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Drought in the Amazon and the La Plata basins - December 2024

GDO Analytical Report

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Drought in the Amazon and the La Plata basins - December 2024

JRC Global Drought Observatory (GDO) of the Copernicus Emergency Management Service (CEMS) - GDO data up to 30/11/2024

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Abstract

- Severe droughts are currently affecting most of the Amazon and the La Plata basins and other regions in South America with extremely dry and warm conditions.
- Heatwaves and warm spells are exacerbating the impacts of the lack of precipitation. The average temperature is abnormally higher than usual.
- Soil moisture and vegetation conditions are severely affected, with negative anomalies over almost the whole South America.
- Many rivers in major basins, including the Amazon and the La Plata, have registered very low discharge in 2023-2024.
- While ENSO (El Niño Southern Oscillation) returned to neutral conditions in the middle of 2024, the tropical North Atlantic has been in an exceptionally warm state. This may have contributed to the dry conditions and above-average temperatures in most of the region.
- Water resources have been severely reduced in most of South America with severe ecological, economic, and social impacts.
- Wildfire danger is high in north-eastern Brazil, coastal regions of Peru, central and northern Chile, and central Argentina.
- Seasonal forecasts point to warmer than average conditions in the coming months. Precipitation forecasts for December 2024 to February 2025 are characterised by higher uncertainty and variability, particularly for central South America. Close monitoring of the drought evolution and proper water use plans are needed.

Introduction

This study is part of the collection *GDO analytical reports* focused on the analysis of drought events affecting Europe as well as the other regions of the world. These studies build on data and information retrieved and processed within the European and Global Drought Observatories of the Copernicus Emergency Management Service. The Observatories aim at detecting, monitoring, and predicting droughts by using a suite of indices and indicators characterising different aspects and phases of a drought. The information is usually complemented with additional sections on impacts, large-scale circulation, and other relevant factors.

Standardized Precipitation Index (SPI)

Severe negative precipitation anomalies are currently affecting many parts of South America. The SPI-3 (i.e. SPI for an accumulation period of 3 months) [1] shows extremely dry conditions in most of the Amazon basin and part of the La Plata basin. The driest regions are in the Pantanal and along the Amazon River (Fig. 1).

The longer accumulation SPI periods from 6 to 24 months ending in November 2024 are shown in Figure 2. These maps highlight the long-lasting lack of precipitation affecting directly water resources, river flows and the hydrology in general. The most affected regions are almost the whole Amazon basin and the central-southern part of the La Plata basin. Additionally, by comparing the different accumulation periods including also SPI-3 (Fig. 1), a remarkable drought persistence, in term of duration and spatial pattern, emerges (despite a slight improvement in the recent months in terms of precipitation). The reduction of the extent and severity of the SPI-3 anomalies (Fig.1) compared to the SPI-6 (Fig.2 top-left) reveals that the last three months have been less critical than the previous ones. Similarly, SPI-12 and SPI-24 are slightly better than SPI-6 (Fig. 2), showing that the most critical months in terms of meteorological drought were May-July 2024. Additionally, northern Argentina and eastern Brazil are showing some recovery. However, all the regions with extremely drier than normal SPI-24 values are severely affected by drought and in critical conditions in terms of water resources. These regions include most of the Amazon and the La Plata basins.

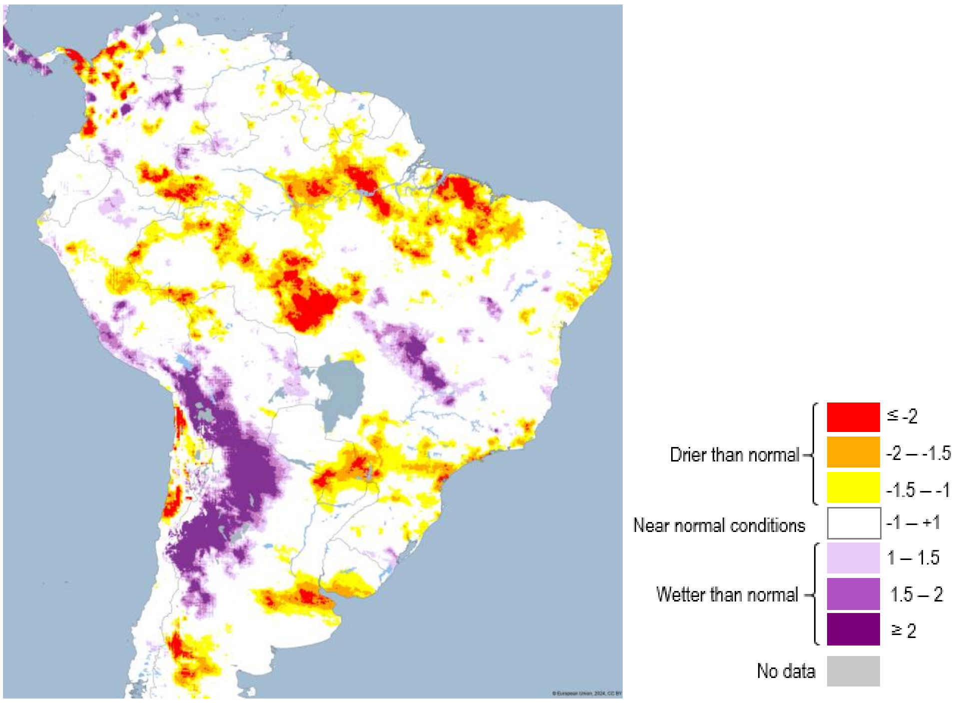

Figure 1: *Standardized Precipitation Index SPI-3 for the 3-month accumulation period ending on 30 November 2024.*[1]

[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.

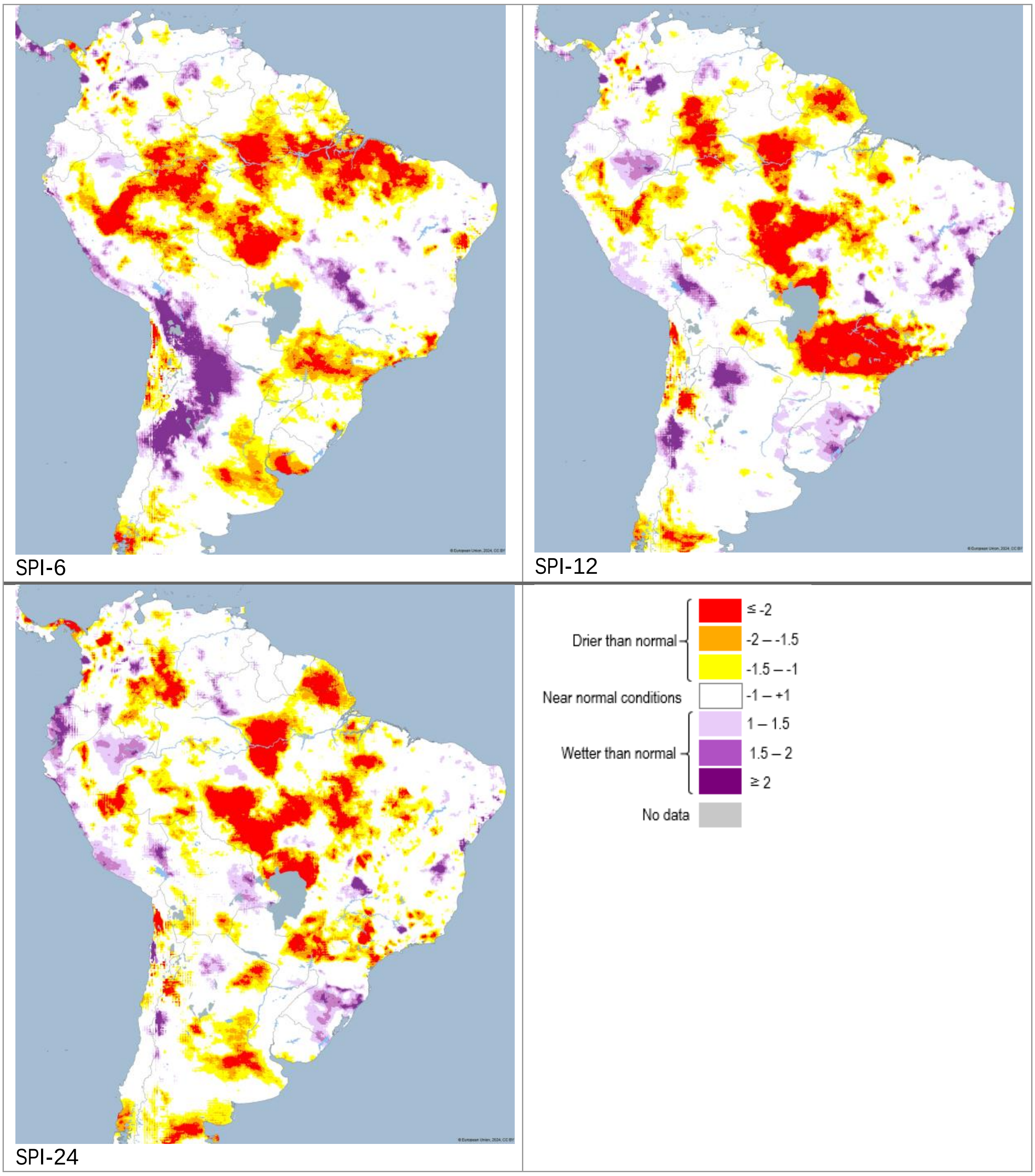

Figure 2: *Standardized Precipitation Index (SPI-6, 12, 24), for 6, 12, 24-month accumulation periods respectively ending on 30 November 2024.*[1]

Different evolving phases of meteorological drought occurred during the period November 2023 – October 2024 (Fig. 3). After November 2023, when the extent of the severe meteorological drought was covering almost the whole Amazon and La Plata basins, the drier than normal conditions slowly reduced and partially faded out. In February-June 2024, only the central-southern Amazon and the north-western La Plata basins were still under drier than normal conditions. Suddenly, in July 2024 the meteorological drought worsened and expanded again covering almost the whole South America till September 2024. Since October 2024 a slight improvement has been observed.

