ISSN 1831-9424

European Commission

JRC Technical Report

Drought in Southern Africa April 2024

GDO Analytical Report

Copernicus Europe's eyes on Earth

Emergency Management Service

Toreti, A., Bavera, D., Acosta Navarro, J., Acquafresca, L., Asega, C., Barbosa, P., Collivignarelli, F., Combere, W. S., de Jager, A., Fioravanti, G., Grimaldi, S., Hrast Essenfelder, A., Kabengela, H., Kamsu Tamo, P. H., Lawal, K. A., Magni, D., Mazzeschi, M., McCormick, N., Meroni, M., Nkurunziza, R. S., Nshimirimana, G., Rembold, F., Salamon, P.

2024

Preparedness Response Recovery

Rapid Mapping | Risk & Recovery Mapping | Floods | Fires | Droughts | Population | Built-up areas

Joint Research Centre

EUR 31913 EN

Contact information
Name: Andrea Toreti
Address: Via E. Fermi 2749, I-21027 ISPRA (VA), Italy
Email : Andrea.TORETI@ec.europa.eu

EU Science Hub
https://joint-research-centre.ec.europa.eu

JRC137785

EUR 31913 EN

PDF ISBN 978-92-68-14915-7 ISSN 1831-9424 doi:10.2760/960341 KJ-NA-31-913-EN-N

Luxembourg: Publications Office of the European Union, 2024

How to cite this report: Toreti, A., Bavera, D., Acosta Navarro, J., Acquafresca, L., Asega, C., Barbosa, P., Collivignarelli, F., Combere, W. S., de Jager, A., Fioravanti, G., Grimaldi, S., Hrast Essenfelder, A., Kabengela, H., Kamsu Tamo, P. H., Lawal, K. A., Magni, D., Mazzeschi, M., McCormick, N., Meroni, M., Nkurunziza, R. S., Nshimirimana, G., Rembold, F., Salamon, P., *Drought in Southern Africa April 2024*, Publications Office of the European Union, Luxembourg, 2024, doi:10.2760/960341, JRC137785.

Drought in Southern Africa - April 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) - GDO data up to 31/03/2024

Drought in Southern Africa - April 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) - GDO data up to 31/03/2024

Abstract

- A severe drought is currently affecting southern Africa and the Zambezi basin, with extremely dry and warm conditions from October 2023 to March 2024.
- Heatwaves are exacerbating the impacts of the lack of precipitation. The average temperature is abnormally high, registering record values since 1960.
- Soil moisture and vegetation conditions are severely affected, with negative anomalies over large areas of the region.
- The Zambezi river is at its lowest discharge for the season corresponding to about 20% of the long-term average.
- Crops have been affected as the extreme conditions occurred in the most critical period of the growing season, with severe economic and social impacts. River flow forecasts suggest that these impacts are likely to get worse.
- Crop damages and losses have caused the IPC (Integrated Food Security Phase Classification) Acute Food Insecurity to range from stressed to crisis level in most of the Zambezi basin regions.
- Hydropower production is severely affected.
- Wildfire danger is high in Namibia, Botswana, and north-western South Africa.
- Seasonal forecasts point to warmer than average conditions in the following months. Early April 2024 precipitation shifts the seasonal forecast towards wetter values but according to May-June-July forecast dry conditions are expected after this temporary relief. Close monitoring of the drought evolution and proper water use plans are needed.

Introduction

Southern Africa, particularly the Zambezi basin, is facing escalating environmental and socio-economic challenges due to the drought affecting the region. Zimbabwe, Zambia, and Malawi have officially declared the state of emergency, underpinning the gravity of the environmental and humanitarian crises at hand.

The Joint Research Centre of the European Commission together with the African Centre of Meteorological Applications for Development (ACMAD) worked jointly to monitoring the development of these climatic conditions, employing advanced forecasting tools and analytical techniques to understand and anticipate the evolving scenario.

This report presents a comprehensive meteorological analysis, based on monitoring indicators and seasonal forecasts. In addition, the warning observed by the African Drought Monitoring and Advisory System, the warnings issued during The Policy Dialogue Day held in August 2023 and a series of briefs for policy and decision makers based on significant weather and climate events updates are provided together with some reported impacts.

Standardized Precipitation Index (SPI)

Severe negative anomalies of precipitation are currently affecting many parts of the Zambezi basin. The SPI-3 (i.e. SPI for an accumulation period of 3 months) shows extremely dry conditions in eastern Angola, most of Zambia, Zimbabwe, Botswana, and Namibia. Some local spots are visible also in Mozambique and South Africa (Fig. 1).[1]

The sequence of SPI-3 from mid-October 2023 to mid-March 2024 (Fig. 2) shows that the drought began in Botswana in October 2023, intensified and expanded progressively to Angola, Zambia, Zimbabwe and Namibia affecting most of Zambezi basin and southern Madagascar as well by the end of the year. Then, after a partial

[1] For more details on the SPI, and the other GDO and EDO indicators of drought-related information used in this report, see the Appendix at the end of the document.

Drought in Southern Africa - April 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) - GDO data up to 31/03/2024

reduction in extent and severity (January 2024) SPI-3 negative anomaly quickly reached the most severe and wide condition during February and March 2024. The drought has been persistent, expanding and intensifying quickly over southern Africa regions. SPI-6 (accumulation period of 6 months, not shown here) shows similar intensity and pattern as SPI-3, confirming the relevance of the most recent months for the ongoing drought (January-March 2024).

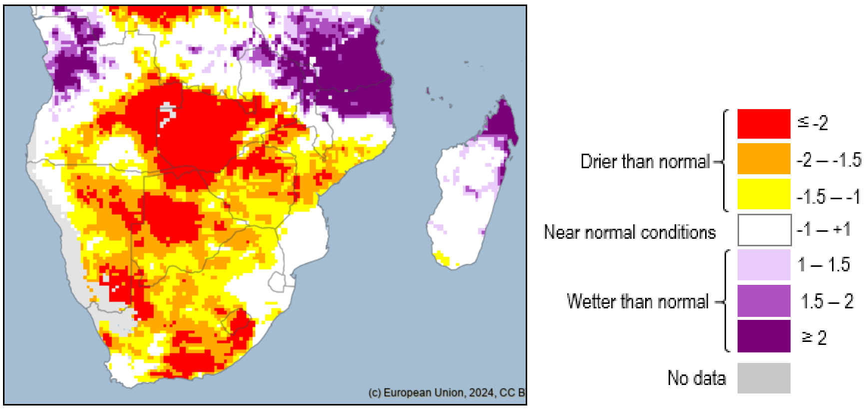

Figure 1: *Standardized Precipitation Index SPI-3 for the 3-month accumulation period ending on 31 March 2024.*[1]

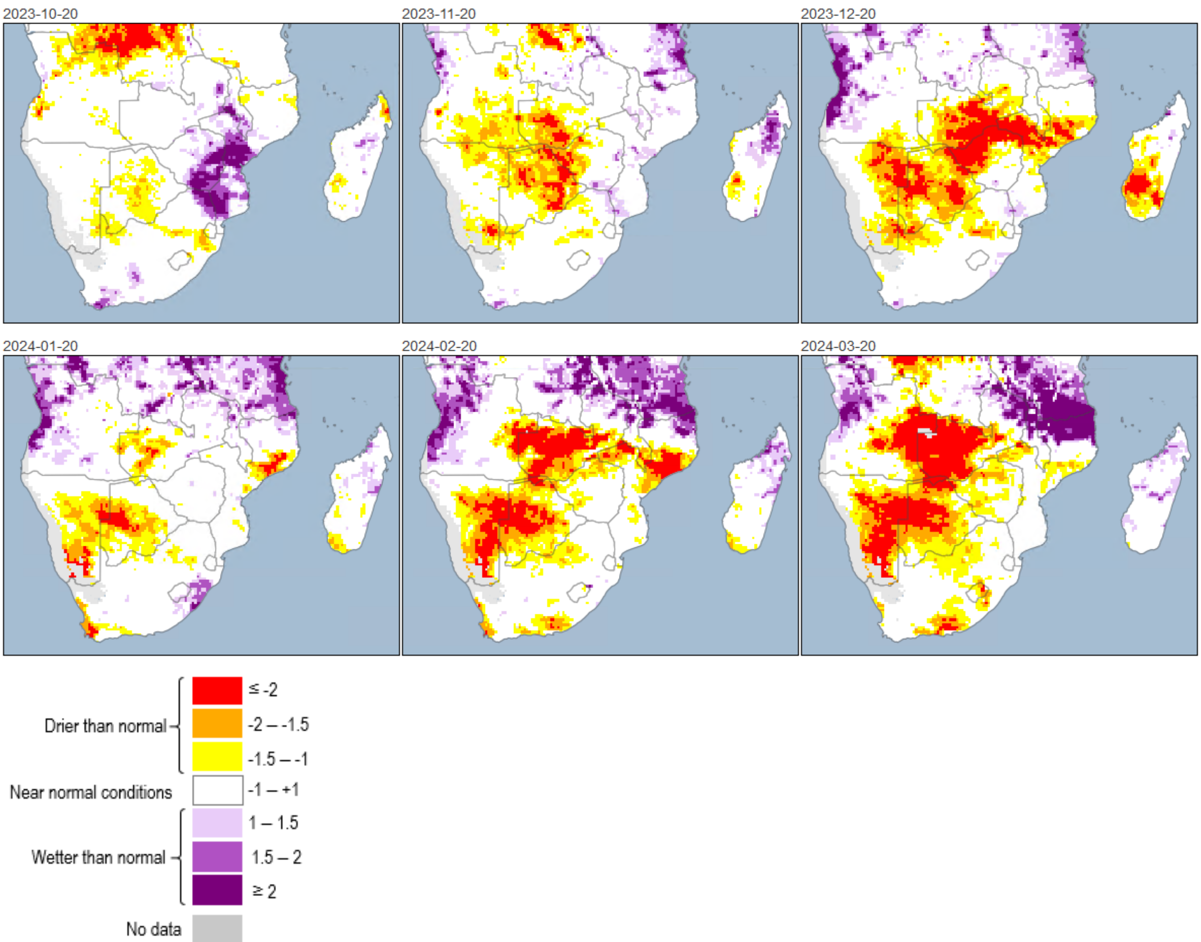

Figure 2: *Standardized Precipitation Index (SPI-3), for 3-month accumulation periods from mid-October 2023 (upper left panel) to mid-March 2024 (bottom right panel).*[1]

The extent of the ongoing drought covers more than the whole Zambezi basin (Fig. 3). Its spatial and temporal dynamics can be estimated using a recently developed method for tracking drought events.[2] This method is used to identify areas under meteorological drought, and estimates the evolution of the event: starting from the central regions of the Zambezi basin in November 2023, expanding to almost all the Zambezi basin by the end of the year, reducing to a small spot mainly in Botswana, and finally expanding again to the whole Zambezi basin and beyond its border in February-March 2024 (Fig. 4). The provisional clusters may further develop into consolidated clusters if meteorological drought conditions will persist.

