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African Center of Meteorological Applications for Development

TECHNICAL NOTE No. 9

THE STATE OF AFRICAN CLIMATE IN 2018

Updated: February, 2019

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1. INTRODUCTION

This technical note provides a summary of the main weather and climate events that have occurred in Africa in 2018. 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 2018 was jointly supported by USAID, WMO, NRC & ACMAD.



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2. DATA, TOOLS AND METHODS

2.1 Data

Temperature:

- GHCN CAMS (NOAA)
- Period : 1950-2018
- Reference period: 1981-2010
- Data source:

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

Precipitation:

- CAMS OPI
- Period: 1981-2018
- 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 2018 were collected from several sources such as UN agencies, Disaster Risk Management departments across the continent and News Papers.



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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 2018

Precipitation totals in 2018 (year and season) are divided by their corresponding mean values and expressed as a percentage.

Note:-Temperature analyses are based on the period from 1950 to 2018.

-Precipitation analyses are based on period from 1981 to 2018.



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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.



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3. CONTINENTAL ASSESSMENT

3.1 Temperature

3.1.1 Ranked temperature

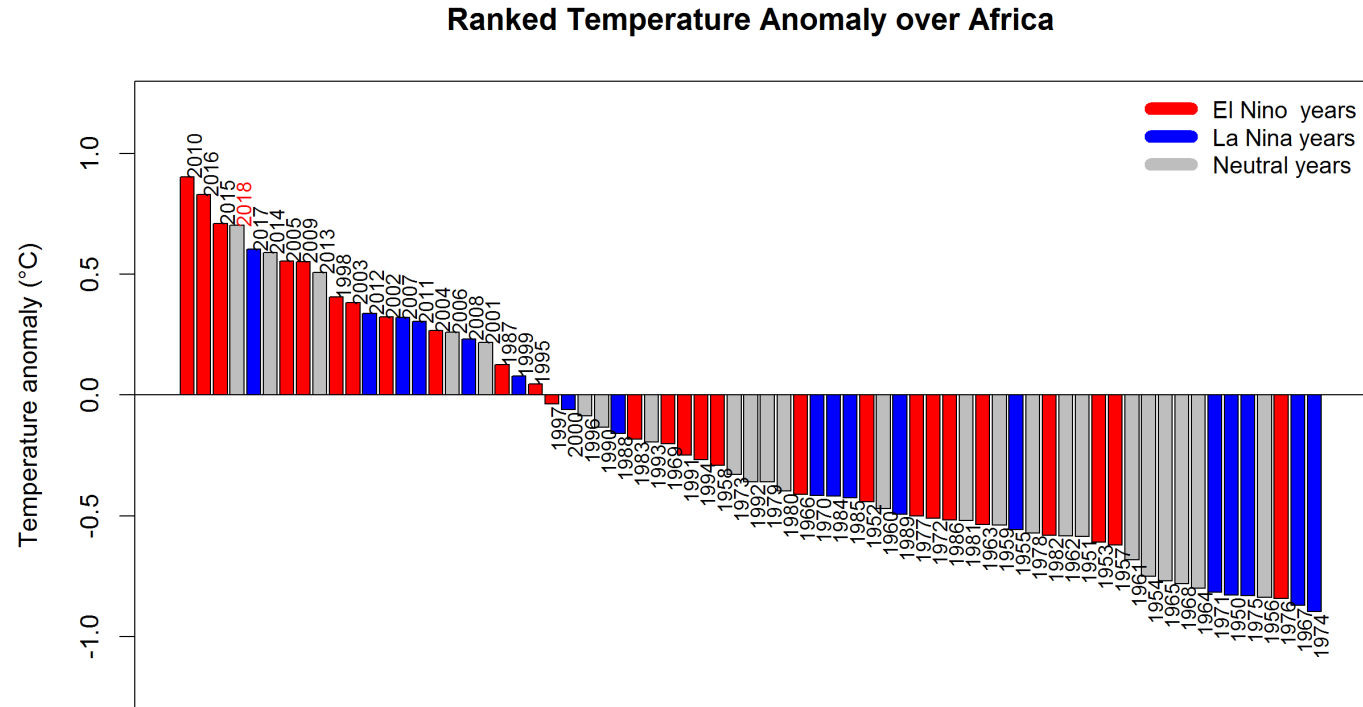


Figure 1: Ranked mean annual temperature anomalies ($^{\circ}\text{C}$) over Africa for 1950- 2018 period relative to 1981-2010.

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

- 2018 is the 4th warmest year on record since 1950 and it is not influenced by ENSO
- 2017 was the 5th warmest year on record since 1950 and was influenced by La Niña.
- 2010 is still the warmest year on record over the African Landmass (It was an EL Niño year)

3.1.2 Trend in temperature over Africa since 1950

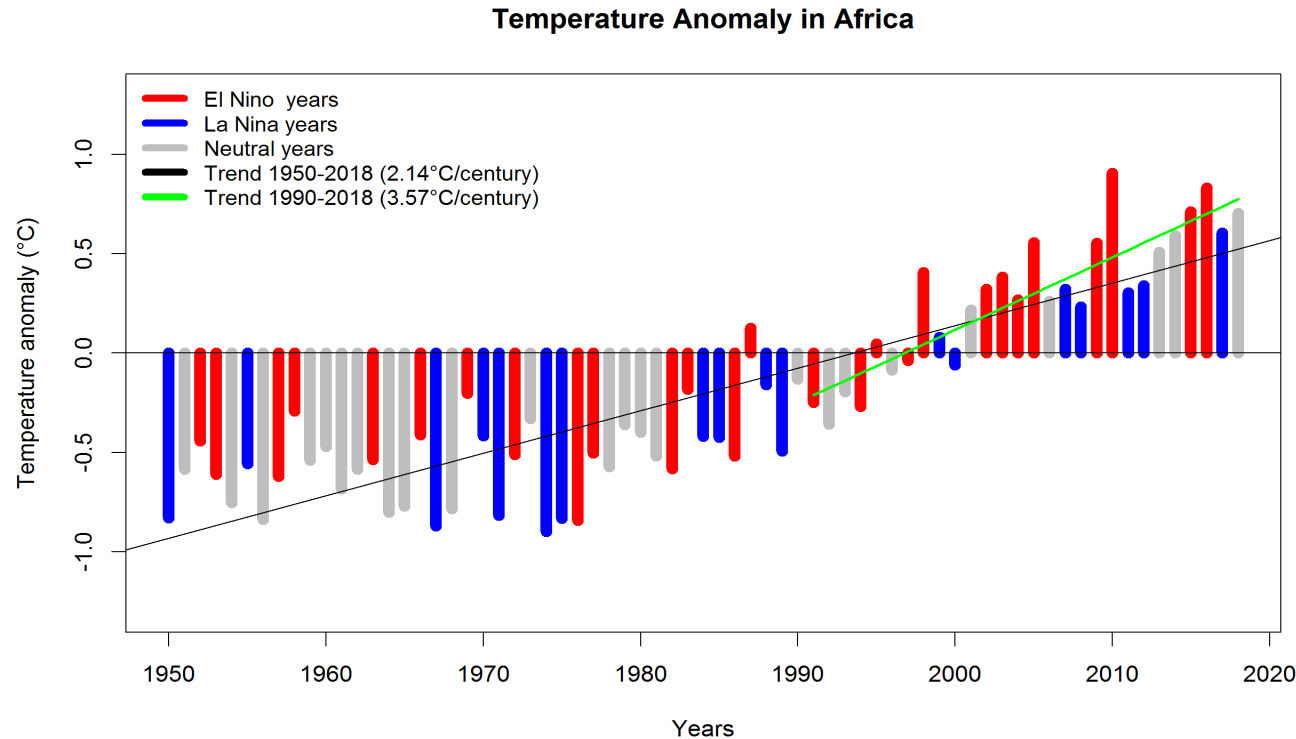
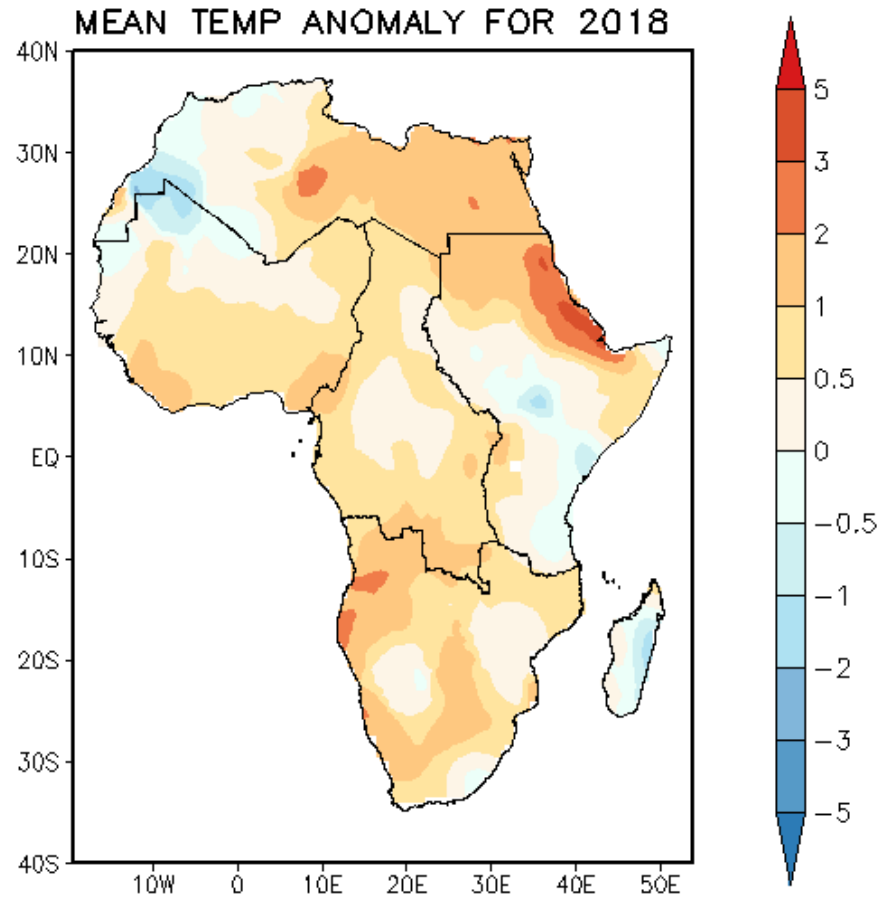