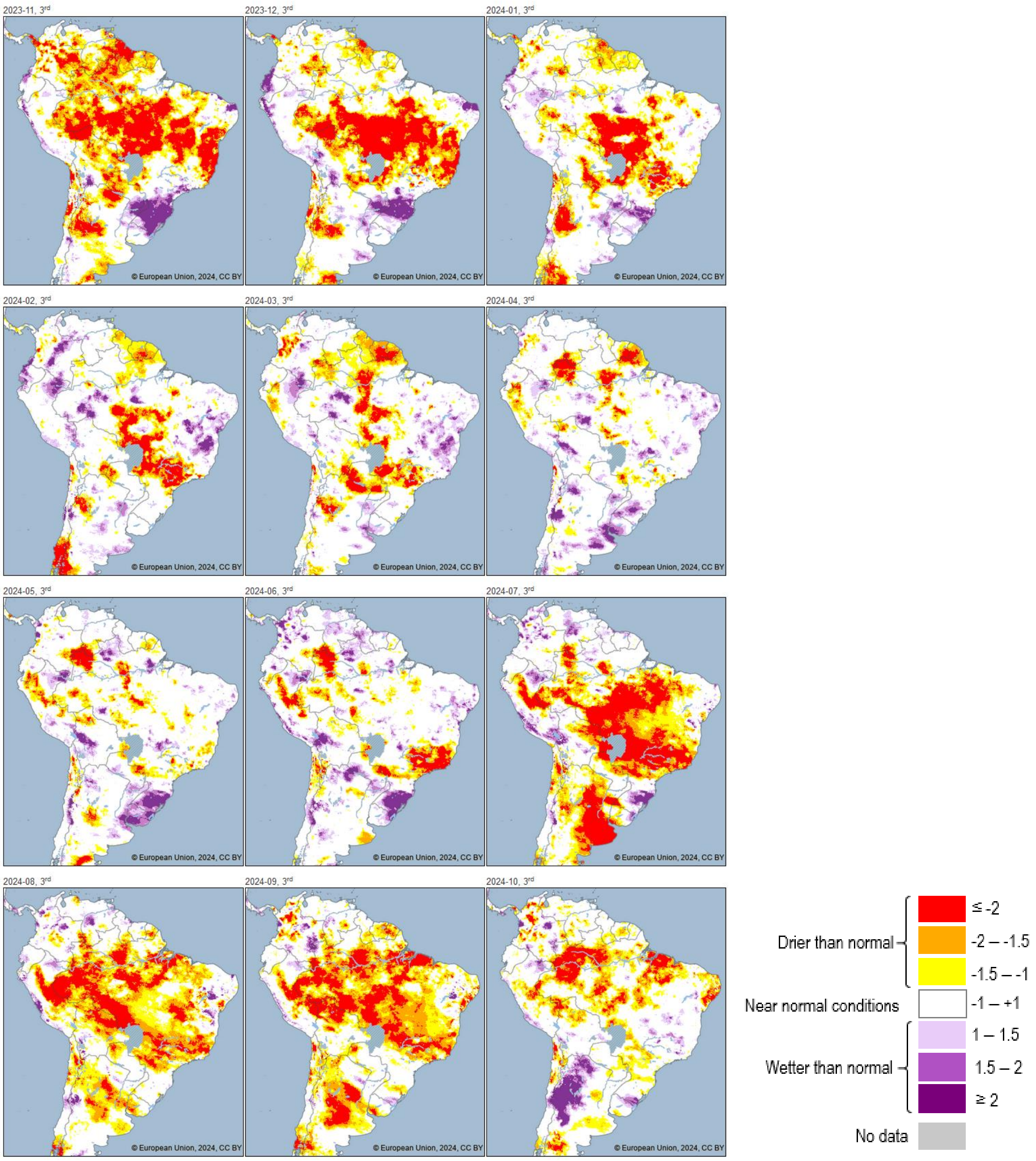

Figure 3: *Standardized Precipitation Index SPI-3 for the 3-month accumulation period at the end of each month from November 2023 to October 2024*[1]

Temperature

October 2024 has been warmer than average (baseline 1991-2020) in most of South America. Northern Argentina, some regions in Bolivia, southern Peru, and in western and southern Brazil experienced October-2024 average temperature anomalies higher than 2 °C. Almost the whole Amazon and La Plata basins registered positive temperature anomaly (Fig. 4).

The yearly average temperature anomalies (November 2023 - October 2024) have been almost everywhere positive within the study area, with very few exceptions (e.g. central western Argentina). Bolivia, south-eastern Peru, northern Argentina, and southern Brazil experienced yearly anomalies higher than 2 °C (Fig. 5).

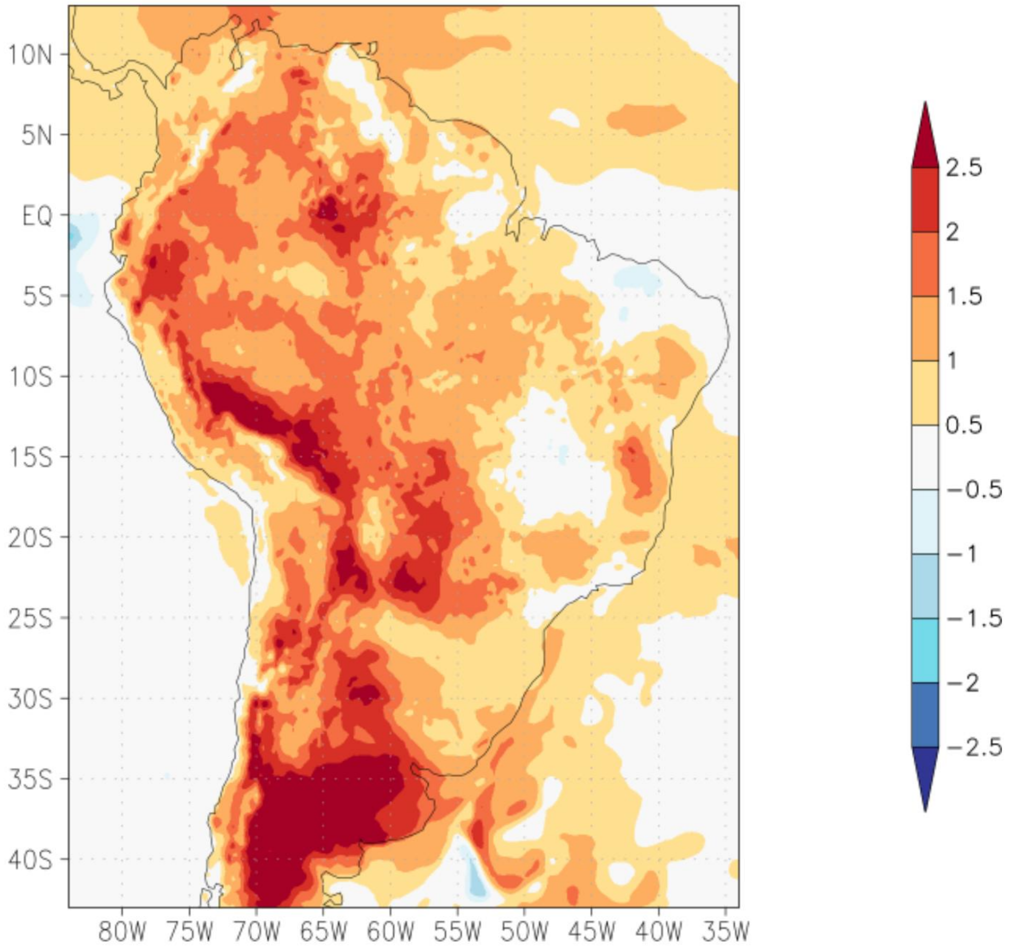

Figure 4: *Average temperature anomaly (ERA5, ECMWF (European Centre for Medium-Range Weather Forecasts) Reanalysis v5) computed for October 2024. Baseline 1991-2020. Source: The KNMI (Koninklijk Nederlands Meteorologisch Instituut) Climate Explorer.*[2]

