GDO Analytical Report

Drought in the Greater Horn of Africa – April 2019

JRC Global Drought Observatory (GDO) and ERCC Analytical Team
15/04/2019

Table of Contents

Executive summary

- A drought is unfolding over the Greater Horn of Africa, specifically Kenya, southern Somalia, Uganda and southern Ethiopia. Despite cumulated precipitation not being lower than the climatic normal in the last year over most locations, the last trimester was slightly drier than usual, triggering concerns for the incoming months.
- Indeed, the precipitation forecasts for the next few months are very negative and robust, and April in particular, which is a key month for yearly water balance, hence supporting the growing concerns for food security and the release of early warnings.
- Despite most reports focusing on the other countries of the Horn of Africa, Uganda shows the worst combination of drought indicators among all countries involved, so there is chance that the drought impacts are going underreported there. Nonetheless, the 3-months outlook suggests a late recovery, followed by wetter conditions over the 6-months outlook.

Geographical context

Most of the Horn of Africa has a hot and dry climate, particularly in the northern and eastern parts and the lowlands, with sparse vegetation, while precipitations are concentrated mostly in the mountainous areas. Rural population greatly depends on the seasonal rainfalls from April to June and from September to December. Droughts are common.

The population in the Horn is extremely vulnerable, due to poverty and political instability, with 13 million people severely food insecure[1]. A vast amount of inhabitants is highly dependent on subsistence agriculture, thus enhancing the risks related to a failed harvest. The heavy reliance

[1] https://ec.europa.eu/echo/where/africa/horn-of-africa_en

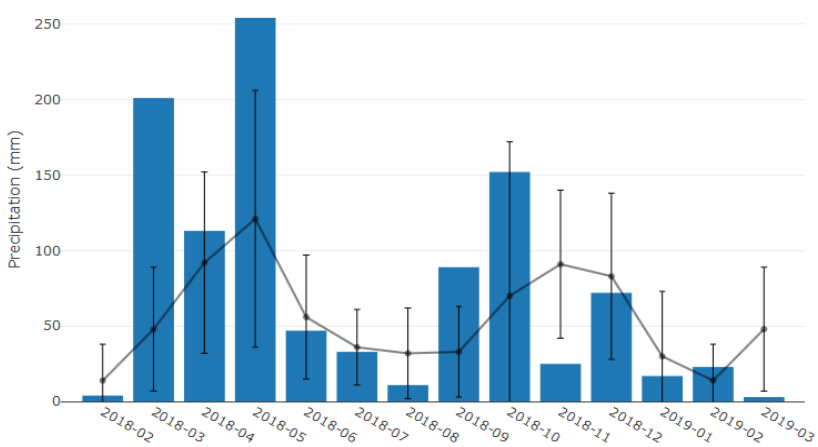
on wet months for rainfed crops and pastures, in presence of a high interannual variability, exposes food security to severe hazards.

Precipitation

Rainfall over the eastern part of the Greater Horn of Africa follows a bimodal pattern, with a peak in April/May (*long rains*) and another during October/November (*short rains*). The intermediate periods are usually dry, despite a marked interannual variability. In the inner and westernmost parts of the Greater Horn, this pattern is much less evident or even missing, replaced by a succession of smaller rainfall up and downs throughout the year.

As from Figure 1, a common feature shared by most regions over the area of interest is the high amount of rainfall received in the first half of 2018, largely in excess compared to the seasonal average. Afterwards it follows a varied succession of wetter or drier than normal months, in line with the pronounced variability typical of the region. The degree at which such abundant precipitation contributed to replenish groundwater is dependent on soil and rock basement characteristics and can't be generalized easily (see e.g. MacDonald et al., 2012[2]). In any case, even in presence of abundant groundwater, this may not be within reach of the most vulnerable population, including farmers and herders dependent on quarterly rains. The overall meteorological balance, given the diversity of monthly rains, is better captured by the SPI (see next section).