Figure 2: Trends in the mean annual temperature anomalies (°C) over Africa for 1950-2018 period.

Data source: http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.GHEN_CAMS/.gridded/.deg0p5/.temp/

There is an increasing trend in temperature anomalies at the continental level since the 1950s (Rate: 2.14°C per century). The rate of increase is much higher from 1990 (Rate: 3.57°C per century).

3.1.3 Spatial temperature anomalies in 2018



- Positive temperature anomalies were generally observed over most parts of Africa, with extremely warm conditions ($\geq +3^{\circ}\text{C}$) recorded over the Horn of Africa.
- Negative anomalies (less warming situation) were recorded over Madagascar, eastern Kenya and Tanzania, northern Mauritania and Morocco.

Figure 3: Mean annual temperature anomalies ($^{\circ}\text{C}$) over Africa in 2018.

Data source: <http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.GHCM/.CAMS/.gridded/.deg0p5/.temp/>

3.1.4 Monthly temperature anomalies

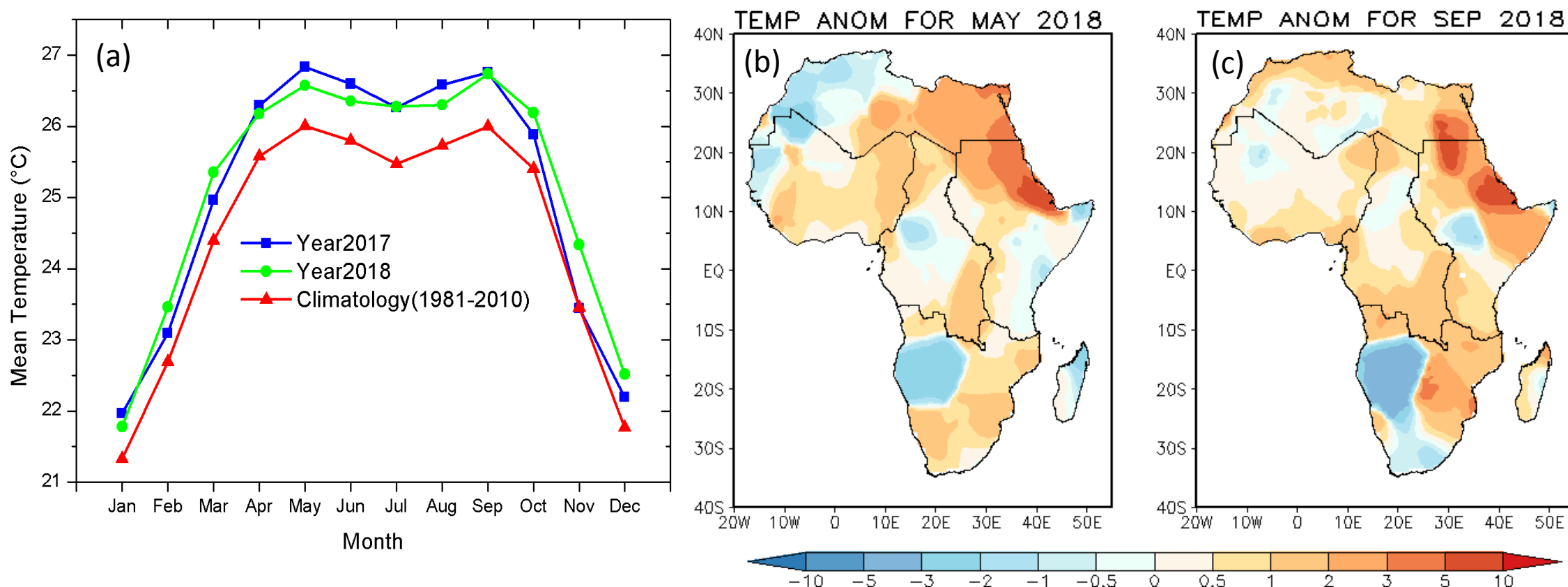
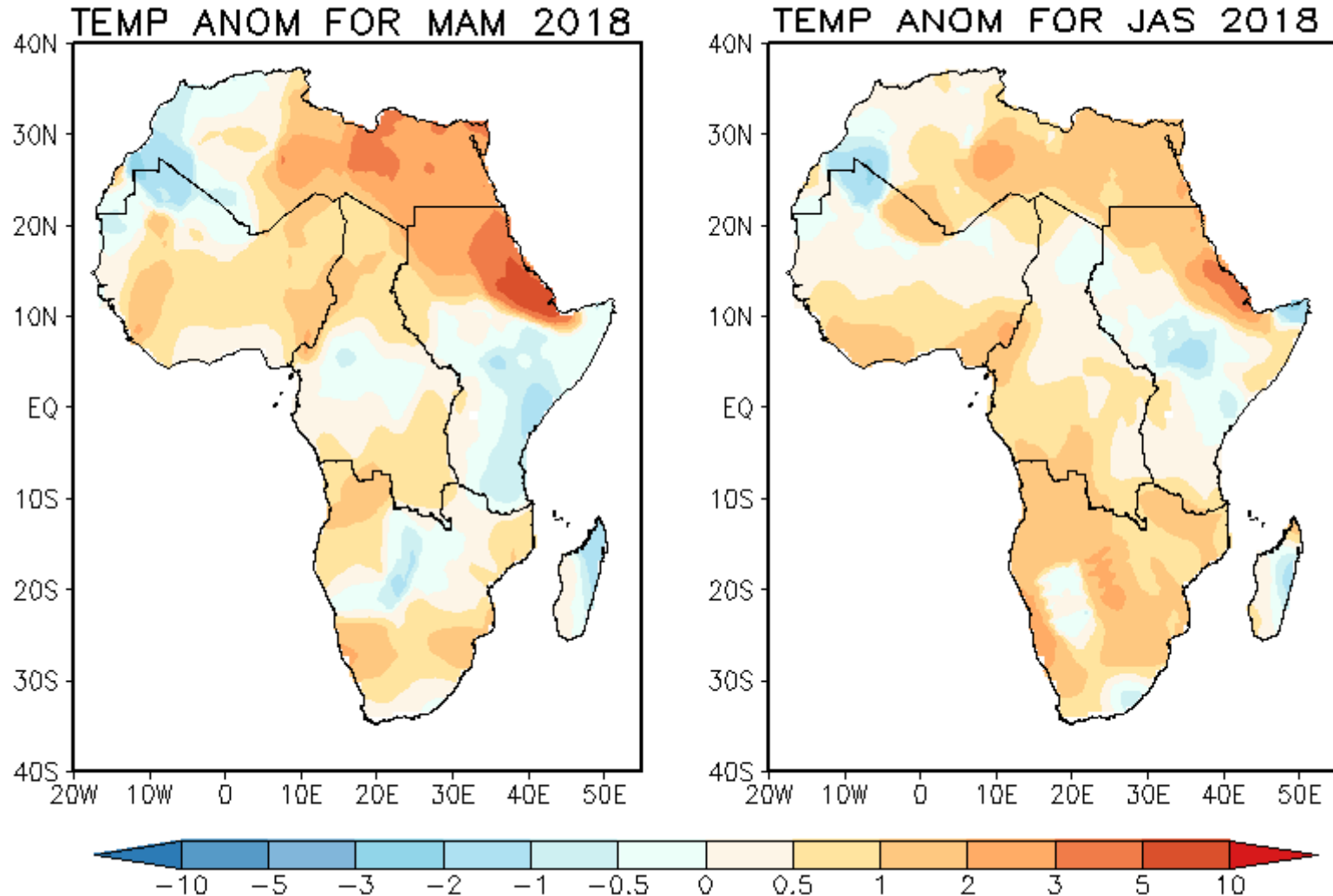


Figure 4: (a) Mean annual cycle of temperature (°C) during 2017 and 2018 and climatology based on the period: 1981-2010. The mean temperature anomalies for the warmest months of 2018 are: (b) May and (c) September.

