MESA
Monitoring for Environment and Security in Africa
AU THEMA

Climate Services for Disaster Risks Reduction in Africa

ACMAD
A project led & implemented by the African Centre of Meteorological Applications for Development

THE CLIMATE IN AFRICA 2016

March 2017

ACMAD-MESA

CLIMATE CHANGE ASSESSMENT SERVICE

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CLIMATE CHANGE ASSESSMENT
Report N° 5, March 2017

THE CLIMATE IN AFRICA 2016

African **C**entre of **M**eteorological **A**pplications for **D**evelopment – **ACMAD –**

Climate Services for the African Union

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1. INTRODUCTION

The World Meteorological Organization (WMO) has been issuing since 1993 a peer reviewed brochure documenting the state of global climate. The brochure highlights the main weather and climate events that occurred during a calendar year, supporting the Global Framework of Climate Services (GFCS), which has major emphasis on Africa. Based on the success of this initiative, the WMO in conjunction with the African Centre of Meteorological Applications for Development (ACMAD), published for the first time in 2013 the annual statement on the status of global climate focusing on the African climate. As a follow up action from the 2013 brochure, ACMAD through the Monitoring for Environment and Security in Africa (MESA) project has taken the responsibility of publishing annually the state of the African climate. The state of climate report is an essential document for formulating plans and long-term policies in Africa as it reveals climate variability and change in the continent, which helps decision makers in adopting policies that are climate change resilient.

This document provides a summary of the main weather and climate events that occurred in Africa during the calendar year of 2016. The major weather and climate events are documented using observed precipitation and temperature data as well as information provided by various UN agencies, newspapers and reports from National Hydrometerological services across the African continent. The year 2016 was the second warmest year on record over the African land masses since 1950. Well above average precipitation with floods were recorded over parts of West Africa while a severe drought affected parts of Eastern Africa.

2. CONTINENTAL CLIMATE ASSESSMENT

2.1 Temperature

The year 2016 was the second warmest on record over the African land mass (Figure 1). The warming rate in 2016 was 1.3 degrees Celsius higher than the WMO reference period (1961-1990), falling behind the year 2010, which was the warmest year on record (1.4 degrees Celsius) in Africa. The northern region of the continent (Algeria, Libya and Egypt) was anomalously warm, with temperature anomalies reaching more than 3 degrees Celsius above average (Figure 2). On the other hand, temperatures in some parts of Southern Africa were slightly cooler than the average, especially over Madagascar.

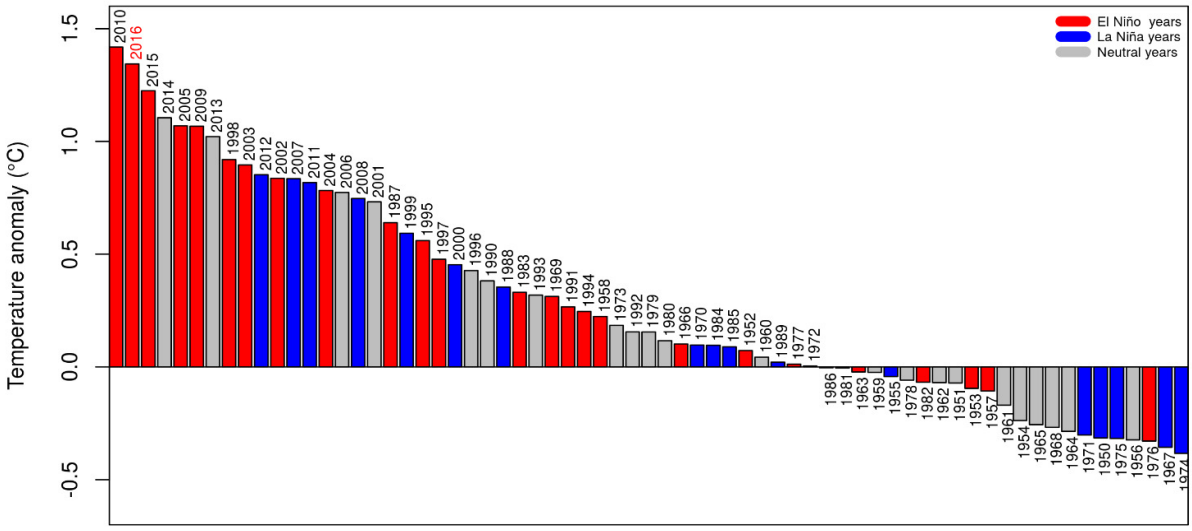

Figure.1: Ranked temperature anomalies (°C) for Africa for the 1950-2016 period, relative to 1961-1990. Red colors represent El Niño years while blue colors represent La Niña years and grey colors correspond to neutral years.

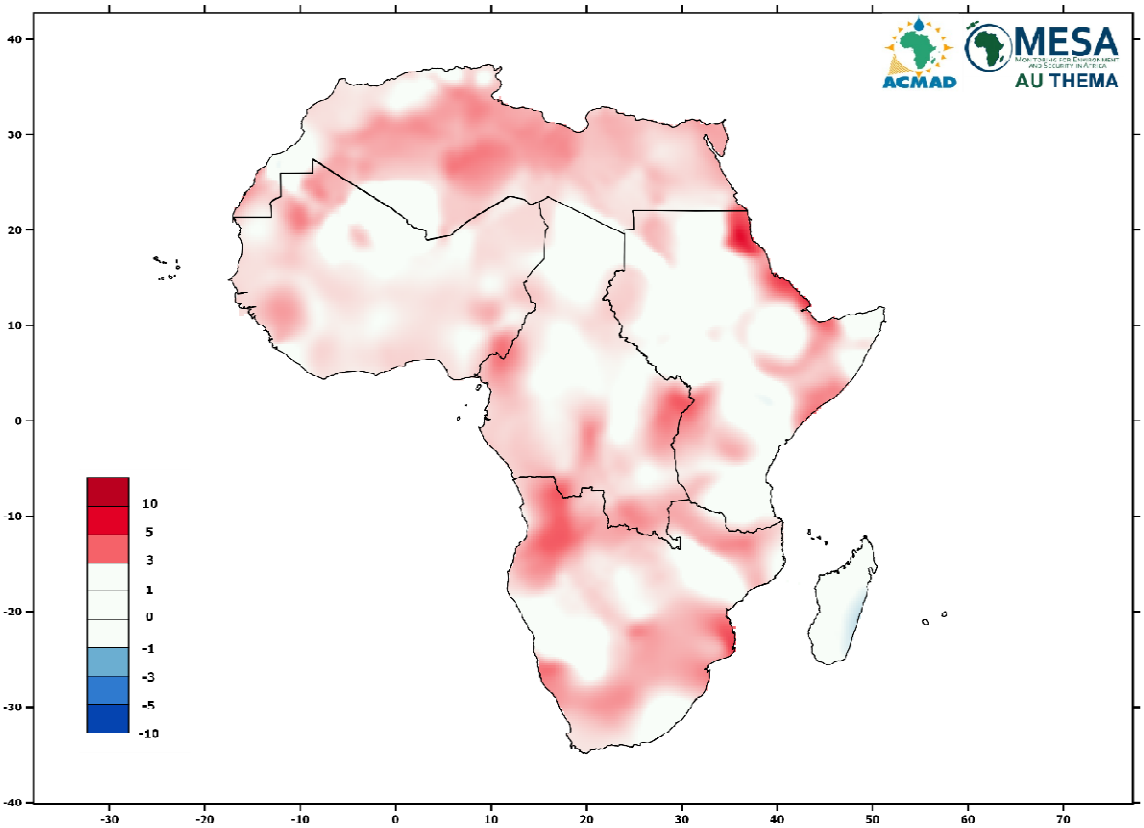

Figure .2: Temperature anomalies (°C) over Africa in 2016 relative to 1961-1990 referenced period. Data source: NOAA/NCEP/CPC

There is a clear warming trend at the continental level (Figure.3). For instance, of 17 warmest years on record in Africa, 16 have been observed in the last 16 years. The warming rate over the past 67 years was about 0.02 degrees Celsius. However, over the past 25 years the warming rate was 0.04 degrees Celsius. At this rate, the warming will reach 4 °C per century. This warming trend in temperatures may jeopardize the Paris Agreement in which the international community has agreed to keep the warming under 2 degrees Celsius with respect to the pre-industrial level by the end of the twenty first century.