Figure 1: *Monthly total precipitation near four selected locations (blue bars), with the long-term monthly averages (1981-2010, solid line).*



Mombasa (southern Kenya)

[2] MacDonald, A M, Bonsor, H C, Ó Dochartaigh, B E, Taylor, R G. 2012. Quantitative maps of groundwater resources in Africa. *Environmental Research Letters 7*, 024009. http://www.bgs.ac.uk/research/groundwater/international/africangroundwater/mapsDownload.html

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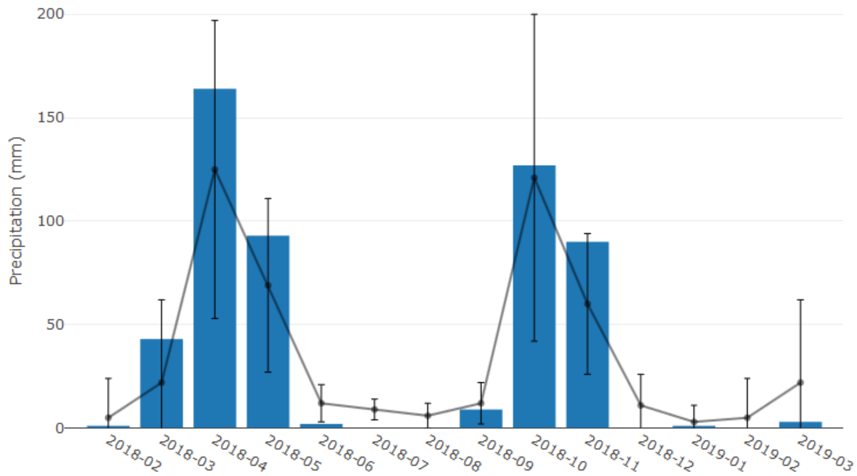
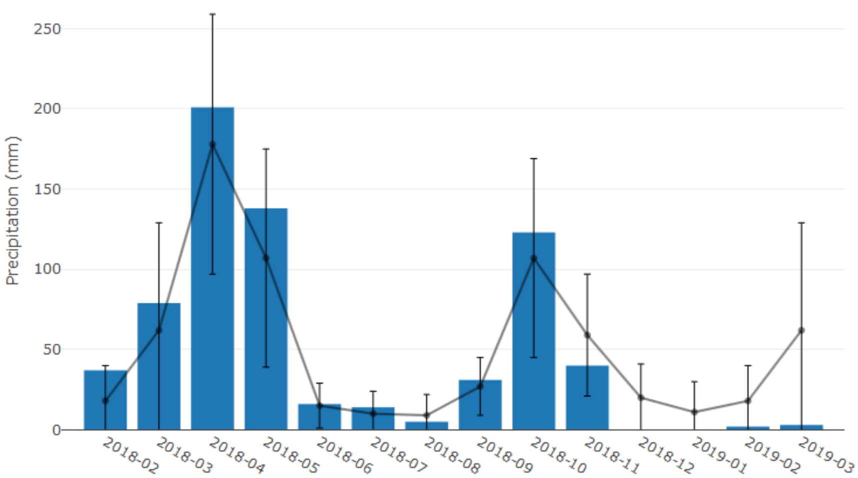
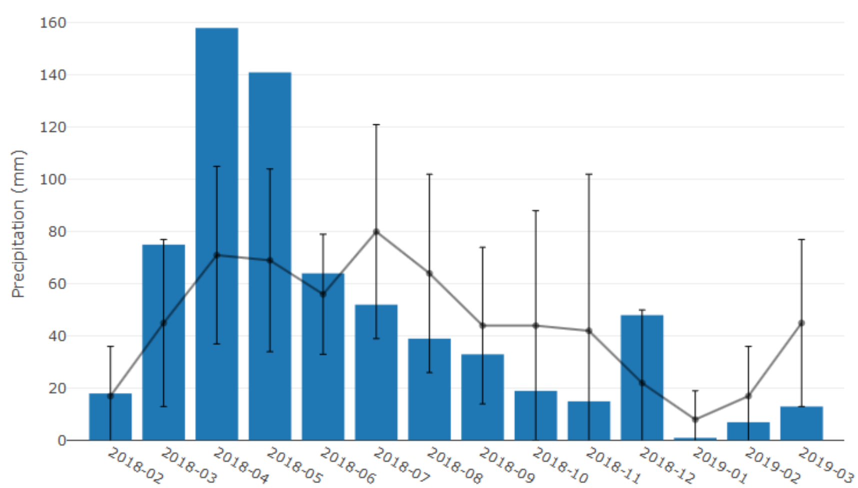


Southern Somalia



Oromia (southern Ethiopia)



Turkana (North-west Kenya)

Drought in the Greater Horn of Africa – April 2019

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15/04/2019

Standardized Precipitation Index (SPI)

The SPI indicator is used to monitor the occurrence of meteorological drought. The lower (i.e. more negative) the SPI, the more intense is the drought.

