Annual State of the Climate of South Africa 2025

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Executive Summary

Global Perspective from the WMO State of the Global Climate 2025

- Greenhouse gases: Concentrations of the three main greenhouse gases – carbon dioxide, methane and nitrous oxide – reached record-high observed levels in 2024, the latest year for which consolidated global values are available (1984-2024). Real-time data from specific locations show that levels of the three greenhouse gases continued to increase in 2025 (see section on greenhouse gases for a local perspective).

- The annually averaged global mean near-surface temperature in 2025 was about 1.44 °C (± 0.13 °C) °C above the 1850-1900 average used to represent pre-industrial conditions. 2025 was one of the three warmest years in the 175-year observational record with 20254 still remaining the warmest. In 2025, ocean heat content reached its highest level in the 65-year observational record, exceeding the previous record high set in 2024.

- In 2025, global mean sea level reached a record high in the satellite record (from 1993 to present).

- Acidification of the ocean surface has continued over the past 39 years as shown by the steady decrease of global average ocean surface pH.

- Extreme weather events in recent years have driven very high levels of new displacement—among the highest recorded since 2008—while also contributing to significant new, onward, and protracted displacement worldwide.

Please see State of the Global Climate 2025 (https://wmo.int/publication-series/state-of-global-climate-2025) for the complete publication.

South Africa

Surface Temperature

South Africa experienced a warm year, among the top 10 warmest years since 1951 based on the data of 26 climate stations. The annual average temperature was about 0.4 ºC above the average of the reference period (1991-2020). A warming trend of approximately 0.17 ºC per decade is indicated for the country, over the period 1951-2025, statistically significant at the 5% level.

Precipitation

The most significant feature of the rainfall during 2025 was the above-normal rainfall amounts received over most of South Africa. The major exception was the Western Cape, extending into the southern interior of the Northern Cape. Especially the South Coast and parts of the Northern Cape received well below-normal rainfall, with some places experiencing extremely dry conditions.

Noteworthy climate and weather events

In South Africa, the year started off with above-normal temperatures over most of the interior, except for the west and extreme north and isolated parts in the east, where relatively wet conditions were experienced. Tropical moisture led to Level 6–8 rain warnings with high risk of localised flooding, especially along the KwaZulu-Natal coast and Midlands. Motorists and residents were urged to exercise caution due to flooding threats. Between mid and late February 2025, intense above-normal rainfall triggered widespread flooding and landslides in eastern South Africa, particularly in KwaZulu-Natal. Multiple warnings were issued by SAWS for heavy rain and localised flooding across the province (and adjacent provinces). Specific impacts reported in February include fatalities and casualties as floodwaters surged in towns and low-lying areas, landslides in residential areas such as KwaMakhutha and Folweni, Other infrastructure damage include destroyed roads, bridges, and homes, with thousands displaced and relocated to shelters. An estimated billions in damages (e.g., R3.1 billion in KZN alone) were incurred.

These wetter than normal conditions continued in the east and extended westwards to cover most of the country by March and April. Widespread disruptive rainfall and thunderstorms were reported across many provinces in early to mid-March 2025, as the above-normal rain extended westwards beyond the east into the interior, including KwaZulu-Natal, Eastern Cape, Free State, Mpumalanga, Gauteng, Limpopo, North-West and the Northern Cape. SAWS issued multiple impact-based warnings for severe thunderstorms and disruptive rain, localised flooding of roads and settlements, strong winds, lightning and hail. These warnings repeatedly covered a broad swath of the country around 12–16 March 2025, reflecting persistent wet patterns.

South Africa

Noteworthy climate and weather events (continued)

However, in May only the extreme west received significant amounts of rain, while the remainder of South Africa were unseasonally dry and cold. Parts of Cape Town experienced localised flooding in May 2025 as rainfall overwhelmed stormwater systems in some urban areas: Heavy downpours in Cape Town led to water buildup on roadways and localised flooding of streets and low-lying urban areas. City disaster management teams responded to service calls relating to flooding in suburbs. The SA Weather Service issued a Yellow Level 2 warning for disruptive rainfall and damaging winds during these episodes. However, no major deaths or large-scale disasters were reported with this event, but it did cause travel disruption, traffic issues, and minor flooding of streets. June and July winter temperatures were mostly below normal and wetter than usual in the extreme south-west and east. Dry conditions persisted over the south coast and southern interior of the Northern Cape.
In August and September temperatures changed to above normal over most parts and extremely dry conditions persisted in the south, spreading eastwards. However, by the end of 2025 dry conditions were well established over the whole south-west of South Africa. Severe drought conditions developed in the Western Cape because of below-normal rainfall since August 2025, especially in the winter rainfall season when this region normally receives the bulk of its precipitation. Patches of extreme drought were experienced in parts of the Boland and adjoining areas, with agricultural impacts such as poor winter crop prospects and low soil moisture. Drought stress specifically threatened winter crops like wheat in these areas by late 2025 due to the lack of typical winter rains. The Western Cape and the Boland emerged as among the most drought-stressed parts of the country by year-end.

Also, by the end of 2025, the south-western coastal areas around the Garden Route in the Western Cape were among the most drought-affected localities in that broader region, despite occasional rainfall earlier in the year. The below-normal rain had important impacts on both water supply and local conditions: The Garden Route Dam in George, a key resource for the town, declined steadily through 2025, dropping to below 50 % capacity by December and prompting stricter municipal water use restrictions. Commentary from local officials pointed to uneven and inadequate rainfall in key catchments, meaning even when storms occurred nearby, much of that rain didn’t fall where the dam could capture it. Currently these dry conditions have also spread eastwards.

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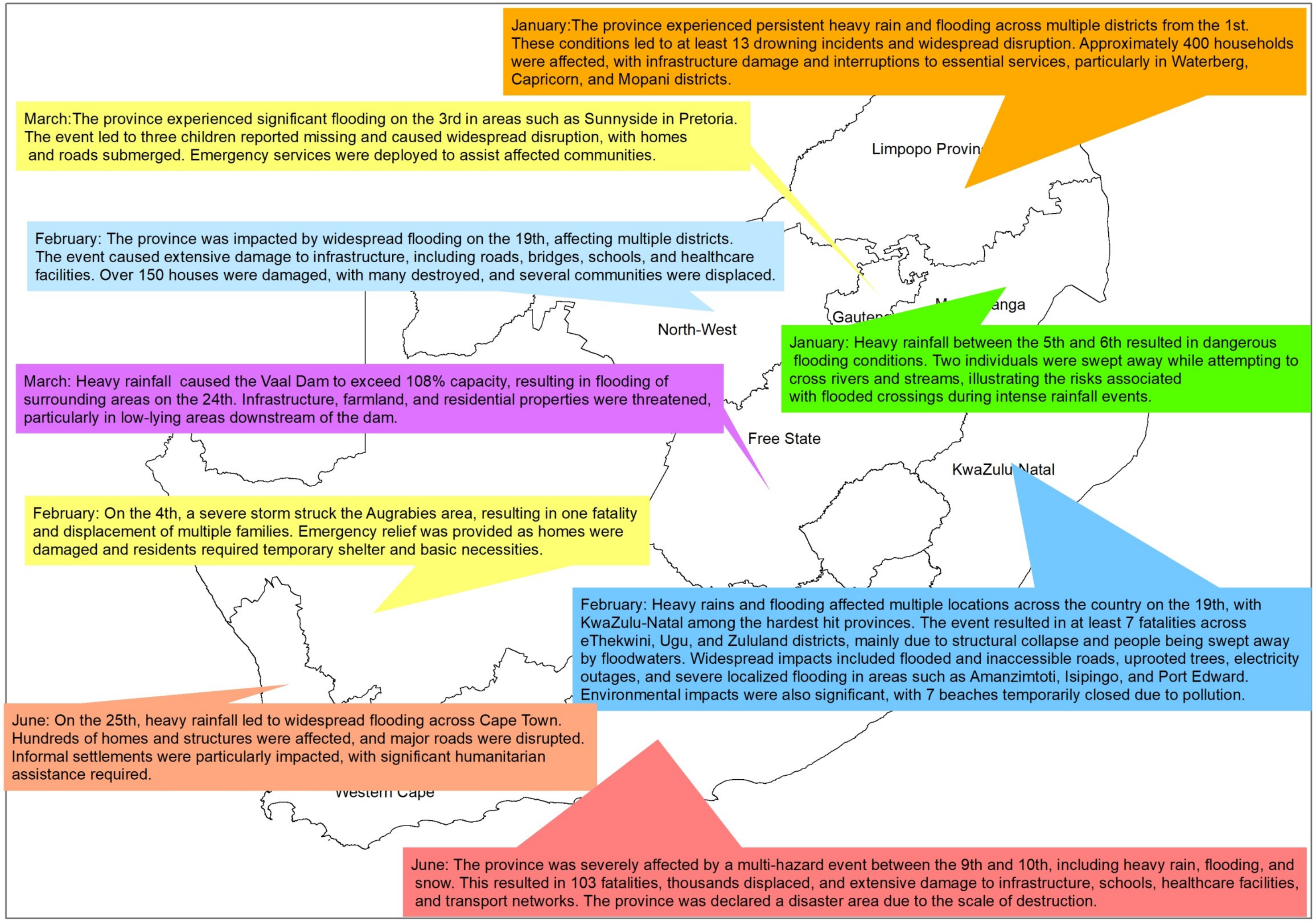
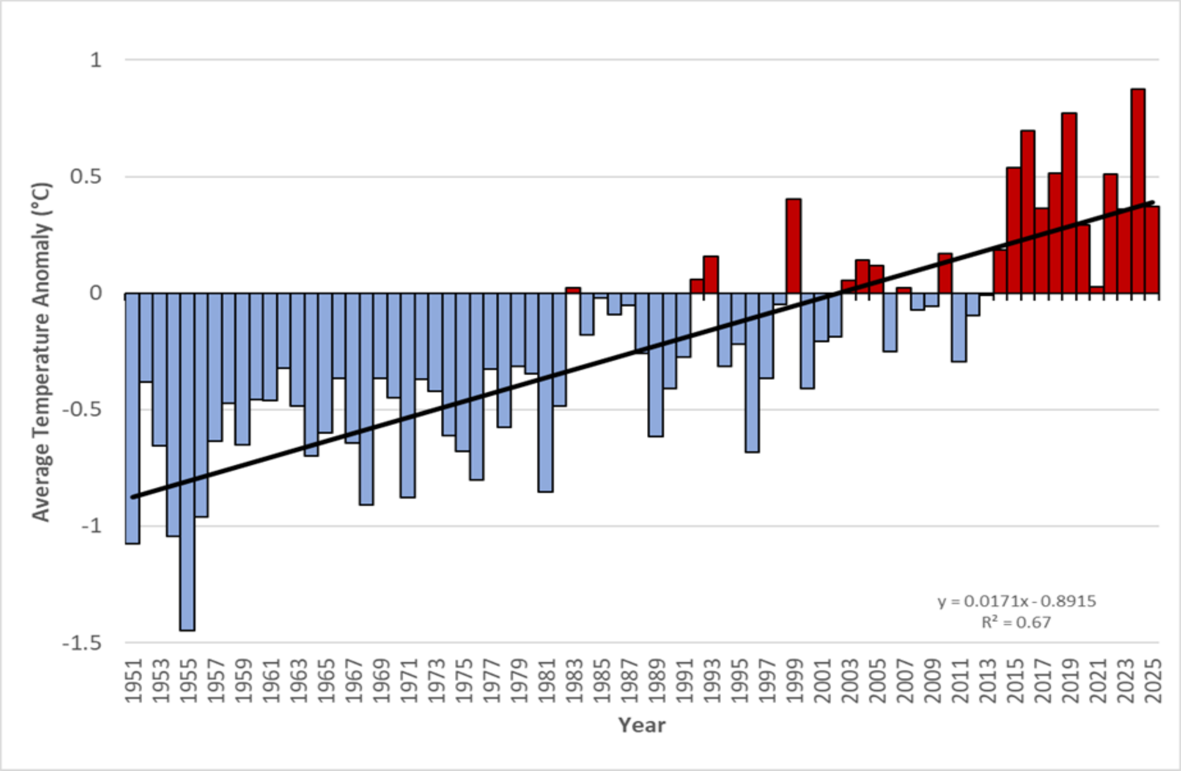
Most significant severe weather events per province



National Climate Overview

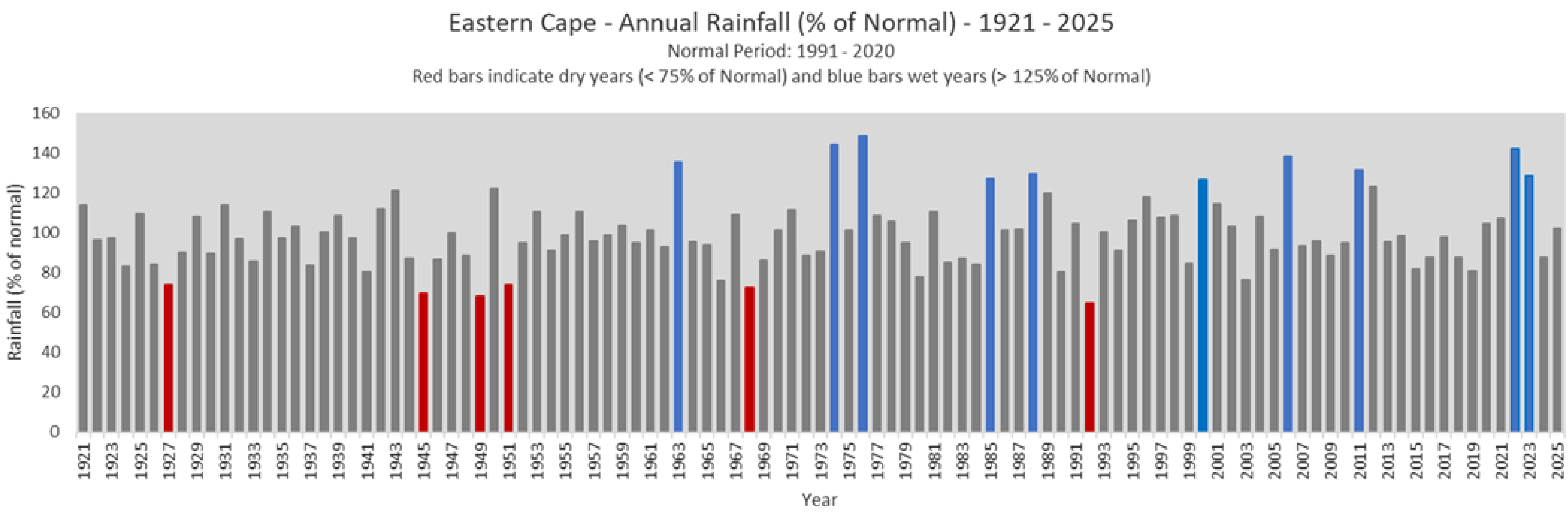
Average Surface Temperature

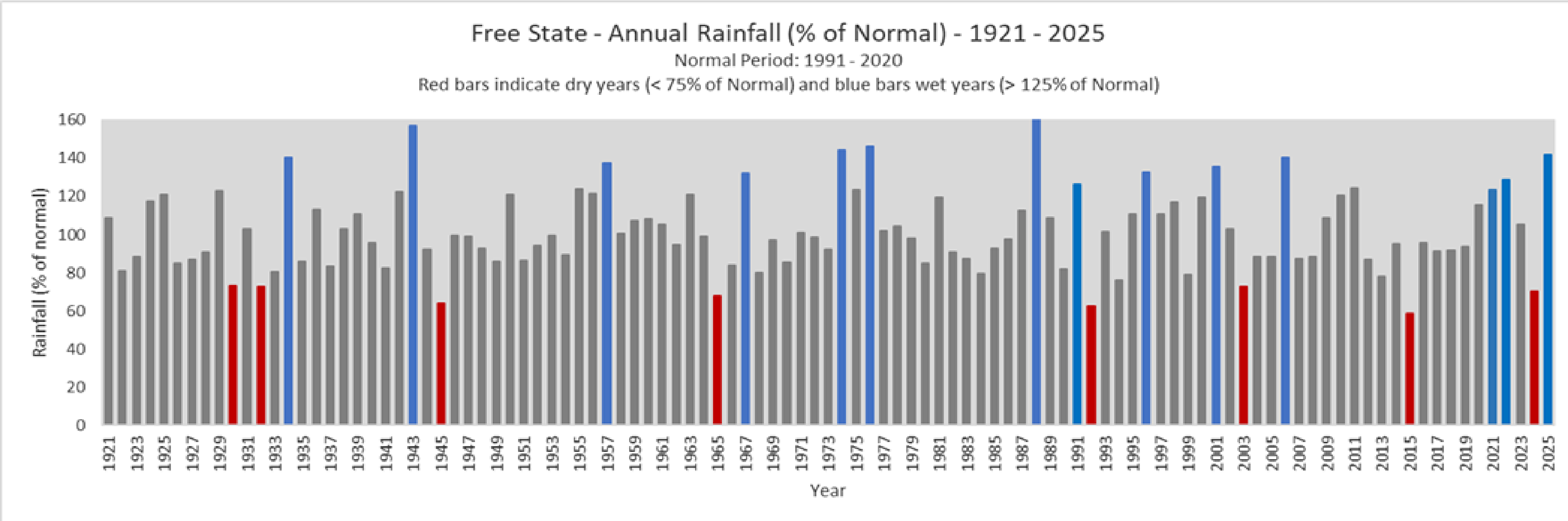
South Africa experienced a warm year, among the top 10 warmest years since 1951 based on the data of 26 climate stations. T was on average about 0.4 ºC above the average of the reference period (1991-2020). A warming trend of approximately 0.17 ºC per decade is indicated for the country, over the period 1951-2025, statistically significant at the 5% level.

