

ISSN 1821-9411



# Statement on the Status of Tanzania Climate in 2013

**TANZANIA METEOROLOGICAL AGENCY  
(TMA)**



**ISSN 1821-9411**



**Tanzania Meteorological Agency (TMA)**

## FOREWORD

Observational evidences are now overwhelmingly convincing that the state of global climate is changing. Climate change signals can be discerned from historical rainfall and temperature data. Trend analysis of temperature and rainfall in most parts of the world has indicated a significant increase in temperature and a slight decrease in rainfall. Over the last few decades most parts of country have experienced substantial increase in frequency and severity of droughts and floods that were associated with devastating socio-economic implications. These extreme climatic events are projected to increase both in frequency and severity. Addressing these challenges require concerted efforts in monitoring the current state of climate and establishing communication strategies that ensure all stakeholders are well informed about the state of the climate, including the extreme weather events and the associated socio-economic implications on regular basis.

Tanzania meteorological Agency (TMA) has started producing statement on the status of Tanzanian climate. This is the third issue in the series of statements that will be published on annual basis, and providing comprehensive information on the status of climate in Tanzania; focusing on temperature, rainfall and cumulative rainfall and extreme events with the associated climatic features and socio-economic impacts during the year.

TMA would like to encourage all stakeholders, including the general public to continue following up and utilize the information and findings from the statements and contribute on reporting extreme weather events especially the localized ones. Also TMA is looking forward to receive comments and suggestions for further improvement of this statement.



Dr. Agnes Kijazi

Director General  
Tanzania Meteorological Agency

## TABLE OF CONTENTS

<b>FOREWORD</b> .....	ii
<b>TABLE OF CONTENTS</b> .....	iii
<b>LIST OF FIGURES</b> .....	iv
<b>LIST OF ABBREVIATIONS</b> .....	v
1.0 Introduction .....	1
2.0 Spatial and Temporal Temperature distribution in 2013 .....	2
2.1 Annual maximum temperature anomalies .....	2
2.2 Monthly maximum temperature anomalies .....	2
2.3 Annual Minimum temperature anomalies .....	5
2.4 Monthly minimum temperature anomalies .....	5
3.0 Rainfall distribution in 2013 .....	8
3.1 Annual rainfall distribution as percentage of the long-term average (1971-2000) .....	8
3.2 Monthly rainfall distribution as percentage of long-term average (1971-2000) .....	8
4.0 Meteorological drought monitoring for the year 2012/2013 .....	11
5.0 Severe weather and extreme climatic events 2013 .....	15
6.0 Factors contributed to severe extreme climatic events .....	15
7.0 Socio-economic implications of severe weather and extreme events .....	16
8.0 Conclusion .....	18

## LIST OF FIGURES

Figure 1: Annual maximum temperature departures (°C) from long-term average of 1971-2000 .....	2
Figure 2a: Monthly maximum temperature departure (°C) from long term average of 1971-2000 from January to June.....	3
Figure 2b: Monthly maximum temperature departure (°C) from long term average of 1971-2000 from July to December .....	4
Figure 3: Annual minimum temperature departure (°C) from long term average of 1971-2000 .....	5
Figure 4a: Monthly minimum temperature departure (°C) from long term average of 1971-2000 from January to June.....	6
Figure 4b: Monthly minimum temperature departure (°C) from long term average of 1971-2000 from July to December .....	7
Figure 5: 2013 rainfall percentages of the long-term average of 1971-2000 .....	8
Figure 6a: Monthly rainfall as percentage of long term average of 1971-2000 from January to June .....	9
Figure 6b: Monthly rainfall as percentage of long term average of 1971-2000 from July to December .....	10
Figure 7a: Monthly cumulative rainfall for Central Tanzania .....	11
Figure 7b: Monthly cumulative rainfall for Northern and Southern Coast Tanzania .....	12
Figure 7c: Monthly cumulative rainfall for South-western highlands and Western region .....	13
Figure 7d: Monthly cumulative rainfall for South-western highlands, Western region and Lake Zone	14
Figure 8: Existence of Tropical cyclone “FELLENG” over the North-east of Madagascar .....	16
Figure 9: Damaged Manung’una bridge at Msisi village in Singida due to flash floods (source: Mwananchi news paper 3rd January 2013) .....	17

