted vegetation growth in first months of the year, however, a gradual decline can be observed throughout March, followed by a sudden drop of FVC values at the

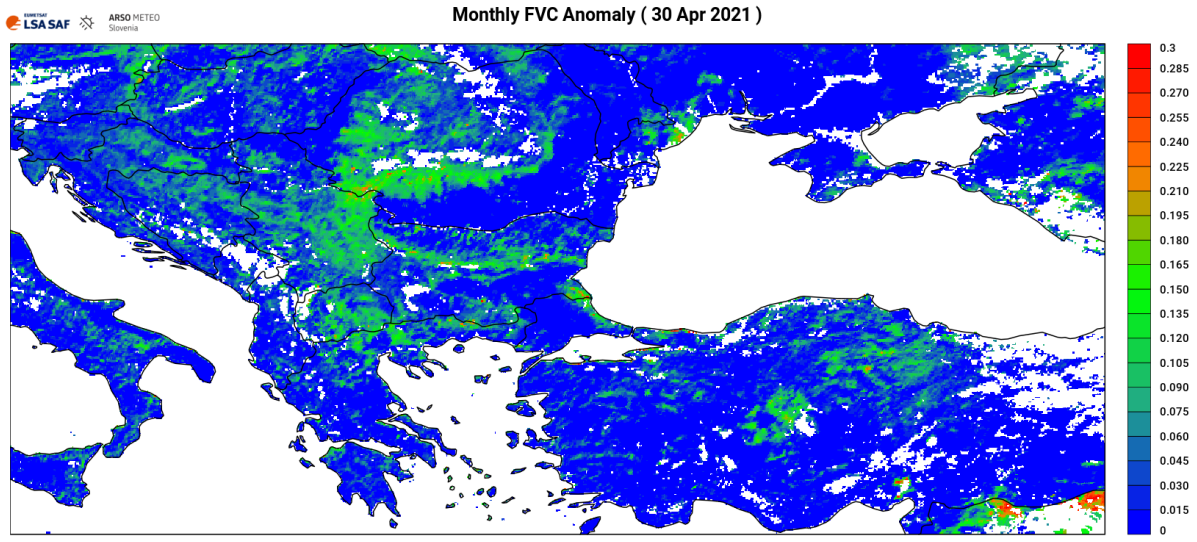
end of the month, similar but less sharp to that experienced also in central part of the country. From April onward, vegetation development continued at its usual rate for spring months although reaching the expected vegetation cover approximately 2-3 weeks later than normal as a result of decline experienced in late March.

GREECE



Vegetation in both Larisa, central Greece and Kalamata, southern Greece, had a promising start to the season, beginning its development earlier than usual. In early March, the extent of the vegetation cover was up to 10 % higher than normal in Kalamata and approximately 25 % higher in Larisa. At both locations, vegetation development surpassed the level of the vegetation cover at their peak of the season. FVC values for Larisa indicate similar vegetation development as in last year or in year 2017 and for Kalamata, FVC values show vegetation senescence follows the expected timing and rate.

Figure below shows negative anomaly of **accumulated 30-day FVC values** as recorded **on 30 April 2021** in comparison to the past 17 years (2004-2020), and is used experimentally.



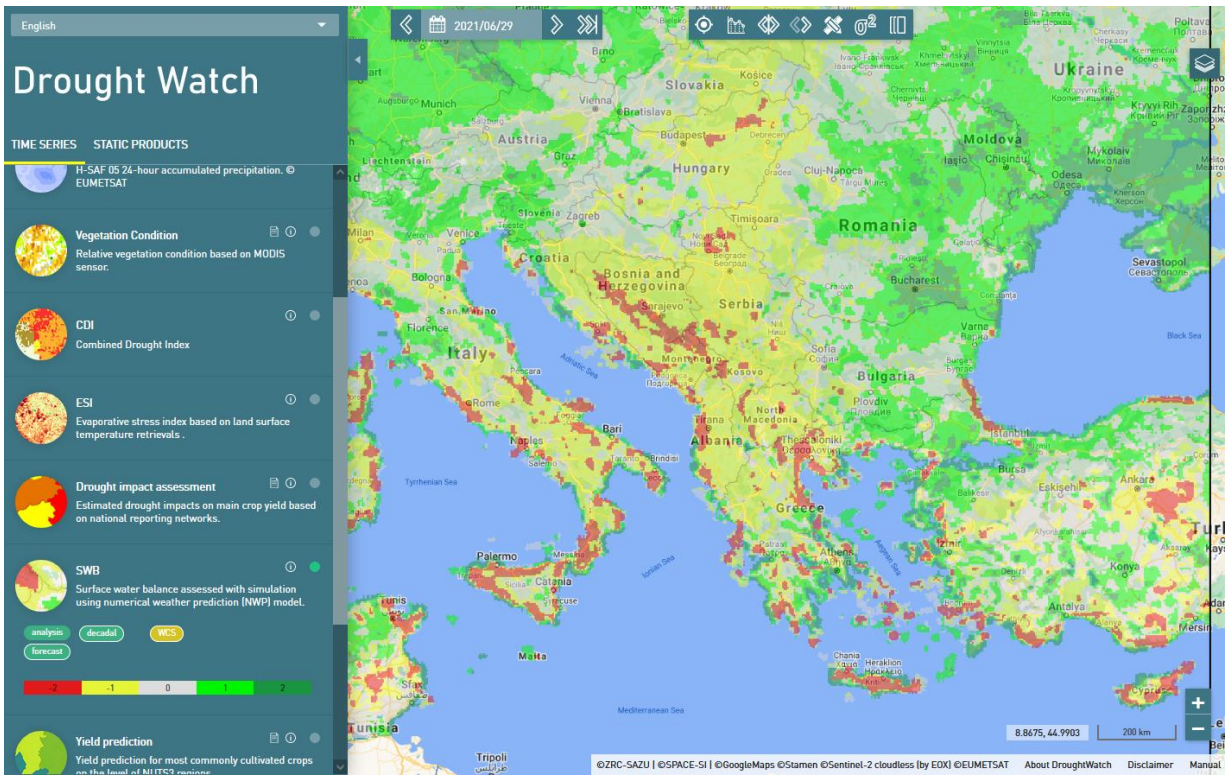
FVC accumulations over April show vegetation growth was lagging behind or did not develop to its usual level over a wider area across the inland part of the region, especially in North Macedonia, central Serbia, western and central Romania, central Turkey and to some degree also along mountainous terrain. The coverage with green vegetation over that part of the region was approximately 10-15 % smaller than usual for this time of year.

IMPACT REPORTS

No drought impacts on the environment were reported across the region.

OUTLOOK

Figure below presents model simulations of the **60-day accumulated surface water balance anomaly** in historical percentile classes for the time period **from 1 May to 29 June 2021**, as seen in Drought Watch tool[1].



[1] https://www.droughtwatch.eu/

In terms of percentile comparison with the long-term records, the accumulated surface water balance will prove wet to very wet in western half of Slovenia but mostly also in countries along the eastern part of the region, from Moldova to Bulgaria, over the Bosporus area and locally over the Aegean Sea and western Turkey. Surface water balance conditions are expected to be unfavourable for the topsoil layer across the rest of the region, especially its

central third and western parts, classifying as dry to very dry compared to the long-term. Also Crete island and local coastal parts in the Aegean Sea area and Mediterranean Turkey will experience very dry surface water balance conditions for this time of year.

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 1991 and 31 December 2020. 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 (1991-2020), 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.