

Annual State of the Climate of South Africa

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Executive Summary

Surface Temperature

South Africa experienced a relatively warm 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 20 climate stations, was on average about 0.4 °C above the average of the reference period (1991-2020), making it approximately the 8th hottest year on record since 1951 (see Figure 1). A warming trend of approximately 0.17 °C per decade is indicated for the country, over the period 1951-2023, statistically significant at the 5% level.

Precipitation

The most significant feature of the rainfall during 2023, presented in Figure 2, is the near-normal rainfall amounts received over most of South Africa, with the exception of the north-western interior which received well below-normal rainfall. In contrast, some regions along the coast and extreme east received well above-normal rainfall, especially in the Mpumalanga province. .

Noteworthy climate and weather events

In South Africa, the year started off with relatively wetter conditions in the central and western interior, but drier than usual in the coastal regions and some north-eastern parts. The eastern province of KwaZulu-Natal was also relatively hot and a few highest maximum and minimum temperatures were broken. In February, higher rainfall shifted to the east, with subsequent lower than normal maximum temperatures, and drier conditions in the western interior. With the higher rainfall, several instances of flash floods were reported, with accompanying damage to infrastructure and in some cases loss of life. In March the Western Cape received much higher than normal rainfall, while it was relatively dry in the rest of the country. The higher than normal rainfall persisted in the Cape Town metropole in April; about 130 residents and 50 shacks were flooded after spells of heavy rain. In May most of the country received above-normal rainfall. Several major flooding events occurred in the eastern and south-eastern coastal region, with more than 1200 residents evacuated from their homes in the Nelson Mandela Bay Municipality in the Eastern Cape after heavy rains on the 13th. Much above normal rainfall occurred over most of the south-western half of South African in June. Many flooding events were reported with hundreds of people left destitute as a consequence. Traffic disruptions in the main arterials connecting the south-west to the remainder of the country occurred. However, in the far north-east it was unusually hot and dry and maximum temperatures of more than 30°C were in many cases reported. Rainfall and temperature conditions in July and August was relatively normal. However, rainfall in September was characterised by many instances of floods in the Western Cape. A series of floods as a result of heavy rainfall on 24-25 September 2023 caused 11 fatalities, the closure of over 200 roads, and over 80,000 people being left without electricity for an extended period. From October the extreme eastern parts of the country received significantly above normal rainfall with many instances of floods in the KwaZulu-Natal province. Apart from several fatalities, extensive damage to infrastructure occurred and hundreds of homes were destroyed. More than 20 people were killed in floods in Ladysmith in the interior due to floods that occurred mainly on 24 December. .

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Severe weather events – 2023

October: Hailstorm the size of an egg hit parts of Gauteng on the 30th causing widespread damage to windows, sliding doors, skylights, roofs, gardens, vehicles and outdoor equipment. The most affected areas include Midrand, Paulshof, Braamfontein, Marlboro and Johannesburg CBD being the hardest hit.

February: Parts of Polokwane were flooded on the 1st after heavy rains hit the area affecting some casualty wards in Pietersburg Hospital. The rain uprooted trees leaving some roads blocked. More than 20 houses in the Nirvana area were flooded. A wall at the Tshwane University of Technology collapsed, injuring one person. The telephone and electricity lines were also affected.

February: Madibeng municipality was declared a disaster area after floods swept away houses and roads on the weekend of the 11th. 80 houses were under water in Bloemhof, and people were evacuated as well as businesses closed after heavy rains that forced the sluice gates in the Vaal River to be opened. Several residents lost their houses, livestock and other belongings. The affected areas include Tswaing, Mahikeng, Rustenburg, Moretele, Matlosana, JB Marks and Lekwa-Teemane local municipalities.

November: A tornado accompanied by heavy rainfall and hail hit Seriti and Thuthukani on the 13th. The heavy storm affected power lines in Thuthuka that supply Morgenzon and surrounding areas with electricity. Several houses roofs were blown away in the Bethal area and the electric poles were damaged.

February: Heavy rains led to the floodgates at the Vaal Dam opening and flooding Parys on the 18th. Some houses along the river bank were flooded and residents were forced to evacuate their homes. A road leading to the Parys Golf Estate was completely covered with water with about seven houses along that area being affected. In another section, the 1919 bridge was covered with water. Some guest houses in the Vaal had to evacuate their guests after the intensification of flooding in the area.

December: A total of 23 people died after flash floods hit Ladysmith on the 24th. The heavy rains led to the Bell Spruit River bursting its banks causing water to overflow onto the N11 road near the Limit Hill robots. This ended with severe damage to infrastructure and several vehicles being swept away. Some of the victims were killed in their sleep. A certain family was the most affected as they lost nine family members.

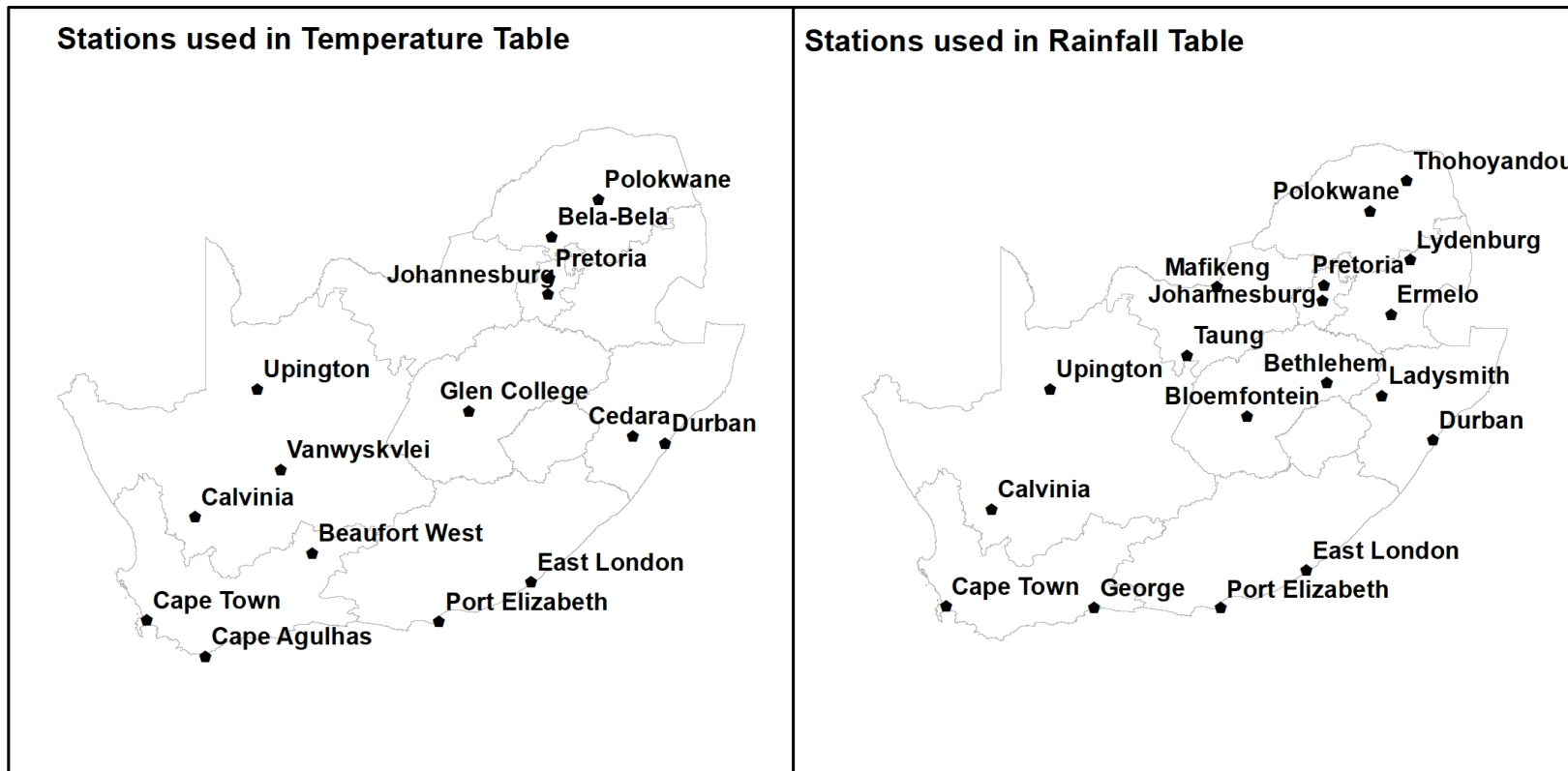
January: Eight farm workers died due to heat stroke in Kakamas when temperatures peaked at 41 degrees Celsius. Two died on the 12th and the other five on the 17th.

September: A 93 years old woman died after being swept off her feet by a huge wave that hit a parking area in Leentjiesklip in George on the 16th. A man was also injured and taken to hospital. Restaurants and houses were damaged as garage doors of eight properties in the Bikini Beach area of Gordon's Bay were affected. The Mossel Bay municipality reported a number of affected areas that resulted in the closure of beaches. Gordon's Bay Yacht Club was ankle deep in water causing damage to electrical appliances. Staff at the Tsitsikamma National Park were evacuated to safety. The N2 was flooded at Touws River near Salinas in Wilderness.

July: Heavy rain and gale-force winds left two people dead and a trail of damage from East London to Garden Route on the weekend of the 29th. The heavy rain also caused infrastructural damage and road closures. One person died at Stoney Drift in Amalinda settlement, East London after a tree fell on his shack while his friend was injured and taken to Frere Hospital. Another one was reported dead at Potsdam village when a wall and roof fell on her while she was sleeping. Nine health facilities in various parts of the province were affected where roofs of clinics and hospitals were blown away resulting in some patients being moved to other facilities. The gale-force winds were recorded at 124km/h at 03H00 am on the 30th. The wind caused damage to infrastructure, uprooted trees, damaged road signs and billboards.