## LIST OF ABBREVIATIONS

<b>AR5</b>	Fifth Assessment Report
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>SST</b>	Sea Surface Temperature
<b>TMA</b>	Tanzania Meteorological Agency
<b>URT</b>	United Republic of Tanzania

## 1.0 INTRODUCTION

Climate variability and change are among the biggest challenges of the 21st century to sustainable economic development. The impacts associated with climate variability and changes are already experienced in many sectors essential for human livelihood in vulnerable communities (URT, 2013). National climate change projection indicates that the frequency and severity of extreme and recurring droughts with devastating effects are increasing in agricultural, water and energy sectors. Currently more than 70% of all natural disasters in Tanzania are hydro-meteorological, and are linked to droughts and floods (Shayo, 2013).

Monitoring climate variability and change is essential to understanding the Earth climate system and its influence on human health, safety and welfare. While observed changes in the Earth's climate have been well documented, regarding how the Earth's climate will vary and change in the future, how these changes will affect societies and economies of developing nations, and how changes in one part of the climate system will influence other aspects of climate is less well understood. There is strong need to continue monitoring climate condition of the country and the associated impacts.

In order to ensure that awareness on weather, climate and climate change is enhanced, there is a need to provide up to-date and reliable information to all stakeholders on the status of the National climate. Therefore Tanzania Meteorological Agency (TMA) issues annual report on the status of the climate in the country. The current statement provides detailed information on spatial and temporal distribution of rainfall and temperature anomalies; cumulative rainfall plots and extremes events from January to December 2013. Incidences of severe weather and extreme climate events and its socio-economic impacts are also discussed.

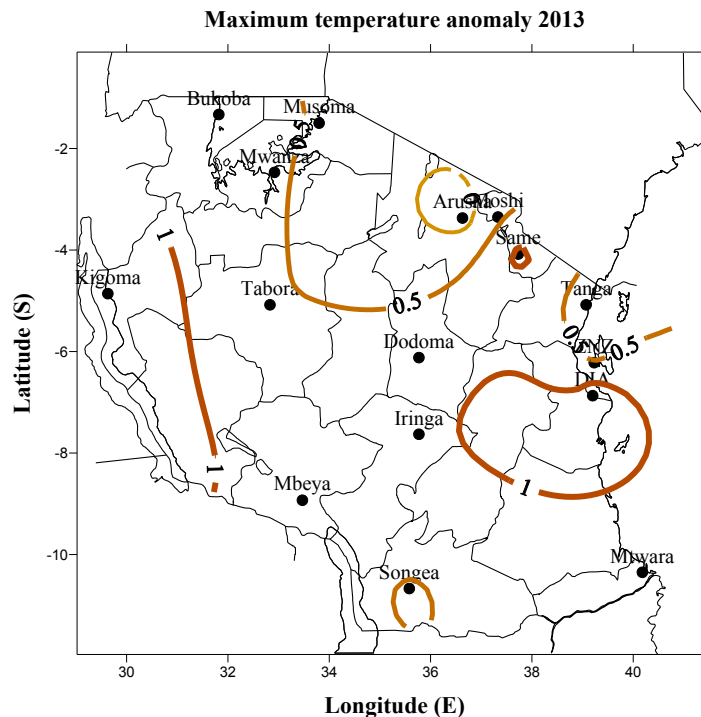
Annual and monthly temperature anomalies are presented in section 2; annual and monthly rainfall percentages are presented in section 3. Section four provides cumulative rainfall plots for drought analysis. The incidences of severe weather and extreme climatic events and associated climatic features with the socio-economic impacts are presented in section 5 and conclusion is presented in section 6.



## 2.0 SPATIAL AND TEMPORAL TEMPERATURE DISTRIBUTION IN 2013

### 2.1 Annual Maximum Temperature Anomalies

Spatial analysis of average annual maximum temperature anomaly indicates that the year 2013 was warmer over the entire country with average maximum temperature anomaly of 0.7 °C above long-term average of 1971-2000. Annual temperature anomaly exceeding 1.0°C is observed at Dar es Salaam, Morogoro, Same, Kibaha and Kigoma meteorological stations (Figure 1).



