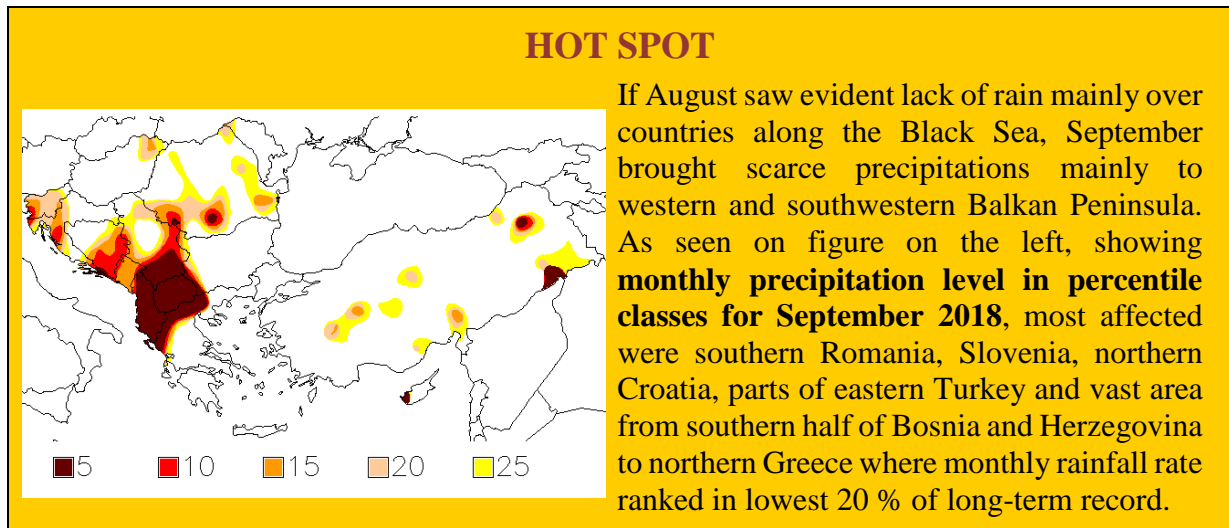


# DROUGHT MONITORING BULLETIN

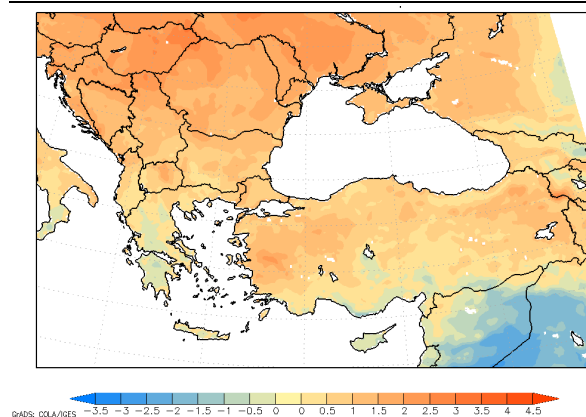
19<sup>th</sup> October 2018



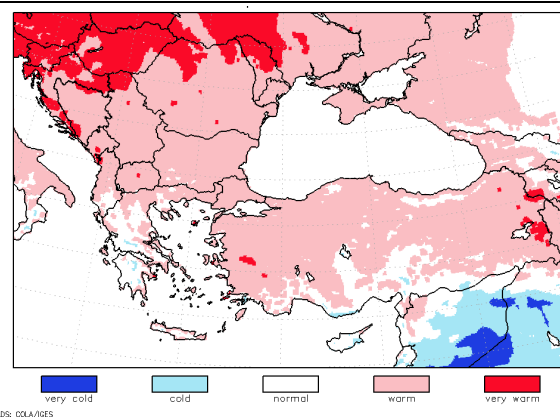
## AIR TEMPERATURES AND SURFACE WATER BALANCE

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 30<sup>th</sup> July to 27<sup>th</sup> September 2018**.