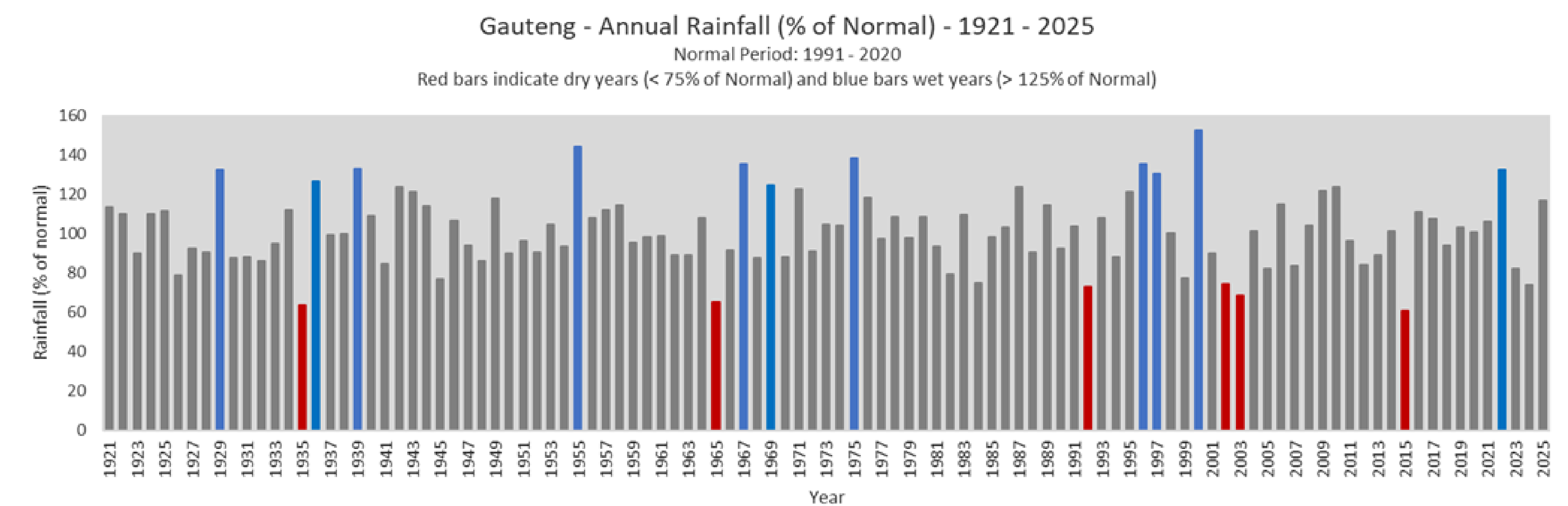


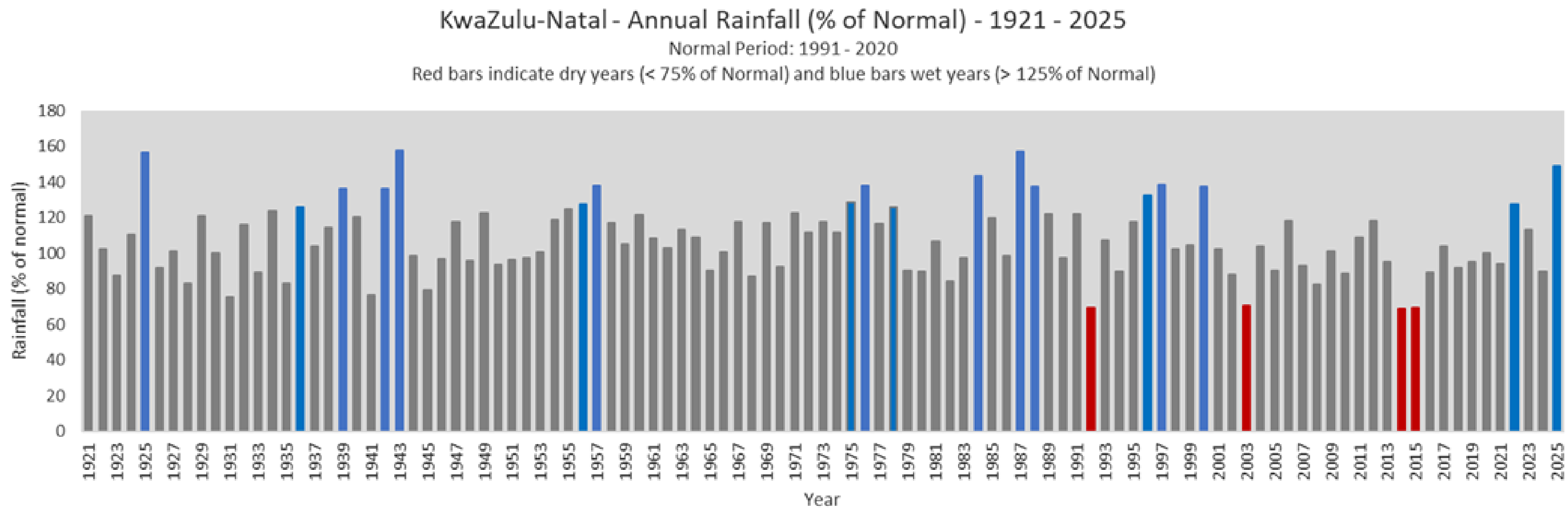
Provincial Rainfall

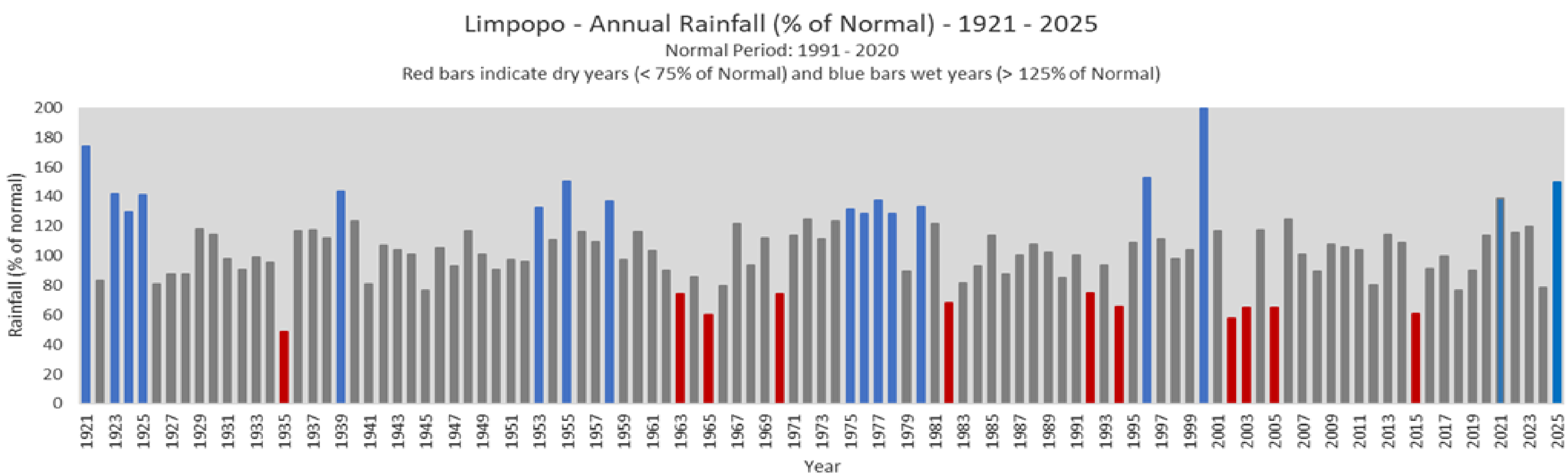
The provincial rainfall statistics are based on the average rainfall of the SAWS-developed homogeneous rainfall districts, that mostly falls within a particular province. This approach ensures a more even weighting of rainfall stations in the spatial rainfall estimations. South Africa received above-normal rainfall across most provinces, except for Gauteng and the Northern, Western, and Eastern Cape, where near-normal rainfall was recorded.

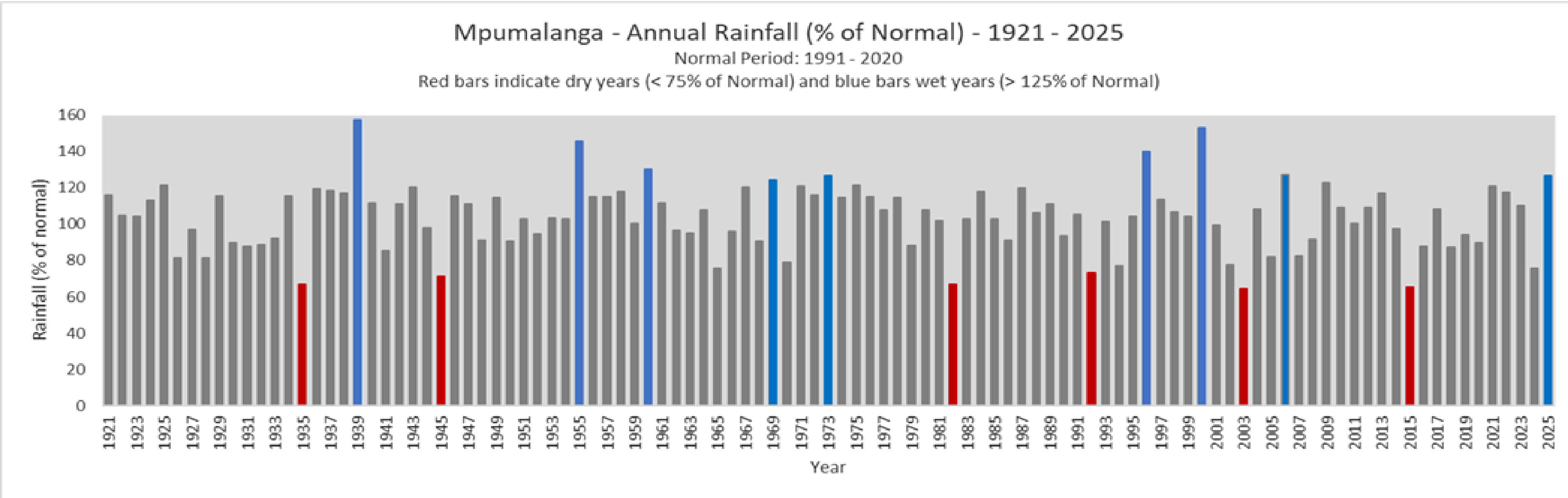


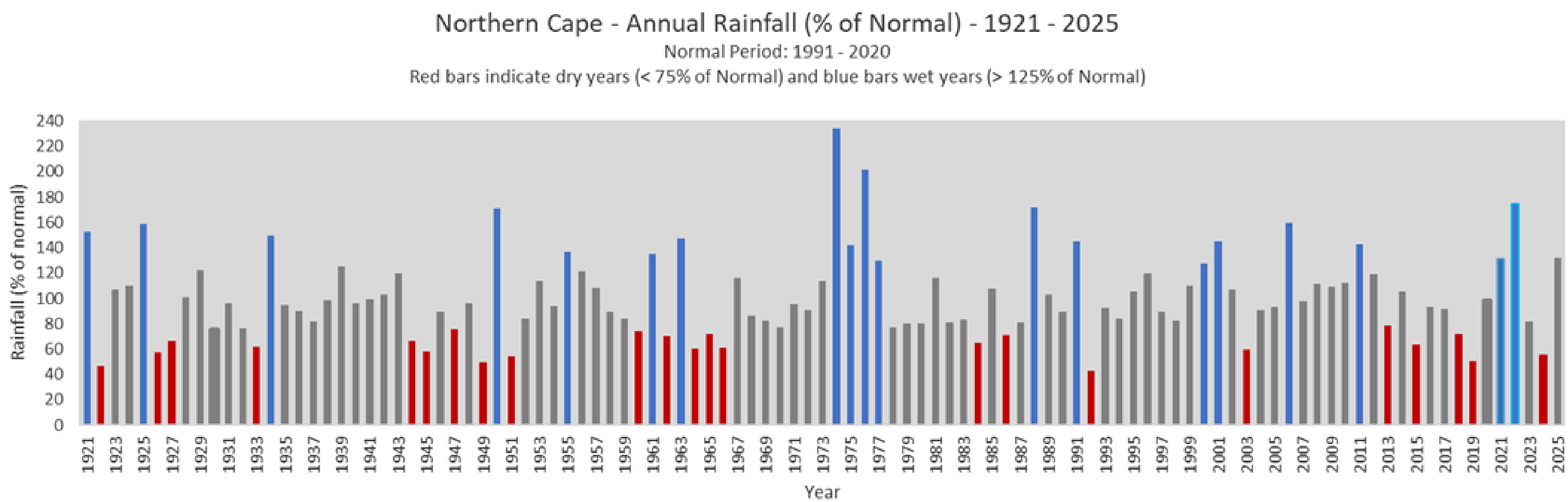

Free State - Annual Rainfall (% of Normal) - 1921 - 2025
Normal Period: 1991 - 2020
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)
Rainfall (% of normal)
Year


Gauteng - Annual Rainfall (% of Normal) - 1921 - 2025
Normal Period: 1991 - 2020
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)
Rainfall (% of normal)
Year

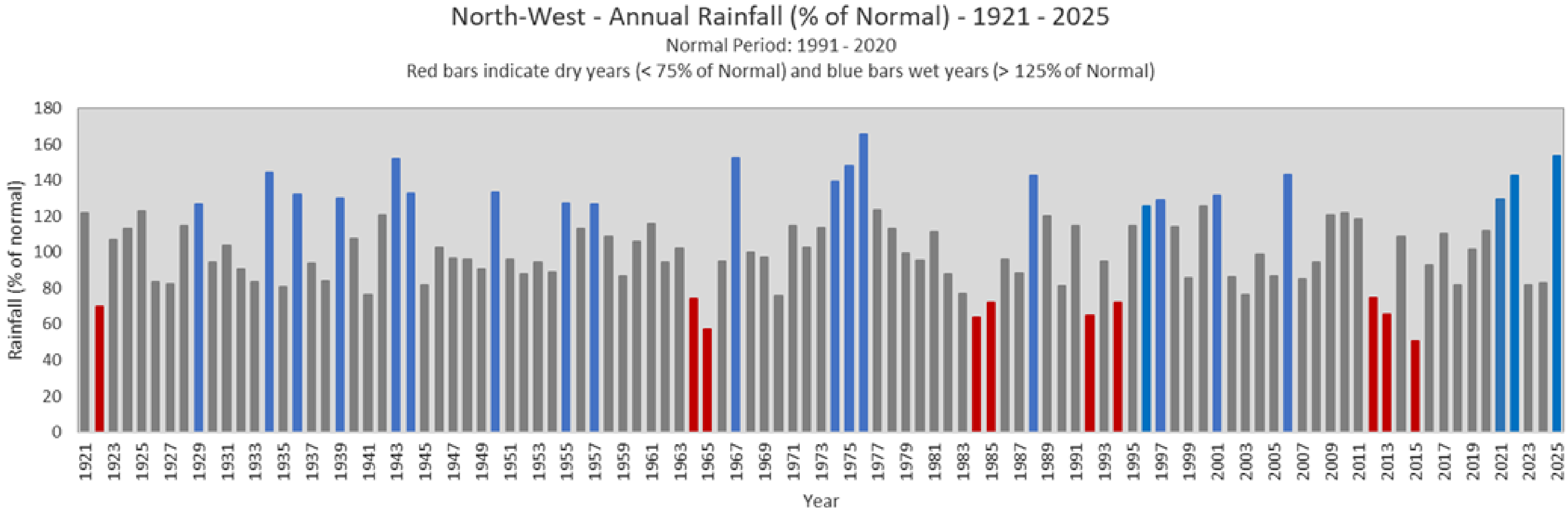

KwaZulu-Natal - Annual Rainfall (% of Normal) - 1921 - 2025
Normal Period: 1991 - 2020
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)
Rainfall (% of normal)
Year

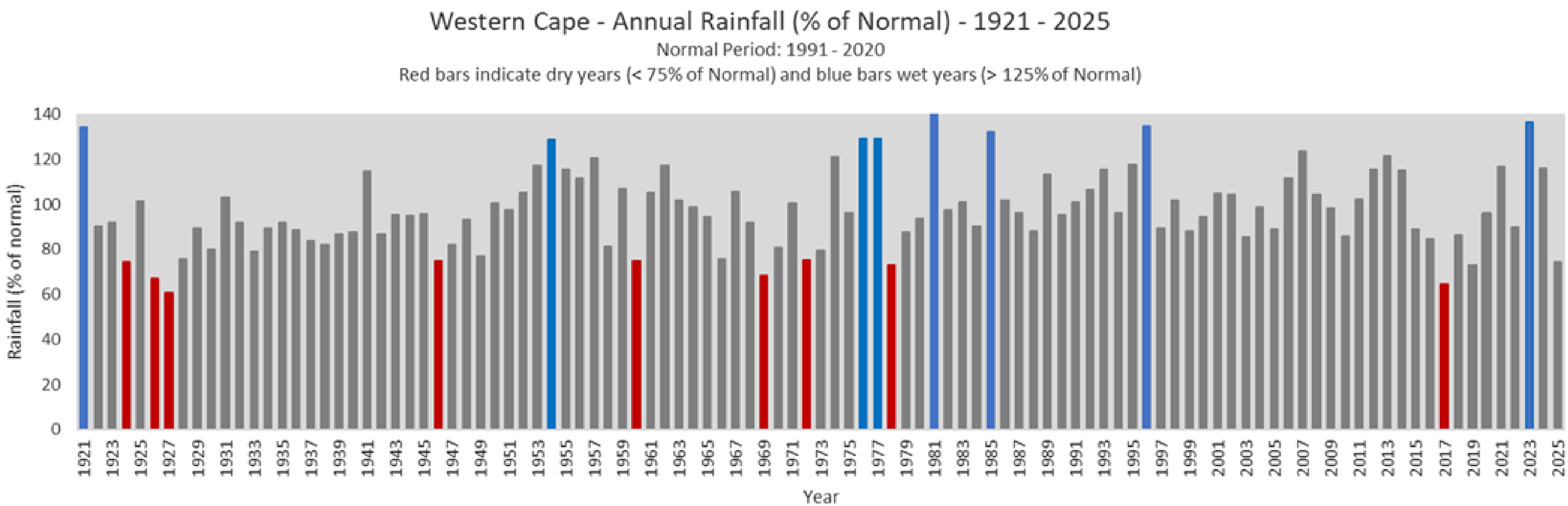

Limpopo - Annual Rainfall (% of Normal) - 1921 - 2025
Normal Period: 1991 - 2020
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)
Rainfall (% of normal)
Year


Mpumalanga - Annual Rainfall (% of Normal) - 1921 - 2025
Normal Period: 1991 - 2020
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)
Rainfall (% of normal)
Year


Northern Cape - Annual Rainfall (% of Normal) - 1921 - 2025
Normal Period: 1991 - 2020
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)
Rainfall (% of normal)
Year

South African Weather Service



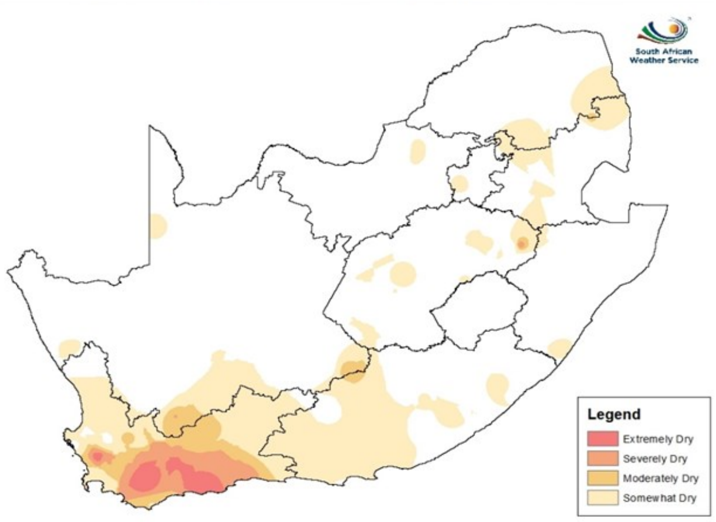


Indications of drought

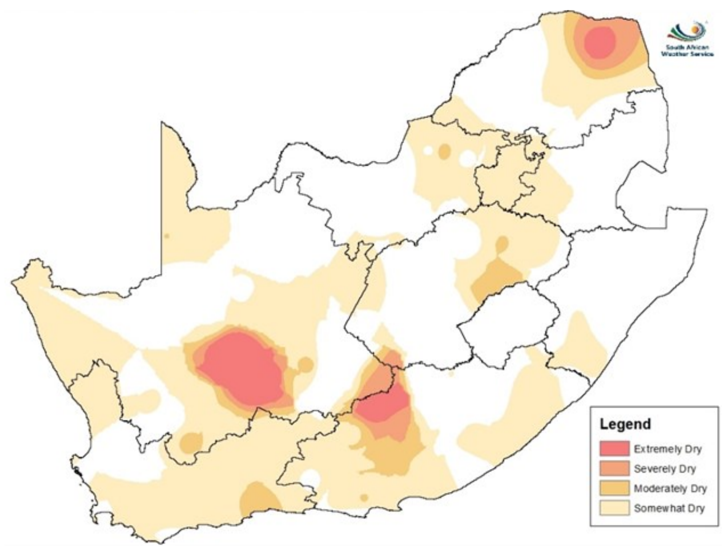
A meteorological drought is defined on the basis of the degree of dryness in comparison to "normal" or average amounts of rainfall for a particular area or place and the duration of the dry period.

The Standardized Precipitation Index (SPI) is an index based on the probability of rainfall for any time scale and can assist in assessing the severity of drought. Long-term drought usually occur when moisture supply is abnormally below average for periods of up to two years, where-after widespread desiccation occurs. A 12-month and 24-month SPI is a comparison of the precipitation for 12 and 24 consecutive months with the same 12 and 24 consecutive months during all the previous years of available data respectively. SPIs of these longer timescales are useful in identifying areas of long-term drought, as they are linked to streamflow, reservoir levels and even groundwater levels. The most noteworthy conditions in the 24-month SPI map below are the severely dry to extremely dry over the southern parts of the Northern Cape and the northwestern parts of the Eastern Cape. However, in 2025, moderate to extremely dry conditions are most noticeable across most parts of the Western Cape.

