

TECHNICAL NOTE No.10

THE PRELIMINARY STATE OF AFRICAN CLIMATE IN 2019

Updated: October, 2019

Prepared by	Dr. Bob Alex Ogwang	Climate Expert
Contributed by	Mr. Hubert Kabengela Dr. Cheikh Dione	Climate Experts
Contributed by	Dr. Andre Kamga	Director General, ACMAD

OUTLINE

- 1. Introduction**
- 2. Data, Tools and Methods**
- 3. Continental assessment**
 - Temperature
 - Precipitation
- 4. Regional assessment**
 - Temperature
 - Precipitation
- 5. Tropical cyclones in the southwestern Indian Ocean**
- 6. Significant Hazards in 2019 and their impacts**

1. INTRODUCTION

This technical note provides a summary of the main weather and climate events that have occurred in Africa in 2019. The major weather and climate events are documented using observed precipitation and temperature data as well as information provided by various UN agencies, news papers and NMHSs across the African continent.

The Technical Note on the state of climate of Africa is issued yearly by ACMAD. The present Technical Note for year 2019 was jointly supported by NORCAP-NRC & ACMAD.

2. DATA, TOOLS AND METHODS

2.1 Data

Temperature:

- GHCN_CAMS (NOAA)
- Period : Jan1950-Sep2019
- Reference period: 1981-2010
- Data source:

http://iridl.ldeo.columbia.edu/SOURCES/NOAA/NCEP/CPC/GHCN_CAMS/gridded/deg0p5/temp/

Precipitation:

- CAMS OPI
- Period: Jan1981-Sep2019
- Reference period: 1981-2010
- Data source:

https://iridl.ldeo.columbia.edu/SOURCES/NOAA/NCEP/CPC/CAMS_OPI/v0208/mean/prcp/

The information about extreme weather events in 2019 were collected from several sources such as UN agencies, Disaster Risk Management departments across the continent and News Papers.

2.2 METHODS

Temperature Anomalies:

- Temperature anomalies (annual, seasonal & monthly) are calculated as the departure from the mean, computed based on the period: 1981-2010 which is a WMO reference period. The annual temperature anomalies are ranked from the warmest to the coolest.

•Precipitation in percentage of average in 2019

Precipitation totals in 2019 (year and season) are divided by their corresponding mean values and expressed as a percentage.

Note:-Temperature analyses are based on January 1950-September 2019 mean values.

-Precipitation analyses are based on January 1981-September 2019 values.

2.3 Tools

Several open source tools were used to generate this technical note:

- Climate Data Operators (CDO, <https://code.zmaw.de/projects/cdo>). CDO was used to compute the temperature anomalies and changes in precipitation.
- QGIS (<http://www.qgis.org/fr/site>), which is an open source version of GIS software. QGIS was used in this technical note to plot the maps of temperature anomalies and the changes in rainfall.
- R software (<https://www.r-project.org/>). Similar to CDO and QGIS, R is a free software. Here we used it to plot the ranked temperature anomalies and calculate the trend in temperature.
- OriginLab software is used to plot the annual cycle of temperature.

3. CONTINENTAL ASSESSMENT

3.1 Temperature

3.1.1 Ranked temperature

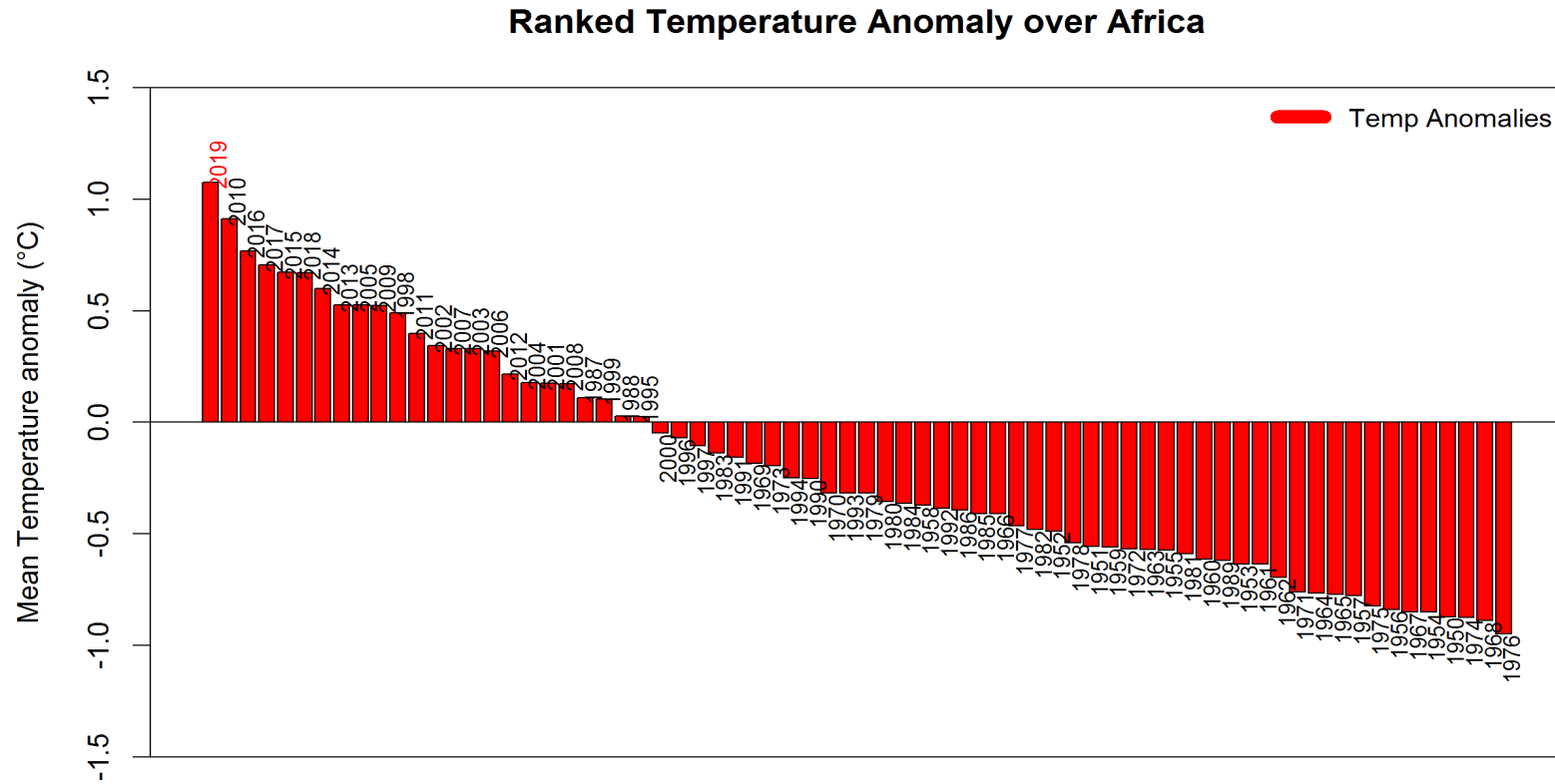


Figure 1: Ranked mean Jan-Sep temperature anomalies (°C) over Africa for 1950- 2019 period, relative to 1981-2010. Data source: http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.GHCN_CAMS/.gridded/.deg0p5/.temp/

- 2019 is so far the warmest year on record since 1950. It is warmer than the record breaking year 2010 by 0.41°C
- 2018 is the 6th warmest year on record since 1950.
- 2010 is now the 2nd warmest year on record over the African Landmass based on Jan-Sep data

3.1.2 Trend in temperature over Africa since 1950

Temperature Anomaly over Africa

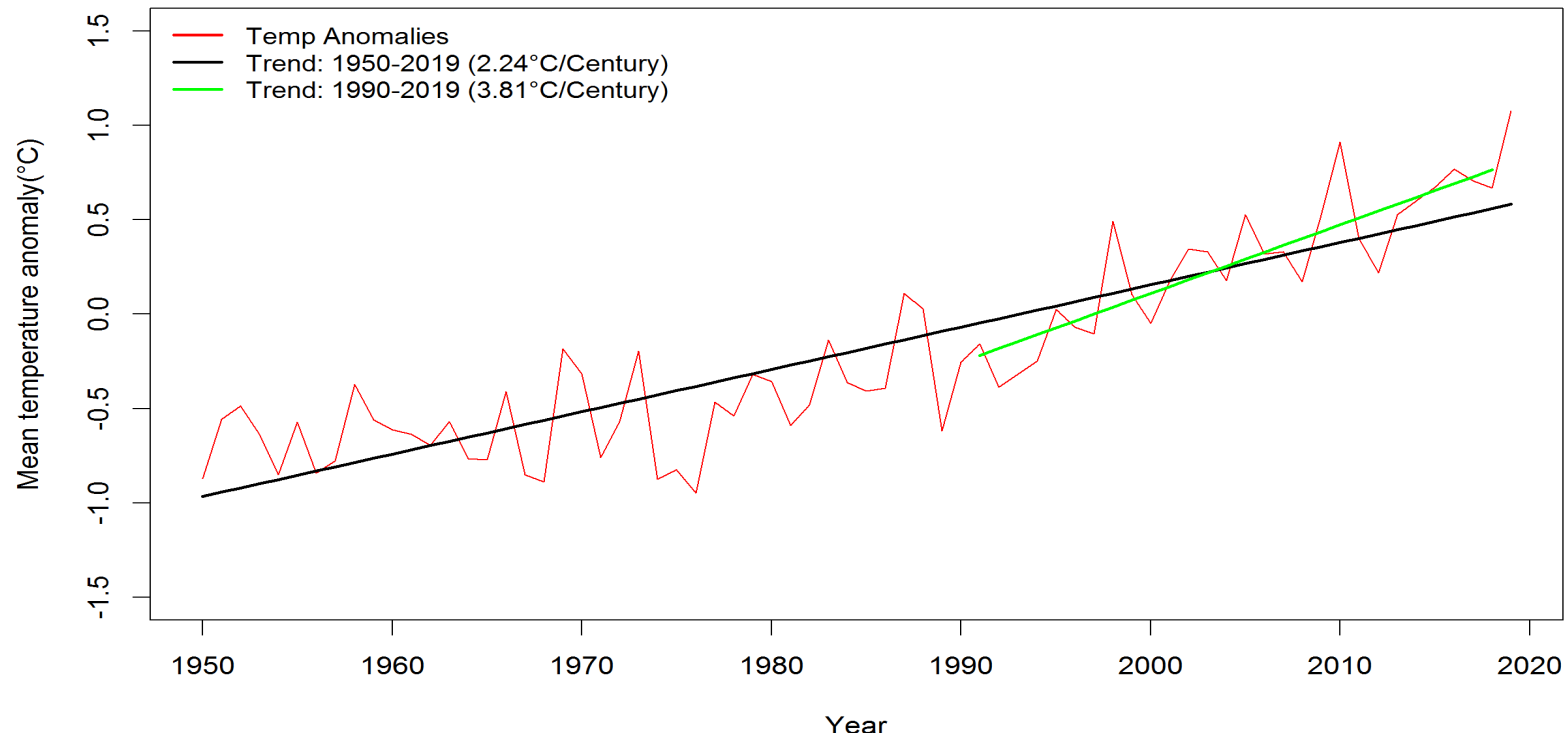
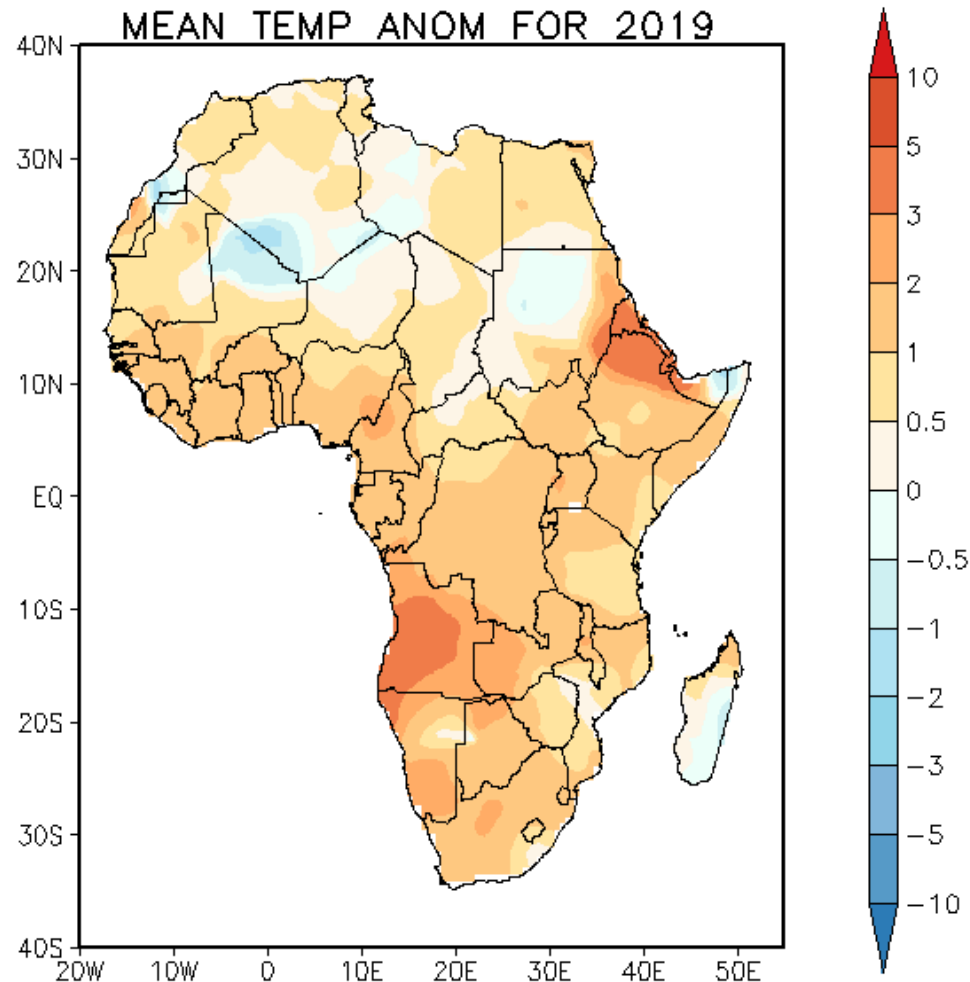