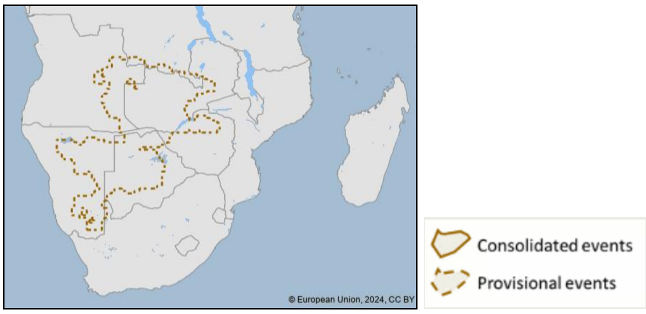

Figure 3: *Spatial-temporal tracking of the meteorological drought in late March 2024[2]. Data source: SPI-3 data derived from the ERA5 precipitation reanalysis.*

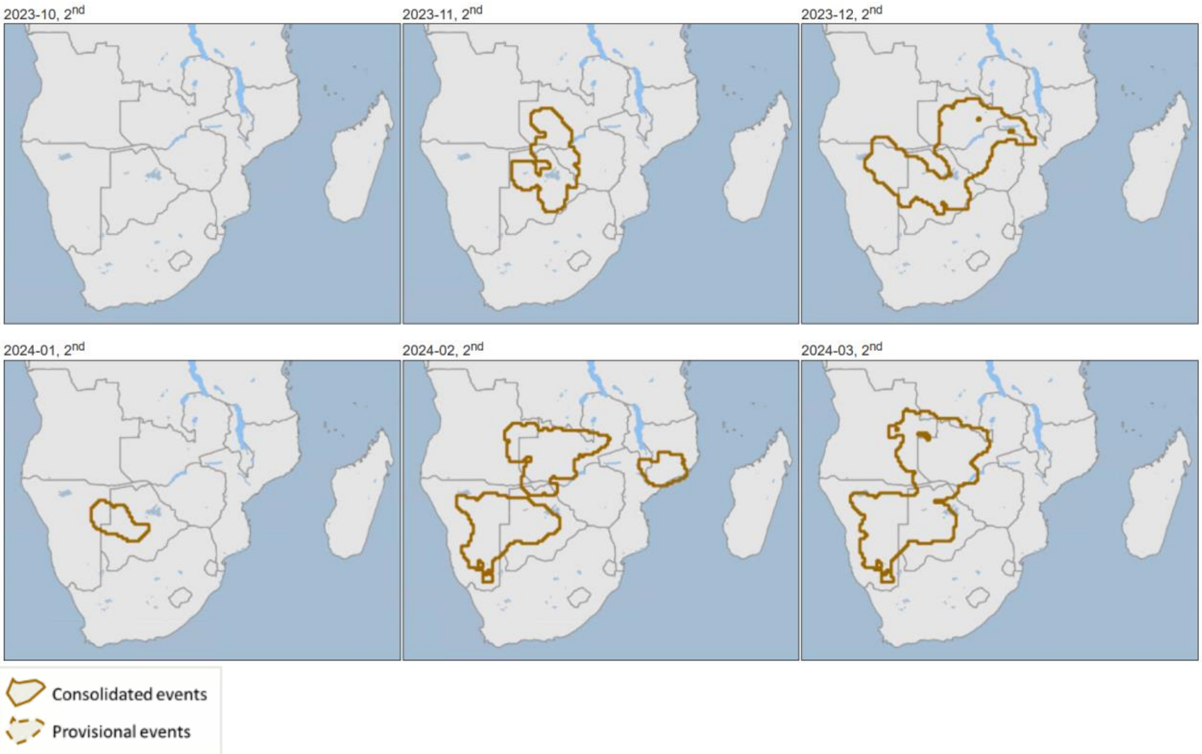

Figure 4: *Spatial-temporal tracking of the meteorological drought during from mid-October 2023 (upper left panel) to mid-March 2024 (bottom right panel)[2]. Data source: SPI-3 data derived from the ERA5 precipitation reanalysis.*

---

[2] The method is based on a generalized three-dimensional density-based clustering algorithm (DBSCAN). See: Cammalleri, C., and A. Toreti, 2023: A Generalized Density-Based Algorithm for the Spatiotemporal Tracking of Drought Events. J. Hydrometeor., 24, 537–548, https://doi.org/10.1175/JHM-D-22-0115.1.

Drought in Southern Africa - April 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) - GDO data up to 31/03/2024

The quantitative analysis of precipitation anomalies is shown in Figure 5. It is evident that Zambia, Malawi, and Zimbabwe have been facing severe rainfall shortages during the period from the beginning of January 2024 to the beginning of April 2024.

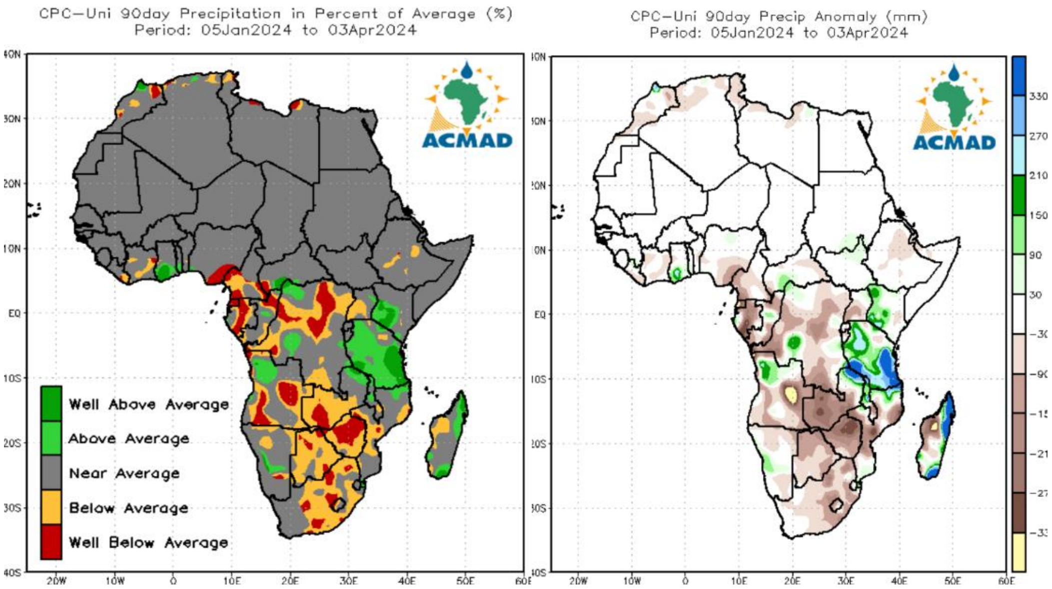

Figure 5: *CPC-Uni 90 days precipitation anomalies in % (left panel) and mm (right panel). Source ACMAD*

Temperature

Most of southern Africa experienced prolonged above-average temperatures from October 2023 to March 2024. In these regions the 6-month average temperature anomaly (baseline 1991-2020) has ranged between 0.5 °C and 1.5 °C, while it has been above 1.5 °C for most of Namibia, Botswana, northern Zimbabwe, southern Zambia, and western Mozambique (Fig. 6). Long-lasting and intense heatwaves worsened the effects of the precipitation deficit on the soil moisture content.

Considering the temporal evolution of the 6-month (Oct-Mar) average temperature anomaly over the Zambezi basin region, the period October 2023 – March 2024 registered the record highest anomaly since 1960 beating the already very warm periods in 2016-2017 and 2019-2020, and reaching almost 1.5 °C anomaly (Fig. 7).

According to the Heat and Cold Wave Index (HCWI)[3], on 13 March 2024 the most severe heatwave hit the whole Zambezi basin and in particular south-eastern Angola, eastern Namibia, Botswana, southern Zambia, western Zimbabwe and northern Mozambique, with a duration longer than two weeks (Fig. 8).

[3] For more details on the Heat and Cold Wave Index (HCWI), and the other GDO and EDO indicators of drought-related information used in this report, see the Appendix at the end of the document.

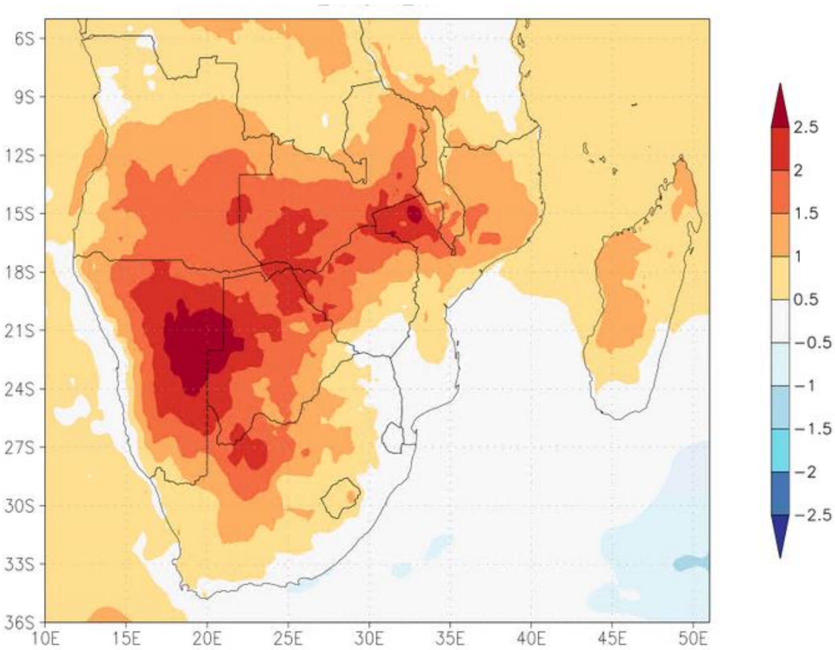

Figure 6: *Average temperature anomaly (ERA5) computed for the period October 2023 - March 2024 (baseline 1991-2020). Source: The KNMI Climate Explorer.*[4]

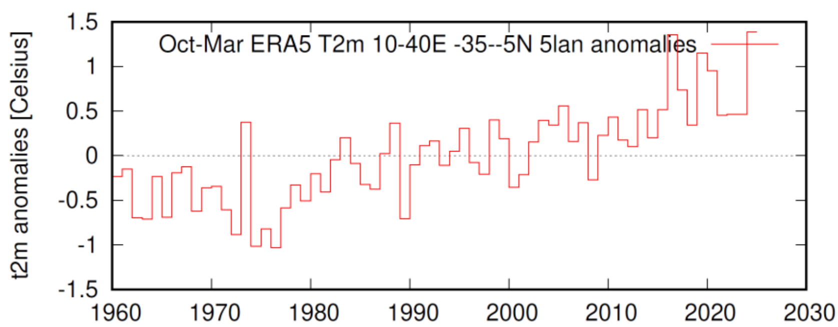

Figure 7: *Average 6-month (Oct-Mar) temperature anomaly (ERA5) computed for the period 1960-2024 (baseline 1991-2020) over southern Africa. Source: The KNMI Climate Explorer.*[4]