The SPI 3 from Figure 2 (left) shows medium to strong deficits for the first trimester of 2019 in south-west Ethiopia and along a band extending from western Kenya across northern Uganda and South Sudan. However, these months are usually relatively dry and do not contribute much to the yearly water budget. In fact, looking at the last nine months, an interval that encompasses the second wet season of 2018 (around October and November), only Kenya and Uganda seem affected by lower than normal precipitation (Figure 2, right). Elsewhere there is no evidence of serious cumulated lack of rainfall, having received enough precipitation at least to compensate the underperforming first trimester of 2019.

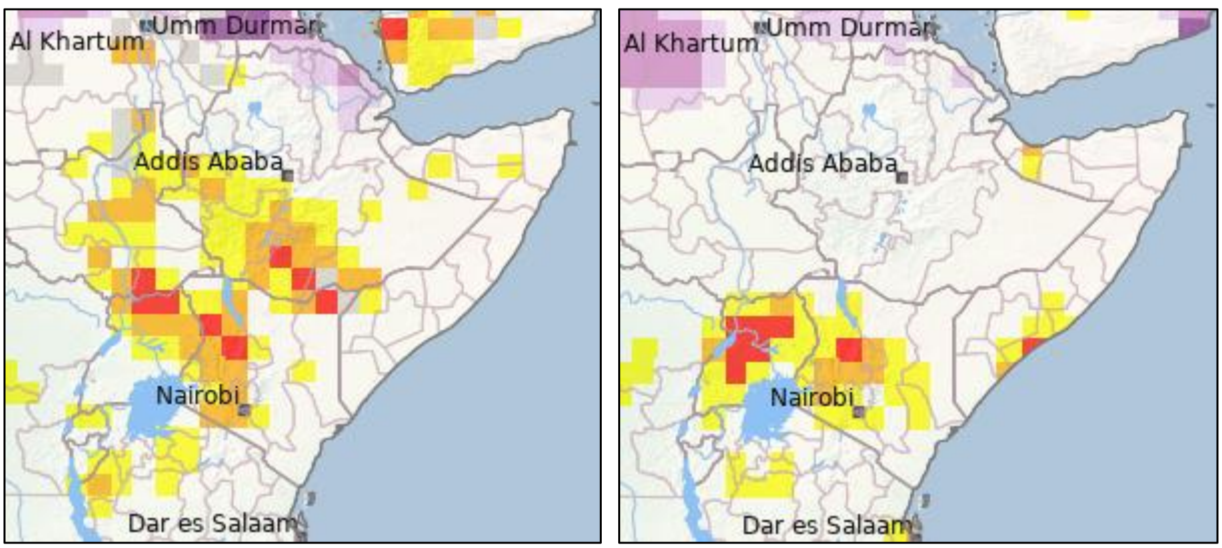
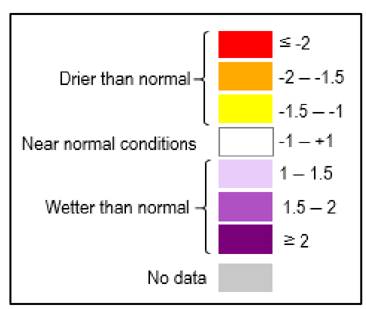
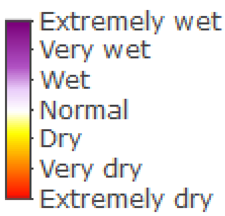