Figure 2: Trends in the mean Jan-Sep temperature anomalies ($^{\circ}\text{C}$) over Africa for 1950-2019 period. Data source: http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.GHEN_CAMS/.gridded/.deg0p5/.temp/

There is an increasing trend in temperature at the continental level since the 1950s (Rate: 2.24°C per century) . The rate of increase is much higher from the 1990s (Rate: 3.81°C per century).

3.1.3 Spatial temperature anomalies in 2019



- Positive temperature anomalies were generally observed over most parts of Africa, with extremely warm conditions ($\geq +3$ °C) recorded over the Horn of Africa (Eritrea, Djibouti and northern Ethiopia) and Angola.
- Negative anomalies (less warming situation) were recorded over Madagascar, southern Algeria and northern Mali and Sudan.

Figure 3: Mean Jan-Sep temperature anomalies (°C) over Africa in 2019. Data source: http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.GHCN_CAMS/.gridded/.deg0p5/.temp/

3.1.4 Monthly temperature anomalies

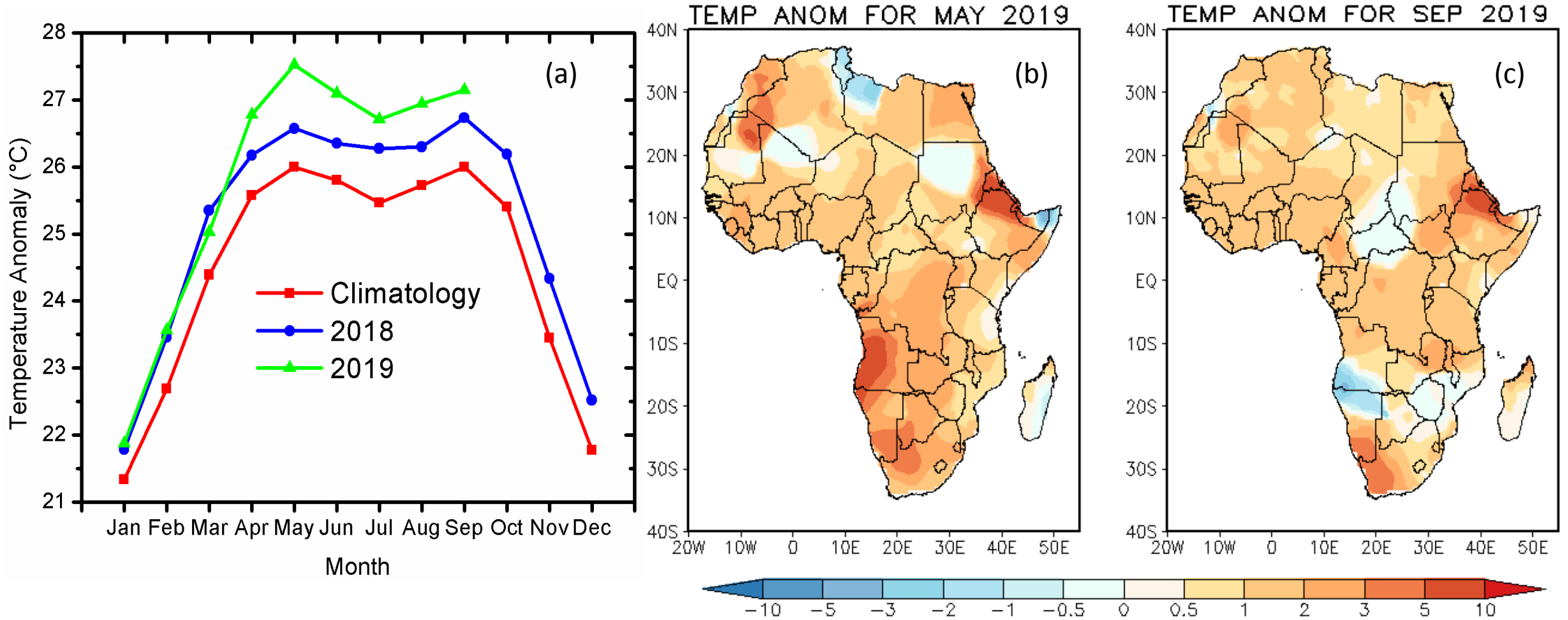
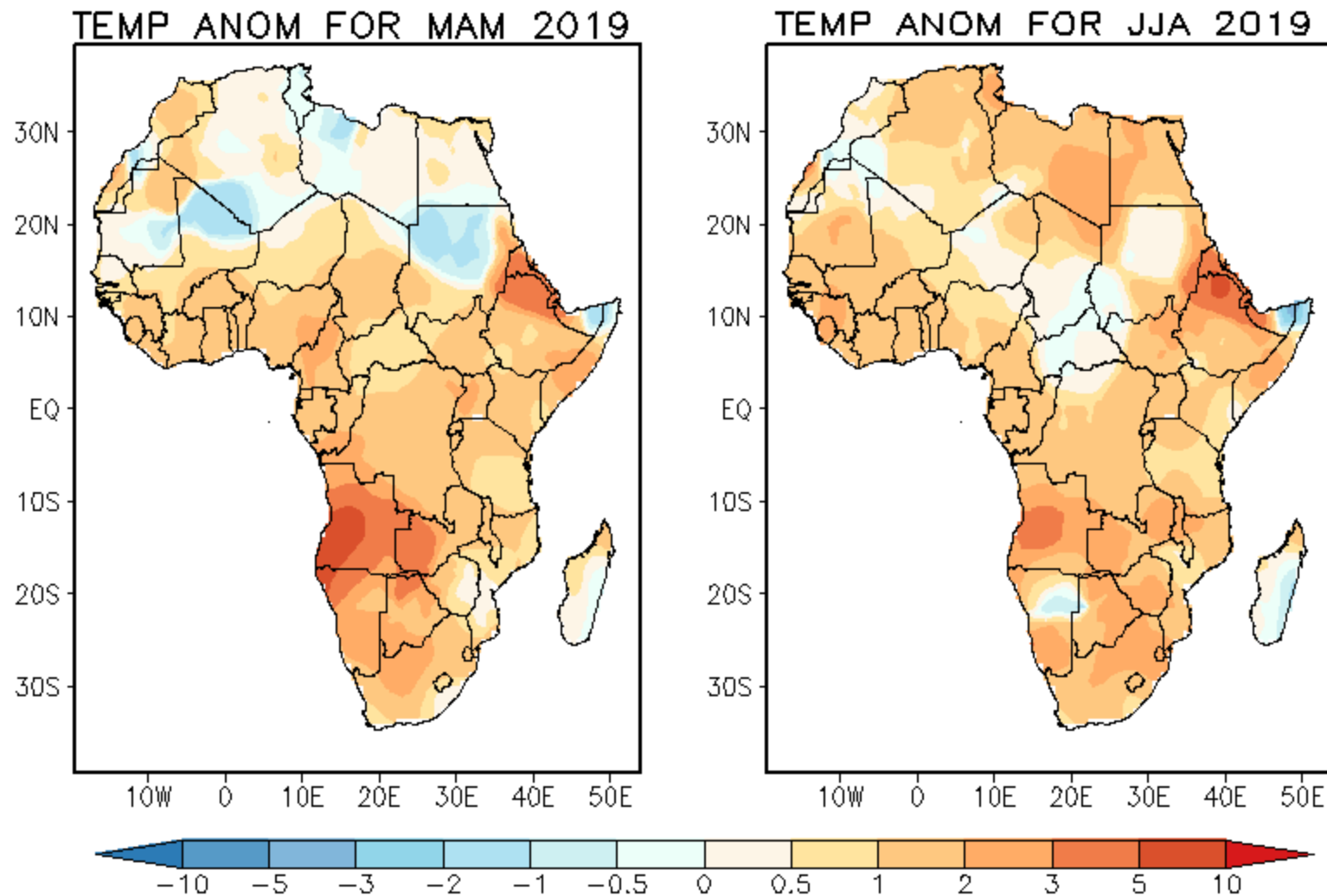


Figure 4: (a) Mean annual cycle of temperature (°C) during 2019 and 2018 and climatology based on the period: 1981-2010. The mean temperature anomalies for the warmest months of 2019 are: (b) May and (c) September. Data source:

http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.GHCN_CAMS/.gridded/.deg0p5/.temp/

May and September are the warmest months so far in 2019 and the warmest on record since 1950, with temperature anomalies of 1.53 & 1.15 °C, respectively

3.1.5 Mean seasonal temperature anomalies in 2019



The MAM season was characterized by higher temperature anomalies over northeastern Ethiopia, Eritrea and Angola.