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

- **May and September** were the warmest months in 2018, with temperature anomalies of 0.57 & 0.74 °C, respectively

3.1.5 Mean seasonal temperature anomalies in 2018

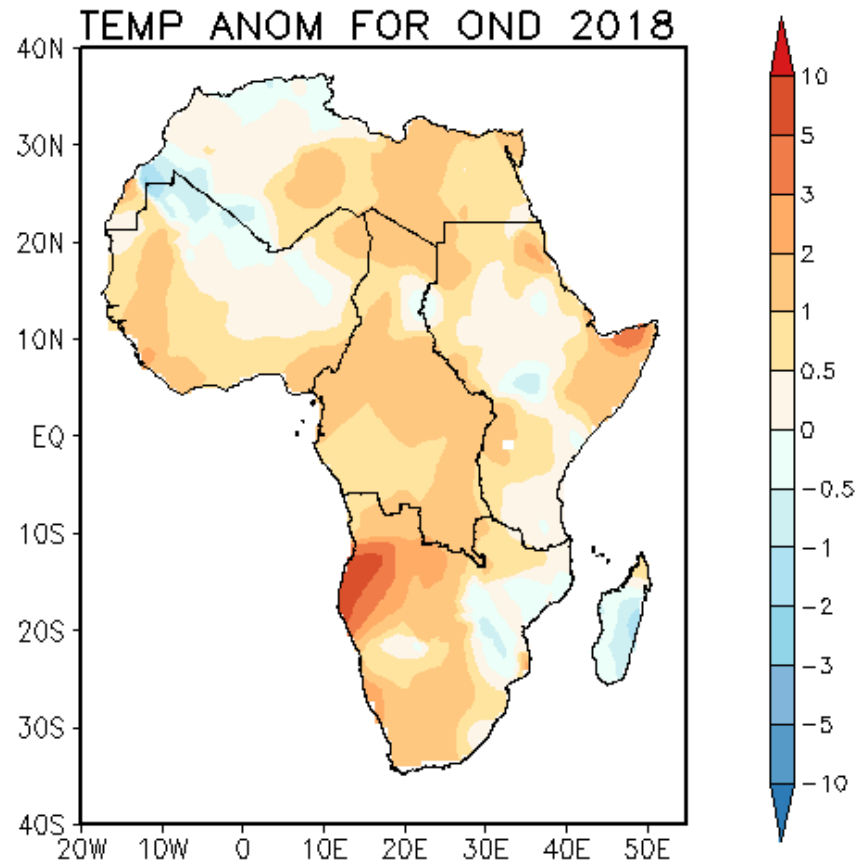


The MAM season was characterized by higher temperature anomalies over northeastern Ethiopia, Eritrea, northern Sudan and Egypt.

Lower temperatures were observed over northern Mauritania, Morocco, parts of Kenya, Tanzania, Uganda, Botswana and northern Madagascar during MAM.

During JAS season, higher temperature anomalies were recorded over northeastern Ethiopia and Eritrea.

Figure 5a: Mean seasonal temperature anomalies ($^{\circ}\text{C}$) in Africa during March-April-May (MAM) and July-August-September (JAS) for 2018. Data source: http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.GHCN_CAMS/.gridded/.deg0p5/.temp/



- OND season was characterized by higher temperature anomalies over northern parts of Namibia and Somalia.

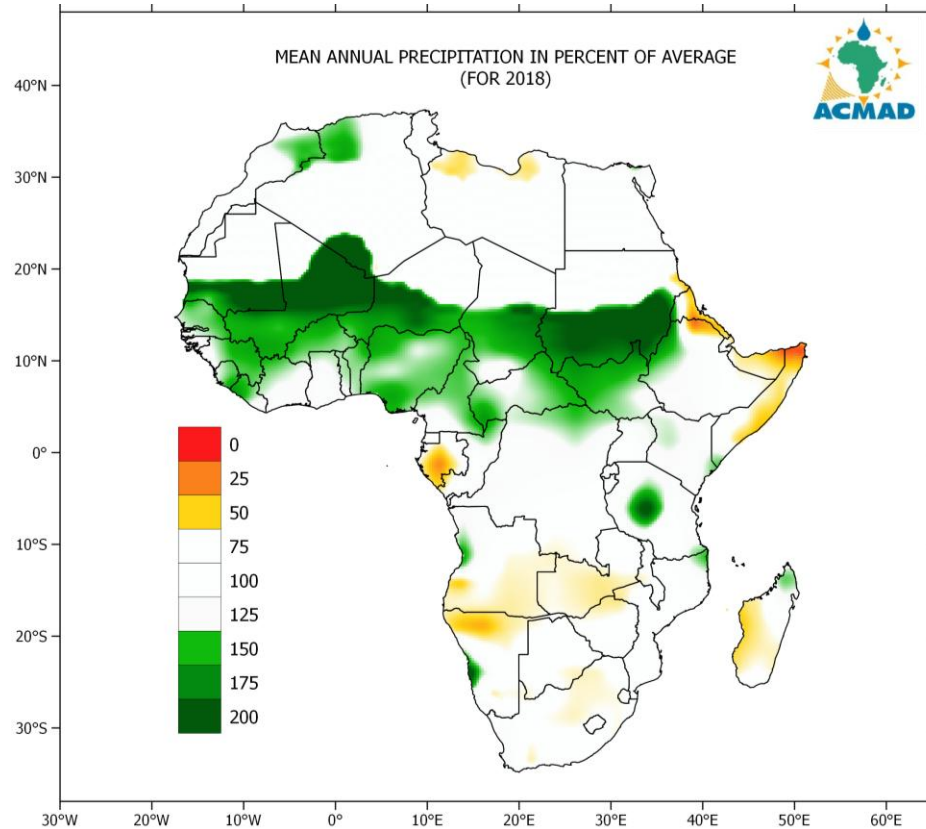
- Lower temperatures were observed over northern Mauritania, southwestern Ethiopia, southern parts of Mozambique and Madagascar during OND season.

Figure 5b: Mean seasonal temperature anomalies (°C) in Africa during October-November-December season of 2018.

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

3.2 Precipitation

3.2.1 Mean precipitation



- Well above average precipitation conditions were observed over southern Mauritania, Mali, Niger and southern Sudan.
- Below average precipitation conditions were recorded over northern Somalia, Eritrea, Djibouti, Gabon, southwestern Madagascar and northern Namibia

•**Figure 6 :** Mean annual precipitation in percent of average over Africa in 2018. Data source:

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

3.2.2 Seasonal precipitation

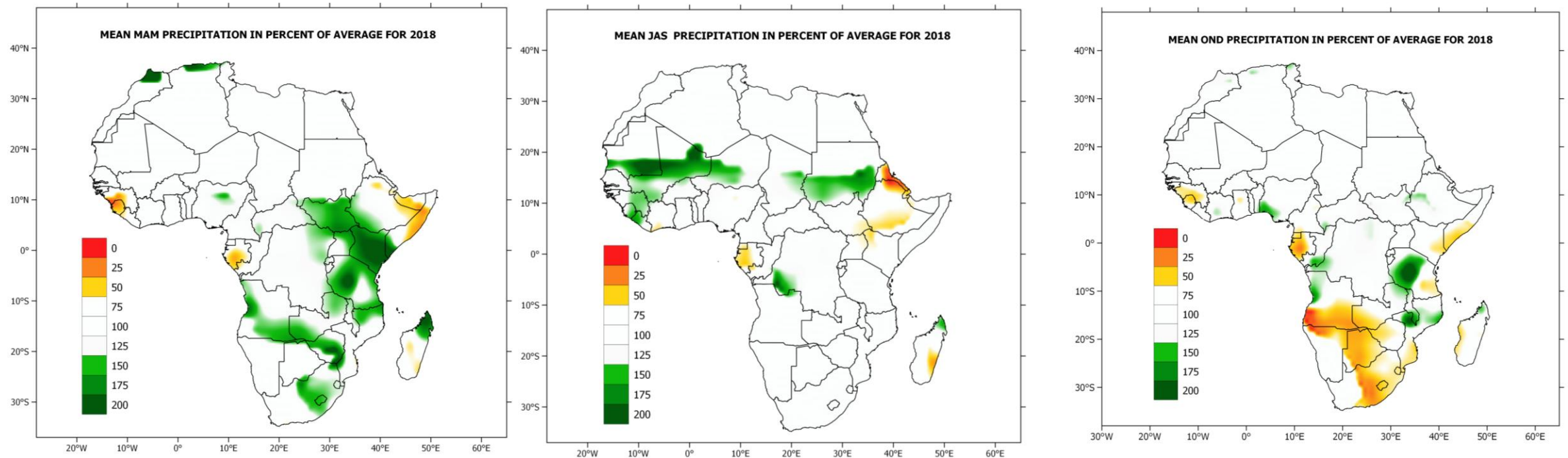
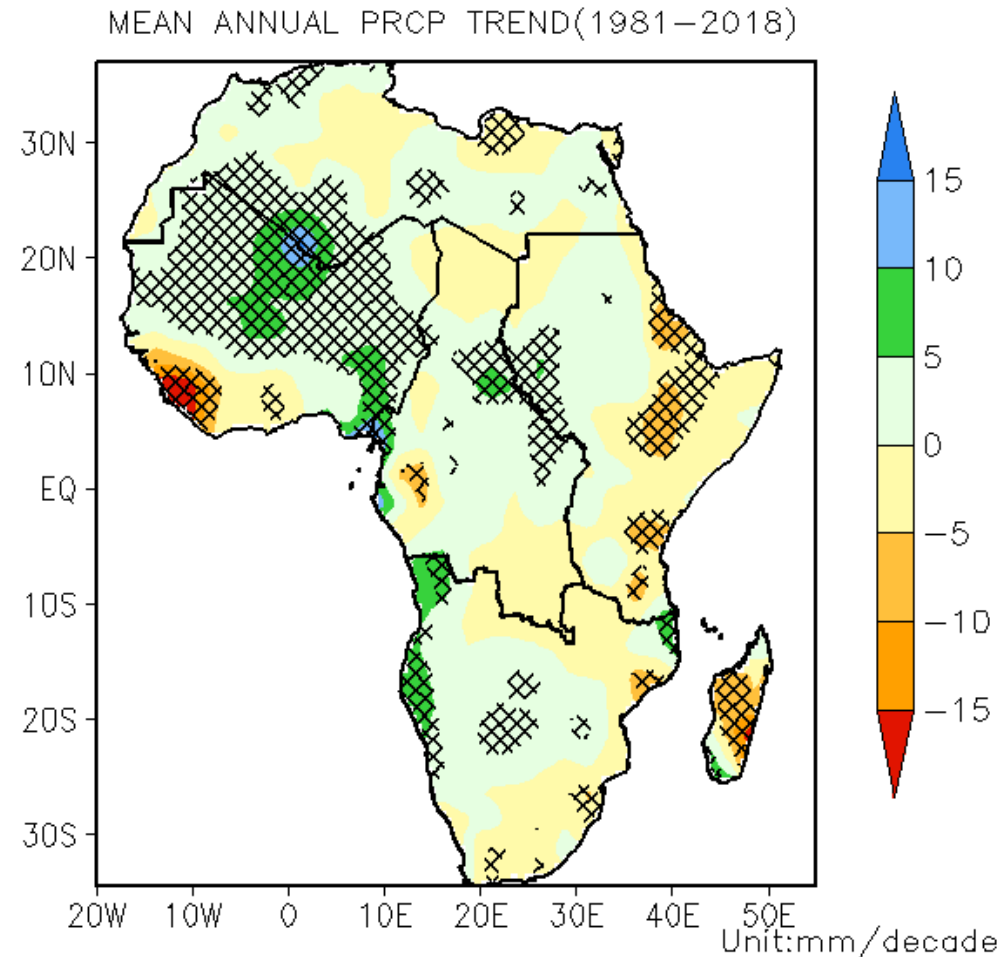


Figure 7a: Precipitation in Percent of average during MAM, JAS and OND seasons over Africa in 2018. Data source:

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

- During MAM, dry conditions were experienced over Somalia, Djibouti and parts of Gabon, Sierra Leone and Guinea. Above average precipitation was observed over most parts of South Sudan, Kenya, Tanzania, as well as parts of southern Africa during this period. During JAS season, wet conditions were mainly observed over the Sahel. OND season was characterized by dry conditions over southern Africa, with wet conditions observed over Tanzania.

3.2.3 Annual Precipitation trend



- There is a significant increasing trend of the annual precipitation over most parts of West Africa.
- Decreasing trends are significant over parts of the Horn of Africa, central Madagascar and Sierra Leone.

Figure 7b : Annual precipitation trend over Africa for the period from 1981-2018. 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/

4. REGIONAL ASSESSMENT

4.1 Temperature

Highlights:

Mean annual temperature for 2018 was the:

- 3rd warmest year over **North Africa**. The rate of increase in temp was 2.30°C (1950-2018) and 4.29 °C (1990-2018) per century.
- 7th warmest year over **West Africa**. The rate of increase in temp was 2.27°C (1950-2018) and 3.88 °C (1990-2018) per century.
- 5th warmest year over **Eastern Africa**. The rate of increase in temp was 2.24°C (1950-2018) and 3.72°C (1990-2018) per century.
- 3rd warmest year over **Central Africa**. The rate of increase in temp was 2.33°C (1950-2018) and 3.65°C (1990-2018) per century.
- 35th warmest year over **Madagascar**. The rate of increase in temp was 1.23°C (1950-2018) and rate of decrease was 1.57 °C (1990-2018) per century.

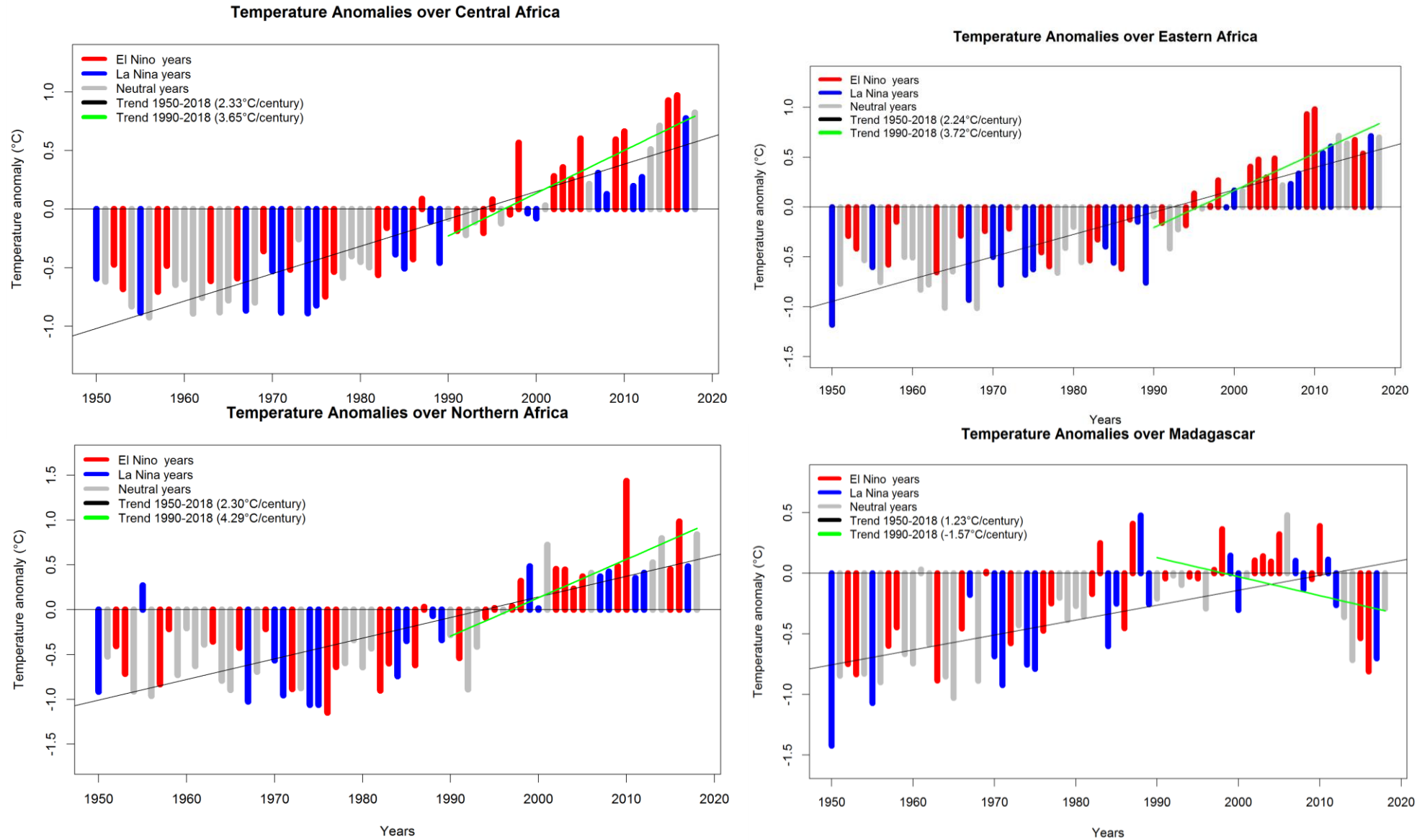


Figure 8a: Trends in the mean annual temperature anomalies (°C) for the African sub-regions over the 1950-2018 period.