AVERAGE AIR TEMPERATURE  
ANOMALY (°C)  
30<sup>th</sup> JULY – 27<sup>th</sup> SEPTEMBER 2018



AVERAGE AIR TEMPERATURE  
PERCENTILE CLASSES  
30<sup>th</sup> JULY – 27<sup>th</sup> SEPTEMBER 2018



September began with air temperatures noticeably warmer than usually all across the region. Highest anomalies of up to 4 °C were spread over most of eastern half of Balkan Peninsula and northwestern half of Turkey, while over southeastern Moldova and in local parts of northeastern Hungary, northern Bulgaria, across Romania and western Turkey they stretched even up to 5 °C. Positive anomalies evenly declined towards the rest of the region, with air temperatures up to 2 °C above the average in a belt area from Slovenia along Adriatic Sea coastline to

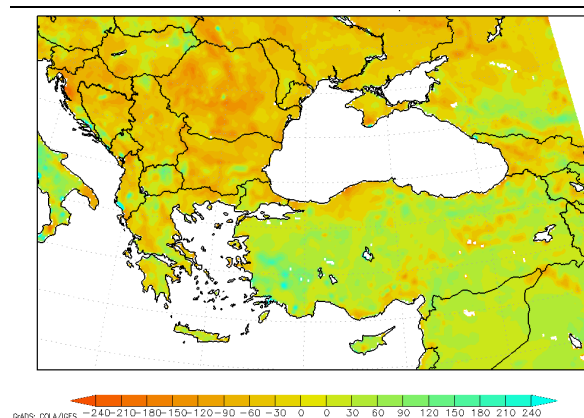
southern Greece, and over most of southeastern Turkey. Lowest anomalies, although still 1 °C above the average, were present in a thin belt along southern Turkey.

Second decade of September brought noticeable changes across many parts of the region. Anomalies increased over its northwestern corner as air temperatures exceeded the average for 3–5 °C over Slovenia and northern Croatia, while anomalies generally dropped elsewhere in the region: air temperatures were up to 3 °C higher than normally over southwestern Romania and in a belt from northern Moldova to Bosnia and Herzegovina, and between 0–2 °C over the rest of Balkan Peninsula, northwestern Turkey and most of its eastern half. Anomalies were even lower, up to 1 °C below the average, in central-western and locally in southeastern Turkey. Over wide part of its southwest, air temperatures were up to 2 °C colder than usually.

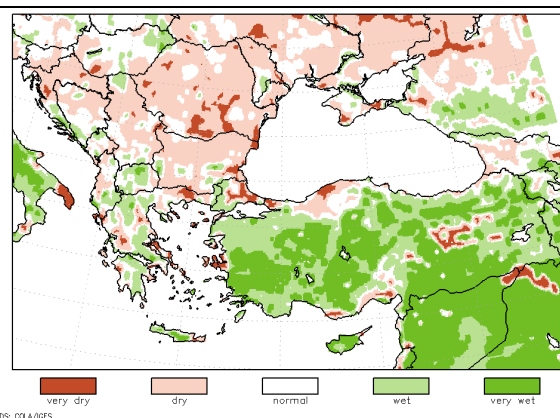
Last decade of September saw below-average temperatures spread all over Balkan Peninsula and northern part of Turkey. In outer areas of Balkan Peninsula, mainly across Moldova and eastern Romania, northeastern Hungary, Slovenia and all along the Adriatic Sea coastline, air temperatures did not exceed the average for more than 1 °C while anomalies of –1 °C were present all over the rest of Balkan Peninsula and central and northwestern Turkey. Locally in central Serbia, southern Bulgaria, continental Greece and over northern Turkey, air temperatures were up to 2 °C colder than normally, classifying them among coldest 5 % of the record. Meanwhile, Turkey’s south-west, southern border area and east experienced unusually warm air temperatures again as anomalies exceeded the average for up to 2 °C, locally across southeastern and southwestern Turkey even up to 3 °C.

60-day overview of air temperatures during August and September shows they were continuously well above the average over northern half of Balkan Peninsula, thus resulting in anomalies over the 60-day period ranging between 2–3 °C. Over central Balkan Peninsula and far western and eastern parts of Turkey, air temperatures were above-average as well, exceeding normal values for 1–2 °C. As a result of alternating periods of warmer-than-usual and colder-than-usual air temperatures in wide part of northern and central Turkey during August and September, the 60-day mean shows normal to slightly positive anomalies, up to 1 °C. While all along southern Turkey and continental Greece, air temperatures were colder than usually, especially in August, meaning negative anomalies of up to 1 °C below the average.