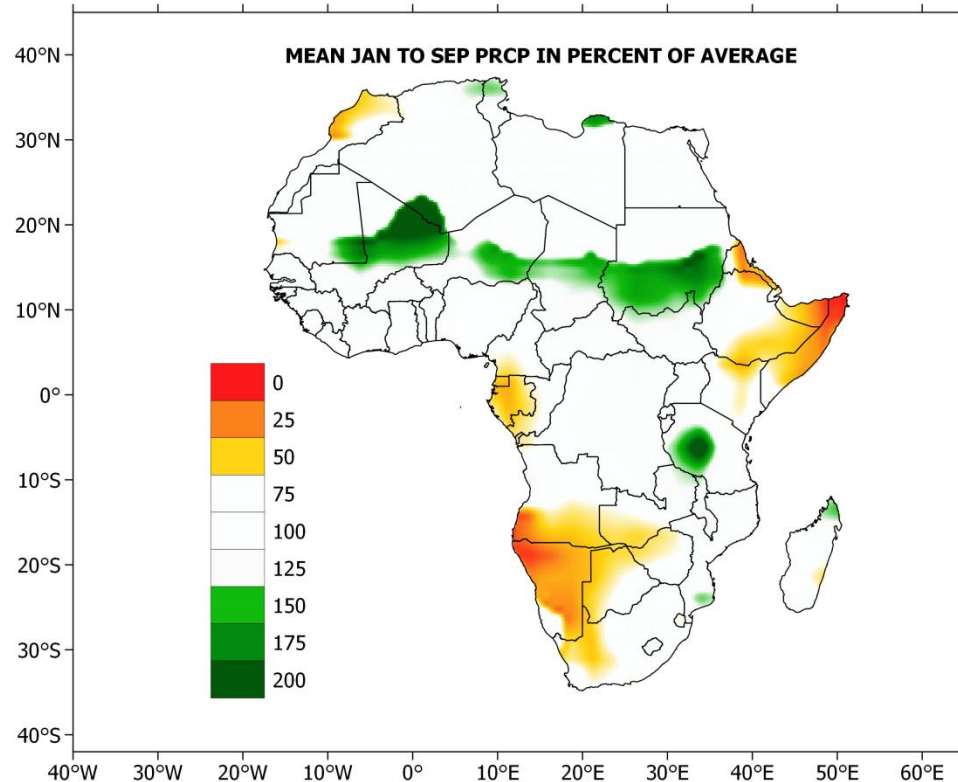
Lower temperatures were observed over northern Mali, southern Algeria, northwestern Libya, parts of Madagascar and northern Somalia. during MAM.

During JJA season, higher temperature anomalies were recorded over central Angola, northeastern Ethiopia and Eritrea.

Figure 5: Mean seasonal temperature anomalies ($^{\circ}\text{C}$) in Africa during March-April-May (MAM) and July-August-September (JAS) for 2019. Data source: http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.GHCN_CAMS/.gridded/.deg0p5/.temp/

3.2 Precipitation

3.2.1 Mean January to September precipitation



- Well above average precipitation conditions were observed over eastern Mauritania, Mali, parts of Niger, Chad and southern Sudan.
- Below average precipitation conditions were recorded over northern Somalia, Eritrea, Djibouti, Gabon, Namibia and southern Angola.

• **Figure 6 :** Mean Jan to Sep precipitation in percent of average over Africa in 2019. Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAM5_OPI/.v0208/.mean/.prcp/

3.2.2 MAM and JAS precipitation

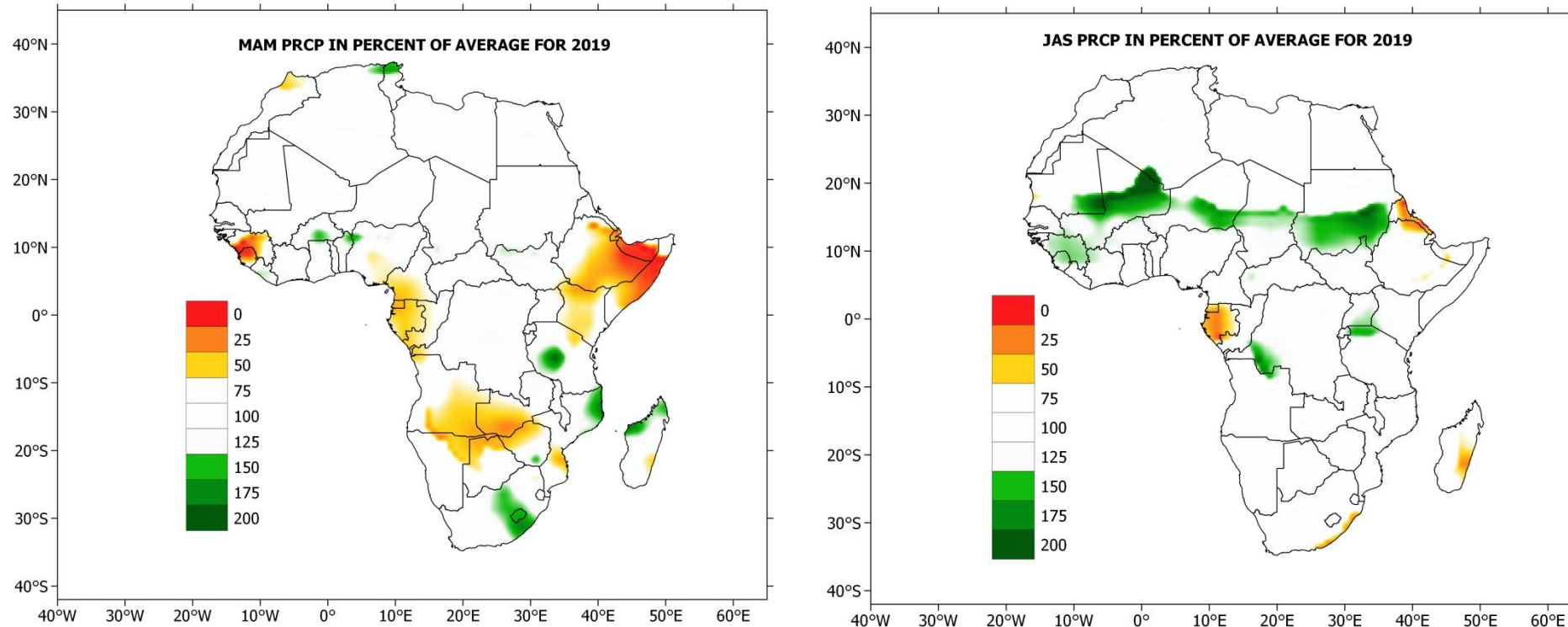


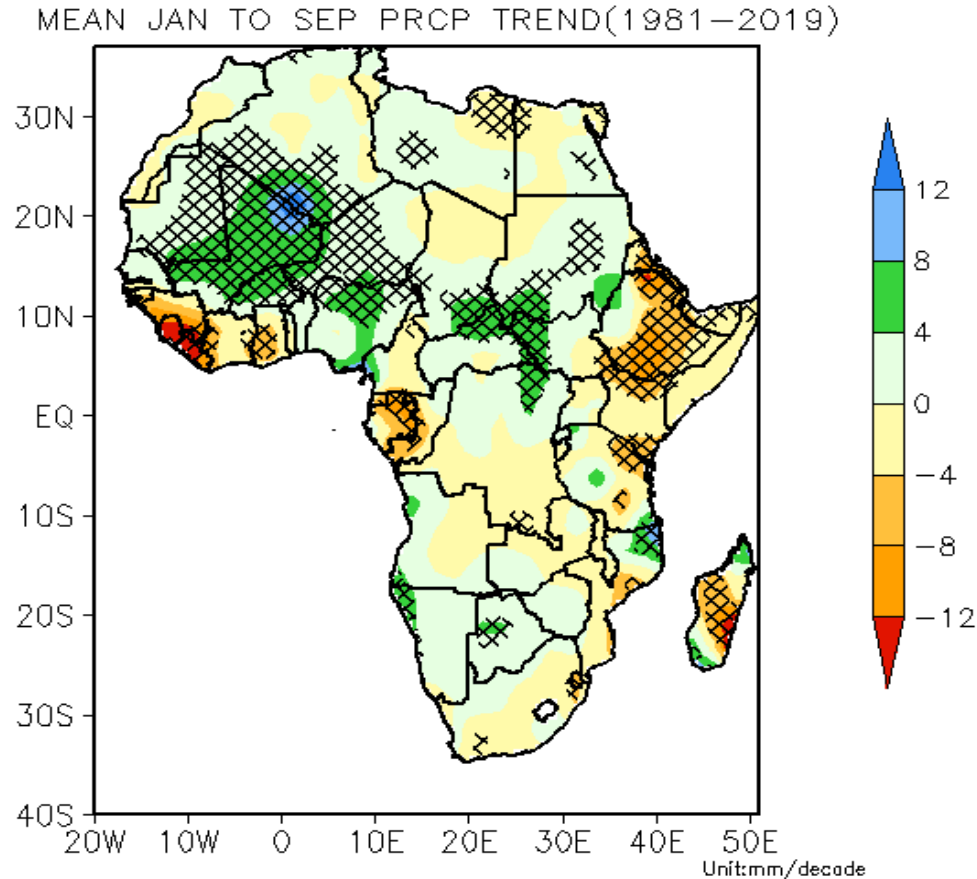
Figure 7a: Precipitation in Percent of average during MAM and JAS seasons over Africa in 2019. Data source:

https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAMS_OPI/.v0208/.mean/.prcp/

- During MAM, dry conditions were experienced over Somalia, eastern Ethiopia, Kenya, Angola, southern Zambia, Sierra Leone and Guinea.
- Above average precipitation was observed over central South Africa and Tanzania, northeastern Mozambique and extreme northwestern Madagascar during this period.
- During JAS season, wet conditions were mainly observed over the Sahel, extreme western DRC and southeastern Uganda. Precipitation deficit were recorded over Gabon, Eritrea and eastern Madagascar.

3.2.3 Mean Precipitation trend

Mean Jan to Sep Precipitation trend



- There is a significantly increasing trend of the mean Jan-Sep precipitation over most parts of Sahel.
- Decreasing trends are significant over parts of the Horn of Africa, central Madagascar, Gabon and Sierra Leone.