[4] The KNMI Climate Explorer https://climexp.knmi.nl

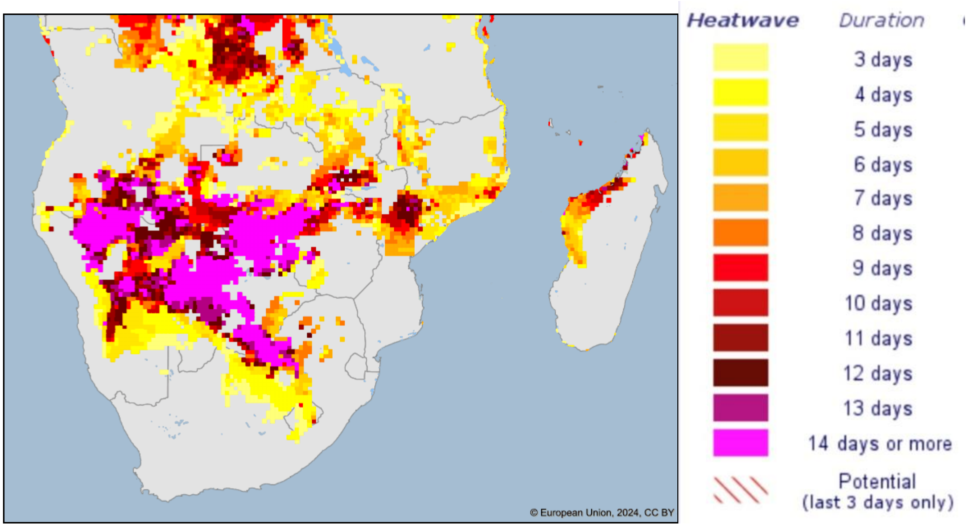

Figure 8: *Duration (in days) of the heatwave computed on 13 March 2024, based on the Heat and Cold Wave Index (HCWI). The yellow to purple colour scheme represents increasing duration of heat wave events.*[3]

Soil moisture

In late March 2024, soil moisture anomalies were remarkably negative over the whole Zambezi basin and in the south-eastern regions of South Africa. In most of Namibia anomalies were negative but with less severe values (Fig. 9). These conditions are the result of a combination of extremely low precipitation and high temperatures in the previous months. The drier-than-normal soil moisture pattern is consistent with the precipitation deficit of the previous months (see Fig. 1 and Fig. 2 – February and March 2024). Moreover, the regions with the strongest negative precipitation anomalies were also the ones affected by higher positive temperature anomalies. This combination contributed to an exacerbated water loss from the soil due to stronger evapotranspiration potential. Large areas in the Zambezi basin show soil moisture anomalies below -2, corresponding to the driest class of the GDO indicator (Fig. 9).[5]

Regarding the evolution of soil moisture anomalies (Fig. 10), they initially slightly affected southern Angola and northern Zambia (Oct-Nov 2023), then expanded to wide regions of the Zambezi basin, south-western South Africa and southern Madagascar (Dec 2023). In January 2024 there has been a temporary reduction of the extent and the severity of the drought with near-normal conditions almost for the whole southern Africa countries. Finally, in February and March 2024 soil moisture conditions rapidly deteriorated reaching the most severe drought value over the whole Zambezi basin and south-eastern South Africa.

In Figure 11 the same temporal evolution of soil moisture is estimated by the ASAP Warning Explorer [6], using the soil moisture z-score (or standardized score), that is the number of standard deviations by which the value of the indicator is above or below its mean value. This dataset is based on satellite data and on the methodology developed in the ESA Climate Change Initiative for Soil Moisture.[7] This dataset shows consistently the same evolution of the soil moisture anomalies confirming the signal of a severe drought started in October-November 2023 and quickly worsened in February-March 2024. Some relevant differences are notable in

[5] For more details on the Soil Moisture Anomaly, and the other GDO and EDO indicators of drought-related information used in the report, see the Appendix at the end of the document.

[6] Anomaly Hotspots of Agricultural Production – Waring Explorer https://agricultural-production-hotspots.ec.europa.eu/wexplorer/

[7] https://cds.climate.copernicus.eu/portfolio/dataset/satellite-soil-moisture

Drought in Southern Africa - April 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) - GDO data up to 31/03/2024

December 2023 for southern Mozambique and north-eastern South Africa where the ASAP product detected wetter signals than the GDO one. Conversely in February and March northern South Africa and southern Botswana appeared to be drier in the ASAP product than the GDO one. These differences confirm the uncertainty related to the different data sources and computation methodology.

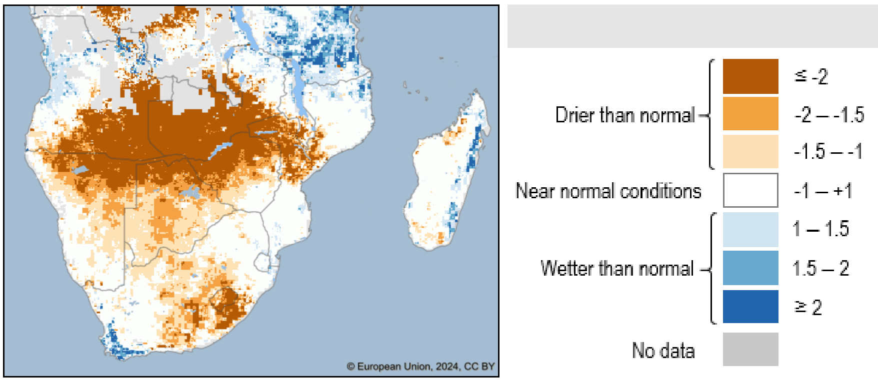

Figure 9: *Soil Moisture Anomaly, late March 2024.*[5]

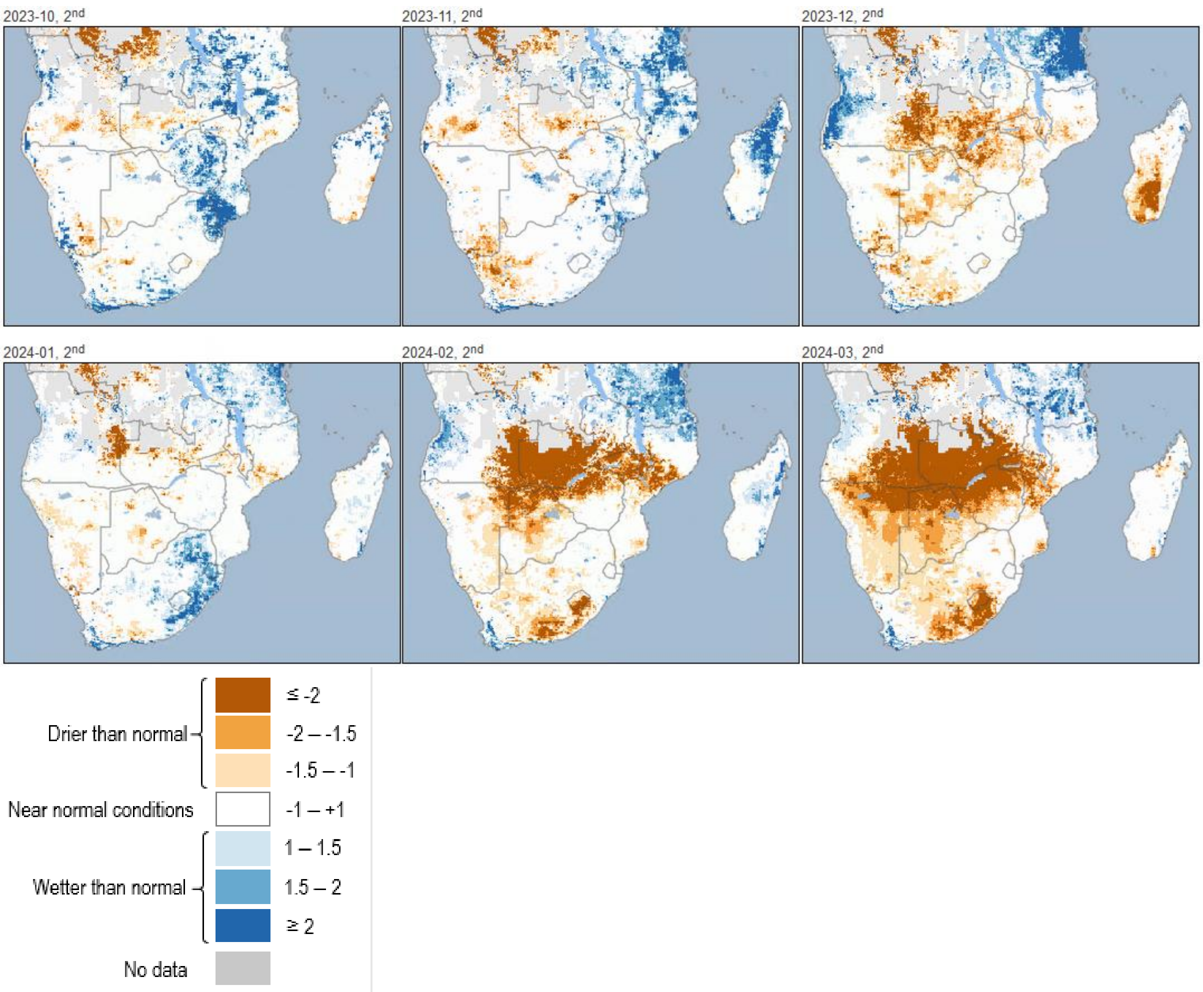

Figure 10: *Soil Moisture Anomaly, 10-day periods from mid-October 2023 to mid-March 2024.*[5]

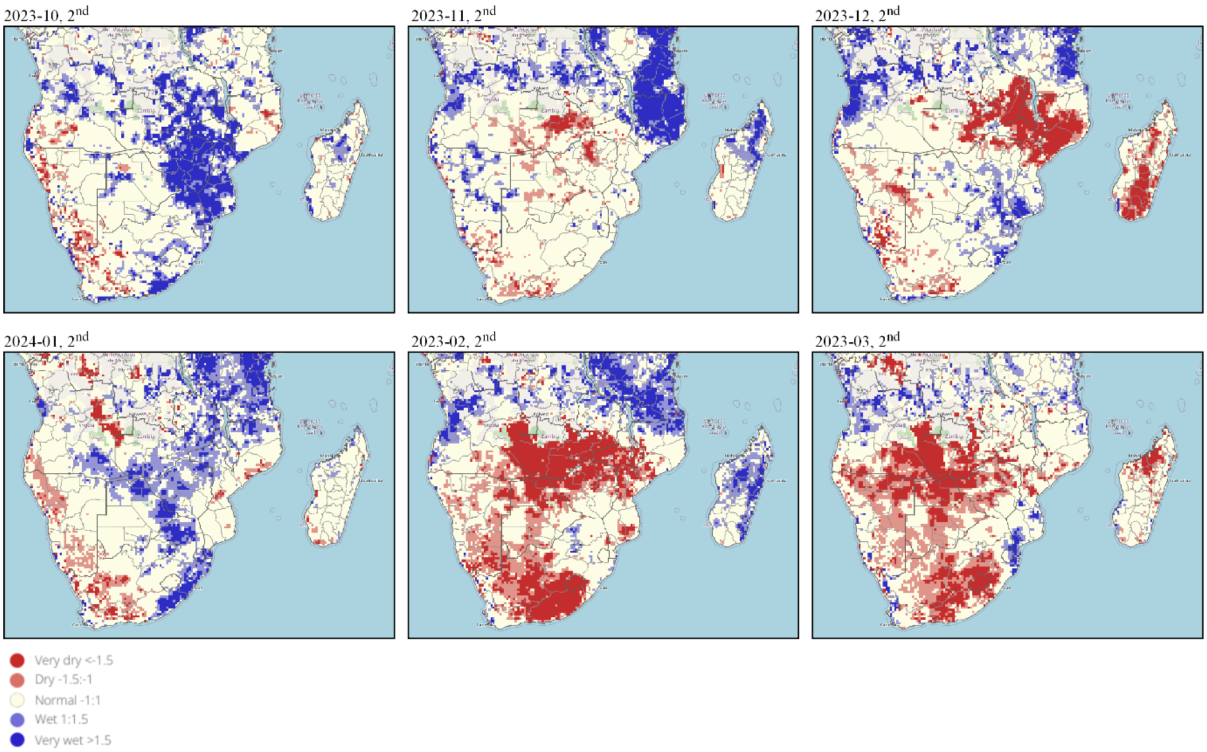

Figure 11: *Soil Moisture Anomaly, 10-day periods from mid-October 2023 to mid-March 2024. Source: ASAP* [6]