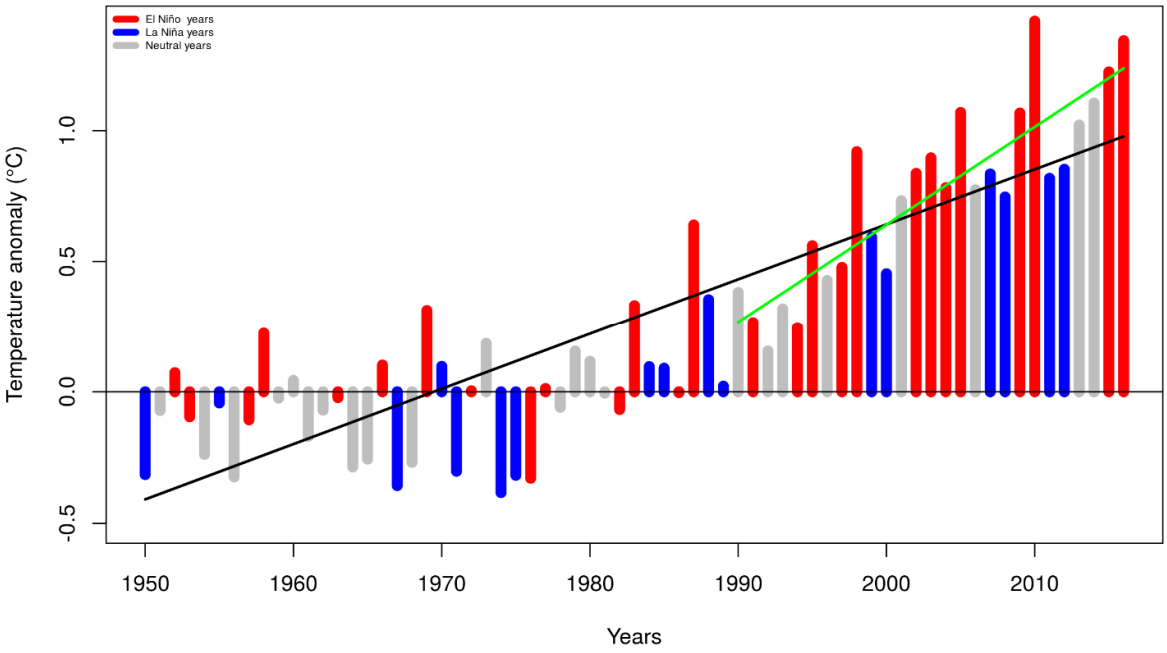

Fig.3: Trend in temperature anomalies over Africa for the 1950-2016 period (black line) and 1990-2016 period (green line). Red colors represent El Niño years while blue colors represent La Niña years and grey colors correspond to neutral years.

The year 2016 was very peculiar, each month in 2016 was warmer than its long term average (Figure 4). For instance, in January 2016 , temperatures in Africa were 1.1°C much warmer than average while in February the temperatures across the African land surface were 1.4°C above the average. April and November were the hottest month in Africa, with temperature anomalies reaching 1.7°C above the average. As shown in Figure.5, unusually warm conditions were recorded over northern Africa (especially, over Algeria and Libya) during April 2016, with temperature anomalies reaching 4°C. Significantly positive temperature anomalies in April were also recorded over other parts in Africa such as southeastern Ethiopia, southern Somalia, much of Angola and southern Mozambique. Well above normal temperature conditions were also recorded in November, especially over Angola and Southern Mozambique.

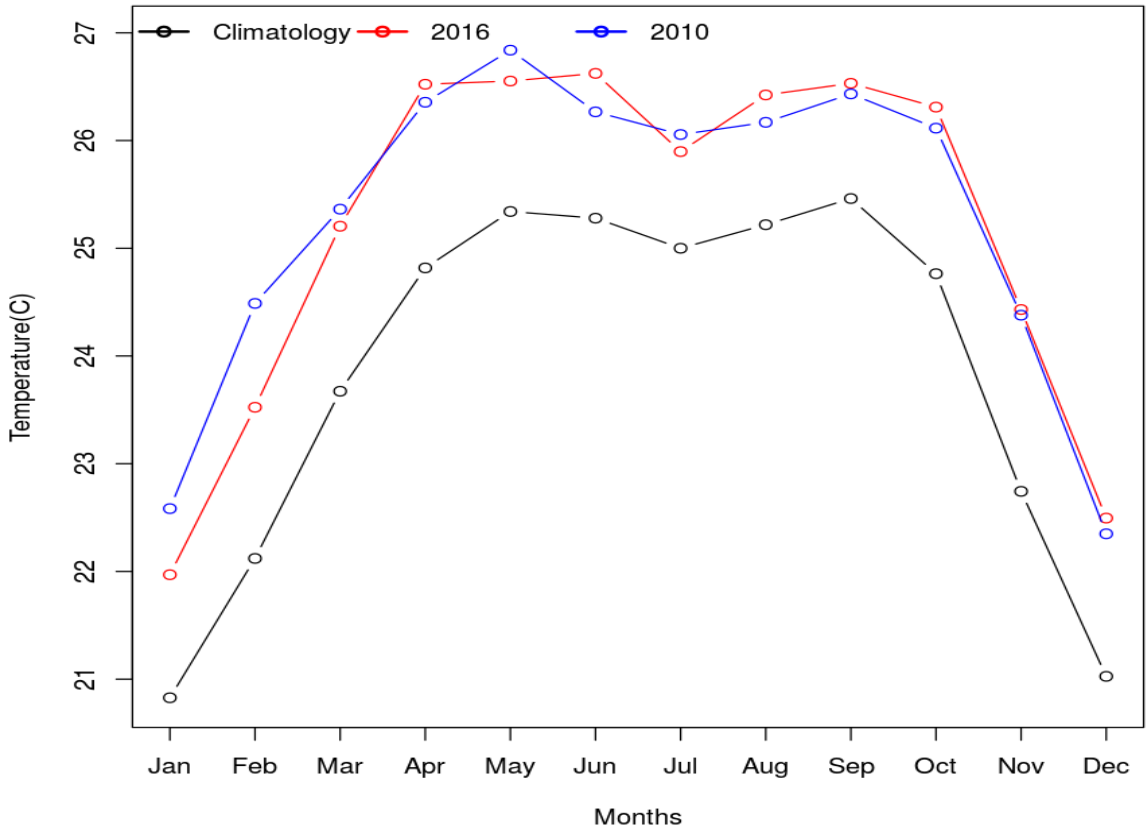

Fig. 4: Annual cycle of the African temperatures. Black line indicates the reference period (1961-90). Blue indicates the 2010 annual cycle and the red line is for 2016.

During the February-March-April (FMA) the average temperature in Africa was 1.4 °C much warmer than the average (Fig.6; top panel). Remarkably, warm conditions were observed across many countries on the continent. For instance, temperatures were exceptionally warm over northern Ethiopia, southern Somalia, and northeast Democratic Republic of Congo (DRC), greater part of Angola, southern Namibia and Mozambique. On the other hand, below normal temperatures were recoded over northern Mali, southwestern Algeria and the east cost of Madagascar. As a whole, the average mean temperature in Africa during the May-June-July (MJJ) period was 1.1°C above the mean (Figure 6; bottom panel). However, temperatures were extremely below average over Madagascar and the tip of the horn of Africa.

