

Trends in Temperature and Precipitation and Sea level rise, 2022



WORLD
METEOROLOGICAL
ORGANIZATION



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Introduction

- Temperature and Precipitation are major meteorological parameters that affect a lot of the socio-economic sectors.
- They determine the climates, in this era of climate change, variation in temperature and precipitation often lead to a shift in the climate anomalies.
- Over the recent years, the trends of temperature and precipitation has have been varied in Africa and under warming atmosphere, the intensity and frequency of the variations will continue to increase.

Global climate context

The global average surface temperatures have been rising since the industrial revolution.

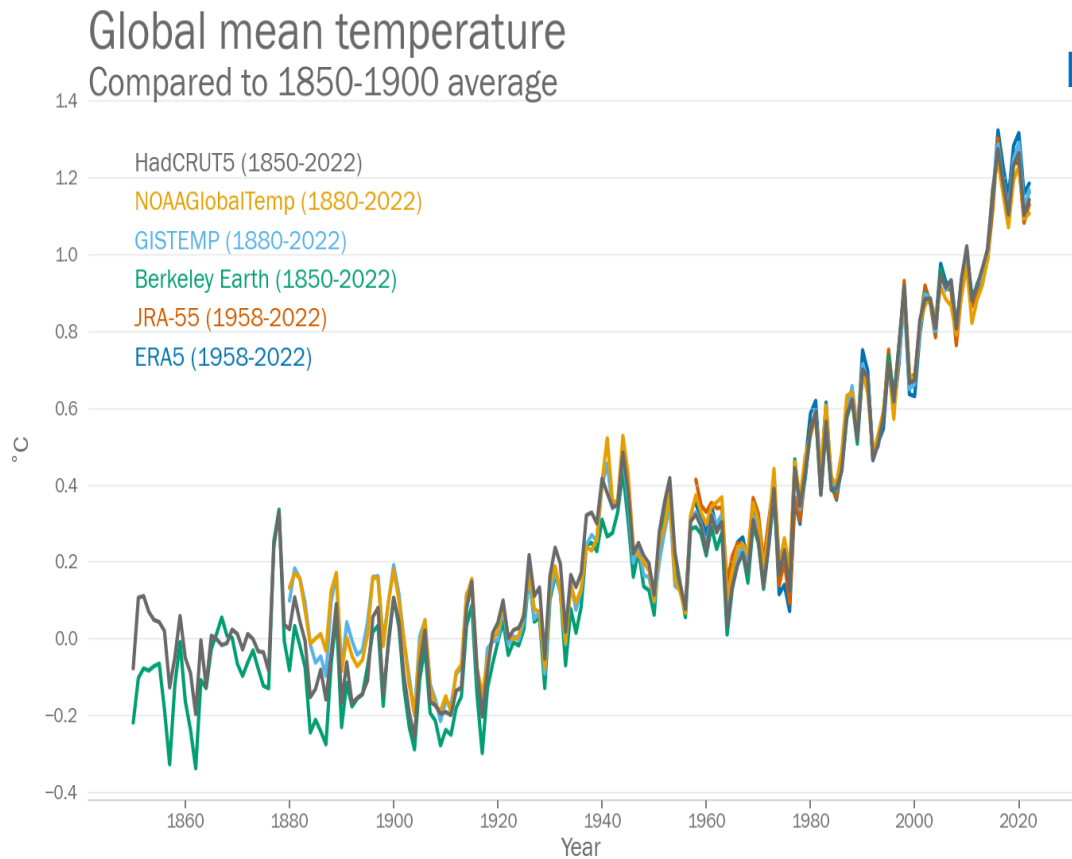
While natural variability plays a part, evidence indicates that human activities, especially emissions of greenhouse gases are greatly responsible for making the earth warmer, especially from the 1950s.