12-month SPI for January 2025 to December 2025



24-month SPI for January 2024 to December 2025



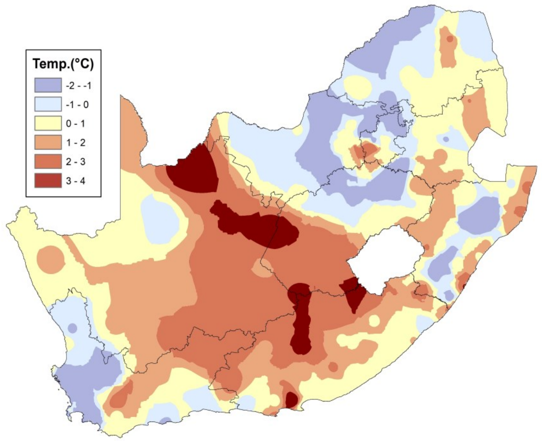
Monthly maps

Following are monthly maps for

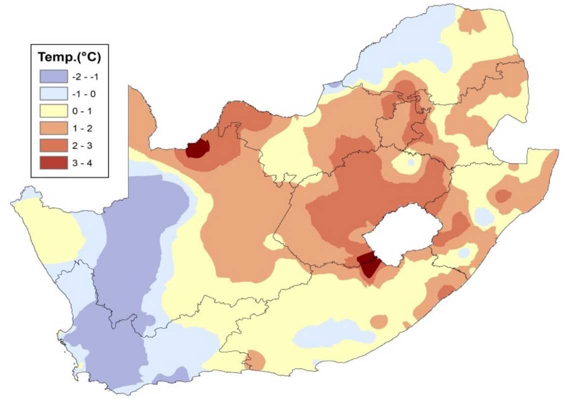
- Maximum temperature deviations from the 1991-2020 normal
- Minimum temperature deviations from the 1991-2020 normal
- Standardized Precipitation Index (SPI), indicating dry areas