Long-term climate statistics

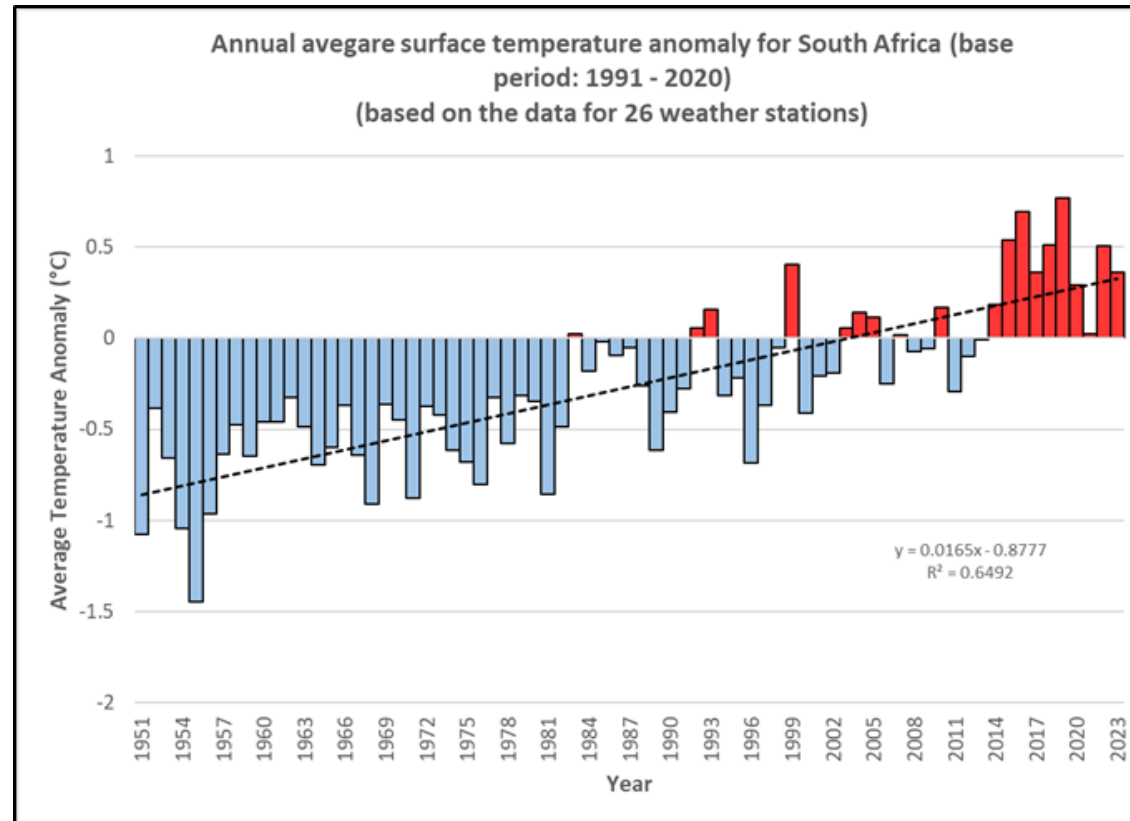
In this section the long term climate statistics are provided for a set of selected weather stations across South Africa, with locations presented in the maps below.



Climate overview

Average Surface Temperature

Mean annual temperature anomalies were calculated from 26 spatially well-distributed and representative climate stations. South Africa experienced a warm year, about 0.36 °C above the average of the reference period (1991-2020), making it approximately the 8th hottest year on record since 1951. A warming trend of 0.17 °C per decade is indicated for the country, over the period 1951-2023, statistically significant at the 5% level.



Maximum Temperature (°C) overview for some long-term climate stations for 2023									
Station	Average -2023	Normal (1991-2020)	Rank (Highest since 1951)	Highest Annual Average (since 1951)	Lowest Annual Average (since 1951)	Highest Daily - 2023 (Date)	Highest Daily (since 1951)	Lowest Daily - 2023 (Date)	Lowest Daily (since 1951)
Limpopo Province									
Bela Bela	29.7	28.2	3	32.3 (2015)	25.1 (1981)	40.4 (2023-10-27)	43.7	12.6 (2023-10-31)	8.1
Polokwane	25.7	25.6	14	26.6 (2019)	23.9 (1955)	34.6 (2023-12-09)	38.4	11.3 (2023-10-31)	8.4
Gauteng									
OR Tambo (Jhb)	23.2	22.5	8	24.2 (2015)	21.5 (2001)	32.9 (2023-10-27)	36.2	5.8 (2023-10-30)	2.5
UP Exp Farm (Pta)	26.4	25.1	6	27.6 (2015)	24.3 (1955)	36.0 (2023-11-27)	40.1	10.0 (2023-10-30)	6.8
Free State									
Glen College (Bfn)	27.9	25.9	3	28.8 (2015)	24.2 (1955)	41.8 (2023-11-27)	42.9	11.0 (2023-10-30)	3.9
KwaZulu-Natal									
Cedara	23.9	23.2	10	24.3 (2015)	21.6 (1968)	36.8 (2023-10-07)	40.1	7.1 (2023-07-20)	5.2
Mt Edgecombe (Dn)	26.9	25.6	5	27.6 (2018)	23.5 (1951)	41.3 (2023-02-20)	42.4	15.9 (2023-07-20)	11.9
Northern Cape									
Calvinia	24.5	24.8	26	26.0 (2019)	23.0 (1955)	40.2 (2023-01-16)	41.9	6.9 (2023-07-30)	2.2
Upington	30.8	29.6	2	30.9 (2019)	27.4 (1976)	44.2 (2023-12-22)	45.3	12.6 (2023-07-30)	6.9
Vanwyksvlei	26.9	27.8	42	29.4 (2019)	25.7 (1955)	42.5 (2023-01-13)	43.9	9.9 (2023-07-30)	7
Western Cape									
Beaufort West	25.5	25.4	22	27.0 (2019)	23.1 (1976)	41.3 (2023-01-13)	44.5	9.1 (2023-05-13)	4.8
Cape Town	22.2	22.5	35	23.4 (1999)	21.0 (1951)	35.4 (2023-02-11)	42.3	13.4 (2023-07-08)	9.4
Cape Agulhas	20.5	20.6	23	20.9 (2019)	19.1 (1955)	33.5 (2023-08-29)	35.6	13.7 (2023-07-09)	10
Eastern Cape									
East London	23.5	23.5	19	24.3 (1999)	22.7 (1971)	40.6 (2023-09-09)	43.9	13.7 (2023-07-20)	9.4
Port Elizabeth	22.7	22.6	18	23.4 (2019)	21.4 (1955)	35.5 (2023-04-19)	40.7	12.0 (2023-07-09)	9.5

Minimum Temperature (°C) overview for some long-term climate stations for 2023									
Station	Average -2023	Normal (1991-2020)	Rank (Highest since 1951)	Highest Annual Average (since 1951)	Lowest Annual Average (since 1951)	Highest Daily - 2023 (Date)	Highest Daily (since 1951)	Lowest Daily - 2023 (Date)	Lowest Daily (since 1951)
Limpopo Province									
Bela Bela	12.6	11.5	3	14.3 (2015)	10.3 (1953)	23.4 (2023-11-24)	27.4	-1.1 (2023-07-10)	-7.4
Polokwane	12.5	11.8	8	12.9 (2019)	9.4 (1955)	20.9 (2023-11-23)	23.8	0.7 (2023-07-13)	-3.8
Gauteng									
OR Tambo (Jhb)	11.2	10.2	6	11.6 (2019)	8.0 (1951)	19.8 (2023-12-05)	23	-4.1 (2023-07-10)	-9.7
UP Exp Farm (Pta)	11.9	11.7	9	12.4 (2019)	8.0 (1951)	22.2 (2023-11-23)	25.7	-1.5 (2023-07-10)	-6.4
Free State									
Glen College (Bfn)	7.3	7.8	56	10.2 (2018)	6.2 (1955)	18.9 (2023-11-28)	24	-6.1 (2023-08-27)	-11.2
KwaZulu-Natal									
Cedara	9.9	9.9	32	10.8 (2016)	7.7 (1951)	19.3 (2023-12-23)	21.6	-2.1 (2023-08-27)	-7.1
Mt Edgecombe (Dn)	16.9	16.1	5	17.5 (2010)	12.8 (1951)	25.7 (2023-01-20)	25.7	8.5 (2023-07-15)	1.9
Northern Cape									
Calvinia	8.5	8.5	19	10.0 (2018)	7.4 (2003)	24.2 (2023-01-17)	28	-4.6 (2023-09-06)	-9
Upington	12.7	12.5	31	14.2 (1999)	10.4 (1955)	28.1 (2023-01-12)	29.6	-2.0 (2023-07-11)	-7.9
Vanwyksvlei	8.1	10.2	72	11.7 (1999)	8.1 (2023)	27.1 (2023-01-12)	27.7	-7.1 (2023-07-31)	-9
Western Cape									
Beaufort West	11.1	11.5	28	12.1 (2019)	8.5 (1951)	25.4 (2023-01-12)	25.9	-0.6 (2023-09-12)	-8.8
Cape Town	12.5	11.9	3	12.6 (2014)	10.0 (1951)	20.3 (2023-02-16)	22.4	2.0 (2023-07-12)	-1.9
Cape Agulhas	14.7	14.6	18	15.3 (2004)	13.1 (1955)	20.9 (2023-03-14)	22.6	7.7 (2023-07-11)	0.8
Eastern Cape									
East London	14.3	14.5	50	15.5 (1952)	14.0 (2013)	22.9 (2023-01-18)	26.5	4.7 (2023-07-25)	2.4
Port Elizabeth	13.1	12.9	33	13.5 (1999)	10.1 (1955)	22.5 (2023-01-18)	23.4	2.4 (2023-07-25)	-2.3

Rainfall (mm) overview for some long-term climate stations for 2023

Station	Total 2023	Normal (1991-2020)	Highest Annual Total (since 1981)	Lowest Annual Total (since 1981)	Highest Daily Total 2023	Highest Daily Total (since 1981)	Number of days with rain >= 1mm -2023	Average number of days per year with rain >= 1mm (1991-2020)
Limpopo Province								
Thohoyandou	811	769	1654 (2000)	331 (1983)	119	199 (2000-02-23)	48	56
Polokwane	385	468	939 (1996)	256 (1985)	40	110 (2018-02-19)	35	43
Gauteng								
Pretoria (Irene)	650	645	977 (2014)	340 (2003)	63	122 (2018-03-22)	55	65
Johannesburg	443	733	1089 (2000)	443 (1984)	41	110 (1985-10-30)	47	69
North-West								
Mafikeng	458	515	874 (1997)	293 (2015)	31	128 (1995-11-18)	47	51
Taung	258	434	1008 (1988)	73 (2009)	22	160 (1988-02-20)	37	40
Mpumalanga								
Ermelo	750	707	1112 (2022)	454 (2001)	72	108 (2017-01-17)	70	65
Lydenburg	827	459	1067 (1987)	84 (2005)	70	86 (2022-10-31)	66	39
Free State								
Bethlehem	730	711	974 (2000)	465 (2015)	46	116 (1992-11-08)	72	73
Bloemfontein	644	591	1064 (1988)	260 (1992)	43	142 (1988-02-21)	62	54
KwaZulu-Natal								
Ladysmith	716	680	1045 (1996)	300 (1993)	49	141 (1987-09-29)	59	62
Mt Edgecombe (Dn)	1004	918	1571 (1988)	312 (1992)	74	307 (2022-04-11)	82	78
Northern Cape								
Upington	170	284	481 (2011)	53 (1986)	64	85 (1996-02-29)	18	25
Calvinia	208	196	379 (1995)	68 (1986)	34	59 (2010-10-15)	31	31
Western Cape								
Cape Town	642	572	707 (1996)	323 (210)	62	97 (2022-06-13)	77	65
George	929	670	1220 (1981)	374 (1981)	74	230(2006-08-01)	89	77
Eastern Cape								
Port Elizabeth	780	541	1033 (2012)	308 (1992)	45	224 (1981-03-25)	88	71
East London	1038	775	1318 (1985)	560 (1997)	59	313 (2002-08-15)	84	78

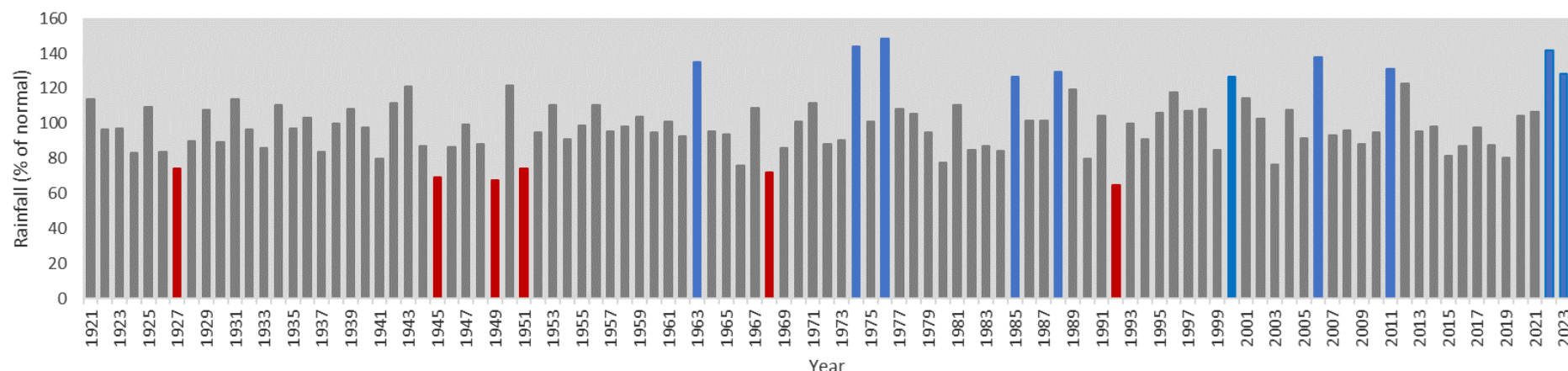
Provincial Rainfall

The provincial rainfall statistics are based on the average rainfall of the homogeneous rainfall districts, developed by SAWS, 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 near-normal rainfall across all the provinces, with a significant improvement in the Northern Cape which has been recording below-normal rainfall in recent years.

