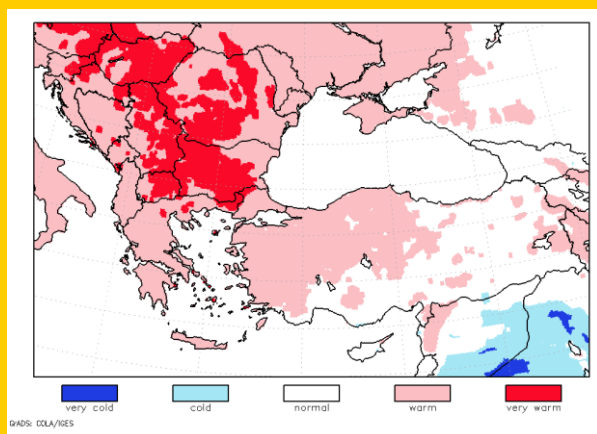


DROUGHT MONITORING BULLETIN

10th July 2017

HOT SPOT

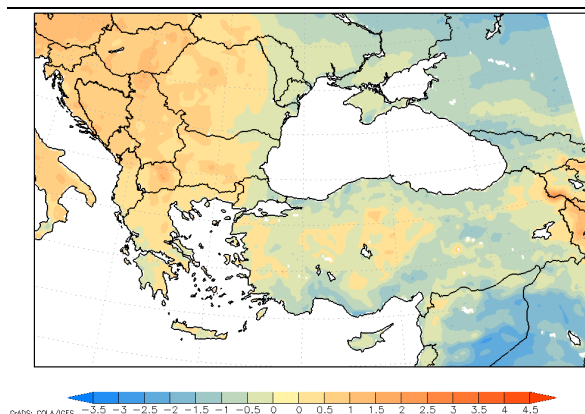


This year's meteorological summer brought extreme air temperatures to the region in its first weeks already. Figure on the left shows anomalies in average air temperatures presented in percentile classes for time period of **20th – 29th June 2017**. Except for eastern and southern Turkey, the entire region was experiencing mean air temperatures above normal conditions that time, in certain parts it rose even up to 6 °C above the average. As heatwave stroke in most countries of Balkan Peninsula in last decade of June, maximum air temperatures of 37–38°C were recorded.

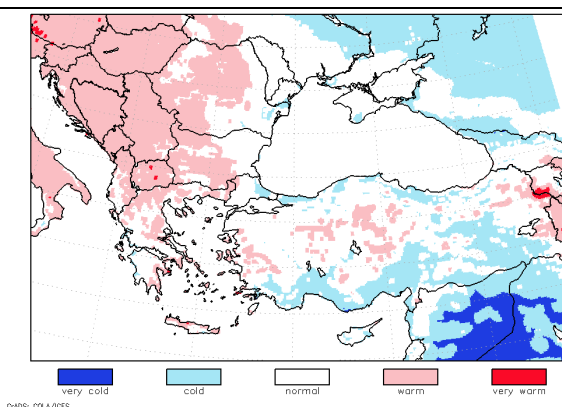
AIR TEMPERATURES AND SURFACE WATER BALANCE

Figures in this section present anomalies of the average air temperature and accumulated water balance as well as classified values of the average **air temperature** and **water balance** in percentile classes for 60-day period from **1st May to 29th June 2017**.

