3

CLIMATIC ENVIRONMENT

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3.1 Climate

3.1.1 South African Climate

Climate, characterised by the long-term patterns and averages of elements such as rainfall, temperature, solar radiation, relative humidity, wind speed, and evaporation, is evident on both temporal and spatial scales. In South Africa, the diverse climatic conditions affecting critical sectors including agriculture, forestry, and biodiversity, similarly influence the availability and distribution of water throughout the country. Ranging from arid conditions in the western regions to humid subtropical climates in the east, the country's varied rainfall patterns create a dynamic and complex water management landscape.

The classification of climate in South Africa is often based on seasonal rainfall patterns such as winter and summer rainfall region. The winter rainfall, typically occurring between May and August and concentrated primarily in the southwestern region, contrasts with the summer rainfall region, covering extensive areas of the country. The latter experiences higher rainfall amounts crucial for replenishing rivers, dams, and reservoirs essential for sustaining numerous sectors. Moreover, the northern and western areas record the highest temperatures, while the elevated regions experience cooler climates. Coastal regions, influenced by the warm Indian Ocean, often maintain higher average temperatures, particularly at night.

The seasonal variability in the country's climate influences water availability and storage dynamics. While summer rainfall regions experience peak flows during wet seasons, winter rainfall areas heavily rely on stored water from dams and reservoirs to meet demands during dry months. Furthermore, climate change exacerbates existing challenges, introducing uncertainties such as changes in rainfall patterns, increased temperatures, and heightened frequency of extreme weather events, which pose challenges for infrastructure development, demand management strategies, and ecosystem sustainability efforts.

The Agricultural Research Council (ARC), with a vast network of weather stations distributed across the country and an extensive agroclimatic archive, provides this Climatic Environment chapter. Furthermore, some analysis and data presented are in this chapter is based on data and information provided by the South African Weather Services (SAWS).

3.1.2 Temperature

Average observed temperatures for the 2022/23 hydrological year are in Figure 3.1. Average temperatures for the hydrological year followed a predictable spatial pattern, with temperatures in the lower tens dominating over the cooler southern to eastern escarpment and eastern Highveld. Highest average temperatures occurred over the traditionally warmer parts including the Limpopo River Valley, Lowveld and north-eastern KZN with values in the lower to mid-twenties dominating. Temperatures were on average near the long-term average over most of the country (Figure 3.1) for the period as a whole, but the north-eastern to eastern lower-lying areas were between 0.5 and 2° C warmer than average.

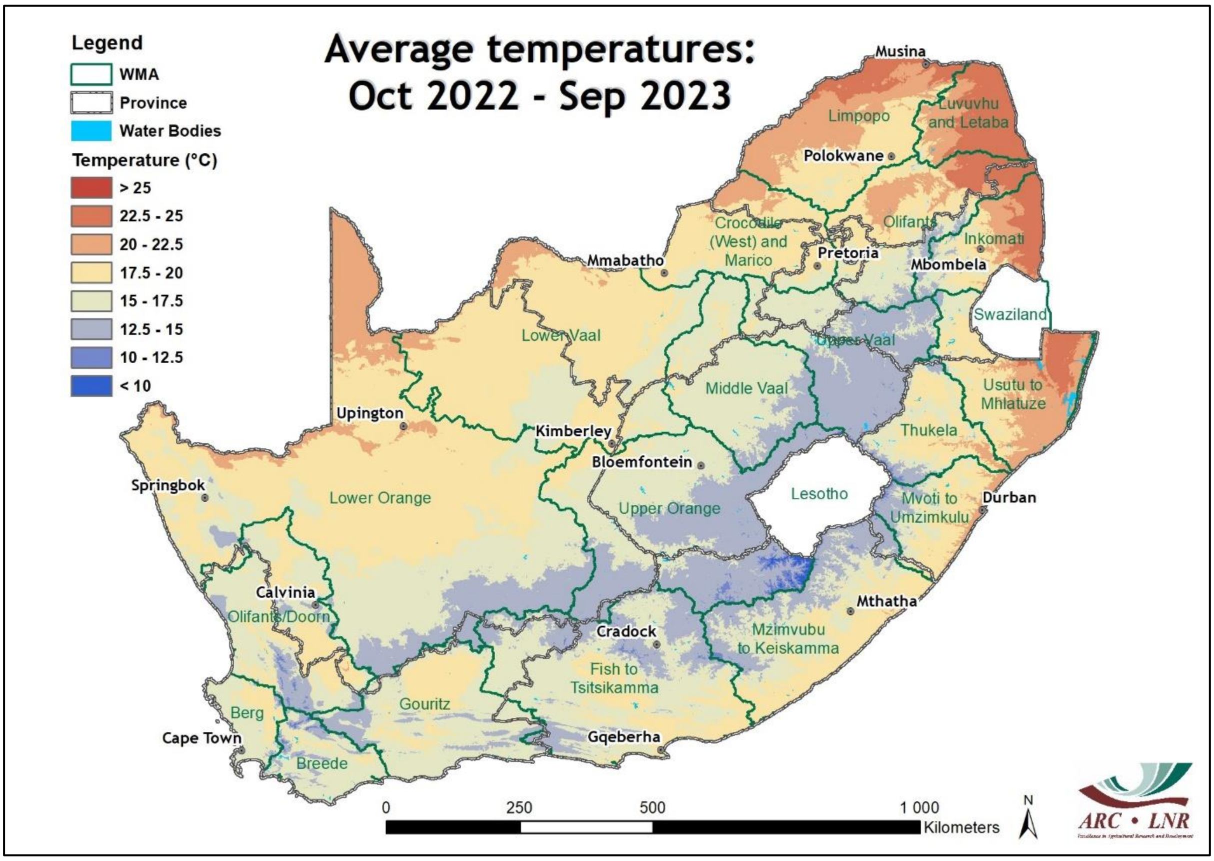


Figure 3.1 Average temperature calculated during the 2022/23 hydrological year.

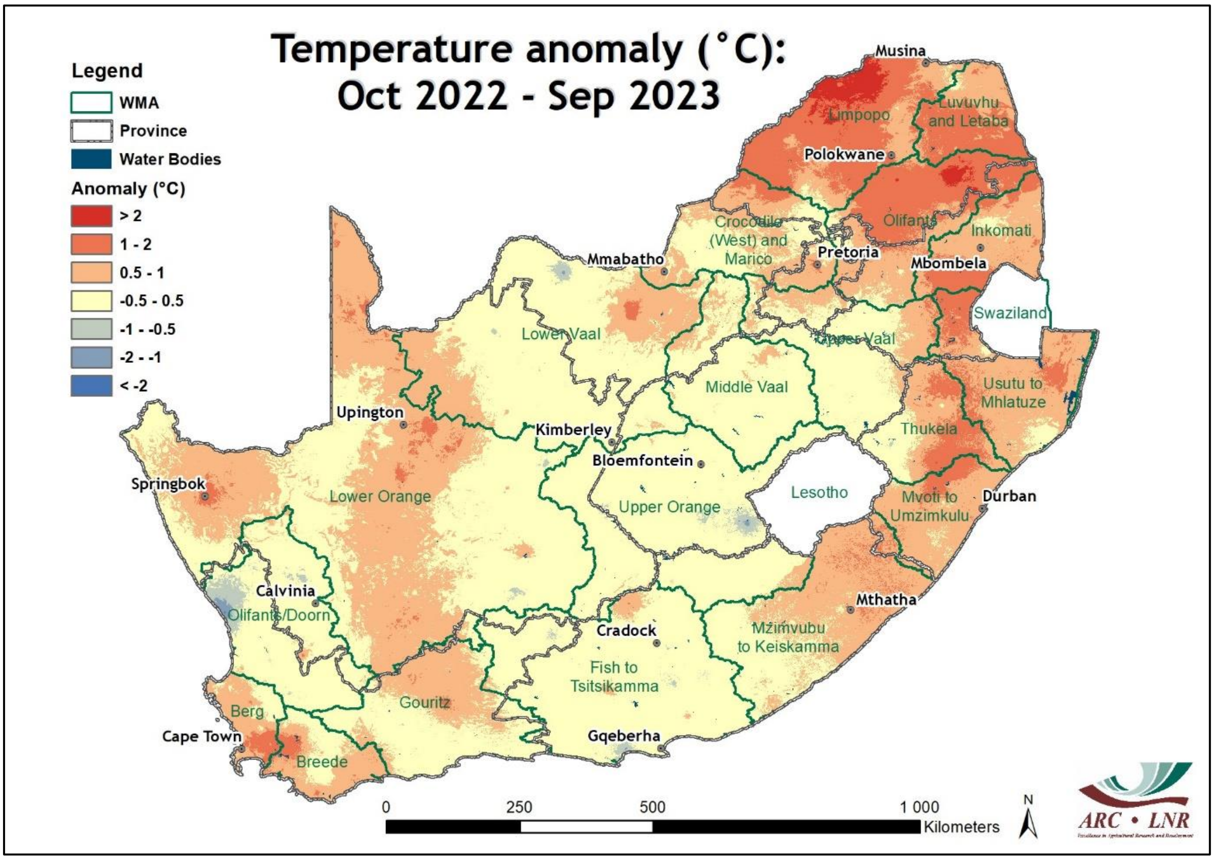
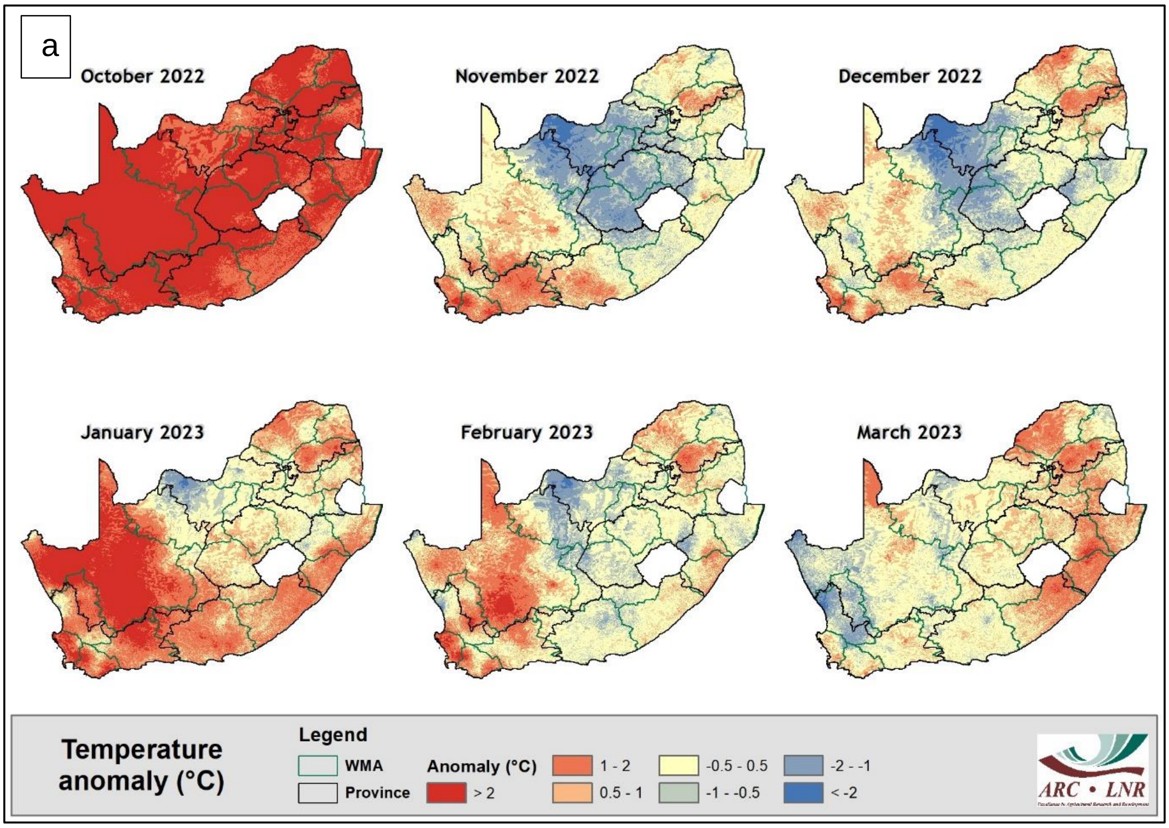


Figure 3.2 Deviation in temperature from the long-term average during the 2022/23 hydrological year.