Eastern Cape - Annual Rainfall (% of Normal) - 1921 - 2023

Normal Period: 1991 - 2020

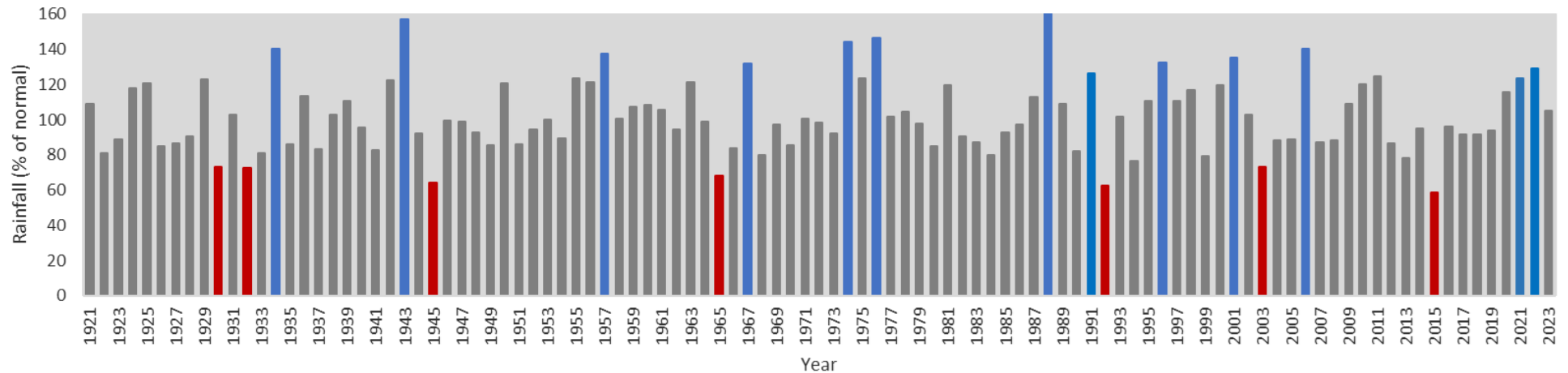
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)



Free State - Annual Rainfall (% of Normal) - 1921 - 2023

Normal Period: 1991 - 2020

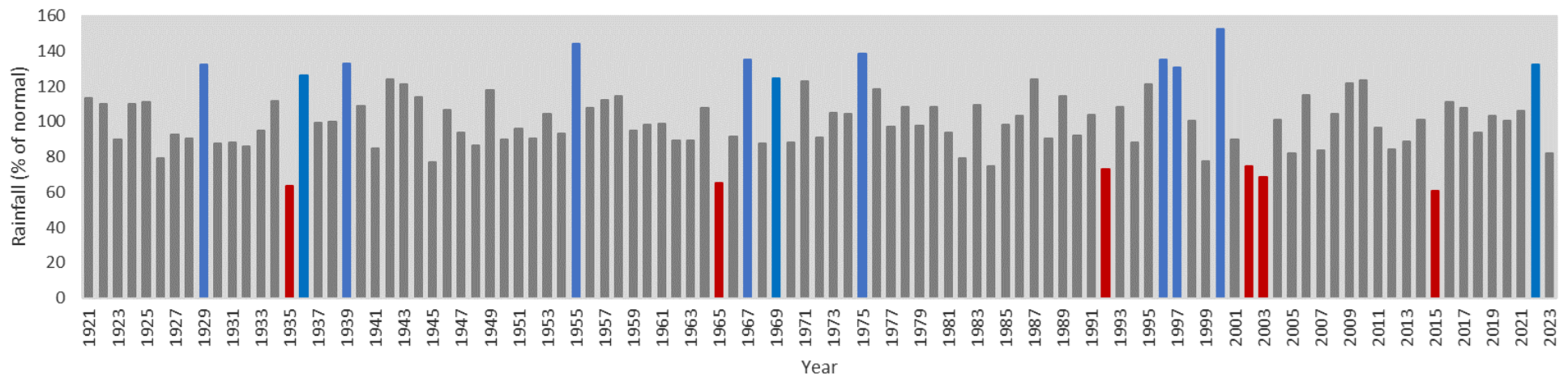
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)



Gauteng - Annual Rainfall (% of Normal) - 1921 - 2023

Normal Period: 1991 - 2020

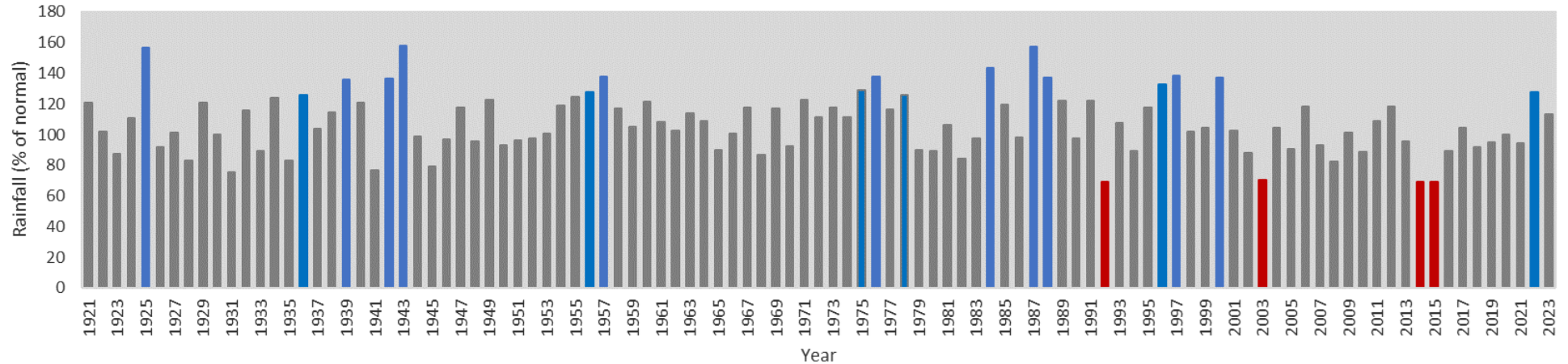
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)



KwaZulu-Natal - Annual Rainfall (% of Normal) - 1921 - 2023

Normal Period: 1991 - 2020

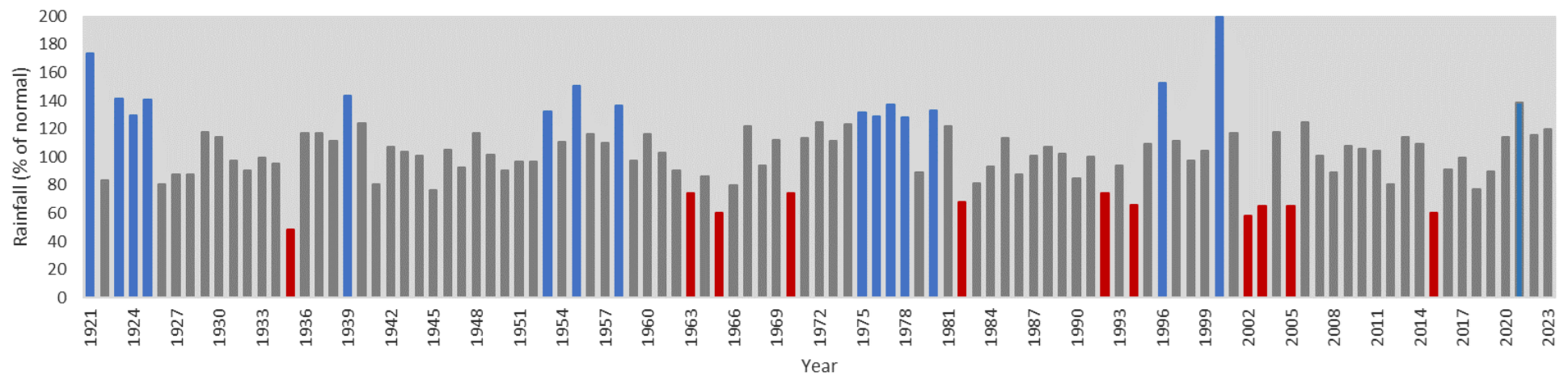
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)



Limpopo - Annual Rainfall (% of Normal) - 1921 - 2023

Normal Period: 1991 - 2020

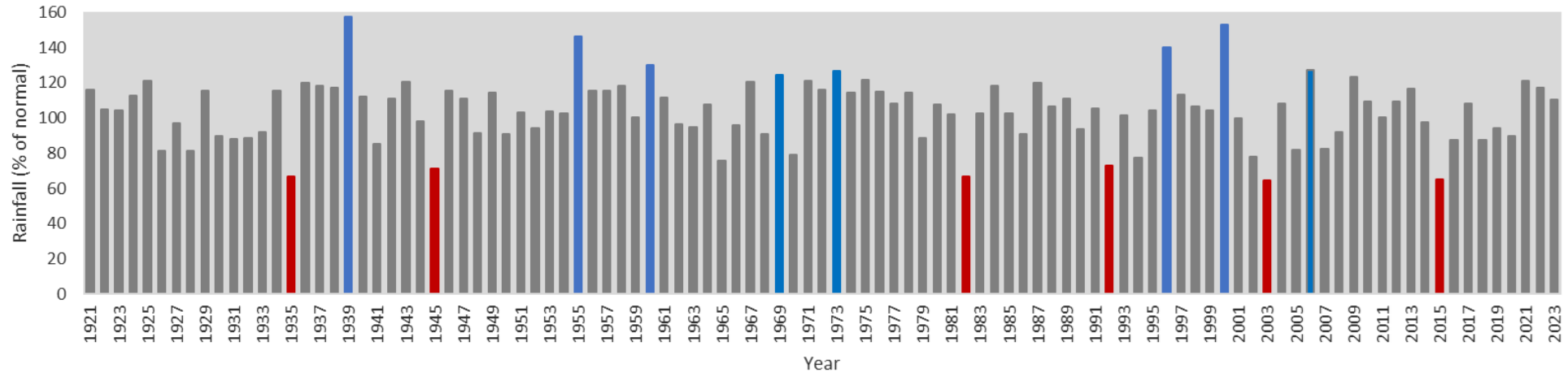
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)