AVERAGE AIR TEMPERATURE
ANOMALY (°C)
1st MAY – 29th JUNE 2017

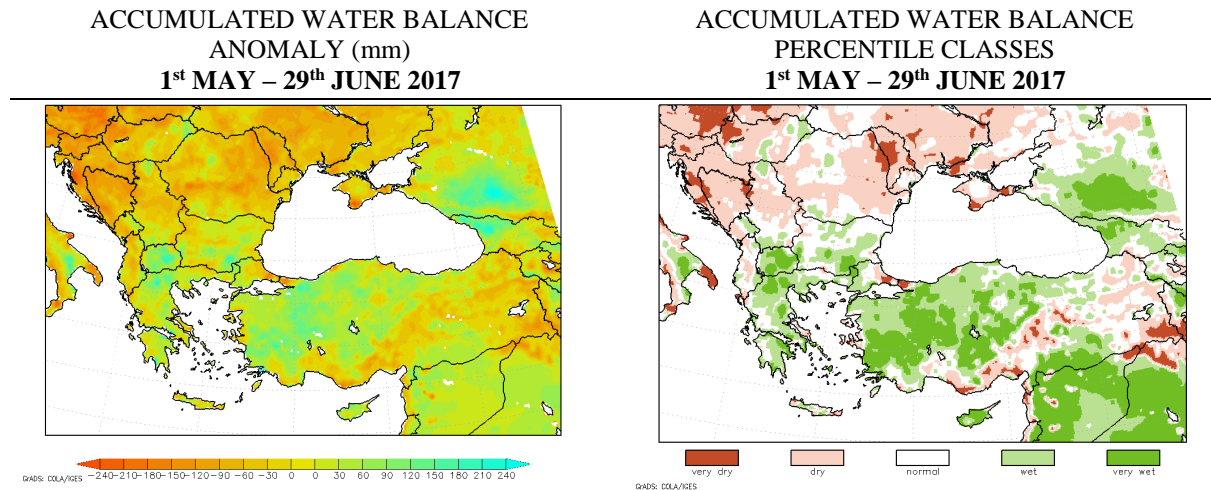


AVERAGE AIR TEMPERATURE
PERCENTILE CLASSES
1st MAY – 29th JUNE 2017



After cold spell in last decade of May, first half of June brought welcome warming to the region with fair air temperatures of average values. Maximum positive deviation of air temperature in early June ranged between 1–2 °C over entire Balkan Peninsula while second decade of June offered slight decrease of air temperatures to 1–2 °C below the average in most countries of the region. In third decade of June, mean air temperatures reached values of 5–6 °C above the average in countries of continental Balkan Peninsula and around 4 °C in areas along the

coastlines of Adriatic, Mediterranean and Black Sea. Overall view of anomalies in air temperature in last 60-day period shows negative deviation of up to 1 °C over eastern Turkey and slightly positive deviation of around 1 °C over northern and central Balkan Peninsula.

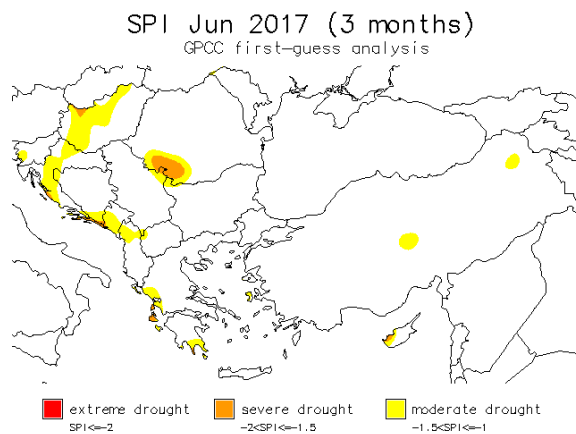
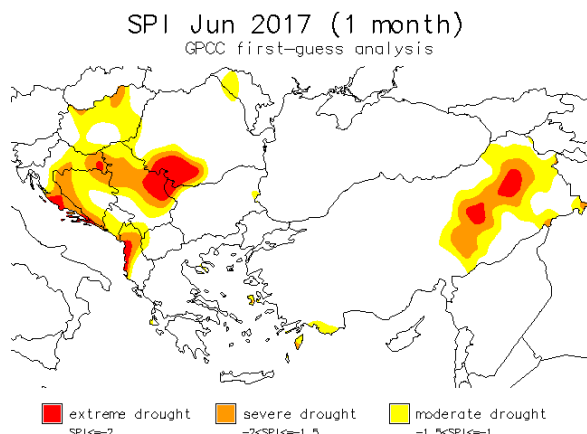