Global Climate Center data sets provide the annual global mean temperature

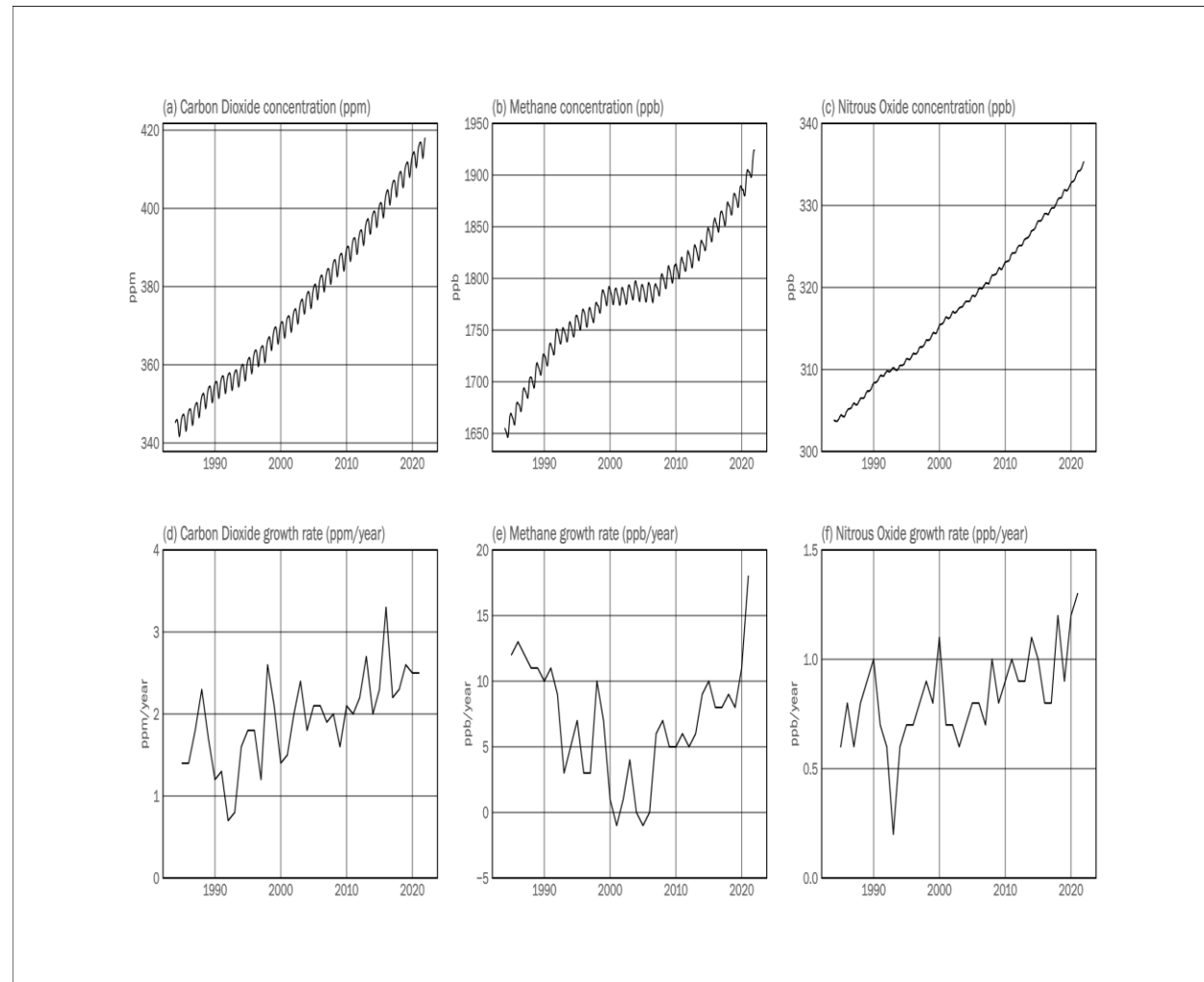
Though warming has not been uniform across the globe, the upward trend in the globally averaged temperatures show that more areas are warming than cooling.

Global temperature trends

Driven by; GHGs such as CO₂, CH₄, N₂O among others



Annual Global mean temperature anomalies (°C, difference from the 1850-1900 average) from 1850-2022. Data are from the following six data sets: Berkeley Earth, ERA5, GISTEMP, HadCRUT5, JRA-55, NOAAGlobalTemp.