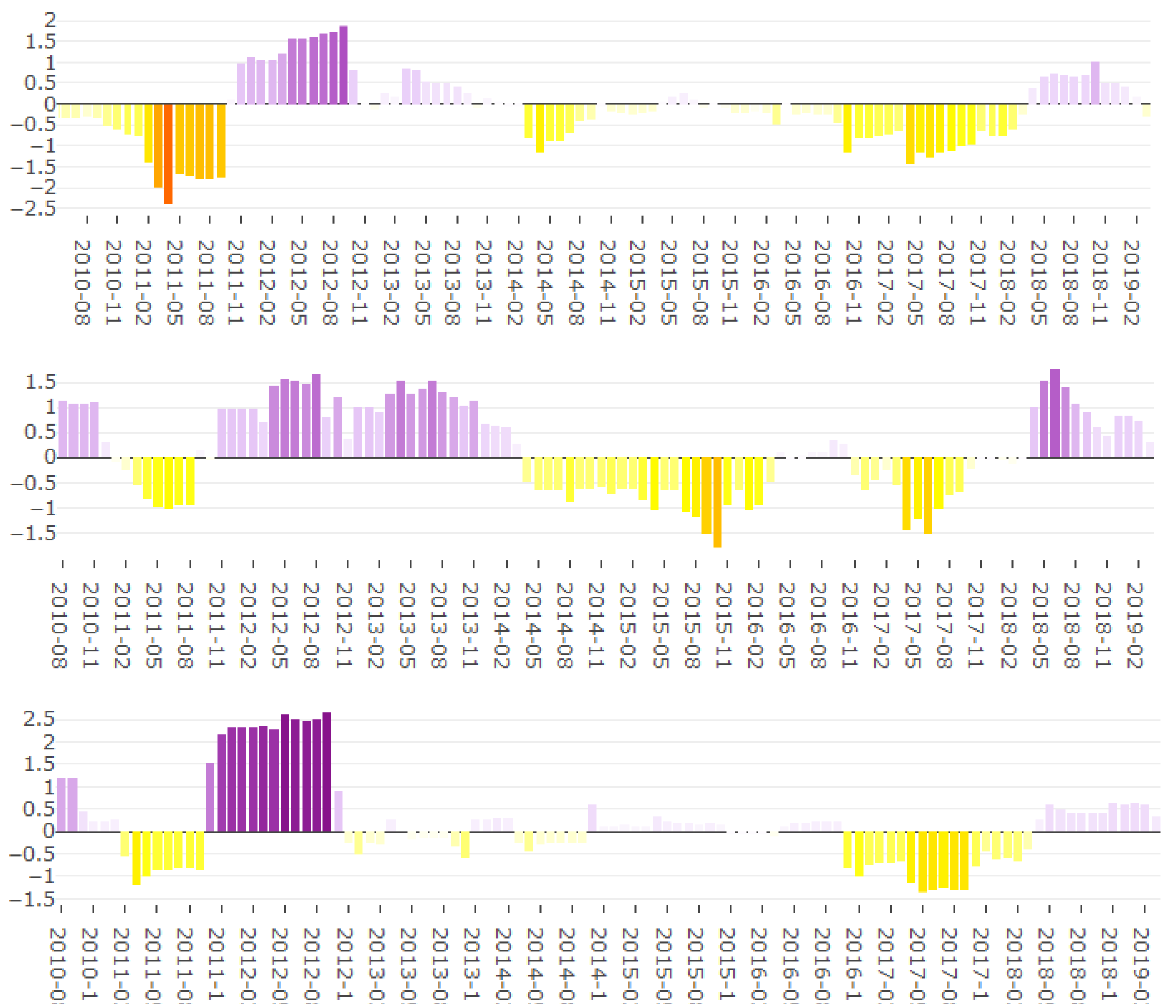
Figure 2: *SPI for the accumulation periods January to March 2019 (SPI-3, left) and July 2018 to March 2019 (SPI-9, right).*



The analysis of time series for SPI and the comparison with the last two severe droughts over the Greater Horn of Africa seems to confirm this view. The current dry spell does not even show up over the cumulated 12 months precipitation over most locations, primarily because of very abundant rainfall in the first rainy season of 2018. Moreover, regardless the cumulative period selected, both the events of 2017 and 2011 greatly surpass the ongoing dry spell in terms of severity and duration (Figure 3). Nevertheless, looking at the three months interval, the dry spell appears to be comparable to the SPI-3 of the past two droughts in specific locations (Figure 4).

Ultimately, under current conditions, there are no strong nor widespread precipitation deficits, but rather patchy distributed dry spells. Despite the mildness of the meteorological drought so far, considering the extreme vulnerability of population, reliant on regular seasonal rainfall for their subsistence, the situation may suffice to threaten food security. This is especially true in light of the current negative forecasts, for April in particular, a key month for water resources in most areas of the Horn of Africa (see next section).





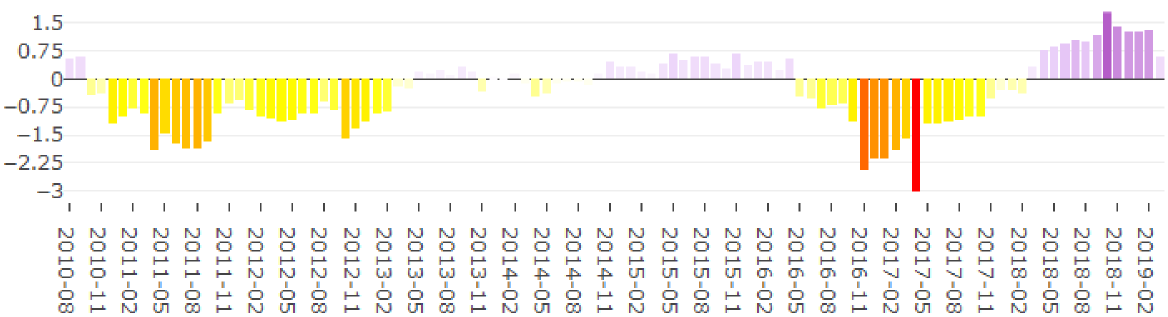


Figure 3: *SPI for a cumulative period of 12 months in selected locations. From top to bottom: Oromia (southern Ethiopia); Turkana (northern Kenya); southern Somalia; Mombasa (southern Kenya).*