Figure 7b : Mean Jan-Sep precipitation trend in Africa over the period from 1981-2019. Hatched areas show significant increase (positive) or decrease (negative) at 95% level of confidence. Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAM5_OPI/.v0208/.mean/.prcp/

Seasonal Precipitation trend

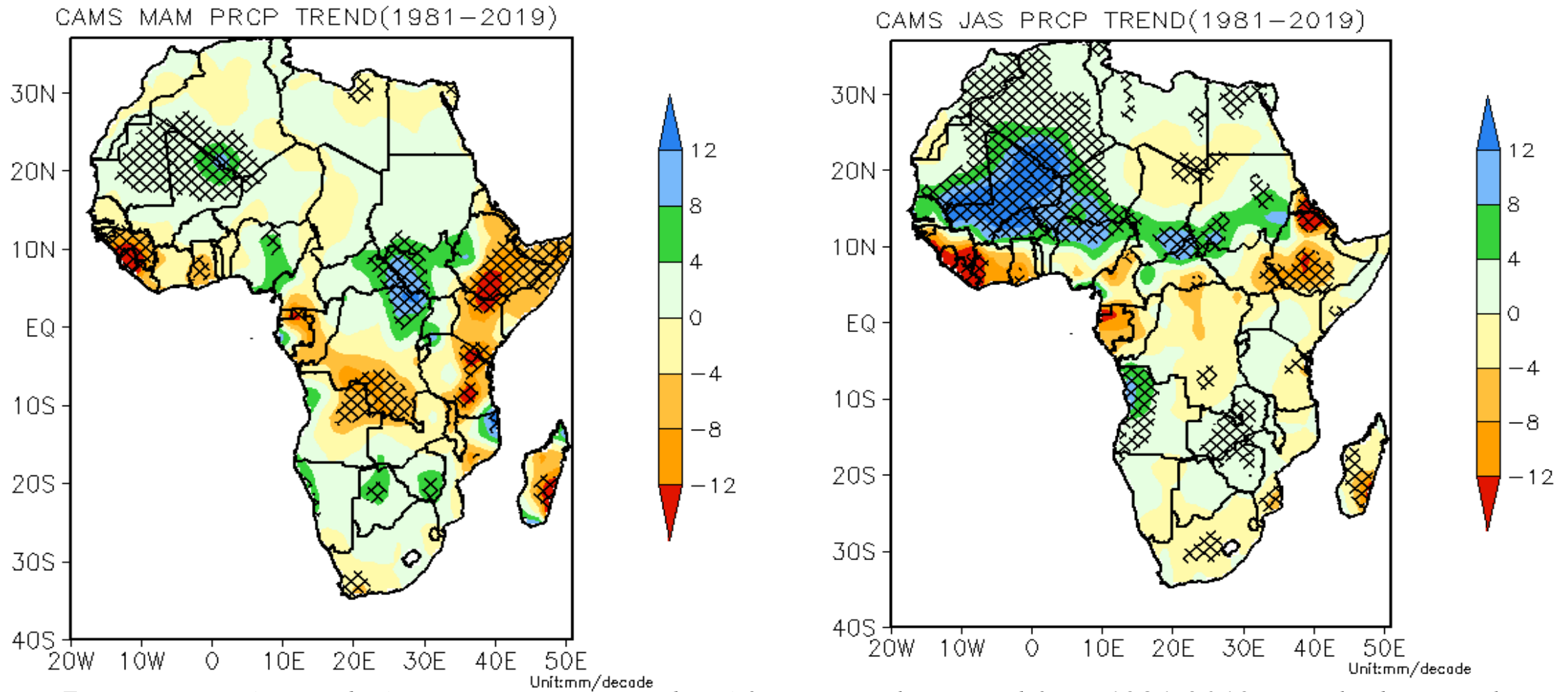


Figure 7c : Mean MAM and JAS precipitation trend in Africa over the period from 1981-2019. Hatched areas show significant increase (positive) or decrease (negative) at 95% level of confidence. Data source:

https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAMS_OPI/.v0208/.mean/.prcp/

In general, there is a significant increase in precipitation over the Sahel. Significantly decreasing trends are evident over eastern Africa, central Madagascar, southern DRC and northeastern Angola for MAM season.

4. REGIONAL ASSESSMENT

4.1 Temperature

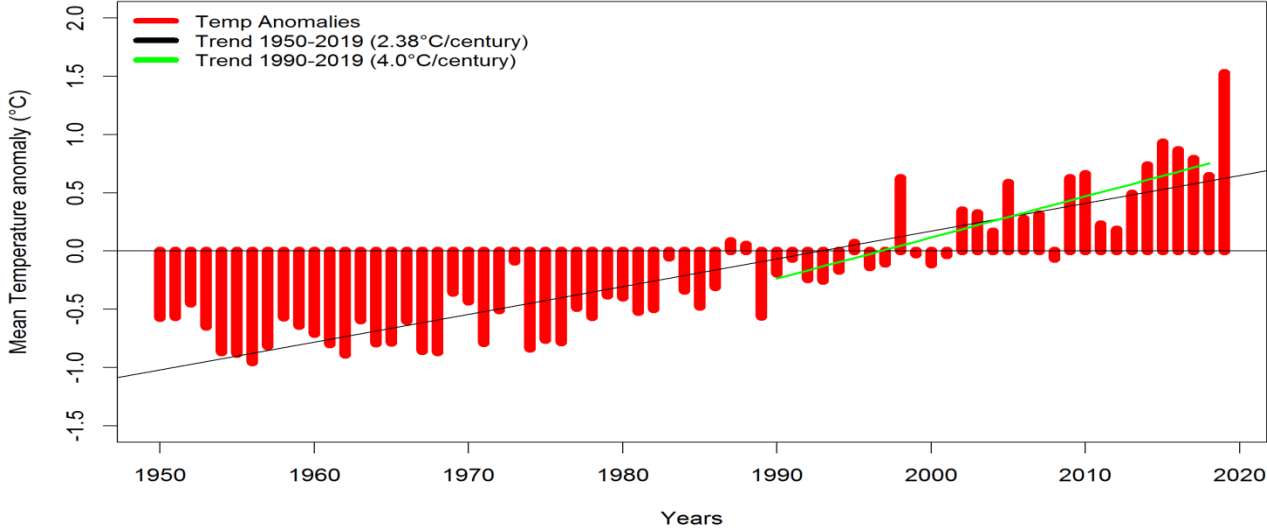
Highlights:

Mean temperature for Jan-Sep 2019 was the:

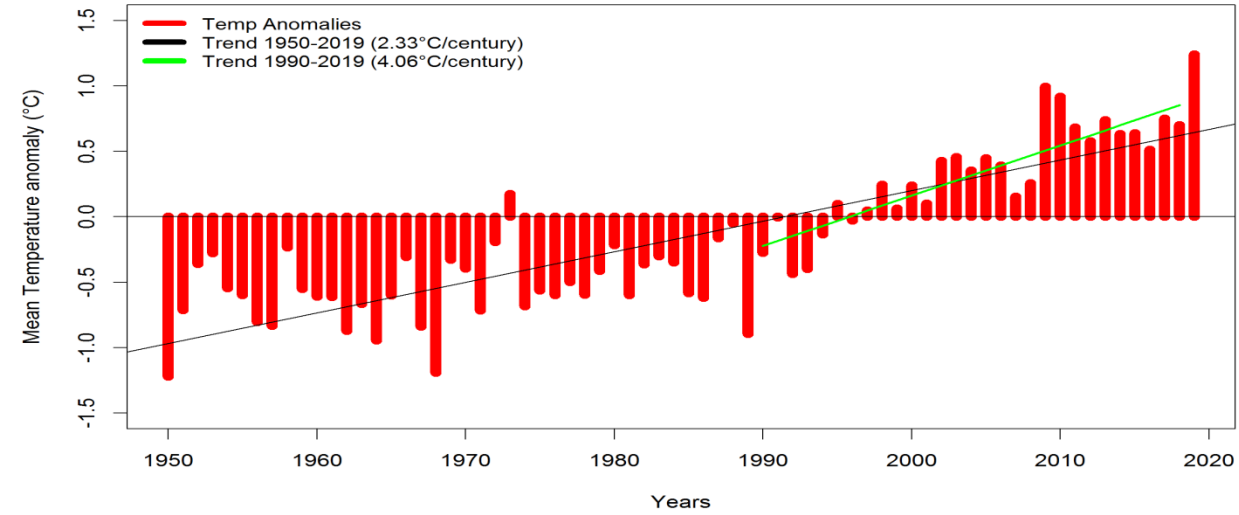
- **Warmest (1st)** year over **Eastern Africa**. The rate of increase in temp was 2.33°C (1950-2019) and 4.06°C (1990-2019) per century.
- **Warmest (1st)** year over **Central Africa**. The rate of increase in temp was 2.38°C (1950-2019) and 4.0°C (1990-2019) per century.
- **Warmest (1st)** year over **Southern Africa**. The rate of increase in temp was 2.03°C (1950-2019) and 3.39°C (1990-2019) per century.
- **15th** warmest year over **North Africa**. The rate of increase in temp was 2.44°C (1950-2019) and 4.47 °C (1990-2019) per century.
- **2nd** warmest year over **West Africa**. The rate of increase in temp was 2.40°C (1950-2019) and 3.87°C (1990-2019) per century.
- **10th** warmest year over the **Islands** (Madagascar). The rate of increase in temp was 1.05°C (1950-2019) and rate of **decrease** was 2.05 °C (1990-2019) per century.