Figures above present accumulated water balance situation in the region over the last 60 days. High temperatures and accompanied high evapotranspiration resulted in negative water balance situation over northern half of Balkan Peninsula. It ranged between 120–150mm in northwestern areas and up to 120mm in central and eastern areas. Some local parts, especially in Carpathians and in northwest of Balkan Peninsula, experienced negative water balance anomalies of even up to 180mm. Lack of precipitation brought dry conditions also to eastern Turkey with negative values of water balance anomaly mainly around 60mm. On the other hand, due to excessive rainfall over the last 60 days in southern half of Balkan Peninsula and western Turkey, accumulated water balance in that area reached positive values. Anomalies from normal state ranged mainly between 90–120mm although in large parts of western Turkey, Macedonia, southern Bulgaria and northern Greece its values reached as high as 210mm.

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.

Severe to extreme drought conditions in June, indicated through SPI1, were present in several countries of central and western Balkan Peninsula as well as in eastern Turkey. SPI for 3-month period from April to June shows smaller extent of drought conditions in the region, mainly because drought conditions in April and May were only present over southern Greece and Slovenia respectively. As seen on the right figure below, 3-month overview of SPI index shows moderate to severe drought in Hungary, Croatia, Montenegro and northern Albania as well as in minor areas in Greece, Romania and Turkey.

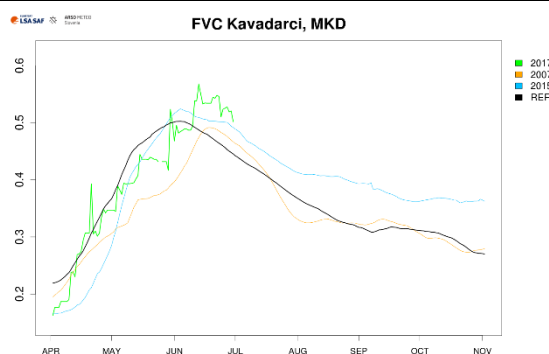
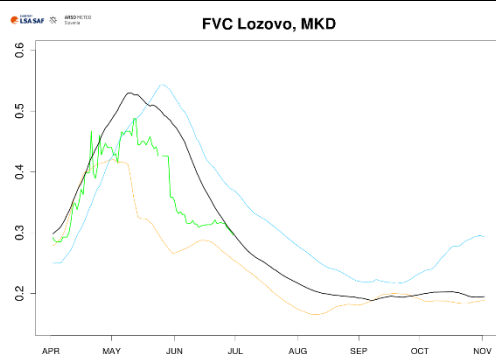


REMOTE SENSING – FRACTION OF VEGETATION COVER

Fraction of vegetation cover (FVC) is vegetation index, based on multi-channel remote sensing measurements (data from Eumetsat's LSA SAF 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 **30th June 2017** in some regions of South-eastern Europe. FVC values for year 2017 are presented as green line. Graphs also include reference line (2007–2016) in black, and lines in blue (year 2015) and yellow (year 2007) for comparison.

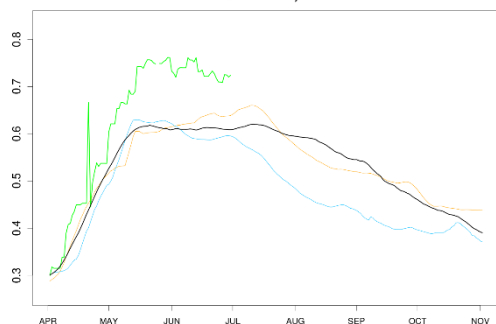
FYR MACEDONIA



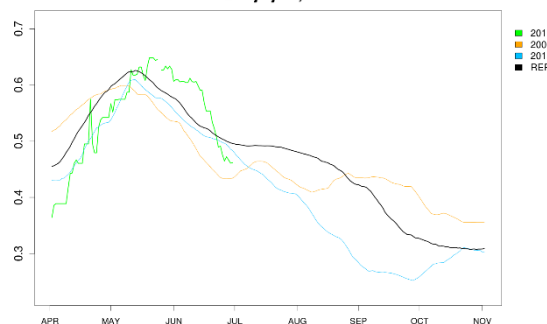
Vegetation in Lozovo in central Macedonia was developing as expected at the beginning of vegetation season although after declining, it reached values of FVC from early April sooner than it was expected to in comparison to reference period. According to FVC index for Kavadarci, vegetation growth is progressing well in southern Macedonia.