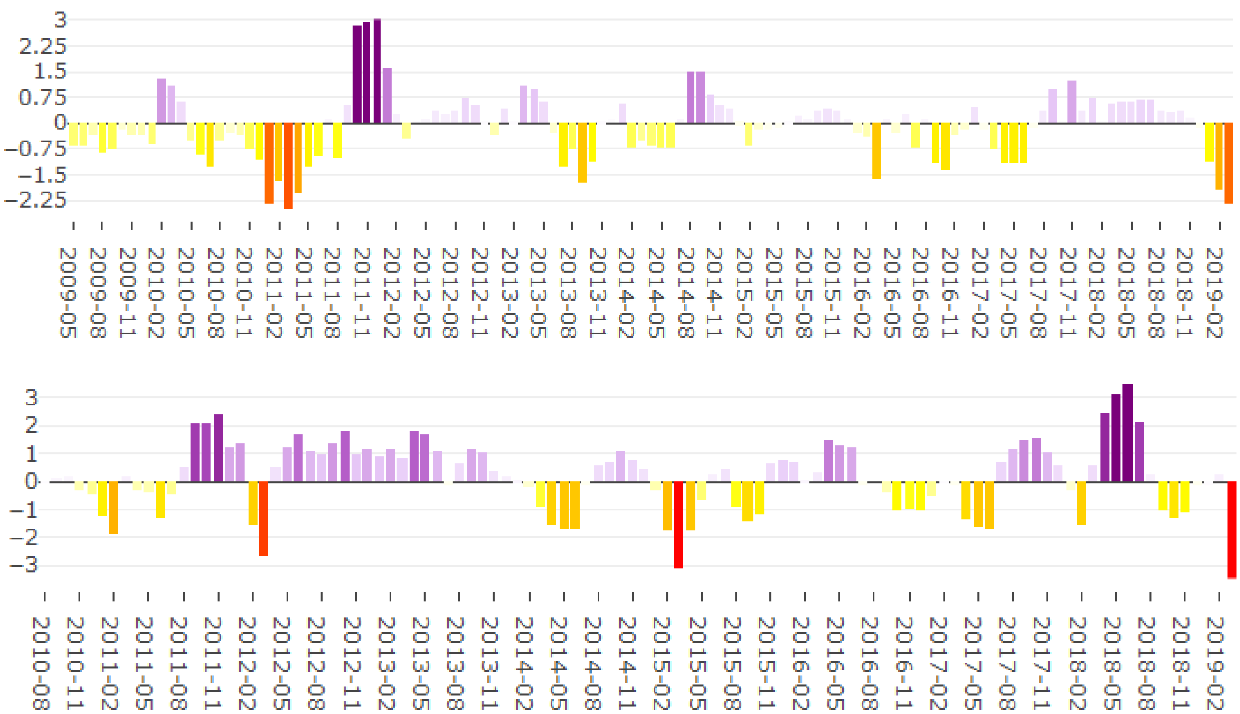


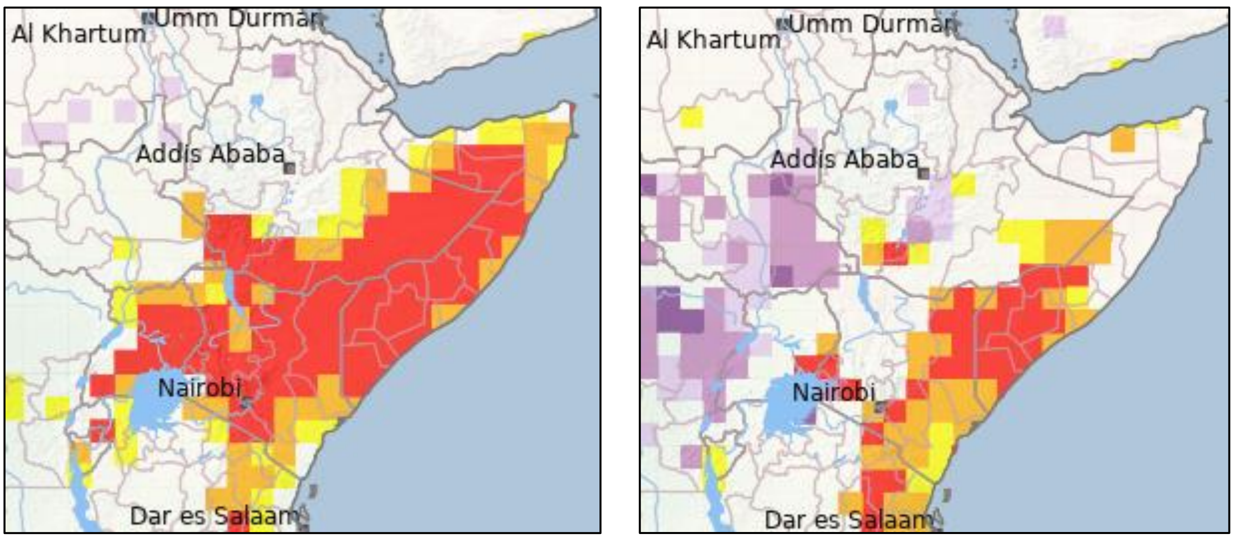
Figure 4: *SPI for a cumulative period of 3 months in two locations. Top: Oromia (southern Ethiopia). Bottom: Turkana (northern Kenya).*

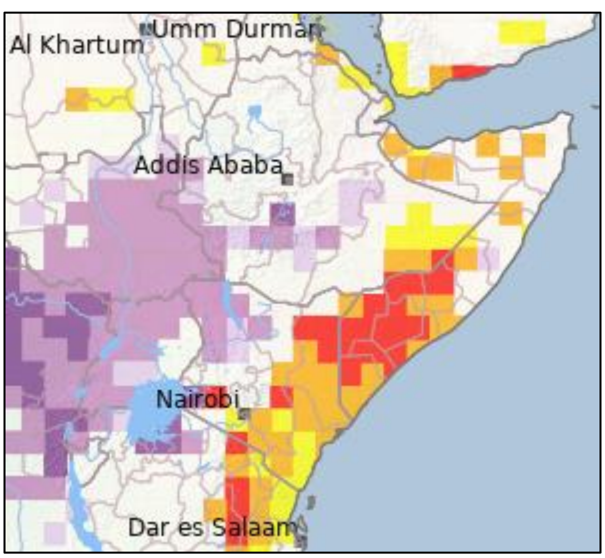
SPI outlook

The forecasts of SPI are based on the ECMWF probabilistic seasonal model of precipitation (S5). The map shows any colors only where the forecast is relatively robust.

April is usually the wettest month of the year in the majority of the Horn of Africa and thus of primary importance for water supply. The outlook for April 2019 is very consistent and very unfavorable, boosting growing concerns about the current extreme dry tendency (Figure 5, top left). The projection extended to three and six months ahead maintains this negative picture for the coastal belt ranging from northern Tanzania to southern Somalia, while it does not show agreement over the persistence of dry conditions for southern Ethiopia, northern Somalia and northern Kenya (Figure 5, top-right and bottom).

Should the forecast materialize as such, it would entail a severe failure of the most important period for water resources in southern Somalia and coastal Kenya, with prolonged dryness and no chance of recovery until October at the least.





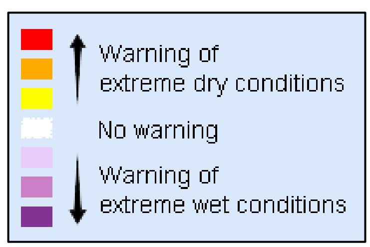


Figure 5: *SPI forecast for three time intervals over the greater Horn of Africa, based on ECMWF S5 ensemble forecasts. Top left: April only (SPI-1). Top right: April to June (SPI-3). Left: April to September (SPI-6).*

fAPAR anomaly and soil moisture anomaly

The fraction of Absorbed Photosynthetically Active Radiation (fAPAR) represents the fraction of the solar energy absorbed by leaves. fAPAR anomalies, specifically the negative deviations from the long term average over the same period, are a good indicator of drought impacts on vegetation. On the other hand, the soil moisture anomaly provides an assessment of the top soil water content, which is a direct measure of drought conditions, specifically the difficulty for plants to extract water from the soil.

Concerning fAPAR, no remarkable negative anomalies are detected for the beginning of April (Figure 6), while a few patches of strong soil moisture anomalies are present, notably over most Uganda, western Kenya and further south in Tanzania, south Somalia and Ethiopia (Figure 7).