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

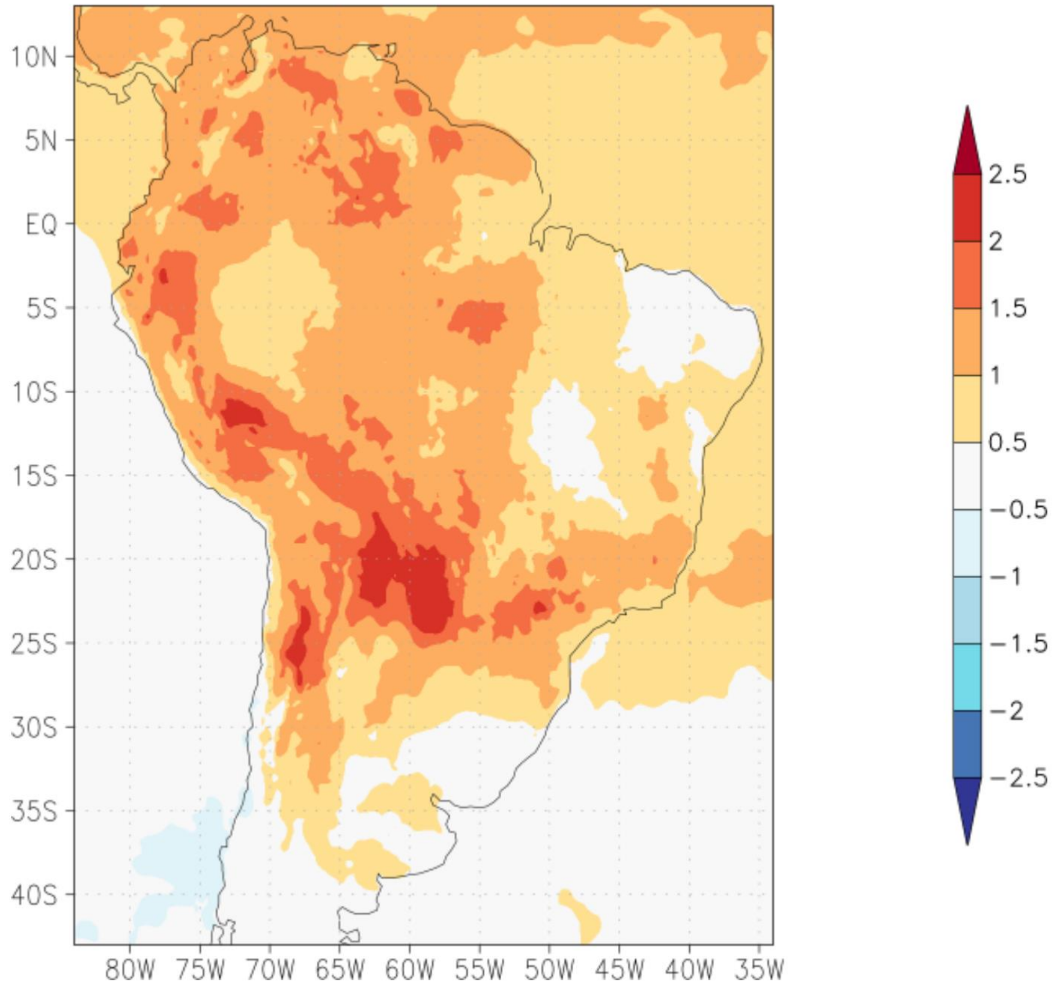

Figure 5: *Average yearly temperature anomaly (ERA5) computed for the period November 2023 - October 2024 (baseline 1991-2020). Source: The KNMI Climate Explorer.*[2]

Persistent positive temperature anomalies were also associated with heatwaves and warm spells. Once an event is detected, two main characteristics can be derived: duration and intensity. The duration is simply the count of the consecutive days belonging to the event. The intensity is calculated as the sum of the temperature exceedances relative to the 90^{th} climatological quantile throughout the event.[3]

In November 2024, a long-lasting heatwave event hit Venezuela, Guyana, and the northern regions of Brazil, with maximum duration longer than 15 days (Fig. 6).

[3] Lavaysse, C., Cammalleri, C., Dosio, A., van der Schrier, G., Toreti, A., and Vogt, J.: Towards a monitoring system of temperature extremes in Europe, Nat. Hazards Earth Syst. Sci., 18, 91–104, https://doi.org/10.5194/nhess-18-91-2018, 2018.

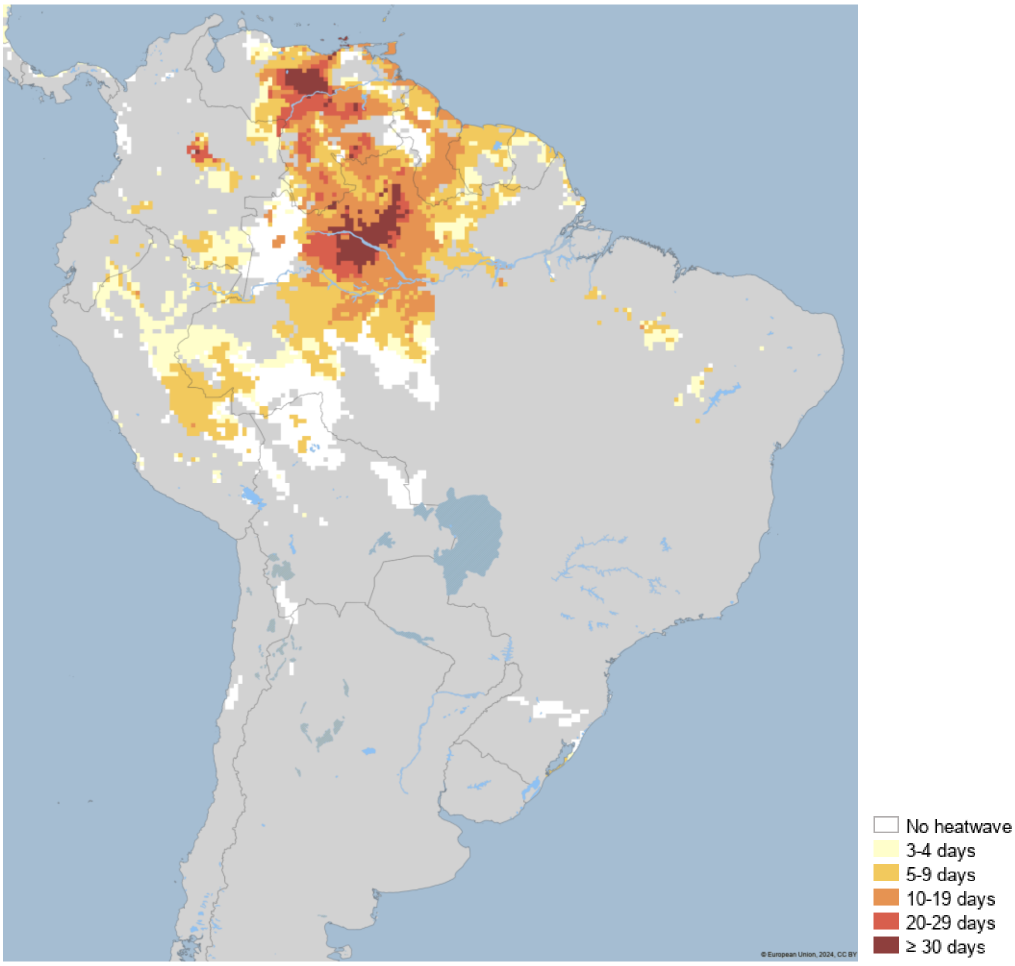

Figure 6: *Duration of the heatwaves/warm spells detected on 5 November 2024.*

Throughout the whole period from November 2023 to October 2024, the longest heatwaves/warm spells have been detected for central-northern South America, affecting mostly northern parts of the Amazon basin, with maximum duration exceeding 2 months (Fig. 7). The intensity map shows that the most severe events in the same period occurred in central and northern South America, in particular, in Venezuela, northern Brazil, northern Peru, Bolivia, Paraguay, and northern Argentina (Fig. 8).

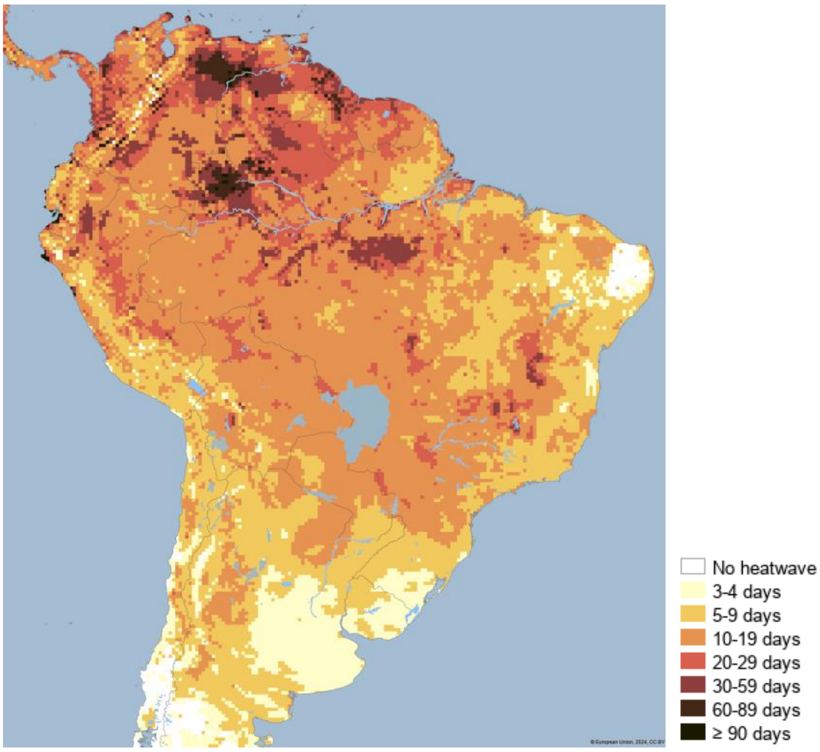

Figure 7: *Maximum duration of the heatwaves/warm spells detected during the period from November 2023 to October 2024.*

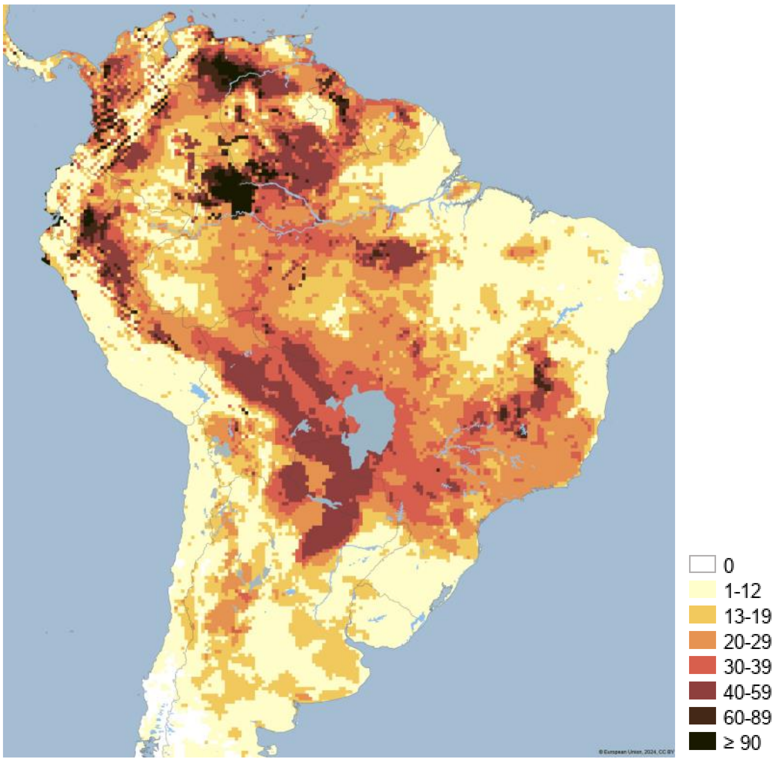

Figure 8: Maximum intensity of the heatwaves/warm spells detected during the period from November 2023 to October 2024.