ACCUMULATED WATER BALANCE  
ANOMALY (mm)  
30<sup>th</sup> JULY – 27<sup>th</sup> SEPTEMBER 2018



ACCUMULATED WATER BALANCE  
PERCENTILE CLASSES  
30<sup>th</sup> JULY – 27<sup>th</sup> SEPTEMBER 2018



On a 60-day scale, most of Balkan Peninsula experienced deficit of accumulated surface water balance while positive values were detected mainly across Turkey where, in comparison to July-August overview, conditions were slightly wetter: although its northern and northwestern part along Black Sea remained the driest, the deficit has lowered to between –90 mm and –150 mm.

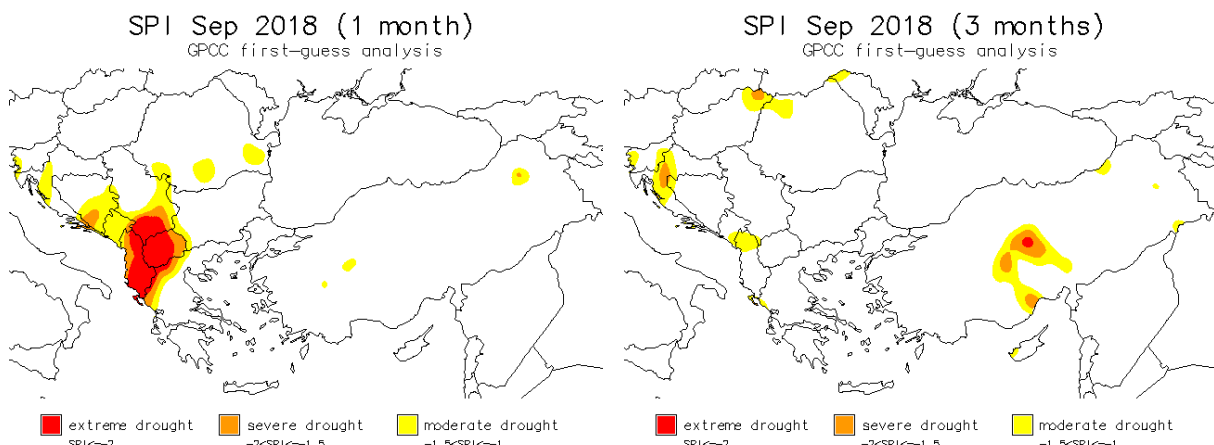
Similarly also for scattered parts along mountainous area from south to northeast of Turkey as water balance deficit did not exceed  $-90$  mm. The rest of the country remained wet with surplus of up to  $60$  mm, in far western Turkey between  $120-180$  mm.

On the other hand, lack of rain and high temperatures noticeably worsened surface water balance across Balkan Peninsula, compared to July-August situation. Deficit, previously present only over its northern areas, now deepened and spread all across it. Highest deficit remained over middle coastal Croatia, up to  $-180$  mm, also most of Romania experienced high deficit, ranging mainly between  $-90$  mm and  $-150$  mm. Elsewhere across Balkan Peninsula surface water balance dropped below the average for between  $-30$  mm to  $-90$  mm, with exception of scattered localized areas, smaller and fewer in number compared to July-August situation, where water balance remained in positive values. They were detected mainly over southern Croatia and southern Albania ranging between  $180-210$  mm, far northeastern Hungary, up to  $120$  mm, northern Serbia and central FYR Macedonia with surplus of up to  $90$  mm and locally over eastern half of continental Greece where it ranged mainly between  $30-60$  mm.

## 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.

Precipitation level in September was extremely low over southern Serbia, Albania, FYR Macedonia and a belt area along northern Greece, bringing extremely dry conditions to that part of the region. Due to precipitation deficit, classified in lowest 15<sup>th</sup> percentile, moderate to severe drought conditions were present in Montenegro, southern half of Bosnia and Herzegovina and in parts of northwestern Balkan Peninsula, southeastern Serbia, locally along southern Romania as well as central-western and northeastern Turkey. Over the past 3 months, different parts of the region experienced extremely low precipitation level on monthly scale. However, evident lack of rain on a 3-month scale was noted mainly in central to southern Turkey and on outer areas of Balkan Peninsula, including far western Greece, northern Albania, wider central Croatia, western Slovenia and northern parts of Hungary, Romania and Moldova.