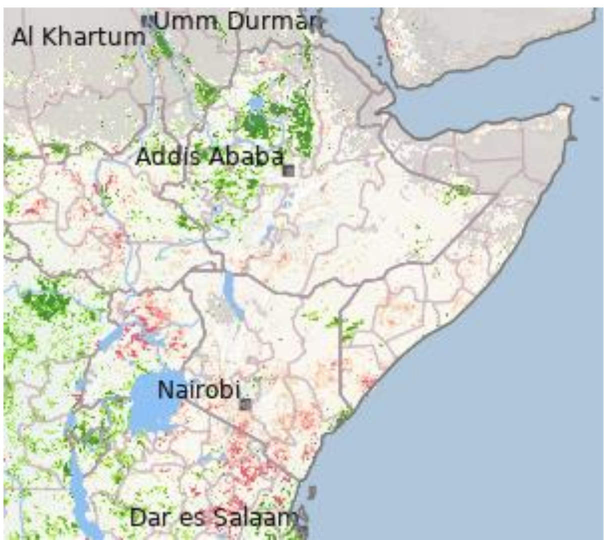
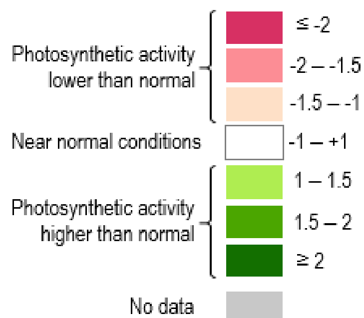


Figure 6: *fAPAR anomaly for the period between 1st and 11th of April 2019.*



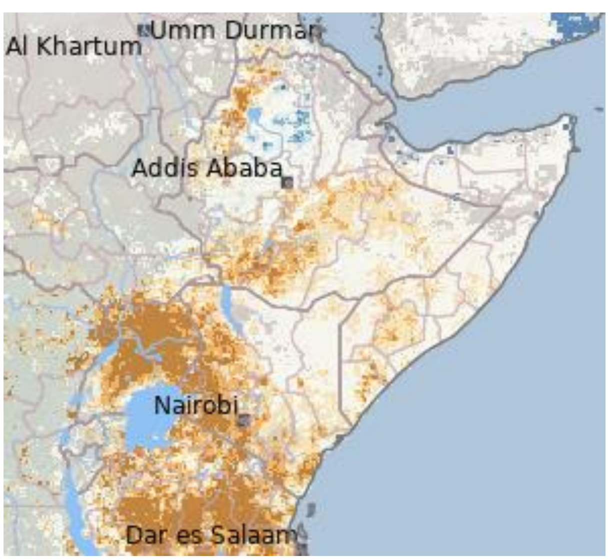
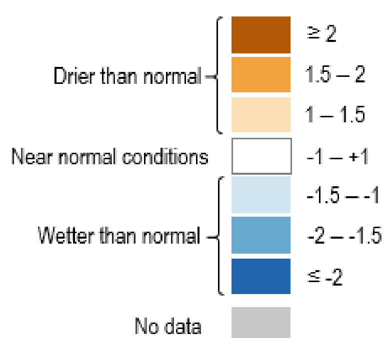


Figure 7: *Soil moisture anomaly for the period between 1st and 11th of April 2019.*



Further insight is provided by the trend of the two indicators in time, as displayed by Figure 8 and 9. In fact, from a situation of largely positive anomalies in both vegetation greenness and wet soil conditions, driven by a very wet first half of 2018, there is a sudden reduction towards average values, with emergence of dry anomalies. In some places though, like most of Uganda, negative anomalies in both indicators are detected since mid-2018.