Soil moisture and groundwater

In late November 2024, soil moisture anomalies have been remarkably negative over almost the whole Amazon basin and the central part of the La Plata basin (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). Moreover, the regions with the strongest negative precipitation anomalies were also affected by positive temperature anomalies. These compound factors contributed to exacerbate water loss from the soil due to stronger evapotranspiration potential. Indeed, large areas in South America show soil moisture anomalies below -2, corresponding to the driest class of the GDO indicator (Fig. 9).[4]

Concerning the evolution of soil moisture anomalies (Fig. 10), a strong persistence with some spatial and temporal variability is estimated. South America has been almost continuously affected by dry soil moisture with only few local and temporary recovery (e.g. in eastern Brazil in February-April 2024). After the severe drought of the previous years, the extent of the drier than normal area reached its maximum in late 2023. Afterwards, slightly reduced reaching its minimum in April-May 2024. Conditions quickly worsened again in October-November 2024, getting back to an extent similar to late 2023 (Figs. 9 and 10).

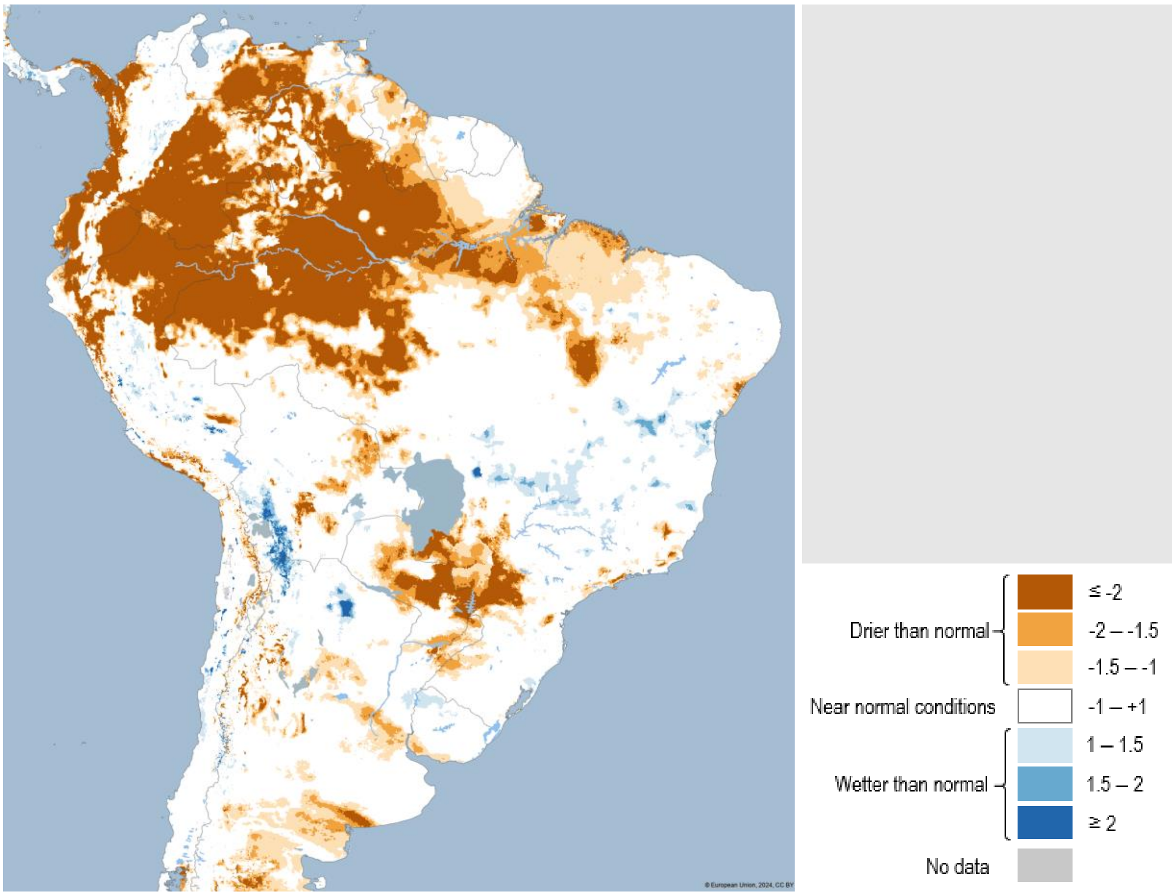

Figure 9: *Soil Moisture Index Anomaly, late November 2024.*[4]

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[4] 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. Note that the map of the latest Soil Moisture Anomaly in figure 14 and those in Figure 15 have been produced using a provisional product including only the modelled data from the Lisflood model used in GloFAS. A new updated version of the ensemble product is under development.

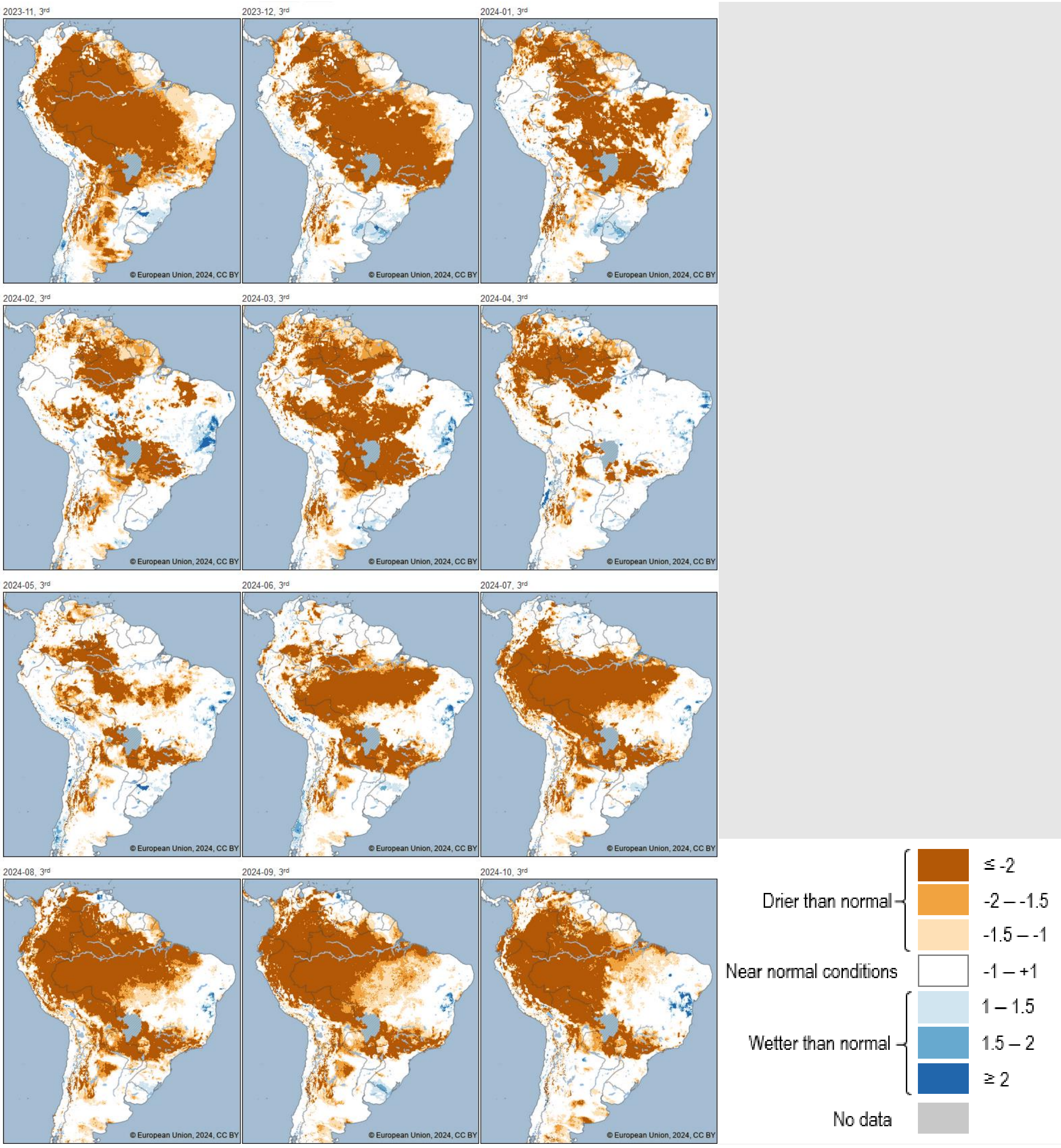

Figure 10: *Soil Moisture Index Anomaly, 10-day periods from November 2023 to October 2024.*[4]