Vegetation biomass

In late March 2024, the satellite-derived NDVI anomaly indicator[8] shows severe vegetation stress in Namibia, Botswana, Zimbabwe, southern Zambia, Malawi, northern Mozambique, and south-eastern South Africa (Fig. 12). These critical and widespread conditions are due to the combined severe lack of precipitation and higher than normal temperatures.

The evolution of NDVI anomalies from mid-October 2023 to mid-March 2024 (Fig. 13) indicates a progressive increasing of vegetation stress, starting from southern Angola and western Zambia in mid-October 2023, expanding to wider regions in Angola in mid- November 2023, including also some regions of Botswana in mid-December 2023. After a temporary extensive recovery in January 2024, by mid-March 2024 vegetation conditions were severely bad in most of the Zambezi basin and over south-eastern South Africa regions.[8]

[8] The standardized score of NDVI is computed from MODIS data and sourced from the JRC-ASAP system (https://agricultural-production-hotspots.ec.europa.eu/)

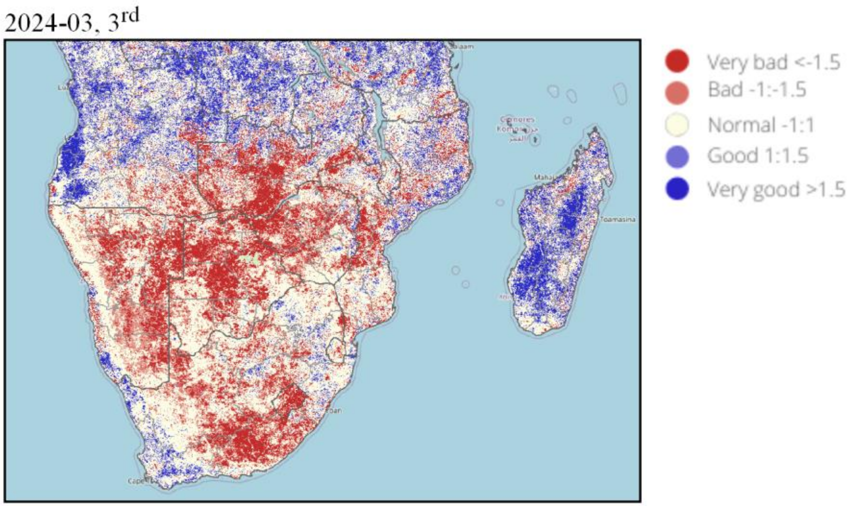

Figure 12: *Satellite-derived NDVI anomaly indicator, a proxy of photosynthetic activity of vegetation, in late March 2024.*[8]

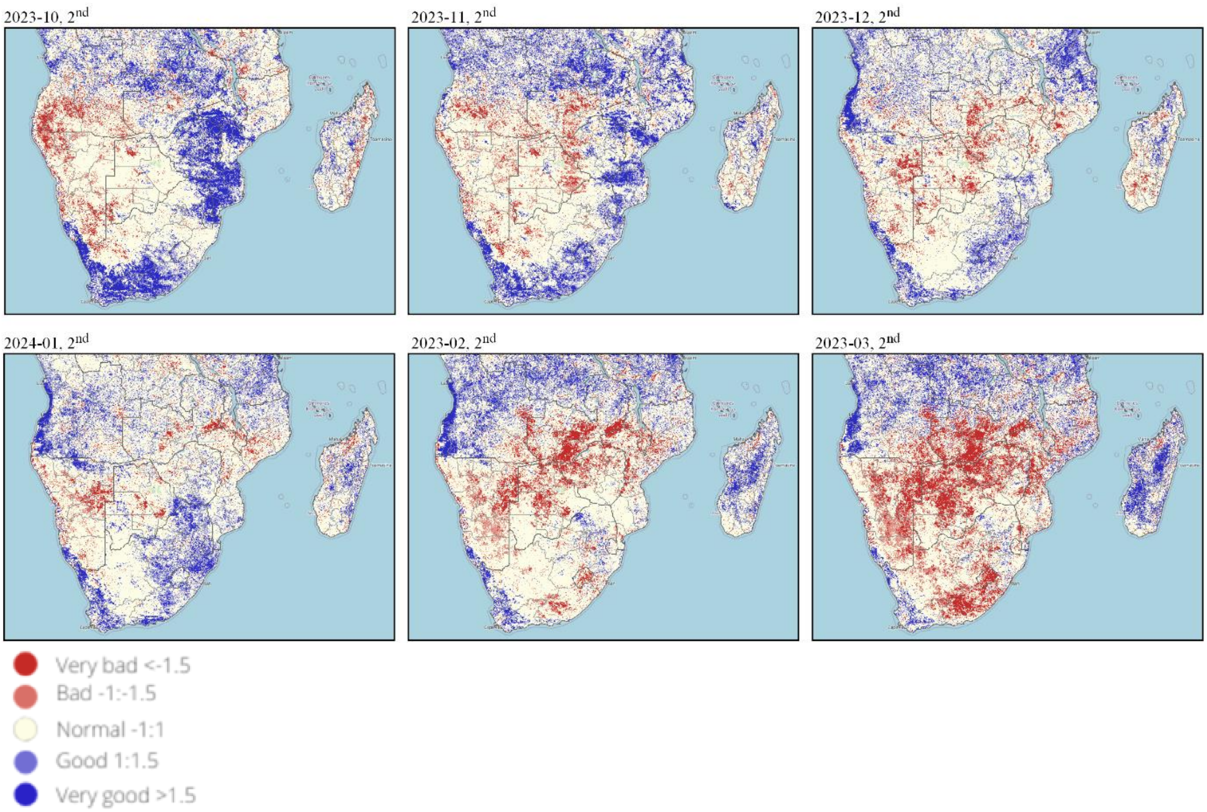

Figure 13: *Satellite-derived NDVI anomaly indicator, a proxy of photosynthetic activity of vegetation, from mid-October 2023 to mid-March 2024.*[8]

Vegetation stress is also visible when 10-m spatial resolution Sentinel-2 data is inspected (Fig. 14). The following images show as an example the state of vegetation on an agricultural area in the Southern province of Zambia. On the left, the false colour composite (NIR/SWIR/RED) for the period February-April 2023 is shown, while on the right the one for the same period of 2024. Red colour represents healthy vegetation. Note the nearly complete absence of water in the irrigation reservoirs. Similar situation can be found in Zimbabwe, Metabeleland North province (Fig. 15).

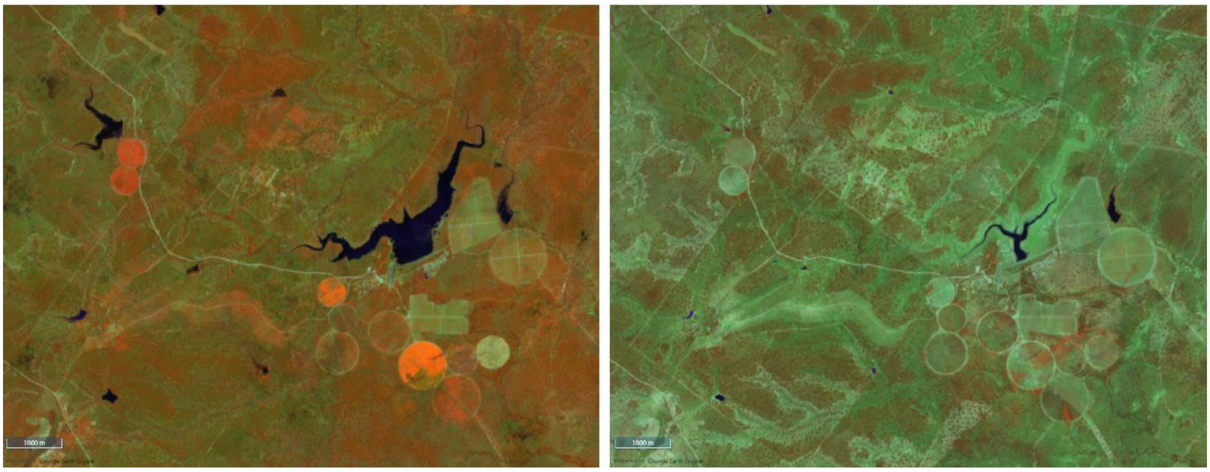

Figure 14. *Sentinel-2 false colour composites for 2023 (left) and 2024 (right) in Southern province (Zambia). Centre coordinates: 26.335,-17.323. Source: ASAP High Resolution Viewer.*

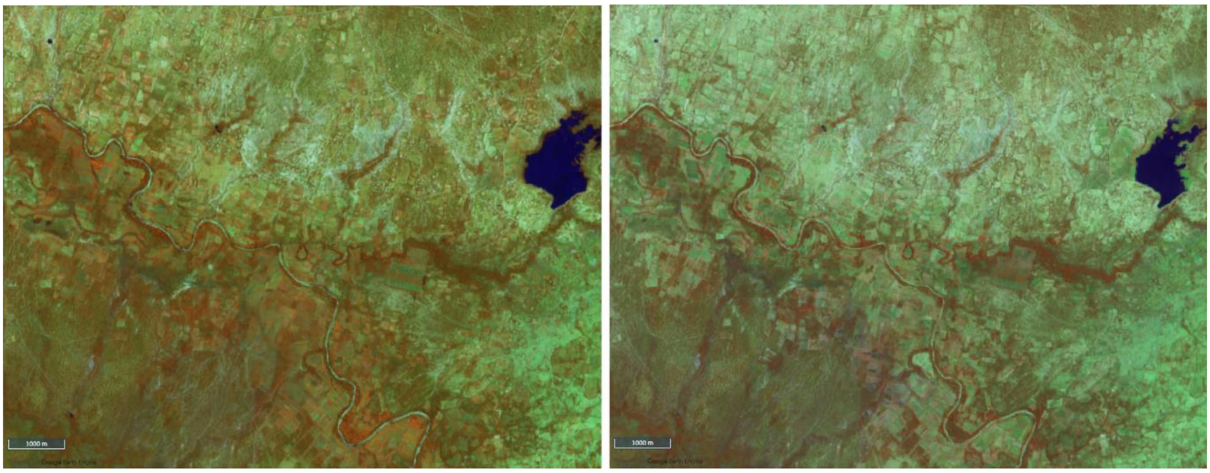

Figure 15. *Sentinel-2 false colour composites for 2023 (left) and 2024 (right) in Matabeleland North province (Zimbabwe). Centre coordinates: 28.433,-19.408. Source: ASAP High Resolution Viewer.*

Combined Drought Indicator - African Drought Monitoring and Advisory System

The African Drought Monitoring and Advisory system is based on the analysis of combined spatial patterns of precipitation, soil moisture and vegetation anomalies. This approach is summarised in the Combined Drought Indicator (CDI) that acts as a traffic light pointing to the areas at risk of agricultural drought, areas where the vegetation has already been affected by drought and areas of no drought conditions. The CDI classification scheme defines four primary drought classes (“No drought”, “Watch”, “Warning” and “Alert”)[9]. The system shows that the CDI for the three 10-day periods from late February 2024 to mid-March 2024 (Fig. 16) were pointing

[9] https://ada.acmad.org/

to a warning with many alerts related to vegetation stress and soil moisture deficit following the below to very below normal rainfall experienced in the previous months.