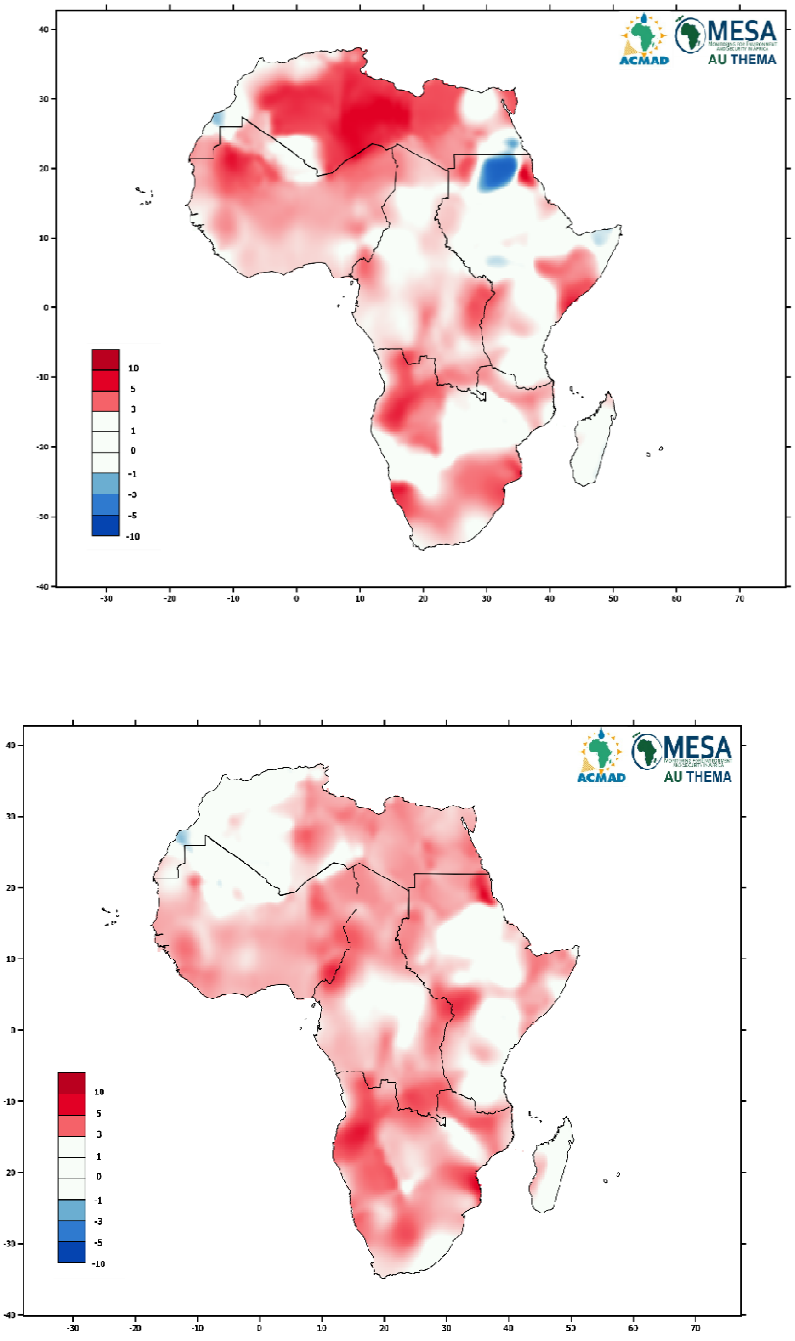

Figure 5: April 2016 (top panel) and November 2016 (bottom panel) temperature anomalies (°C) in Africa.

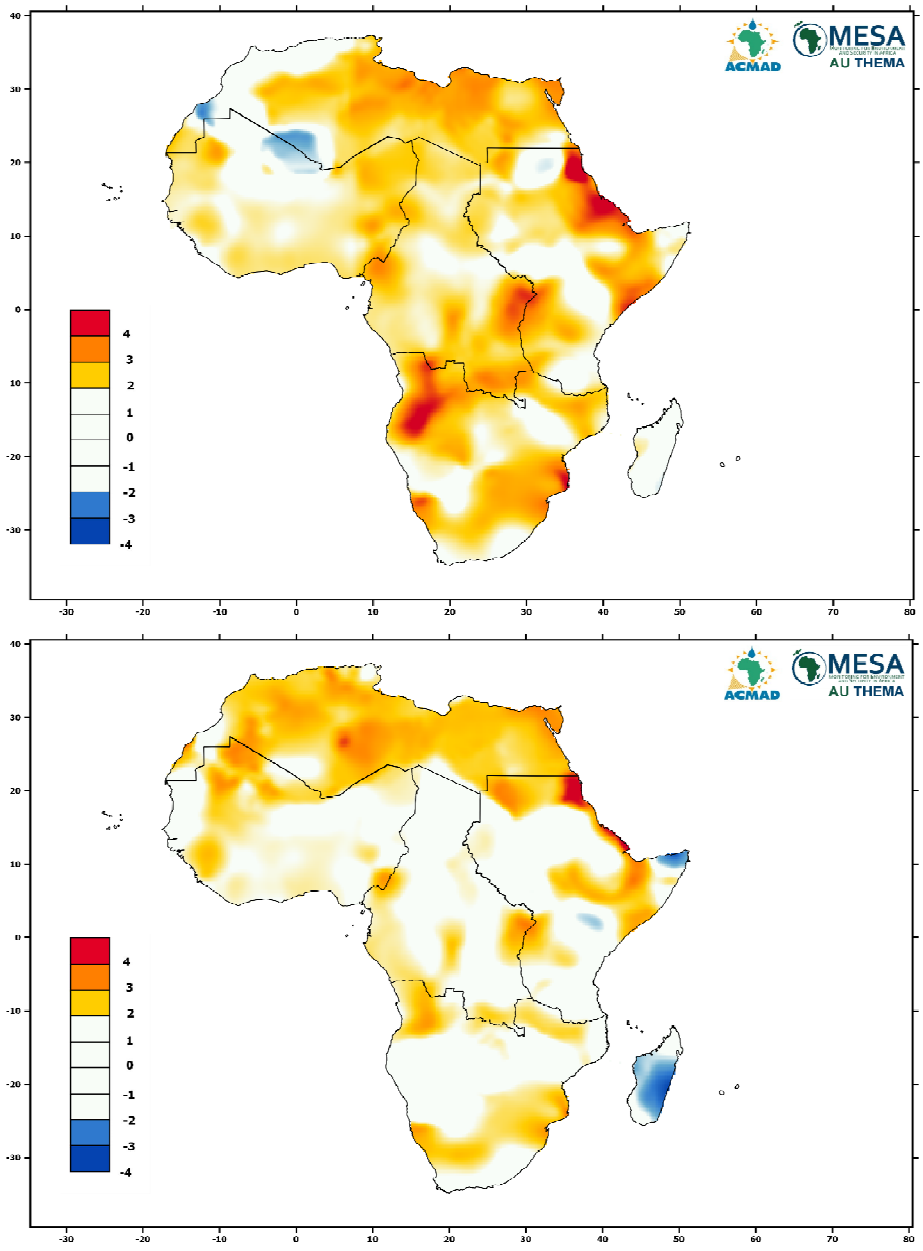

Fig. 6: Seasonal temperature anomalies (°C) in Africa during February-March-April (FMA) period (top panel) and May-June-July (MJJ) period (bottom panel).

2.2 Precipitation

The percent of average precipitation in Africa during the year 2016 is presented in Figure 7. Compared to the reference period (1981-2010), rainfall was well below average over the northern part Algeria, Libya and Egypt. Precipitation was also well below the average over Somalia, Kenya and Madagascar, leading to severe drought conditions over those countries. Conversely, the bulk of the Sahel region experienced well above average rainfall conditions, leading to flood occurrence over Mali, Ghana, Niger and Chad.