The Total Water Storage (TWS) Anomaly indicator is used for determining the occurrence of long-term hydrological drought conditions and is often used as a proxy of substantial lowering of the groundwater level. This indicator is computed as anomalies of TWS data derived from the GRACE (Gravity Recovery and Climate Experiment) twin satellites.[5]

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[5] Landerer, F.W.; Swenson, S.C. Accuracy of scaled GRACE terrestrial water storage estimates. Water Resour.Res. 2012, 48, W04531

The TWS anomaly has a good correlation with long-term SPI (12, 24, 48 months).[6] In September 2024, large areas of the Amazon and the La Plata basins were suffering from severe negative anomalies, particularly affecting western Brazil, eastern Peru, and most of Bolivia (Fig. 11).[7]

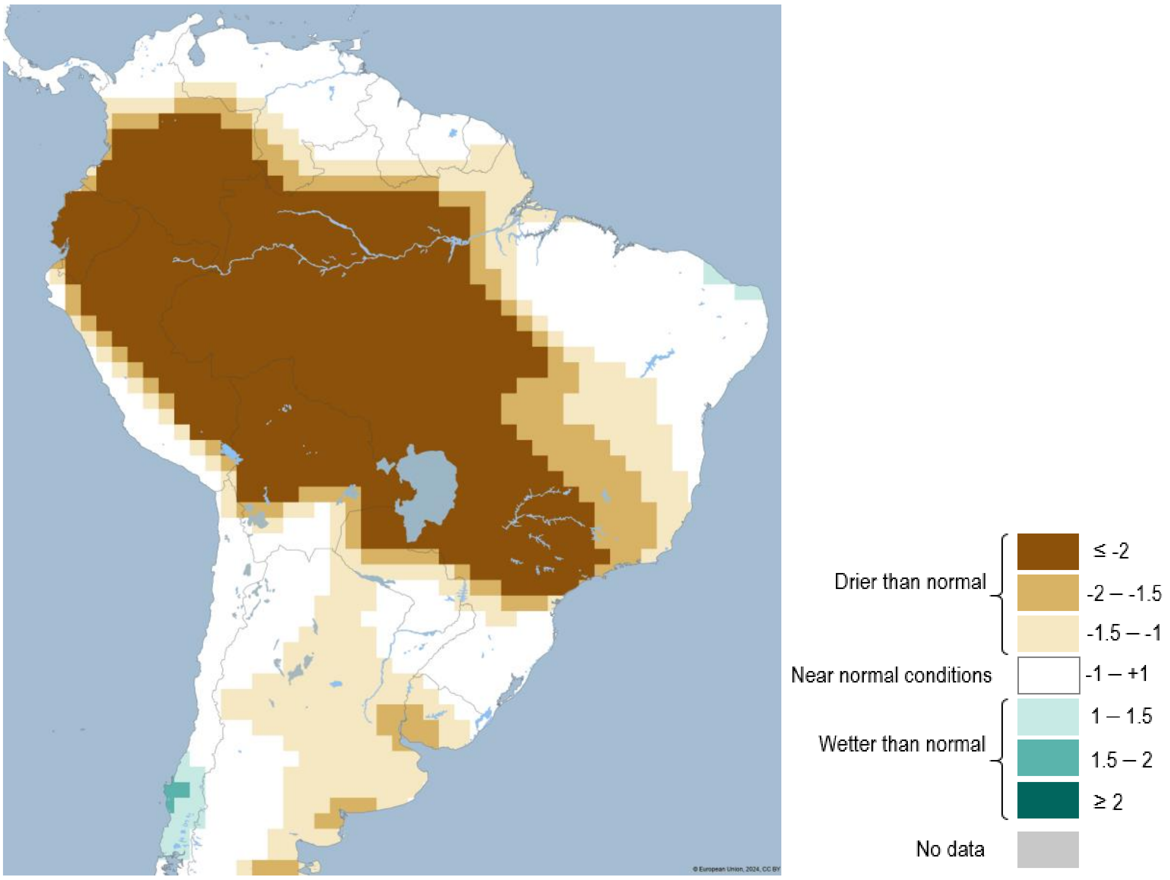

Figure 11: *GRACE-derived Total Water Storage (TWS) Anomaly, for September 2024.*[7]

Figure 12 shows the evolution of TWS anomaly from September 2023 to August 2024. In South America, after an almost normal period (ending in September 2023), dry conditions affected the Amazon and La Plata basins with persistent and severely dry anomalies since October 2023.

[6] Cammalleri, C., Barbosa, P., Vogt, J.V. 2019. Analysing the Relationship between Multiple-Timescale SPI and GRACE Terrestrial Water Storage in the Framework of Drought Monitoring. Water 11(8), 1672. https://doi.org/10.3390/w11081672.

[7] For more details on the GRACE-derived Total Water Storage (TWS) Anomaly indicator, and the other GDO and EDO indicators of drought-related information used in the report, see the Appendix at the end of the document.

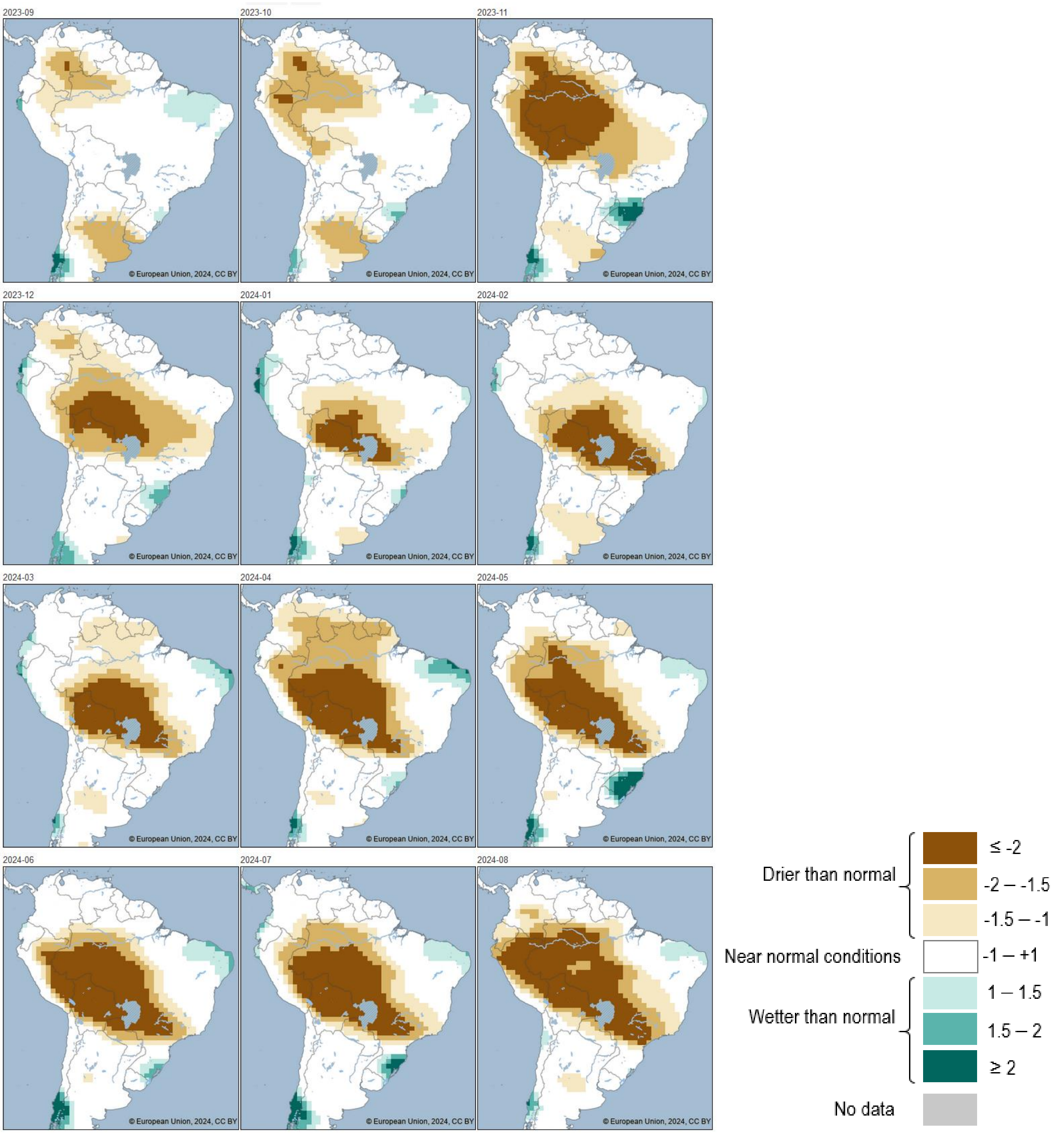

Figure 12: *GRACE-derived Total Water Storage (TWS) Anomaly, from September 2023 to August 2024.*[7]

Vegetation biomass

In late November 2024, the satellite-derived fAPAR (Fraction of Absorbed Photosynthetically Active Radiation) anomaly indicator[8] shows vegetation stress over large parts of the Amazon basin and the La Plata basin. Northern Bolivia and central-northern Argentina are the most severely affected regions (Fig. 13). The high number of missing data make it difficult to assess the real evolution respect to the previous months.

The evolution of the fAPAR anomaly from November 2023 to October 2024 (Fig. 14) points to variable vegetation stress conditions, with relevant spatial differences. Alternating worsening and improving conditions are visible in South America, but the main spatial pattern remains stable in time with good vegetation conditions mainly in eastern Brazil and overall in north-eastern Argentina. In November 2023, most of northern Argentina and Bolivia were severely affected. Afterwards, the poor vegetation conditions expanded from the La Plata basin to the Amazon basin with severe worsening from July 2024 onward.