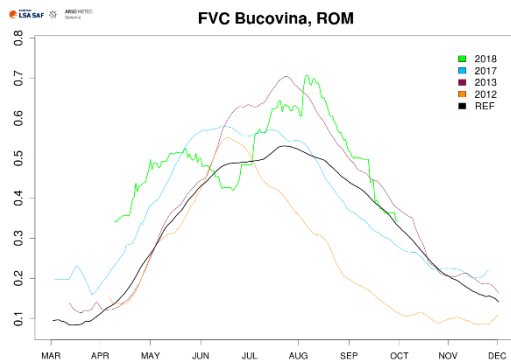
## REMOTE SENSING – FRACTION OF VEGETATION COVER

*Fraction of vegetation cover (FVC) is vegetation index, based on multi-channel remote sensing measurements (data from Eumetsat's LSA SAF 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 and then FVC slowly drops with vegetation senescence. Line shape depends on sort of the vegetation.*

Graphs below present the **vegetation situation** as recorded on **29<sup>th</sup> September 2018** in some regions of Southeastern Europe. FVC values for year 2018 are presented as green line. Graphs also include reference line (2004–2017 period) in black, and lines in light blue (year 2017), magenta (year 2013) and orange (year 2012) for comparison.

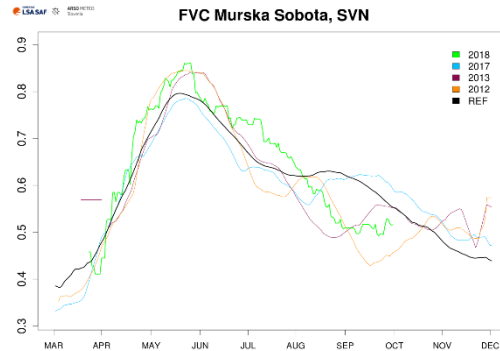
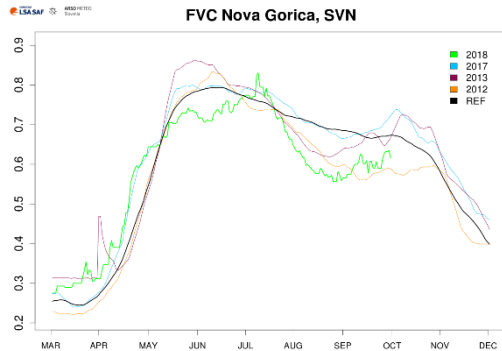
Possible missing values or sharp decline of values could be a result of a prolonged cloudy weather, extreme weather events or snow blanket.

### ROMANIA



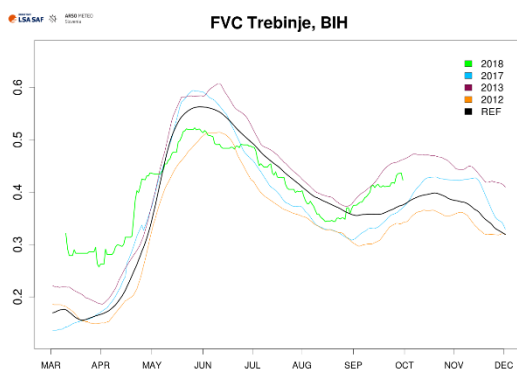
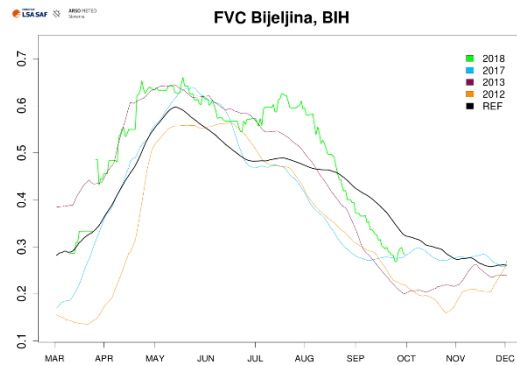
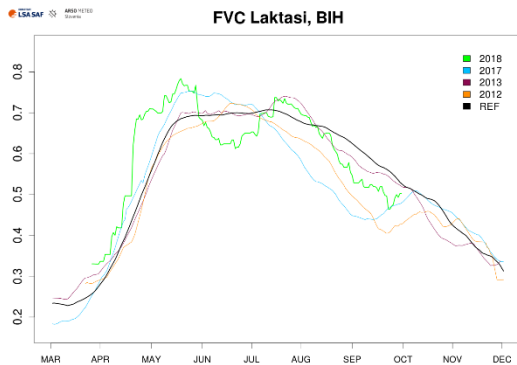
In Bucovina, vegetation development reached its peak of the season in mid-August, slightly later than usually, and exceeded it for almost 20 %. Decline in vegetation cover that followed occurred at the higher rate than normally, especially in September. However, due to greatly exceeding average vegetation cover during summer months, FVC index stood at usual values at the end of September.