Regional Temperature Evolution

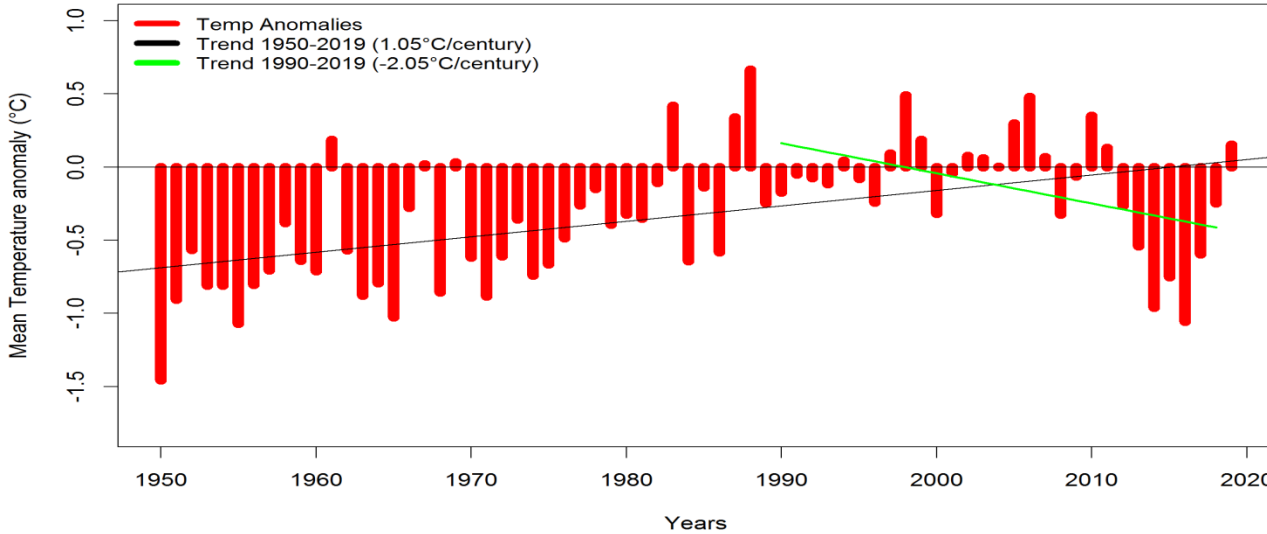
Temperature Anomaly over Central Africa



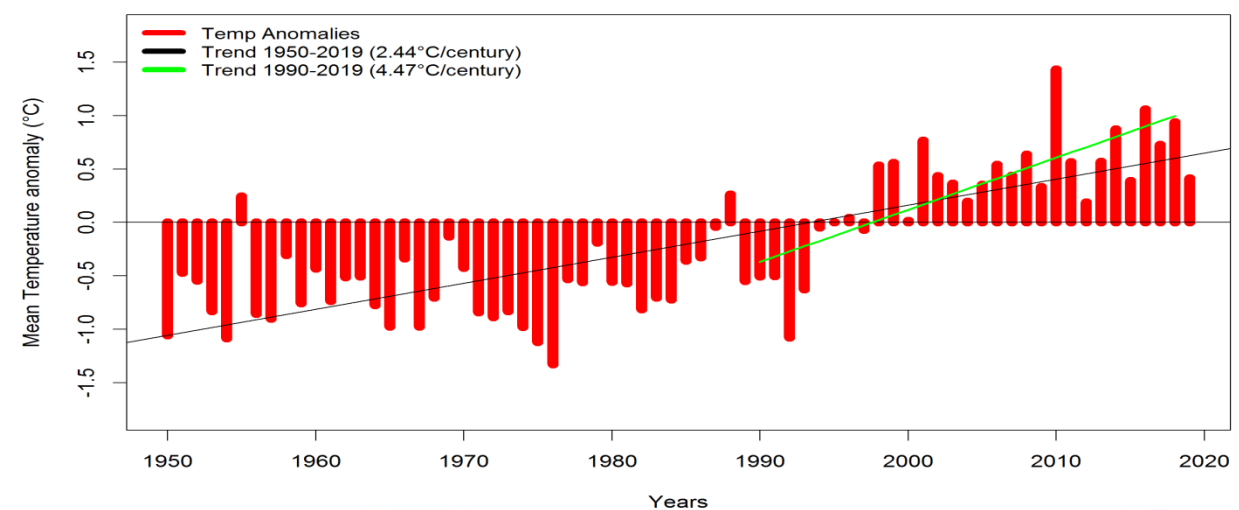
Temperature Anomaly over Eastern Africa



Temperature Anomaly over Madagascar



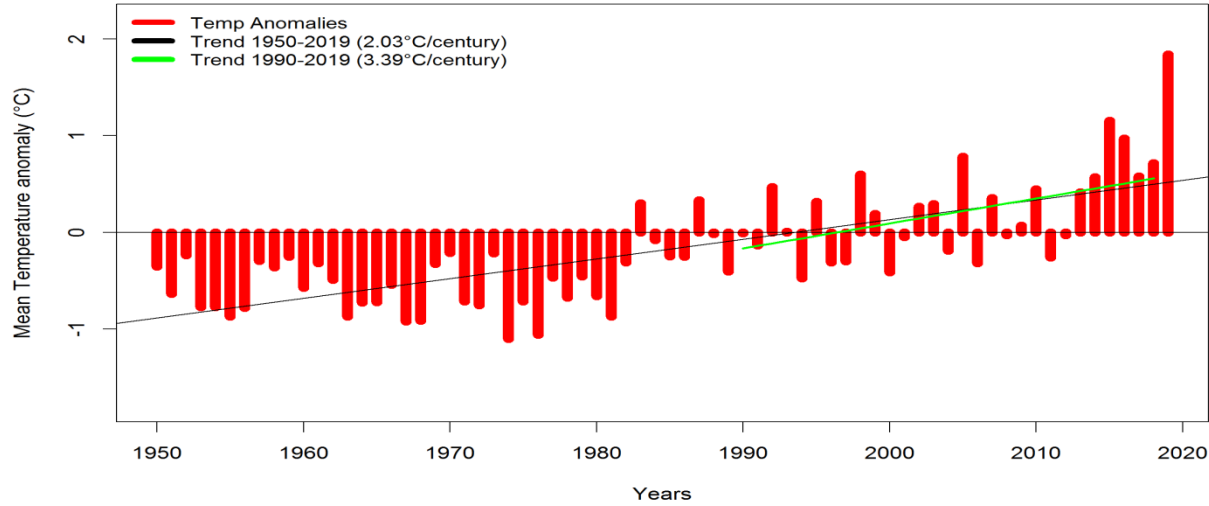
Temperature Anomaly over North Africa



NORWEGIAN CAPACITY
OPERATED BY NRC



Temperature Anomaly over Southern Africa



Temperature Anomaly over West Africa

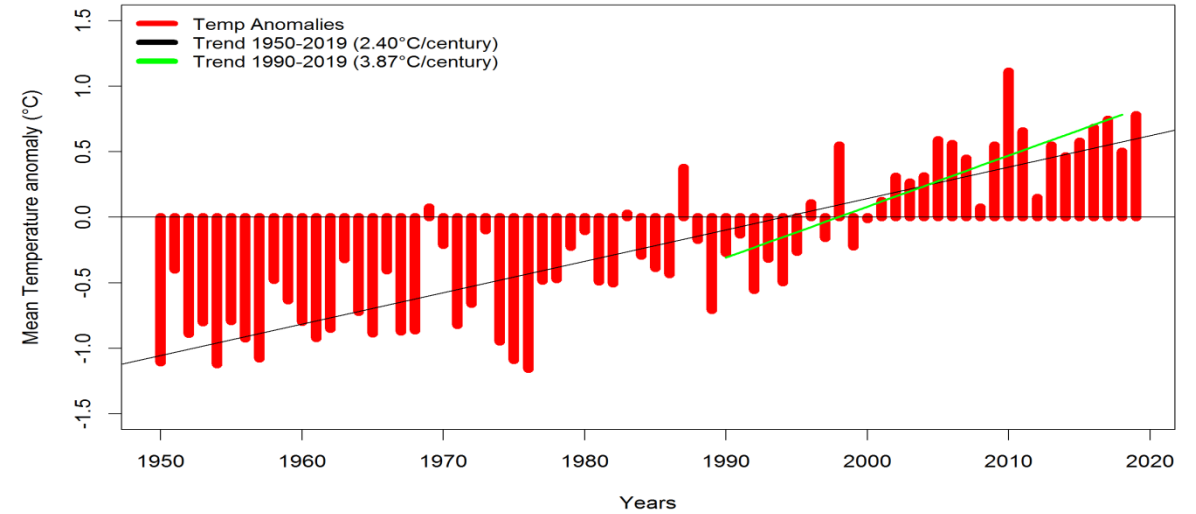


Figure 8: Trend in Jan-Nov temperature anomalies (°C) for the African sub-regions over the 1950-2018 period. Data source: http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.GHEN_CAMS/.gridded/.deg0p5/.temp/

4.2 Summary of temperature anomalies and rankings per sub-region

Table 1: Observed warming levels for the mean January to September 2019 temperature with respect to 1981-2010 reference period and their respective rankings per sub-region

<i>Region</i>	<i>Anomaly (°C)</i>	<i>Ranking per region since 1950</i>
Africa	+1.08	1st
Northern Africa	+0.42	15th
Southern Africa	+ 1.84	1st
Western Africa	+0.78	2nd
Eastern Africa	+1.24	1st
Central Africa	+1.53	1st
Madagascar	+0.15	10th

4. 2 Precipitation

4.2.1 Southern Africa

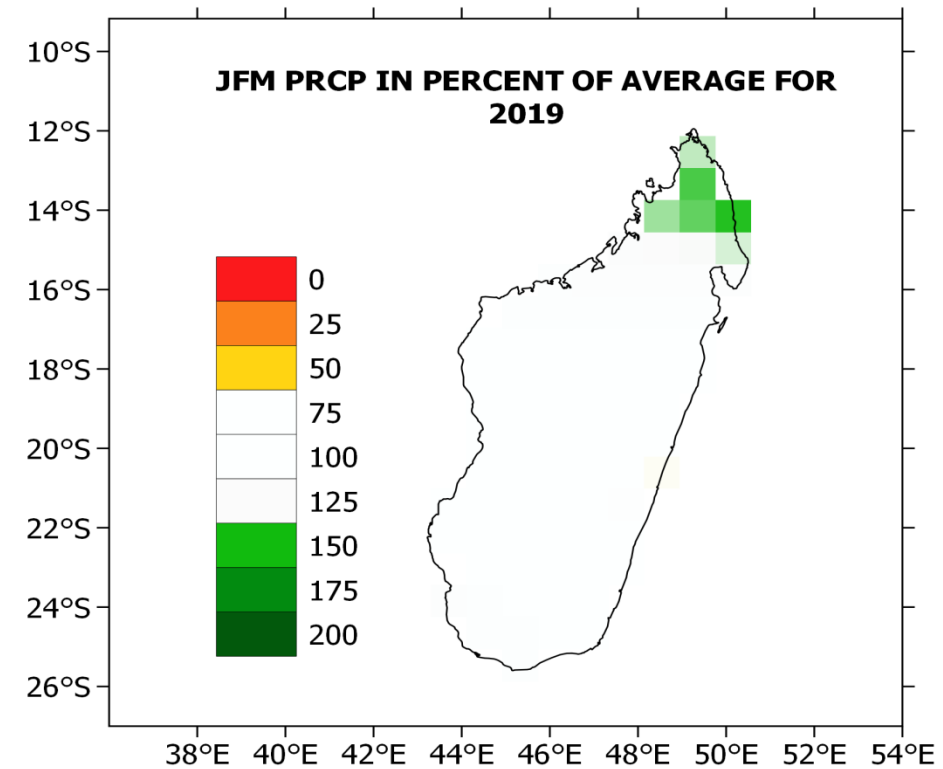
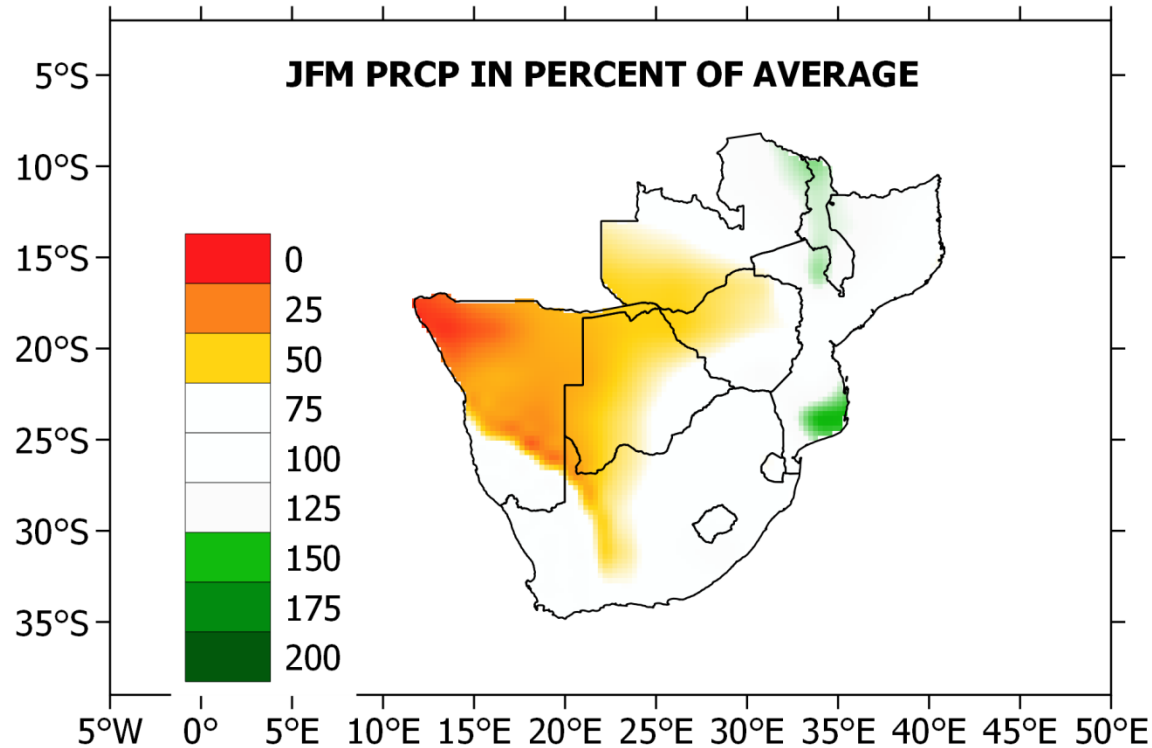