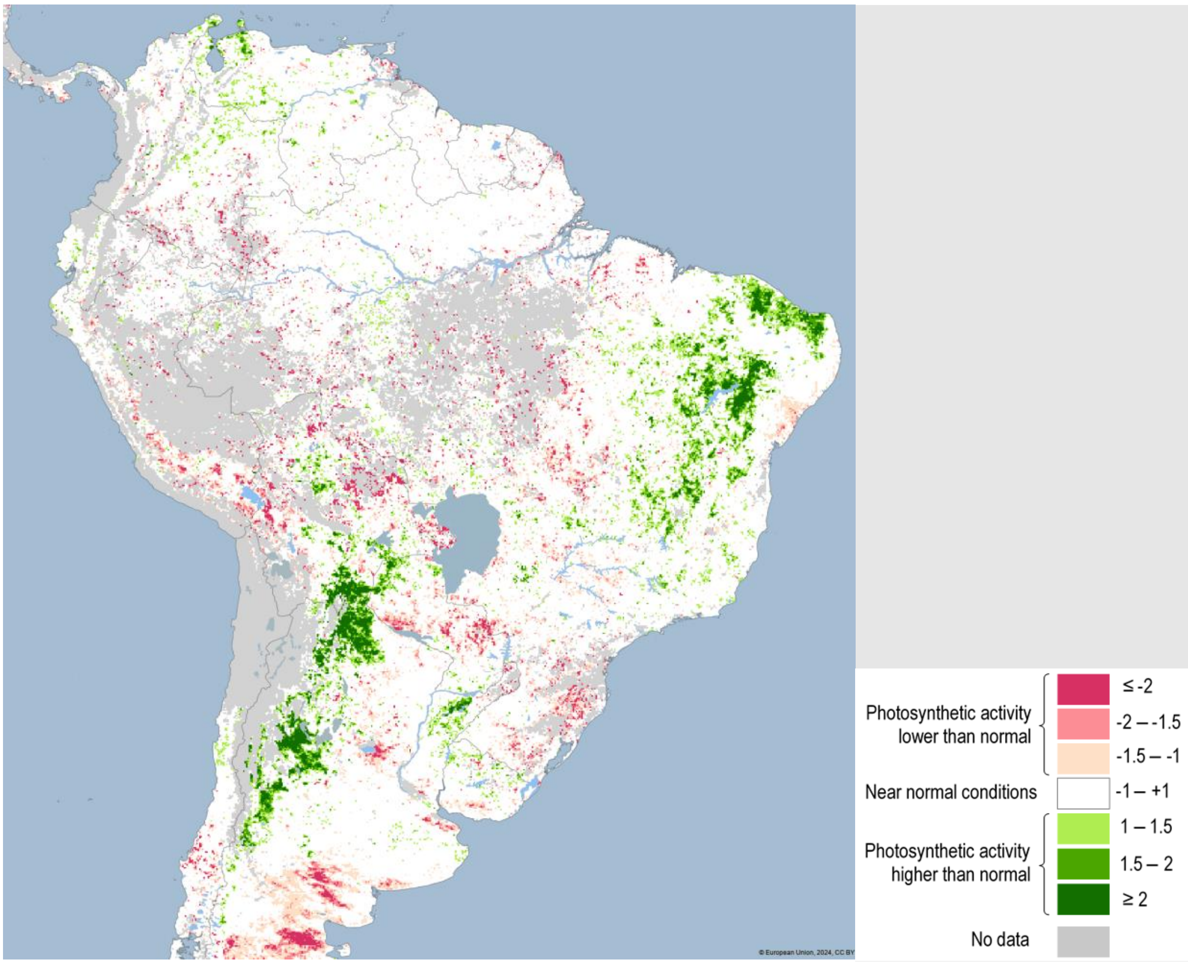

Figure 13: *Satellite-derived fAPAR anomaly indicator (measuring photosynthetic activity of vegetation) in late November 2024.*[8]

[8] For more details on the satellite-derived Fraction of Absorbed Photosynthetically Active Radiation (fAPAR) anomaly indicator, and the other GDO and EDO indicators of drought-related information used in the report, see the Appendix at the end of the document.

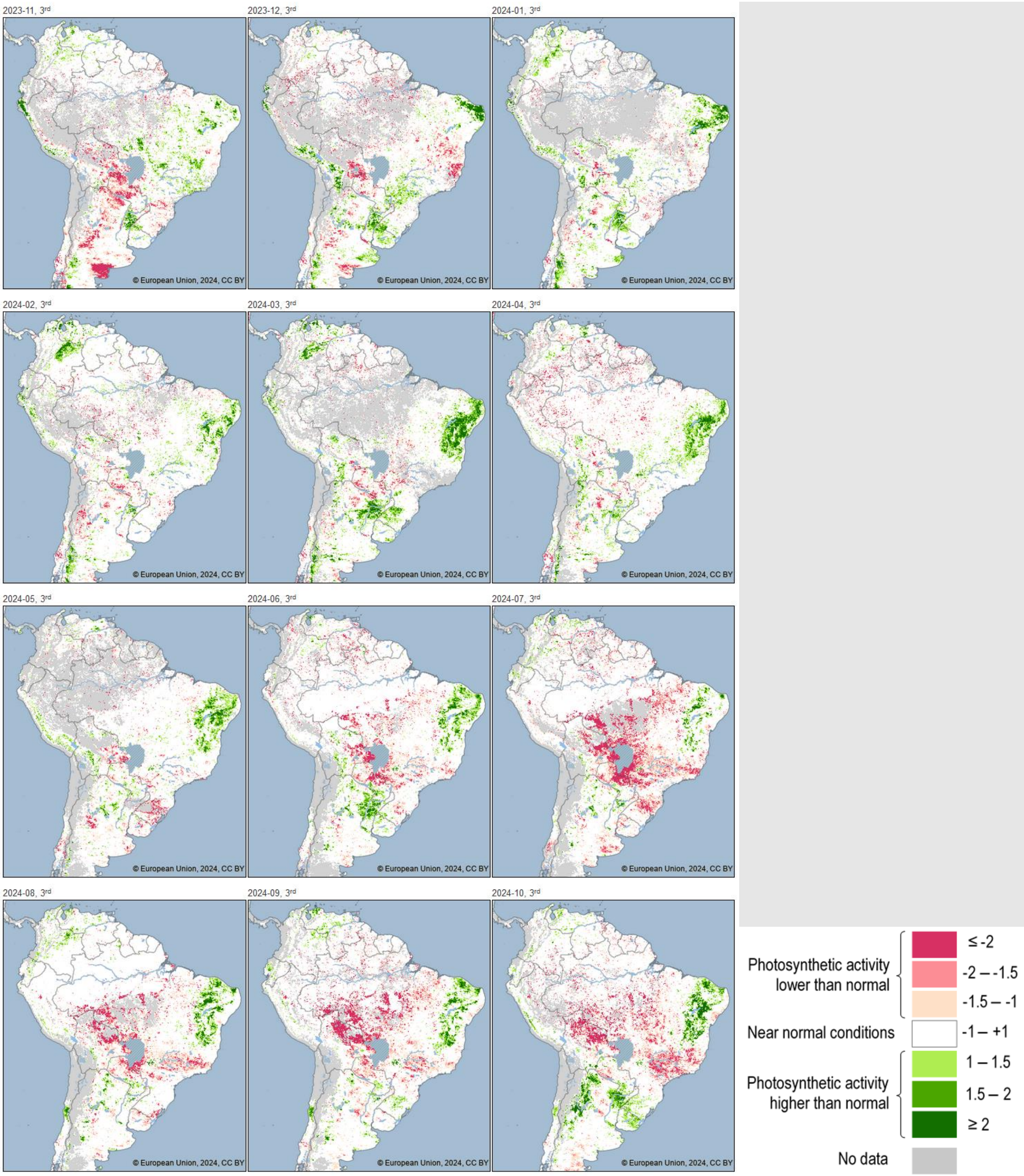

Figure 14: *Satellite-derived fAPAR anomaly indicator (measuring photosynthetic activity of vegetation) at the end of each month from November 2023 to October 2024.* [8]

Large-scale drivers

The neighbouring Pacific and Atlantic Oceans have a strong influence on hydroclimatic conditions across South America. The combined variability of ENSO (El Niño Southern Oscillation) and the Tropical North Atlantic (TNA) explains more than half of the variance of the annual Amazon rainfall[9].

During positive ENSO events (i.e. El Niño), warmer-than-average eastern and central tropical Pacific water induces atmospheric stability in the northern Amazon basin, and the region typically experiences drier and warmer conditions than usual[10] between June and March. On the other hand, El Niño usually drives wetter-than-average conditions in the La Plata basin from September to January[11].

A warmer-than-usual TNA drives a reduction of moisture flux to the Amazon basin from the Atlantic Ocean through changes in atmospheric circulation. This oceanic moisture is essential for feeding the rainforest mechanism of moisture recycling through successive evapotranspiration and precipitation cycles, impacting particularly the southern part of the basin during the dry season[9]. An important fraction of the rainfall in downwind regions such as Pantanal and the La Plata basin is generated from moisture that originates in the Amazon and transported southwards by the South American Low-Level Jet[12]. This means that a large scale drying of the Amazon basin induced by El Niño, a warm TNA or other driver, could also partially lead to drought conditions further south.

The period from June 2023 to May 2024 was marked by an El Niño event that peaked around the end of 2023 (Fig. 15) and returned to neutral conditions during the austral winter (June-August) of 2024. The TNA, despite having peaked already at the beginning of 2024 is still in an extraordinarily warm phase not seen since at least 1900 (Fig 15). The contribution of these two drivers, exacerbated by climate change, is likely to be the main large-scale driver of the widespread drought conditions in most of South America in the last year[13].