January 2025

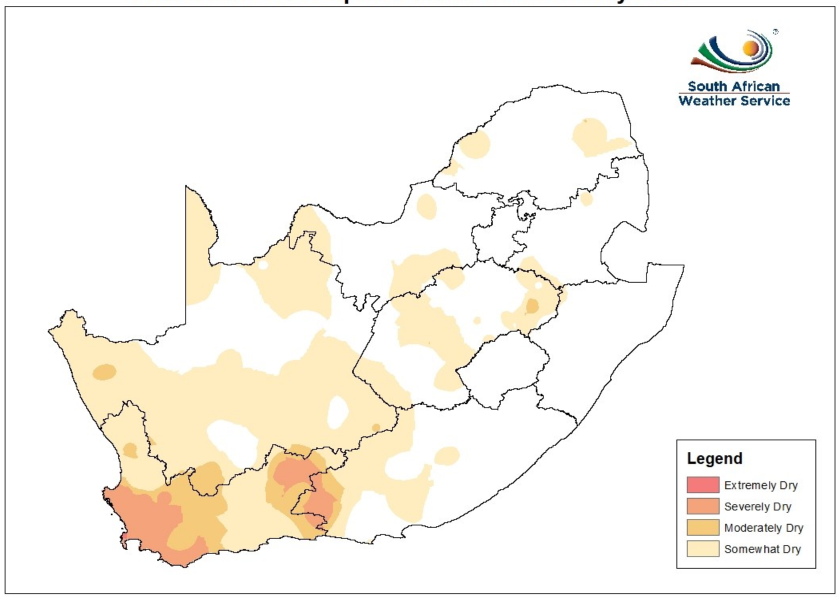
Maximum temperature deviations



Minimum temperature deviations

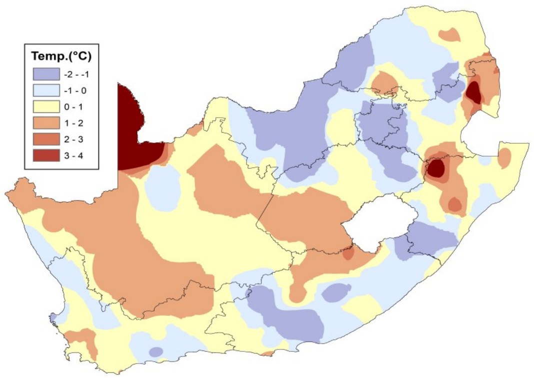


Standardised Precipitation Index for January 2025

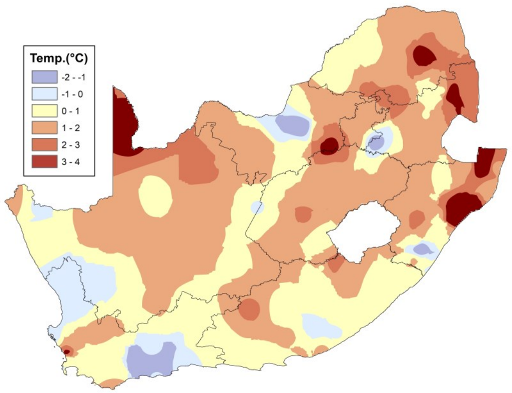


February 2025

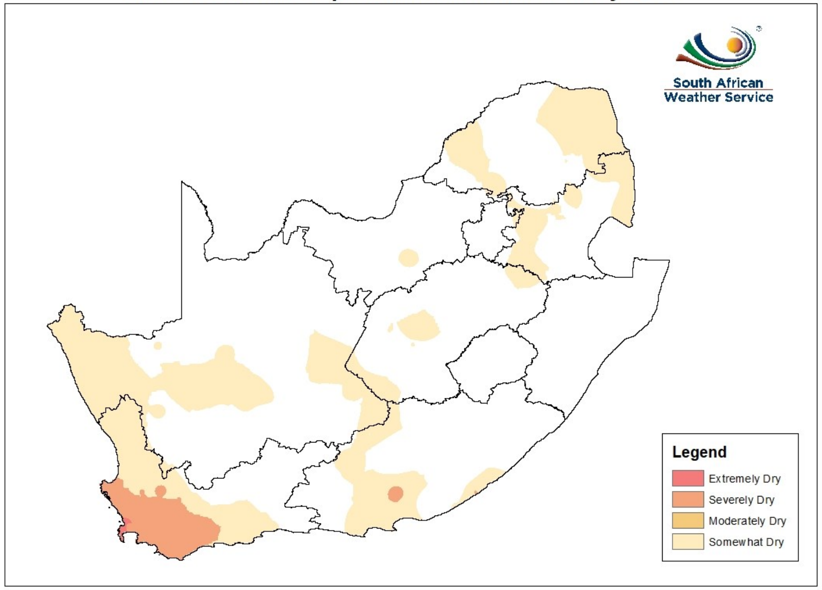
Maximum temperature deviations



Minimum temperature deviations

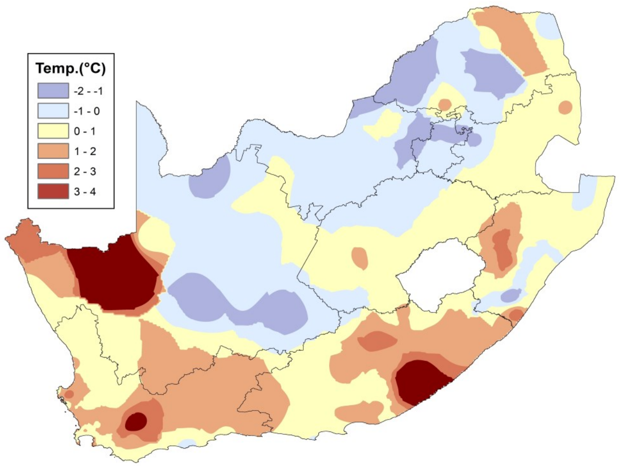


Standardised Precipitation Index for February 2025

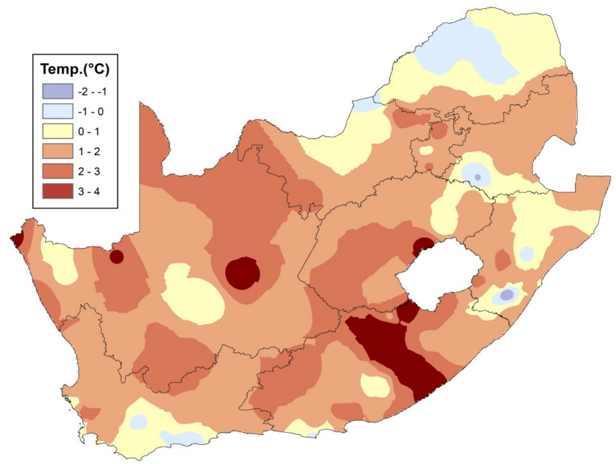


March 2025

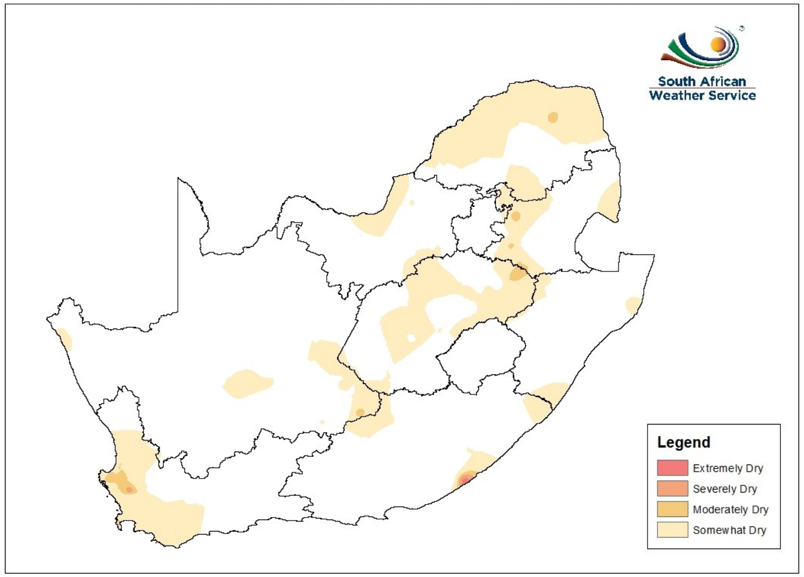
Maximum temperature deviations



Minimum temperature deviations

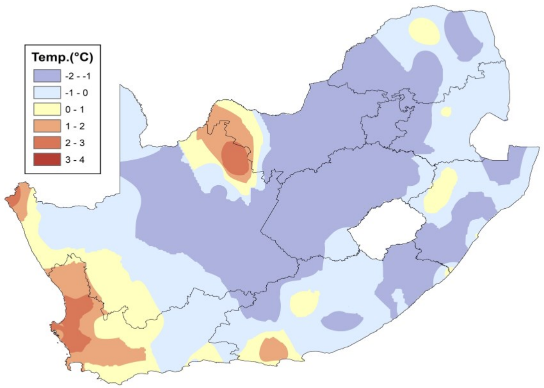


Standardised Precipitation Index for March 2025

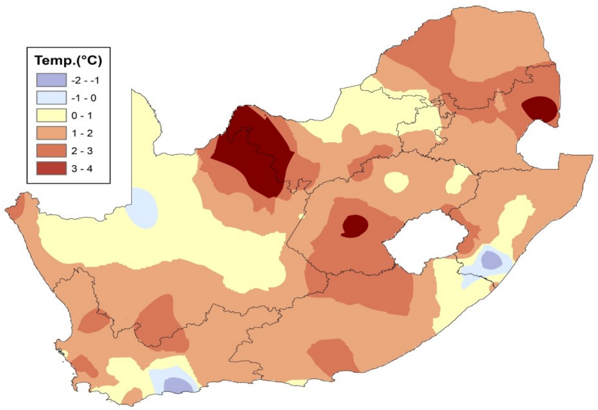


April 2025

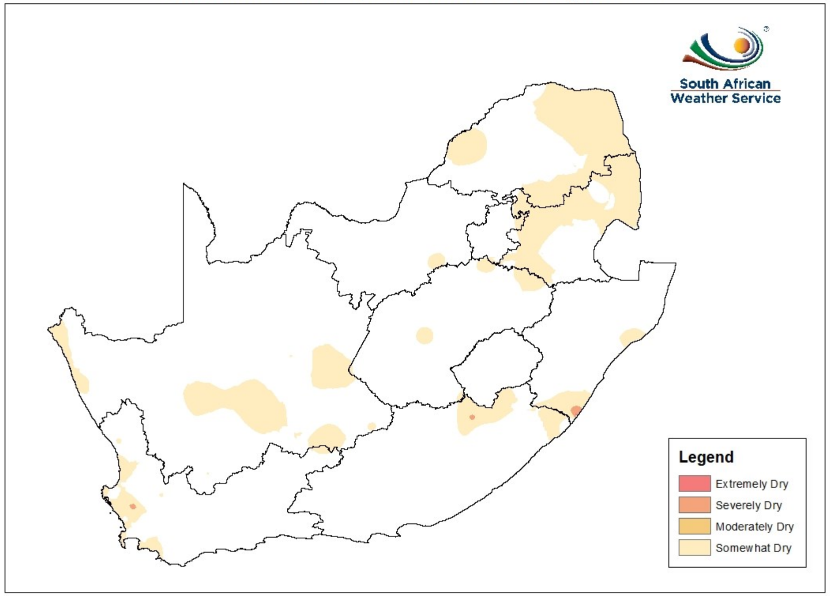
Maximum temperature deviations



Minimum temperature deviations

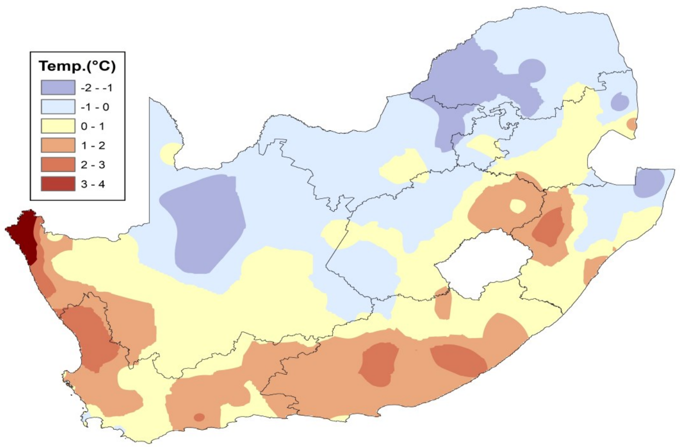


Standardised Precipitation Index for April 2025

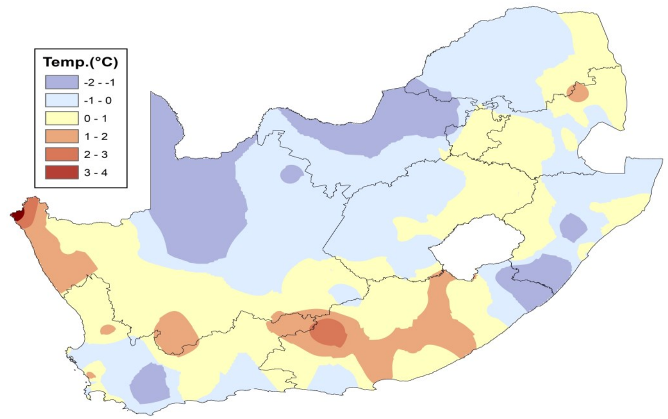


May 2025

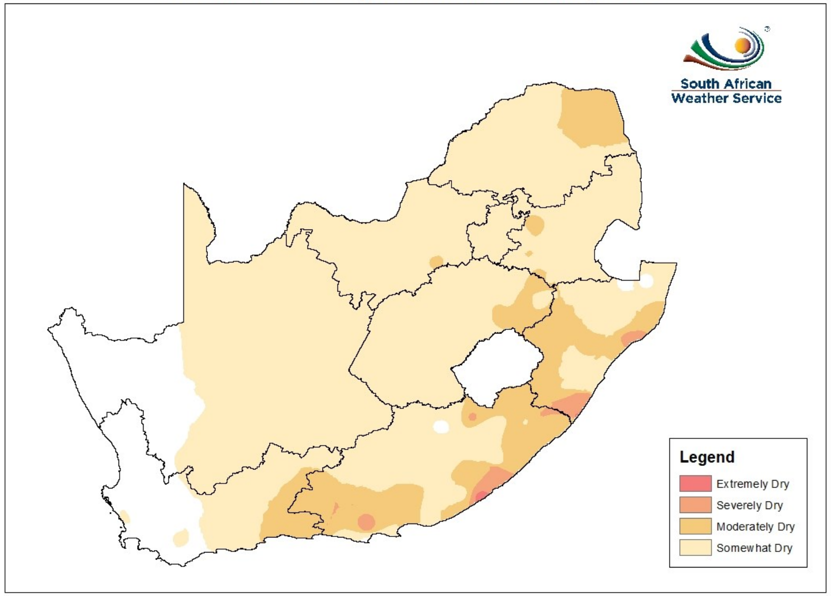
Maximum temperature deviations



Minimum temperature deviations

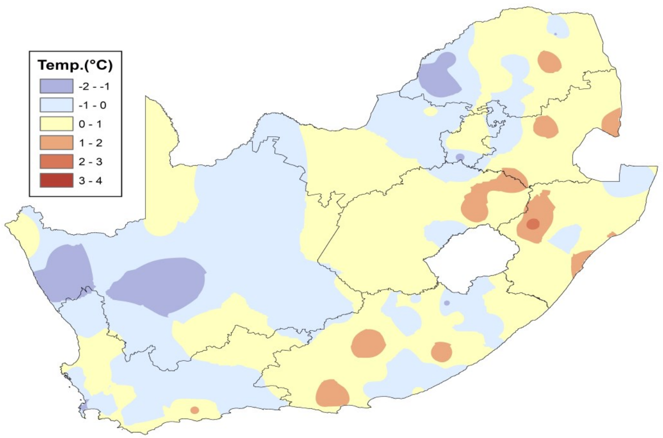


Standardised Precipitation Index for May 2025

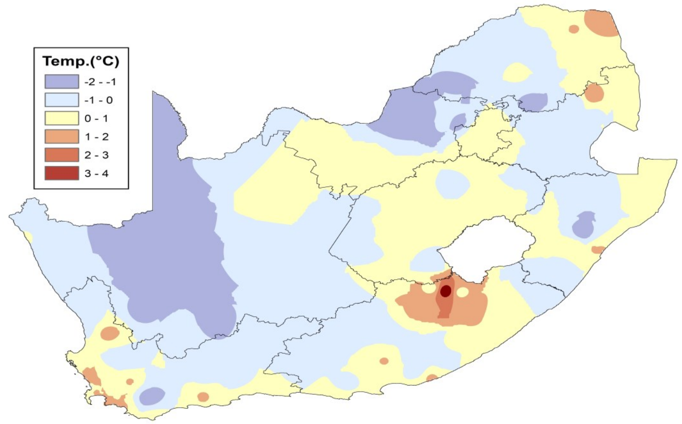


June 2025

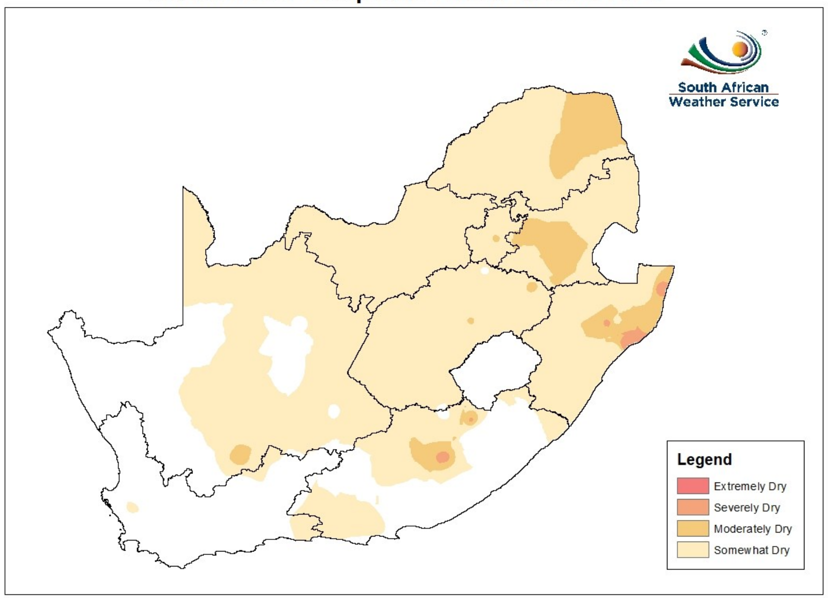
Maximum temperature deviations



Minimum temperature deviations

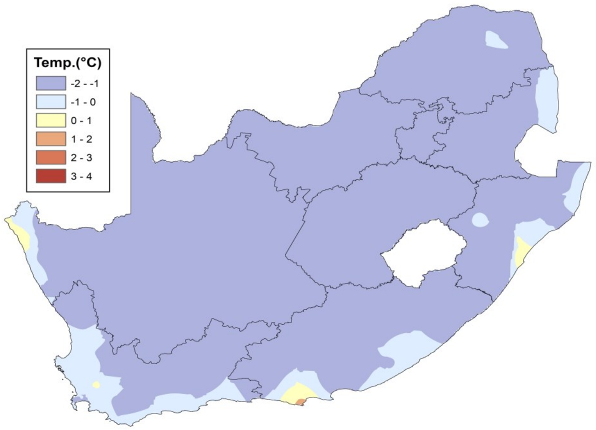


Standardised Precipitation Index for June 2025

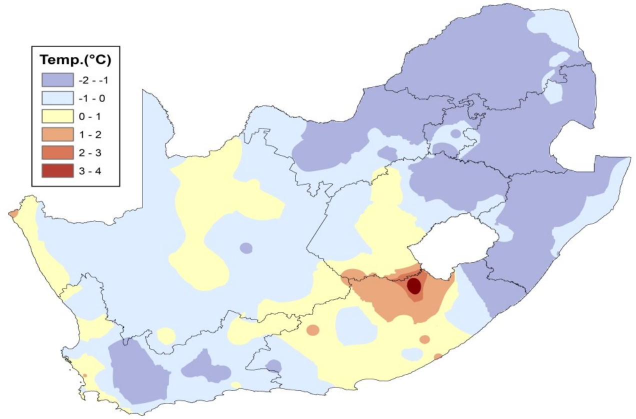


July 2025

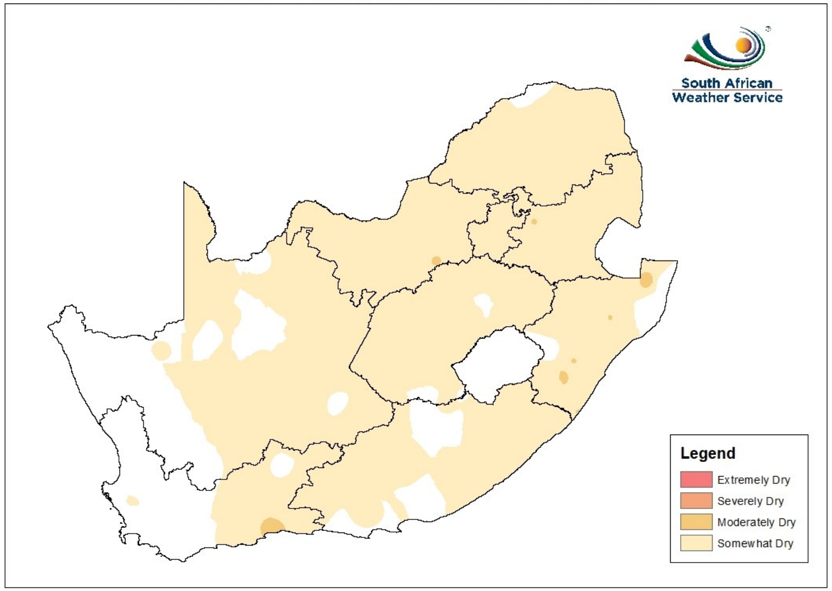
Maximum temperature deviations



Minimum temperature deviations

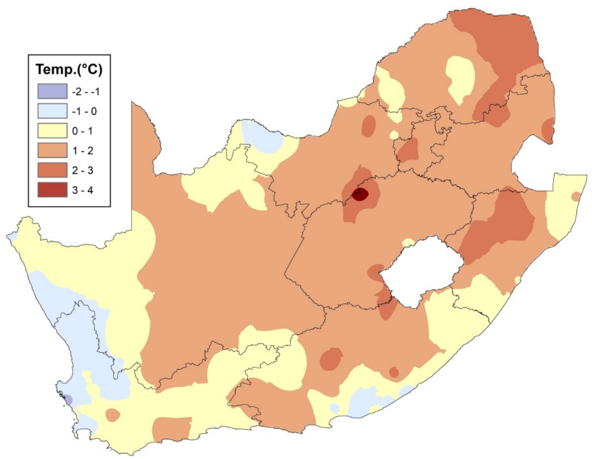


Standardised Precipitation Index for July 2025

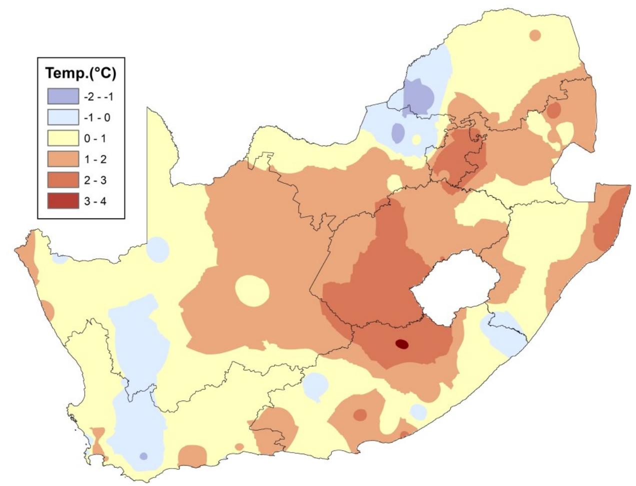


August 2025

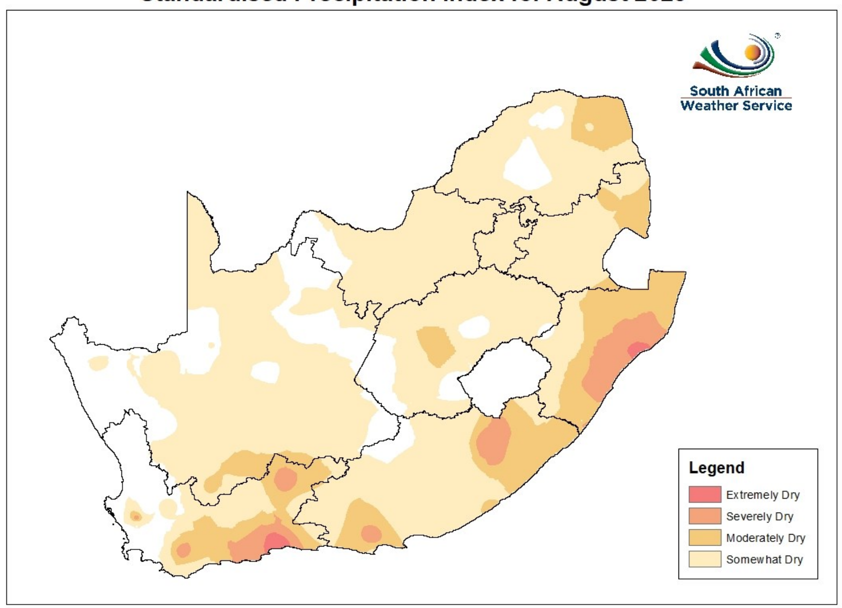
Maximum temperature deviations



Minimum temperature deviations

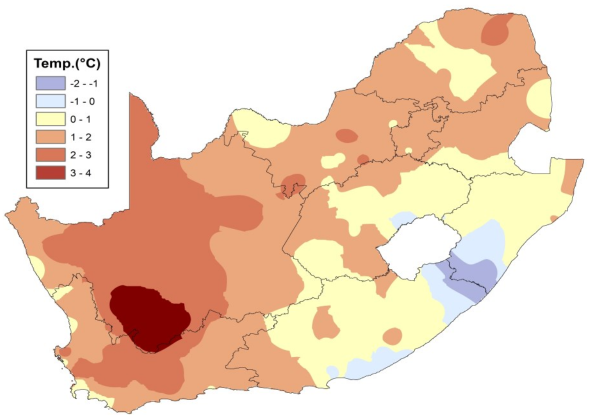


Standardised Precipitation Index for August 2025

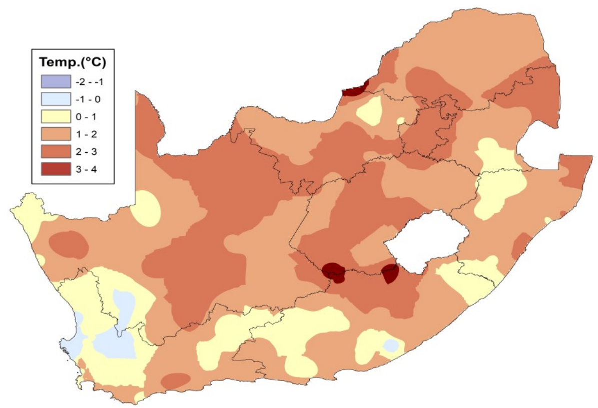


September 2025

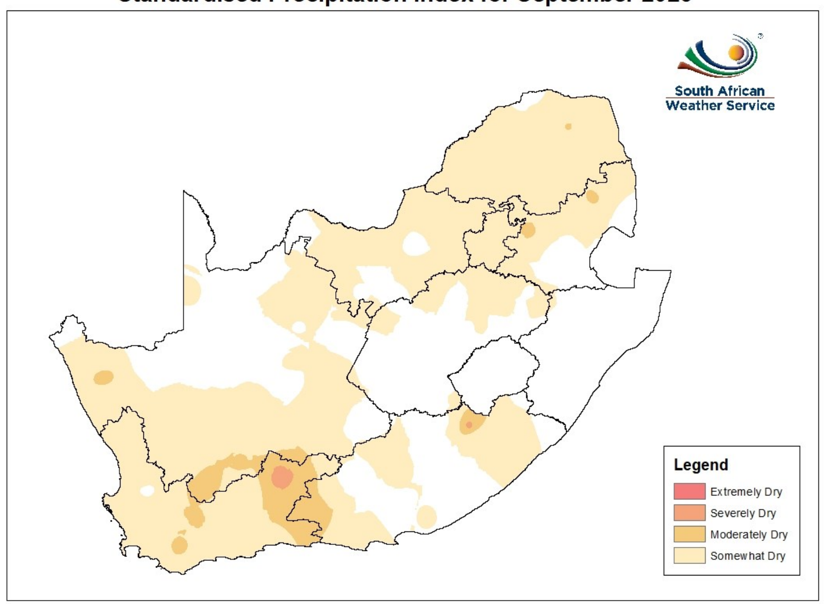
Maximum temperature deviations



Minimum temperature deviations

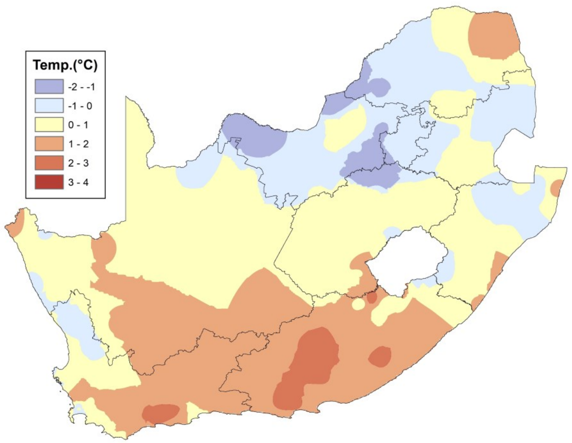


Standardised Precipitation Index for September 2025



October 2025

Maximum temperature deviations



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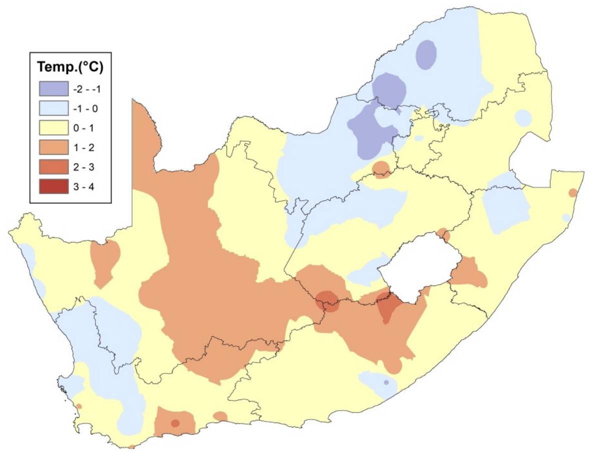
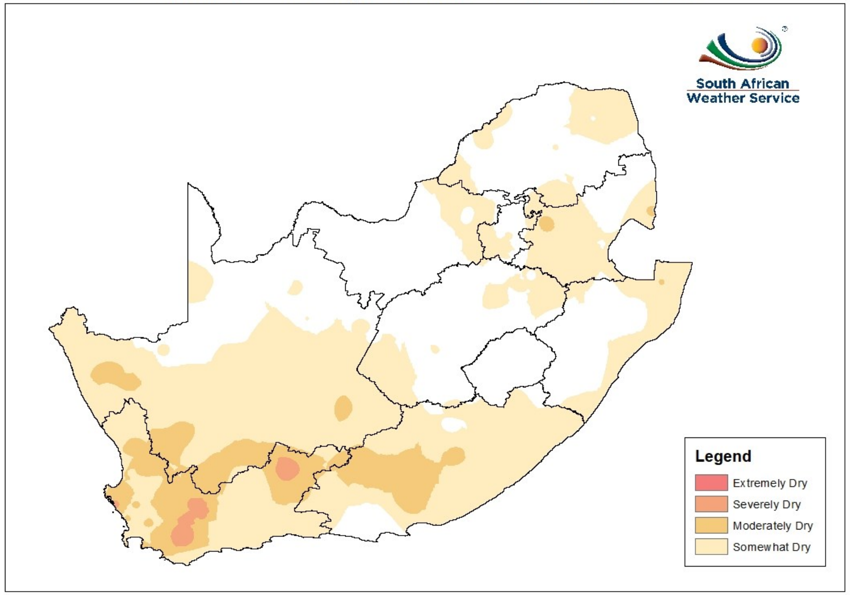
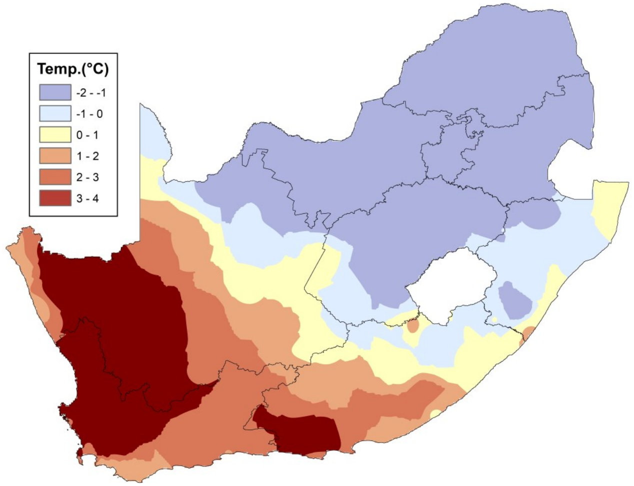