The monthly break-down of the average temperature anomalies are shown for the summer and winter seasons of the 2022/23 hydrological year in Figure 3.3a and 3.3b, respectively. The only month that was warm across the country was October 2022. Hot and dry conditions dominated during a large part of the month and rain only started over the interior towards the end of the month. Throughout the summer season of the hydrological year, the wetter months (November, December and February – see monthly rainfall maps in Figure 3.7), were also relatively cool’ likely linked to increased cloud cover, over the central parts of the country, with temperatures below the long-term average.

The western interior was 2°C or more warmer than the long-term average during October and December 2022. The largest positive contributions to temperature deviation over the northeastern to eastern low-lying areas occurred during October 2022 when the entire country was relatively warm and then more specifically over these areas during autumn and early winter (April – June) as well as September 2023 when the central to western and southern parts of the country were cooler than average.



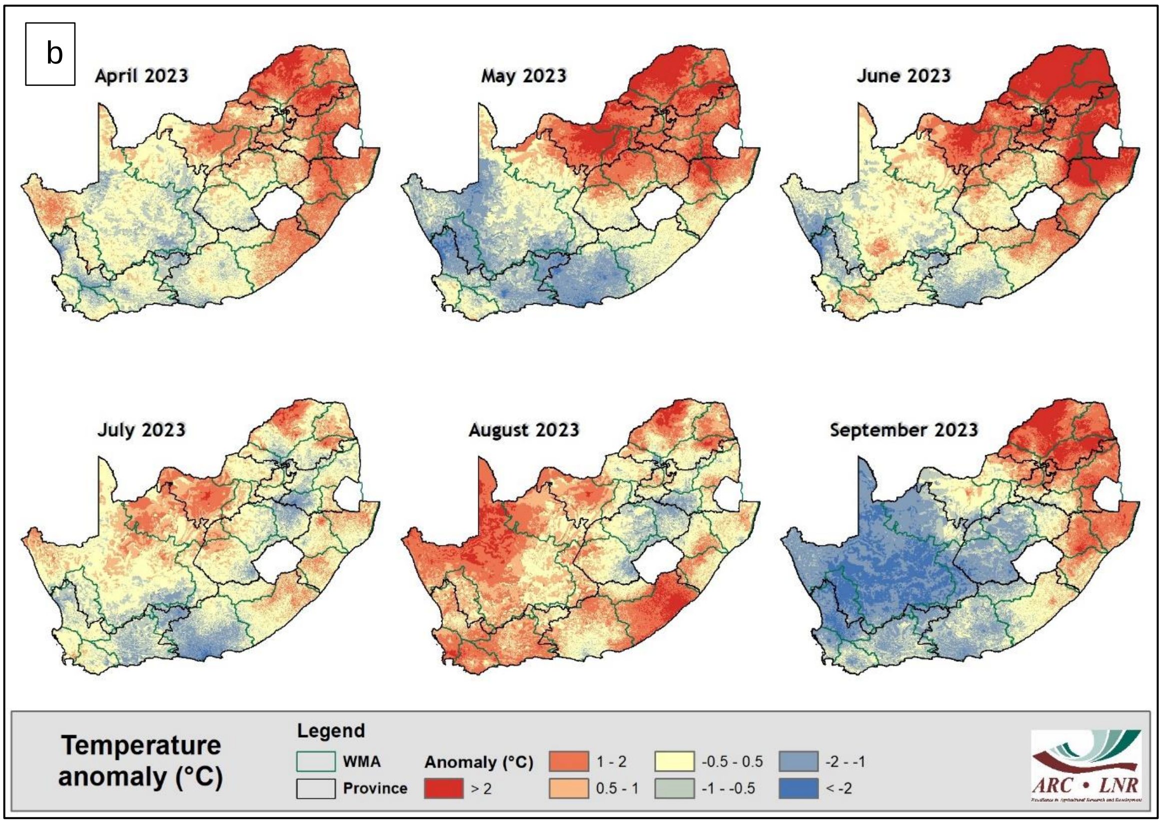


Figure 3.3 (a) Monthly deviation in temperature from the long-term average during the summer season of the 2022/23 hydrological year (b) Monthly deviation in temperature from the long-term average during the winter season of the 2022/23 hydrological year.

South Africa experienced a relatively warm calendar year, especially in the central and northern interior. In the south, however, temperatures were near-normal. The annual mean temperature anomaly for 2023, based on the data of 26 climate stations of the SAWS, was on average about 0.4 ºC above the average of the reference period (1991-2020), making it approximately the 8th hottest year on record since 1951 (Figure 3.4). A warming trend of approximately 0.17 ºC per decade is indicated for the country, over the period 1951-2023, statistically significant at the 5% level (SAWS, 2024).

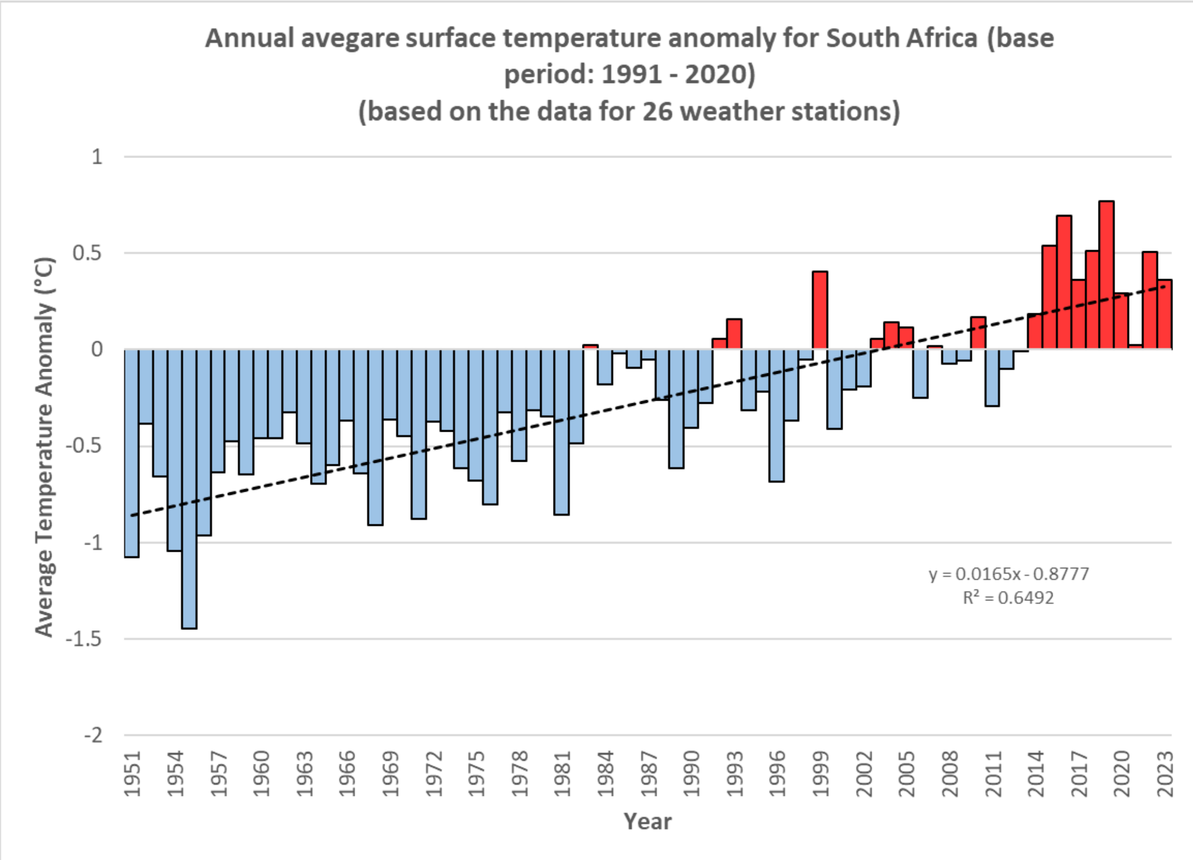


Figure 3.4 Average surface temperature deviation over South Africa based on 26 climate stations: 1951 - 2021 (base period: 1991 - 2020). The linear trend is indicated (Source: South African Weather Service).

3.1.3 Rainfall

The period of reporting included the 2022/23 summer which was the third consecutive summer falling within the protracted 2020-2023 La Niña event. Similar to the previous two summers, wetter and cooler conditions occurred for extended periods of the summer, as is typical during La Niña events. The period also included the 2023 winter which was characterised by above-normal rainfall over large parts of the winter rainfall region. The winter rainfall region has now experienced several winters with near normal to above-normal rainfall since the multi-year drought of the 2015 – 2018 period.

Considering the large-scale change that occurred, in general, the very wet anomaly over most of the interior, diminished somewhat during the 2022/23 hydrological year while a drier signal over the southern to south-western parts was replaced by enhanced wetness. Total rainfall for the 2022/23 hydrological year (October 2022 – September 2023) is presented in Figure 3.5.

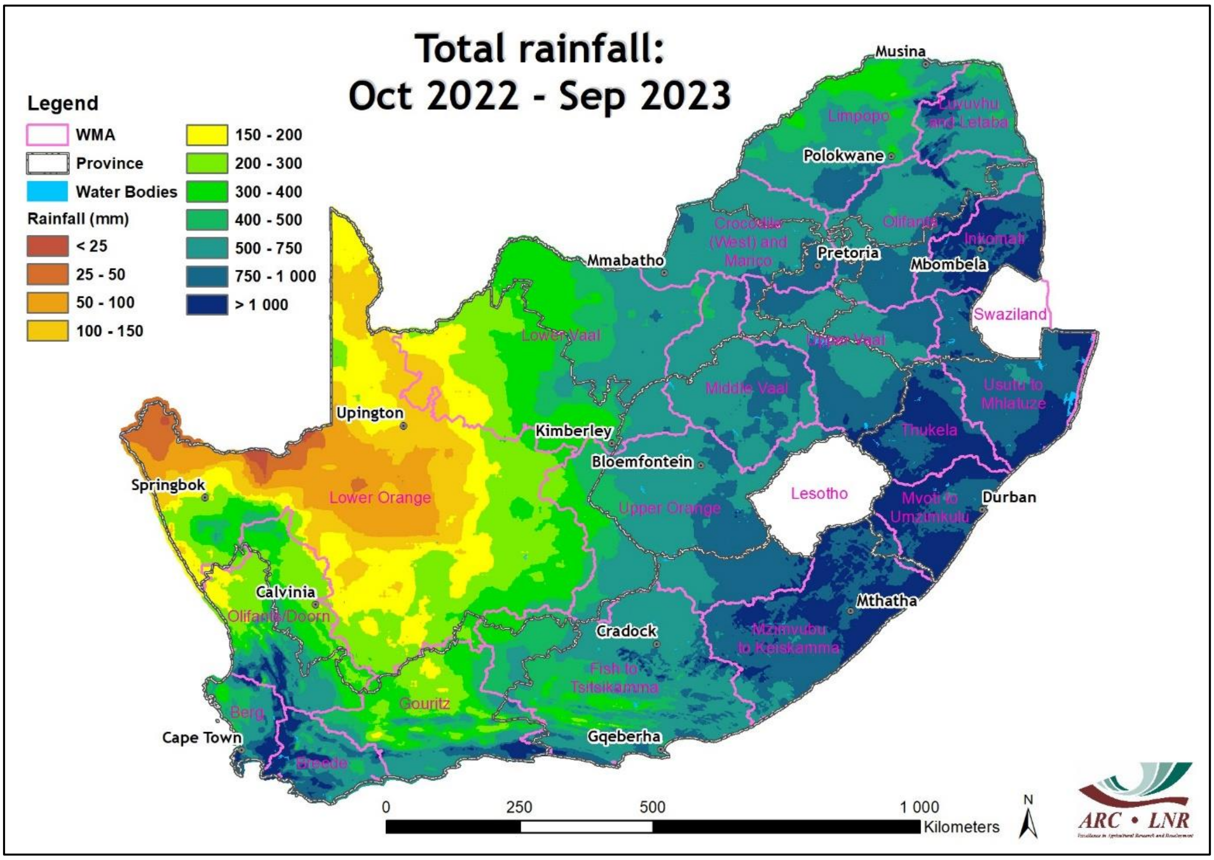


Figure 3.5 Rainfall (mm) for the Hydrological year October 2022 to September 2023.