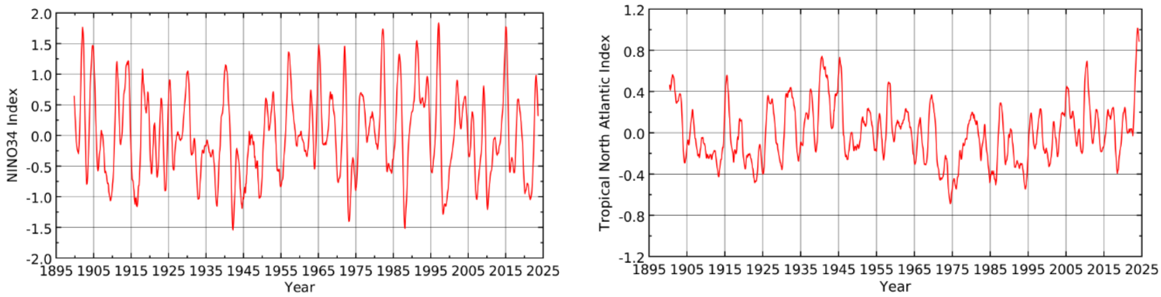

Figure 15: *Left: Relative NINO3.4 index (after removing the warming signal). Right: Linearly detrended Tropical North Atlantic (TNA) Index. The series are smoothed using a 12-month running mean. The last month used in the analysis of the timeseries is October 2024.The NINO3.4 and TNA regions are defined by the spatial averages in the boxes from 5S-5N and 170W-120W, and from 5N-25N and 70W-10W, respectively. Source:* ERSSTv5.

[9] https://link.springer.com/article/10.1007/s00382-009-0551-6

[10] https://www.nature.com/articles/s41598-024-58782-5

[11] https://journals.ametsoc.org/view/journals/wefo/35/6/WAF-D-19-0235.1.xml

[12] https://link.springer.com/article/10.1007/s00704-012-0637-7

[13] https://publications.jrc.ec.europa.eu/repository/handle/JRC139423

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 (Copernicus Emergency Management Service) Global Wildfire Information System (GWIS) provides mapping services of the fire danger forecast all over the world.[14] A moderate-to-very high danger is shown over north-eastern Brazil, coastal regions of Peru, central and northern Chile, and central Argentina up to 30 November 2024 (Fig. 16).

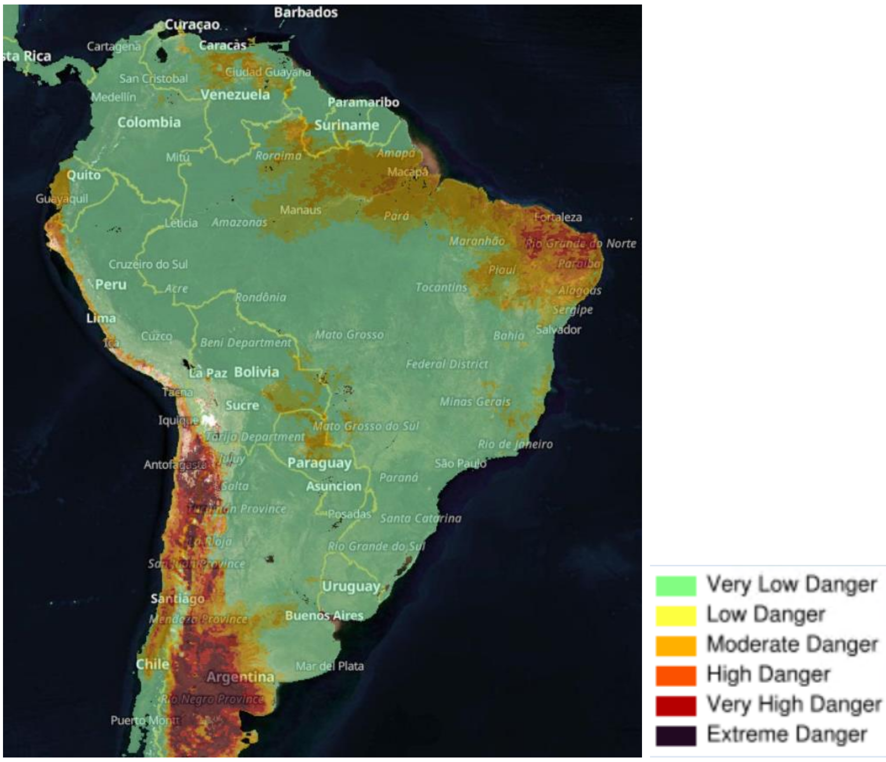

Figure 16: *Fire danger forecast expressed by the Fire Weather Index up to 30 November 2024. Data source: Global Wildfire Information System (GWIS)* [14].

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

Seasonal forecast

From December 2024 to February 2025, drier than average conditions (baseline 1981-2016) are predicted over central-eastern Brazil, most of Bolivia, northern Argentina, and central Chile. Wetter than average conditions are predicted over northern South America (Fig. 17).

According to the Copernicus C3S (Copernicus Climate Change Service) seasonal forecasts[15], warmer than usual conditions are likely to occur in the whole South America up to February 2025. Precipitation forecasts (December 2024 – February 2025) are lower than average for eastern Brazil, while wetter than normal conditions are predicted for northern South America. Strong differences and great variability between models give a relevant uncertainty for precipitation seasonal forecast, in particular for central South America. Close monitoring is required to assess the severity and the extent of the impacts over the coming season.

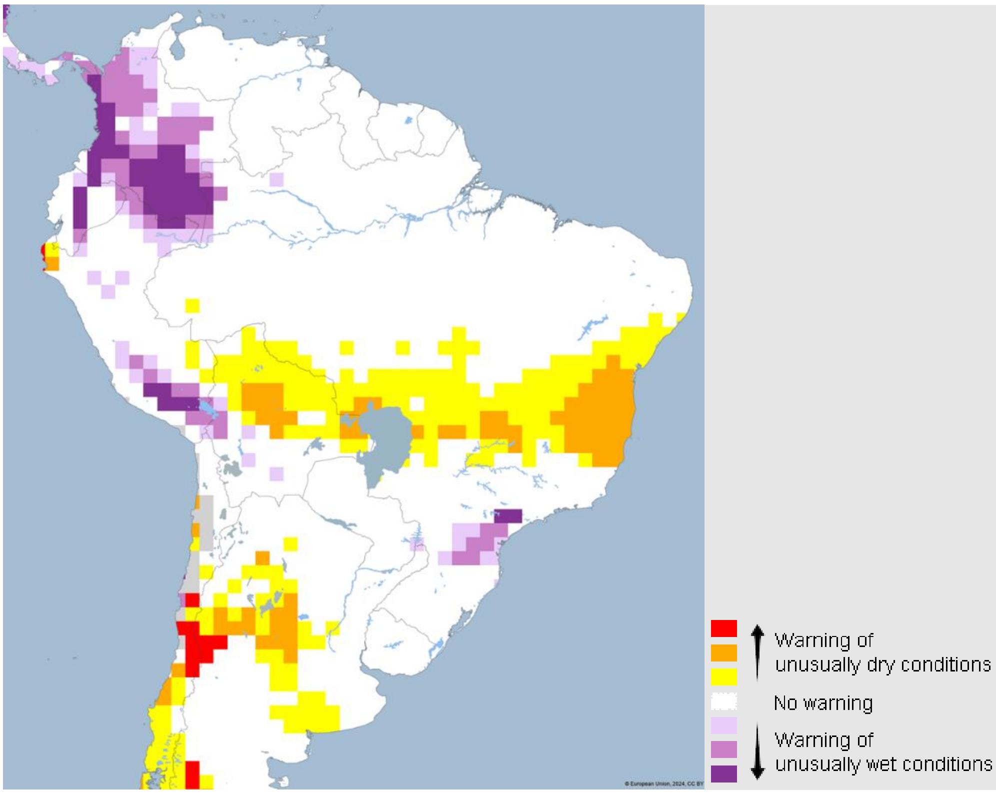

Figure 17: *Multi-system Indicator for Forecasting Unusually Wet and Dry Conditions, December 2024 – February 2025, based on dynamic forecasting systems from seven producing centres : ECMWF (European Centre for Medium-Range Weather Forecasts), CMCC (Centro Euro-Mediterraneo sui Cambiamenti Climatici), DWD (Deutscher Wetterdienst), ECCC (Environment and Climate Change Canada), Météo France, NCEP (USA National Centers for Environmental Prediction), UKMO (UK Meteorological Office).*[16]

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

[16] 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.

The probability of occurrence of low river flows anomalies (compared with the seasonal discharge thresholds generated using the CEMS GloFAS, Global Flood Awareness System, seasonal reforecast[17]) from November 2024 to February 2025 is high in most of Brazil, Peru, and Bolivia. Medium-low probability is forecasted for the rest of South America, as shown in Figure 18[18]. It shows the maximum probability of high flow or low flow anomaly, averaged for each major basin, and at any point in the forecast lead time.[19] 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.