Standardised Precipitation Index for October 2025

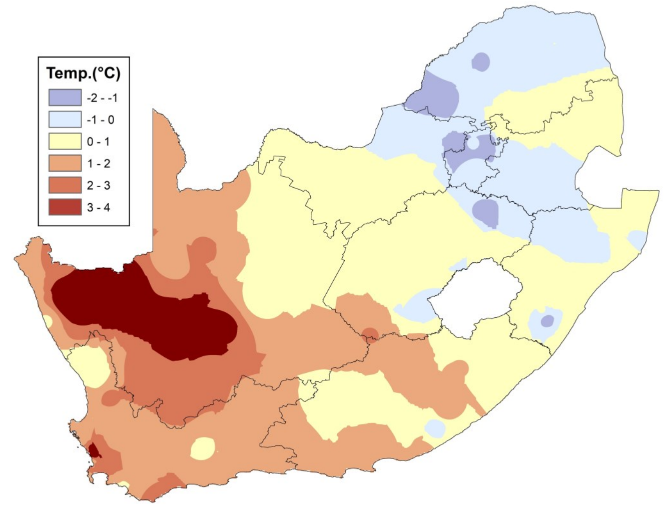


November 2025

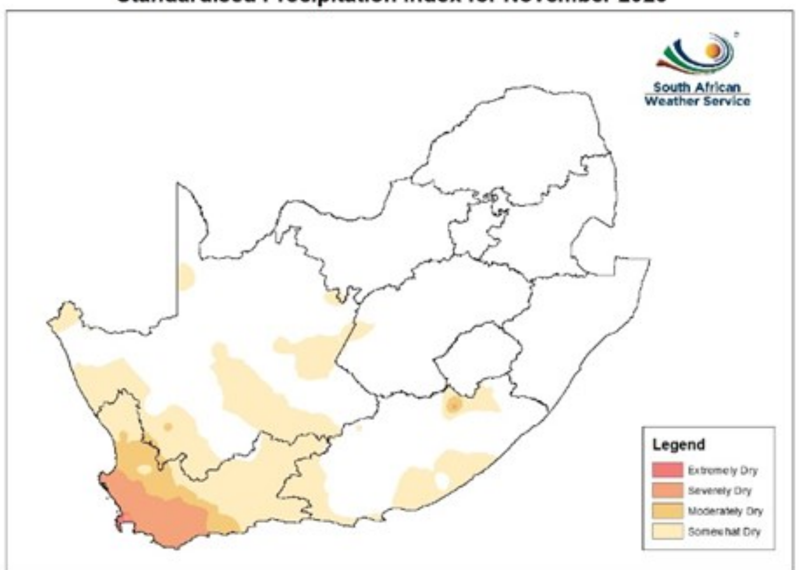
Maximum temperature deviations



Minimum temperature deviations

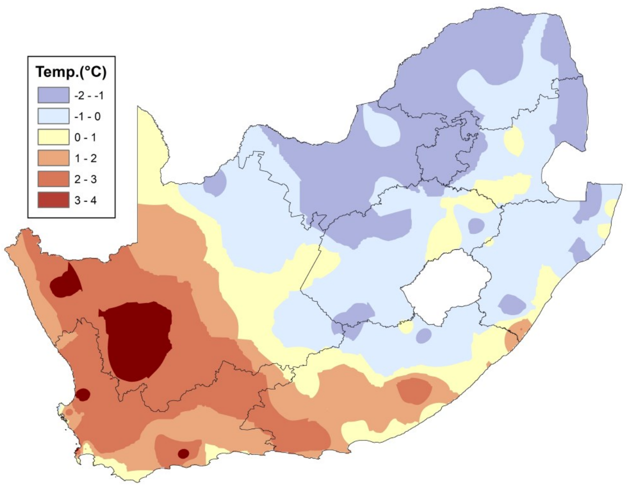


Standardised Precipitation Index for November 2025

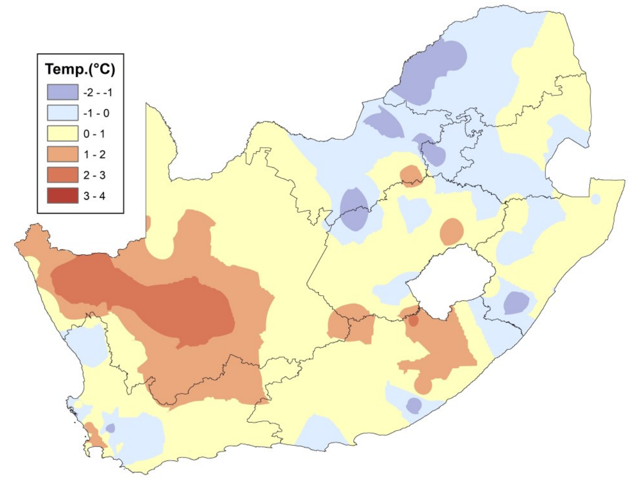


December 2025

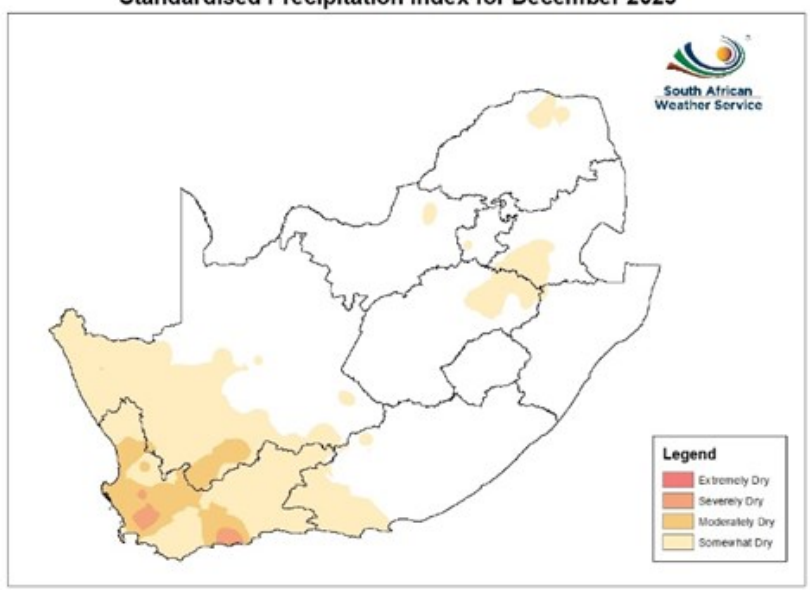
Maximum temperature deviations



Minimum temperature deviations



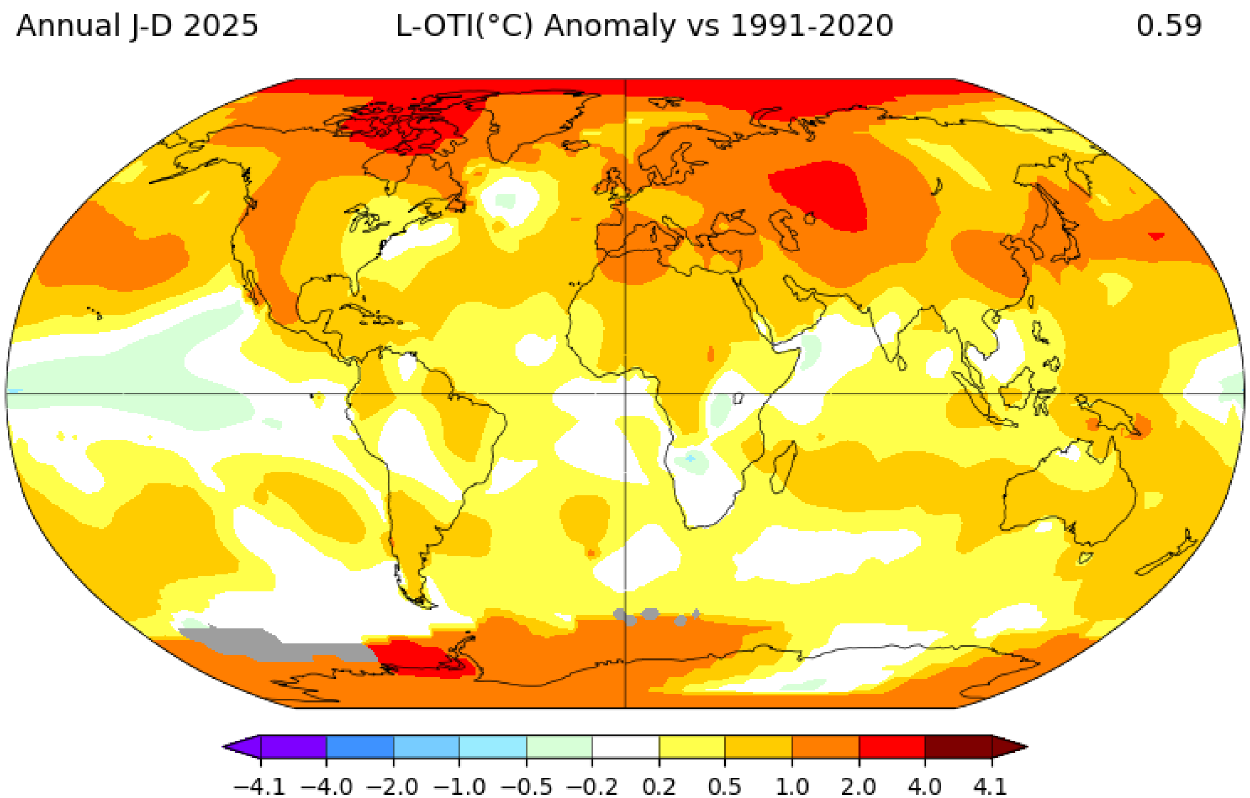
Standardised Precipitation Index for December 2025



Sea-Surface Temperature Anomalies

Sea-surface temperature anomalies around the coast of South Africa for 2024 shows values slightly above the 1991—2020 normal ((0.2 to 0.5°C). This is somewhat lower than the global anomaly of about 0.6°C.

Source: Data.GISS: GISS Surface Temperature Analysis (GISTEMP v4) (https://data.giss.nasa.gov/gistemp/maps): Accessed 13-04-2025
GISTEMP Team, 2025: GISS Surface Temperature Analysis (GISTEMP), version 4. NASA Goddard Institute for Space Studies. Dataset accessed 20YY-MM-DD at https://data.giss.nasa.gov/gistemp/.
Lenssen, N., G.A. Schmidt, M. Hendrickson, P. Jacobs, M. Menne, and R. Ruedy, 2024: A GISTEMPv4 observational uncertainty ensemble. J. Geophys. Res. Atmos., 129, no. 17, e2023JD040179, doi:10.1029/2023JD040179.



Greenhouse Gases

South Africa, in particular SAWS, maintains a long-term GHG measurement facility at Cape Point.

Cape Point data reflects the global averages, which show that atmospheric concentrations of all the major long-lived greenhouse gases continue to increase, consequently driving climate change processes.

The rate of CO_2 accumulation in the atmosphere has increased unabatedly since atmospheric measurements began. Global average annual mean CO_2 concentration reached 423.9 ppm for the 2024 period, having had a record high accumulation rate of 3.5 ppm/yr in 2024.

Similarly, during the past 2 years, the quantities of both atmospheric methane and nitrous oxide have increased at unsurpassed levels.

Carbon dioxide (CO_2)

The Cape Point Global Atmosphere Watch (GAW) station in South Africa, located on the Cape Peninsula, plays a critical role in monitoring atmospheric carbon dioxide (CO_2) and other relevant greenhouse gas levels in the Southern Hemisphere. As one of the few major monitoring sites in the Southern Hemisphere, and the most comprehensive in all of Africa, the station provides valuable data on CO_2 concentrations, helping to track trends over time and contributing to refining global climate models predictions.

Current data from Cape Point shows a steady increase in CO_2 concentrations, which is in line with global trends. The station has recorded consistently rising CO_2 levels, with average concentrations moving close to the 424 parts per million (ppm) mark in recent years. This is significant as it mirrors the rising CO_2 levels seen at other major stations, such as Mauna Loa in Hawaii as well as Cape Grim in Australia. The data collected at Cape Point not only reflects the global impact of human activities, such as fossil fuel combustion and deforestation, but also natural processes such as biomass burning - both of which contribute to the observed rise in greenhouse gases. These measurements are essential for understanding the pace and impact of climate change, especially in a region like Southern Africa, which is highly vulnerable to climate variability and extreme weather events influenced by increasing atmospheric CO_2.

Cape Point Global Atmosphere Watch Station

The Cape Point Global Atmosphere Watch (GAW) Station, located at the southern tip of Africa, is one of the Southern Hemisphere's key greenhouse gas monitoring stations in the World Meteorological Organization's GAW network. It has been collecting valuable GHG data for 45 years.

Atmospheric concentrations of CO_2 measured at Cape Point remain in a continuous upward cycle with annual trends and growth rates accelerating since measurements started in 1992. This is also consistent with other Southern Hemisphere stations as well as the global trend. The annual average CO_2 at Cape Point reached 423.4 ppm for the 2024 -25 period.

Greenhouse gas concentrations in the Southern Hemisphere are typically lower than the global averages since the bulk of the emissions originate in the Northern Hemisphere. It takes approximately 1 year for Northern Hemisphere air, with higher greenhouse gas concentrations, to mix into the Southern Hemisphere and appear in the Cape Point observations.

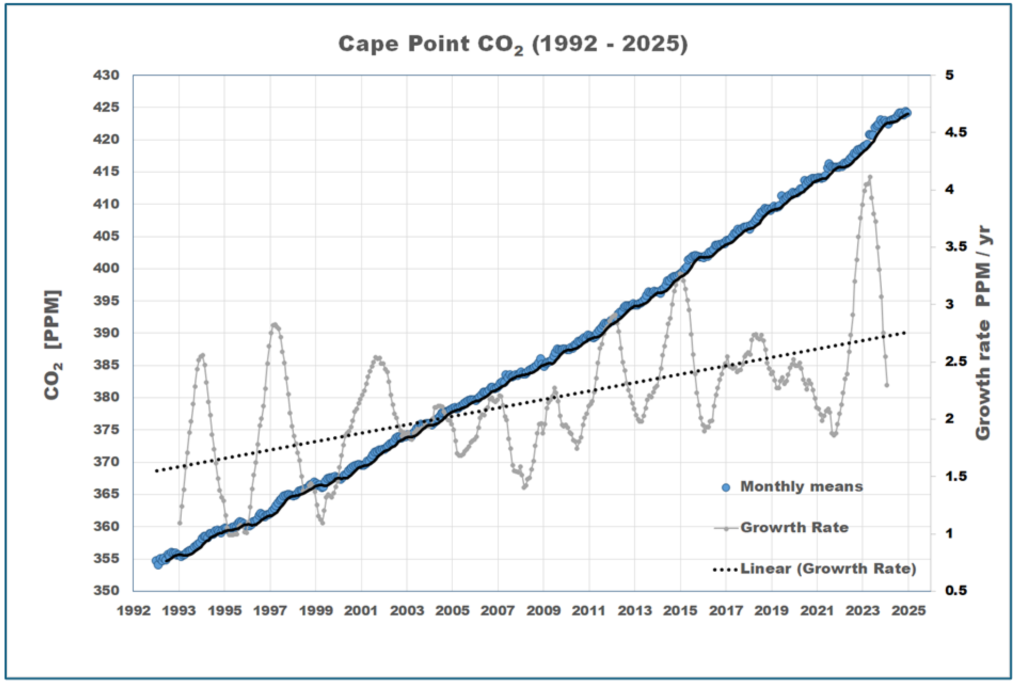


Figure 1: Blue circles represent Cape Point monthly mean CO_2 in clean air, measured from 1993 to end 2023. The monthly means are computed from hourly data and represent thousands of individual measurements. To obtain clean air measurements, the data was selected to include only periods when airmasses have travelled long distances across the Southern Ocean and is consequently free from any local sources of pollution. The grey line is the calculated annual growth rate at Cape Point, and linear trend (black dashed line).

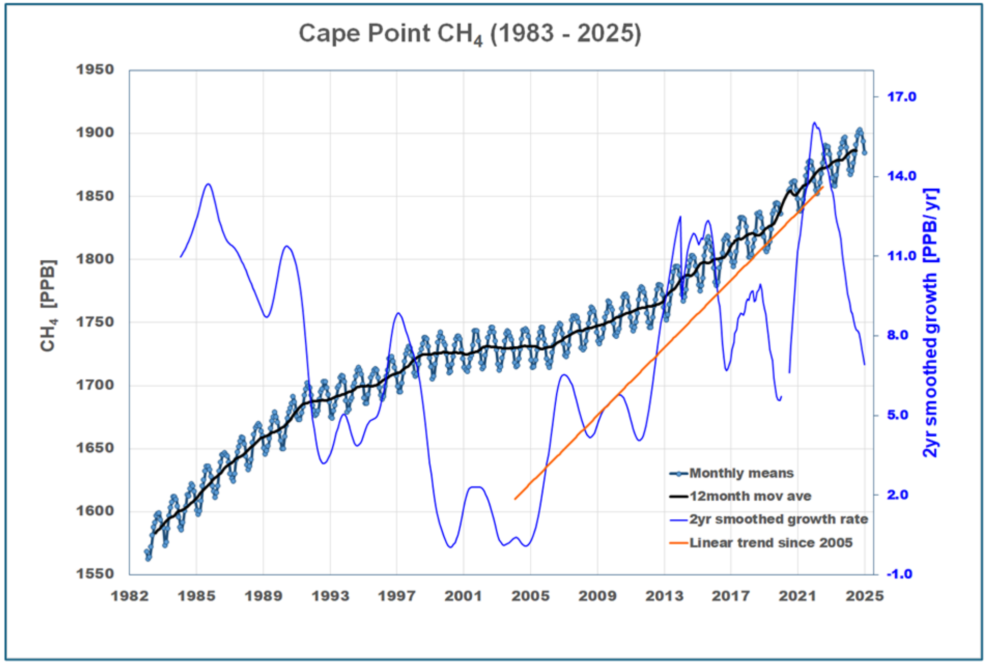
The global annual mean CO_2 concentration in 2024 was 423.9 ppm — signifying a 152% increase from the concentration of 277 ppm recorded in pre-industrial times. The rising CO_2 levels recorded at Cape Point align with the broader trends in the Southern Hemisphere, and they serve as a stark reminder of the cumulative global impact of greenhouse gas emissions. Although South Africa has committed to reducing its emissions and expanding renewable energy sources, the challenges remain considerable, given the country's current energy infrastructure and economic constraints. Cape Point's continuous CO_2 measurements are thus critical not only for tracking atmospheric changes but also for informing South African policy on emissions and climate adaptation.

Methane (CH_4)

The most significant of the non-CO_2 greenhouse gases are methane and nitrous oxide. In 2023, the global annual mean concentration of methane was 1,942 parts per billion (ppb), whilst Cape Point recorded 1886 ppb, somewhat lower than the global mean. This amounts to a 266% rise above the 1750 benchmark level of 729 ppb. Methane (CH_4) is the second most important greenhouse gas in terms of radiative forcing and is emitted from a wide range of sources, both natural and anthropogenic. South Africa's methane levels, monitored at sites like the Cape Point Global Atmospheric Watch (GAW) station, have been influenced by trends seen globally and across the Southern Hemisphere. Methane concentrations have shown a concerning increase, consistent with the global upward trend of greenhouse gas emissions. The Southern Hemisphere, generally having lower methane emissions than the Northern Hemisphere, is now experiencing accelerated growth in methane levels, in part due to regional emissions from agriculture, waste, and energy extraction activities, especially in fossil fuel production areas like Africa and Australia.

Globally, methane emissions are estimated to have reached around 120 million tons in 2023, much of which comes from energy production, agriculture, and waste. This has been exacerbated by large methane emission events detected by satellites, which rose by over 50% from 2022 to 2023. Microbial decomposition of organic matter in wetlands is the largest single source of methane emissions known to us.

South Africa’s methane levels and trends reflect the broader Southern Hemisphere challenges, and as such, emissions need to be managed more effectively to prevent further contributions to global warming, which methane can accelerate significantly.
In Africa, methane reduction strategies are still developing, but the continent plays a critical role due to its natural gas reserves and growing industries, which need improved regulation and methane monitoring practices to achieve meaningful reductions.



Blue circles represent Cape Point monthly mean CH4 in clean air, measured since 1983. The blue line represents a 2yr smoothed growth rate, highlighting complicated processes that resulted in much variation from year to year. A linear trend line (red) was fitted through the 2005 – 2023 growth rate, to show the steep increase during the past 2 decades which closely tracks the global observed CH4 trend.

Human activities are responsible for emissions from fossil fuel extraction and use (including natural gas), farming of livestock, rice cultivation and waste from landfills and agriculture. Together, these sources account for about 65% of global methane emissions. Methane has a global warming potential 81 times stronger than CO2 when measured over a 20-year timeframe.

However, since 2020, atmospheric methane concentration has increased rapidly, by more than 10 ppb per year, with rises of 13 and 11 ppb in 2022 and 2023 respectively. These record high growth rates have abated somewhat to single-digit values in the 2024 - 2025 period.

Nitrous oxide (N_2O)

The third-most significant non-CO_2 greenhouse gas is nitrous oxide, occurring in the natural atmosphere in part per billion (ppb) levels. Nitrous oxide (N_2O) has a global warming potential of 273 times that of CO_2 when calculated for a 20-year lifespan.

N_2O is emitted into the atmosphere from both natural sources (oceans, soils, biomass burning) and anthropogenic sources (fertilizer use, and various industrial processes) in an approximately 57% to 43% ratio. The globally averaged N_2O concentration in 2023 reached 338.0 ±0.1 ppb, showing an increase of 1.0 ppb with respect to the previous year. The current 2024 levels have increased by 125% from the pre-industrial level (270.1 ppb). The annual increase from 2023 to 2024 was slightly higher (1.3 ppb) than the increase from 2021 to 2022 (1.1 ppb) and slightly higher than the mean growth rate obtained from the past 10 years (1.1 ppb yr-1).