The patterns of generally wetter and drier parts of the country followed a typical pattern with the lowest totals of less than 50mm along parts of the Lower Orange River Valley and highest totals over the mountainous area in the winter rainfall region in the southwest, along parts of the Garden Route in the south and along the south-eastern to eastern escarpment and towards the eastern seaboard. Most of the eastern half of the country received in excess of 500mm during the hydrological year. On the escarpment and further east over Mpumalanga, KZN and the Eastern Cape, totals exceeded 1000mm.

Relative to the long-term average, rainfall over most of the country was high during the period in total (Figure 3.6). Most of the country received above-average rainfall over the period as a whole, with the most notable exception being the central to northern parts of the Northern Cape where most of the region received below-average rainfall.

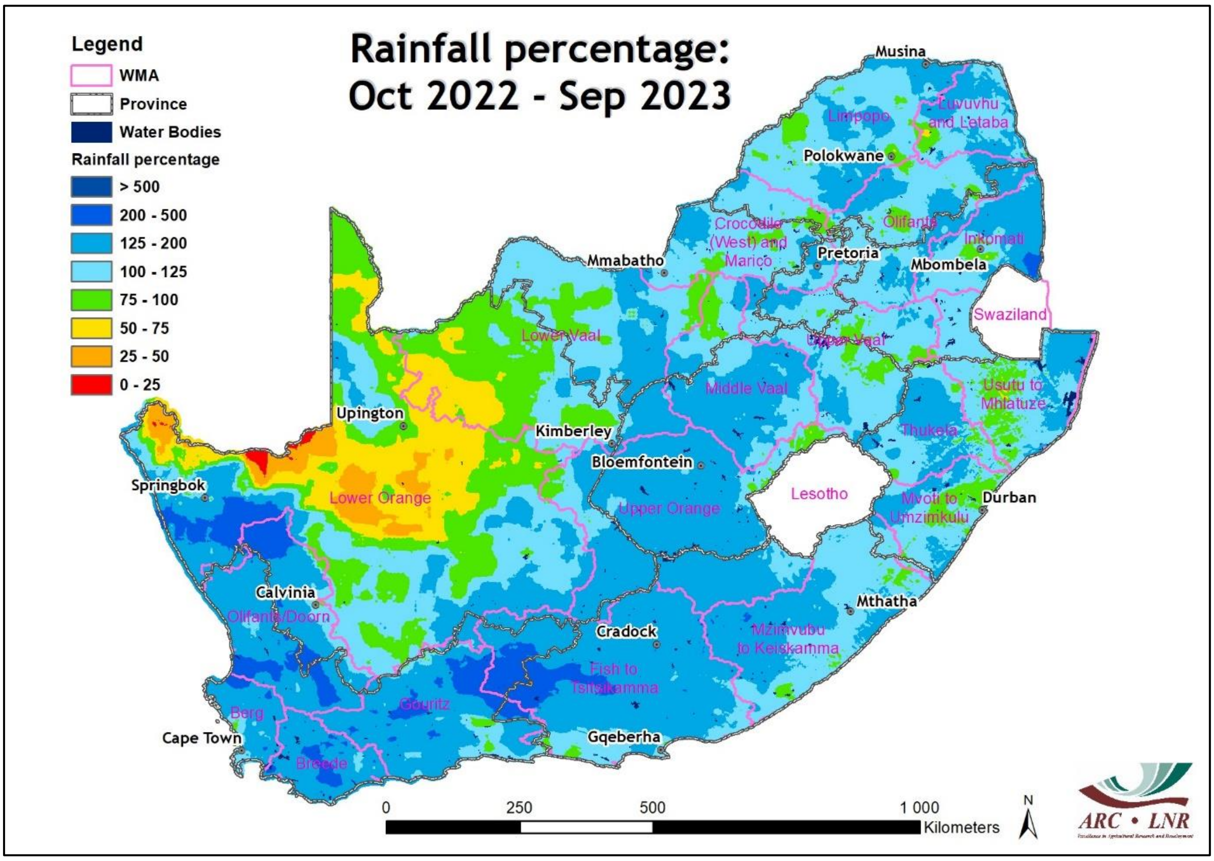


Figure 3.6 Rainfall (percentage of long-term average) for the water year October 2022 to September 2023

The monthly maps, providing the temporal detail during the period, is presented in Figure 3.7a and 3.7b, representing the summer and winter season of the hydrological year, respectively. Considering the monthly distribution of rainfall during the 2022/23 hydrological year, the summer-rainfall region generally received above-average rainfall during the October to December period and again during February and May. Above-average rainfall during these months over much of the summer rainfall region played an important role in the eventual above-average total rainfall observed for the hydrological year in total. Largest contributions leading to above-average rainfall over the winter rainfall region occurred in March, May, June and September.

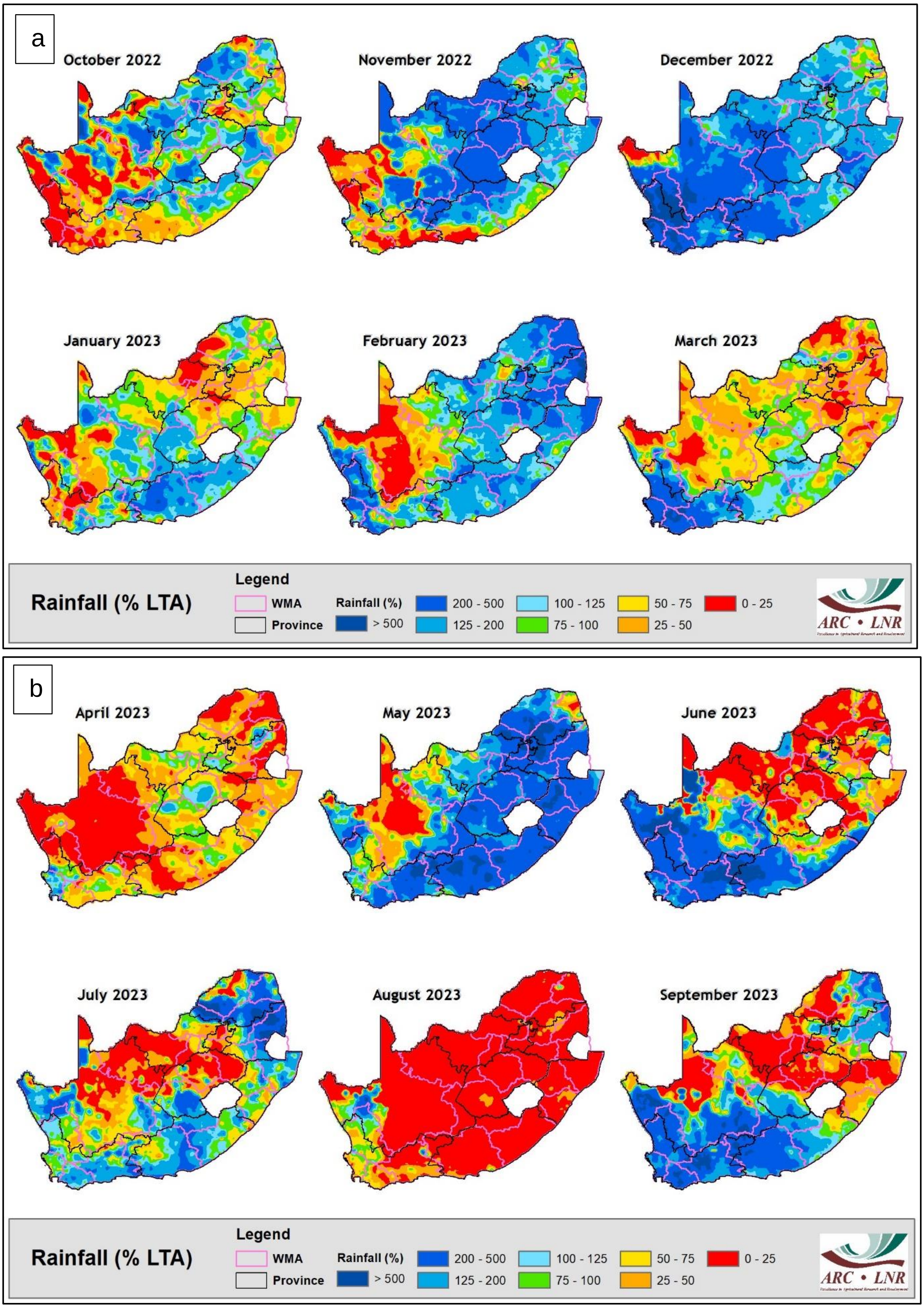


Figure 3.7 (a) Rainfall (percentage of long-term average) per month as indicated for the summer season of the 2022/23 hydrological year (b) Rainfall (percentage of long-term average) per month as indicated for April to September 2023.

During the summer season (October – March) of the hydrological year, the north-eastern parts of the country (large parts of the summer rainfall region) was relatively dry during certain periods while the central to southern parts received above-average rainfall. These periods occurred during January and also March 2023. During most months within the summer season of the hydrological year, large parts of the Northern Cape received below-average rainfall. December 2022 was the only summer month during which almost the entire western interior (including the Northern Cape) received above-average rainfall.

Rainfall was above average over the winter rainfall region during a number of the summer-season months: December, February and March. This was associated with several cut-off lows developing over the region during the period, resulting in unseasonal widespread and sometimes significant rainfall over the winter rainfall region. The summer rainfall region was relatively dry during April, but widespread above-average rainfall occurred during May over most of the country. Several rain-bearing systems developed and caused rain over the summer rainfall region during the first half of the month (May 2023). During the winter season of the hydrological year (April to September), widespread above-average rain occurred over the winter rainfall region and also the south-western third of the country (most of the Cape Provinces) during May, June, July and September. April and August 2023 were relatively dry over almost the entire country, including the winter rainfall region, with large areas receiving less than 50% or even less than 25% of the long-term average rainfall during these months.

The long-term total rainfall anomalies from the hydrological year 1922 – 2023 is presented in Figure 3.8 per water management area. The following classes were used: less than 75% is a dry year, 76-125% is a normal year, while greater than 125 % is a wet year. The Berg-Olifants, Breede-Gouritz, Mzimbvubu-Tsitsikamma and Olifants WMA has experienced a wet hydrological year. Other water management areas experienced a normal year, with no WMA which experienced a dry year across the Country.

Figure 3.8 Hydrological year long-term trends of Rainfall Anomalies: > 125% (wet) & < 75% (dry) (Data Source: SAWS)

3.2 Potential Evapotranspiration

Figure 3.9 shows the total Potential Evapotranspiration (PET) calculated from observed weather data for 2022/23 hydrological year. The PET for the hydrological year follows the typical distribution with highest totals over the warmer, drier northwestern parts of the country, exceeding 1 500 mm and lowest values over the coastal areas in the south and south-east, including the Garden Route, where the total PET for the 12-month period is lower than 900 mm in some places.