Figure 9: Mean January-February-March (JFM) precipitation in percent of average over Southern Africa for 2019. Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAM5_OPI/.v0208/.mean/.prcp/

- While most parts of Southern Africa recorded near normal conditions, above average rainfall was observed over Malawi and northeastern parts of Mozambique and Madagascar. Dry conditions were recorded over most parts of Namibia, Botswana, Zimbabwe and Zambia.

4.2.2 Western Africa

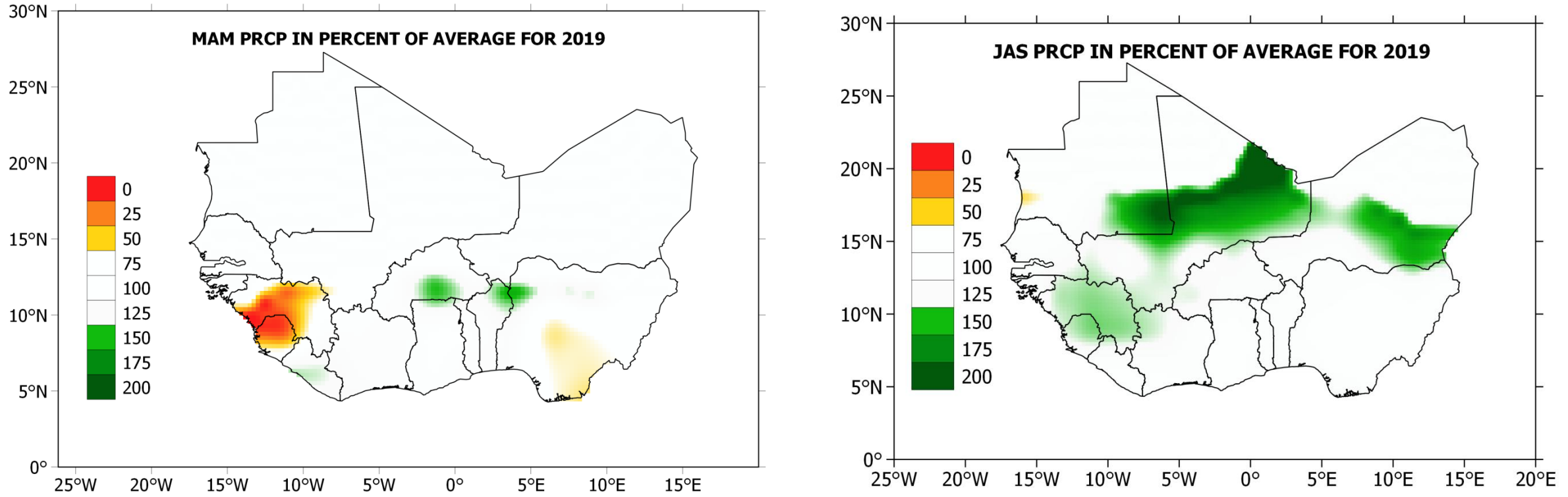


Figure 10: Precipitation in percent of average over West Africa for MAM and JAS seasons. Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAMS_OPI/.v0208/.mean/.prcp/

- Wet conditions were recorded over central Burkina Faso, extreme northeastern Benin and northwestern Nigeria, with dry conditions over Sierra Leone and parts of Guinea during MAM season.
- During JAS, most parts of the Sahel recorded above average rainfall, including, eastern Mauritania, Mali and central and eastern Niger, as well as Sierra Leone and Guinea

4.2.3 Central Africa

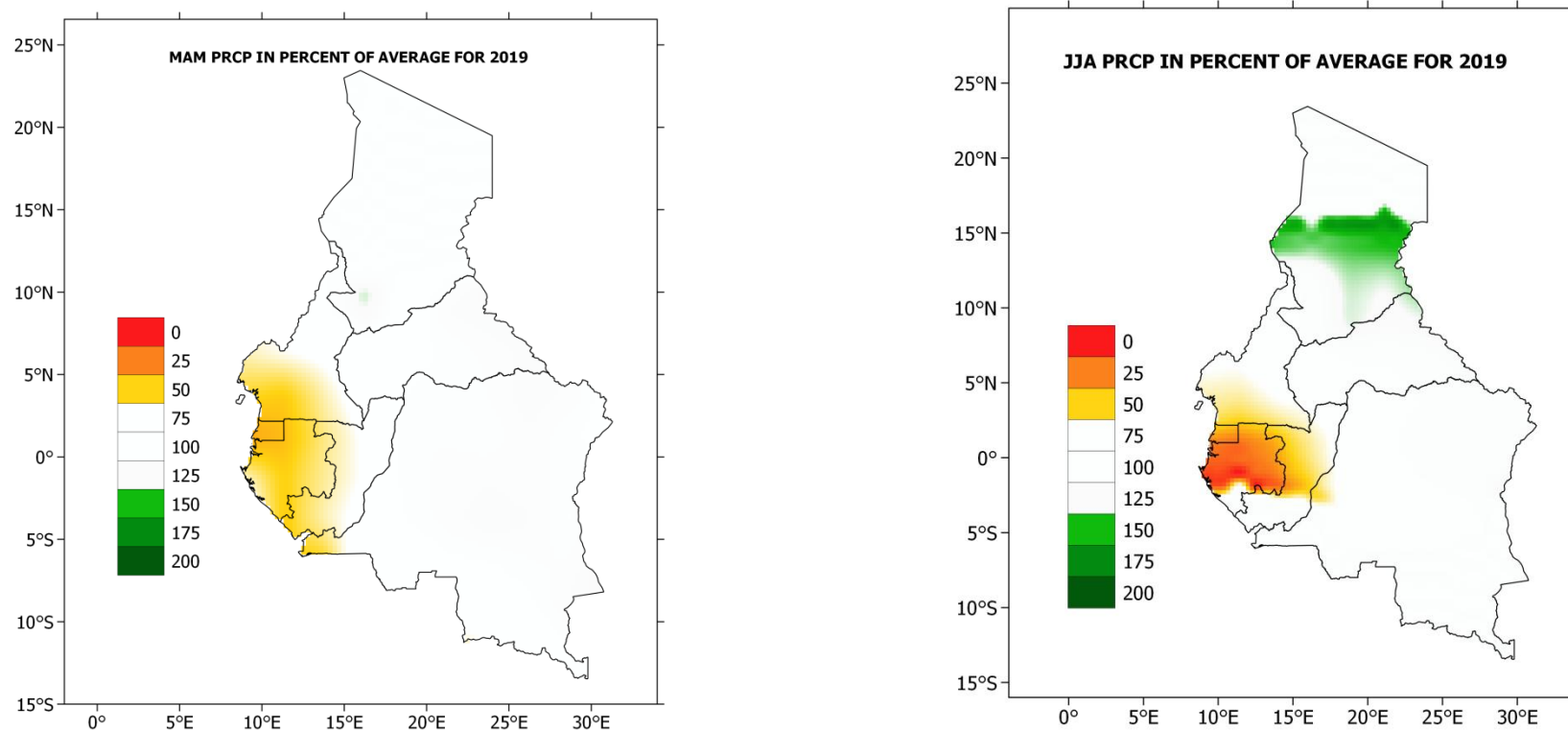


Figure 11: Precipitation in percent of average over Central Africa in 2019 MAM and JJA seasons. . Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAMS_OPI/.v0208/.mean/.prcp/

- Most parts recorded near normal conditions during MAM season, while dry conditions were recorded over Gabon, southern Cameroon and Congo.
- During JJA, dry conditions prevailed over Gabon, whereas wet conditions were observed over central and eastern Chad.

4.2.4 Eastern Africa

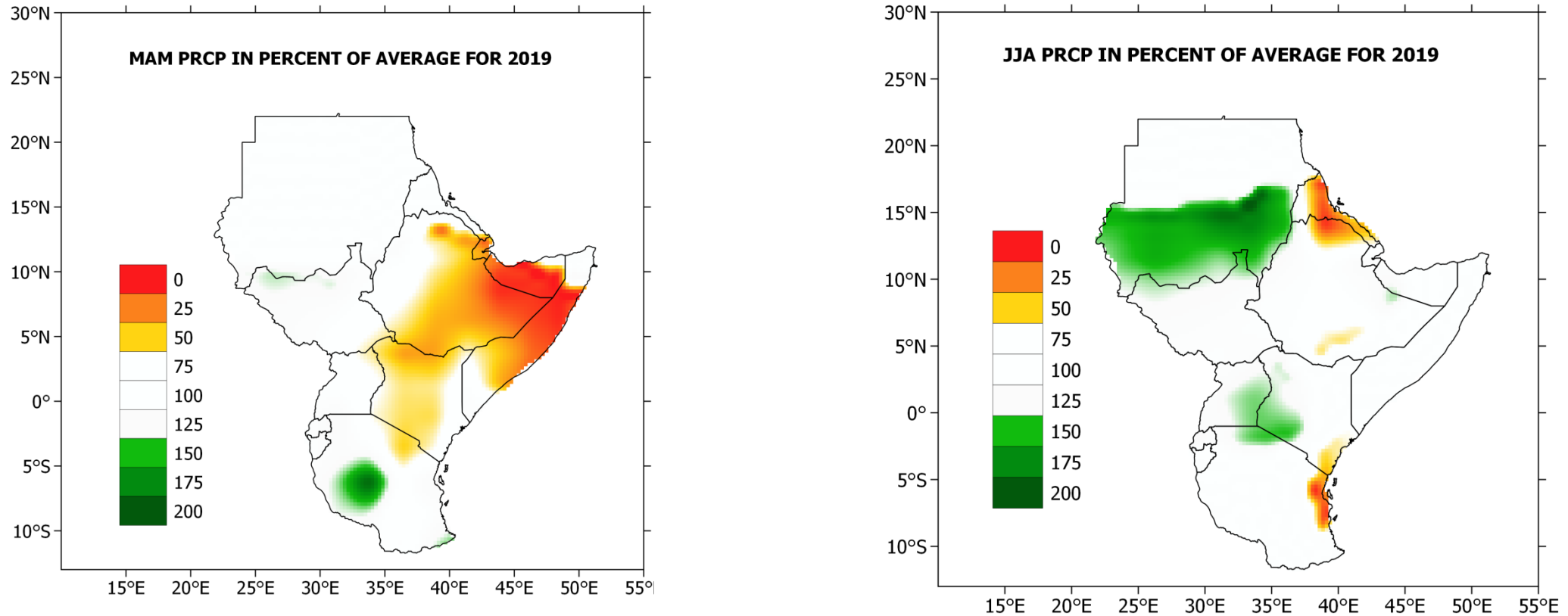


Figure 12: Precipitation in percent of average over East Africa in 2019 for MAM and JJA seasons. . Data source:

https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAM5_OPI/.v0208/.mean/.prcp/