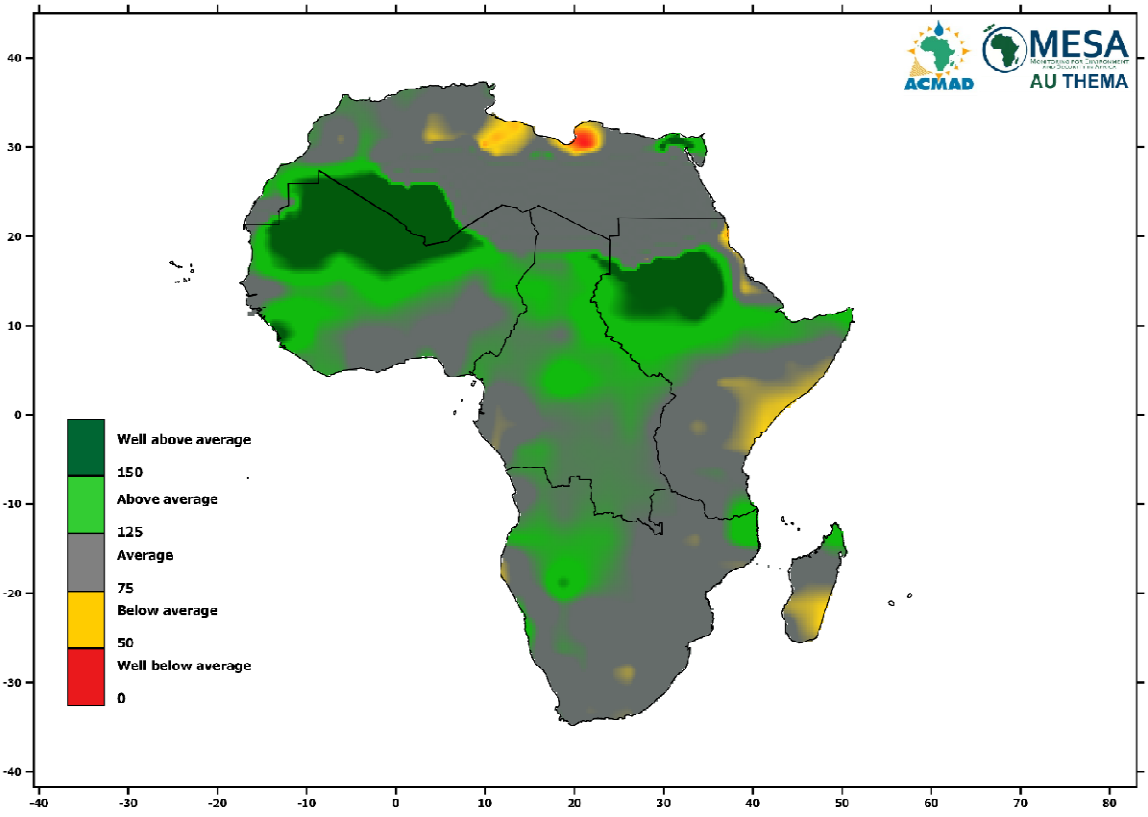

Fig.7: Percentage of rainfall change in 2016 over Africa, relative to the 1981-2010 period.

As noted already, dry conditions were experieced over northern parts of Algeria, Libya and Egypt during the FMA period (Figure.8). On the contrary, South Sudan and northern Ethiopia recorded well above average conditions over the same period, which persisted in MAM and JAS seasons. During the October-November-December (OND) season, well below average precipitation conditions were observed over Eastern Africa (especially over Somalia

and Kenya). Deficits in rainfall combined with extremely high temperatures created the necessary conditions for the onset of a severe drought over this regions. Drought situation was also recorded over portions of Southern Africa during the OND period, especially over Angola, central South Africa and northern Mozambique.

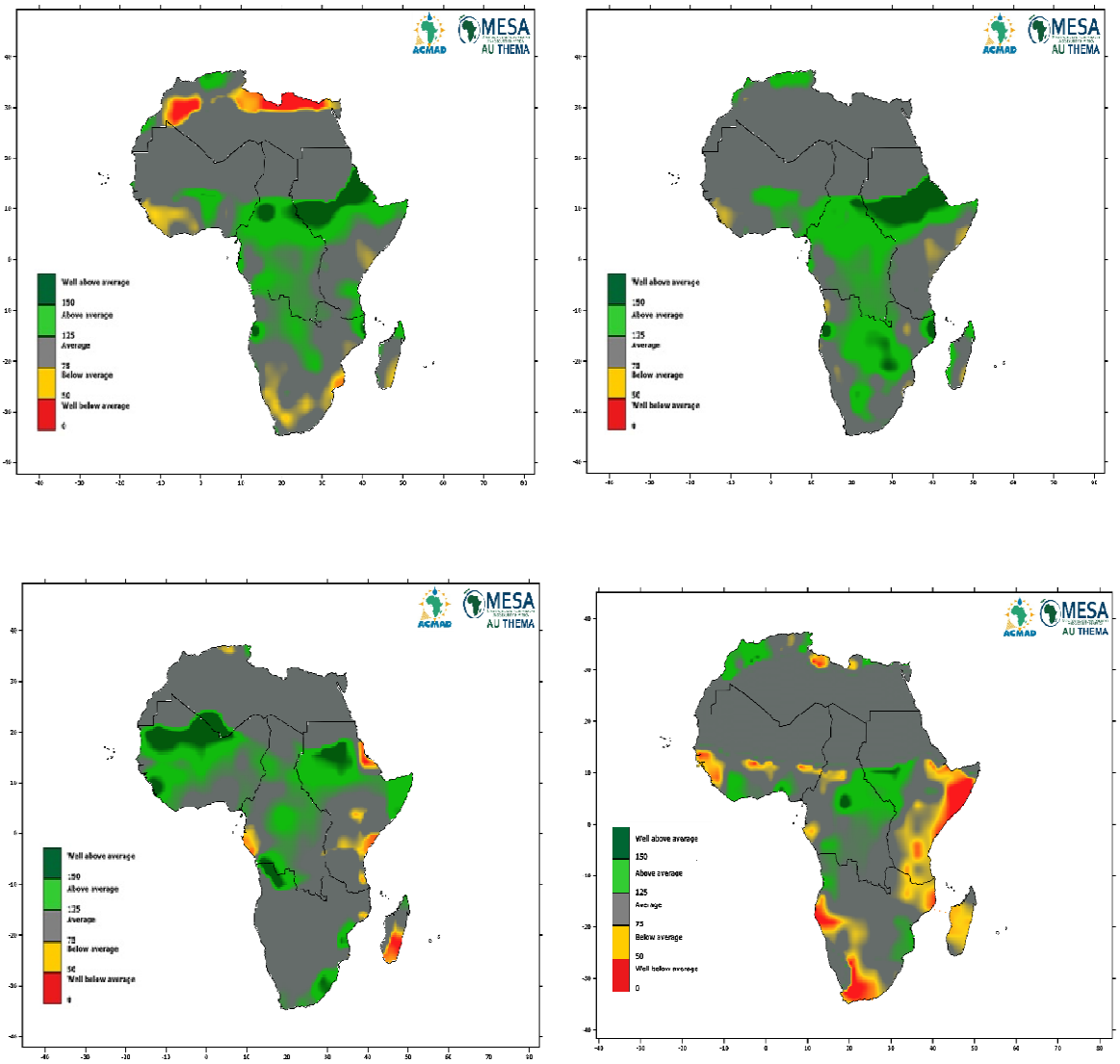

Fig.8: Percent of average rainfall in FMA (top left), MAM (top right) ,JAS (bottom) and OND over Africa in 201

3. REGIONAL CLIMATE ASSESSMENT

3.1 Temperatures

Over the Northern Africa (Figure 9), the average temperature anomalies were 1.6 degrees warmer than the long term mean. As result, the year 2016 was ranked as the second warmest year on record over this region. The year 2010 was the warmest on record (above 2 degrees) over this region. Similar to the North Africa, 2016 was ranked as the second warmest year on record (1.3 °C above the average) over the West African region, behind the year 2010 when the anomalies reached 1.5 °C. The year of 2016 was classified as the warmest year on record (1.5°C) over the Central Africa. In fact, the central African region has been observing record-breaking temperatures over the last three years. On the other hand, the year of 2016 was relatively cooler (1.1°C) over the Eastern African region. As such, 2016 was ranked as the 8th warm year on record over this region and 2010 remains the warmest year (1.5 °C) on record over this area.

Over Southern Africa, 2016 was placed as the second warmest year on record (1.6 °C), behind the year 2015 when the region recorded 1.8 °C above the long term mean. Temperatures in 2016 were mild over the island countries in the Indian Ocean. As a result, 2016 was ranked one of the coldest year with temperature anomalies -0.4 degrees below the long term mean.