Mpumalanga - Annual Rainfall (% of Normal) - 1921 - 2023

Normal Period: 1991 - 2020

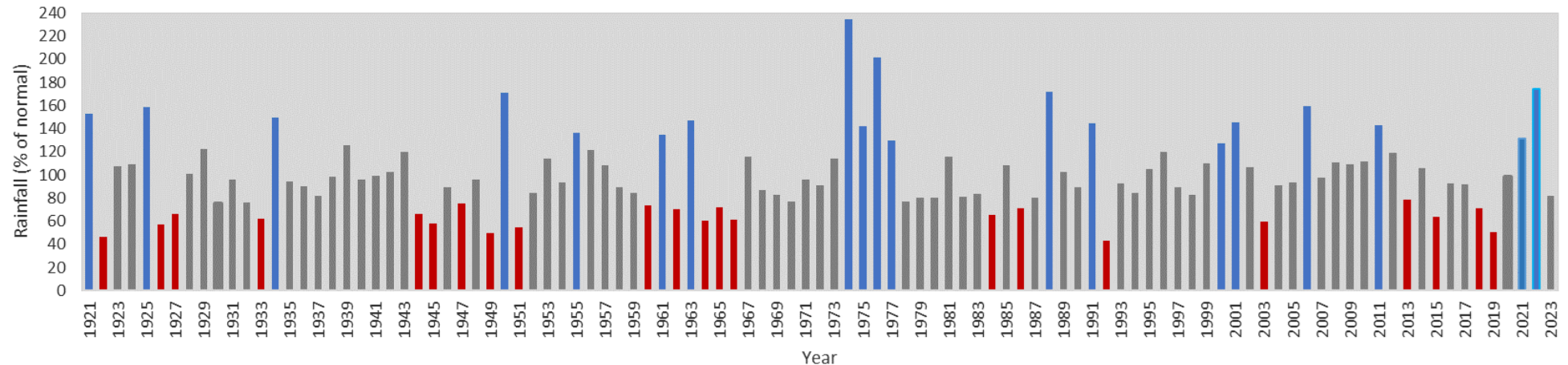
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)



Northern Cape - Annual Rainfall (% of Normal) - 1921 - 2023

Normal Period: 1991 - 2020

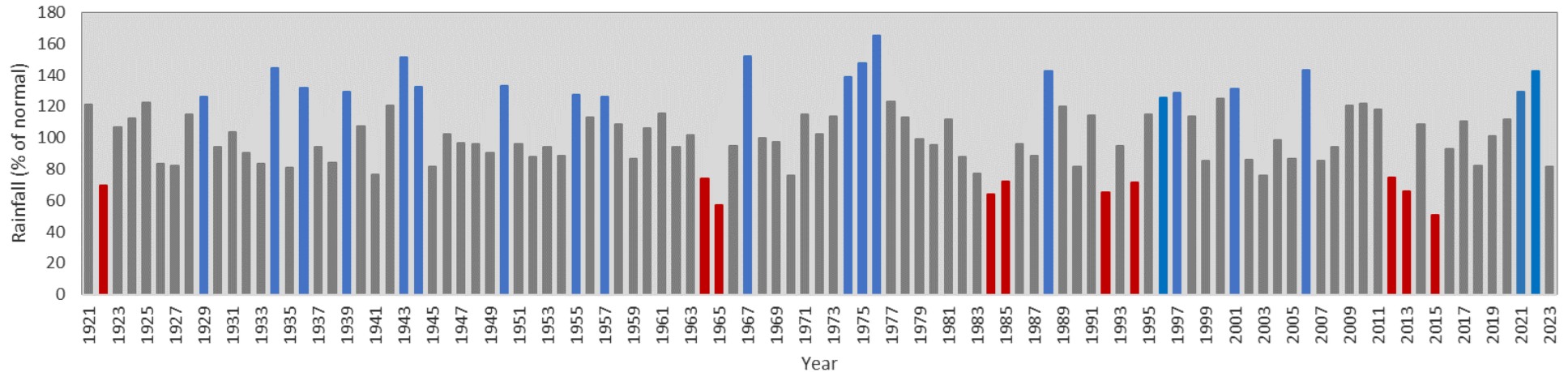
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)



North-West - Annual Rainfall (% of Normal) - 1921 - 2023

Normal Period: 1991 - 2020

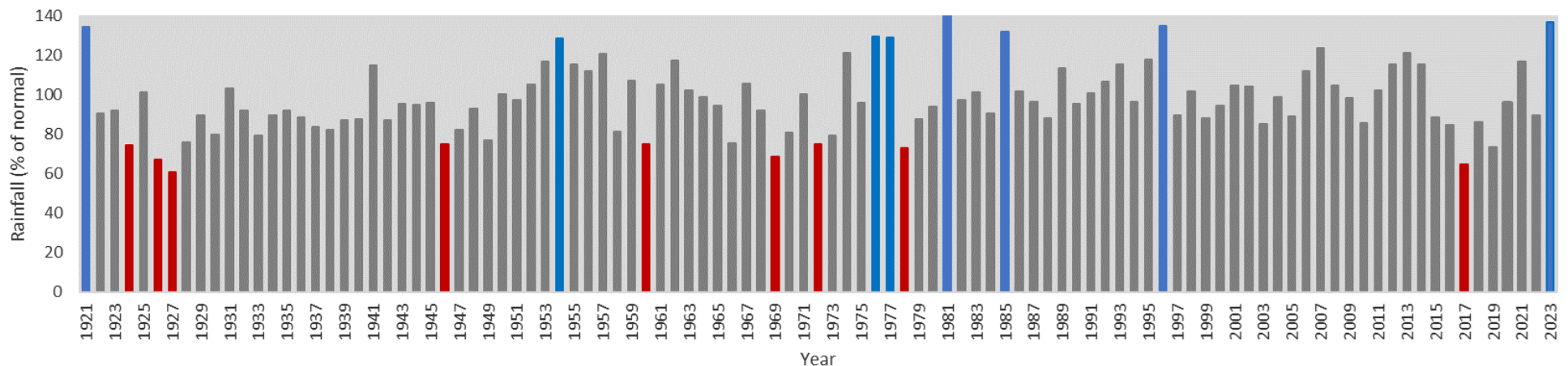
Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)



Western Cape - Annual Rainfall (% of Normal) - 1921 - 2023

Normal Period: 1991 - 2020

Red bars indicate dry years (< 75% of Normal) and blue bars wet years (> 125% of Normal)

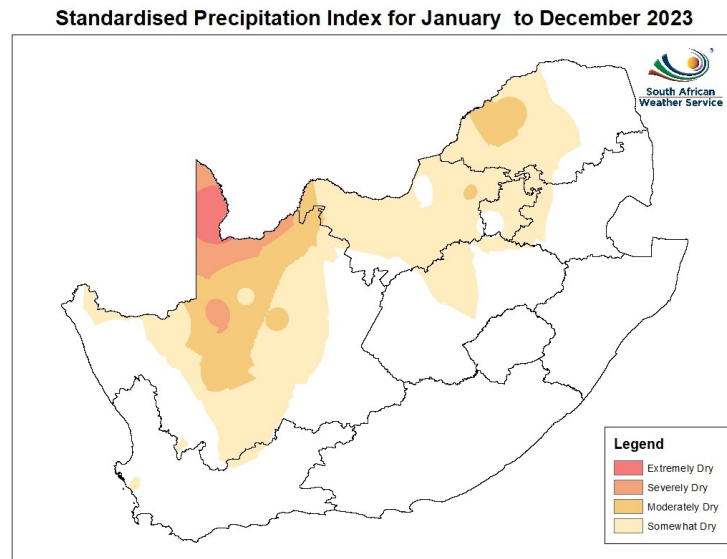


Indications of drought

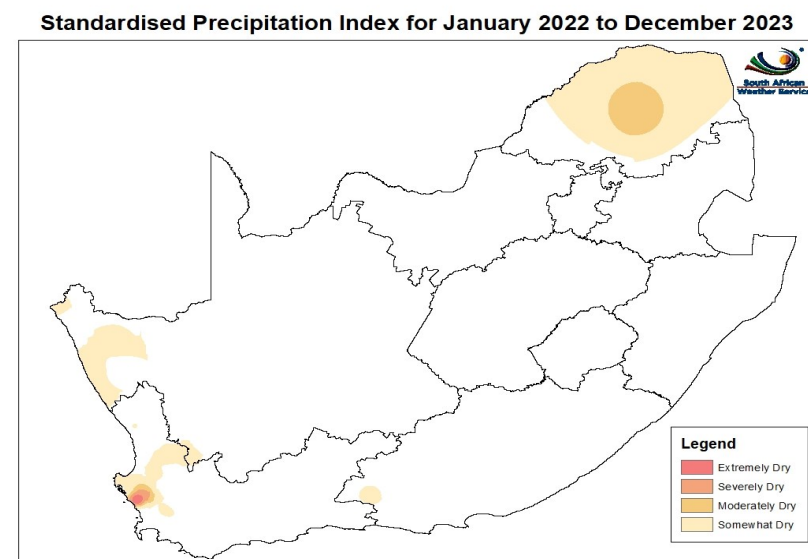
A meteorological drought is defined on the basis of the degree of dryness in comparison to “normal” or average amounts of rainfall for a particular area or place and the duration of the dry period.

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 drought, as they are linked to streamflow, reservoir levels and even groundwater levels. The most noteworthy in the 24-month SPI map below are the moderately dry to extremely dry conditions in the western and south-western parts of the country, but also moderately dry conditions in isolated parts of the Eastern Cape and Limpopo Provinces. However, considering only last year, some north-western parts in the Northern Cape, North-West nad Limpopo were moderate to extremely dry.