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

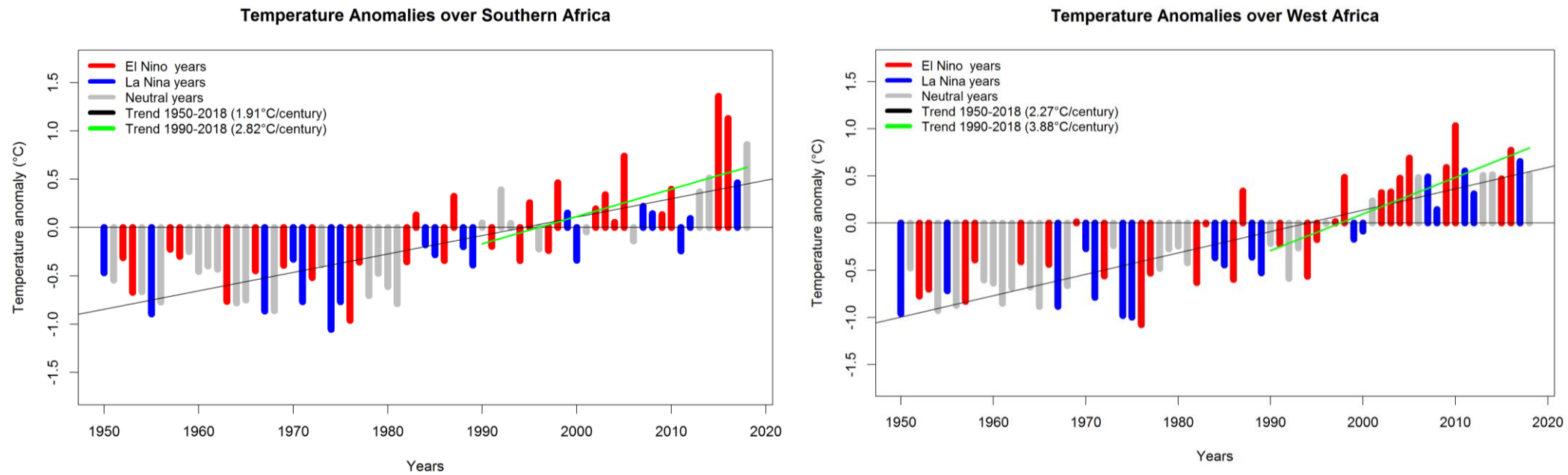


Figure 8b: Trends in the mean annual temperature anomalies (°C) for the African sub-regions over the period:1950 to 2018.

Data source: http://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.GHCM_CAMS/.gridded/.deg0p5/.temp/

Summary of temperature anomalies per sub-region

Table 1: Observed mean annual surface temperature anomalies for 2018 and their respective rankings per sub-region

<i>Region</i>	<i>Anomaly (°C)</i>	<i>Ranking per region since 1950</i>
Africa	+0.70	4th
Northern Africa	+0.84	3rd
Southern Africa	+ 0.86	3rd
Western Africa	+0.52	7th
Eastern Africa	+ 0.70	5th
Central Africa	+0.82	3rd
Madagascar	-0.29	35th



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4. 2 Precipitation

4.2.1 Southern Africa

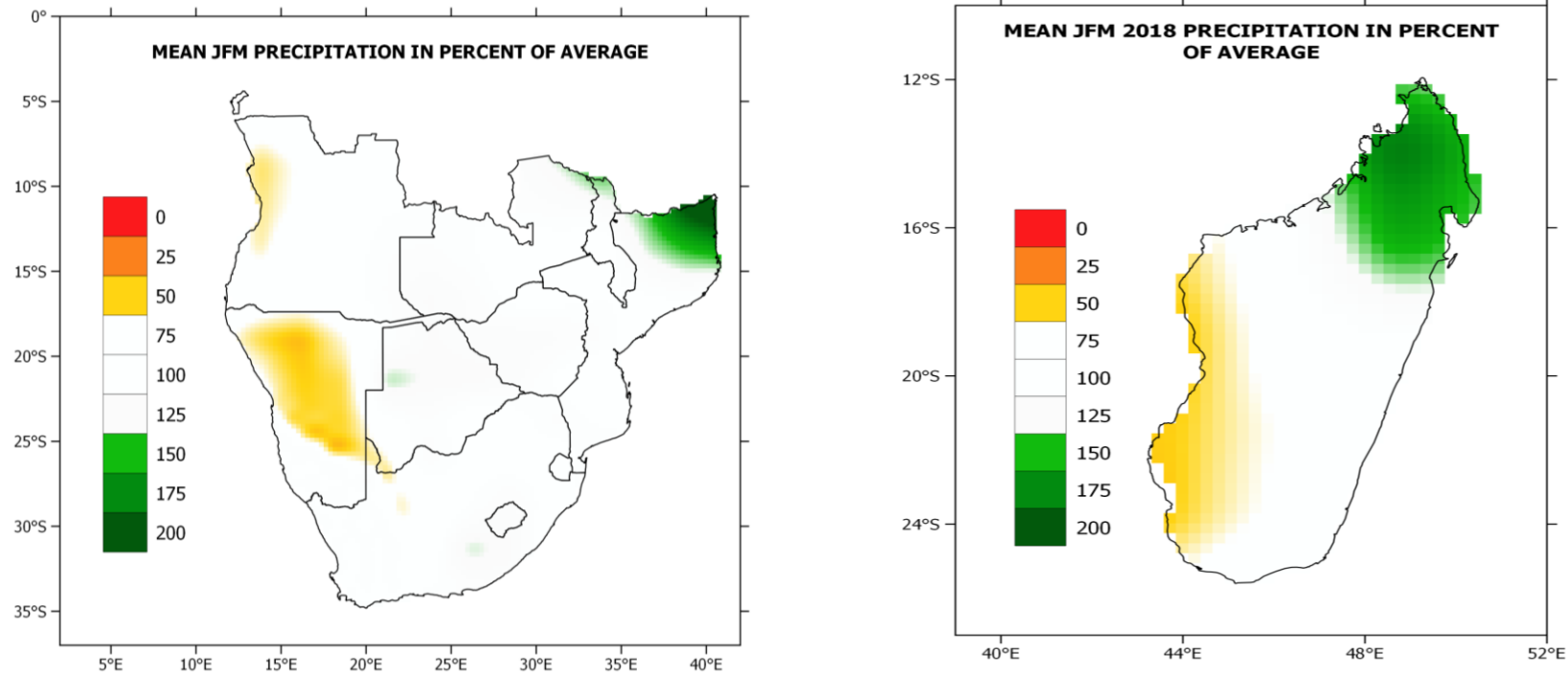


Figure 9: Mean January-February-March (JFM) precipitation in percent of average over Southern Africa for 2018. Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAM5_OPI/.v0208/.mean/.prcp/

- While most parts of Southern Africa recorded near normal conditions, above average rainfall was observed over northern parts of Mozambique and Madagascar. Dry conditions were recorded over western Madagascar and Namibia.

4.2.2 Western Africa

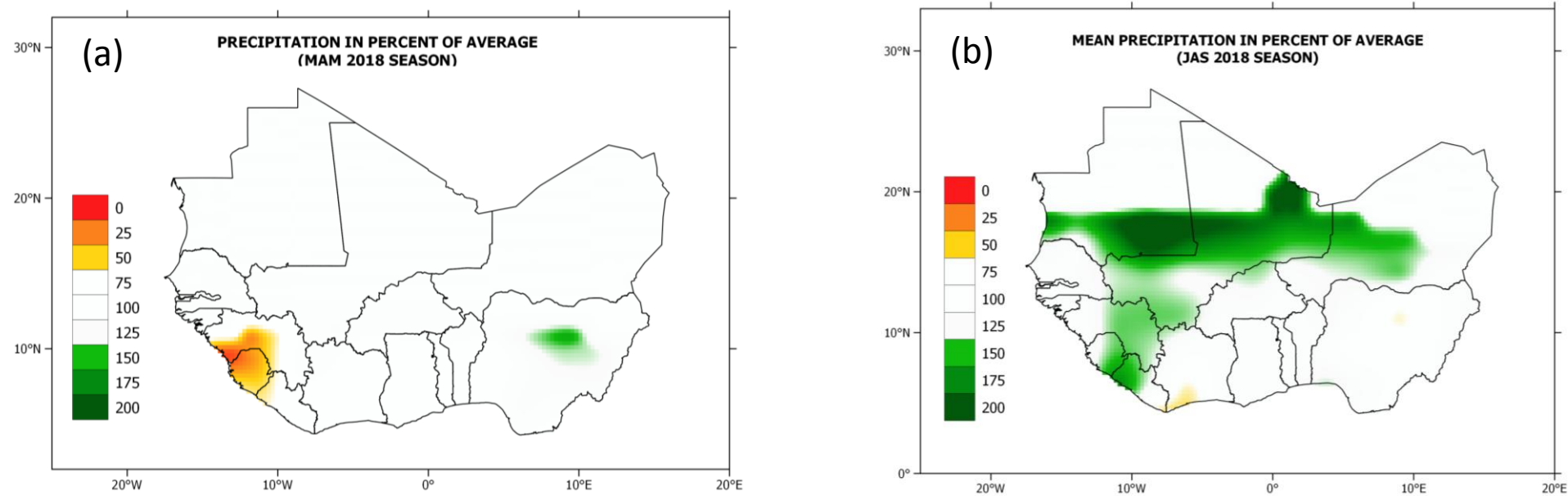


Figure 10: Precipitation in percent of average over West Africa (a) MAM and (b) JAS.

Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAMS_OPI/.v0208/.mean/.precip/

- Wet conditions were recorded over central 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 Sierra Leone and Guinea countries.

4.2.3 Central Africa

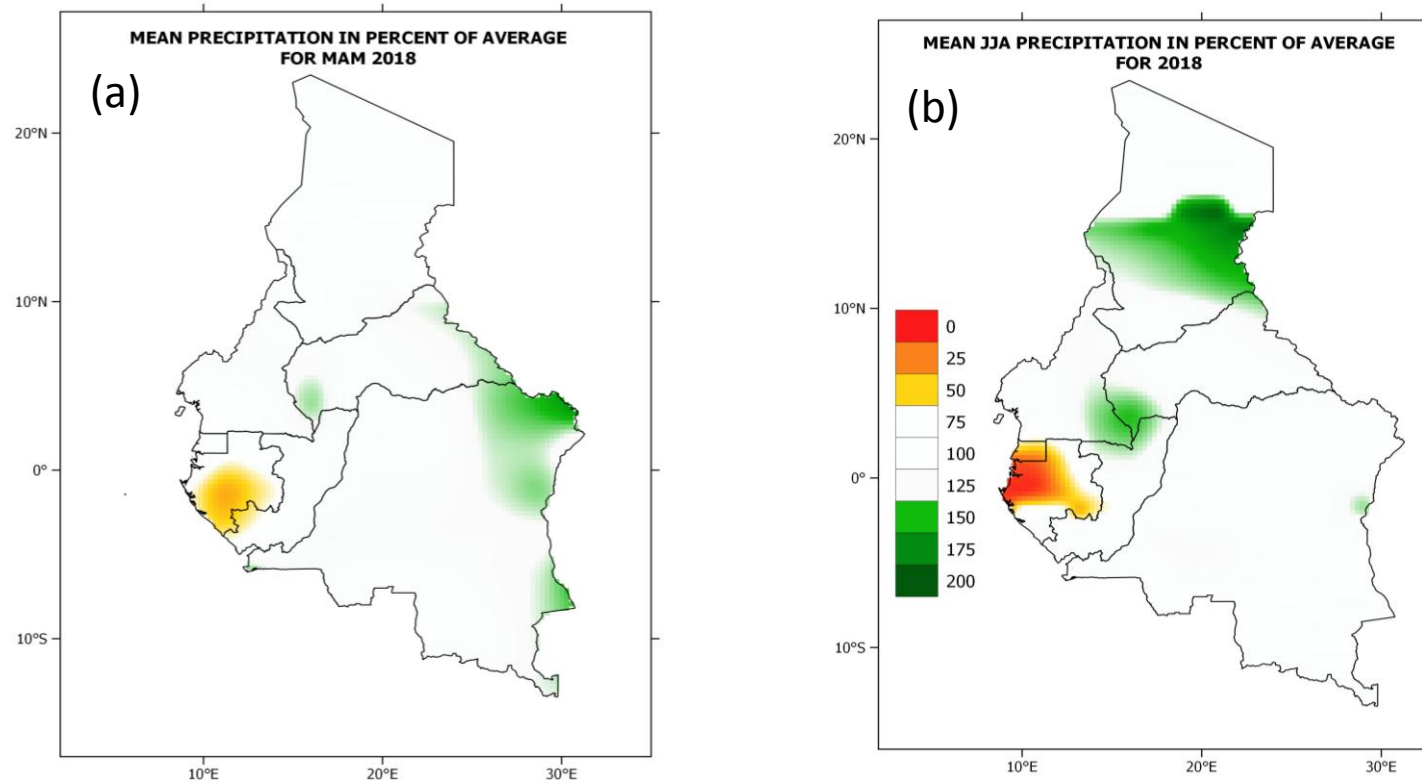


Figure 11: Precipitation in percent of average over Central Africa in 2018 (a) MAM and (b) JJA. . Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAMS_OPI/.v0208/.mean/.prcp/

- Wet conditions were recorded over northeastern DRC during MAM season, while dry conditions were recorded over Gabon.
- During JJA, dry conditions prevailed over Gabon, whereas wet conditions were observed over central Chad, southeastern Cameroon, and southern CAR.

4.2.4 Eastern Africa

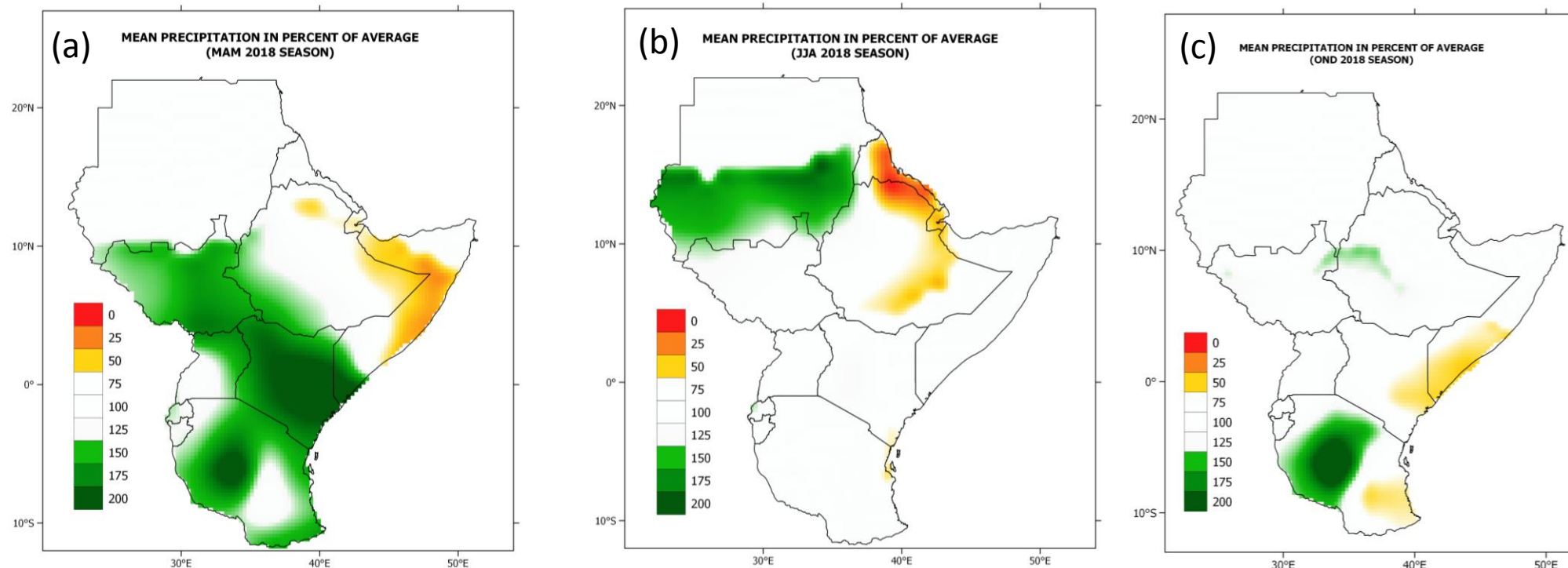


Figure 12: Precipitation in percent of average over East Africa in 2018 (a) MAM, (b) JJA and (c) OND seasons. . Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAMS_OPI/.v0208/.mean/.prcp/