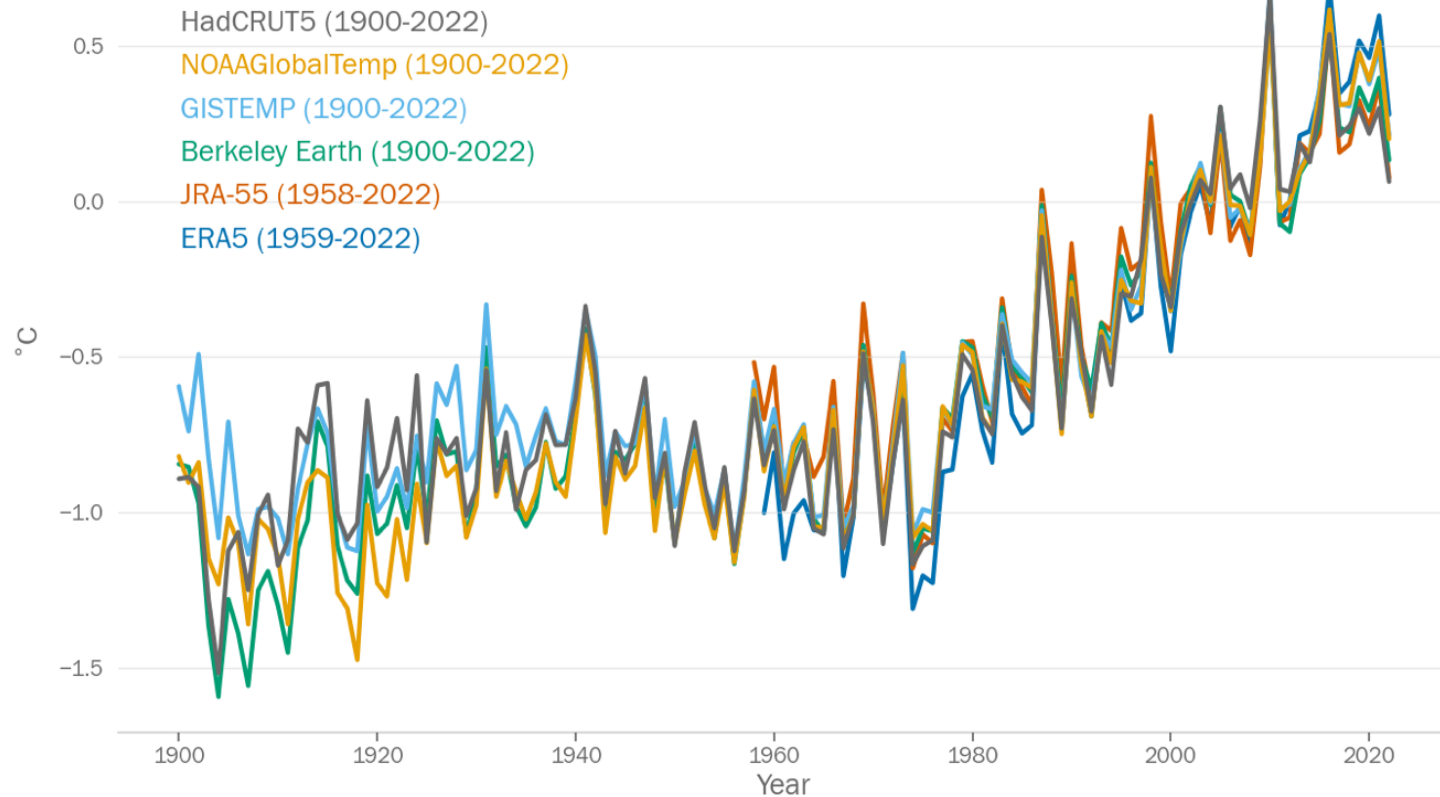


The global annual mean near-surface temperature in 2022 was 1.15 °C [1.02 °C to 1.28 °C] above the 1850–1900 pre-industrial average making it the 5th or 6th Warmest year

Atmospheric concentrations of the three major greenhouse gases reached new record observed highs in 2021, with levels of carbon dioxide (CO₂) at 415.7 ppm, methane (CH₄) at 1908 ppb and nitrous oxide (N₂O) at 334.5 ppb respectively.

Over the past two decades, the ocean warming rate has increased, and the ocean heat content in 2022 was the highest on record.

WMO RA | Africa annual temperature Compared to 1991-2020 average



Annual mean temperature for Africa (°C, difference from the 1991-2020 average) from 1900-2022. In the last 123 years, 2022 ranked among top 20 warmest years

Regional temperature trends

- Annual mean temperature trend in Africa is similar to the global trend but with some notable differences
- Average temperature in the continent has increased slightly more than the global average and has been increasing over the past four decades.



For global mean temperature, the Sixth Assessment Report (AR6) of IPCC uses the **reference period 1850–1900 for calculating anomalies** in relation to pre-industrial levels



Regional temperature anomalies can also be expressed **relative to the reference period 1961–1990**



However, this pre-industrial reference period **cannot be used in all regions** as a baseline for calculating regional anomalies, due to insufficient reliable long-term data for estimating region-specific averages prior to 1900.



This reference period **1961–1990 is recommended by WMO** for assessing long-term temperature change.