### SLOVENIA



Vegetation development in Nova Gorica in western Slovenia experienced unusually strong decline since early July that lasted until late August when, according to FVC values, vegetation cover was about 15 % below the average values for that time of year. Vegetation development has progressed throughout September although it remained below-average at the end of the month. August saw similar negative changes in vegetation development also in Murska Sobota in northwestern Slovenia but further declining stopped in September. At the end of vegetation season, FVC values for Murska Sobota were slightly under-average.

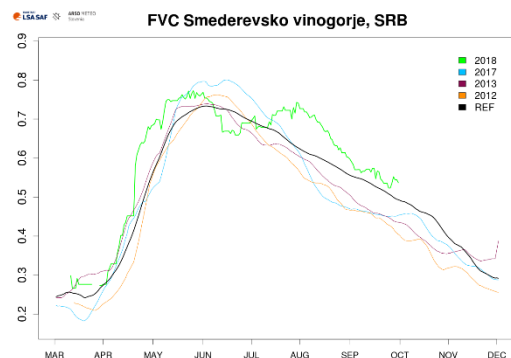
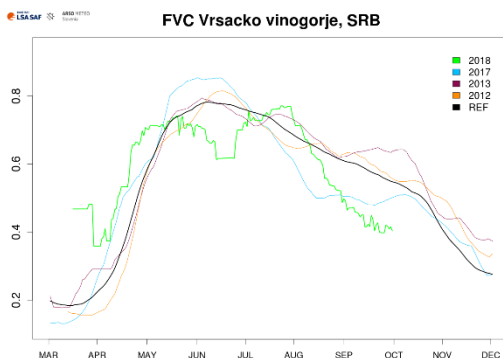
## BOSNIA AND HERZEGOVINA (REPUBLIC OF SRPSKA)



Vegetation in Laktaši and Bijeljina along northern Bosnia and Herzegovina followed similar development patterns this vegetation season. Compared to usual state, FVC index shows continuously exceeding values for Bijeljina all vegetation season until mid-August. Then, vegetation at both location started experiencing a strong decline which resulted in continuously under-average FVC values throughout September but with a slight improvement indicated in last days of

the month. In southern Bosnia and Herzegovina (Trebinje), vegetation season started with above-average level of vegetation cover. From May to mid-August, development followed the usual pattern although the level of vegetation cover was continuously slightly under-average. Another boost in vegetation growth, usually expected to come in autumn months, this year began in late August already and has since then progressed similarly as in year 2013.