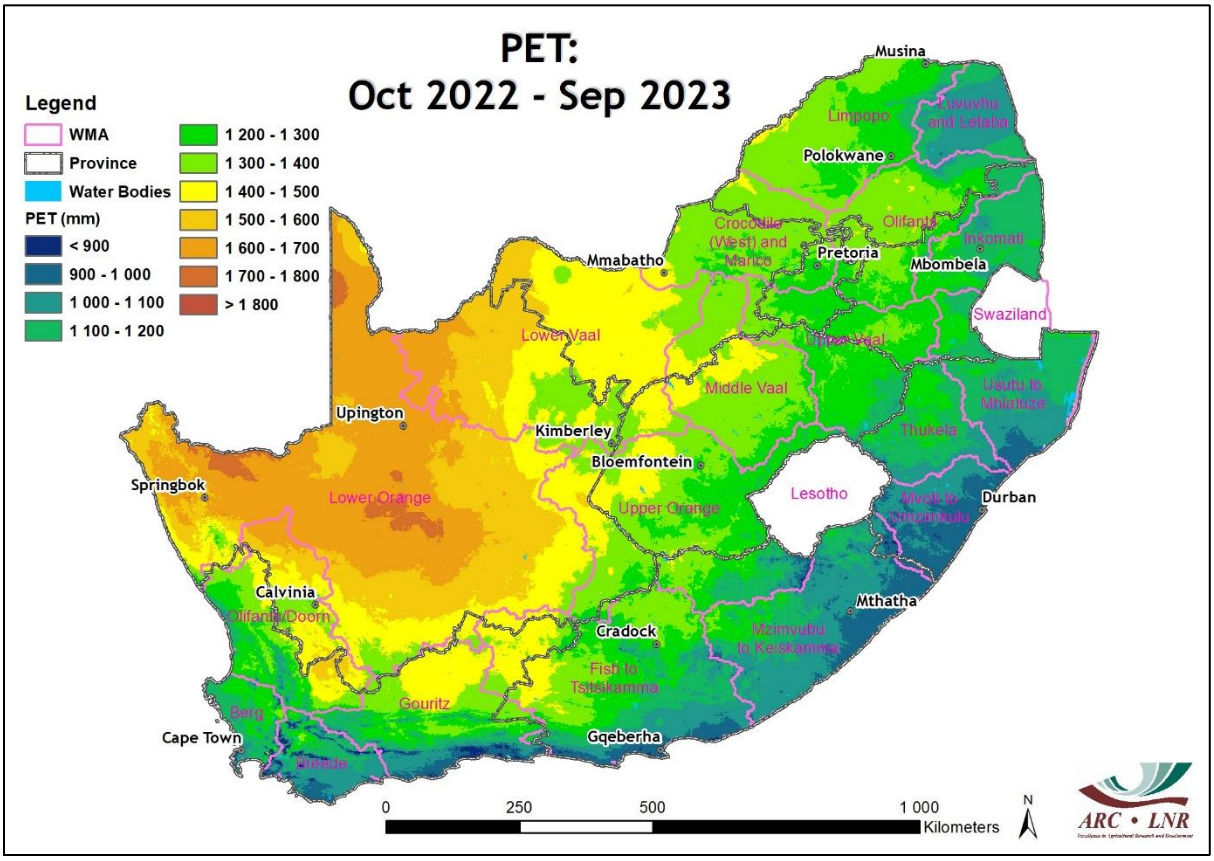


Figure 3.9 Potential Evapotranspiration (PET - mm) for the 2022/23 hydrological year.

Due to cooler conditions especially during the summer months over the interior, together with cloudy and cool conditions and above-normal rainfall during winter over much of the winter rainfall region, most of the country experienced low PET than the long-term average (Figure 3.10). This is especially pronounced over the central parts of the country where negative anomalies exceeded 100 mm.

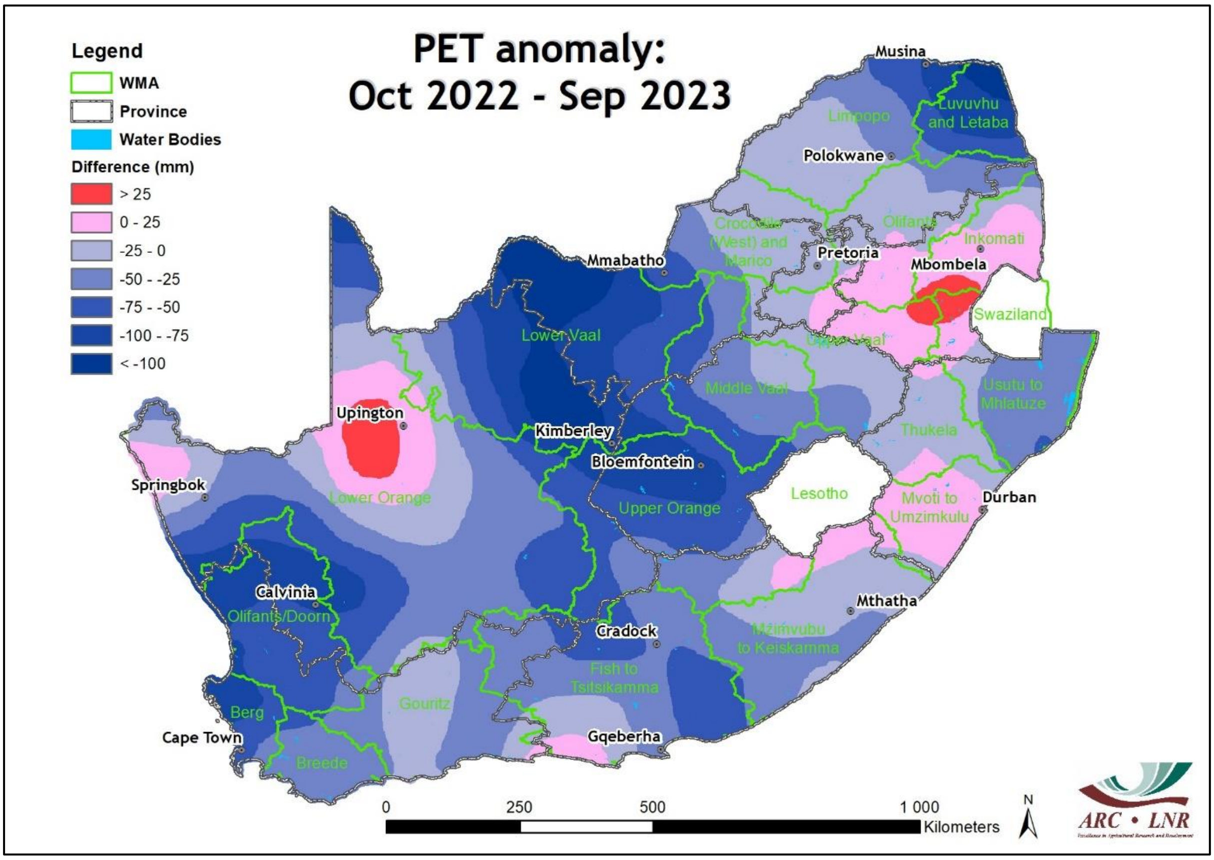


Figure 3.10 Difference (mm) in total Potential Evapotranspiration (PET) for the 2022/23 hydrological year with the long-term average (2022/23 total minus the long-term average value).

3.3 Indicators of Drought

3.3.1 Standardised Precipitation Index

The classification of meteorological drought is based on precipitation’s departure from normal (long-term average) over time. Hydrological drought refers to deficiencies in surface and subsurface water supplies due to prolonged meteorological drought. It is measured using indicators derived from streamflow, dam storage levels, and groundwater levels. When precipitation (mostly rainfall in the context of South Africa) is low for a long time, it is reflected in a decline in surface flow and storage and subsurface water levels (soil moisture and groundwater).

The Standardised Precipitation Index (SPI) is an index based on the probability of rainfall for any time scale and can assist in assessing the severity of any drought. The 12- and 24-month SPI maps give an indication of areas where prolonged droughts exist, in other words, where below-normal rainfall occurred over a period of one year or longer.

Relating rainfall to an indicator of drought, the Standardised Precipitation Index (SPI) for the 2-year period ending in September 2023 (Figure 3.11) shows that drought over this longer time scale was virtually absent. Over the interior, this can be linked to the protracted La Niña period of which the 2022 – 2023 years were part of. Much of the central to south-eastern and eastern interior can be characterised as extremely wet over this period as a whole while only an extremely small part of the country near the Richtersveld experienced moderate to severe drought.

Considering only the 2022-2023 hydrological year, the 12-month SPI by September 2023 is presented in Figure 3.12. While drought extent was still very limited during the 2022/2023 hydrological year, near-normal rainfall occurred for the hydrological year as a whole over most of the interior, with severely to extremely wet conditions limited to the winter rainfall region and southern interior. Moderate to severe drought was limited to the north-western parts of the Northern Cape, especially along the Lower Orange River Valley.

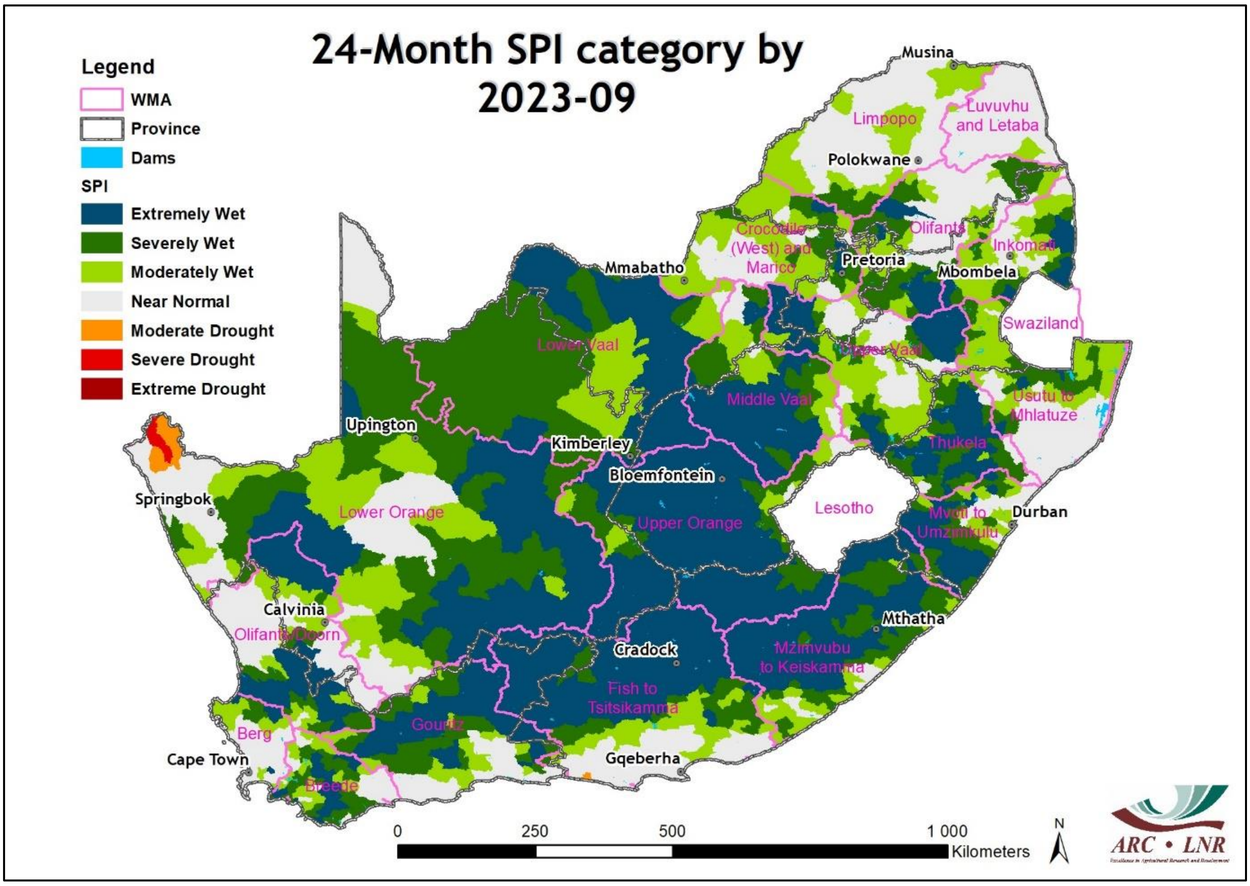


Figure 3.11 24-Month Standardised Precipitation Index (SPI) by September 2023

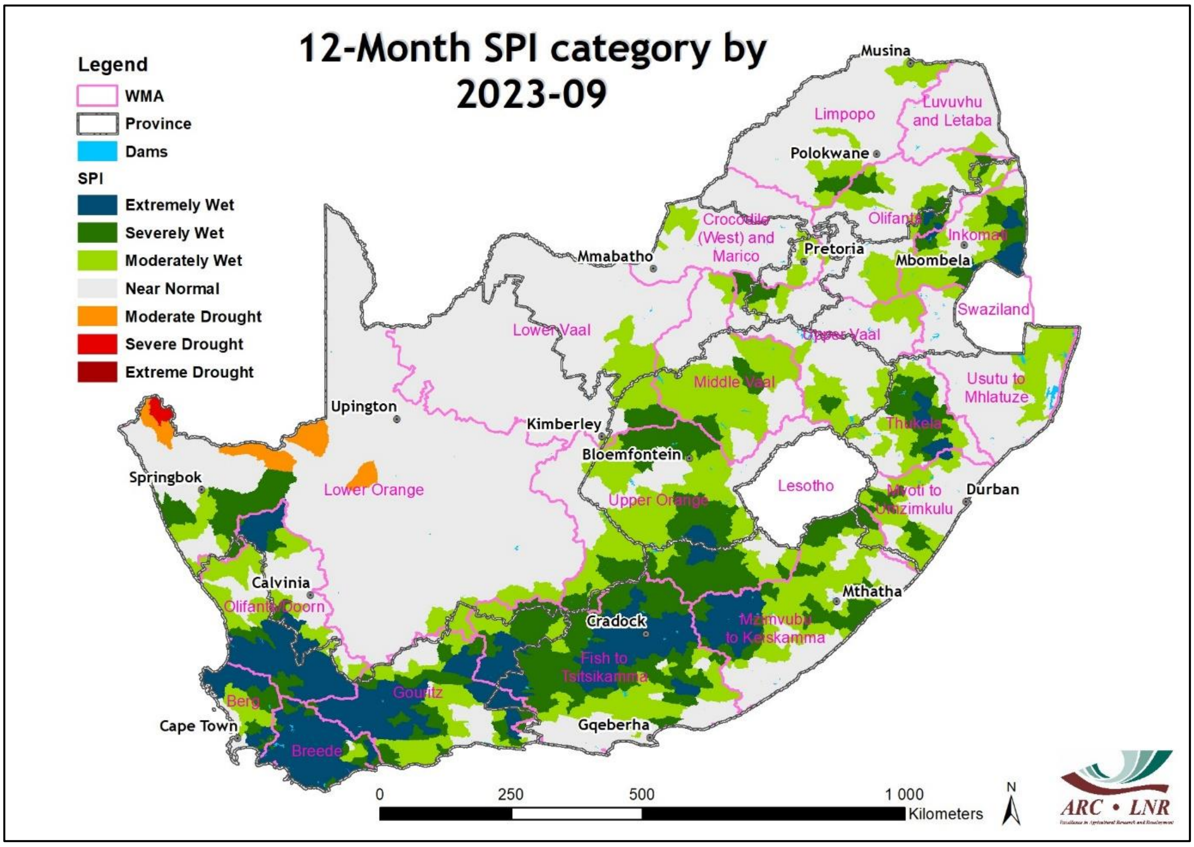


Figure 3.12 12-Month Standardised Precipitation Index (SPI) by September 2023.