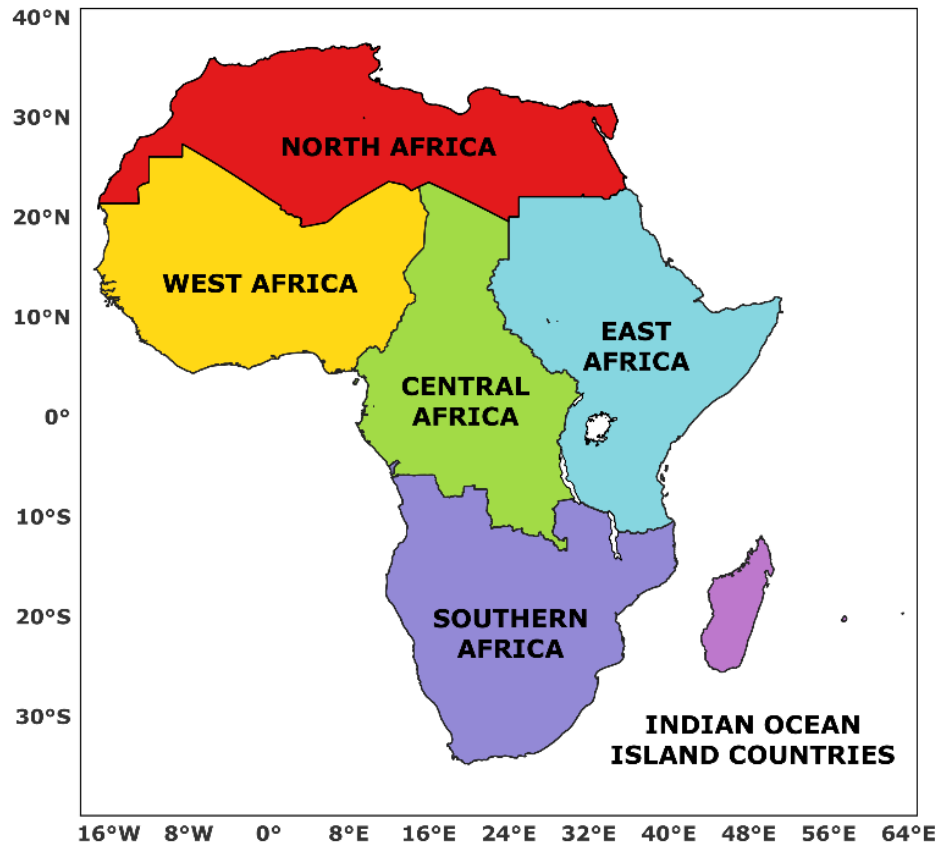


Instead, the **1991–2020 climatological standard normal reference period is used** for computing anomalies in temperature and other indicators



In the report 2022, exceptions to the use of these baseline periods for the calculation of anomalies, **where they occur, are explicitly noted.**

Temperature trends in Africa Sub regions



African continued to observe a warming trend, with an average rate of change of **+0.3 °C/decade between 1991 and 2022**, compared to +0.2 °C/decade between 1961 and 1990.