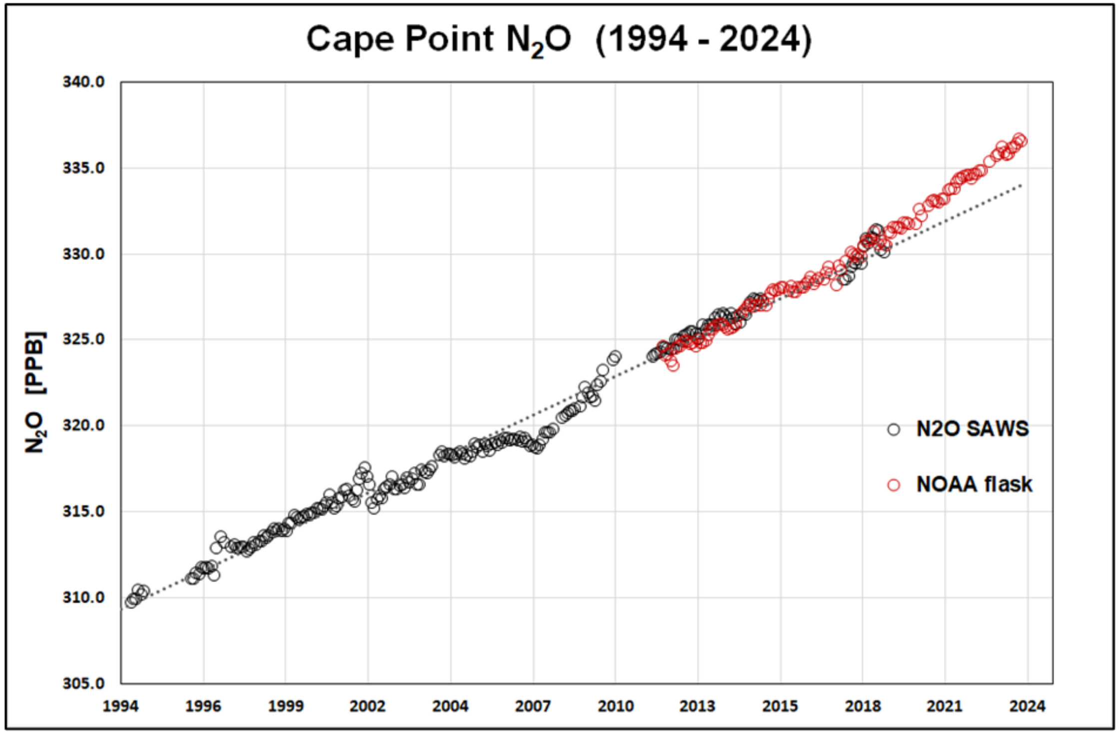


***Figure 3:** Black circles represent Cape Point monthly mean N_2O in clean air, measured since 1994. The data was selected to only include periods when air-masses have travelled long distances across the Southern Ocean and is consequently free from any local sources of pollution. Red circles represent the NOAA co-operative flask sampling network data (since 2012). A linear regression (black dotted line) shows a deviation (accelerated growth) during the past couple of years.*

Extreme Climate Trends: 1996 - 2025

Core Indices

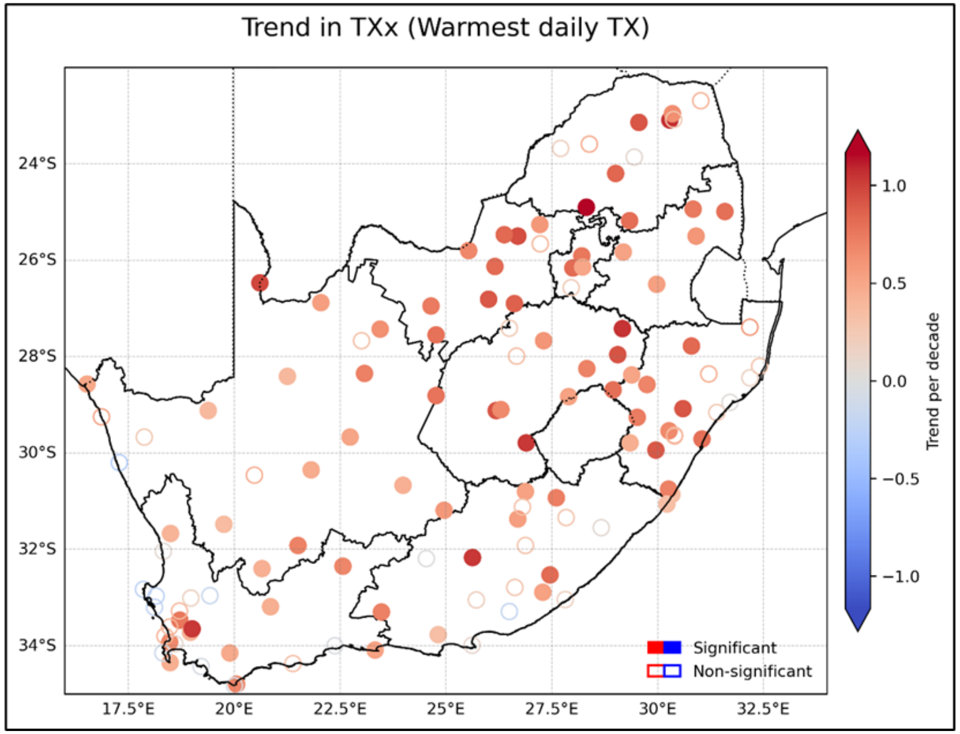
The extreme climate indices are based on a first set of basic indices, defined as the “core” indices and developed to be generally relevant to most climate-sensitive sectors. Since this set of indices are widely applied globally, these indices were used as a departure point in the selection process. There are 25 core indices deemed relevant to the South Africa climate. In addition to the selection of the core indices, not all of these indicate broadly significant trends, although some are nevertheless included due to their relative importance to the assessment of extreme climate trends. The following table presents the list of 11 selected core indices, followed by maps indicating the individual station trends in the same sequence as listed.

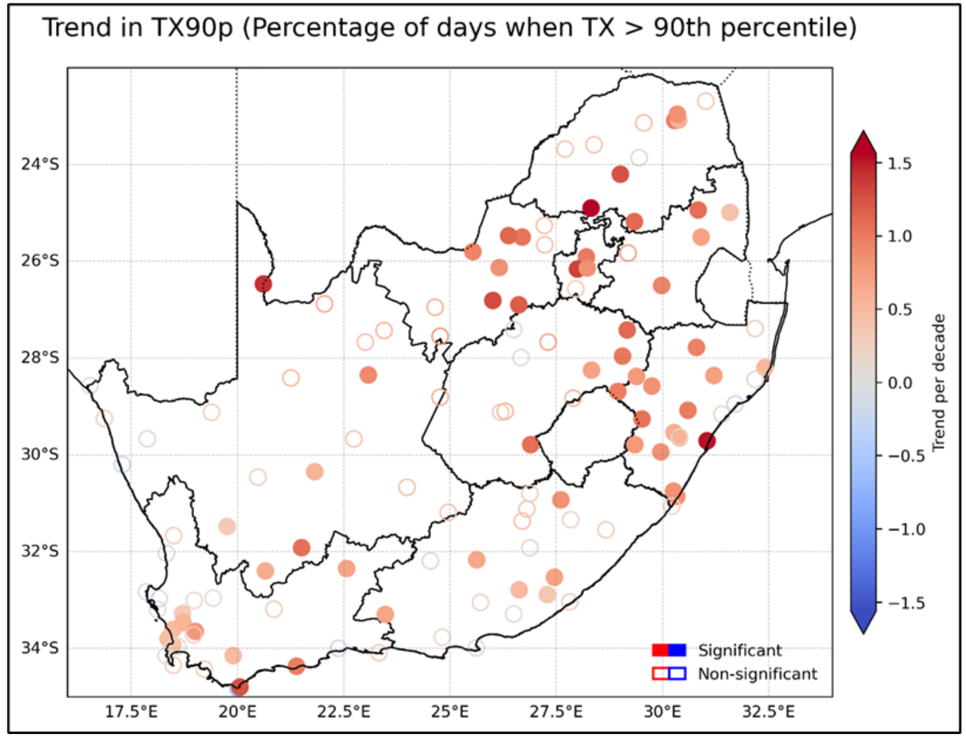
Index	Definition	Variable
Monthly maximum value of daily maximum temperature (TX_x)	Let TX_x be the daily maximum temperatures in month k, period j. The maximum daily maximum temperature each month is then: $TX_{xkj} = max(TX_{xkj})$	TX
Percentage of days when daily maximum temperature is greater than the 90th percentile (TX90p)	Let TX_{ij} be the daily maximum temperature on day i in period j and let $TX_{in}90$ be the calendar day 90th percentile centred on a 5 -day window for the base period 1961-1990. The percentage of time for the base period is determined where: $TX_{ij} > TX_{in}90$.	TX
Monthly maximum value of daily minimum temperature (TN_x)	Let TN_x be the daily minimum temperatures in month k, period j. The maximum daily minimum temperature each month is then: $TN_{xkj} = max(TN_{xkj})$	TN
Number of frost days (FD)	Annual count of days when daily minimum temperature is less than 0°C. Let TN_{ij} be daily minimum temperature on day i in year j. Count the number of days where: $TN_{ij} < 0°C$	TN
Percentage of days when daily minimum temperature is greater than the 90th percentile (TN90p)	Let TN_{ij} be the daily minimum temperature on day i in period j and let $TN_{in}90$ be the calendar day 90th percentile centred on a 5-day window for the base period 1961-1990. The percentage of time for the base period is determined where: $TN_{ij} > TN_{in}90$.	TN

Extreme Climate Trends: 1996 - 2025

Percentage of days when daily minimum temperature is less than the 10th percentile (TN10p)	Let TN_{ij} be the daily minimum temperature on day i in period j and let $TN_{in}10$ be the calendar day 10th percentile centred on a 5-day window for the base period 1961-1990. The percentage of time for the base period is determined where: $TN_{ij} = TN_{in}10$.	TN
Daily temperature range (DTR)	Monthly mean difference between daily maximum and minimum temperature Let TX_{ij} and TN_{ij} be the daily maximum and minimum temperature, respectively, on day i in period j. If I represents the number of days in j, then: $DTR_j = \frac{\sum_{i=1}^{I} (TX_{ij} - TN_{ij})}{I}$	TN and TX
Annual total precipitation in wet days (PRCPTOT)	Annual total precipitation in wet days: Let RR_{ij} be the daily precipitation amount on day i in period j. If I represents the number of days in j , then: $PRCPTOT_j = \sum_{i=1}^{I} RR_{ij}$	RR
Maximum length of dry spell, maximum number of consecutive days with daily precipitation less than 1mm (CDD)	Let RR_{ij} be the daily precipitation amount on day i in period j. Count the largest number of consecutive days where: $RR_{ij} < 1mm$	RR
Monthly maximum 1-day precipitation (Rx1day)	Let RR_{ij} be the daily precipitation amount on day i in period j. The maximum 1-day value for period j are: $Rx1day_j = max(RR_{ij})$	RR
Simple precipitation intensity index (SDII)	Let RR_{wj} be the daily precipitation amount on wet days, w (RR ≥ 1mm) in period j. If W represents number of wet days in j, then: $SDII_j = \frac{\sum_{w=1}^{W} RR_{wj}}{W}$	RR