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

4.2.5 North Africa

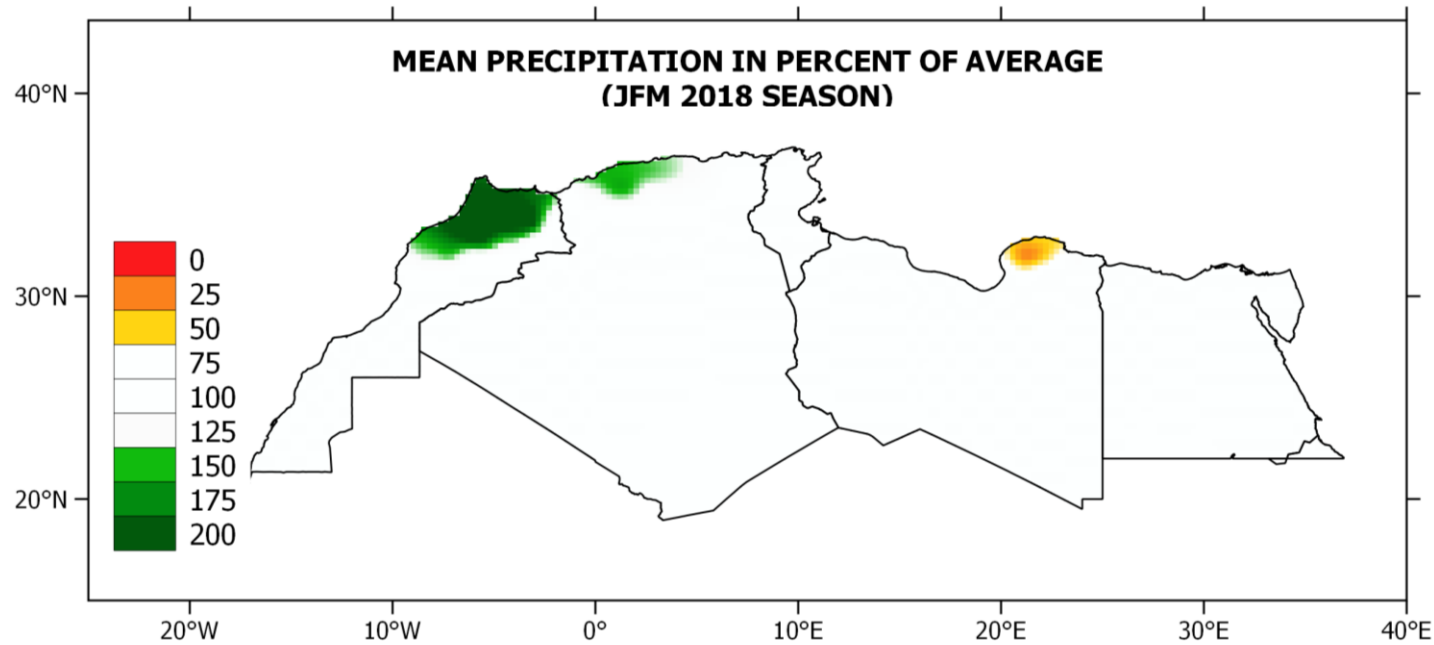
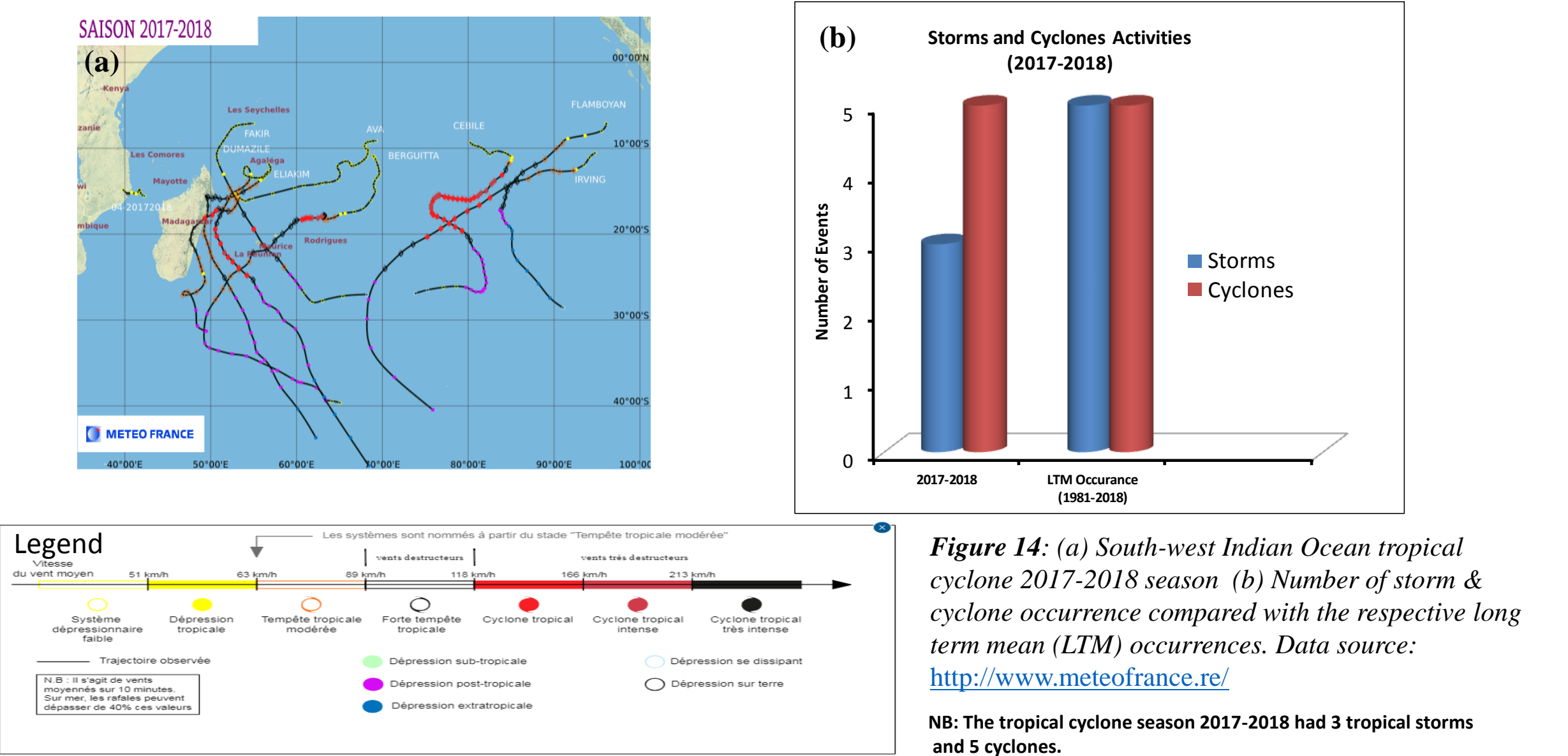


Figure 13: Mean JFM 2018 precipitation in percent of average over North Africa. . Data source: https://iridl.ldeo.columbia.edu/SOURCES/.NOAA/.NCEP/.CPC/.CAMS_OPI/.v0208/.mean/.prcp/