12-month SPI for January 2023 to December 2023



24-month SPI for January 2022 to December 2023



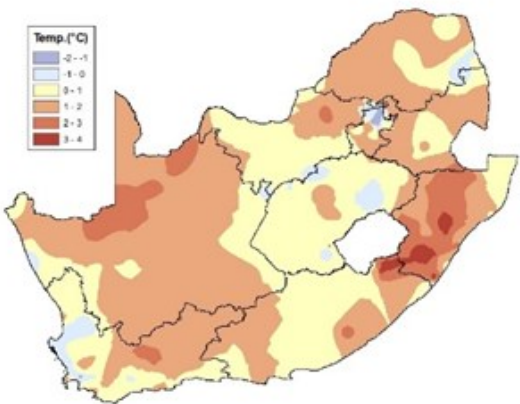
Monthly maps

Following are monthly maps for

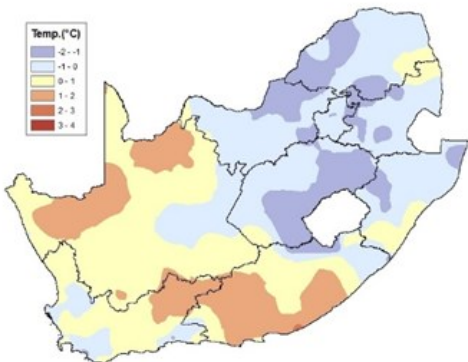
- Maximum temperature deviations from the 1981-2010 normal
- Minimum temperature deviations from the 1981-2010 normal
- Standardized Precipitation Index (SPI), indicating dry areas
- Lightning-stroke density indicating the number of strokes per square kilometer

January 2023

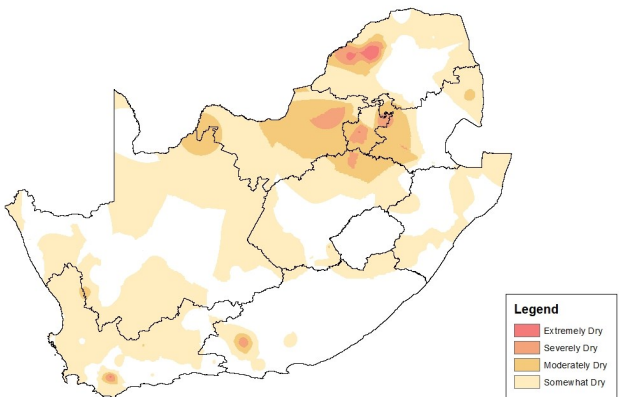
Maximum temperature deviations



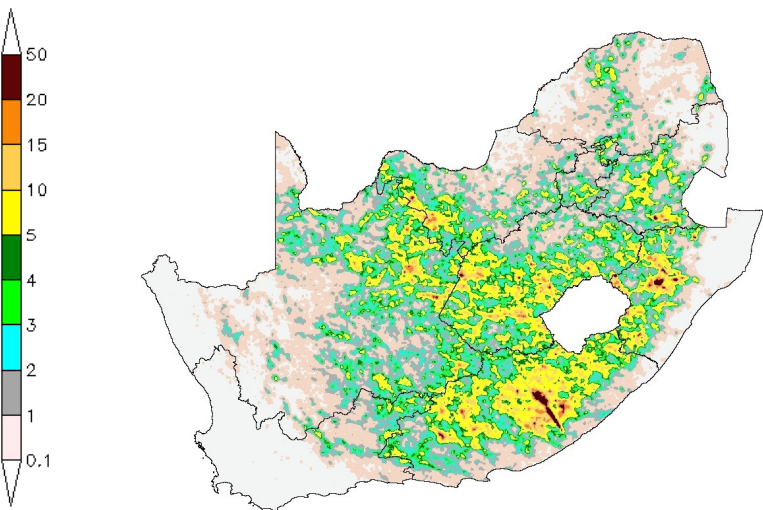
Minimum temperature deviations



SPI

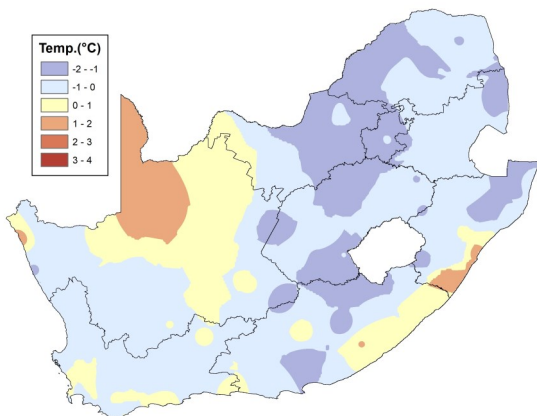


Lightning-stroke density

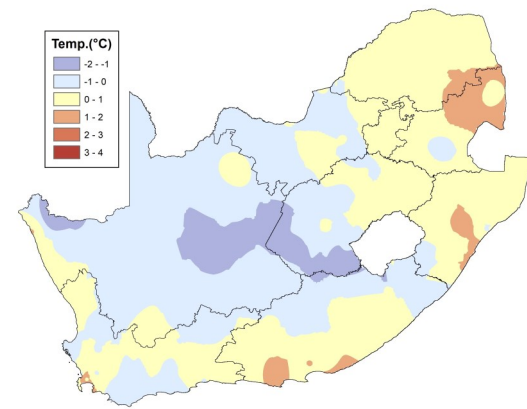


February 2023

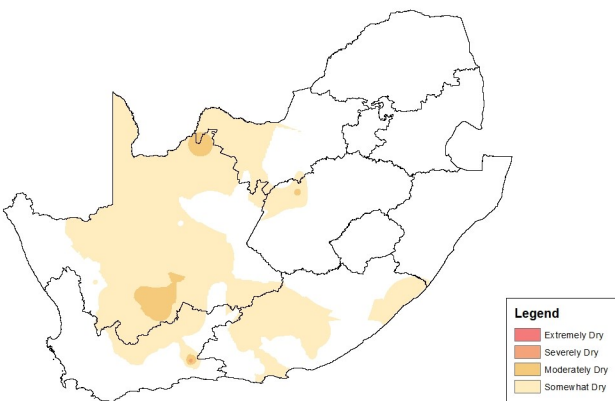
Maximum temperature deviations



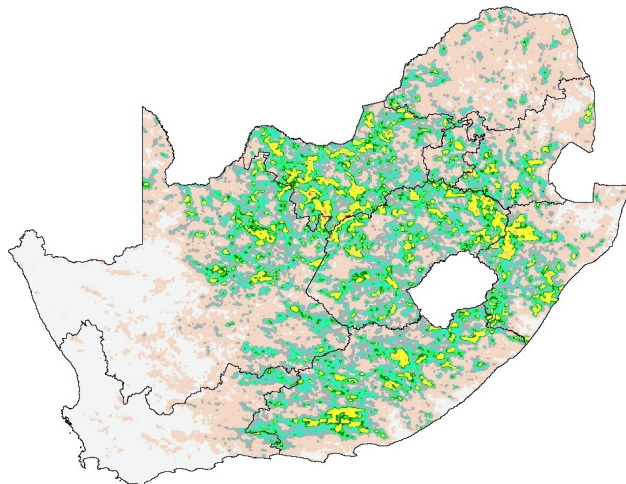
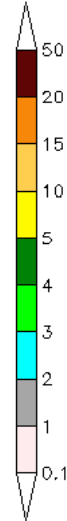
Minimum temperature deviations