BOSNIA AND HERZEGOVINA (REPUBLIC OF SRPSKA)

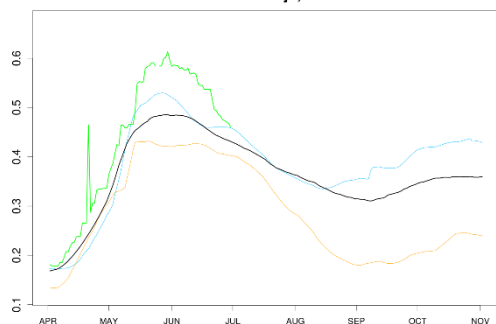
FVC Laktasi, BIH



FVC Bijeljina, BIH



FVC Trebinje, BIH

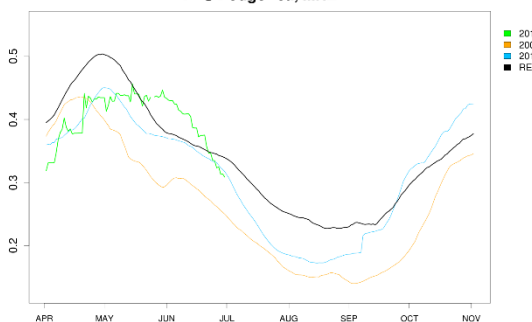


Vegetation development in both areas of Laktaši in the north and Trebinje in the south of Bosnia and Herzegovina exceeded the expected level over the last two months. At its peak in mid-May, values of FVC at both locations were around 15% above the average of past 10 years for this time of year. Vegetation level in northeast of the country (Bijeljina) declined since mid-June although it is currently still within the expected range.

MONTENEGRO

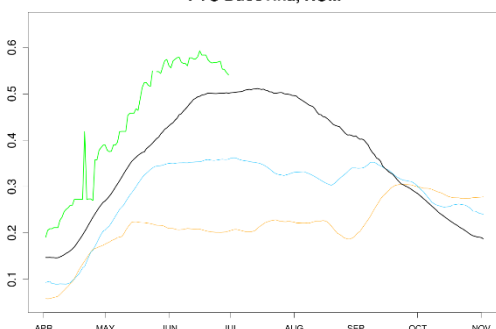
In Podgorica, vegetation development started late this vegetation season. Even upon its peak, it did not reach the level of development according to reference period as values of FVC stayed below the reference line.