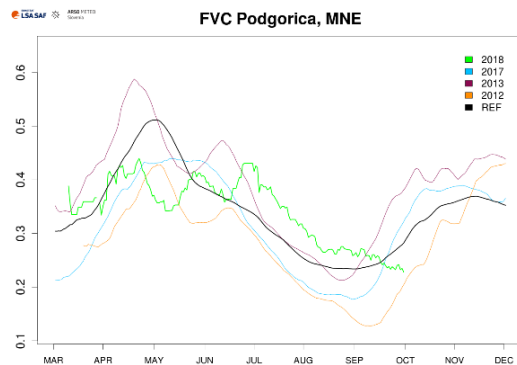
## REPUBLIC OF SERBIA



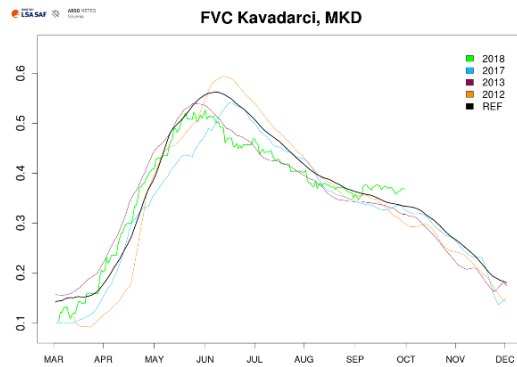
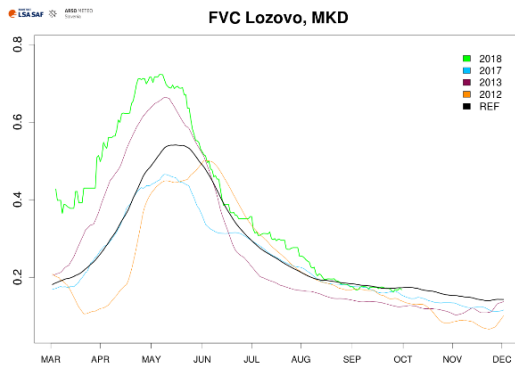
Vegetation developed relatively well in first months of vegetation season both in Vršacko vinogorje in northeastern Serbia as well as Smederevsko vinogorje in central Serbia. During mid-May to mid-June period, vegetation declined which was unusual for the two locations but was followed by another boost in July. Since early August, vegetation has been declining but at higher rate than normally, especially in Vršacko vinogorje where vegetation cover at the end of September was about 15 % smaller than normally this time of year. Due to favourable conditions in July which resulted in another boost of vegetation growth this summer, FVC values for central Serbia remained above-average also at the end of September.

## MONTENEGRO

Vegetation growth in Podgorica followed its usual pattern only until mid-April, then unfavourable weather conditions of next months resulted in unordinary alternating periods of decline and boost of vegetation cover. In early July when FVC values were about 10 % above the average, development started declining at the usual rate until early September. Then, vegetation was expected to start developing again but further decline is noticed, resulting in slightly below-average FVC values as of the end of September.

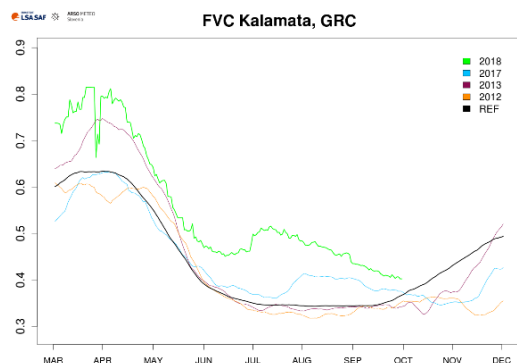
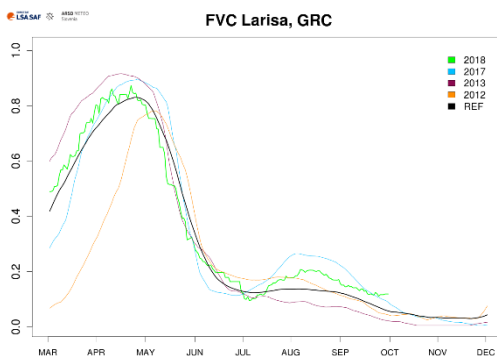