**Figure 1: Annual maximum temperature departures (°C) from long-term average of 1971-2000**

### 2.2 Monthly Maximum Temperature Anomalies

Generally maximum temperatures were above long term average of 1971-2000 across the country from January to December, with the highest monthly maximum temperature of 1.3°C observed in July. The monthly maximum temperature anomaly was notably high in Arusha during the month of July and relatively low in March. Other below average maximum temperature was observed at Moshi, in February, March and April, Figures 2a and 2b.

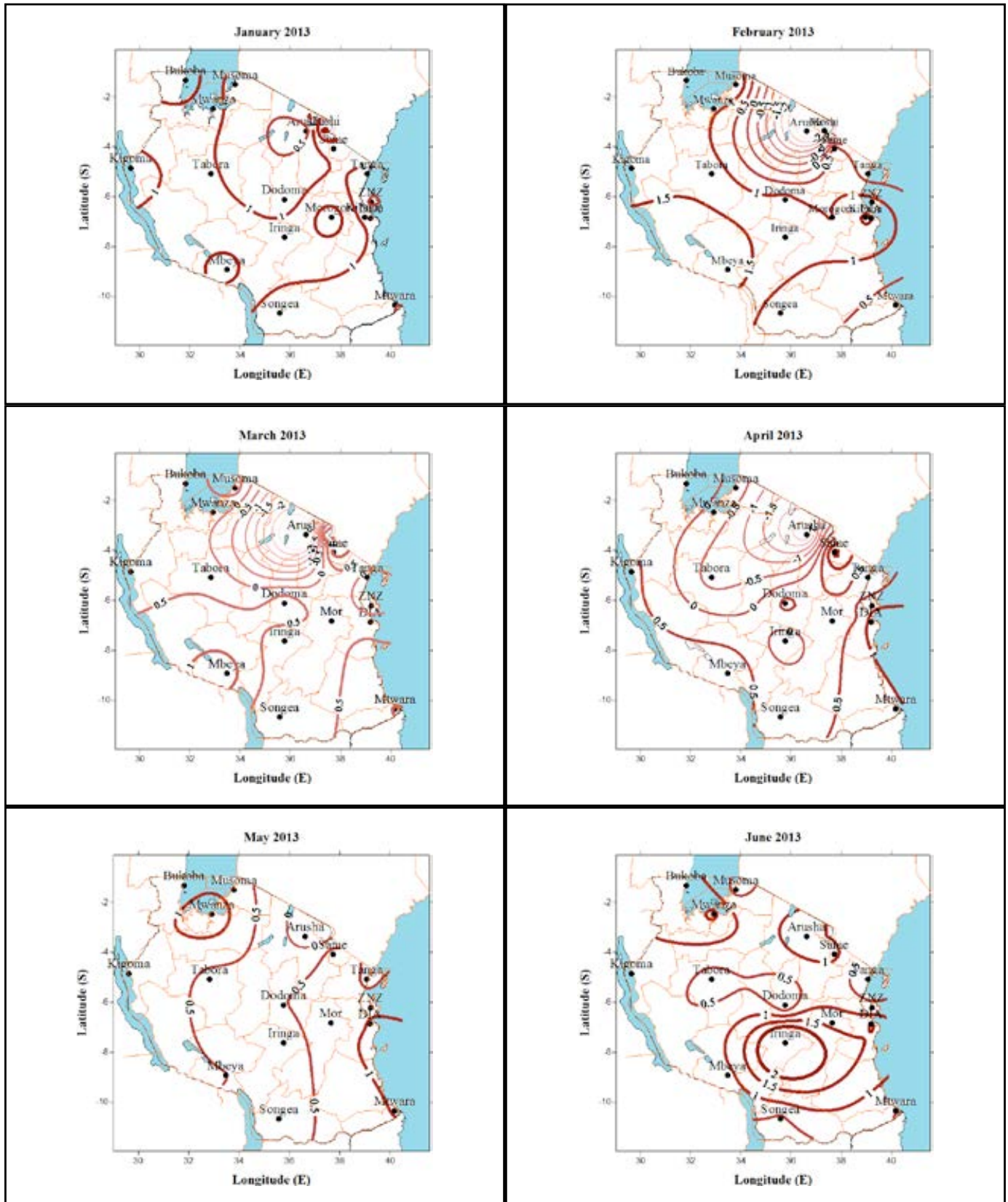


Figure 2a: Monthly maximum temperature departures (°C) from long-term average of 1971-2000 from January - June