- Eastern Africa sub-region experienced rainfall deficit over eastern Ethiopia, Djibouti, Kenya and Somalia, with wet conditions recorded over central Tanzania during MAM season.
- During JJA, southern Sudan, eastern Uganda and western Kenya experienced wet conditions. The rest of the region had near normal conditions, except Eritrea and part of the eastern coast of Tanzania and Kenya which had dry conditions.

4.2.5 North Africa

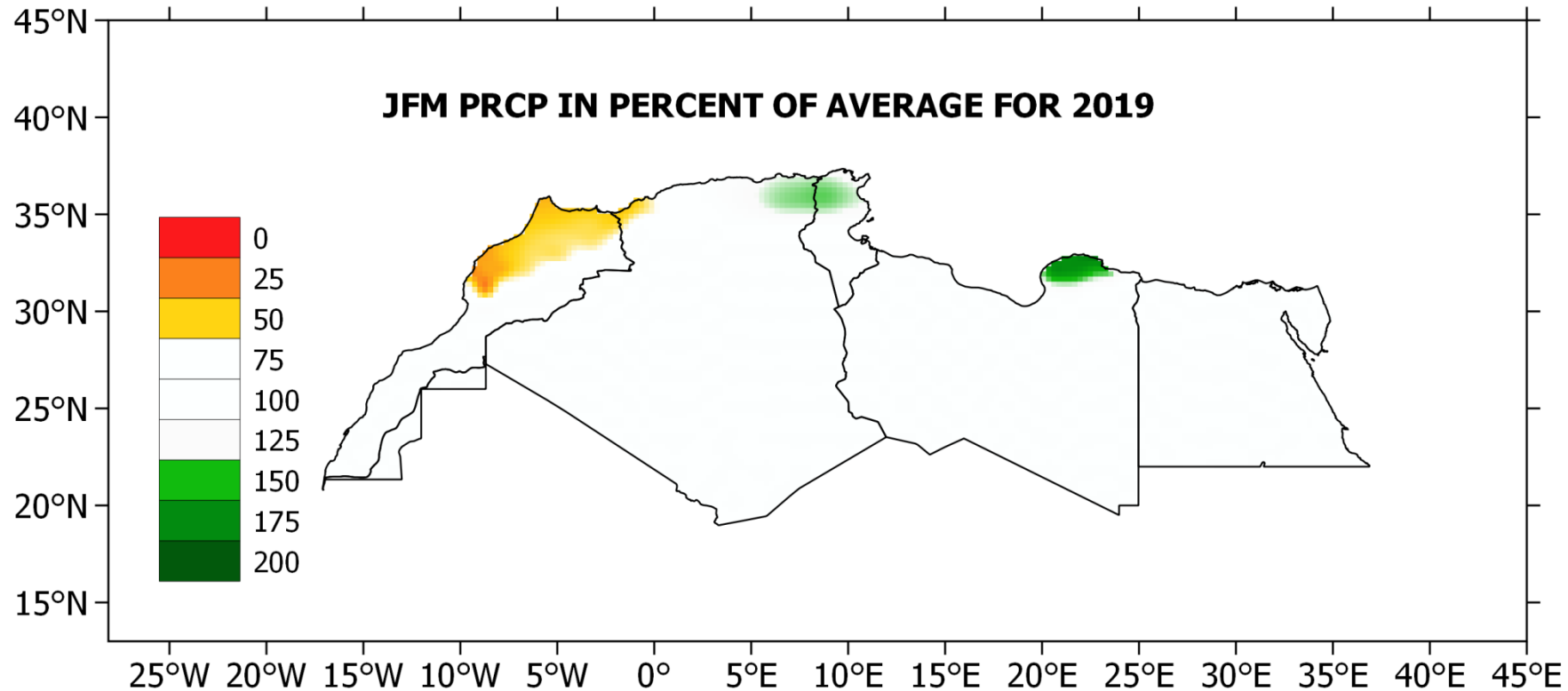


Figure 13: Mean JFM 2019 precipitation in percent of average over North Africa. . Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAMS_OPI/.v0208/.mean/.prcp/

- Wet conditions were experienced over extreme northern Algeria, Tunisia and Libya. The rest of the region had near normal conditions during JFM season.

5. Tropical cyclones in the Southwestern Indian Ocean for 2018-2019 Season

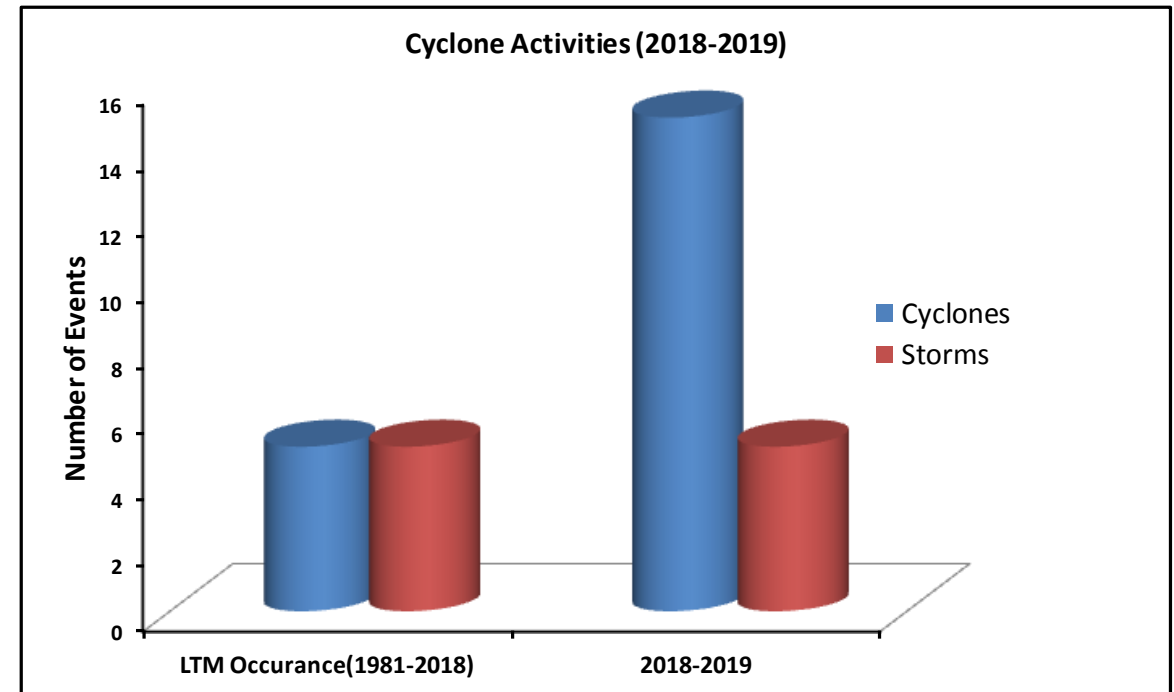
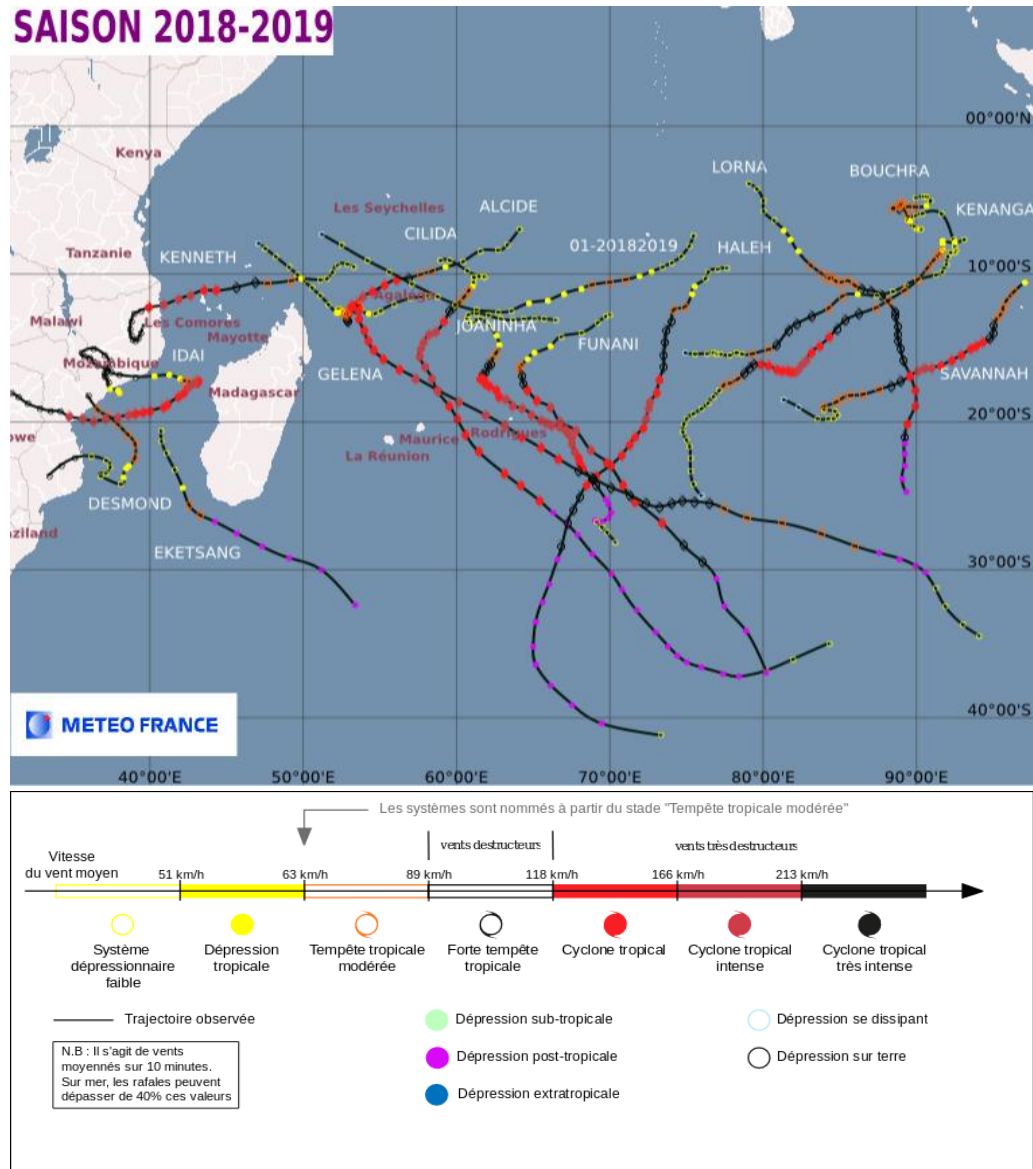