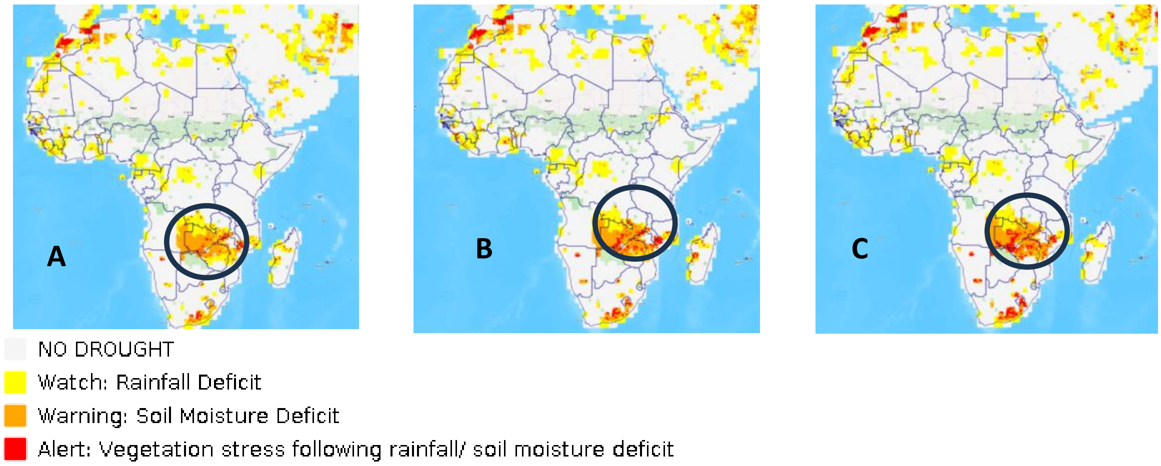

Figure 16: *CDI for late February (A), early March (B) mid- March (C) 2024. Source ACMAD*[9]

Large-scale drivers

In the period from October 2023 to March 2024 El Niño conditions characterised the tropical Pacific Ocean. The NINO3.4 index was approximately 1.2, indicating moderate to strong conditions (Fig. 17). Historical data on precipitation and temperature anomalies during previous El Niño events show drier and warmer conditions than usual in most of southern Africa. This can be inferred by averaging the years in which the NINO3.4 index was above 1 (dotted blue line in Fig. 17). This composite analysis indicates that there is a notable agreement with the observed precipitation and temperature anomalies in the past 6 months (Figs. 1 and 6), despite a lack of statistical significance for temperature. This analysis suggests that El Niño is likely a significant factor contributing to the drought conditions in southern Africa in recent months. It is important to note that El Niño is a naturally recurring phenomenon that influences climate patterns globally, and it is currently occurring against a backdrop of global warming, which may exacerbate its effects and other natural climate phenomena.

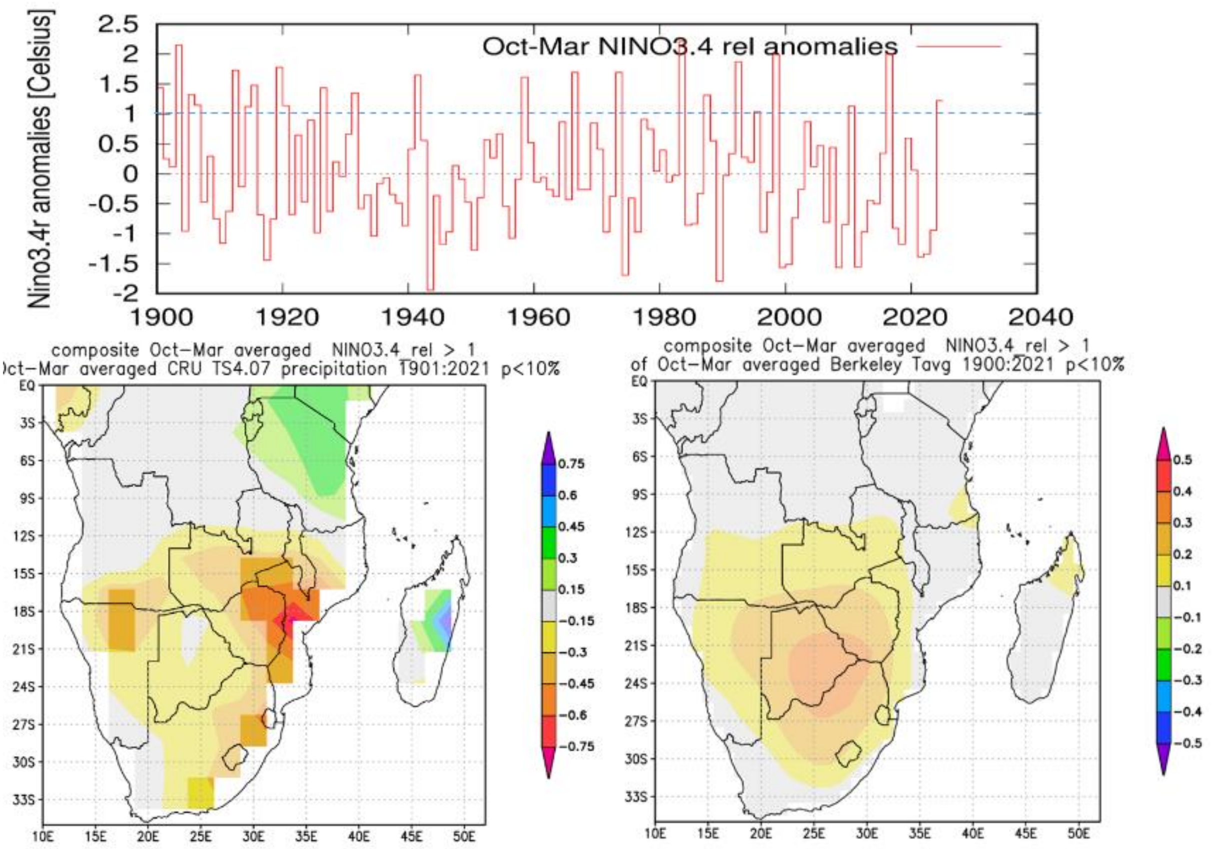

Figure 17: *Top: Temporal evolution of the mean October-March relative NINO3.4 index since 1900 (ERSSTv5). Bottom left: Composite of anomalous precipitation (mm/day) in the years in which the Oct-Mar NINO3.4 index is above 1, during 1900-2021. Bottom right: Composite of anomalous temperature (K) in the years in which the Oct-Mar NINO3.4 index is above 1, during 1900-2021. Source: The KNMI Climate Explorer.[4]*

Fire danger forecast

The wildfire hazard is a direct consequence of the elevated temperature anomalies and surface dryness, combined with the availability of fuel (i.e. dry litter and wood). The CEMS Global Wildfire Information System (GWIS) provides mapping services of the fire danger forecast all over the world.[10] A moderate-to-very high danger is shown over Namibia, Botswana, north-western South Africa, northern Mozambique and southern Madagascar up to 11 April 2024 (Fig. 18).

[10] https://gwis.jrc.ec.europa.eu/

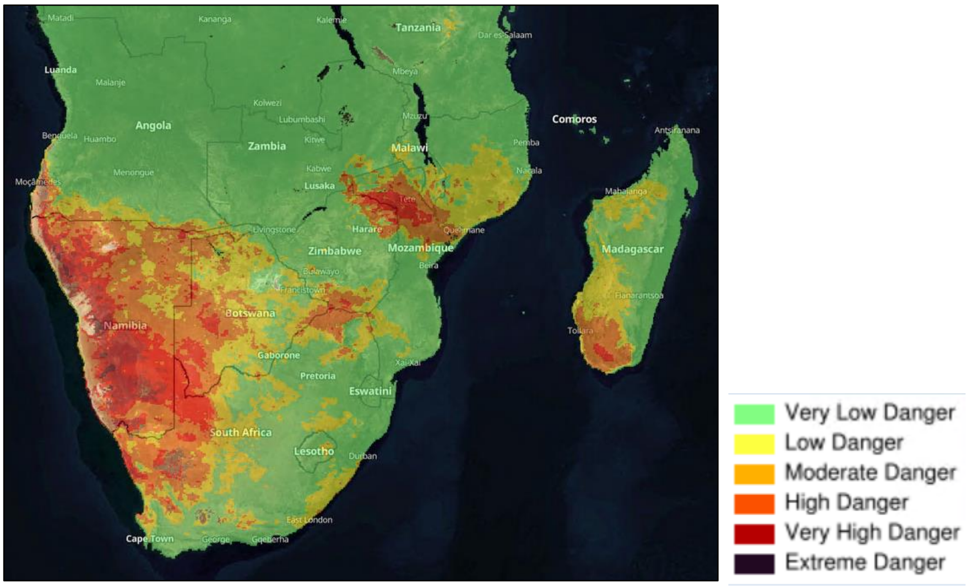

Figure 18: *Fire danger forecast expressed by the Fire Weather Index up to 11 April 2024. Data source: Global Wildfire Information System (GWIS)* [10].

Seasonal forecast

From April to June 2024, close to average or wetter than average conditions (baseline 1981-2016) are predicted over most of southern Africa and in particular the highest wetter anomalies are expected for eastern Angola and western Zambia. Only for south-western Namibia, western South Africa, northern Mozambique and south-western Madagascar drier than average conditions are predicted, as shown in Figure 19.