## FYR MACEDONIA



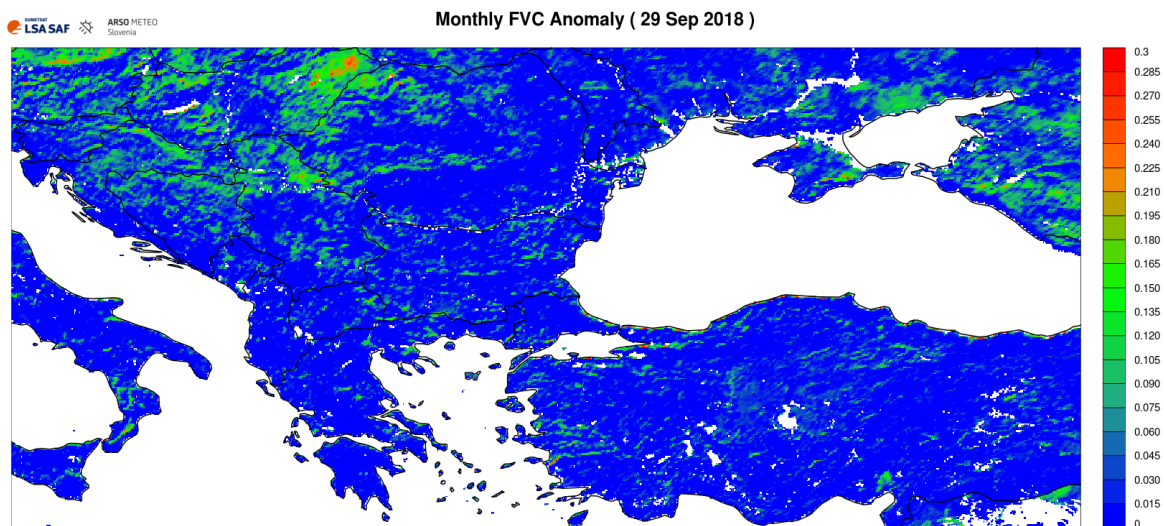
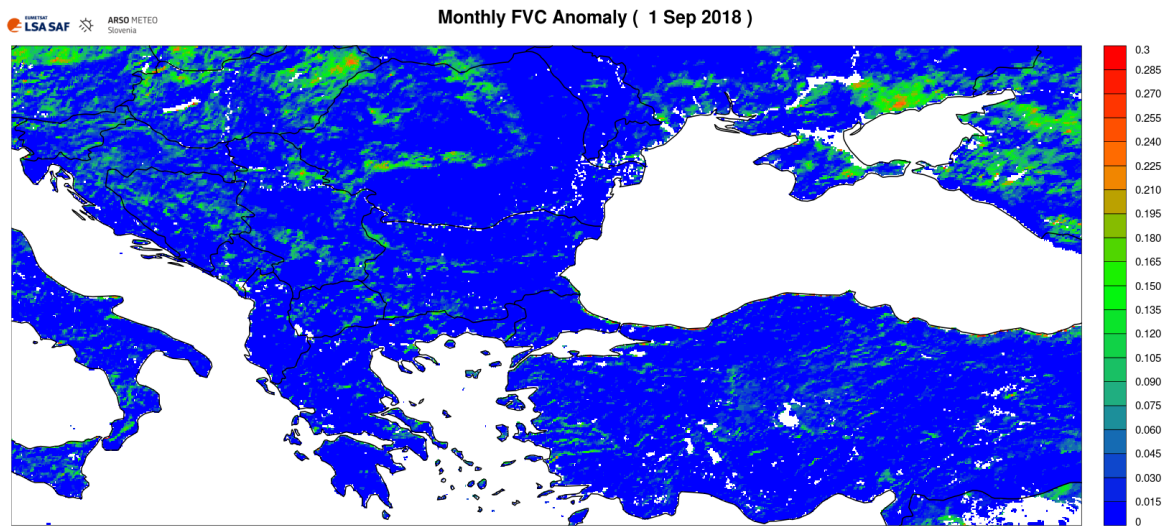
Vegetation in Kavadarci in southern FYR Macedonia followed well the expected development throughout this year. The only exception was summer decline which started slightly earlier than normally, resulting in below-average FVC values mainly in June and July. In Lozovo in central part of the country, first months of vegetation season were favourable for vegetation growth as FVC exceeded the reference for nearly 20 %. Then since June, vegetation development was declining as expected, with no major deviations noted.

## GREECE



Also in Larisa in central-eastern Greece, vegetation development followed well the expected pattern throughout this year. The only deviation from the usual state is a minor vegetation boost noticed since mid-July, keeping FVC values up to 5 % above the average during September as well. On the other hand, weather conditions in Kalamata in southern Greece were favourable to vegetation growth throughout the entire vegetation season as FVC values continuously exceeded the long-term average, for about 10–20 %. At the end of September, vegetation development was expected to progress again but which is not reflected in current FVC values.

Figures below show negative anomaly of **accumulated 30-day FVC values** as recorded on **1<sup>st</sup> September and 29<sup>th</sup> September 2018** in comparison to the past 14 years (2004–2017) and are used experimentally.



Negative FVC accumulations for September indicate worsening of the situation across northern half of Balkan Peninsula over the last month. Northeastern Hungary remains mostly affected as monthly FVC range between 20–25 % below the average. Areas where FVC accumulations dropped for 10–15 % throughout September, include mainly continental Croatia, northern Serbia and southeastern Hungary across to northwestern Romania.