Figure 14: Cyclone activity statistics for 2018-2019 cyclone season compared with the long term mean (LTM) occurrence

6. Selected Significant Weather related Hazards in 2019 and their Impacts

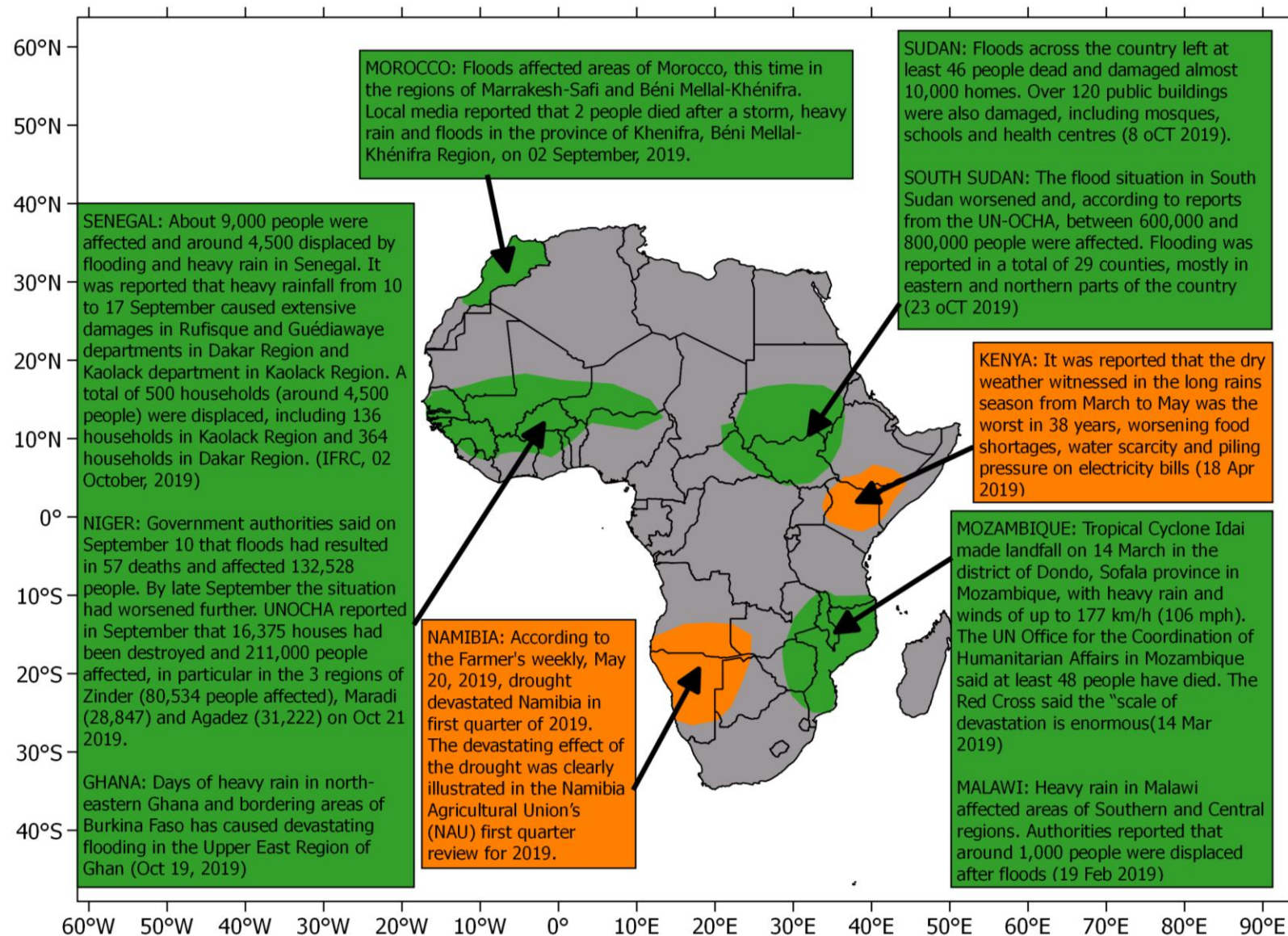


Figure 15: Selected significant weather related hazards in 2019

Table of detailed information of [sampled](#) significant events, hazards and impacts per region and country.

Eastern Africa

<p>Sudan (Oct 8, 2019)</p>	<p>Floods across the country left at least 46 people dead and damaged almost 10,000 homes. Over 120 public buildings were also damaged, including mosques, schools and health centres. http://floodlist.com/africa/sudan-north-darfur-floods-october-2019</p>
<p>Kenya (18 Apr 2019)</p>	<p>KENYA: It was reported that the dry weather witnessed in the long rains season from March to May was the worst in 38 years, worsening food shortages, water scarcity and piling pressure on electricity bills (CGTN Africa & Daily Nation, 18 APRIL 2019) https://allafrica.com/stories/201904190044.html</p>
<p>South Sudan (23 Oct 2019)</p>	<p>The flood situation in South Sudan worsened and, according to reports from the UN-OCHA, between 600,000 and 800,000 people were affected. Flooding was reported in a total of 29 counties, mostly in eastern and northern parts of the country. http://floodlist.com/africa/south-sudan-800000-affected-by-floods-says-un</p>
<p>Somalia (23 Oct , 2019)</p>	<p>Over 70,000 were displaced as overflowing rivers in Somalia forced over 70,000 people to relocate to higher ground (UN-OCHA, 23 October, 2019) http://floodlist.com/africa/somalia-over-70000-displaced-as-rivers-overflow</p>

West Africa	
<p>Senegal (2 Oct 2019)</p>	<p>About 9,000 people were affected and around 4,500 displaced by flooding and heavy rain in Senegal. It was reported that heavy rainfall from 10 to 17 September caused extensive damages in Rufisque and Guédiawaye departments in Dakar Region and Kaolack department in Kaolack Region. A total of 500 households (around 4,500 people) were displaced, including 136 households in Kaolack Region and 364 households in Dakar Region. (IFRC, 02 October, 2019) http://floodlist.com/africa/senegal-floods-dakar-kaolack-september-2019</p>
<p>Ghana (19 Oct, 2019)</p>	<p>Days of heavy rain in north-eastern Ghana and bordering areas of Burkina Faso has caused devastating flooding in the Upper East Region of Ghana. The affected districts include Bolgatanga, Kassena-Nankana Municipal (Navrongo), Kassena Nankana West, Bawku Municipal, Builsa North, Builsa South, Binduri, Talensi, Garu-Tempene and Bongo. Local media in Ghana reported that 29 people died in flood-related incidents, between 1,000 and 4,000 buildings were destroyed or severely damaged, including almost 2,000 in Kassena-Nankana Municipal, which includes the town of Navrongo and 830 in Bongo district (FloodList, 19 Oct, 2019). http://floodlist.com/africa/ghana-floods-upper-east-region-october-2019</p>
<p>Côte d'Ivoire (5 Oct 2019)</p>	<p>In Abidjan, 1 person died after flooding caused a building to collapse in Yopougon district of the city, a vehicle was swept away by flood waters. Roads were severely damaged, causing major traffic disruption. Some areas of the city recorded more than 120mm of rain on 05 October, 2019. http://floodlist.com/africa/cote-divoire-floods-abidjan-aboisso-october-2019</p>
<p>Niger (21 Oct 2019)</p>	<p>Government authorities said on September 10 that floods had resulted in 57 deaths and affected 132,528 people. By late September the situation had worsened further. UNOCHA reported in September that 16,375 houses had been destroyed and 211,000 people affected, in particular in the 3 regions of Zinder (80,534 people affected), Maradi (28,847) and Agadez (31,222). http://floodlist.com/africa/niger-floods-diffa-region-october-2019</p>
Southern Africa	
<p>Namibia (20 May 2019)</p>	<p>According to Annelie Coleman (Farmer's weekly, May 20, 2019), drought devastated Namibia in first quarter of 2019. The devastating effect of the drought in Namibia was clearly illustrated in the Namibia Agricultural Union's (NAU) first quarter review for 2019. https://www.farmersweekly.co.za/agri-news/africa/drought-devastates-namibia-in-first-quarter-of-2019/</p>
<p>Malawi (19 February 2019)</p>	<p>Heavy rain in Malawi affected areas of Southern and Central regions. Authorities reported that around 1,000 people were displaced after floods. (19 February 2019). http://floodlist.com/africa/malawi-floods-central-southern-regions-february-2019</p>
<p>Mozambique (14 Mar, 2019)</p>	<p>Tropical Cyclone Idai made landfall on 14 March in the district of Dondo, Sofala province in Mozambique, with heavy rain and winds of up to 177 km/h (106 mph). The UN Office for the Coordination of Humanitarian Affairs in Mozambique said at least 48 people have died. The Red Cross said the "scale of devastation is enormous." http://floodlist.com/africa/mozambique-zimbabwe-tropical-cyclone-idai-march-2019</p>
Central Africa	
<p>DRC (4 Oct 2019)</p>	<p>Heavy rain caused flash floods in Kinshasa, capital of the Democratic Republic of the Congo, from around 04 October, 2019, leaving at least 6 people dead and around 30 houses destroyed. Further heavy rain and floods hit the city from 14 October. http://floodlist.com/africa/drc-floods-kinshasa-october-2019</p>

Central Africa continued	
Central African Republic (24 Oct 2019)	Thousands of people were displaced and dozens of homes destroyed after rivers overflowed in the Central African Republic. Over 6,000 people were displaced by flooding in the capital, Bangui. Local media reported that the Ubangi (Oubangui) river broke its banks after a period of heavy rain. http://floodlist.com/africa/central-african-republic-floods-october-2019
Cameroon (18 Oct 2019)	Flooding along the Logone River affected parts of Chad as well as areas of the Far North Region in Cameroon. It was reported that the flooding affected 70,000 people in Cameroon and 30,000 across the border in Chad. http://floodlist.com/africa/cameroon-floods-far-north-region-october-2019
Northern Africa	
Morocco (4 September 2019)	Floods affected areas of Morocco, this time in the regions of Marrakesh-Safi and Béni Mellal-Khénifra. Local media reported that 2 people died after a storm, heavy rain and floods in the province of Khenifra, Béni Mellal-Khénifra Region, on 02 September, 2019. http://floodlist.com/africa/morocco-floods-khenifra-implil-september-2019

-----THE END-----