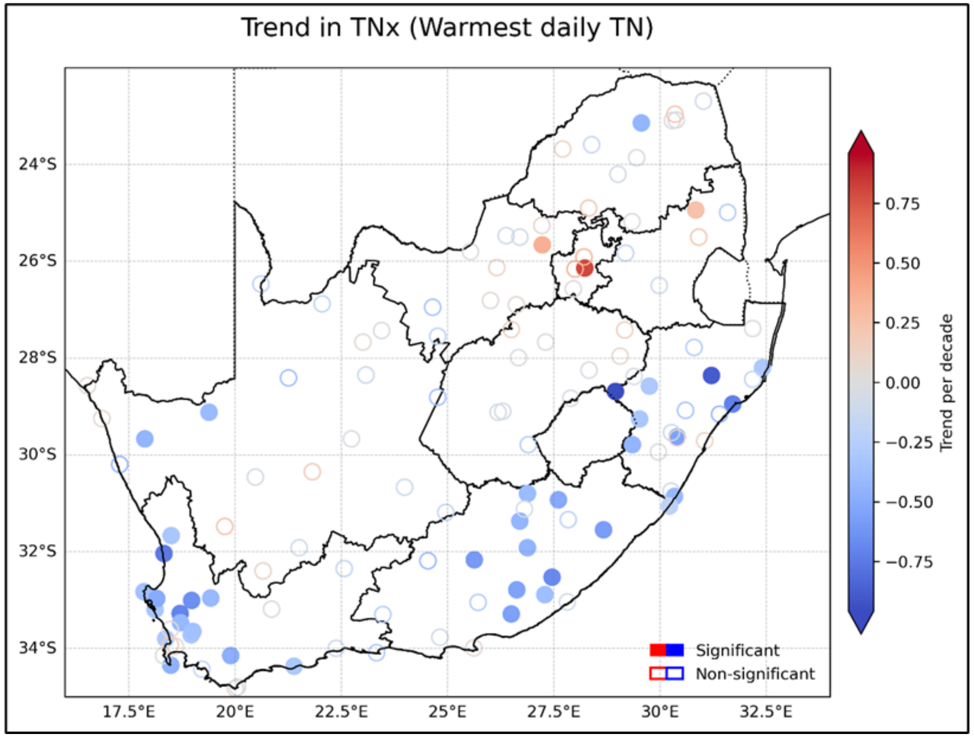
Extreme Climate Trends: 1996 - 2025

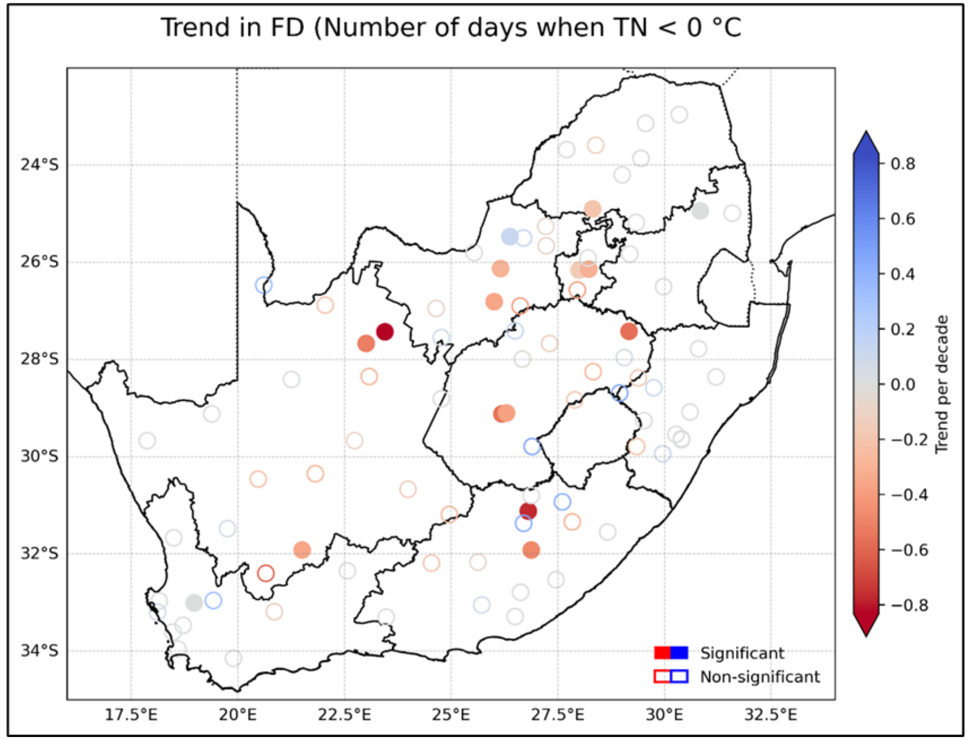




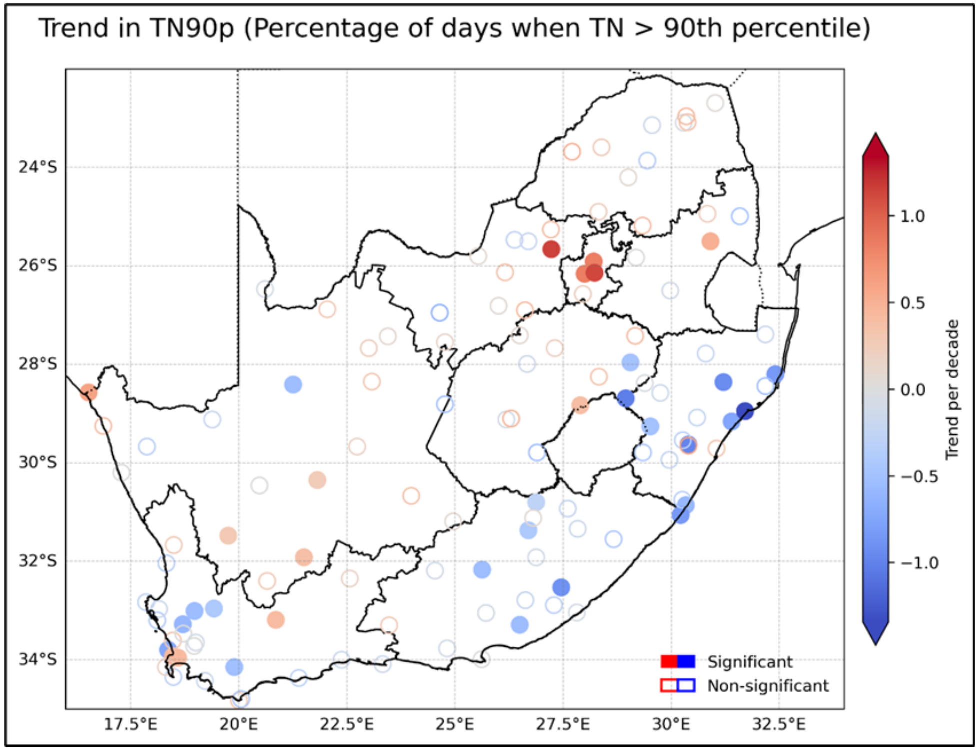
South African Weather Service

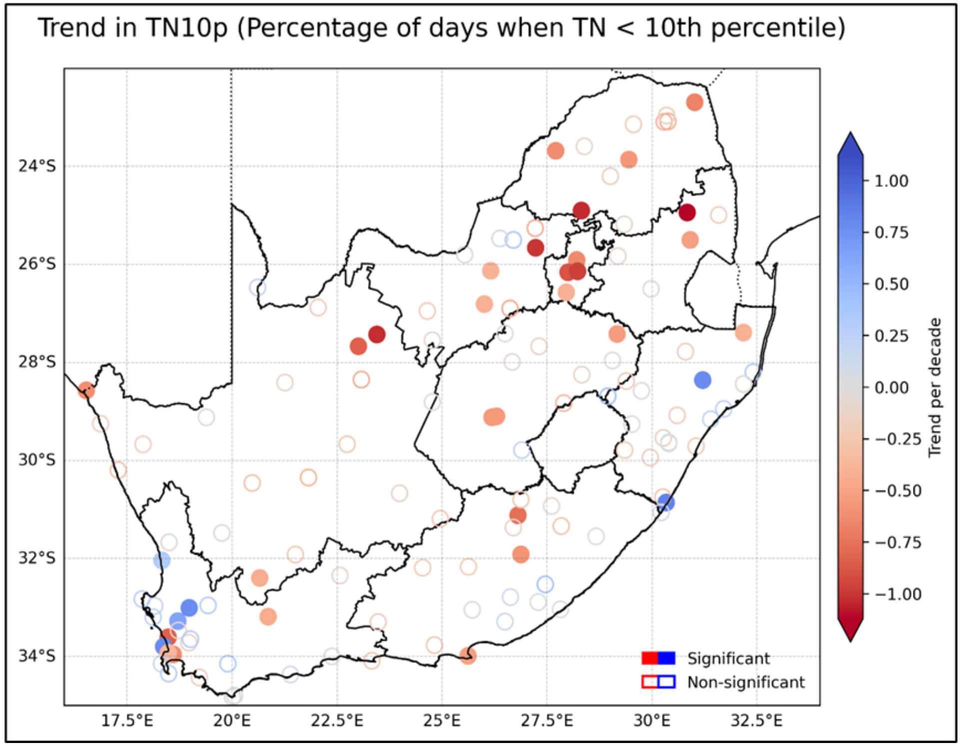
Extreme Climate Trends: 1996 - 2025



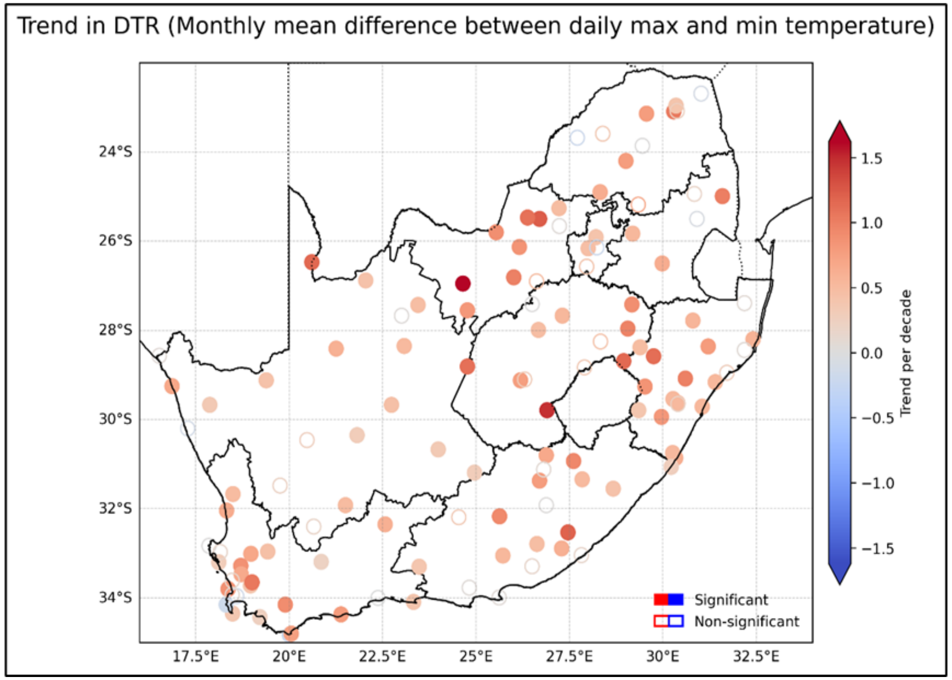


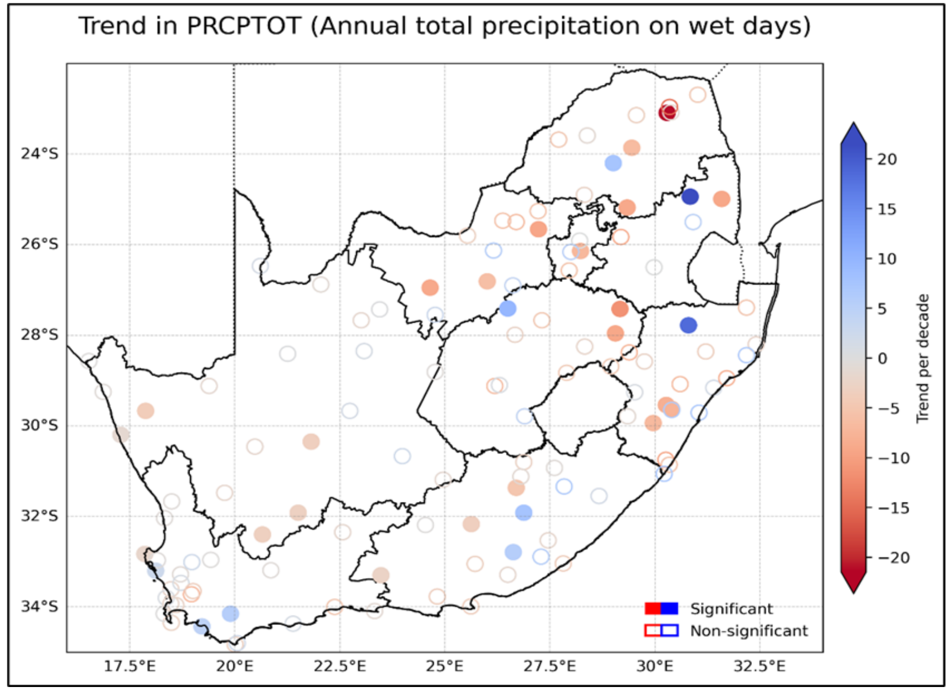
Extreme Climate Trends: 1996 - 2025





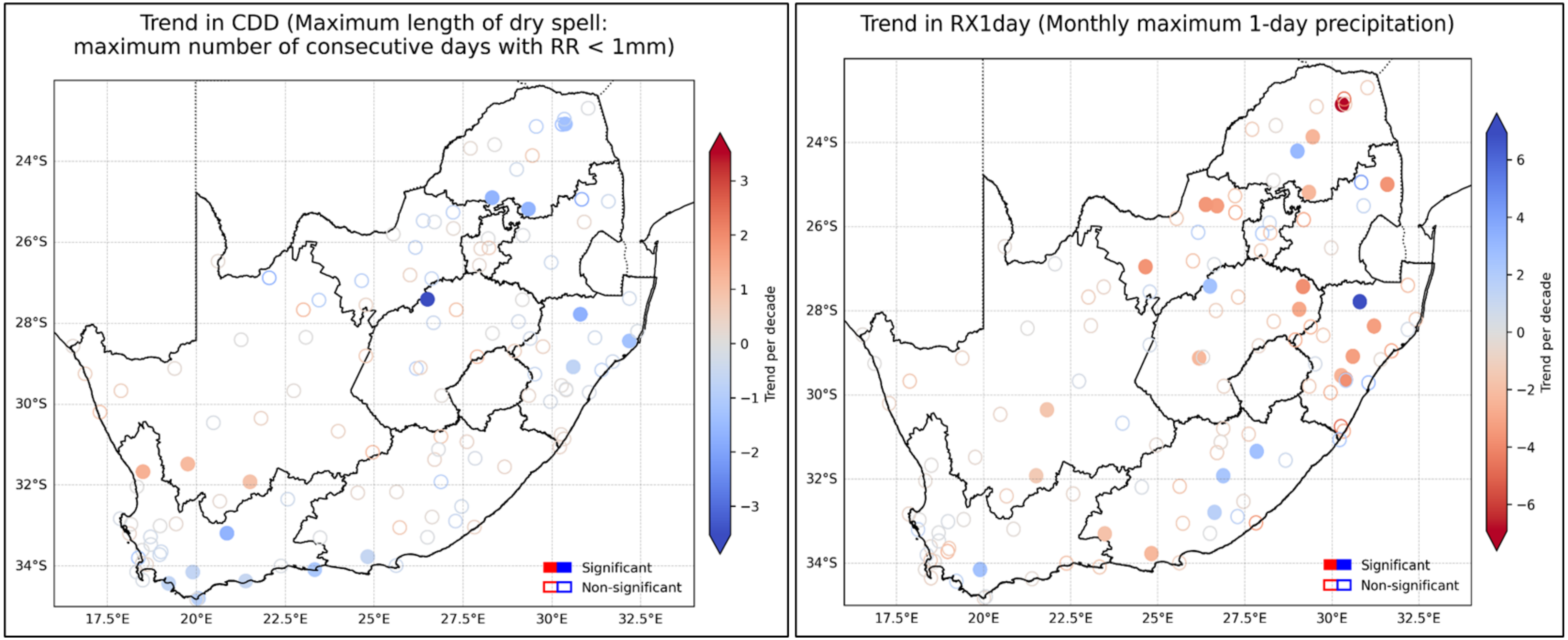
Extreme Climate Trends: 1996 - 2025



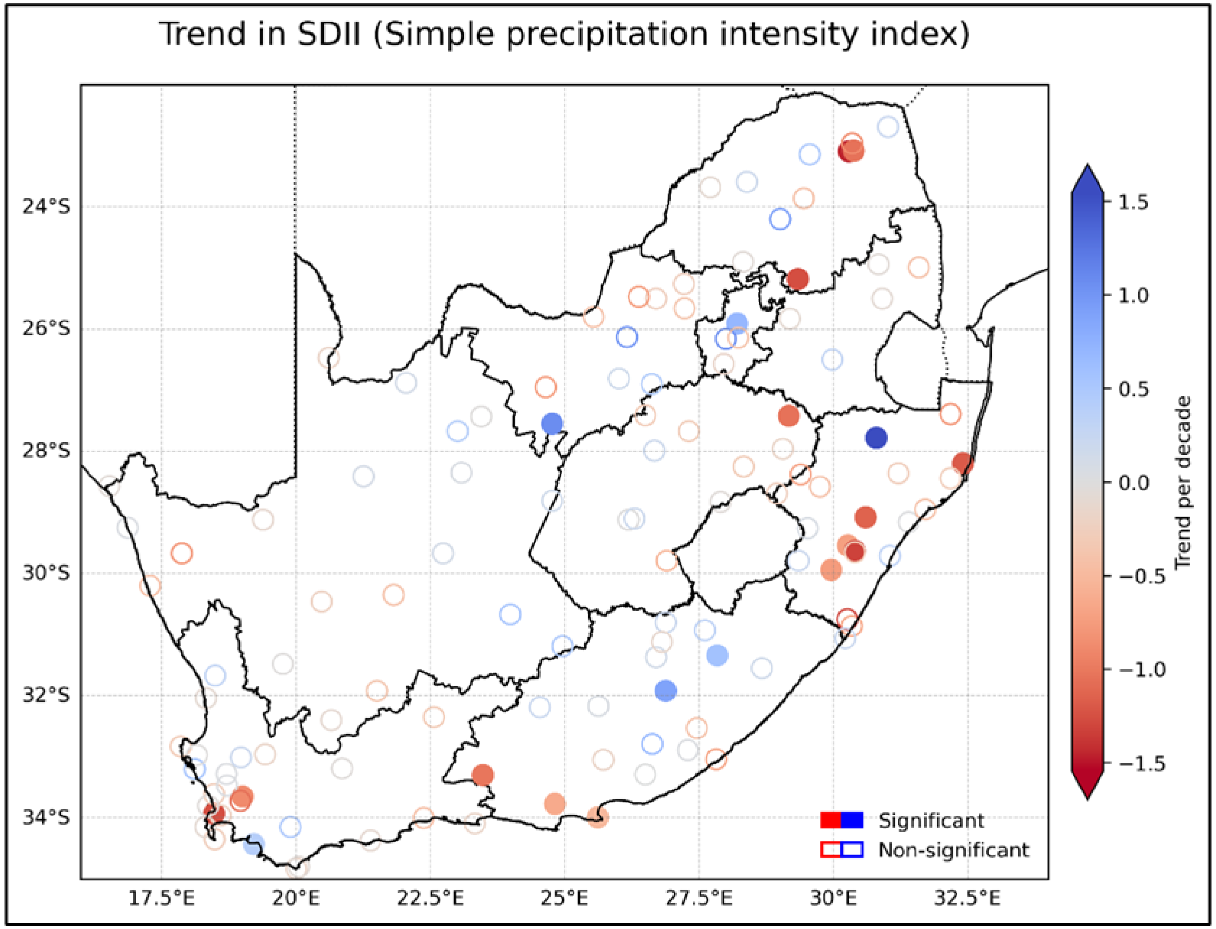


South African Weather Service

Extreme Climate Trends: 1996 - 2025



Extreme Climate Trends: 1996 - 2025



Extreme Climate Trends: 1996 - 2025

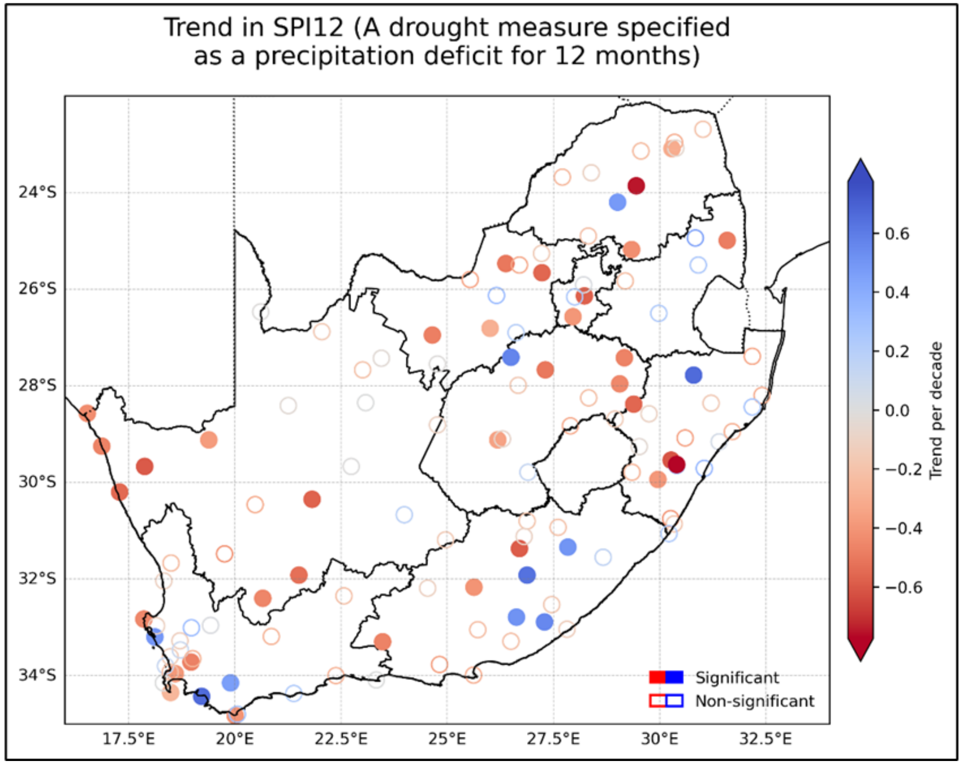
Sector-specific indicators

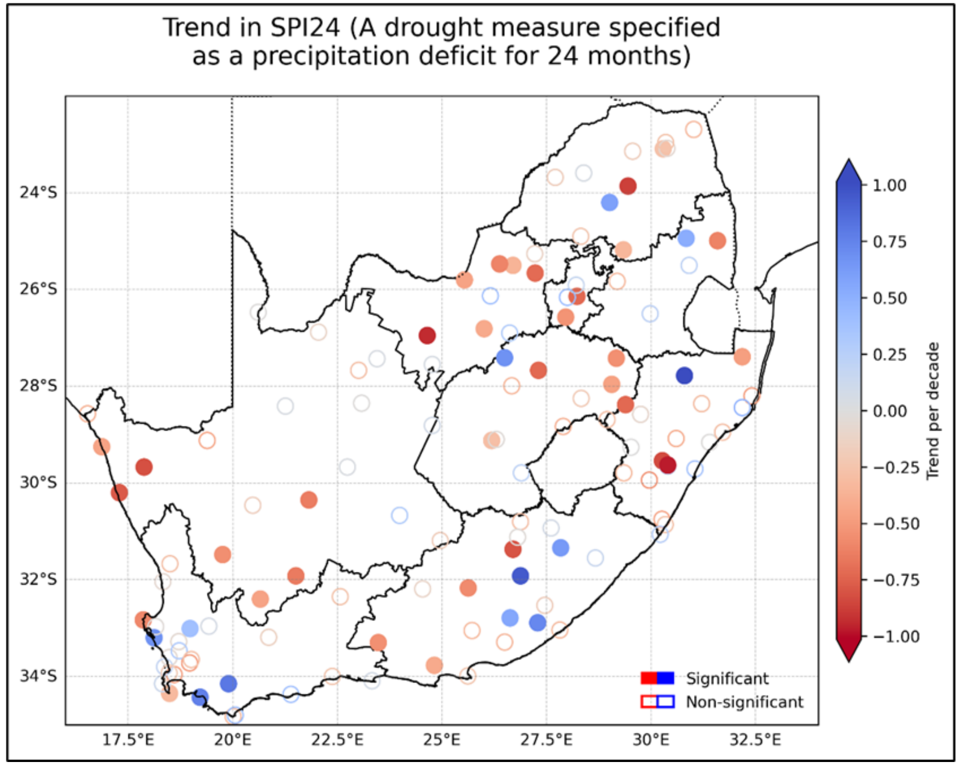
This section includes additional indicators, which account for specific aspects of our changing climate and their impact on climate sensitive sectors. The complete set of ClimPact indices was developed with the following sectors in mind: health, agriculture and food security, and water resources; and so, extend the applicability of the ETCCDI indices for these sectors. These indices may also be useful in other sectors, for example, disaster risk reduction, energy or forestry: The following indices are included, listed in the following table:

Table: Details of the additional ET-SCI Indices included and relevant sectors (H = health, AFS = Agriculture and Forestry, WRH = water resources and hydrology)

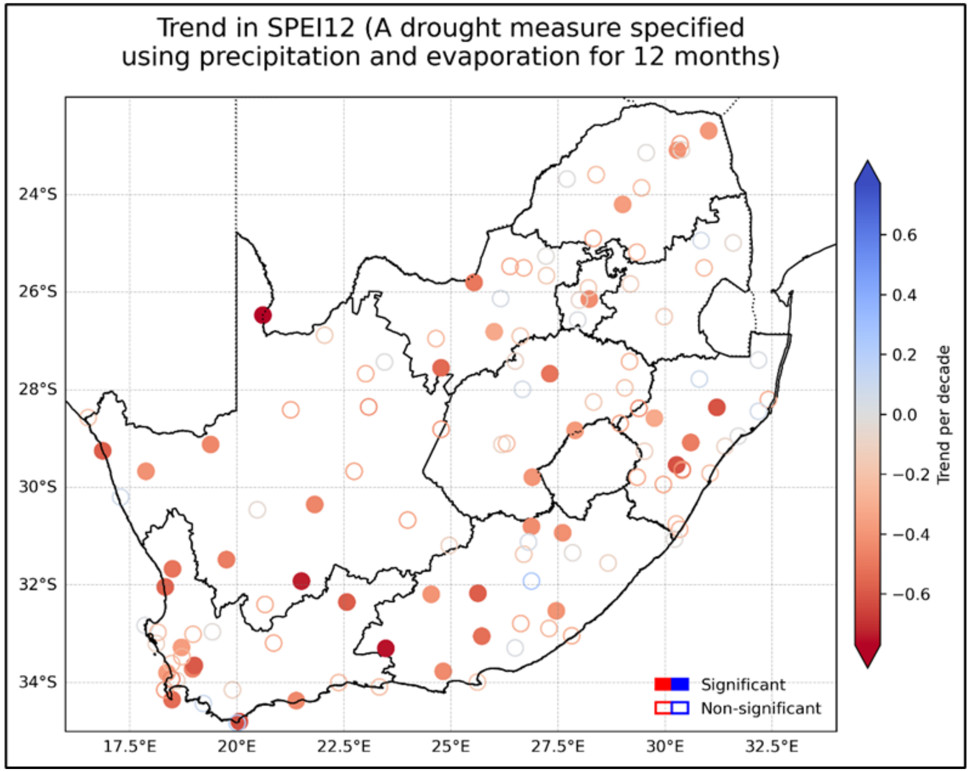
Index	Name	Definition	Units	Sectors
SPI12 and SPI24	Standardized Precipitation Index for 4 time periods (4 indicators).	Measure of drought using the Standardized Precipitation Index.	-	H,AFS and WRH
SPEI12 and SPEI24	Standardized Precipitation evapotranspiration Index for 4 time periods (4 indicators).	Measure of drought using the Standardized Precipitation Evapotranspiration Index.	-	H,AFS and WRH
TXge30	Tmax at least 30°C	Number of days when TX > = 30 °C	Days	H,AFS
TNlt2	TN below 2°C	Number of days when TN < 2 °C	Days	AFS
WSDI3	User defined WSDI	Annual number of days contributing to events where 3 or more consecutive days experience TX > 90th percentile	Days	H,AFS and WRH
GDDgrown10	Growing degree days	The annual sum of Tmean – n, where n is 10℃ and Tmean > n	Degree days	H,AFS