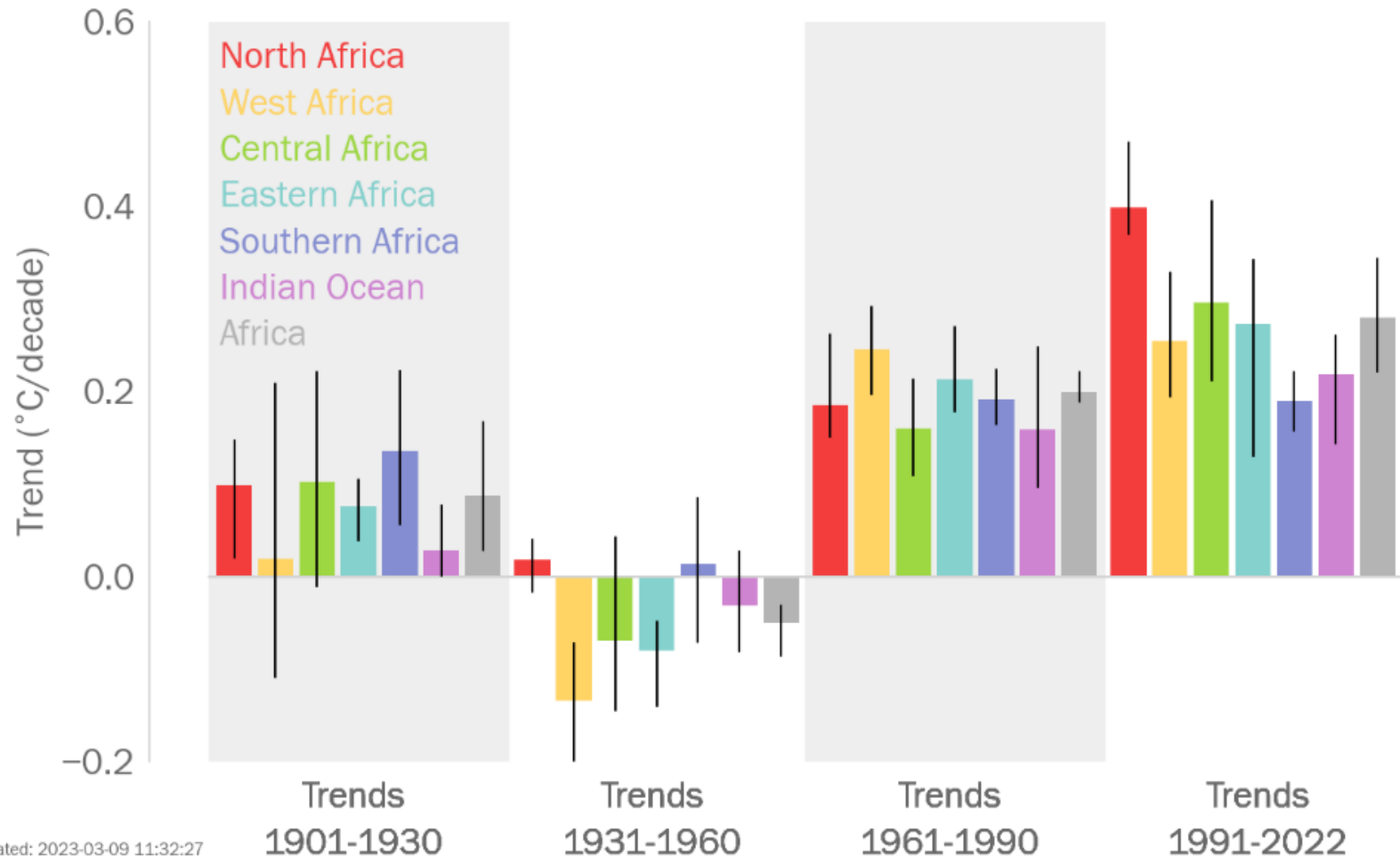
The recent trend has increased slightly more than the global average of **+0.2 °C/decade for the 1991-2022** period.

All six African sub-regions **also experienced an increase in temperature trend in the past 60 years** compared to the period before 1960.

The warming has **been most rapid in North Africa**, with +0.4 °C/decade between 1991 and 2022, compared to +0.2 °C/decade between 1961 and 1990.

Southern Africa experienced the least warming trend compared to the other sub-regions, with +0.2 °C/decade between 1991 and 2022.

Regional trends Africa



Trends in the area average temperature in °C/decade for the six African sub-regions

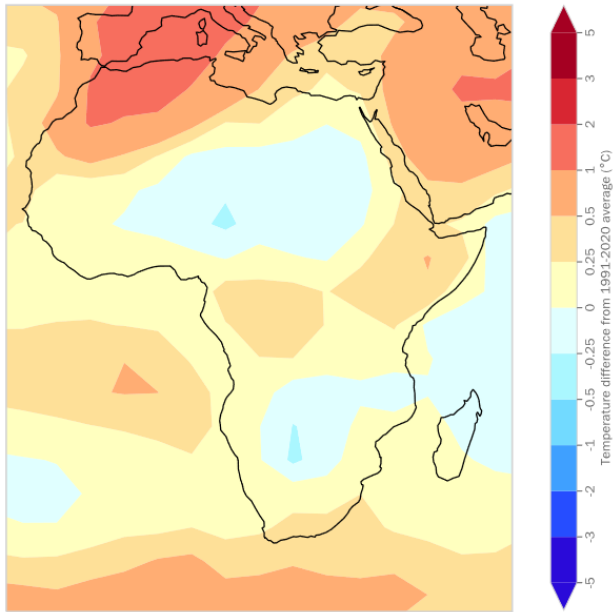
Regional Temperature Anomalies

In 2022, most of Africa recorded temperatures above the 1991-2020 average, with exception Southern Africa