FVC Podgorica, MNE



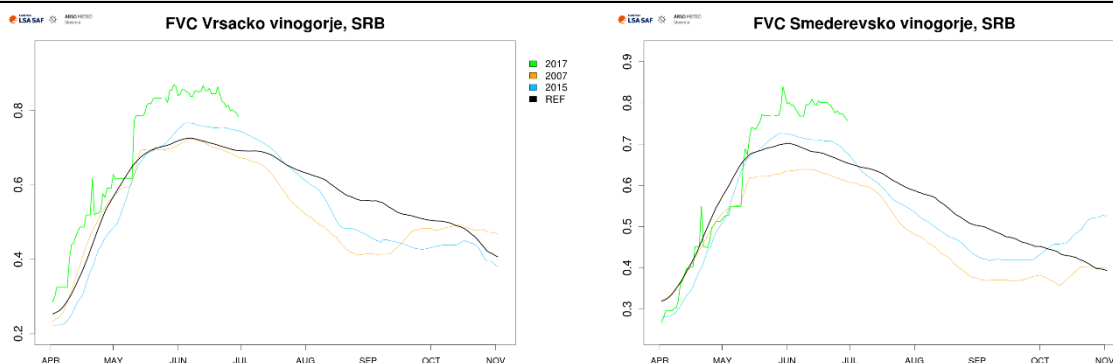
ROMANIA

FVC Bucovina, ROM



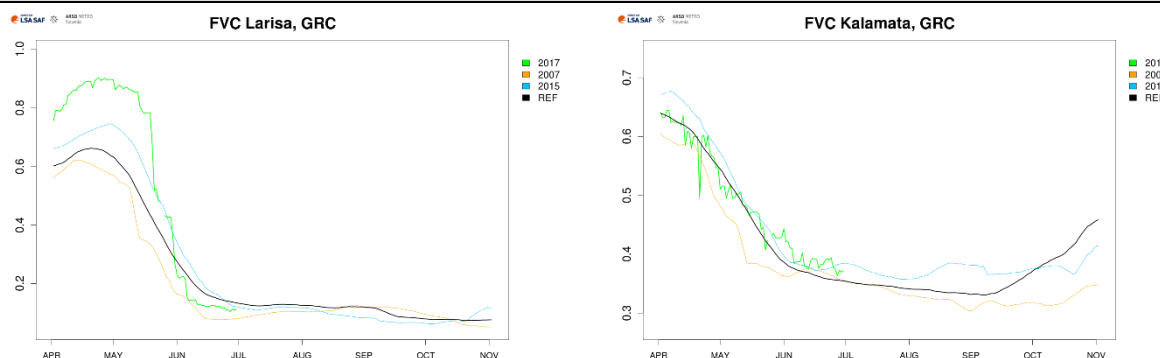
Vegetation development in Bucovina in northern Romania started earlier this vegetation season in comparison to previous years. Since then, it has been progressing in a same trend as expected according to values of 10-year average.

REPUBLIC OF SERBIA



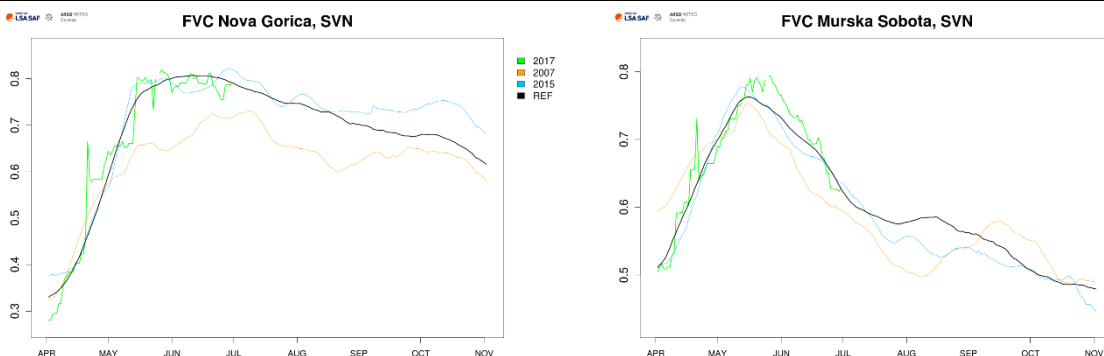
FVC index for both Vršacko vinogorje and Smederevsko vinogorje shows vegetation development followed well the reference line in northeastern and central Serbia this vegetation season. Favourable combination of air temperature and water balance situation in May boosted vegetation growth and it stayed on high level since.