When presented as a time series, the SPI shows its evolution over time. SPI values of longer timescales help determine the persistence and the magnitudes of drought events, and flash points. Additionally, it can assist in identifying areas where hydrological droughts (low streamflow, dam levels, and even groundwater levels) are likely to be experienced. This time series also makes it possible to analyse and visualise the intensity of the drought in an area of interest.

The time series of the 12-month SPI, summarised by WMA, is given in Figure 3.13 providing insight into the wetter and drier periods since 2015. Over most of the country (north-eastern central to western, eastern to south-eastern) parts, wetter periods occurred around 2017 and then again during the 2021-2023 period. Drier periods, with widespread drought, occurred during the 2015-2016 period as well as the 2018 – 2020. Over the southern to south-western parts, including the winter rainfall region, the south-western winter rainfall region experienced regular drought conditions from 2015 to 2020 (Berg WMA, Olifants WMA). Further east, the drought period only started by 2017, lasting until 2021 or 2022 in some cases. A shorter dry period also occurred in the southwest and to a lesser extent in the south during 2022. In general, the southern to south-western parts became relatively wet towards 2023.

Throughout the 2022/23 hydrological year, rainfall distribution was such that the 12-month SPI over the southern to south-western WMAs, including those in the winter rainfall region, reached a peak while WMAs over the rest of the country trended somewhat drier following a peak that occurred during 2022.

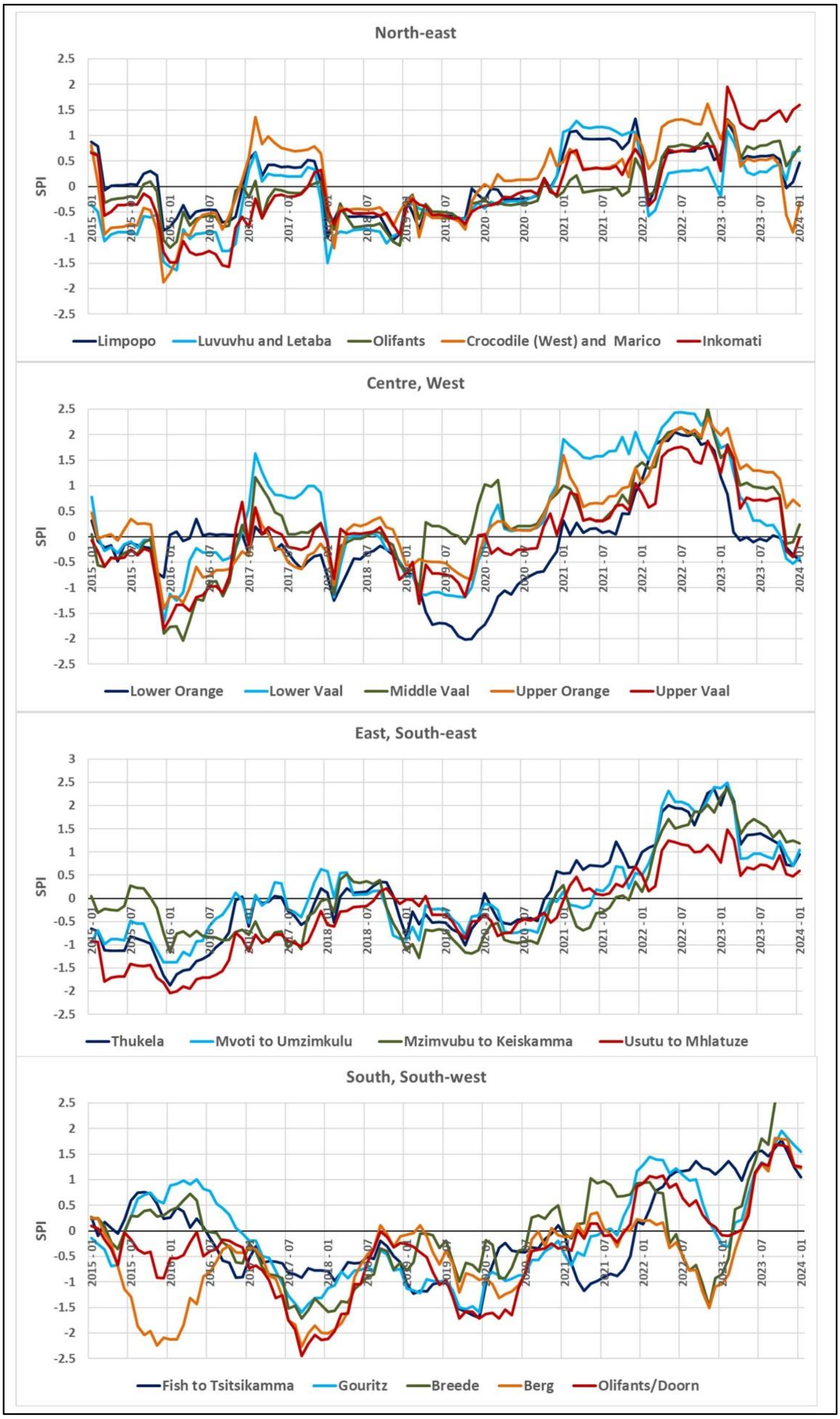


Figure 3.13 12-Month SPI, per WMA as indicated, for the north-eastern (top), central to western parts (upper-middle), eastern to south-eastern parts (lower-middle) and southern to south-western parts (bottom) of South Africa, for the period 2015 – 2023.

3.3.2 Vegetation activity

Figure 3.14 presents the cumulative vegetation activity, as represented by the cumulative Normalised Difference Vegetation Index (NDVI), expressed as a percentage of the long-term average (Percentage of Average Seasonal Greenness – PASG) calculated over the entire 2022/23 hydrological year.

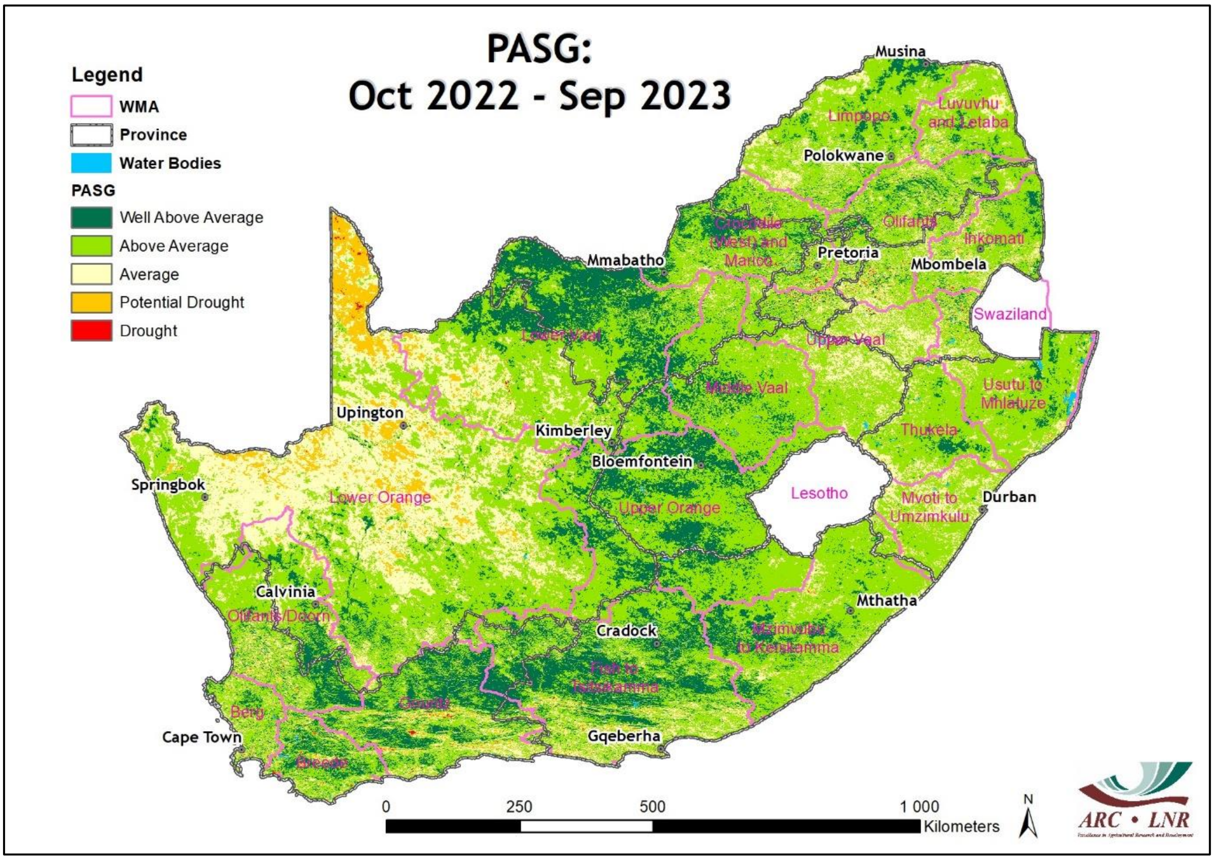


Figure 3.14 Percentage of Average Seasonal Greenness (PASG) for the 2022/23 hydrological year.

Cumulative vegetation activity as represented by the PASG was above average during the 2022/23 hydrological year over almost the entire country, associated with the above-average rainfall observed during this period over most parts. It is especially the central interior as well as the southern parts, including parts of the winter rainfall region, where vegetation activity was well above average. Over these same areas, largest positive deviations in terms of percentage of average rainfall were observed (Figure 3.6) and moderately to severely or extremely wet conditions occurred according to the SPI Map. Drier conditions over the northern to north-western parts of the Northern Cape as indicated in the rainfall and SPI maps had a negative effect on cumulative vegetation activity relative to the long-term average.

3.4 Extreme Weather Events

3.4.1 Extreme temperature event implications on water resources

Over South Africa and during October 2022 - September 2023, there were several notable periods of extremely hot or cold conditions, two of which include the anomalously hot period of 9-23 January 2023 and the anomalously cold period of 9-12 July 2023 (Figure 3.15). During 9-23 January daily average temperatures were anomalously hotter over all regions of South Africa, but were highest over central regions, reaching up to 5.5˚ C higher than normal (Figure 3.15). During 9-12 July 2023 daily average temperatures were similarly anomalously cooler over all regions of South Africa, but were lowest over central, reaching up to 6.5˚ C cooler than normal.