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

5. Tropical cyclones in the Southwestern Indian Ocean



6. Selected Significant Weather related Hazards in 2018 and their Impacts

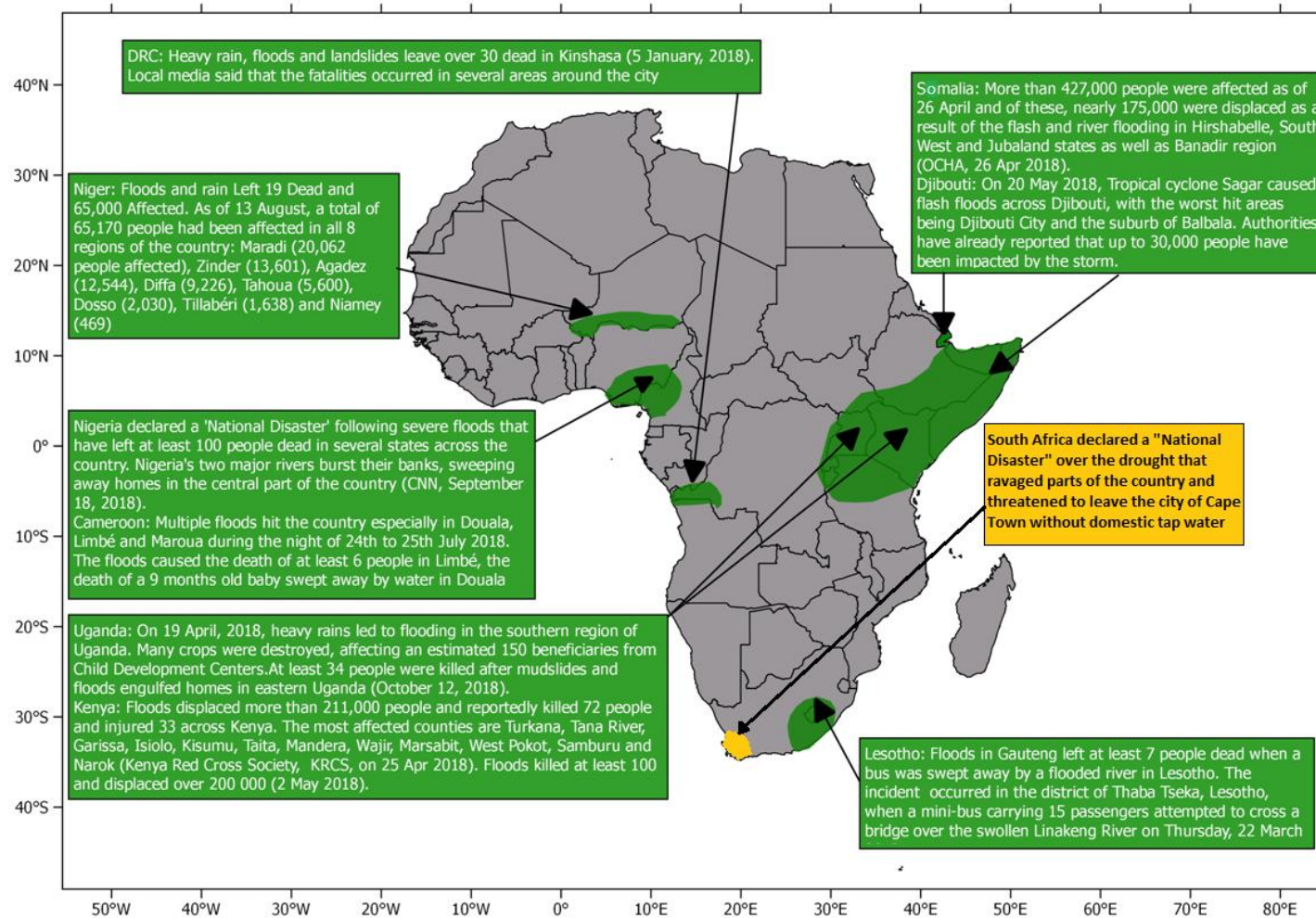


Figure 16: Selected significant weather related hazards in 2018

Table of detailed information of **sampled significant events, hazards and impacts per region and country.**

Eastern Africa	
Uganda (Oct 12, 2018)	At least 34 people were killed after mudslides and floods engulfed homes in eastern Uganda. At least six villages in Bududa district, located on the border with Kenya were affected (October 12, 2018, CNN-Kampala, Uganda). https://edition.cnn.com/2018/10/12/africa/uganda-mudslides-40-dead/index.html
Kenya (25 Apr 2018; 2 May 2018)	Floods displaced more than 211,000 people and reportedly killed 72 people and injured 33 across Kenya. The most affected counties are Turkana, Tana River, Garissa, Isiolo, Kisumu, Taita, Mandera, Wajir, Marsabit, West Pokot, Samburu and Narok (Kenya Red Cross Society, KRCS). The floods disrupted livelihoods, with at least 8,450 acres of farmland submerged in water and more than 6,000 livestock killed, destroyed houses and damaged infrastructure, such as roads and health facilities (OCHA, 25 Apr 2018). https://reliefweb.int/report/kenya/ocha-flash-update-1-floods-kenya-25-april-2018 Floods killed at least 100 and displaced over 200 000 (2 May 2018). https://www.news24.com/Africa/News/pics-kenya-floods-kill-at-least-100-displace-over-200-000-20180502
Djibouti (20 May 2018)	20 May 2018, Tropical cyclone Sagar caused flash floods across Djibouti, with the worst hit areas being Djibouti City and the suburb of Balbala. Authorities have already reported that up to 30,000 people have been impacted by the storm. https://disasterscharter.org/en/web/guest/activations/-/article/flood-in-djibouti-activation-572-
Sudan (During June, Jul and early November, 2018)	During Jul 2018, floods affected over 45,000 people, led to 23 human deaths and 61 injuries. In addition, more than 8,900 families were rendered homeless. Over 200,000 people in 15 of Sudan's 18 states were affected by heavy rains and flash floods between June and early November, according to the Government's Humanitarian Aid Commission (HAC). This is almost double the 122,500 people affected by floods the same time last year. The worst affected states are Kassala (47,500 people), Sennar (33,800 people) and West Kordofan (33,200 people). (OCHA, 4 Nov 2018 . https://reliefweb.int/disaster/fl-2018-000128-sdn
Somalia (26 April , 2018)	More than 427,000 people were affected as of 26 April and of these, nearly 175,000 were displaced as a result of the flash and river flooding in Hirshabelle, South West and Jubaland states as well as Banadir region (OCHA, 26 Apr 2018). https://reliefweb.int/disaster/ff-2018-000041-som
Burundi (04 May, 2018)	Severe flooding in Gatumba on 04 May affected 12,956 people and 2,133 houses in 9 locations. Red Cross said that the flooding resulted from a period of heavy rain causing the overflow of two rivers, Rusizi 1 and 2, which are tributaries of Lake Tanganyika crossing Gatumba area from Kivu. http://floodlist.com/africa/burundi-butererefloods-april-may-2018-in

West Africa	
<p>Nigeria</p> <p>(September 18, 2018; October 9, 2018)</p>	<p>Nigeria declared a 'national disaster' following severe floods that have left at least 100 people dead in several states across the country. Nigeria's two major rivers burst their banks, sweeping away homes in the central part of the country (CNN, September 18, 2018). https://edition.cnn.com/2018/09/18/africa/nigeria-flood-national-disaster/index.html</p> <p>By October 9, 2018, a total of 103 Local Government areas across 10 states in Nigeria, were impacted by severe flooding with an estimated 1.9 million people affected.</p>
<p>Niger</p> <p>(13 August, 2018)</p>	<p>Floods and rain Left 19 Dead and 65,000 Affected. As of 13 August, a total of 65,170 people had been affected in all 8 regions of the country: Maradi (20,062 people affected), Zinder (13,601), Agadez (12,544), Diffa (9,226), Tahoua (5,600), Dosso (2,030), Tillabéri (1,638) and Niamey (469). http://floodlist.com/africa/niger-floods-july-august-2018</p>
Southern Africa	
<p>Lesotho</p> <p>(22 March 2018)</p>	<p>Floods in Gauteng left at least 7 people dead when a bus was swept away by a flooded river in Lesotho. The incident occurred in the district of Thaba Tseka, Lesotho, when a mini-bus carrying 15 passengers attempted to cross a bridge over the swollen Linakeng River on Thursday, 22 March 2018. Put this text in tabular format. http://floodlist.com/tag/south-africa</p>
<p>South Africa</p> <p>(13 February 2018)</p>	<p>South Africa declared a "national disaster" over a drought that ravaged parts of the country and threatened to leave the city of Cape Town without domestic tap water . https://phys.org/news/2018-06-safrica-state-disaster-drought.html#jCp (The City of Cape Town said on its web site that Day Zero had been “pushed out to 2019.” Residents had to live with stringent consumption restrictions, which stood at 50 litres per person per day)</p>
<p>Mauritius</p> <p>(24 April, 2018)</p>	<p>Mauritius experienced heavy rain from tropical cyclone Fakir that Triggered deadly landslide on 24 April, 2018. http://floodlist.com/africa/reunion-mauritius-cyclone-fakir-april-2018</p>
Central Africa	
<p>DRC</p> <p>(5 January, 2018)</p>	<p>Heavy rain, floods and landslides leave over 30 dead in Kinshasa (5 January, 2018). At least 37 people are thought to have died, and it is feared that this figure could rise as further assessments are carried out.</p> <p>Local media said that the fatalities occurred in several areas around the city, including in Ngaliema, Selembao, Bandalungwa, Limete and Barumbu. http://floodlist.com/africa/drc-floods-landslides-kinshasa-january-2018</p>

Central Africa continued	
<p>Côte d'Ivoire (18 June 2018)</p>	<p>The Country's National Civil Protection Office (ONPC) said that heavy rainfall on 18 June 2018 resulted in flooding that caused at least 18 deaths in Abidjan and severe material damage. As of 19 June, 115 people had been rescued from the floods and provided with shelter by authorities. http://floodlist.com/africa/ivory-coast-abidjan-floods-june-2018</p>
<p>Cameroon (24th & 25th July 2018)</p>	<p>Multiple floods hit the country especially in Douala, Limbé and Maroua during the night of 24th to 25th July 2018. The floods caused the death of at least 6 people in Limbé, the death of a 9 months old baby swept away by water in Douala and important material damages estimated in several hundred millions FCFA francs in Limbé as well as in Douala and the destruction of 700 houses in Maroua, that consequently left thousands homeless and concerns on the economic activities in the whole region. http://www.africanews.com/2018/07/25/cameroon-cities-of-douala-limbe-hit-by-heavy-flooding/ (Africa News; GardaWorld Crisi24 News Alerts; Tebopost news, ...)</p>