With the exception of the island countries, which show a decreasing trend in temperatures over the last 25 years, all other regions in the African continent exhibit a warming trend in temperature.

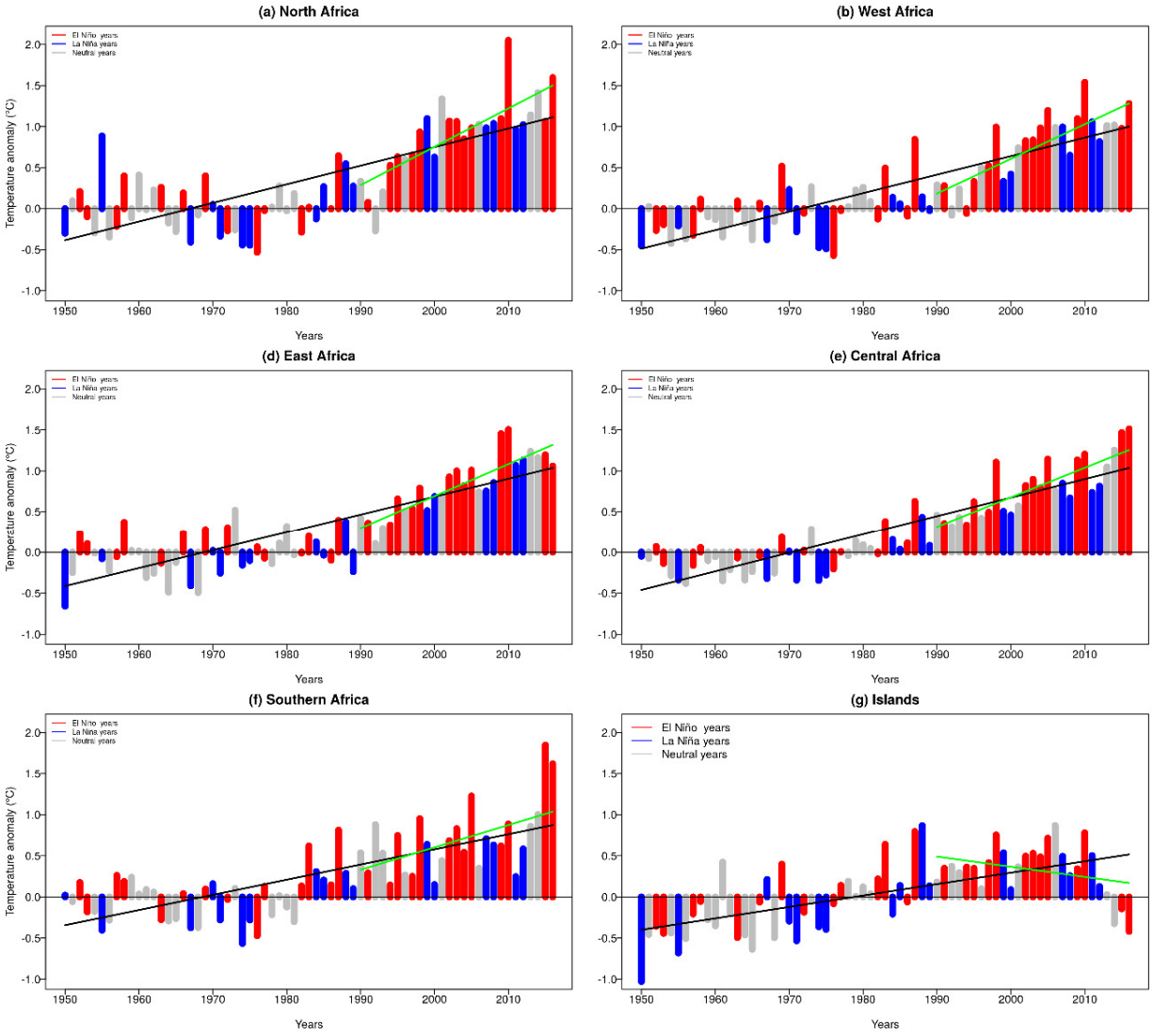

Figure 9: Trend in temperature anomalies over six sub-regions in Africa for the 1950-2016 period (black line) and 1990-2016 period (green line). Red colors represent El Niño years while blue colors represent La Niña years and grey colors correspond to neutral years.

3.2. Precipitation

3.2.1 West Africa

During the March-April-May (MAM) period of 2016, Wet conditions were recorded over Burkina Faso, southwestern Niger and Benin, whereas below average rainfall conditions were experienced over western Guinea, Sierra Leone and Liberia (Figure 10). However, when averaged over the whole rainy season (from June to October), Guinea, Sierra Leone and Liberia experienced well above precipitation.

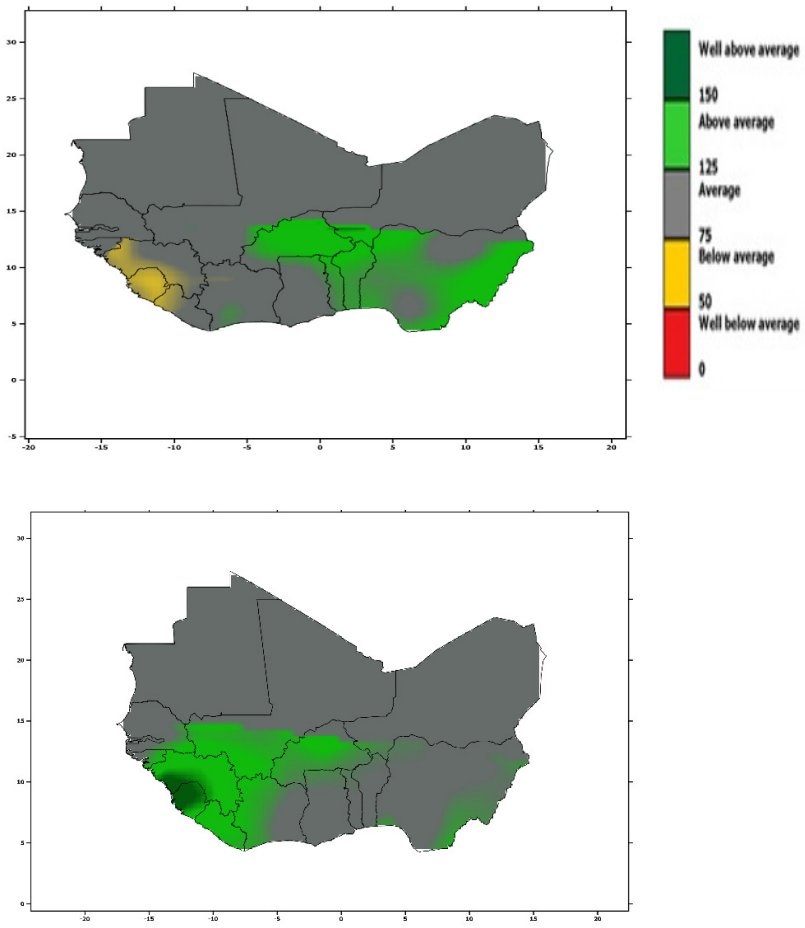

Figure 10: Percent of average precipitation over West Africa during the March-April-May (MAM) and June-July-August-September-October (JJASO).

3.2.2 Central Africa

Over the central African region, above average precipitation was recorded over a bulk of the region during the March-April-May period (Figure 11). The Central African Republic (CAR), recorded above average precipitation almost throughout the year (March to November) of 2016.