Many negative implications of these events were reported by media, and in the context of water resources such anomalously hot and cold events can have significant negative impacts. In the context of heatwaves (and the 9-23 January 2023 heatwave) and other extremely hot temperature events (e.g., warm spells), higher temperatures enhance evaporation of surface waters (i.e., dams, lakes and rivers) and even soil water, reducing the quantity of available water that can be used for drinking and household, irrigation and industrial use. In times of drought or when there has been limited rainfall, higher temperatures resulting from extreme temperature events can exacerbate already dry conditions by enhancing evaporation and associated high-pressure systems (often the systems causing heatwaves) can also block rain-bearing weather systems leading to even drier conditions.

With these extremely hot events, there is typically increased water demand not only for domestic consumption but also for agricultural and industrial uses. These heightened water demands coupled with increased evaporation can easily strain water resources. Above this, elevated temperatures can also impact water quality by promoting the growth of harmful algal blooms and increasing the concentration of pollutants in water bodies. In some instances, it has also been reported that extremely hot temperatures can even stress water infrastructure, leading to increased wear and tear on infrastructure components, and in extreme cases, may cause failures or disruptions in water supply systems.

On the other hand, extremely cold temperatures can also impact water resources, but to a lesser extent. In the context of cold waves (and the 9-12 July 2023 cold wave) and other extremely cold temperature events (e.g., cold snaps), the impact on water availability can be felt through freezing over of water bodies, limiting available water that can be used for drinking and household, irrigation and industrial use. However, over South Africa, this is extremely rare as the country is characterised by an overall warm climate, but in regions such as the Lesotho Highlands, representing an important water source for the country, freezing over of water resources can occur. Over these cooler regions, events of extremely cold temperatures can potentially impact water infrastructure by freezing water within pipes and potentially leading to burst pipes or water leaks or other failures as a consequence, in turn causing disruptions in water supply.

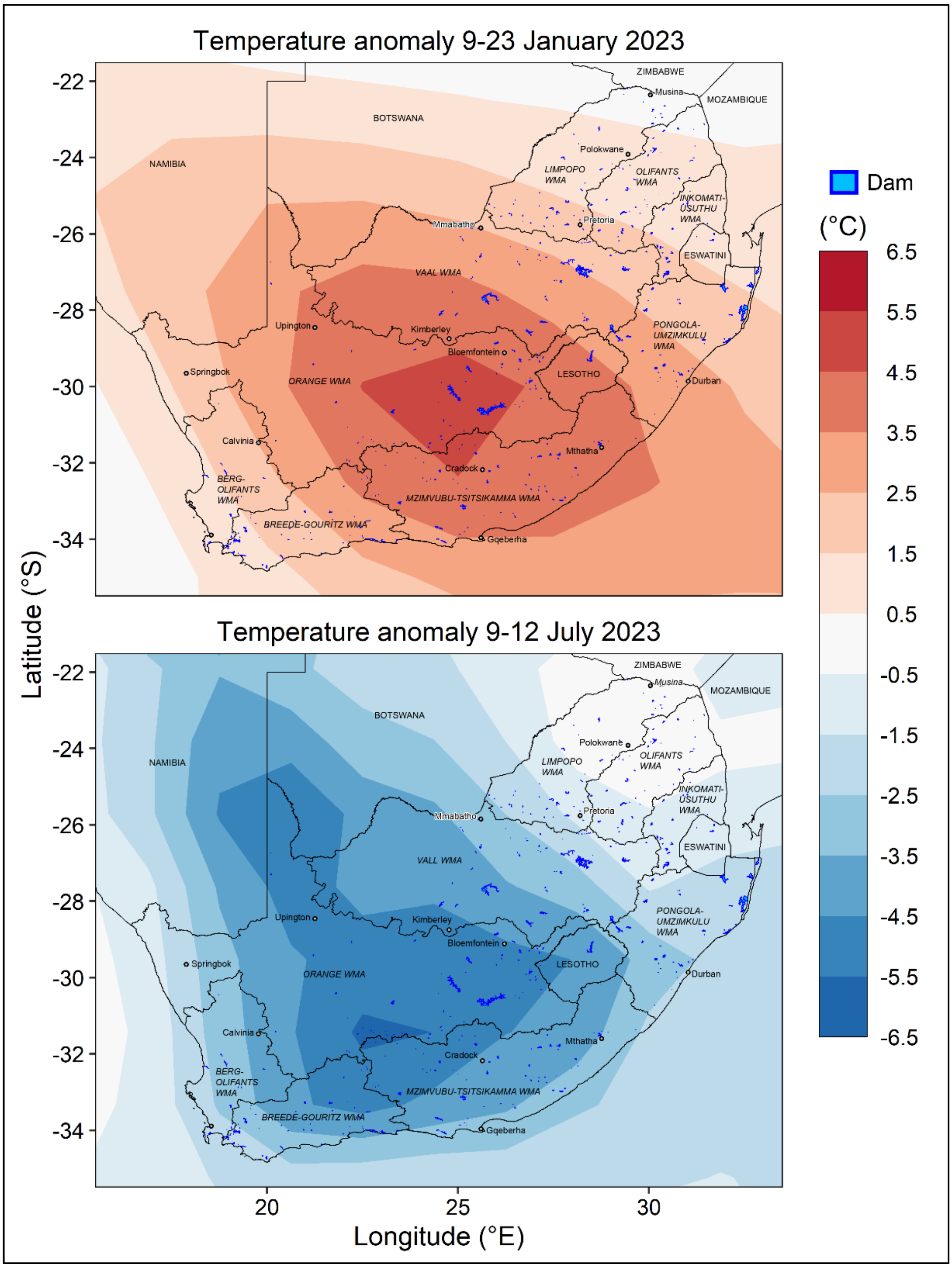


Figure 3.15 Maps of the daily temperature anomalies recorded for (a) 9-23 January 2023 and (b) 9-12 July 2023. Data source: NCEP/NCAR Reanalysis at a spatial resolution of 2.5˚ (https://psl.noaa.gov/data/gridded/data.ncep.reanalysis.html). The anomalies mapped represent the deviation of 9-23 January and 9-12 July temperatures from long-term mean temperatures for 1991-2020.

3.4.2 Extreme Rainfall Events

After relatively dry conditions during January 2023, widespread thundershowers occurred by the end of the month over the summer rainfall region. Thundershowers continued into February, with widespread significant falls over the northeastern half of the country. The 10-day total rainfall (Figure 3.16, top) exceeded 150mm over several areas, but reached a maximum extent over the eastern and northeastern escarpment, Lowveld and northern parts of KwaZulu-Natal. Several locations experienced 24-hour totals exceeding 100 mm during this period. Totals over this period exceeded 300 mm over the escarpment and Lowveld of Mpumalanga. Over these areas, flooding occurred in several rivers, including the Crocodile and Komati rivers in Mpumalanga. Localized flooding also occurred over parts of northern Kwa-Zulu Natal. The presence of a tropical low moving over the northeastern parts of the country (indicated by “L” in Figure 3.16, bottom) contributed large amounts of tropical moisture and uplift while general circulation patterns further enhanced the favourability for rainfall during this specific period.

The winter rainfall region and the rest of the southern parts of South Africa received above-normal rainfall during winter and spring of 2023. One of the wettest periods over the winter rainfall region occurred during 11 – 18 June, when a quick succession of several cold fronts moved across the southern parts of the country from the west, resulting in widespread rainfall over the western parts and significant totals especially over the southwestern mountainous areas (Figure 3.17, top). Figure 3.17, bottom, shows a frontal system with a zonal alignment moving across the southern parts during this period, responsible for widespread significant rainfall especially over the western parts of the winter rainfall region. Parts of the Swartland received in excess of 150 mm, while multi-day totals reached 300 mm in parts of the Boland.

September 2023 was an extremely wet month over the southern parts of the country and widespread heavy rain during this month over the southern parts helped ending the drought conditions that lingered over some of the southeastern to southern parts of the country. Heavy rainfall during spring is almost always associated with cut-off low pressure systems. During September 2023, this was no exception. A significant widespread heavy rainfall event occurred from 23 to 27 September, when a cut-off low (indicated with an “L”, Figure 3.18, bottom) developed near the west coast and moved across the southern parts of the country, causing widespread rain and thundershowers with heavy falls especially in the mountainous region. As the system moved across the region, 2-day totals exceeded 100 mm over especially the mountainous regions in the southwest, along the Garden Route in the south and southern to southeastern parts of the Eastern Cape. Multi-day totals exceeded 150 mm in some of these mountainous areas and even exceeded 300 mm over the southwestern mountainous areas in the Western Cape (Figure 3.18, top). With river systems already full following widespread above-normal rainfall earlier during the winter, widespread flooding occurred, resulting in loss of lives and widespread infrastructure damage and road closures.

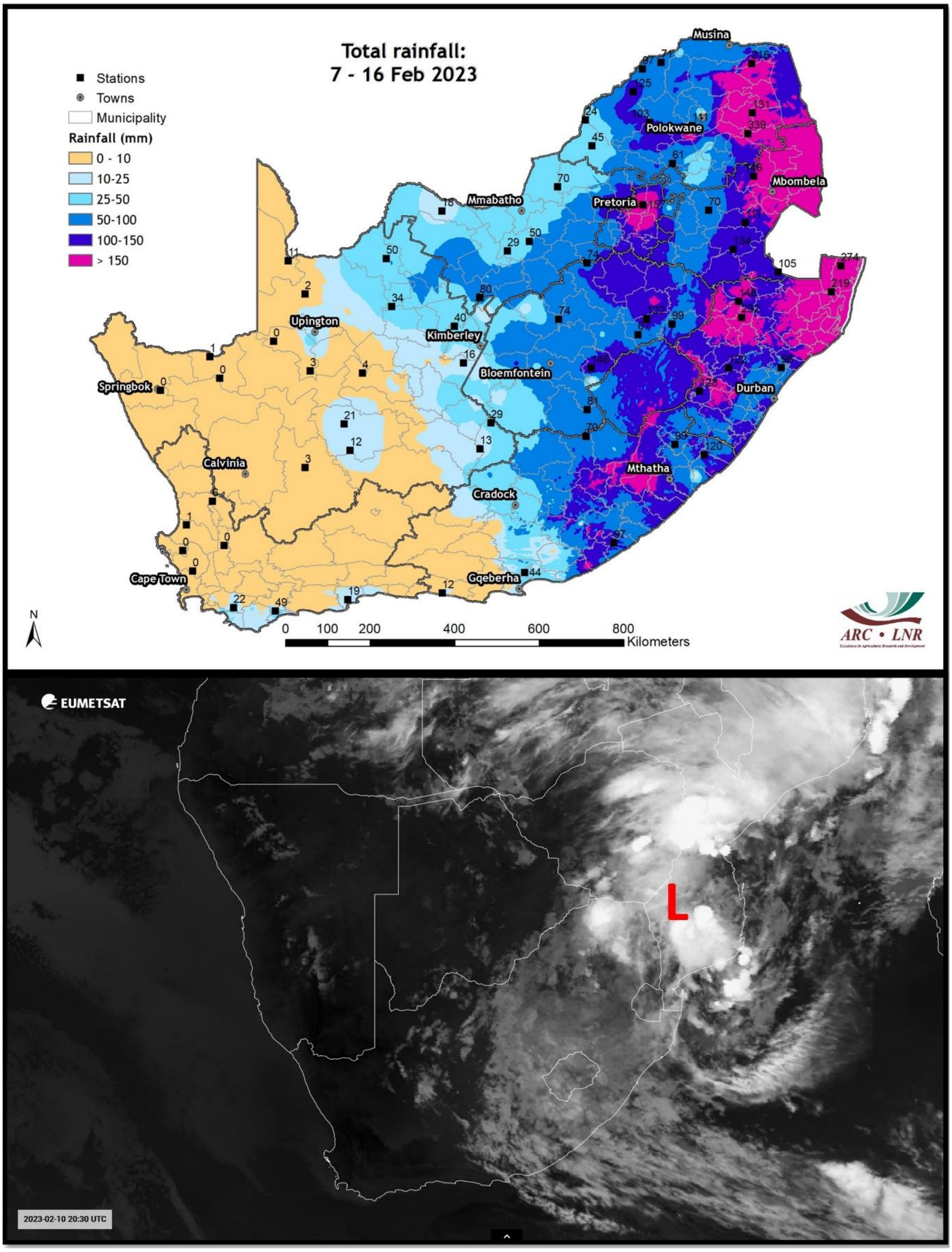


Figure 3.16 Total rainfall (mm) during 7 – 16 February 2023 (top) and Meteosat Second Generation thermal infrared image on 9 February (bottom).