GREECE



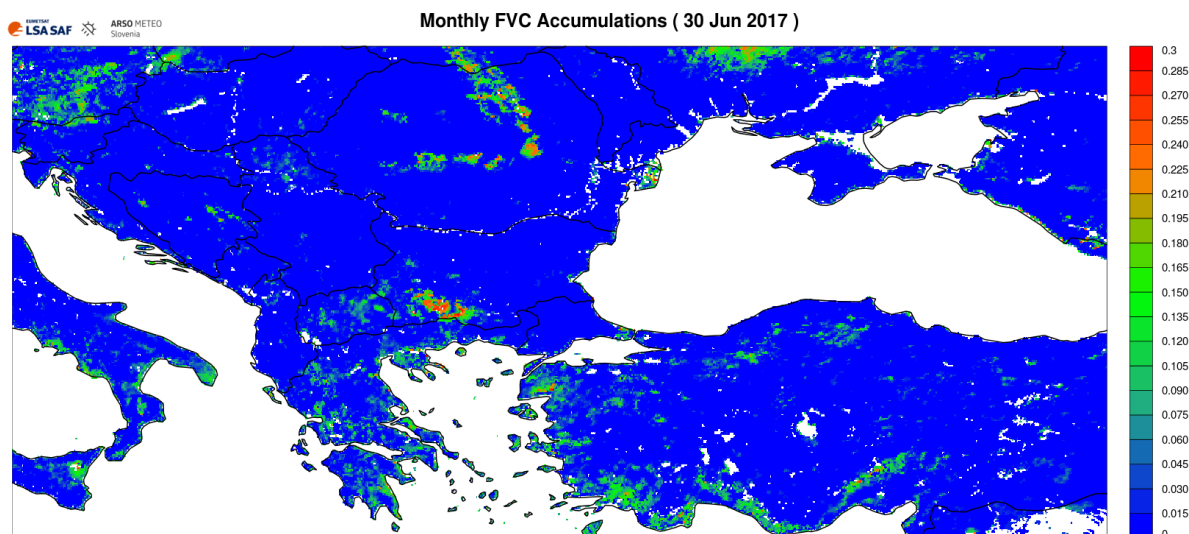
After a good start of vegetation growth at the beginning of this year's vegetation season in Larisa, sudden drop of vegetation level occurred in late May and early June. Values of FVC in that area stayed low in late June as well, currently standing at similar values as previous years. According to FVC index, there were no significant deviation in level of vegetation in southern Greece (Kalamata).

SLOVENIA



Despite negative water balance anomalies and above-average air temperatures in Slovenia in June, values of FVC index show that vegetation is developing as expected and following well the values of reference period for both Nova Gorica and Murska Sobota.

Figure below shows negative anomaly of **accumulated 30-day FVC** recorded on **30th June 2017** in comparison with the past ten years (2007–2016) and is used experimentally.



Monthly accumulations of FVC index show negative deviations across Macedonia and Greece as well as along the coastline of western half of Turkey where values stand around 12–15% below the average of reference period for this time of year. Vegetation cover of past 30 days did not reach the average level also in mountain area of southern Bulgaria and in Carpathians in Romania. Negative anomalies in these areas reached values as high as 28%.

IMPACT REPORTS

Several reports on heatwave came from Romania, Bulgaria, Serbia and Croatia including red alerts by national meteorological services and accompanied recommendations for high temperatures by countries' ministries of health although no drought impacts on different sectors as a result of heatwave were reported so far in these countries.

Slovenian Environment Agency issued a report on arid state of stream discharge of most rivers in Slovenia due to lasting lack of precipitation. Most affected are rivers of western and southwestern Slovenia where current levels of stream discharge classify in lowest 5th percentile. [1]

Hungarian Meteorological Service reported of drought affecting more and more ground in rural areas of the country. It is leaving negative impacts on corn and sunflower and has now increasingly become a concern for fodder. [2, 3]

Republic Hydrometeorological Service of Serbia reported of negative impacts of drought on agricultural plants in last decade of June as well, stating high daily air temperatures and

deficiency of precipitations were not suitable for corn, sunflower, soy and sugar beet. Lack of precipitation is already causing development backlog in many crops that can have negative impacts on the quality of fruit and reduced yield. [4]