SPI

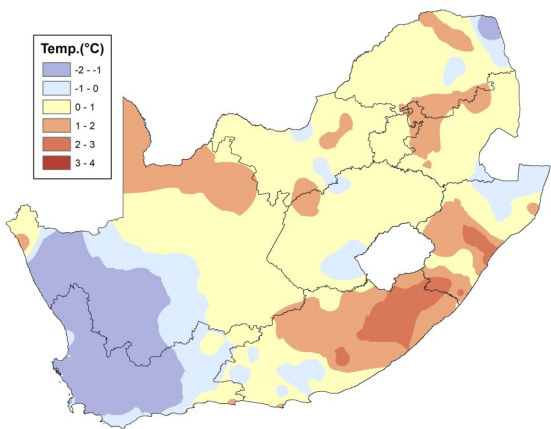


Lightning-stroke density

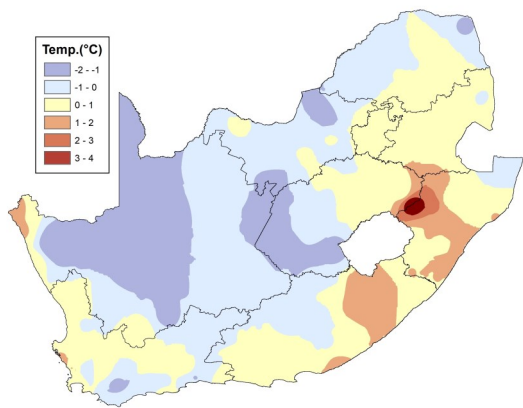


March 2023

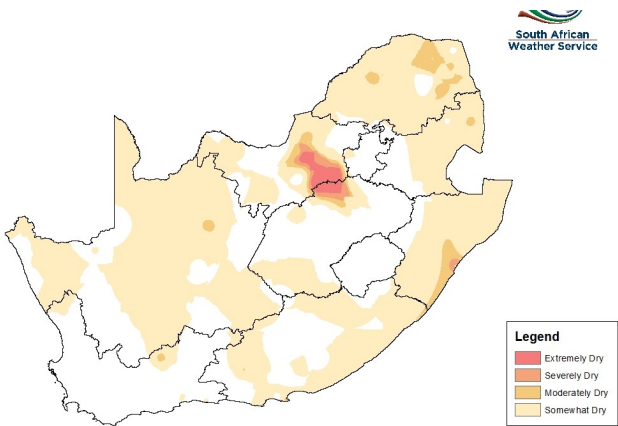
Maximum temperature deviations



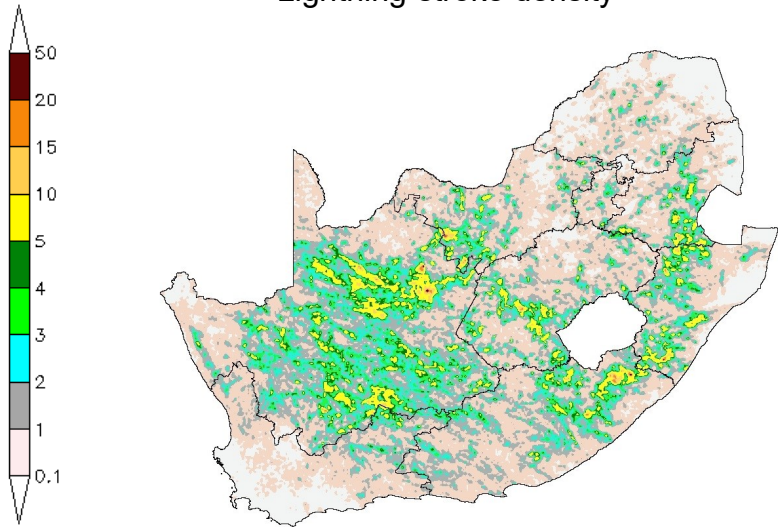
Minimum temperature deviations



SPI

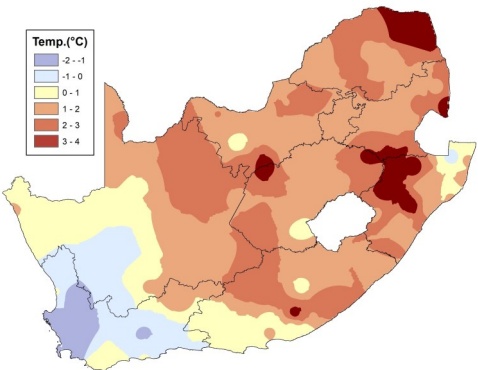


Lightning-stroke density

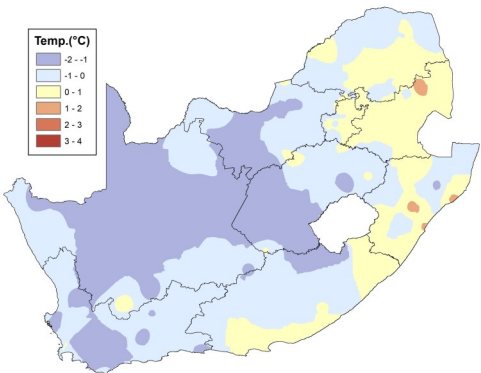


April 2023

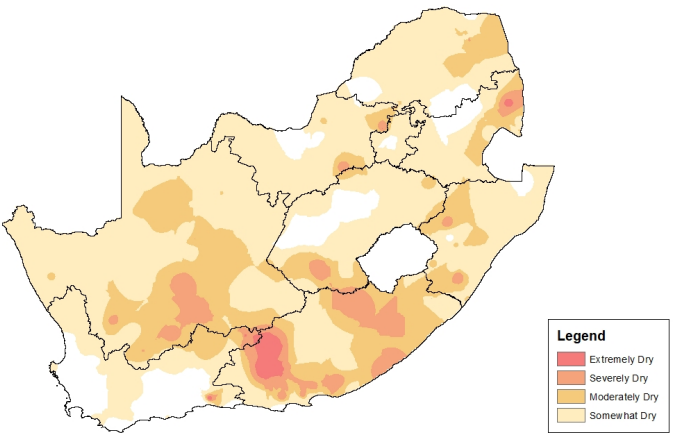
Maximum temperature deviations



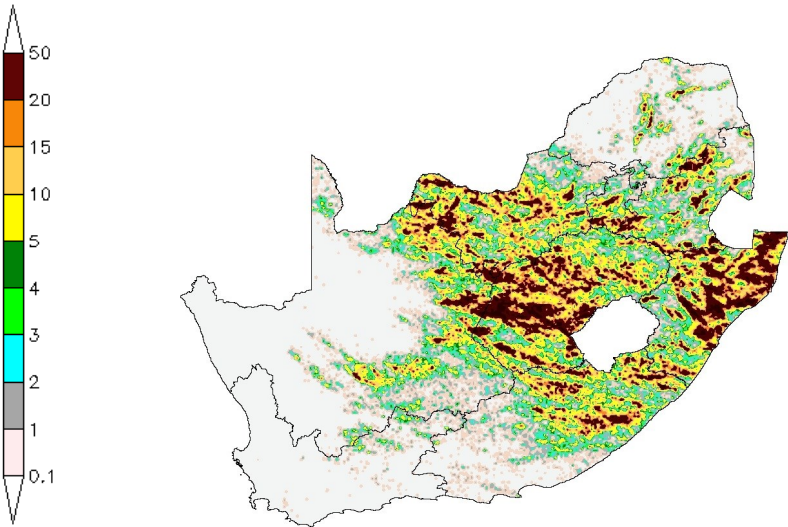
Minimum temperature deviations



SPI

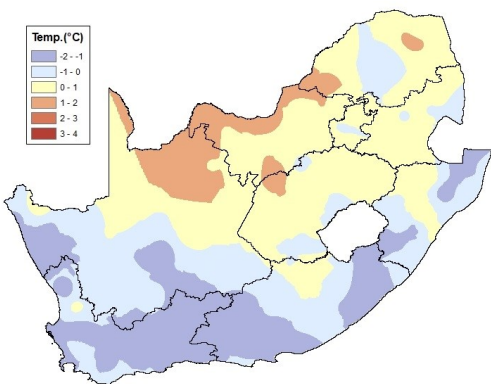


Lightning-stroke density

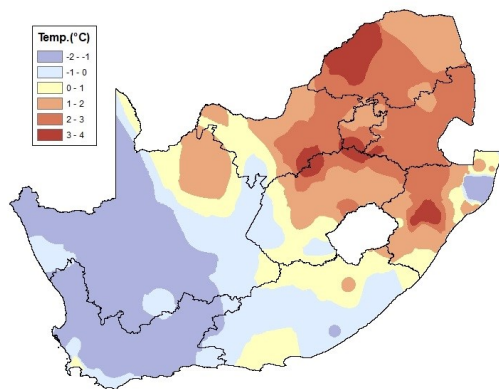


May 2023

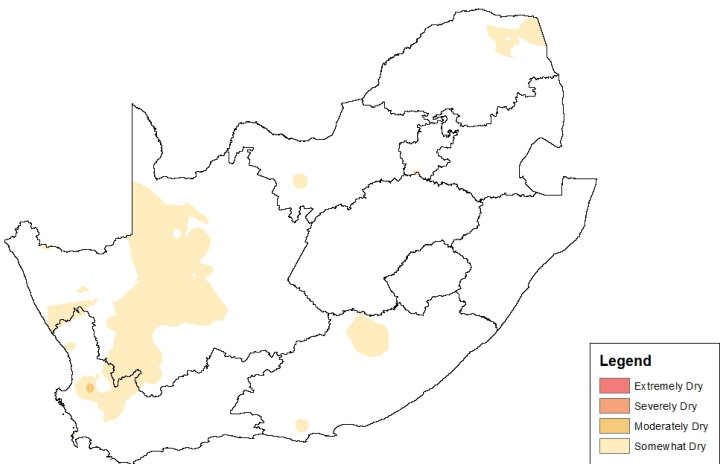
Maximum temperature deviations



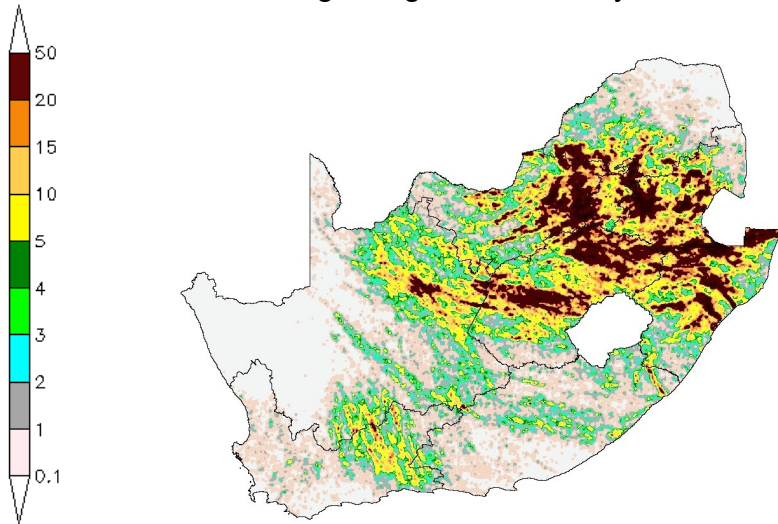
Minimum temperature deviations



SPI

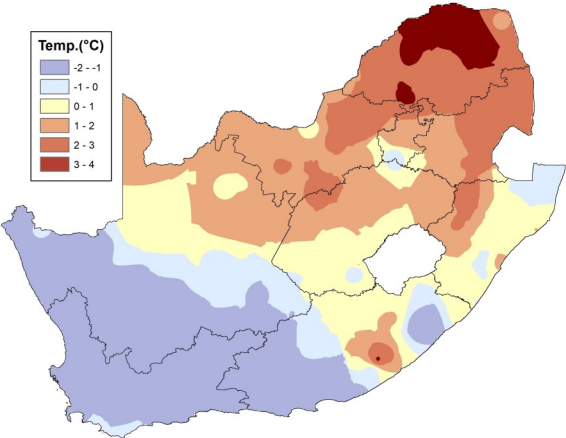


Lightning-stroke density

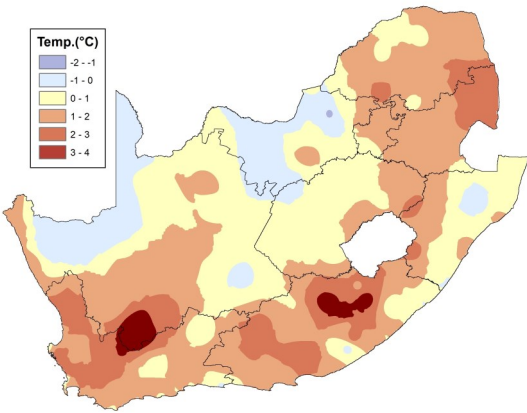


June 2023

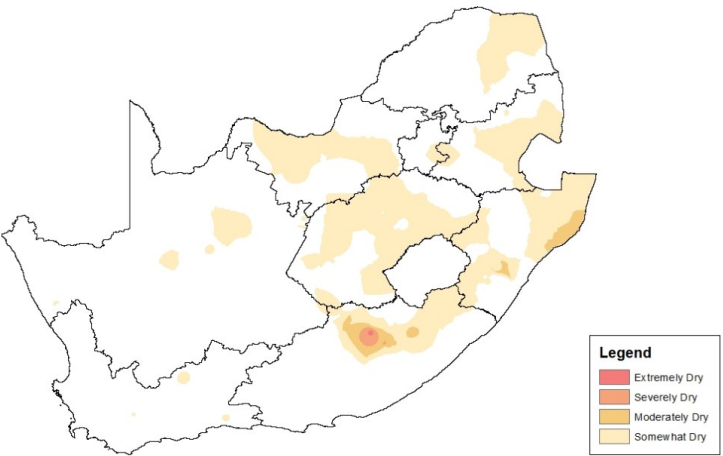
Maximum temperature deviations



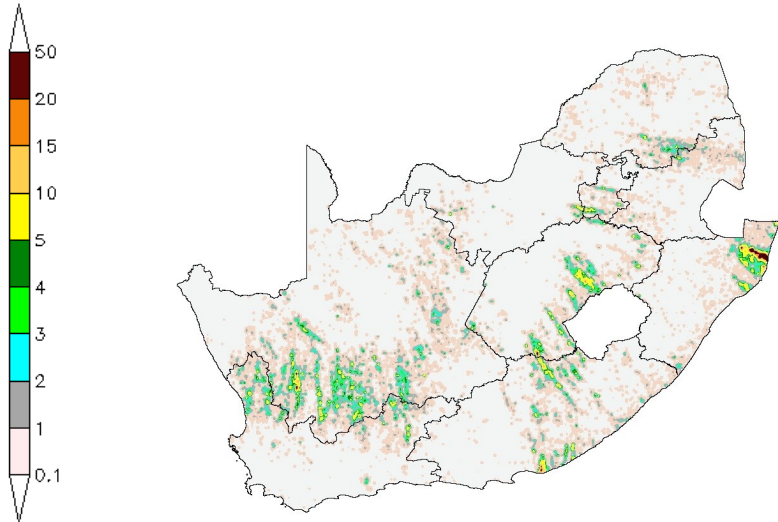