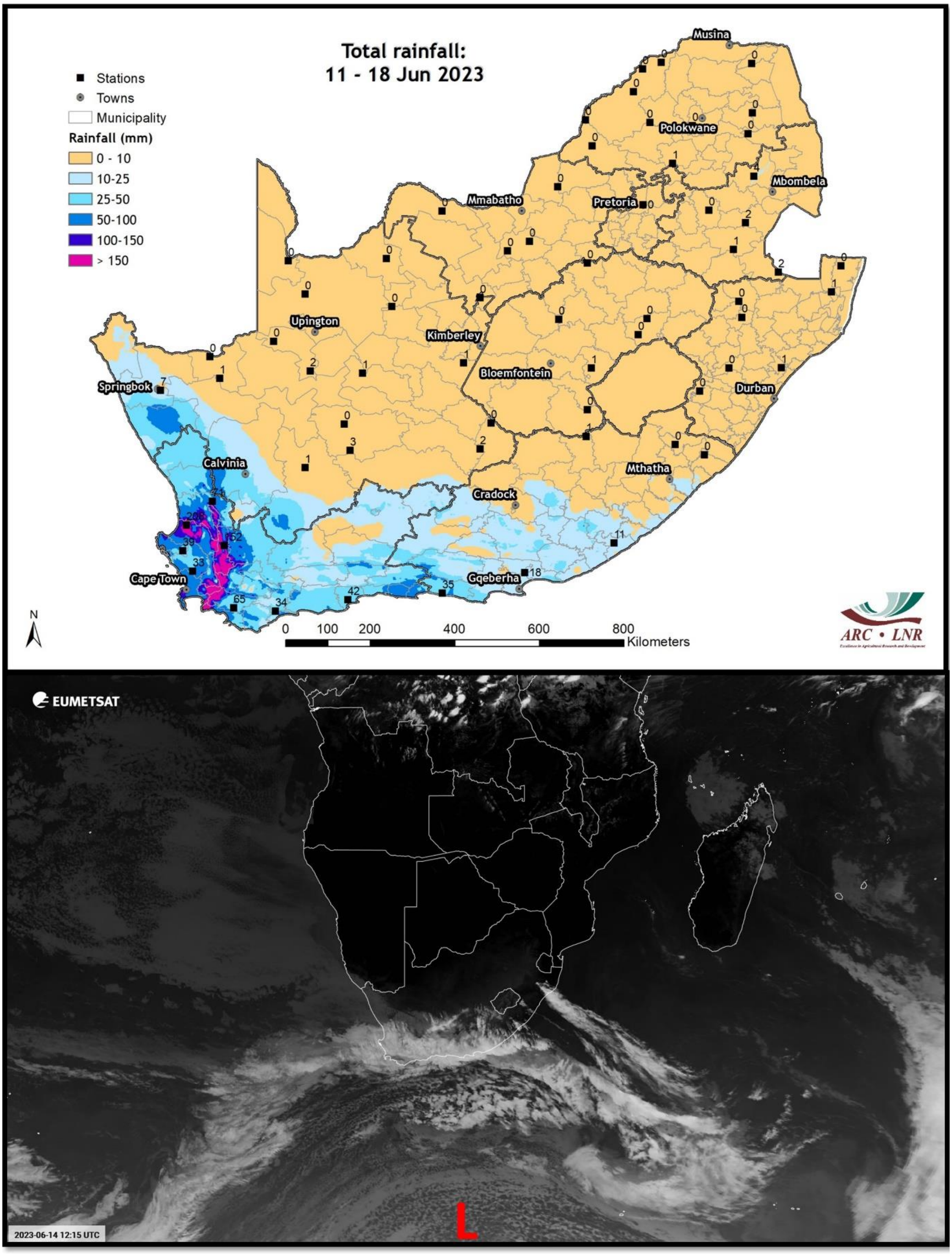


Figure 3.17 Total rainfall (mm) during 11 – 18 June 2023 (top) and Meteosat Second Generation thermal infrared image on 14 June (bottom).

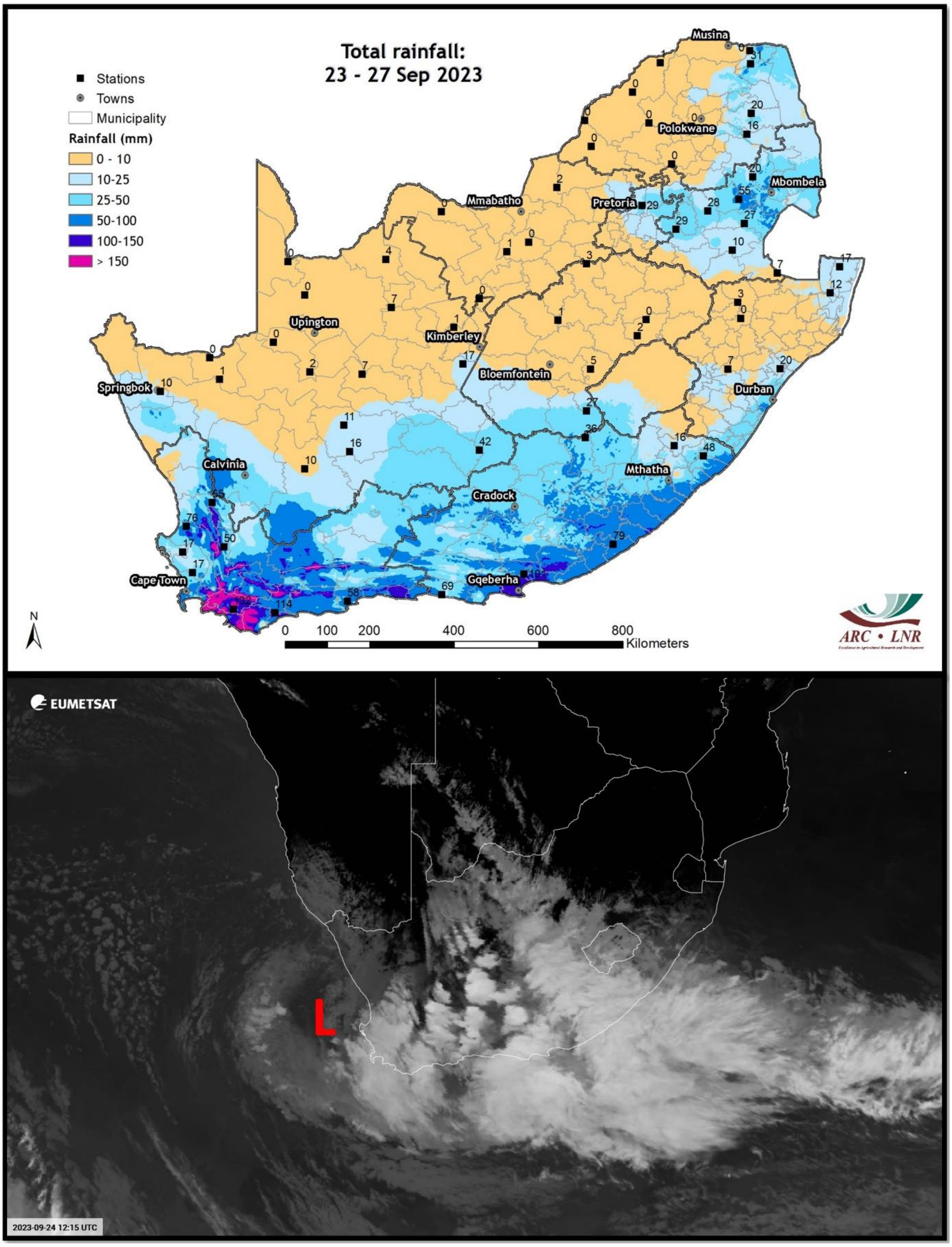


Figure 3.18 Total rainfall (mm) during 23 – 27 September 2023 (top) and Meteosat Second Generation thermal infrared image on 24 September (bottom).

3.4.3 Floods

During the Hydrological years 2021/22 and 2022/23, El Niño-Southern Oscillation (ENSO) was in a La Niña phase, associated with above-normal rainfall over most summer rainfall regions. In November 2022, normal to above-normal rainfall occurred mainly over the country's eastern half and isolated parts of the Northern and Western Cape Provinces. As a result, some urbanised areas experienced severe flooding. Furthermore, a trough (low-pressure system) resulted in heavy rainfall, primarily over parts of Gauteng. As a result, widespread flooding was reported between 11 and 13 November 2022 for parts of Gauteng, Mpumalanga, and the southwestern parts of Limpopo. Sinkholes were reported in places over the West Rand and Pretoria. Widespread flooding across the southern Highveld of Mpumalanga near Standerton and Secunda resulted in a large inflow of water into the Vaal Dam, raising dam levels and resulting in the decision to open sluice gates several times for flood management during this period of high inflows.

The calendar year 2023 commenced with relatively wetter conditions in the central and western parts, while the coastal regions and some north-eastern parts of the country experienced drier-than-usual conditions. Port St Johns, which is located in the Eastern Cape Province, experienced floods on 23 March 2023. The heavy rains were caused by a cut-off low situated west of the country, supported by a strong high-pressure surge in the south to southeast of the country. The cut-off low resulted in thunderstorm activity for several provinces, including the Eastern Cape. The local municipalities that were affected by floods included Ingquza Hill, King Sabata Dalindyebo, and Port St John's, which were the worst affected. Tremendous destruction to infrastructure, households, and businesses was observed in all other affected areas.

In May 2023, above-normal rainfall was experienced across most parts of the country, with major flooding events occurring in the eastern and south-eastern coastal regions. On 13 May, heavy rains led to the evacuation of over 1 200 residents from their homes in the Nelson Mandela Bay Municipality in the Eastern Cape.

In June 2023, flooding occurred in three provinces: the Western Cape, the Northern Cape, and KwaZulu-Natal. A fast-moving cold front landed over the Western Cape, bringing cold temperatures and rainfall. The resultant torrential rains wreaked havoc in the Western Cape Province on 14-15 June 2023, causing flooding in several areas. It was reported that in Rawsonville, more than 1000 people were displaced and housed in Rawsonville's town hall, while Riverview residents in Citrusdal were given emergency shelters. In the Namakwa District Municipality in Northern Cape, Richtersveld, Kamiesberg, and Nama Khoi Municipal regions received higher than normal rainfall from 27 June 2023. This flooding resulted in infrastructure damage in various regions, including washed-away bridges that limited residents' access to healthcare facilities and shops. On 27-28 June 2023, KwaZulu-Natal experienced a catastrophic, unprecedented flash flood in winter. Severe weather, including high gusts and heavy rain, began on 27 June 2023. Paddock in Ugu District received 176 mm of rain in a 24-hour period ending on 28 June, Sezela in Ugu District received 84 mm, while the Greater eThekwini Metropolitan region received 72 mm. On 24 and 25 September 2023, the Western Cape faced multiple floods, resulting in 11 fatalities, the closure of over 200 roads, and more than 80,000 people enduring prolonged power outages.