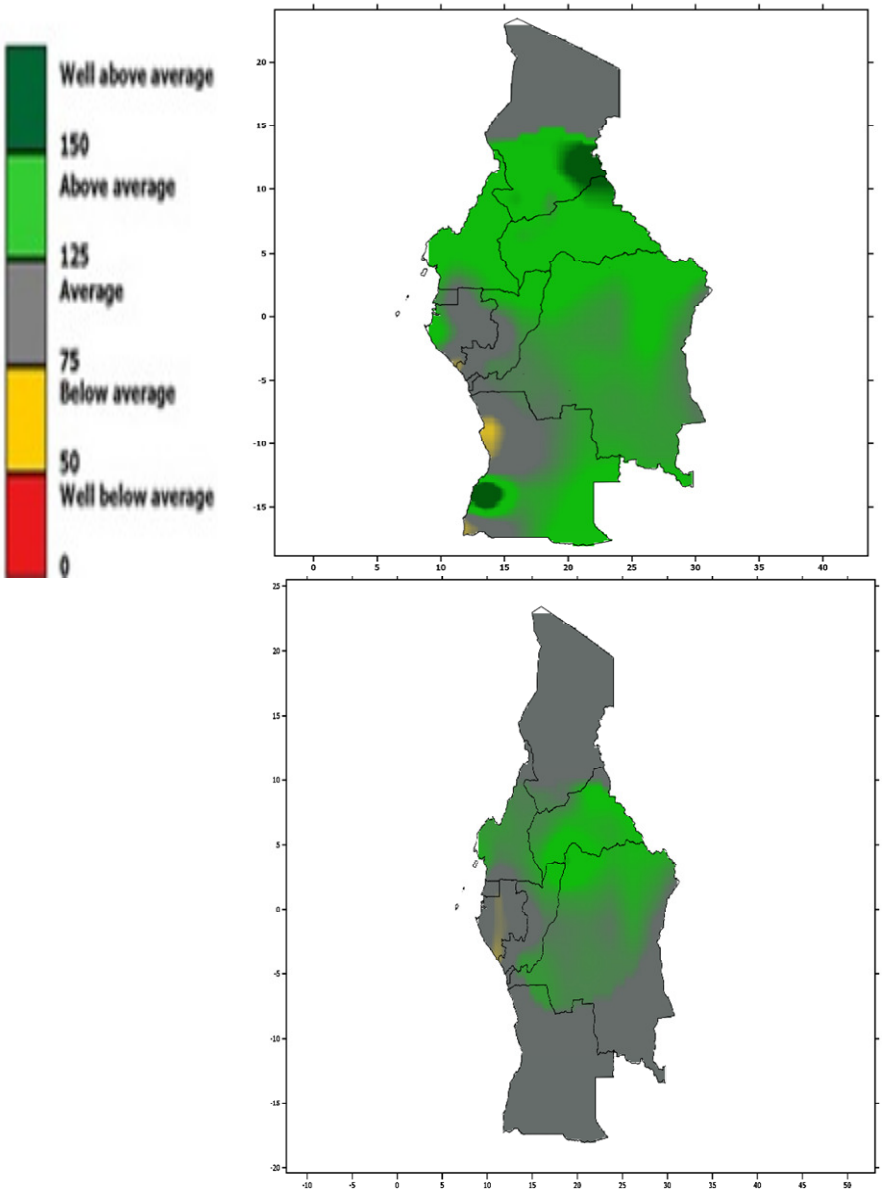

Fig.11: Percent of average precipitation over Central Africa during the March-April-May (MAM) and March to November (bottom panel).

3.2.3 East Africa

The Eastern Africa sub-region has experienced rainfall surplus over the southern part of Sudan, the whole South Sudan and the northern part of Ethiopia during the MAM period (Figure 12). However, during JAS period, some parts of the region suffered moderate to severe drought (e.g., southeastern Kenya and bulk of Eritrea). These drought conditions expanded over the region and persisted until the end of the year.

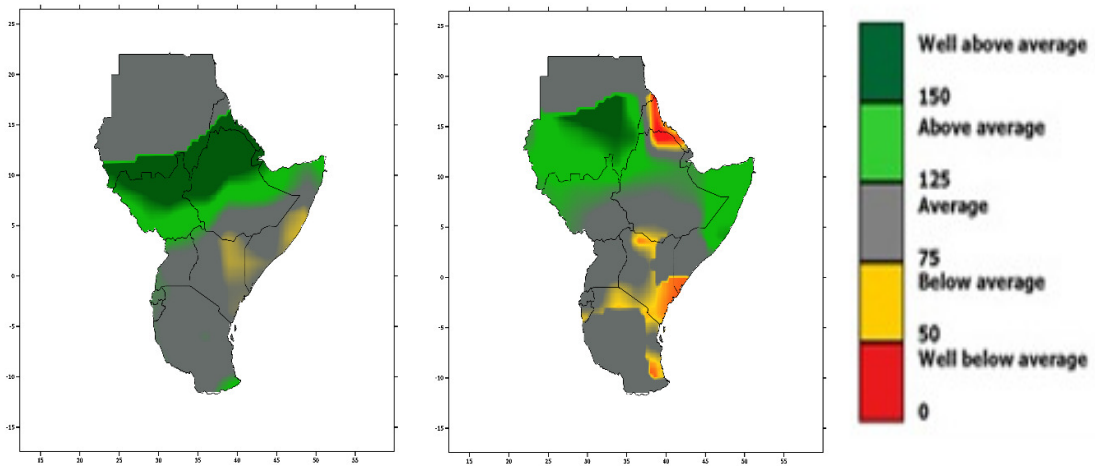

Figure 12: Percent of average precipitation over East Africa during (left panel) MAM and (right panel) JAS seasons.

3.2.4 Southern Africa

While some parts of the contiguous Southern Africa (e.g., southwestern Zambia and western Zimbabwe) have recorded above rainfall conditions during the first quarter of 2016 (February-March-April), other portions of the sub-region (e.g., southern Angola and Mozambique) experienced rainfall deficit (Figure 13). The well below average precipitation conditions over southern Mozambique are remnants of a prolonged drought in the region.

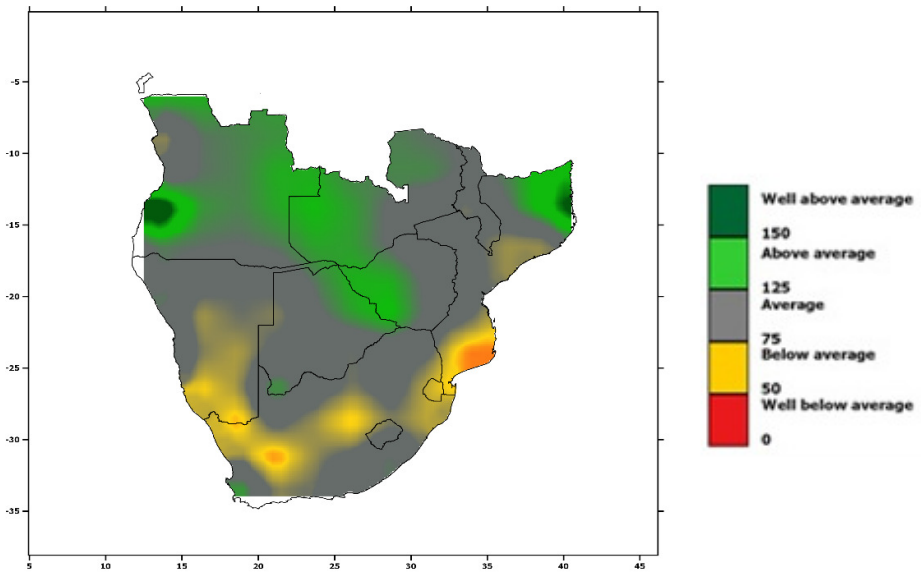

Figure. 13: Percent of average precipitation over Southern Africa during the February-March-April (FMA) in 2016.

3.2.5 Indian Ocean Countries

During the FMA 2016 period, rainfall was well above the average over the northern tip of Madagascar (Figure 14). In contrast, the southeastern part of the country has experienced less rains during the same period. The rainfall deficit stretched to the central Madagascar and prevailed until the end of the year.