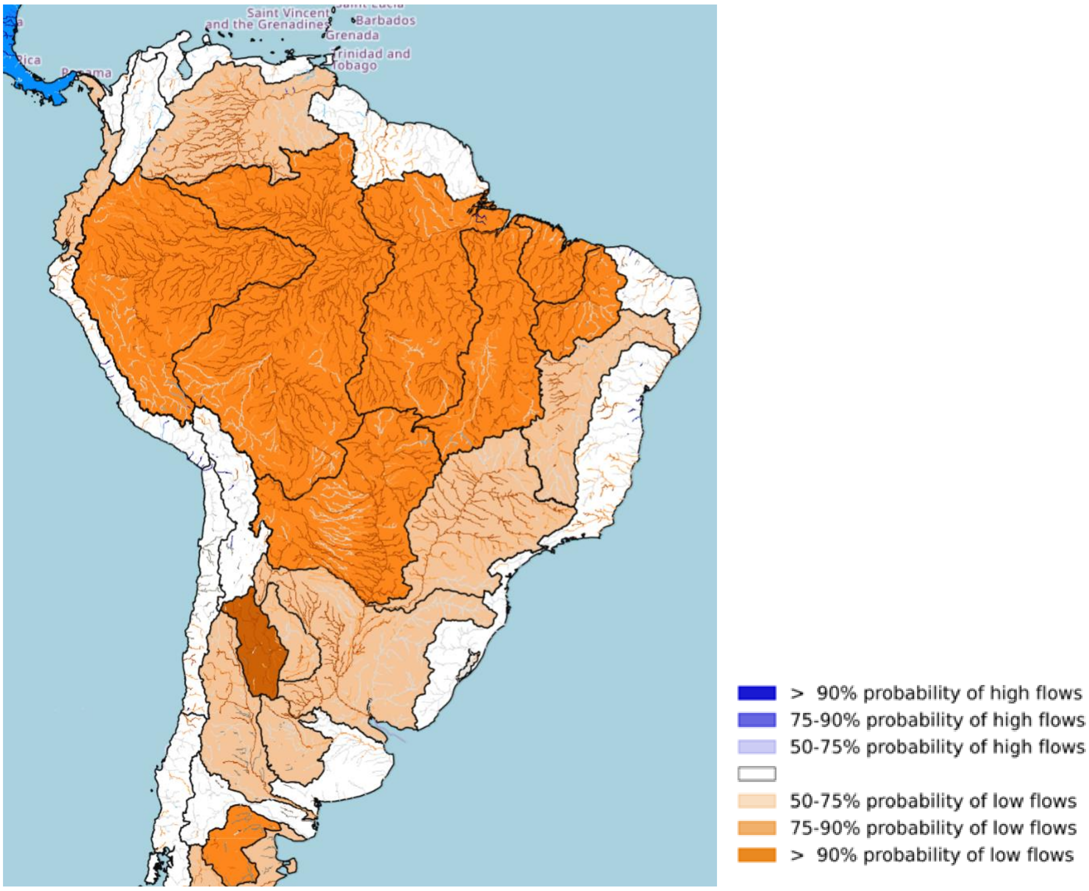

Figure 18: *Maximum probability [%] of high (> 80th percentile) or low (< 20th percentile) river flow, during the 4-month forecast horizon (November 2024 – February 2025) for basins and river network. Source: CEMS Global Flood Awareness System (GloFAS).*[20]

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

[18] The analysis is based on the CEMS GloFAS global implementation of 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/

[19] The Basin Overview gives a quick global overview, for more detailed information across the river network, and sub-basin differences, it is recommended to refer to the Seasonal Outlook - River Network and Seasonal Outlook - Reporting Points products.

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

Reported impacts

According to GEOGLAM (Group on Earth Observations Global Agricultural Monitoring) Crop Monitor bulletins of November 2024[21], at the end of October mixed crop conditions and forecasts have been reported for Argentina and Brazil. In Argentina, wheat conditions have improved in the central agricultural areas (due to recent rainfall events), but northern and central-western regions face reduced yields due to prolonged drought. As for maize, sowing of the early-planted crop is ongoing under favourable conditions, while in Brazil, sowing of the spring-planted crop is progressing under similar conditions, albeit with a reduced total sown area expected. In Brazil, rice sowing continues under favourable conditions and regular rainfall has supported soybean sowing activities in the central-western, southern, and southeastern regions, with an estimated increase in total sown area. However, soybean sowing in the north is delayed due to lack of rainfall. The forecast for Argentina indicates slightly drier-than-average conditions for the next two weeks and drier-than-average conditions across the core agricultural areas in the long-term. In contrast, Brazil's November outlook suggests a mix of above and below-average precipitation, with temperatures likely to be above-average, potentially alleviating drought conditions in some regions while exacerbating them in others.

CEMADEN (Centro de Monitoramento e Alertas de Desastres Naturais, the Brazilian Natural Disaster Monitoring and Alert Center) has released a comprehensive drought situational assessment of the Brazilian territory on September 2024[22]. The report indicates that many municipalities have faced drought conditions for 12 consecutive months, which has significantly reduced river levels and increased the risk of fire spreading. Many regions in Brazil have faced a considerable number of consecutive days without rain: the Central-West, part of the Southeast and Northeast regions are the most affected by the water deficit, with more than 100 consecutive days without precipitation, especially in Goiás and parts of the states of Mato Grosso, Minas Gerais and Bahia. Municipalities in the state of Minas Gerais such as Verdelândia, Nova Porteirinha, Pai Pedro, Janaúba, Catuti and Capitão Enéas, as well as others in the surrounding area, have already accumulated around 150 days without rain. The report highlights that, in addition to its intensity, the current drought is already one of the longest in recent decades.

INPA (Instituto Nacional de Pesquisas da Amazônia, the Brazilian National Institute for Amazon Research) indicates that forest fires have been a source of concern in the Amazon region in 2023 and 2024[23], resulting in higher than usual concentrations of particulate matter and pollution in the atmosphere. Indeed, monitoring stations in the area have recorded extremely high carbon monoxide levels of about 3,000 ppb (parts per billion) in late 2023 (for reference, in April and May, which are part of the rainy season, the number varies between 80 and 100 ppb). The increase in fires in the Amazon region combined with wind dynamics favoured the arrival of smoke plumes to far reaching places in the country, including major cities in the South and Southeast regions of Brazil.

South America's major rivers are facing unprecedented low water levels due to severe droughts episodes in the continent, disrupting shipping and agriculture, particularly in the Amazon and Paraná river basins. The Paraguay River has seen a record low level while the Paraná River in Argentina is also near to year-lows, impacting grain shipments, fishing, and navigation in countries such as Bolivia, Paraguay, Argentina, and Brazil[24]. Paraguay's fishing union estimates that the decline in water levels has put 1,600 fishermen out of

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

[22] https://www.gov.br/cemaden/pt-br/assuntos/monitoramento/monitoramento-de-seca-para-o-brasil/monitoramento-de-secas-e-impactos-no-brasil-agosto-2024/NOTATECNICAN529202SEICEMADENSECAS.pdf

[23] https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/noticias/2024/09/queimadas-aumentam-em-ate-80-vezes-a-concentracao-de-poluentes-na-atmosfera-da-amazonia

[24] https://apnews.com/article/paraguay-river-drought-amazon-fires-climate-change-deforestation-shortage-ce7bb22855f6ed9af43381aa246c7d30

work. The Amazon and one of its main tributaries, the Madeira River, have also registered new daily record lows[25].

The Brazilian president Lula da Silva announced in September 2024 the plan to create a National Climate Authority, with the aim to deal with extreme natural phenomena[26].

[25] https://www.reuters.com/world/americas/brazils-amazon-drought-disrupts-residents-lives-2024-09-15/

[26] https://en.mercopress.com/2024/09/11/brazil-lula-announces-creation-of-national-climate-authority

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 satellite-based fraction of Absorbed Photosynthetically Active Radiation (fAPAR) monitors the fraction of solar energy absorbed by leaves. It is a measure of vegetation health and growth. Negative fAPAR anomalies with respect to the long-term average are associated with negative impacts on vegetation.

The Multi-system 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 seven components: ECMWF (European Centre for Medium-Range Weather Forecasts), CMCC (Centro Euro-Mediterraneo sui Cambiamenti Climatici), DWD (Deutscher Wetterdienst), ECCC (Environment and Climate Change Canada), Météo France, NCEP (USA National Centers for Environmental Prediction), UKMO (UK Meteorological Office).

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

Glossary of terms and acronyms

C3S	Copernicus Climate Change Service
CEMADEN	Centro de Monitoramento e Alertas de Desastres Naturais
CEMS	Copernicus Emergency Management Service
CMCC	Centro Euro-Mediterraneo sui Cambiamenti Climatici
DWD	Deutscher Wetterdienst
EDO	European Drought Observatory of CEMS
EC	European Commission
ECCC	Environment and Climate Change Canada
ECMWF	European Centre for Medium-Range Weather Forecasts
ENSO	El Niño Southern Oscillation
ERA5	ECMWF Reanalysis v5
ERCC	European Emergency Response Coordination Centre
fAPAR	Fraction of Absorbed Photosynthetically Active Radiation
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
INPA	Instituto Nacional de Pesquisas da Amazônia
JMA	Japan Meteorological Agency
JRC	Joint Research Centre
KNMI	Koninklijk Nederlands Meteorologisch Instituut
NCEP	USA National Centers for Environmental Prediction
ppb	parts per billion
SEAS5	Seasonal Forecasting System 5
SMA	Soil Moisture Anomaly

SPI	Standardized Precipitation Index
TNA	Tropical North Atlantic
TWS	Total Water Storage
UK	United Kingdom of Great Britain and Northern Ireland
UKMO	UK Meteorological Office
UN	United Nations
USA	United States of America
VIIRS	Visible Infrared Imaging Radiometer Suite

GDO and EDO indicators versioning

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

GDO, EDO indicator	Version
▪ Soil Moisture Index Anomaly (SMA)	*v. 3.0.0*
▪ Fraction of Absorbed Photosynthetically Active Radiation (fAPAR) Anomaly (VIIRS, Visible Infrared Imaging Radiometer Suite)	*v. 3.0.0*
▪ GRACE-derived Total Water Storage (TWS) Anomaly	*v. 2.1.0*
▪ Multi-System Indicator for Forecasting Unusually Wet and Dry Conditions	*v. 1.2.0*
▪ Standardized Precipitation Index (SPI, CHIRPS)	*v. 2.0.0*

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

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