These wet conditions are related to the precipitation occurring mainly in eastern Angola, western Zambia, northern Botswana, and southern Mozambique in early April 2024 (Fig. 20). This seems to be just a temporary relief as, according to the Copernicus C3S seasonal forecasts[11], warmer than usual conditions are likely to occur in the whole southern Africa, with large positive anomalies, up to July 2024. Precipitation forecasts are lower than average, with a good agreement and only a small variability between models. Close monitoring is required to assess the severity and the extent of the impacts over the coming season.

The probability of occurrence of low flows anomalies (compared with the seasonal discharge thresholds generated using the GloFAS seasonal reforecast[12]) for rivers in southern Africa from April to July 2024 is high, mainly in western Zambia and south-eastern Angola, as shown in Figure 21.[13] The prolonged lack of precipitation, severe heatwaves, and warmer-than-average forecast are likely to reduce river flows further, with direct impacts on agriculture, ecosystems and energy production. Water resource management should be cautiously planned to limit impacts and identify adaptation strategies.

---

[11] https://climate.copernicus.eu/seasonal-forecasts

[12] https://global-flood.emergency.copernicus.eu/technical-information/glofas-seasonal/

[13] The analysis is based on the open source LISFLOOD hydrological model outputs driven by 51 ensemble members of the ECMWF SEAS5 forecast. For more information: https://ec-jrc.github.io/lisflood/

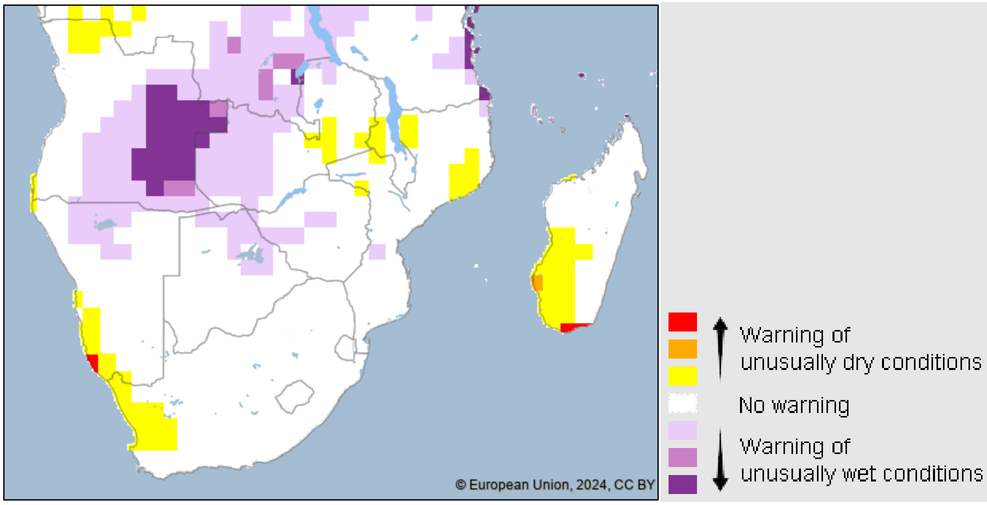

Figure 19: *Indicator for Forecasting Unusually Wet and Dry Conditions, Apr-Jun 2024 (based on ECMWF SEAS5).*[14]

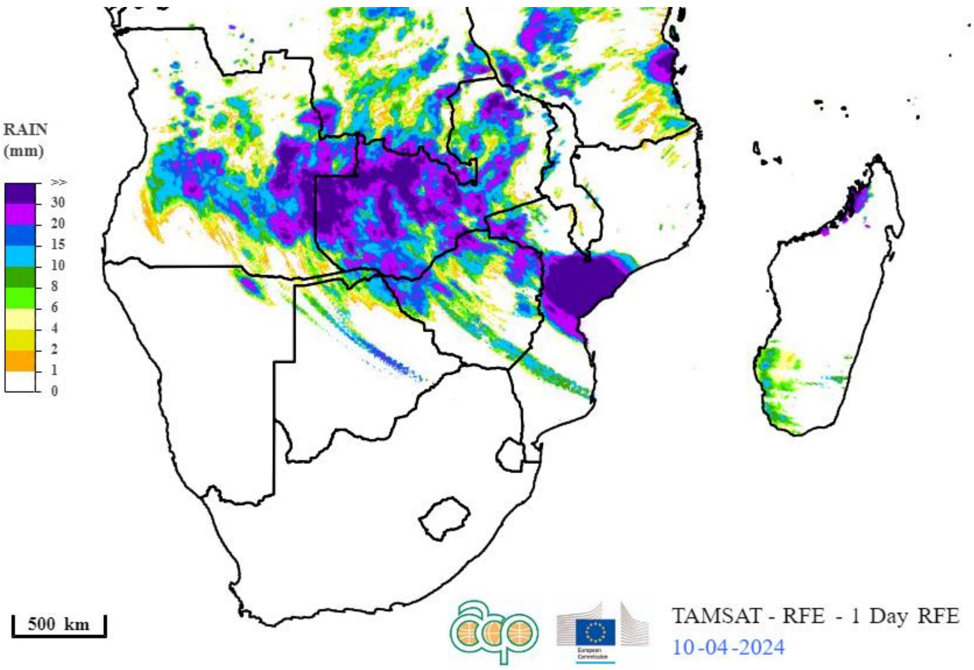

Figure 20: *Precipitation in early April 2024 based on TAMSAT*[15]*. Source: Environmental Station (Version 3.0) [Computer software].*[16]

[14] For more details on the Indicator for Forecasting Unusually Wet and Dry Conditions, and the other GDO and EDO indicators of drought-related information used in the report, see the Appendix at the end of the document.

[15] Tropical Application of Meteorology using SATellite and ground-based data https://research.reading.ac.uk/tamsat/

[16] https://estation.jrc.ec.europa.eu/eStation3/

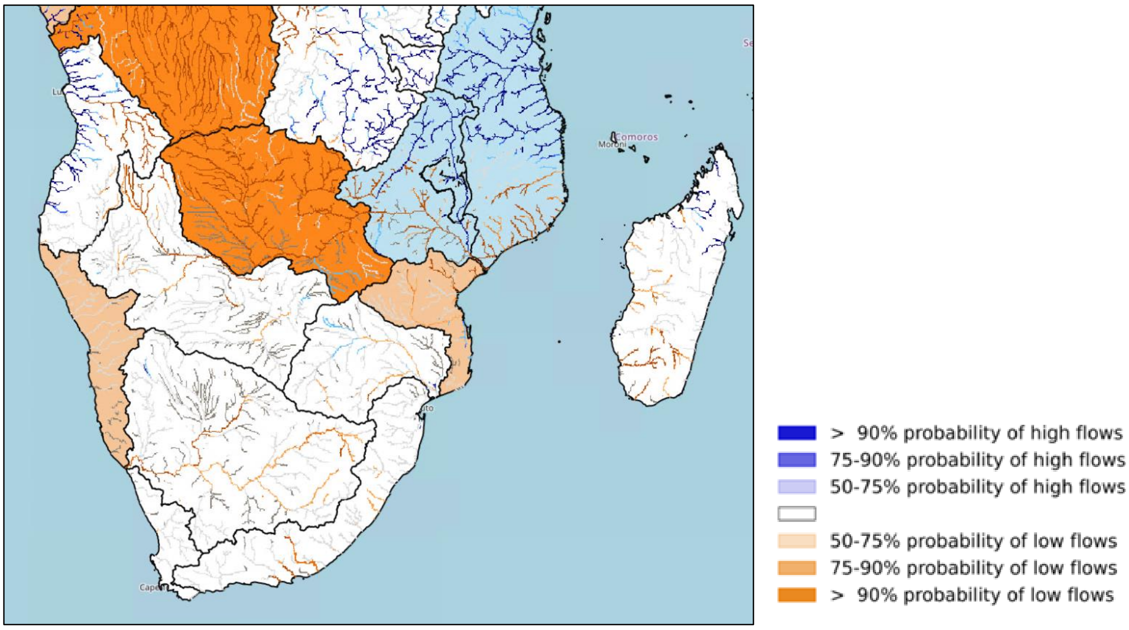

Figure 21: *Maximum probability [%] of high (> 80th percentile) or low (< 20th percentile) river flow, during the 4-month forecast horizon (April-July 2024) for basins and river network. Source: CEMS Global Flood Awareness System (GloFAS).*[17]

ACMAD's Long-Range Forecast shows that the outlook for the rainfall season (January - April 2024) is below average and normal to below average rainfall over northern Africa, most of the SADC (Southern African Development Community) countries and north of Madagascar. Similar climatological patterns are expected to persist in the Zambezi basin in the months ahead (Fig. 22).

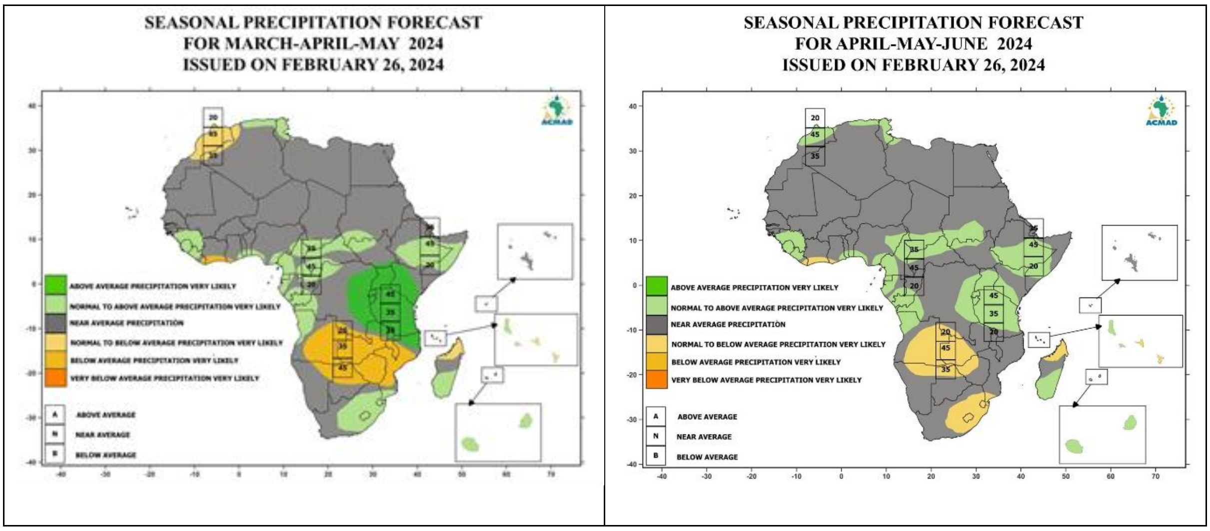

Figure 22: *Seasonal Precipitation forecast for March-April-May and April-May-June 2024 issued on February 26, 2024. Source: ACMAD*

The current drought condition in part of southern Africa has been forecast during the consensus seasonal forecast update conducted under ACMAD's coordination with the contribution of Regional Climate Centres (ICPAC, SADC-CSC, AGRHYMET and CAPC-AC). The consensus seasonal forecast indicated that the evolution of

[17] https://global-flood.emergency.copernicus.eu/

the ENSO and IOD during 2023/2024 would cause record below to well below average precipitation associated with drought of moderate to high intensity with significant impacts in many parts of southern Africa.