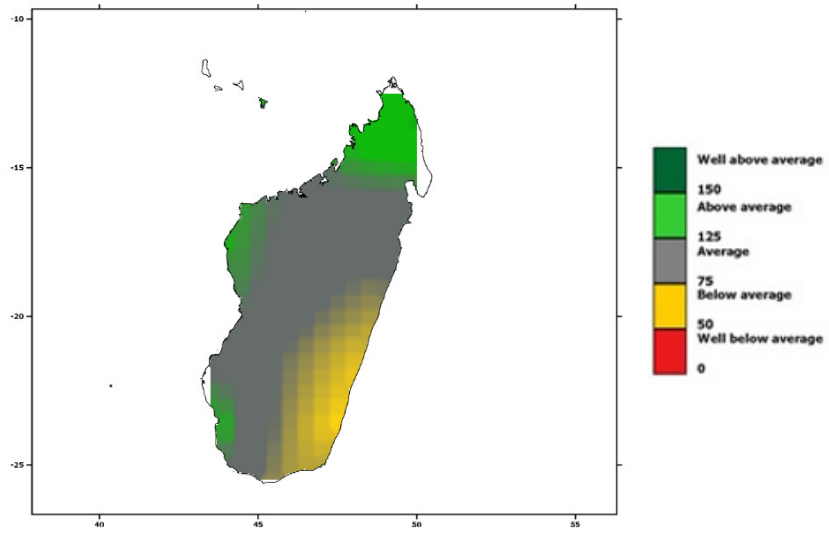

Figure 14: Percent of average precipitation over the Indian Ocean countries during the February-March-April (FMA) in 2016.

3.3. Tropical cyclones in the South-west Indian Basin

During the 2015/2016 season the Southwest-west Indian basin recorded 8 named storms:

- Tropical storm ANABELLE (17-27 November 2015)
- Tropical storm BOHALE (7-14 December 2015)
- Tropical cyclone CORENTIN (19-28 January 2016)
- Tropical storm DAYA (7-12 February 2016)
- Tropical cyclone URIAH (12-22 February 2016)
- Tropical cyclone EMERAUDE (14-23 March 2016)
- Tropical storm NR07 (18-30 March 2016)
- Tropical cyclone FANTALA (10-26 April 2016)

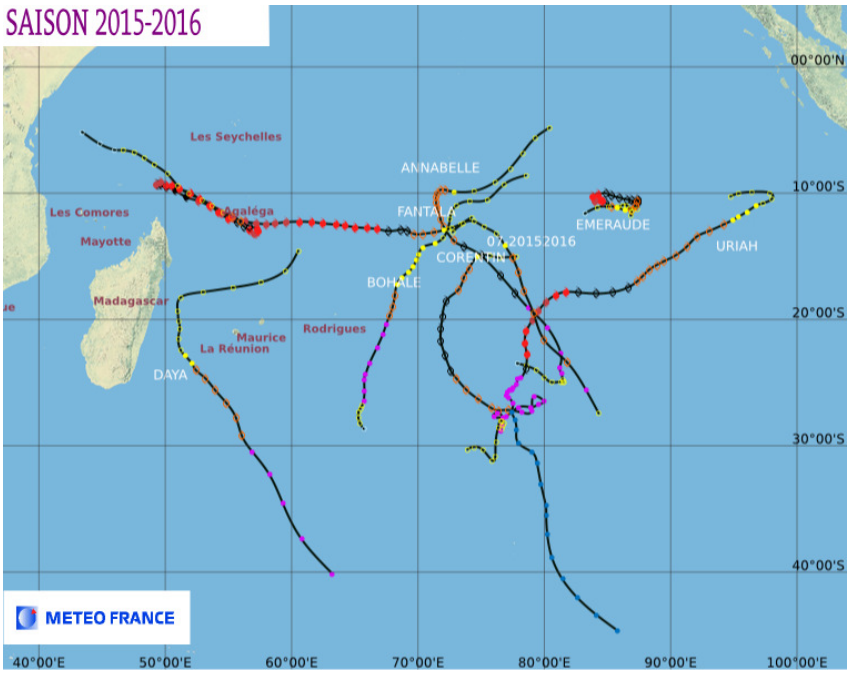

Figure 15: Observed tracks of tropical cyclones in the South-West Indian basin during the 2015/20 season . Source: http://www.meteofrance.re/

4. SIGNIFICANT HAZARDS IN 2016 AND THEIR IMPACTS

The year of 2016 was rich in terms of weather and climate extreme events (see Figure 16). Well above average precipitation with floods were recorded over West Africa (e.g., Mali, Ghana, Niger and Chad) and East Africa (e.g., South Sudan and Ethiopia). On the other hand, severe drought conditions over parts of Southern Africa (e.g., South Africa, northern Mozambique and Madagascar) and over East Africa (Kenya and Somalia) affected livestock, food production and power generation. Detailed information on significant weather and climate events is given in table 1.

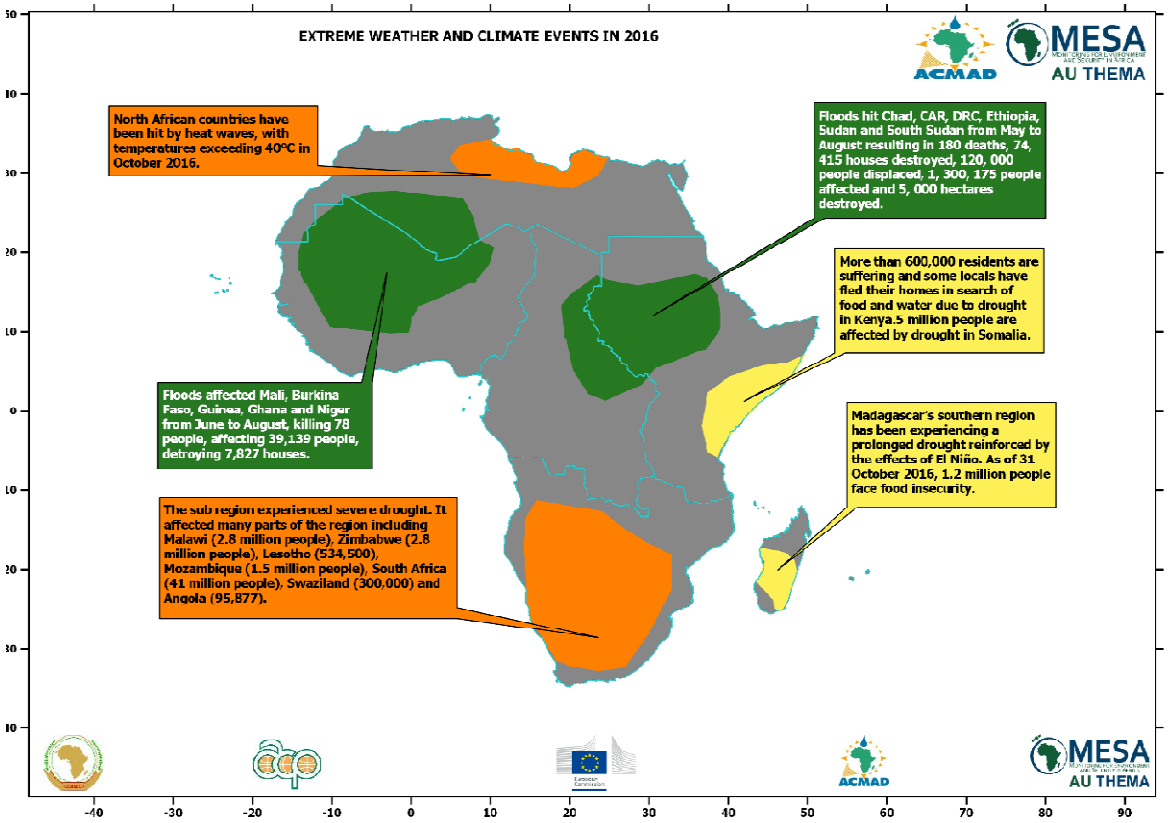

Figure 16: Significant hazards in 2016 and their impacts

Table1: Detailed information on significant events, hazards and impacts per region and country.