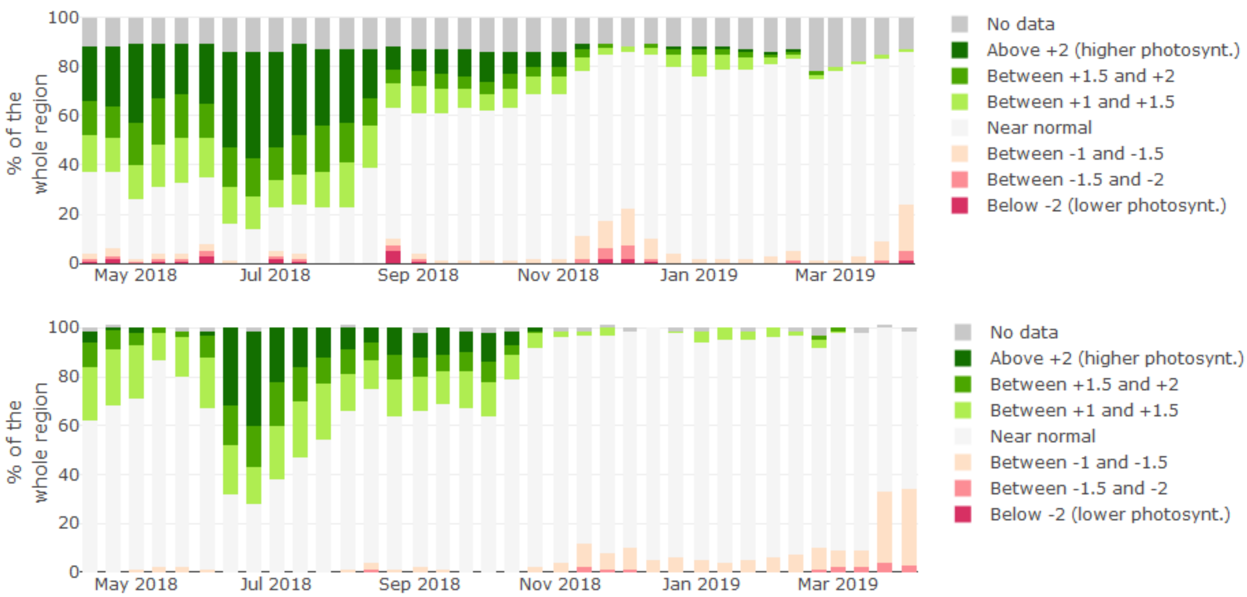


Figure 8: *fAPAR anomaly, evolution over Rift Valley, Kenya (top) and southern Somalia (bottom).*

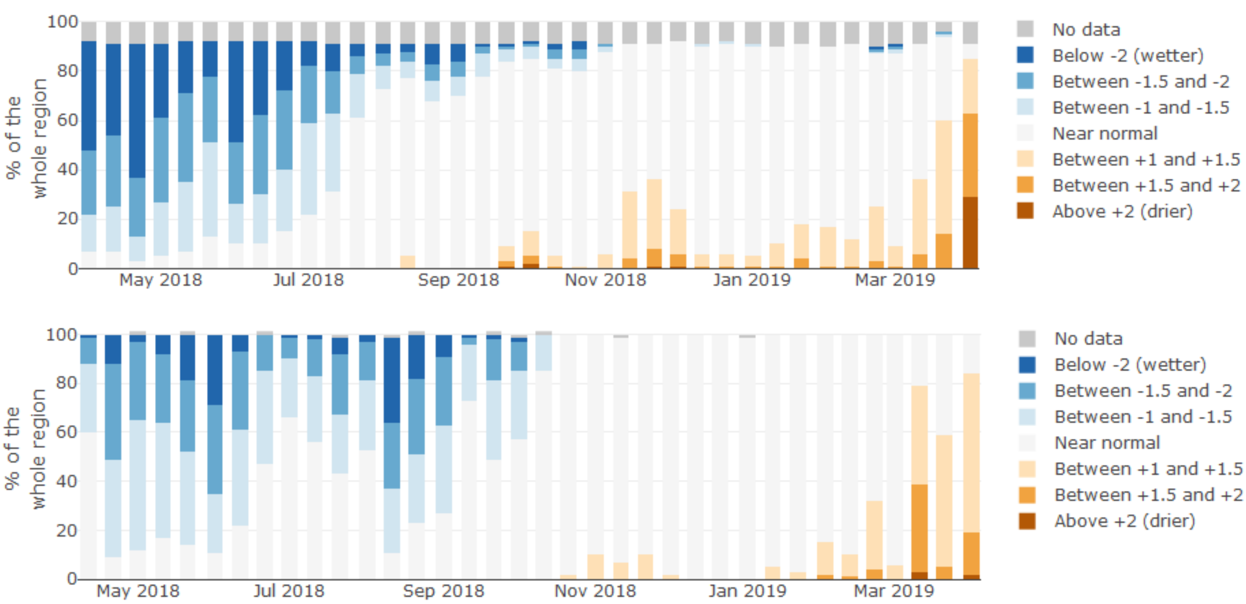


Figure 9: *Soil moist. anom., evolution over Rift Valley, Kenya (top) and south Somalia (bottom).*

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Information sources

Global Drought Observatory (GDO) - Joint Research Centre of European Commission

***Distribution**: for ERCC and related partners use.*

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