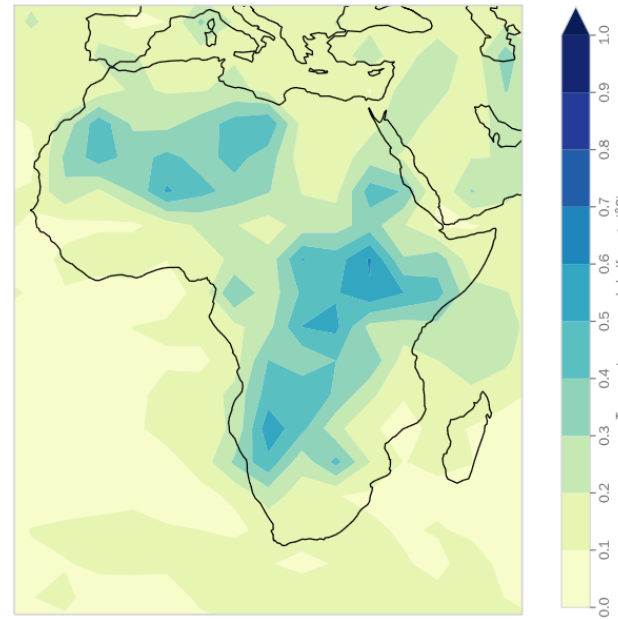
The highest temperature anomalies were recorded across north-western Africa, especially in Morocco and northern Algeria.

North Africa recorded the highest 2022 temperature anomalies compared to other African sub-regions, at 0.50 °C above the 1991-2020 average and 1.40 °C above the 1961-1990 average

Annual Temperature Anomalies 2022



Annual Temperature Anomalies Uncertainty 2022



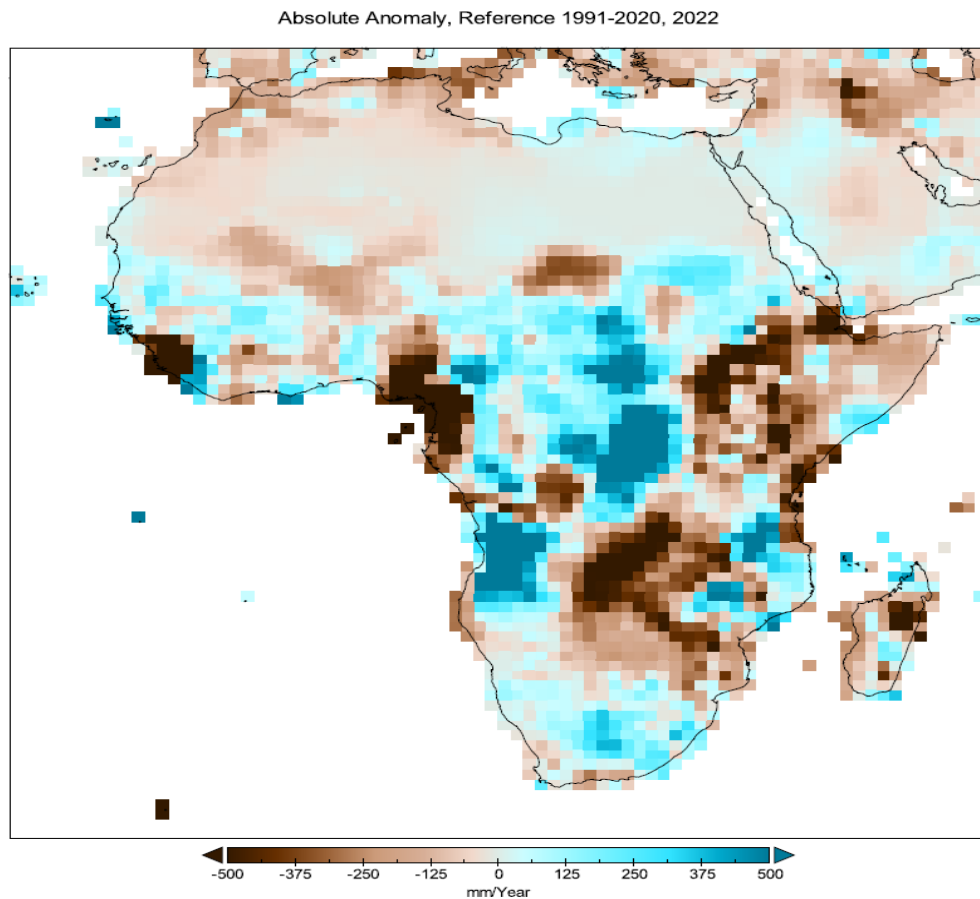
South Africa had a mean annual temperature 0.4 °C above the average of 1991-2020 reference period, making 2022 the fourth hottest year on record in the country since 1951.

Cameroon reported one of the coldest years in the past twenty years, with a temperature anomaly of -0.24 °C for 2022 compared with the 1991-2020 average

Near-surface air temperature anomalies in °C for 2022 relative to the 1991–2020 and 1961–1990 reference periods. The range of anomalies among these data sets is given in the brackets.