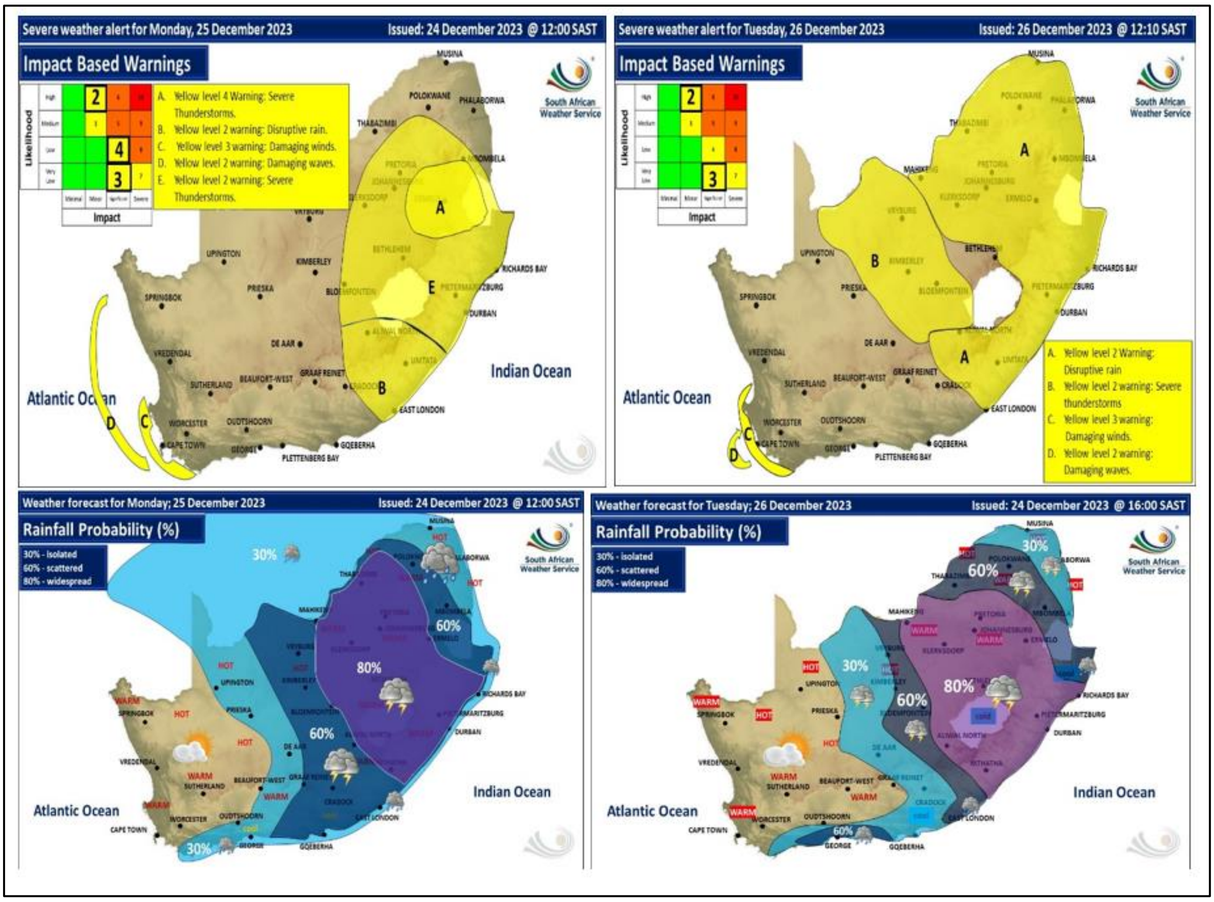


Figure 3.19 Severe weather warnings and rainfall predictions for 25 and 26 December 2023. (Source: SAWS)

These heavy rains caused widespread destruction, affecting households, businesses, and public infrastructure such as schools, roads, and bridges (Figure 3.20). The uThukela District was severely affected, with 23 deaths reported during floods that hit Ladysmith on 24 December 2023 and more than 100 houses damaged.

On 24 December 2023, weather stations in the Ladysmith area reported approximately 60mm of rain within an hour, with approximately 80mm of rain falling over three hours. Strong winds also damaged over 40 homes in King Cetshwayo District, destroying several businesses in the Eshowe industrial area. By 31 December 2023, the number of fatalities from extreme weather conditions in KZN had risen to 31, with three people still missing. COGTA reported that over 600 households and over 140 dwellings were destroyed (COGTA, 2023).

Figure 3.20 Destruction caused by floods in Ladysmith, KZN. (Source: SABC News).

3.5 Weather Forecast

El Niño Southern Oscillation or ENSO is a term used to describe the naturally occurring dynamic ocean-atmosphere phases of a significant part of the Pacific Ocean. This dynamic state fluctuates over periods of months along a gradient where the two extreme states are known as El Niño versus La Niña. In essence, El Niño is characterized by warmer-than-average sea surface temperatures in the ocean adjacent to the south-central coast of the Americas, while La Niña is characterized by lower-than-average sea surface temperatures in that same region (Sweijd et al, 2024).

In early July 2023, the World Meteorological Organisation officially declared the “onset of El Niño Conditions” – this was a moment (persistent sea surface threshold exceedance) that this year’s ENSO phase or state was officially recognised as an El Niño. This was anticipated as early as March 2023 supported by both the observations data and climate models. The current status of this El Niño is provided below.

Ongoing monitoring of the El Niño and a wide range of climate metrics have been conducted and data from this season’s features relative to other years’ seasons are now available. We have now passed the peak of this season, the metrics of the 2023 El Niño show that this season’s event, while not as intense as the strongest such events of the past, was within the range of the top four such events recorded in the past. This is illustrated in Figure 3.21 which provides an index of the Sea-Surface Temperature (SST) anomalies for the 8 most intense Los Niños on record.

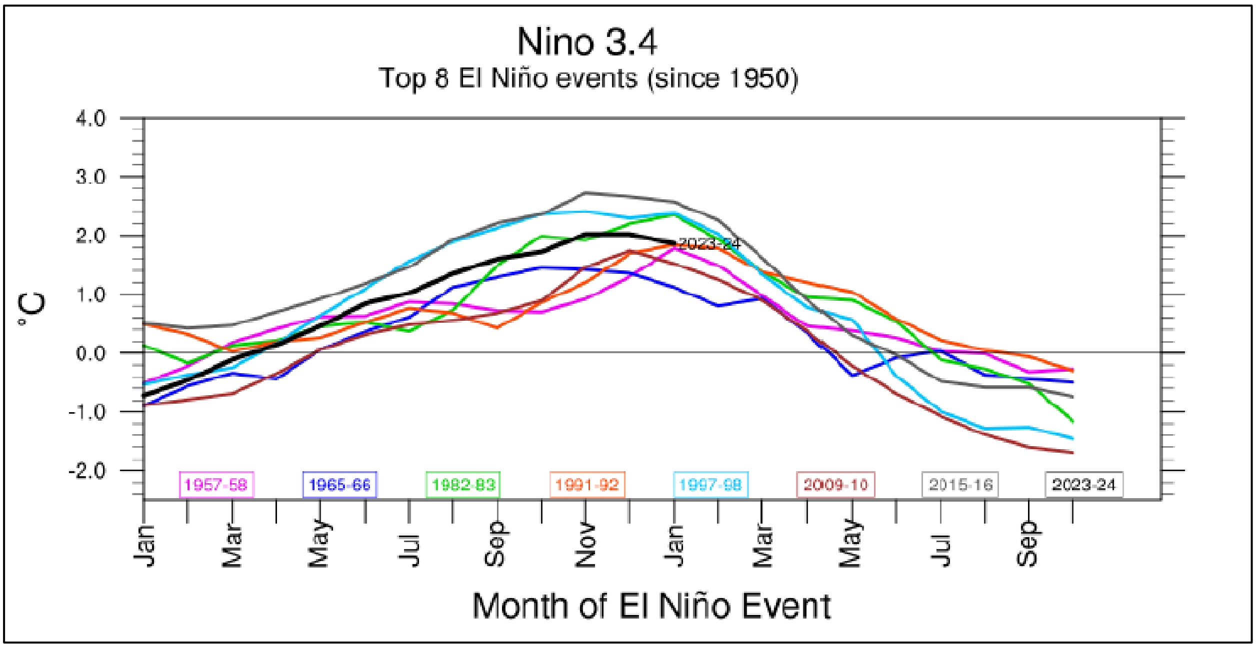


Figure 3.21 SST anomalies averaged over the NINO3.4 region 5°North-5°South;170-120°West. Calculated from the Monthly NOAA ERSST V5 (at NOAA/CPC). Sourced from NOAA PSL.

The El Niño-Southern Oscillation (ENSO) is currently in a strong El Niño state. This event is predicted to persist through the 2023/24 summer months.

- The impacts of ENSO in South Africa are drier and warmer conditions during the summer seasons.
- SAWS multi-model rainfall forecast predicts mostly **below-normal rainfall** over most of the country during Feb-Mar-Apr (FMA), Mar-Apr-May (MAM), and Apr-May-Jun (AMJ), except some central parts of South Africa during MAM, which have a higher probability of **above-normal rainfall** (Figure 3.22).
- The anticipated below-normal rainfall conditions, coupled with above-normal minimum and maximum temperatures, are likely to reduce surface water levels, particularly in drought-affected areas.
- Minimum and maximum temperatures are expected to be mostly above normal countrywide, and this is likely to increase the demand for cooling for the forecast period.

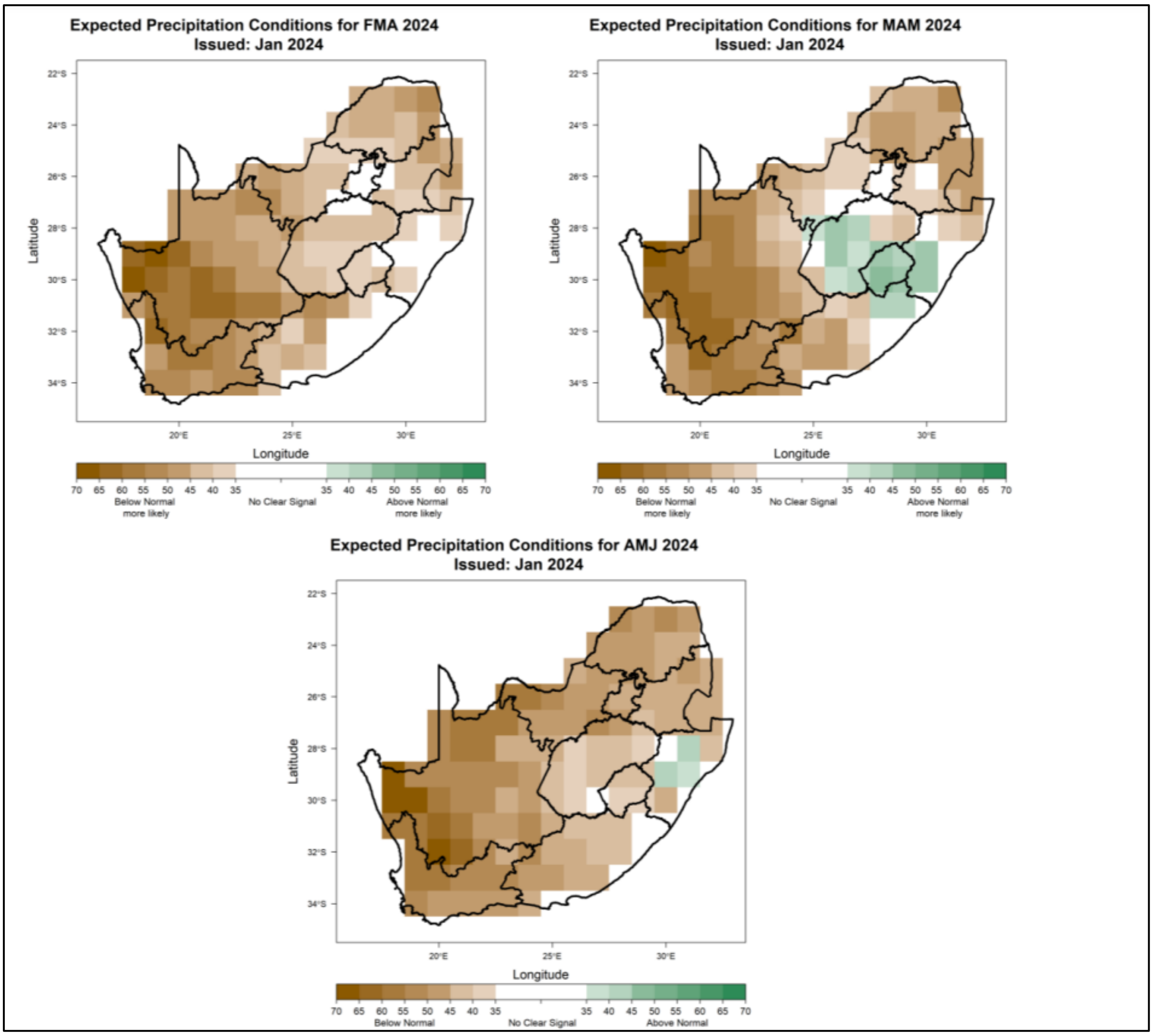


Figure 3.22 February-March-April 2024 (FMA; left), March-April-May 2024 (MAM; right), April-May-June 2024 (AMJ; bottom) seasonal precipitation prediction. Maps indicate the highest probability of the above-normal and below-normal categories.

El Niño did display some of the typical features of impact on our climate with a somewhat drier rainy season and much warmer summer season relative to the long-term average. The manifestation of this was not as severe as similar events in the past and due to the previous years' good rain (La Niña years), there was sufficient water storage to offset any impact of the drying. Nevertheless, there was a discernible impact on dam levels during this period.