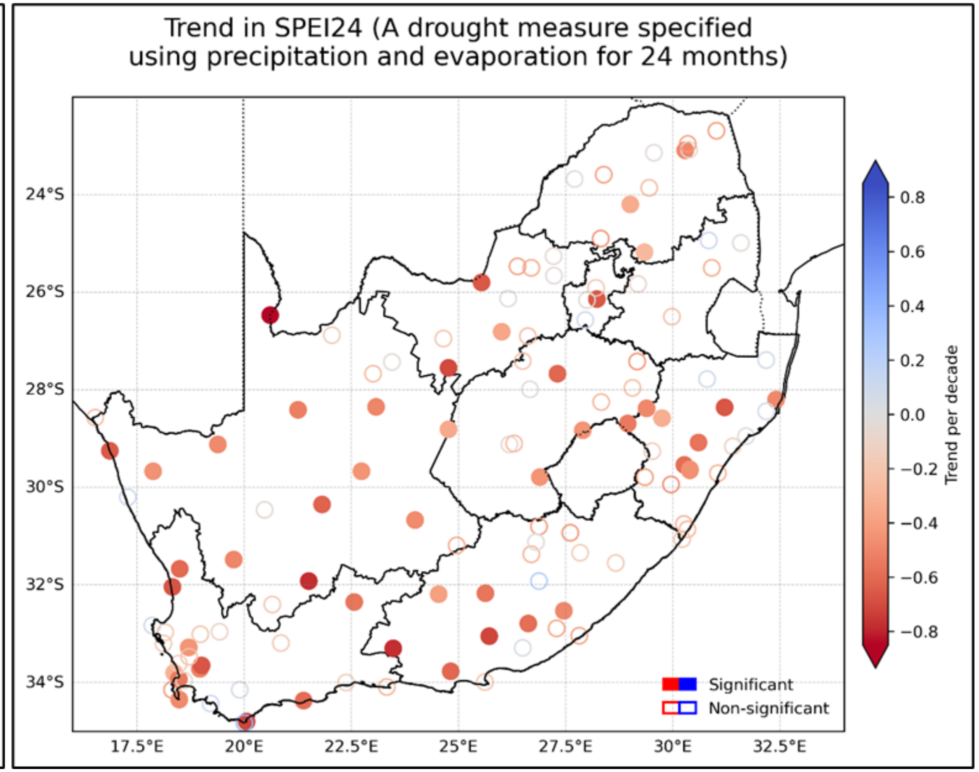
Extreme Climate Trends: 1996 - 2025



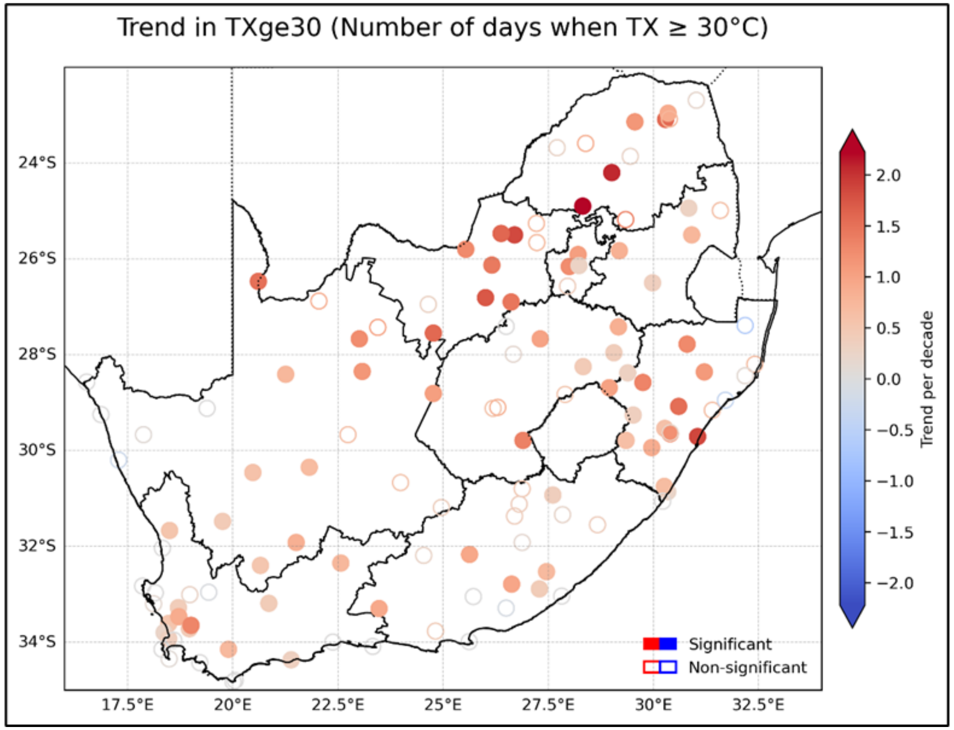


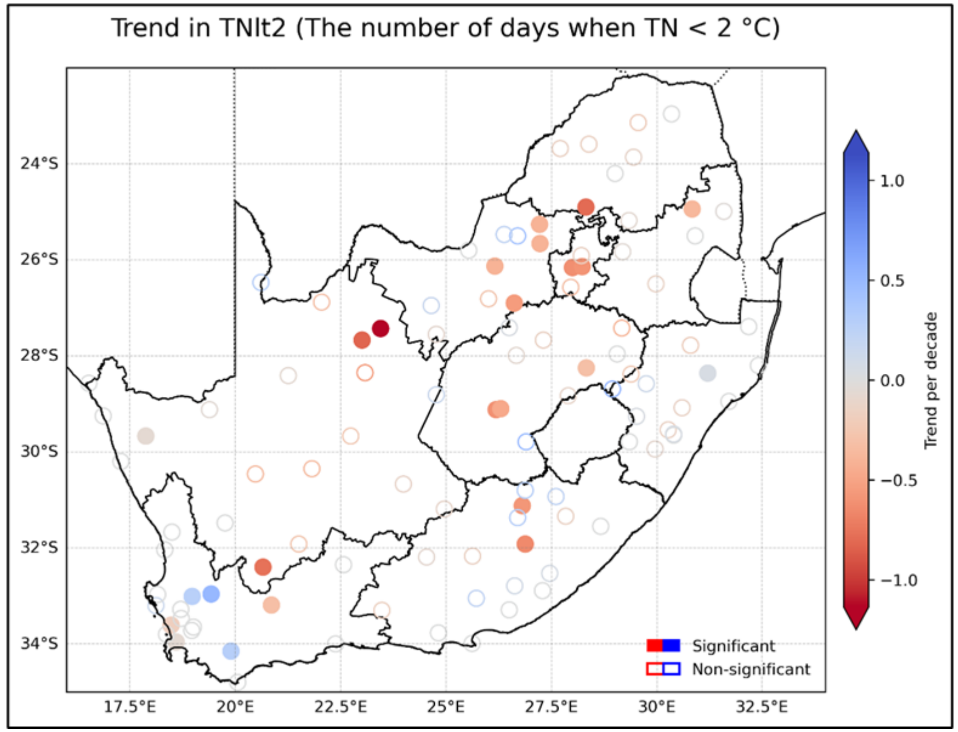
Extreme Climate Trends: 1996 - 2025





Extreme Climate Trends: 1996 - 2025





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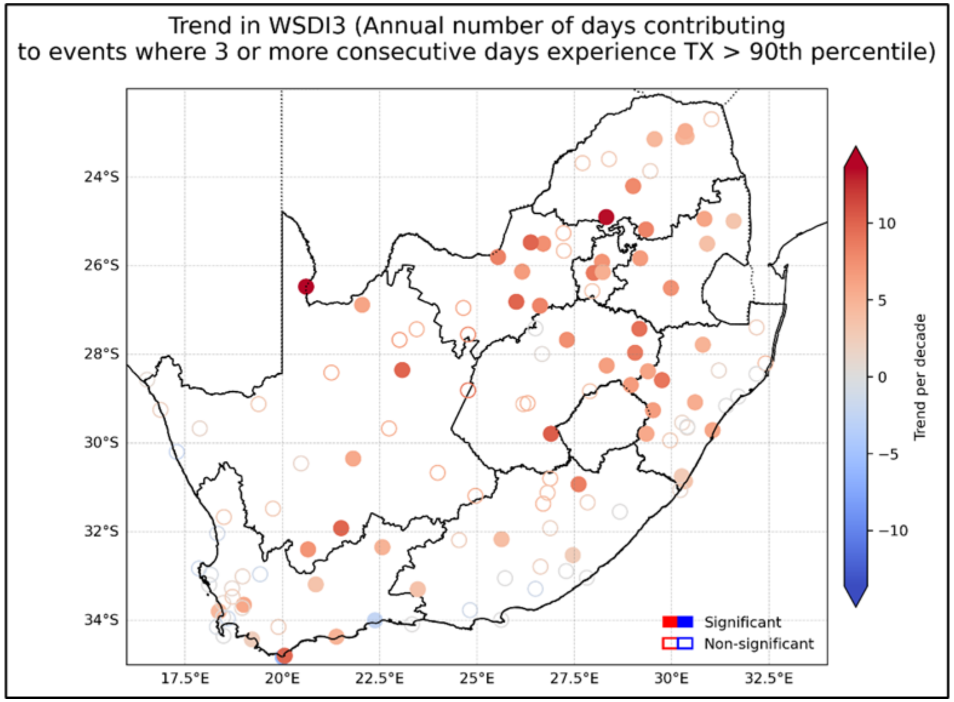
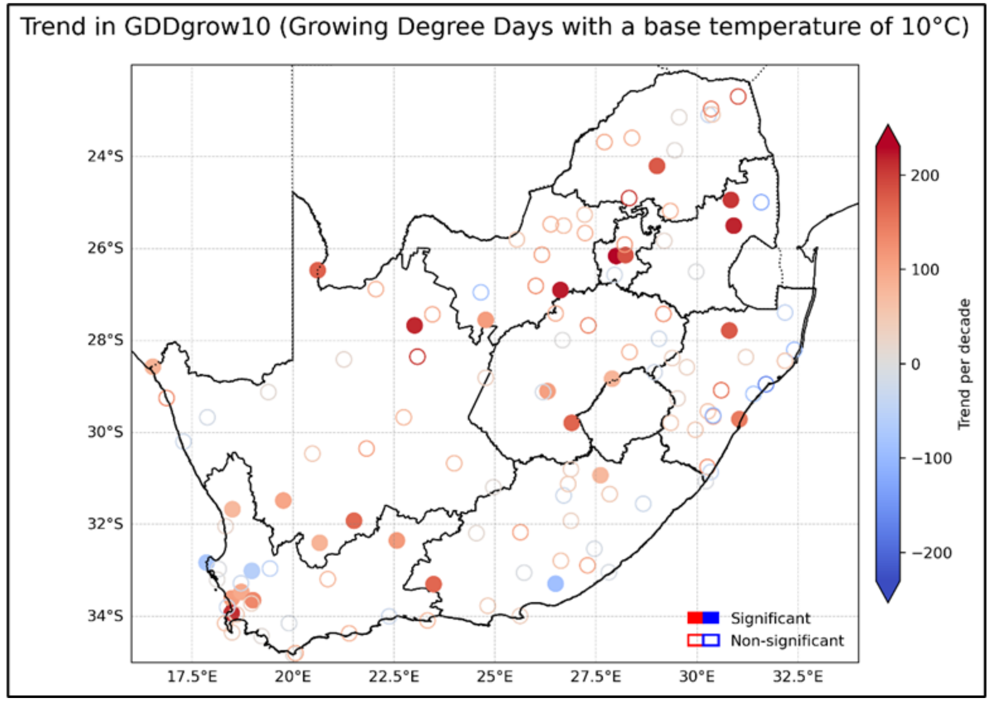




Extreme Climate Trends: 1996 - 2025

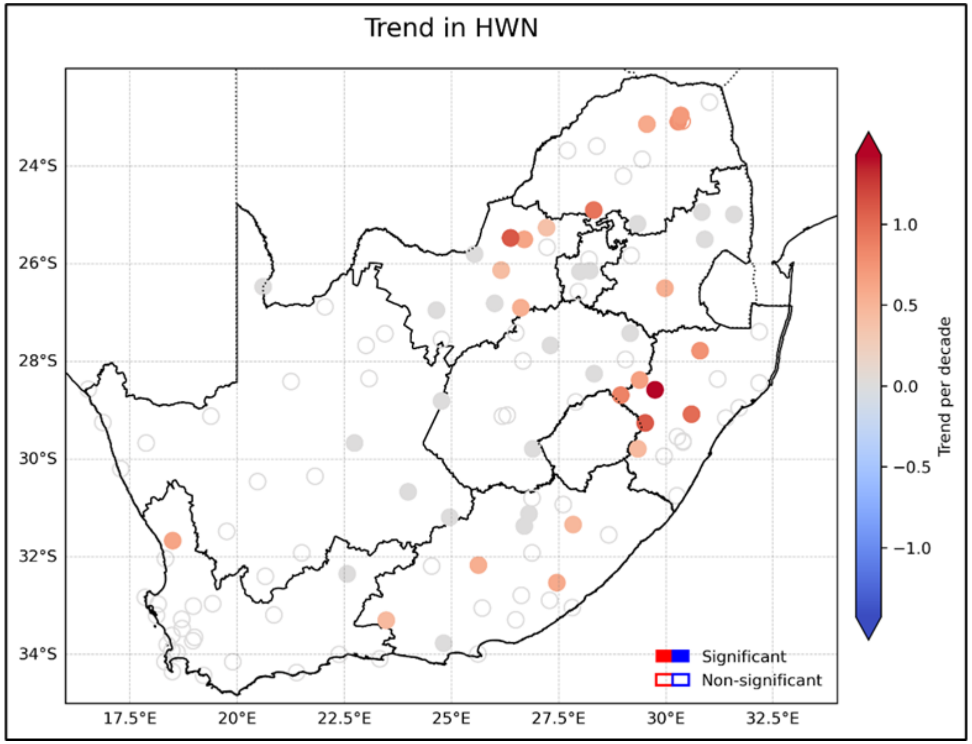
Heat waves indices

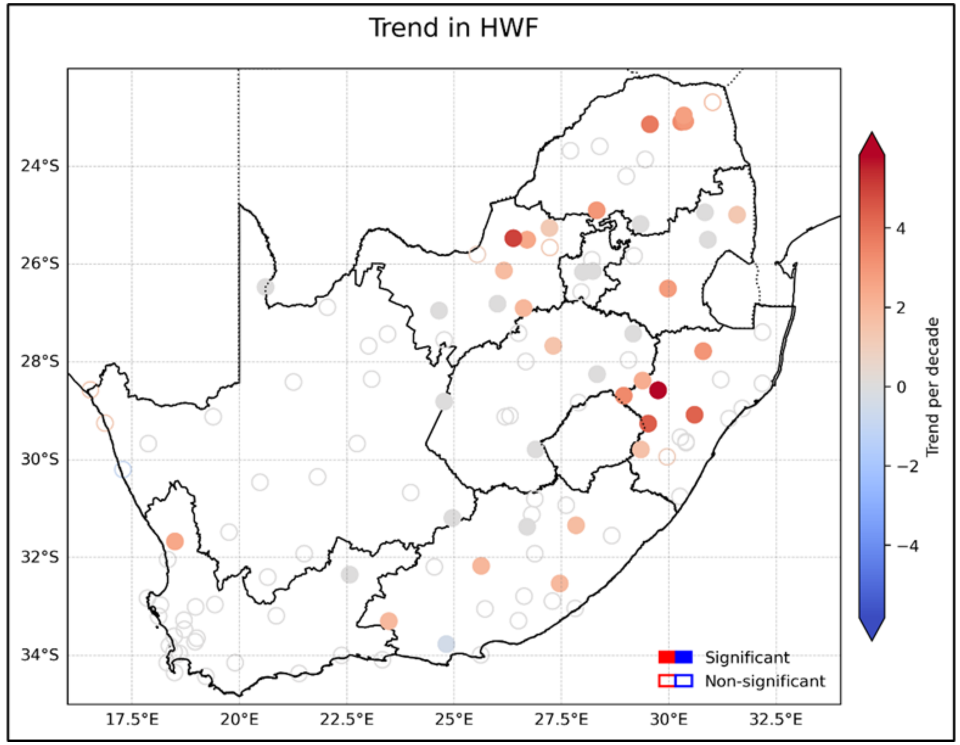
Heat wave characteristics, which are relevant to most sectors, are based on the definitions by Perkins and Alexander (2013) and are listed in the following table:

Table: Selected heat wave characteristics defined by Perkins and Alexander (2013)

Index	Name	Definition	Units	Sectors
HWN	Heatwave Number	The number of individual heatwaves that occur each summer (Nov – Mar). A heatwave is defined as 3 or more days where TX > 90th percentile or where TN > 90th percentile	-	H,AFS and WRH
HWF	Heatwave Frequency	The number of days that contribute to heatwaves identified by HWN	Days	H,AFS and WRH
HWD	Heatwave Duration	The length of the longest heatwave identified by HWN.	Days	H,AFS and WRH

Extreme Climate Trends: 1996 - 2025





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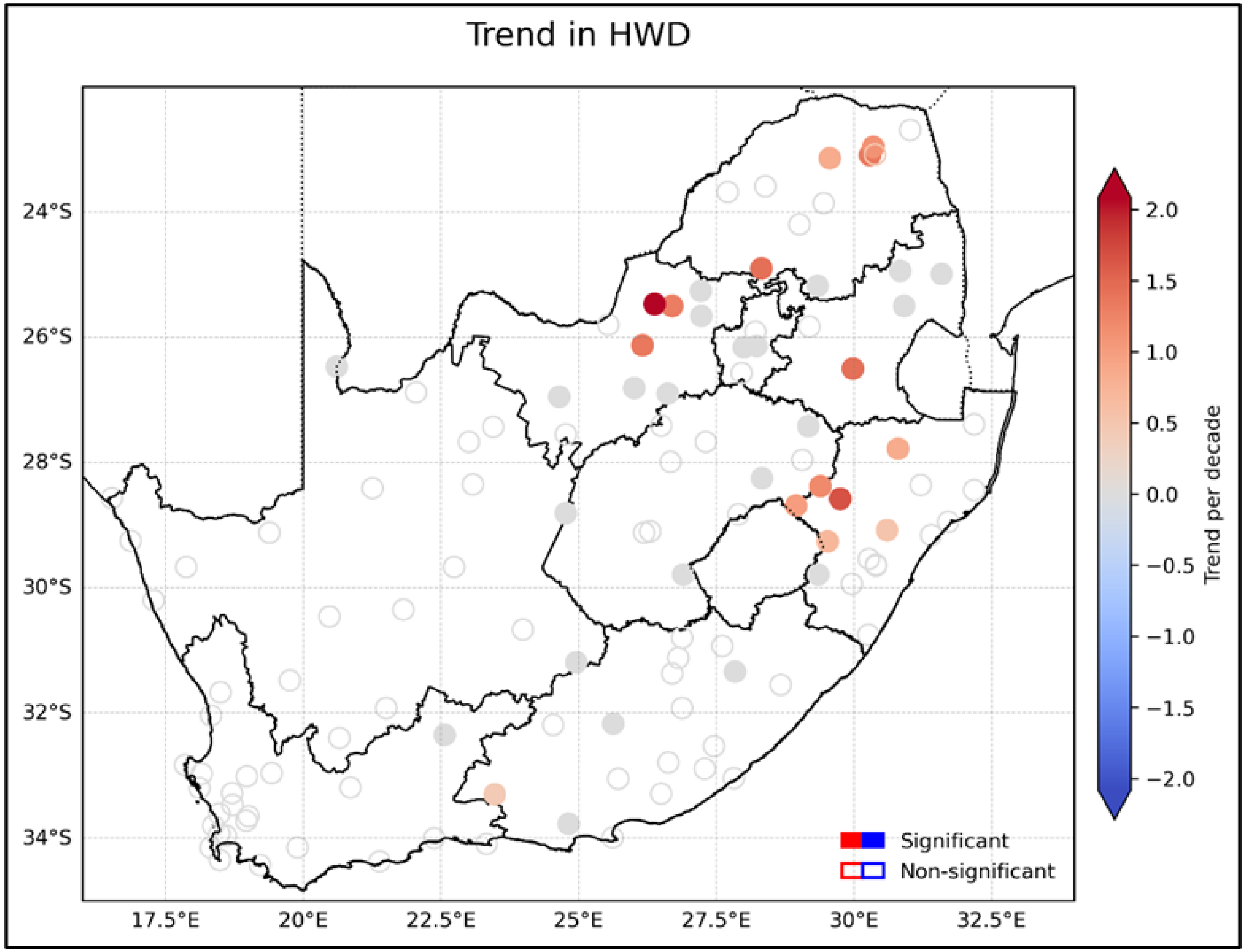

Extreme Climate Trends: General Summary

General summary

Maximum temperature

The selected indices based on maximum temperature (TX) indicate general warming across South Africa. The highest annual TX (TXx) shows stronger warming trends in the north and extreme south. A similar pattern of warming is evident for the trend in hot days (TX90P).

The number of heat waves (HWN) has risen significantly in the north-eastern interior, especially western North-West and the KwaZulu-Natal interior. The same applies to the number of days contributing to heat waves (HWF) and the annual maximum heat wave length (HWD).

Minimum temperature

The indices based on minimum temperature (TN) indicate warming but less consistent spatially and magnitudinal. While the annual warmest TN (TNx) shows significant increases over and close to Gauteng there are large areas of the coastal provinces that show the opposite sign. Similar cooling patterns are observed for warm nights (TN90P) and cold nights (TN10P), but not as widespread as the case for TNx. For TN10P the warming footprint in the northern interior is much larger than for the other TN indices, indicating relatively large-scale decreases in cold nights. This observation is strengthened by the trends in frost days, where many places in the northern interior experienced significant decreases.

Daily maximum temperature has risen stronger and over most of South Africa, compared to minimum temperatures. This stronger warming in TX is best illustrated by the significant increase in the diurnal temperature range (DTR) over most of the country, but especially over the North-West Province and surrounds, the western interior of KwaZulu-Natal and South-Western Cape.

Precipitation

Considering the annual total precipitation (PRCPT) trends over the last 30 years, the results can only be described as “mixed” although there are more stations that show significant drying than wetting. In a near-stationary climatic period, as analysed, it follows that trends should also not be consistent for other rainfall indicators, such as short-term rainfall extremes, which is indeed the case.

Trends in the long-term Standardized Precipitation Index (SPI12 and SPI24) show mixed results but mostly drying. However, the Standardized Precipitation Evapotranspiration Index (SPEI12 and SPEI24) which incorporates surface temperature, show spatially consistent negative trends (i.e. long-term droughts becoming more prevalent) over most of South Africa.