Sub-regions	1991 – 2020	1961 – 1990
North Africa	0.50 °C [0.41 °C – 0.65 °C]	1.40 °C [1.24 °C – 1.64 °C]
West Africa	0.03 °C [-0.18 °C – 0.14°C]	0.71 °C [0.39 °C – 0.87°C]
Central Africa	0.13 °C [-0.04 °C – 0.37 °C]	0.80 °C [0.60 °C – 1.11 °C]
East Africa	0.14 °C [-0.02 °C – 0.28 °C]	0.90°C [0.69 °C – 1.12 °C]
Southern Africa	0.01 °C [-0.17 °C – 0.12 °C]	0.61°C [0.42 °C – 0.75 °C]
Indian Ocean Island countries	0.03 °C [-0.04 °C – 0.10 °C]	0.60 °C [0.49 °C – 0.70 °C]
Africa	0.16 °C [0.06 °C – 0.28 °C]	0.88 °C [0.74 °C – 1.07 °C]

Precipitation trends in Africa



Precipitation anomalies were above the 1991-2020 average in **north-eastern Africa**, large part of **West Africa**, **eastern Sahel region**, **Sudan**, and parts of South Africa. Regions with a marked rainfall deficit included the **western part of North Africa**, the **Horn of Africa**, parts of **Southern Africa**, and **Madagascar**

Precipitation anomalies in mm for 2022. **Blue areas indicate above-average precipitation**, while brown areas indicate **below-average precipitation**. The reference period is 1991-2020.

Over North and West Africa; Below-normal annual rainfall prevailed over much of the area, especially in Morocco, Algeria, Tunisia, and western Libya. The Gulf of Sidra and northern Egypt experienced above-average precipitation, with excesses over 50 mm

West Africa **experienced a delayed onset of its monsoon rainy season** for the second consecutive year, although the monsoon season **rainfall totals were higher than normal.**

Southern Mauritania, western Senegal, central Mali, western Burkina Faso, south-eastern Niger, southern Ghana, southern Togo, eastern Benin and parts of Nigeria **received enhanced rainfall.** Northern Mali, south-eastern Guinea, parts of Côte d'Ivoire and portions of Nigeria **observed suppressed precipitation**

In Central Africa, large positive precipitation anomalies (more than 200 mm above the average) were recorded in central and southern Chad, northern Cameroon, Central African Republic, parts of Congo and the Democratic Republic of the Congo.

Negative precipitation anomalies of over 350 mm were observed across south-western Cameroon, Equatorial Guinea, Gabon and portions of the southern part of the Democratic Republic of the Congo.

In East Africa, much of Sudan, southern Tanzania recorded wetter-than-normal conditions, with rainfall in some areas above the highest decile.

Ethiopia, northern Uganda, Somalia and Kenya recorded drier-than-normal conditions, with rainfall in some areas below the lowest decile

Most of Ethiopia, Kenya and Somalia experienced five consecutive below-average rainfall seasons, leading to an exceptional multi-seasonal

In Southern Africa, rainfall surpluses of over 200 mm were experienced across central and western Angola. The central South Africa and Mozambique observed enhanced rainfall with areas in the highest 10% of the climatology period.

Rainfall deficits of over 200 mm were observed across eastern Angola, Zambia, Zimbabwe and southern part of South Africa, with areas in the lowest 10% of the climatology

In the West Indian Ocean, suppressed rainfall resulted in negative anomalies of over 200 mm in eastern Madagascar and Seychelles. Rainfall surplus was recorded in the Comoros and some local areas in Madagascar. Intense rainfall as a result of the tropical weather systems at the beginning of the year allowed some easing of the long-term drought that affected the southern Madagascar.

SEA LEVEL RISE

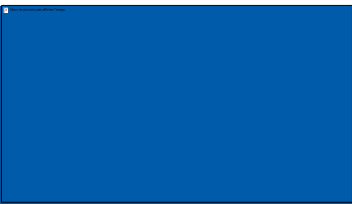
Since the early 1990s, sea levels have been routinely measured globally and regionally by high-precision altimeter satellites.

Over the past three decades, the global mean sea level has risen at an average rate of 3.4 ± 0.3 mm/yr and has accelerated in response to ocean warming and land ice melt.