Minimum temperature deviations



SPI

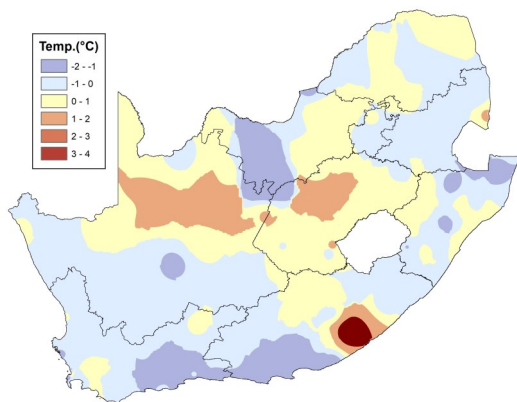


Lightning-stroke density

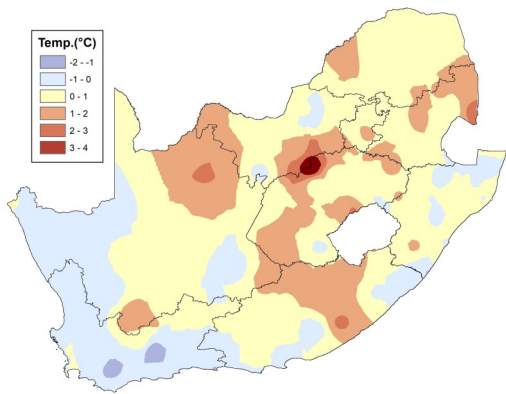


July 2023

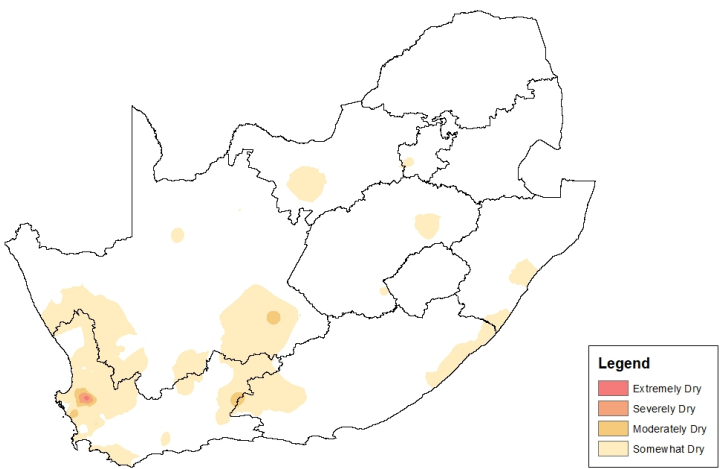
Maximum temperature deviations



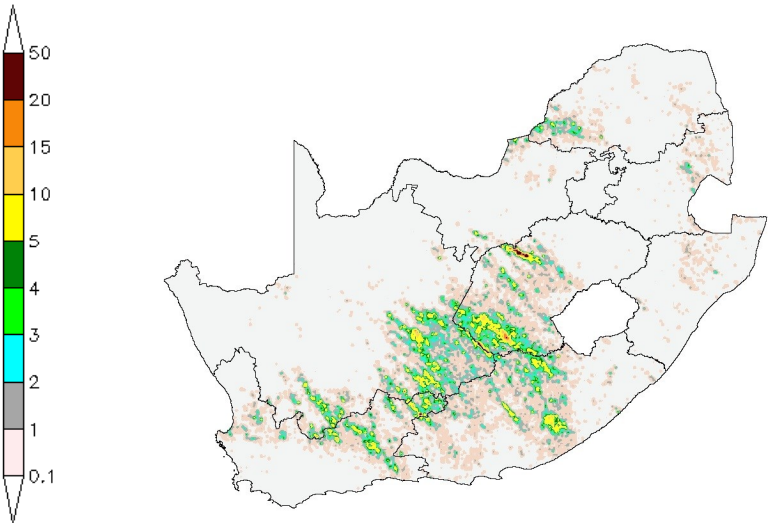
Minimum temperature deviations



SPI

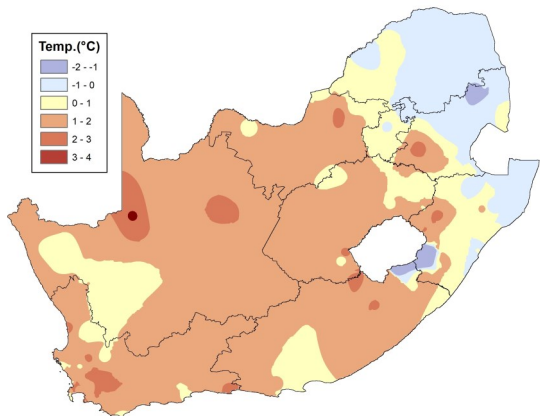


Lightning-stroke density

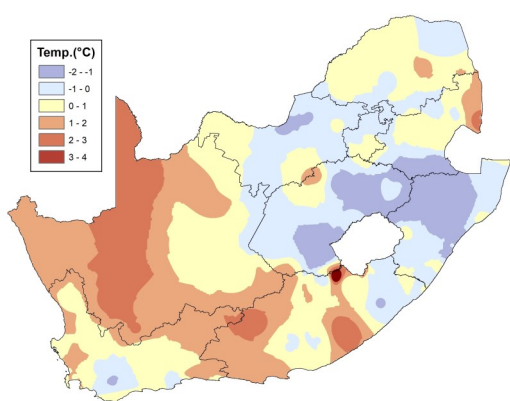


August 2023

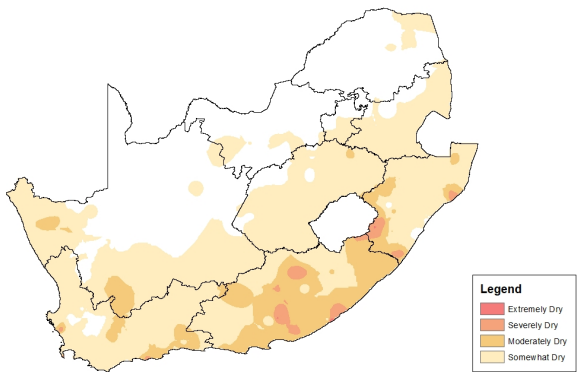
Maximum temperature deviations



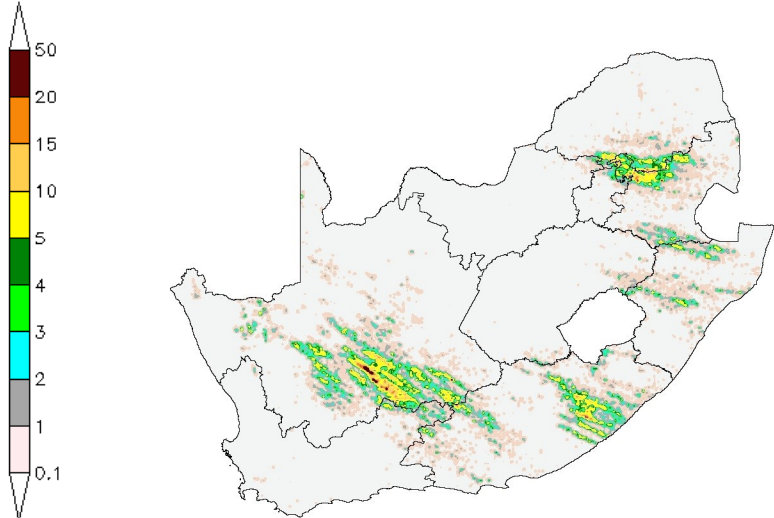
Minimum temperature deviations



SPI

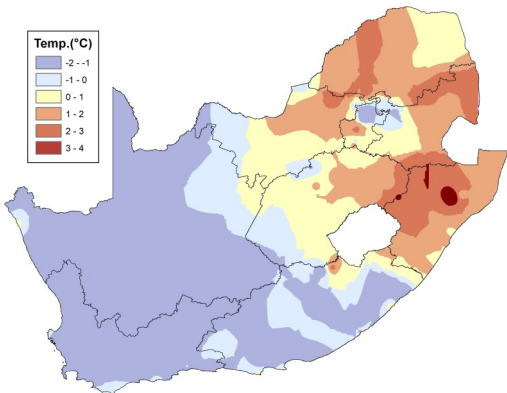


Lightning-stroke density

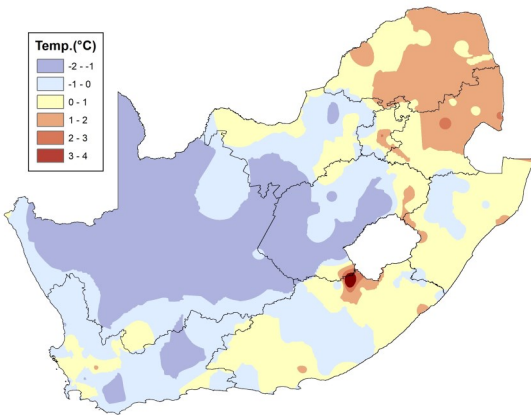


September 2023

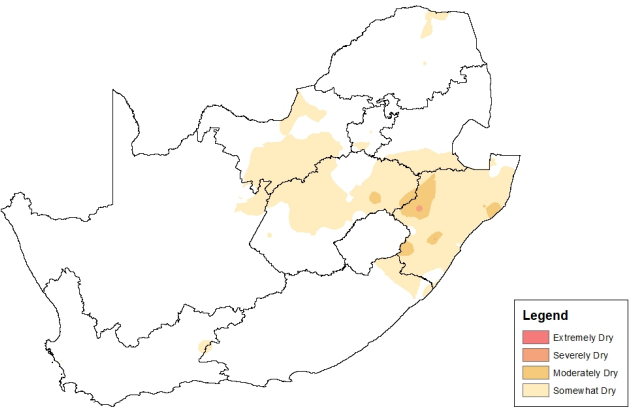
Maximum temperature deviations



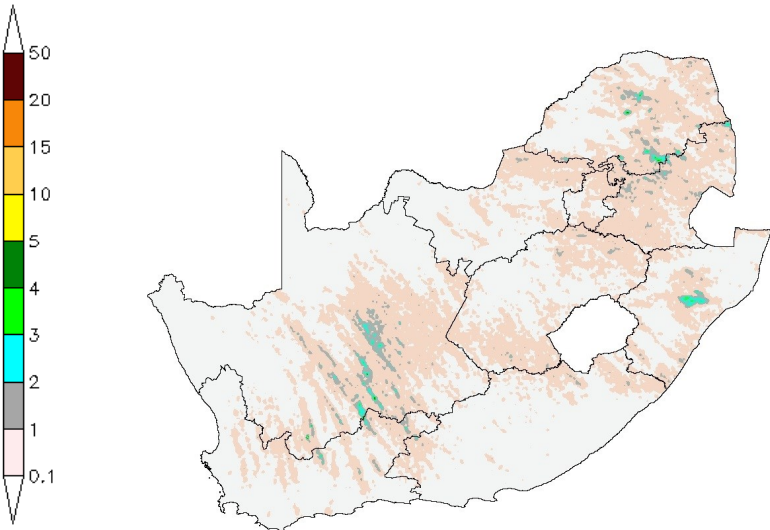
Minimum temperature deviations



SPI

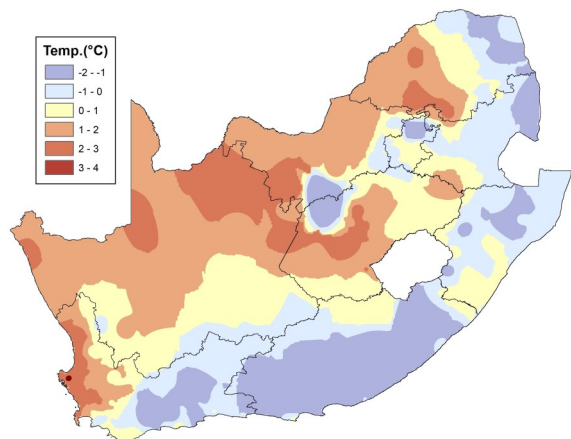


Lightning-stroke density

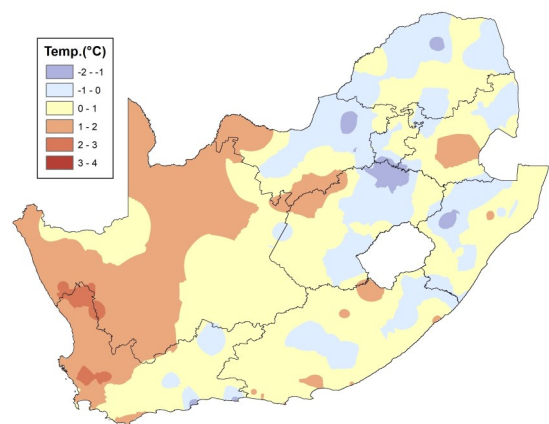


October 2023

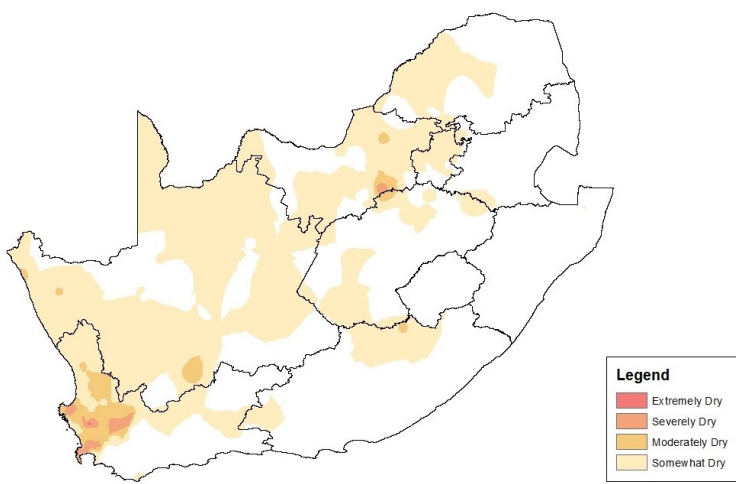
Maximum temperature deviations