Reported impacts

According to the Integrated Food Security Phase Classification due to the crop damages and losses the Acute Food Insecurity ranges from stressed to crisis level (i.e. IPC Phase 2 and 3)[18] in most of the Zambezi basin regions.

The Zambezi river flow at Chavuma is slowly increasing but the current flow is extremely low for the season, by far the lowest ever recorded. The flow is 410 m^3/s on 2nd April 2024 whilst last year on the same date it was 1,479 m^3/s and the long-term average (1968-present) is about 2,000 m^3/s.[19]

According to GEOGLAM (Group on Earth Observations Global Agricultural Monitoring) Crop Monitor for Early Waring Report of April 2024[20] southern Africa is currently experiencing a severe and prolonged drought, resulting in below-average yields and failure conditions for crops in several countries. The delayed start of the seasonal rains, along with persistent dry and hot conditions, has contributed to crop failure in southern and central Zambia, Zimbabwe, and in southern Malawi. The impact of the drought has resulted in national disaster declarations in these countries. The forecast for below-average rainfall through June indicates little chance of recovery for the remainder of the cropping season, posing a significant threat to food security in the region. In particular maize cultivation has been severely affected and poor to failure conditions have been reported for western and central Zambia, Zimbabwe, central and southern Malawi, central-northern Mozambique, central-northern South Africa, south-eastern Botswana, southern Angola, and northern Namibia (Fig. 23).

[18] https://www.ipcinfo.org/ipcinfo-website/ipc-overview-and-classification-system/ipc-acute-food-insecurity-classification/

[19] https://www.zambezira.org/hydrology/river-flows

[20] https://www.cropmonitor.org/crop-monitor-for-early-warning#section10; https://static1.squarespace.com/static/636c12f7f9c2561de642a866/t/660ec5a4f3850c469c33e7cb/1712244135497/EarlyWarning_CropMonitor_202404.pdf

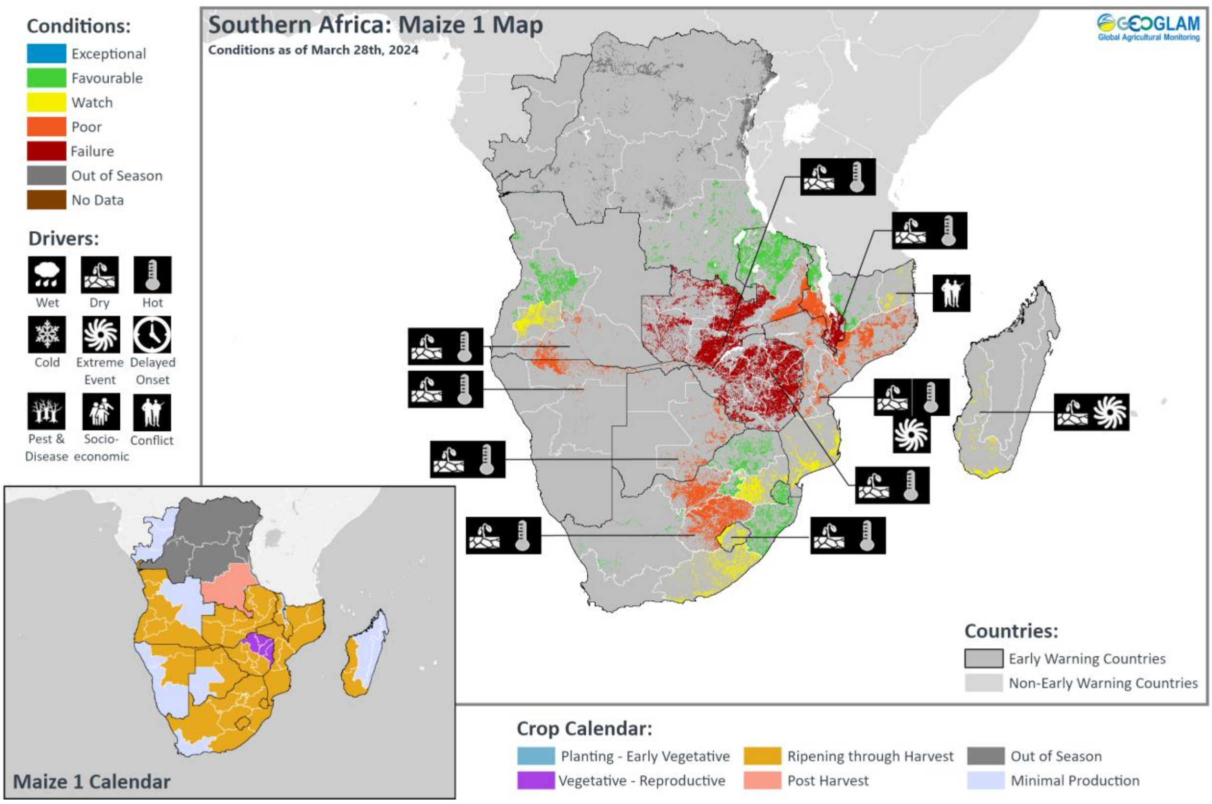

Figure 23: *Crop condition map synthesizing Maize 1 conditions as of March 28th. Crop conditions over the main growing areas are based on a combination of inputs including remotely sensed data, ground observations, field reports, national, and regional experts. Crops that are in other than favourable conditions are labelled on the map with their driver. Source: GEOGLAM Crop Monitor for Early Waring*[21]

Zimbabwean president Emmerson Mnangagwa has declared a state of disaster on 3 April 2024, due to a severe drought that has been affecting the country. The drought has resulted in a significant decrease in crop yields and livestock, leading to food shortages and water scarcity in many parts of the country. The government is requesting international assistance to help mitigate the impact of the drought and provide relief to affected communities. This declaration underscores the urgent need for humanitarian aid to address the growing crisis in Zimbabwe. The drought has also affected electricity production as Zimbabwe is highly reliant on hydroelectric power.[22]

In Zimbabwe the missed rainy season has led to significantly below-normal to failed harvests, high food prices, and constrained access to markets. The drought and high temperatures have further reduced potential crop yields and led to deteriorating water and pasture conditions, especially in semi-arid areas. The depreciation of the local currency has driven increases in the cost of living, making goods and services increasingly unaffordable for low-income households. Staple grain prices are higher than normal, and the government has implemented measures to enhance food availability and access. The tobacco marketing season is expected to improve household access to income, despite a lower harvest due to erratic and below-average rainfall. Overall, the poor harvests, economic challenges, and high prices are expected to drive area-level crisis outcomes in

[21] https://www.cropmonitor.org/

[22] https://www.theguardian.com/world/2024/apr/03/zimbabwean-president-declares-state-of-disaster-due-to-drought

deficit-producing areas and increase the number of households facing stressed outcomes in surplus-producing areas.[23]

In southern Angola, poor households are facing constrained access to staple foods due to weak purchasing power and above-average prices. The poor rainfall during the 2023/24 season has resulted in poor cropping conditions, leading to below-average harvests. Macroeconomic challenges, including high inflation and reduced fuel subsidies, are also contributing to high food prices. As a result, at least one in five households in southern Angola is expected to remain in Crisis (IPC Phase 3) through September.[24]

In late February, Zambia declared the severe drought a national disaster and emergency that has affected 84 of the country's 116 districts.[25] Moreover, the government announced that the drought has destroyed about 1 million hectares of the 2.2 million hectares planted with maize. Given that half of the area planted to maize is lost, it could have significant negative consequences on food security not only for the country but also for the region, as Zambia is one of southern Africa main producers and exporters of maize.[26]

On March 23, the president Malawi declared a state of disaster as 23 out of the country's 28 districts have been affected by the El Niño conditions, and a preliminary assessment by the government estimated that up to 2 million farming households and 44 percent of the national cropping area have been affected.[27]

In South Africa, a favourable start of the rainy season was followed by dry and hot weather since mid-January over a large part of the summer-grain producing region. The situation has resulted in reduced yield prospects, particularly in North West and Free State provinces. As a result, maize production is officially estimated to be 19 percent lower than the previous year's record crop.[28]

ACMAD brief for policy and decision makers

The brief for policymakers is an impact-based forecast produced in collaboration with all the African Regional Climate Centres (RCCs). The brief contains specific details on the nature of these impacts and recommended actions for policymakers. As it can be seen in Figure 24 the drought conditions have been detected and impact-based forecasts issued since August 2023. Drought conditions have been observed in both southern and northern regions of Africa. During the policy dialogue day for anticipatory action, the African Centre of Meteorological Application for Development (ACMAD) presented its Probabilistic Forecast for October to December (Fig. 24C) along with an Impact-Based Forecast for August to December 2023 (Fig. 24B). This underscores the impending drought conditions, emphasizing the need for proactive measures.

[23] https://fews.net/southern-africa/zimbabwe

[24] https://fews.net/southern-africa/angola

[25] https://www.africanews.com/2024/03/01/zambia-declares-national-emergency-over-drought/

[26] https://apnews.com/article/drought-national-disaster-emergency-electricity-4cc6a2105f4641efe17e10a5b75f78a5

[27] https://www.wfp.org/news/wfp-urges-global-support-malawi-faces-looming-food-crisis-triggered-el-nino

[28] https://static1.squarespace.com/static/636c12f7f9c2561de642a866/t/660ec5a4f3850c469c33e7cb/1712244135497/EarlyWarning_CropMonitor_202404.pdf

Drought in Southern Africa - April 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) - GDO data up to 31/03/2024