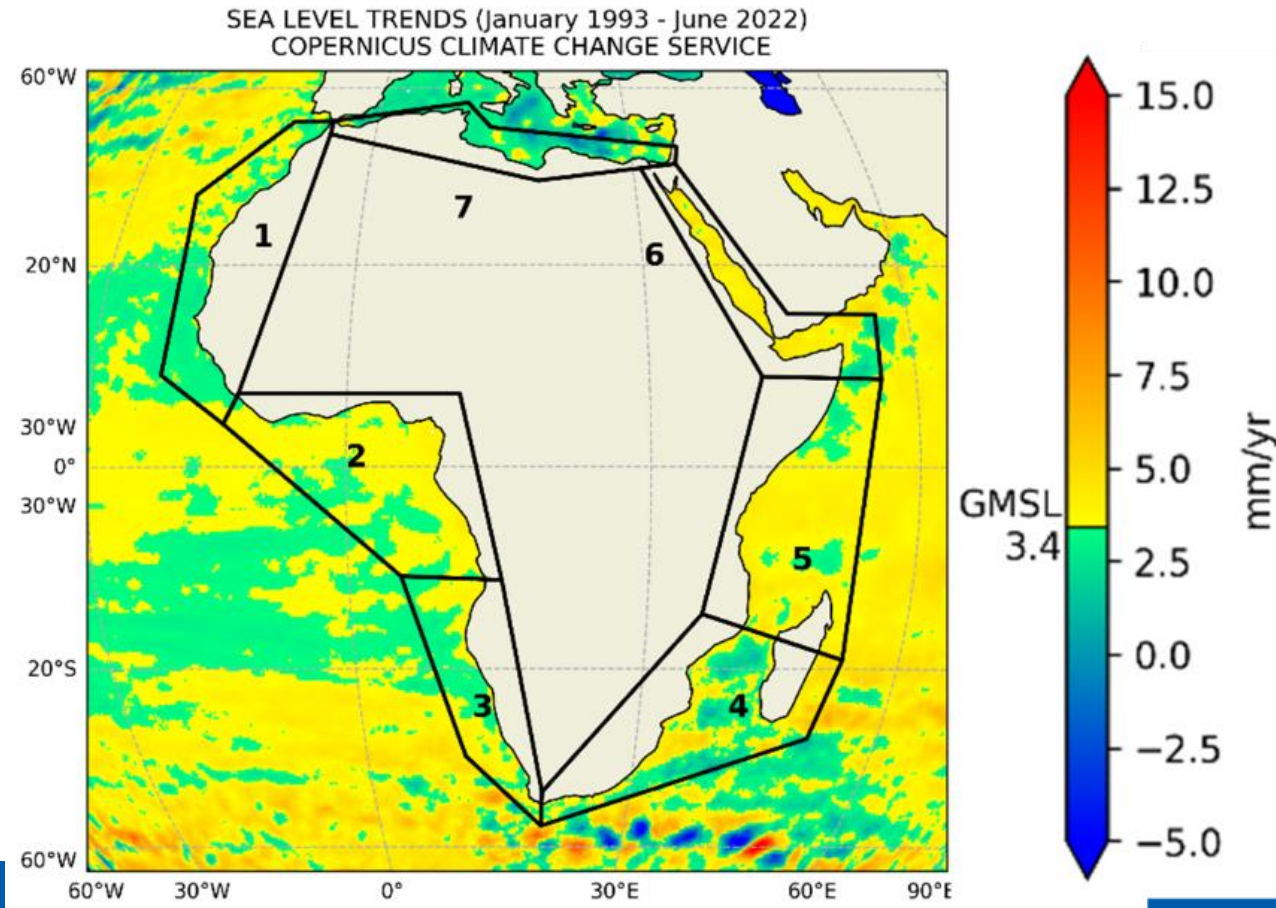
The sea-level rise was measured in the 7 coastal regions of Africa from January 1993 to June 2022. The rate of sea-level rise in these coastal regions does not differ much from the global mean over the same period.

The highest rate of sea-level rise around Africa has been observed along the coastal areas of the Red Sea, with a rate of 3.7 mm/yr, followed by the western Indian Ocean, where the rate exceeds 3.6 mm/yr. The rate of sea-level rise is lower than the global mean over the southern Mediterranean Sea, with a rate of about 2.4 mm/yr.

Coastal regions of the western Indian Ocean and the Red Sea are subject to significant interannual variability. For instance, significant variations occur during ENSO events.



The 2022 report considers 7 coastal regions of Africa, as compared to the 2021 report which considered 12 coastal regions. The number of coastal regions has been reduced to simplify the division and follow the circulation zones of ocean currents.



Box number	Ocean	Rate of sea level rise (mm/yr)
1	Northeast Atlantic	3.2 ± 0.1
2	Tropical Atlantic	3.4 ± 0.1
3	Southeast Atlantic	3.3 ± 0.1
4	Southwest Indian Ocean	3.2 ± 0.1
5	Western Indian Ocean	3.6 ± 0.2
6	Red Sea	3.7 ± 0.2
7	Southern Mediterranean Sea	2.4 ± 0.2
-	Global	3.4 ± 0.3

Thank you



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