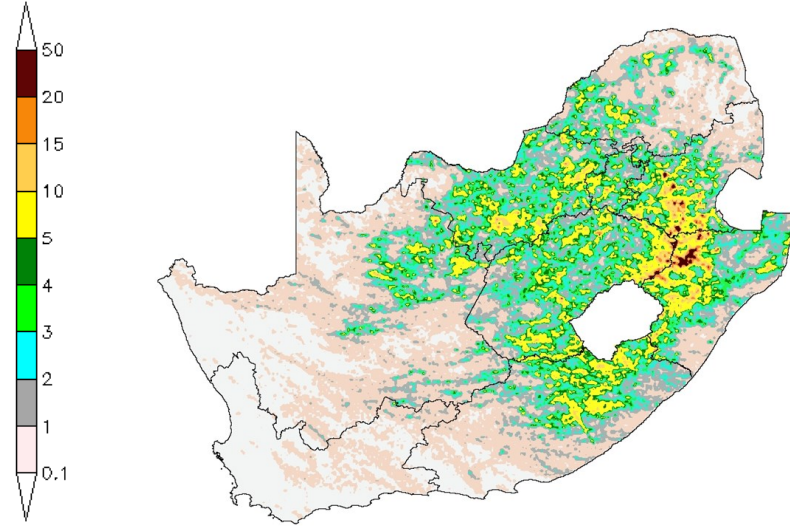
Minimum temperature deviations



SPI

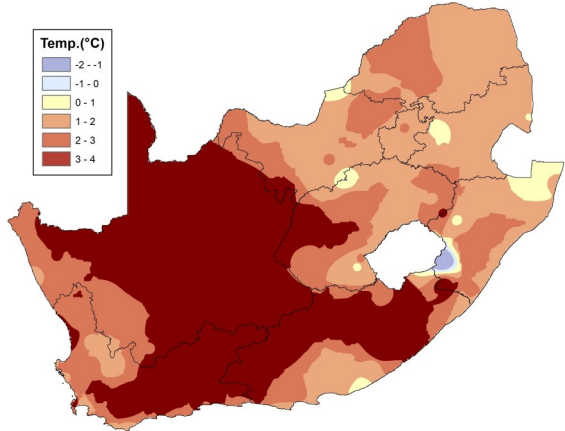


Lightning-stroke density

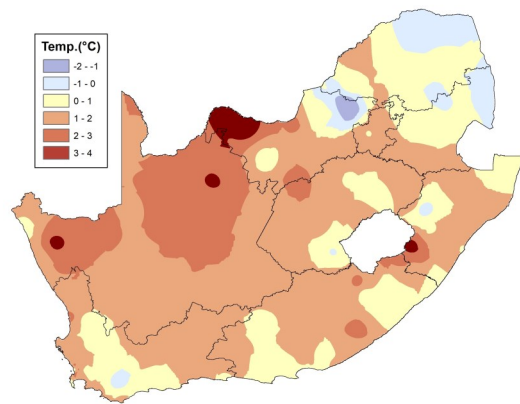


November 2023

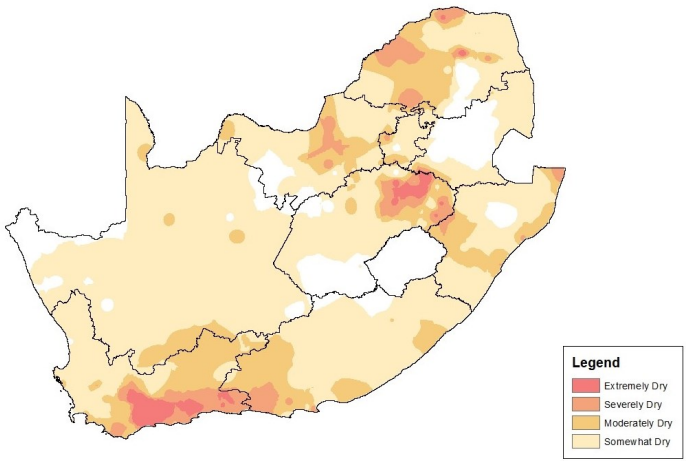
Maximum temperature deviations



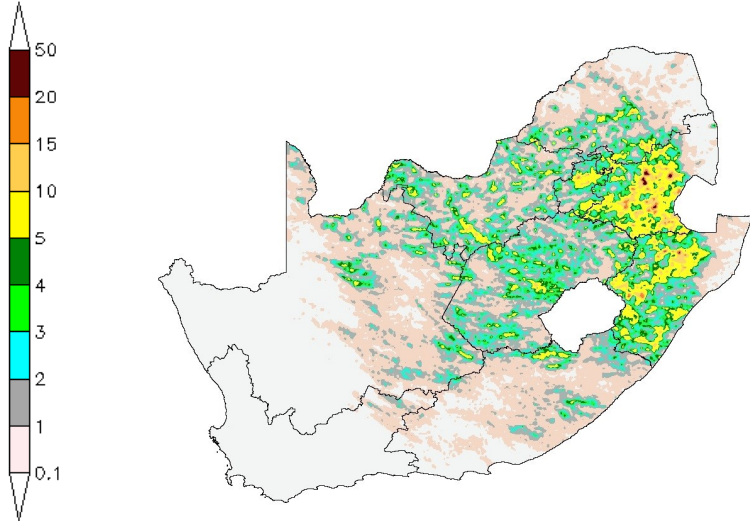
Minimum temperature deviations



SPI

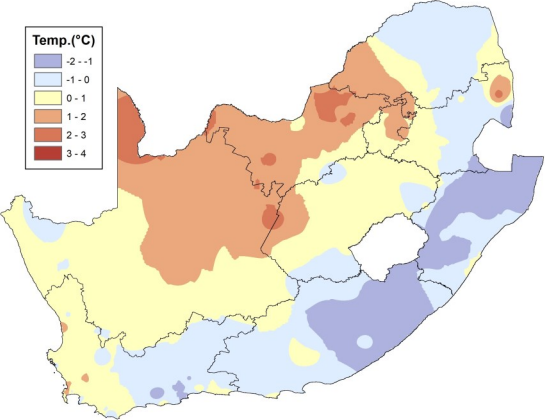


Lightning-stroke density

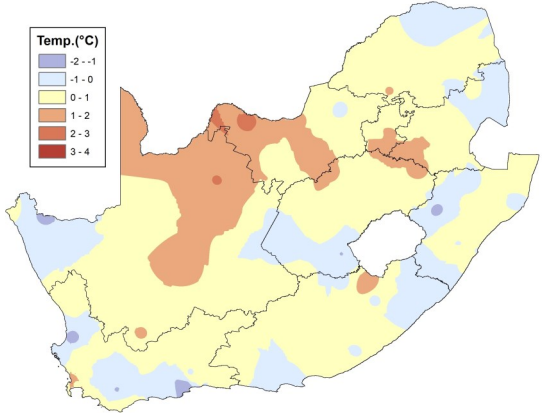


December 2023

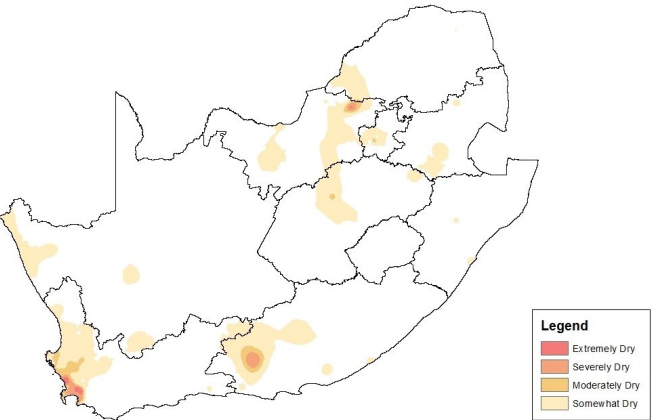
Maximum temperature deviations



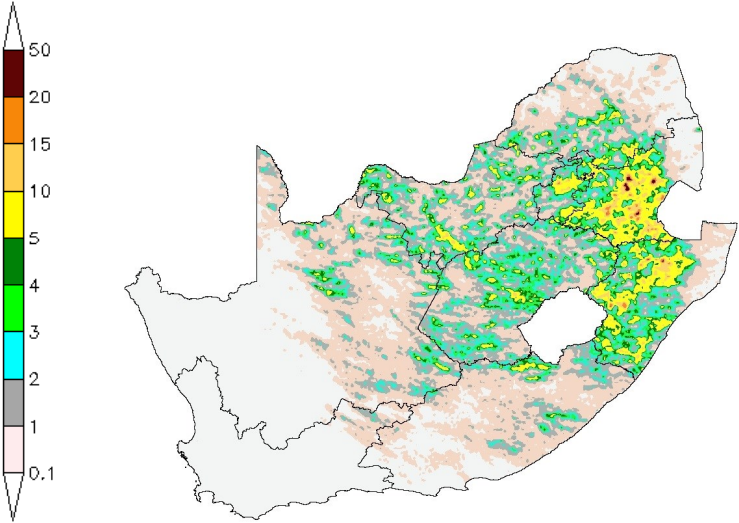
Minimum temperature deviations



SPI



Lightning-stroke density



Sunshine in the main centres

The daily average sunshine in the main centres of Cape Town, Port Elizabeth, Durban and Johannesburg is presented in the table below. Compared to the 1991—2020 average all of the large cities experienced close to normal expected sunshine.

City	Daily average sunshine in 2023	Daily average sunshine (1991—2020)
Cape Town	8,2	8,5
Port Elizabeth	7,2	7,6
Durban	6,6	6,5
Johannesburg	8,5	8,8