## IMPACT REPORTS

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

## OUTLOOK

Comparison of 60 Days Accumulated Water Balance  
Time Period 29 Aug – 27 Oct 2018 with Historical Percentile Classes

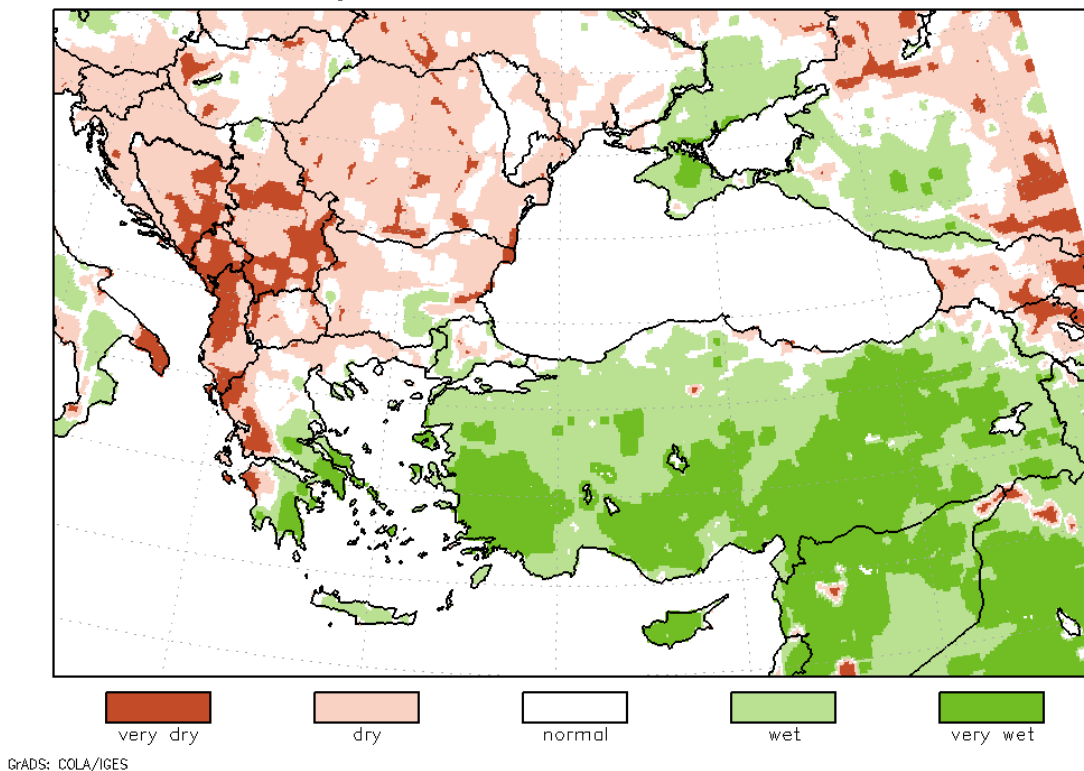


Figure above presents the model simulations of the **60-days surface water balance anomaly** (percentile) for the time period **from 29<sup>th</sup> August to 27<sup>th</sup> October 2018**. Compared to the last known state till 17<sup>th</sup> October, water balance outlook shows wider extent of very wet areas over far western, central and across eastern Turkey as well as southeastern Greece. A welcome change from dry to normal conditions is foreseen for areas all along northern Turkey and its south. Wet conditions will remain over southeastern Bulgaria and small areas over northeastern Hungary. Except for far northern Serbia where a change from normal to wet conditions is expected, dry conditions will remain over the rest of Balkan Peninsula while very dry conditions are expected to continue over its southeastern part as well as western Greece.

### Methodology

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; gpcc.dwd.de). NWP simulations are performed with Non-hydrostatic Meso-scale Model (NMM, see: <http://www.dtcenter.org/wrf-nmm/users/>). Historical DMCSEE model climatology was computed with NMM model for time period between 1st January 1979 and 31st December 2016. European Centre for Medium Range Weather Forecast (ECMWF) ERA-Interim data set (see: <http://www.ecmwf.int/en/research/climate-reanalysis/era-interim>) was used as input for simulations. Long term averages (1979–2016), 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.