WEST AFRICA		
Nigeria	In ***June 2016***, in Lagos, floating school collapses in heavy rains In ***March2016,*** a building under construction came down	58 students who were using the facility as an annex had been relocated to the main school nearby because of concerns from parents about the effects of annual rains. (Agence France-Presse, 09 June 2016) At least 34 people died. (Agence France-Presse, 09 June 2016)
Niger	***On 14 June 2016,***Bazagor, a town in the northwestern province of Tchintabaradenerecei vedtorrential rains. In Ingal, near the northern city of Agadez, "85 millimetres (3 inches) of rain fell in two hours" On ***25 July 2016***, 7 regions (Agadez, Tahoua, Diffa, Maradi, Tillaberi, Zinder, Niamey) affected by floods	Three dead, destroyed 100 stores and 100 homes Hundreds of people have been left homeless, more than 8,000 goats, sheep, cattle and camel killed in the area, where animal corpses are visible over 20 kilometres (Agence France-Presse, 20 June 2016) 11 people died, around 30 000 people affected, 4 193 displaced and 1 693 houses destroyed. (OCHA, 26 July 2016)
Cameroon	***On 6 June 2016***, heavy rains accompanied by strong wind destroyed the town of Mayo-Oulo in Northern Cameroon Recurring natural disasters such as droughts and floods combined with the volatility of markets.	Four people died and destroyed so many houses including sub division and military camp houses in Mayo-Oulo(Crtv, 7 June 2016) pushed many households and communities into chronic vulnerability. (UN Office for the Coordination of Humanitarian Affairs, 8 August 2016)
Chad	***On 15 and 16 June 2016*** N'Djamena received heavy rains	Floods destroyed many houses and many people displaced (Journaldu Tchad.com, 17 June 2016)
Ghana	***On 16 June 2016,*** Accra received 185 mm in one	10 people killed by floods, homes and transportation routes have been disrupted as

	day	well(Morocco World News, 27 June 2016)
Guinea	***On 12 July 2016 to morning of 13 July 2016,*** heavy rainsin Conakry and north Entanord.	4 people died and 5 others injured (News Guinee 360°, 13 July 2016)
Mali	***Between 12 and 27 July 2016,*** Heavy rain caused disasters in different areas	13 people died and 9135 injured. 1459 houses collapsed and 850 households affected.(Le Républicain, 29 July 2016)
Burkina Faso	***On 20 July 2016,*** Heavy rains destroyed Ouagadougou and surrounding areas. The station of Po recorded 122 mm in two days ***On 11 August 2016*** flash floods destroyed the suburbs and shantytowns of Ouagadougou	Killed 4 people and destroyed 2000 houses. (LeFaso.net, 22 July 2016) At least 12 people have been killed in Burkina Faso in floods caused by torrential rainstorms, 2,577 damaged houses, while nearly 100 tons of grain have been lost, 237 granaries destroyed, 123 sheep and goats were put down and more than 630 poultry died (Agence France-Presse, 11 August 2016)
CENTRAL AFRICA		
DRC	Between ***October 2015 and March 2016***, heavy rains affected 11 provinces of DRC	550 000 people affected by floods, 65 000 houses damaged and 5000 hectares demolished. (JeuneAfrique, 3 March 2016)
CAR	On ***27 July 2016***, 6 six districts in Bangui affected by heavy rains	Rain destroyed so many houses.(CENTRAFRIQUE-PRESSE.COM, 31 July 2016)
EASTERN AFRICA		
Rwanda	On ***07 May 2016*** landslides caused by heavy rains in northern Rwanda	At least 53 people died, more than 500 houses destroyed and damaged infrastructure across the country, especially in the north.(BBC NEWS, 9 May 2016)
Kenya	**Floods:** On ***29 April 2016*** heavy rains caused floods and landslides across the country and a residential	At least 10 people are known to have died, and 121 people rescued, more than 800 houses were affected by flooding. (BBC NEWS,30April 2016)

	building collapsed in Huruma district. **Drought:** West Pokot County are facing acute hunger following drought in the area	More than 600,000 residents are suffering and Some locals have fled their homes in search of food and water(Kenya Daily Nation, 20 June 2016)
Somalia	On ***10 May 2016*** heavy rains have led to flash floods and river flooding in the country	An estimated 70,000 people have been displaced by floods in BeletWeyne in Hiraan region as a result of the rising water levels in the Shabelle River following heavy rains in the Ethiopian highlands. Nearly 60 percent of BeletWeyne town was inundated by flood waters. (OCHA, 28 May 2016)
Ethiopia	Since ***April 2016***, heavy spring/belg rains have caused floods and landslides. **Drought:** Ethiopia faced the worst drought in 50 years	100 deaths as of 12 May. Up to 120,000 people have been displaced in six regions. The most affected regions are Somali, Oromia, Southern Nations, Nationalities, and Peoples (SNNP), Afar, Amhara, and Harari – already severely affected by the El Niño drought. (ACAPS, 9 May 2016) Many people affected and faced food crisis (UNOCHA, 7 July 2016)
Sudan	On ***17 June 2016***, floods destroyed and damage houses in Sennar State On 13 ***July 2016,*** different places of South Sudan received flash floods.	Heavy rains and flash floods in Singa, the capital of Sennar State have destroyed 1,160 houses and damaged another 1,320 homes, according to the Sudanese Red Crescent Society (SRCS). (Ocha, June 2016) Heavy rainfall across Sudan last week caused the death of about 13 people, as well as extensive material loss.
South Sudan	**On *05 August 2016*,** rains, floods destroy hundreds of South Darfur homes On ***13 July 2016,*** Flash floods streaming from the Tagali and Magali mountains destroyed about 200 homes in camp Naivasha in Shangil Tobaya, North Darfur on Wednesday morning	According to the Government of Sudan, the Sudanese Red Crescent Society (SRCS) and partners, 80,175 people have been affected by the heavy rains and flooding across Sudan to date (8/8/2016) this year. 5,955 houses have been damaged of which 5,492 were entirely destroyed. (Radio Dabanga, 07 August 2016) About 200 homes were destroyed in camp Naivasha in ShangilTobaya, North Darfur. Many families displaced and damaged infrastructures (Radio Dabanga, 14 July 2016)

Burundi	On ***16 May 2016***, floods destroyed houses in Gatumba in Mutimbuzi District of Bujumbura province (West of of Burundi)	800 houses destroyed and many people displaced. (Burundi Government site, Mai 2016)
SOUTHERN AFRICA		
Zimbabwe	On ***4 February 2016*** the Government of Zimbabwe declared a state of National Disaster in view of the El Nino induced poor rains and the escalating food insecurity situation in the country.	2.8million People are in food-Insecurity (UN, March 2016)
Malawi	On *12 April 2016,* Malawi has declared a state of disaster over worsening food shortages caused by a severe drought as concerns grow over a hunger crisis spreading across much of southern Africa.	2.8millionPeople are in food-Insecurity (UN, March 2016)
Lesotho	On *02February 2016,* the Government of Lesotho declared a state of drought emergency and appealed for assistance from the international community	534,500 People are in food-Insecurity (UN, March 2016)
Mozambique	The Government of Mozambique activated *on 12 April 2016* the institutional Red alert due to drought.	1.5 million People are in food-Insecurity (UN, March 2016)
Swaziland	On *18 February2016* the Government declared a national state of emergency due to the drought, as El Nino impacts become more apparent.	at least 300,000 people - a third of the population - in dire need of assistance, specifically with for food and water
Angola	Severe acute malnutrition due to drought Office of the Resident	As per ***7 Jun***e 2016, a total of 3,023 yellow fever suspected cases has been recorded in 18/18

	Coordinator Situation Report no.3 reported yellow fever due to drought	provinces of Angola, including 337 deaths (case fatality rate 11.1%), 4 deaths were reported in Cunene, 22 in Huila and 1 in Namibe. **(**UN Resident Coordinator for Angola, 13 June 2016)
INDIAN OCEAN COUNTRIES		
Madagascar	**On *22 March 2016,*** the government of Madagascar has declared a state of emergency for southern Madagascar due to severe drought.	1.1 million People are in food-Insecurity (UN, March 2016)
Northern AFRICA		
Morocco, Algeria, Libya and Egypt	During June July the region was hit by heatwaves, with temperatures exceeding 40°	Created distress in the population and disrupted the fasting process during the Ramadan period. African news(http://www.africanews.com/2016/06/23/heatwave-in-egypt-making-it-difficult-for-those-observing-ramadan/)