Drought conditions left impacts also on the economy sector in Albania, according to ESC Adriatic. It reports of launching procedure for electricity import to overcome domestic production's shortages provoked by drought. [5]

[1] <http://www.arso.gov.si/novice/datoteke/037798-su%C5%A1a%20junij%201.pdf>

[2] <http://www.met.hu/idojaras/agrometeorologia/elemzes/index.php?id=1915>

[3] <http://www.met.hu/idojaras/agrometeorologia/elemzes/index.php?id=1911>

[4] <http://www.hidmet.gov.rs/podaci/agro/mesec.pdf>

[5] <http://esc.albaniaenergy.org/en/2017/07/01/albania-import-electricity-due-drought-balkan-green-energy-news-26th-june-2017/>

OUTLOOK

Comparison of 60 Days Accumulated Water Balance
Time Period 21 May – 19 Jul 2017 with Historical Percentile Classes

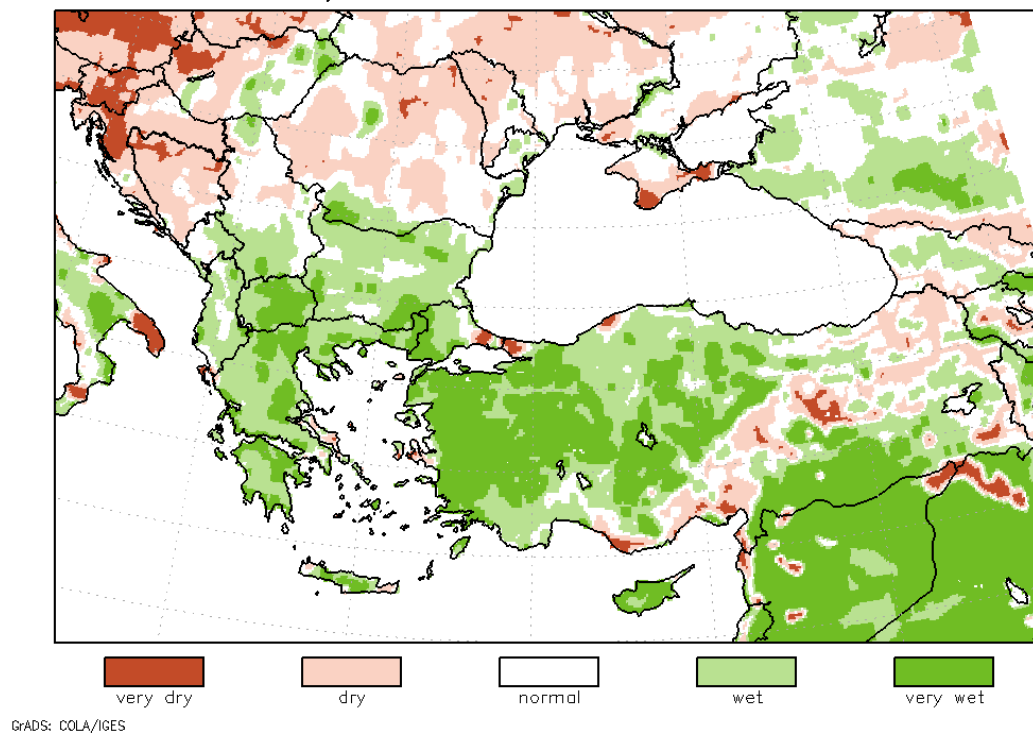


Figure presents the model simulations of the **60-days water balance anomaly** (mm) for the time period from **21st May to 19th July 2017**. Dry conditions will persist over northwestern and northeastern areas of Balkan Peninsula as well as northeastern Turkey. Wider area in western half of Turkey compared to previous situation will experience very wet conditions. Greece and Macedonia will remain in wet conditions as well but major change from dry to wet conditions in comparison to previous state of water balance is expected to occur in Albania, Montenegro, Serbia and eastern Hungary.

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-hydrostatical 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.