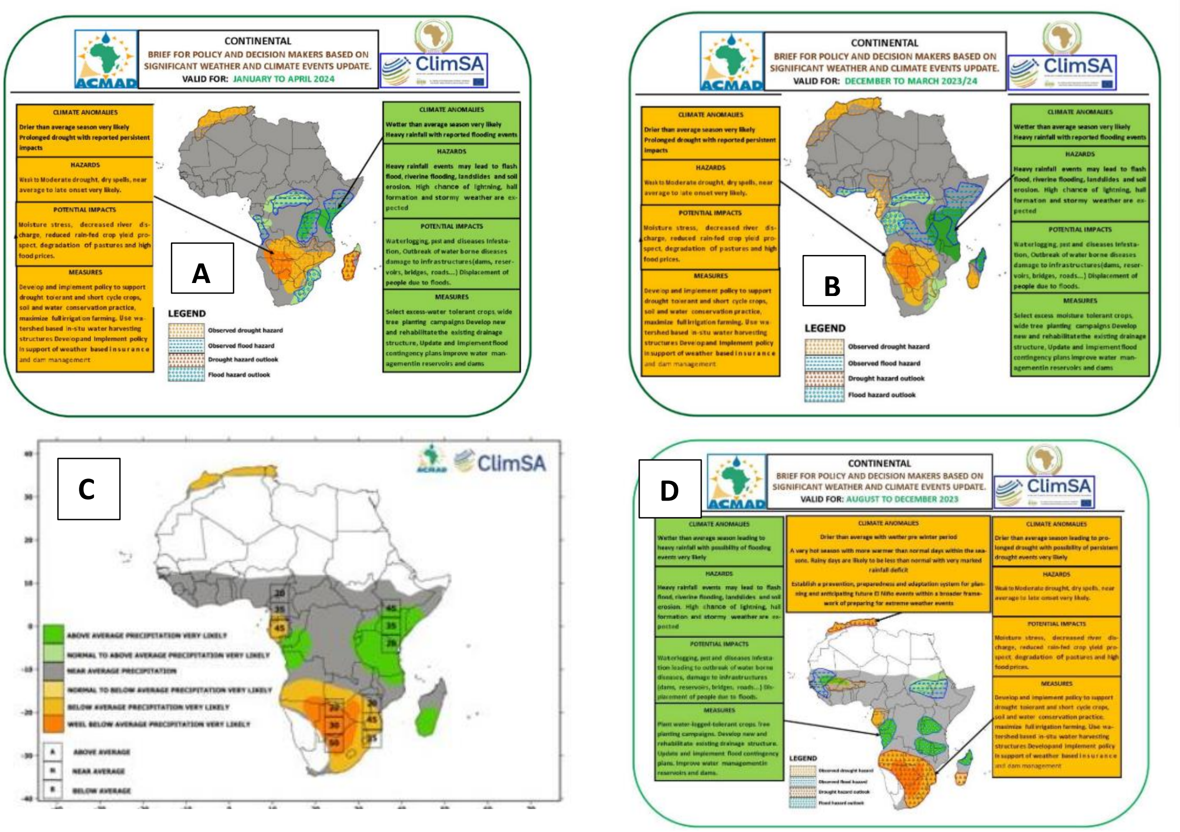

Figure 24: *Impact based forecast for December 2023 to March 2024 (A), January to April 2024 (B), and August to December 2023. Probabilistic Forecast for October to December 2023 (C). Source: ACMAD*

Global overview

In late March 2024 the other most severe and critical drought events in the world are the long-lasting drought in South America affecting both La Plata and Amazon basins, the severe and persistent drought in the Mediterranean region and in particular affecting Morocco, Algeria and southern Spain. Other critical conditions regard Argentina, Panama, southern Italy particularly Sicily, central Asia. These areas are well highlighted by the negative soil moisture anomaly shown in Fig. 25.

According to the seasonal forecast based on the Indicator for Forecasting Unusually Wet and Dry Conditions[14], potentially critical drought may emerge in central-southern Canada, central US, Mexico, south-east Asia, north-eastern China, and western Australia. Moreover, the already critical conditions in South America, southern and northern Africa, and Mediterranean will likely persist and possibly get worse. (Fig. 26)

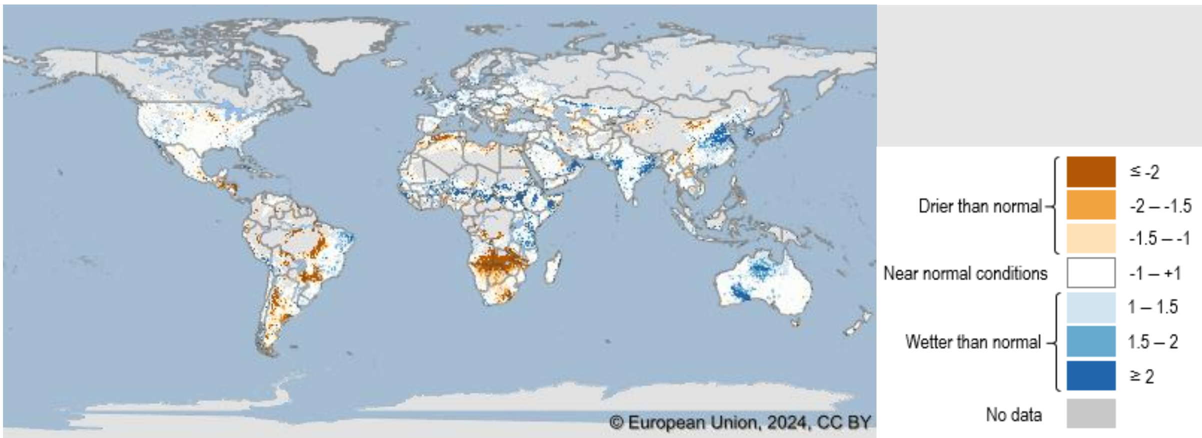

Figure 25: Soil Moisture Anomaly, late March 2024. [5]

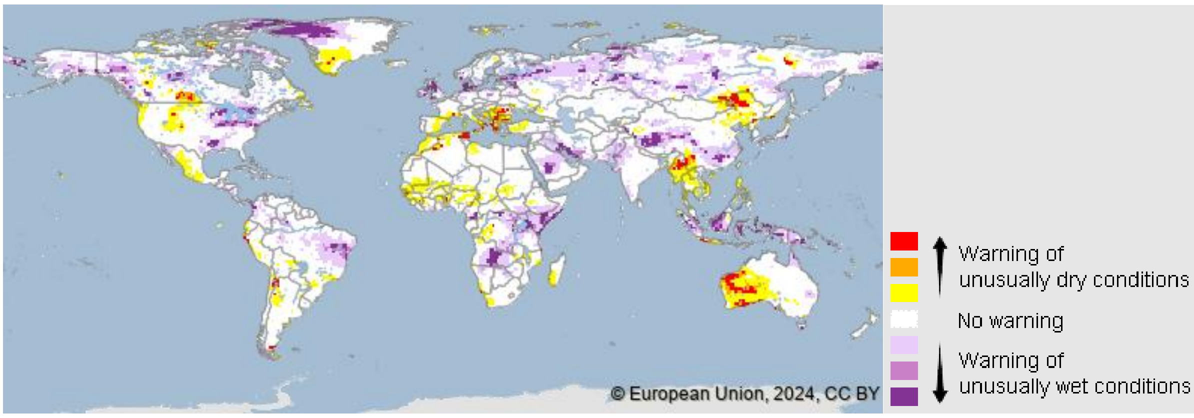

Figure 26: *Indicator for Forecasting Unusually Wet and Dry Conditions, Apr-Jun 2024 (based on ECMWF SEAS5).* [14]

Appendix: GDO and EDO indicators of drought-related information

The Standardized Precipitation Index (SPI) provides information on the intensity and duration of the precipitation deficit (or surplus). SPI is used to monitor the occurrence of drought. The lower (i.e., more negative) the SPI, the more intense is the drought. SPI can be computed for different accumulation periods: the 3-month period is often used to evaluate agricultural drought and the 12-month (or even 24-month) period for hydrological drought, when rivers fall dry and groundwater tables lower.

Lack of precipitation induces a reduction of soil water content. The Soil Moisture Anomaly provides an assessment of the deviations from normal conditions of root zone water content. It is a direct measure of drought associated with the difficulty of plants in extracting water from the soil.

The Indicator for Forecasting Unusually Wet and Dry Conditions provides early risk information for Europe. The indicator is computed from forecasted SPI-1, SPI-3, and SPI-6 derived from the ECMWF seasonal forecast system SEAS5.

Check https://drought.emergency.copernicus.eu/factsheets for more details on the indicators.

Glossary of terms and acronyms

ACMAD	African Centre of Meteorological Applications for Development
ASAP	Anomaly Hotspots of Agricultural Production
CDI	Combined Drought Indicator
CEMS	Copernicus Emergency Management Service
EDO	European Drought Observatory of CEMS
EC	European Commission
ECMWF	European Centre for Medium-Range Weather Forecasts
ERA5	ECMWF Reanalysis v5
ERCC	European Emergency Response Coordination Centre
ESA	European Space Agency
GDO	Global Drought Observatory of CEMS
GEOGLAM	Group on Earth Observations Global Agricultural Monitoring
GloFAS	Global Flood Awareness System of CEMS
GRACE	Gravity Recovery and Climate Experiment
GWIS	Global Wildfire Information System
HCWI	Heat and Cold Wave Index
IPC	Integrated Food Security Phase Classification
JRC	Joint Research Centre
KNMI	Koninklijk Nederlands Meteorologisch Instituut
LFI	Low-Flow Index
MARS	Monitoring Agricultural Resources
MJJ	May-June-Jul
MODIS	Moderate-Resolution Imaging Spectroradiometer
NDVI	Normalized Difference Vegetation Index
RCC	Regional Climate Centre
SADC	Southern African Development Community
SMA	Soil Moisture Anomaly
SPI	Standardized Precipitation Index
TAMSAT	Tropical Application of Meteorology using SATellite and ground-based data
TWS	Total Water Storage
VIIRS	Visible Infrared Imaging Radiometer Suite
WMO	World Meteorological Organization

Drought in Southern Africa - April 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) - GDO data up to 31/03/2024

GDO and EDO indicators versioning

The GDO and EDO indicators appear in this report with the following versions:

GDO, EDO indicator	Version
▪ Ensemble Soil Moisture Anomaly (SMA)	*v.3.0.1*
▪ Indicator for Forecasting Unusually Wet and Dry Conditions	*v .1.1.0*
▪ Standardized Precipitation Index (SPI, ERA5)	*v.1.0.0*
▪ Heat and Cold Wave Index (HCWI)	*v.1.0.0*
▪ Meteorological Drought Tracking (SPI-3 ERA5)	*v.1.0.1*

Check https://drought.emergency.copernicus.eu/download for more details on indicator versions.

Distribution

For use by the ERCC and related partners, and publicly available for download at GDO website: https://drought.emergency.copernicus.eu/reports

List of Figures

Drought in Southern Africa - April 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) - GDO data up to 31/03/2024

Authors

European Commission, Joint Research Centre, Dir. E Space, Security & Migration, Disaster Risk Management Unit - Drought Team

Toreti A. [i] *(Team Leader)*
Bavera D. [ii]
Acosta Navarro J. [i]
Acquafresca Laura [iii]
Barbosa P. [i]
de Jager A. [i]
Fioravanti G. [i]
Hrast Essenfelder A. [i]
Magni D. [ii]
Mazzeschi M. [iii]

African Centre of Meteorological Applications for Development

Nkurunziza R. S.
Kamsu Tamo P. H.
Lawal K. A.
Nshimirimana G.
Combere W. S.
Kabengela H.
Asega C.

European Commission, Joint Research Centre, Dir. E Space, Security & Migration, Disaster Risk Management Unit - Floods Team

Salamon P. [i] *(Team Leader)*
McCormick N. [i]
Grimaldi S. [i]

European Commission, Joint Research Centre, Directorate D Sustainable Resources, Food Security Unit

Rembold F. [i] *(Team Leader)*
Collivignarelli F. [i]
Meroni M. [iv]

European Union Civil Protection and Humanitarian Aid

European Commission

[i] European Commission Joint Research Centre, Ispra, Italy
[ii] Arcadia SIT, Milano, Italy
[iii] Uni Systems, Luxembourg
[iv] Seidor, Milan, Italy

Science for policy

The Joint Research Centre (JRC) provides independent, evidence-based knowledge and science, supporting EU policies to positively impact society

EU Science Hub
joint-research-centre.ec.europa.eu

@EU_ScienceHub

EU Science Hub - Joint Research Centre

EU Science, Research and Innovation

EU Science Hub

@eu_science

Publications Office of the European Union