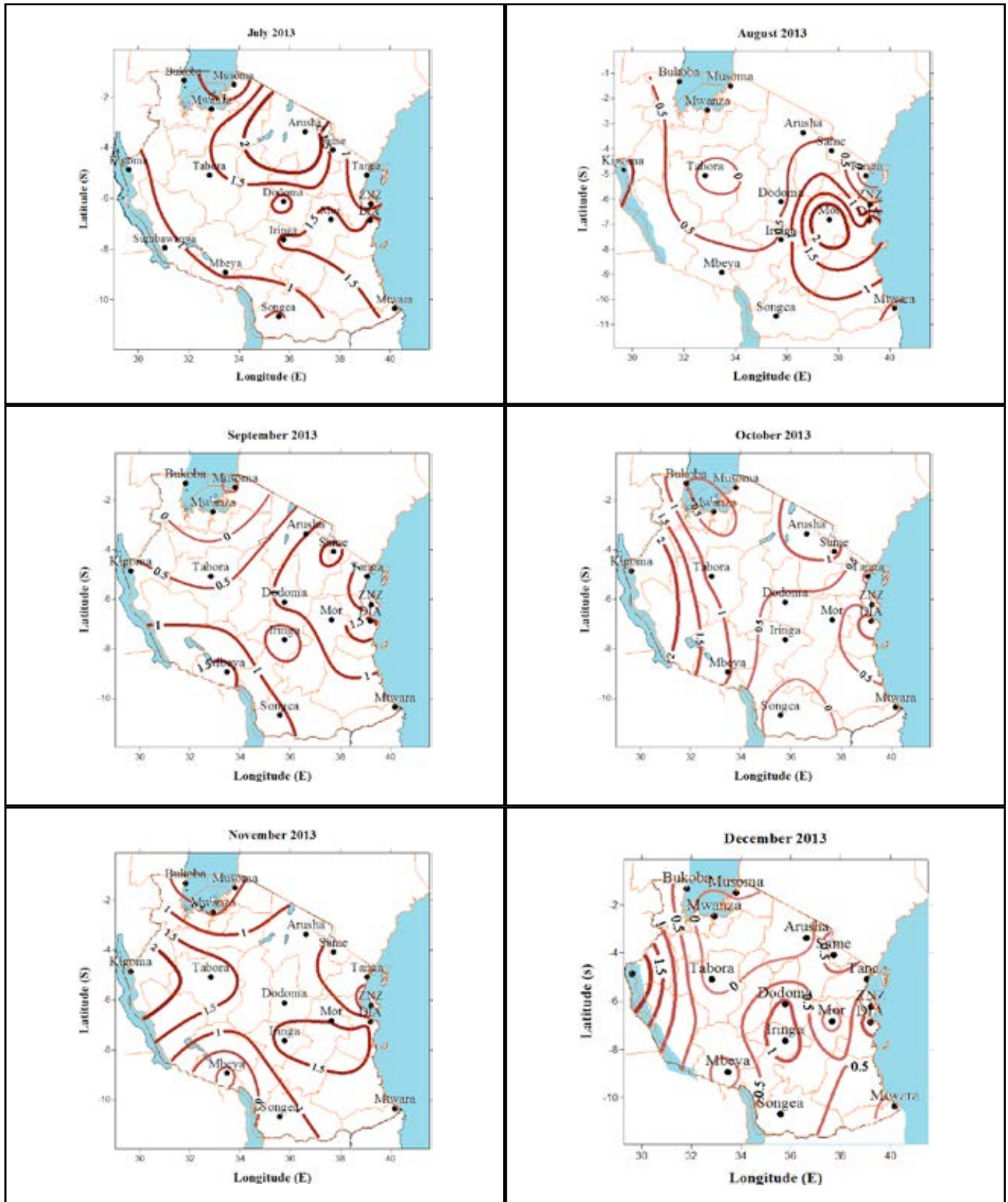


Figure 2b: Monthly maximum temperature departures ( $^{\circ}\text{C}$ ) from long-term average of 1971-2000 from July - December

### 2.3 Annual Minimum Temperature Anomalies

The average annual minimum temperature was above long term average of 1971-2000 by 0.6 °C across the entire country. The presence of above average minimum temperature indicates nocturnal warming over the most parts of the country. In contrast, the southern part of the country observed below average minimum temperatures, Figure 3.

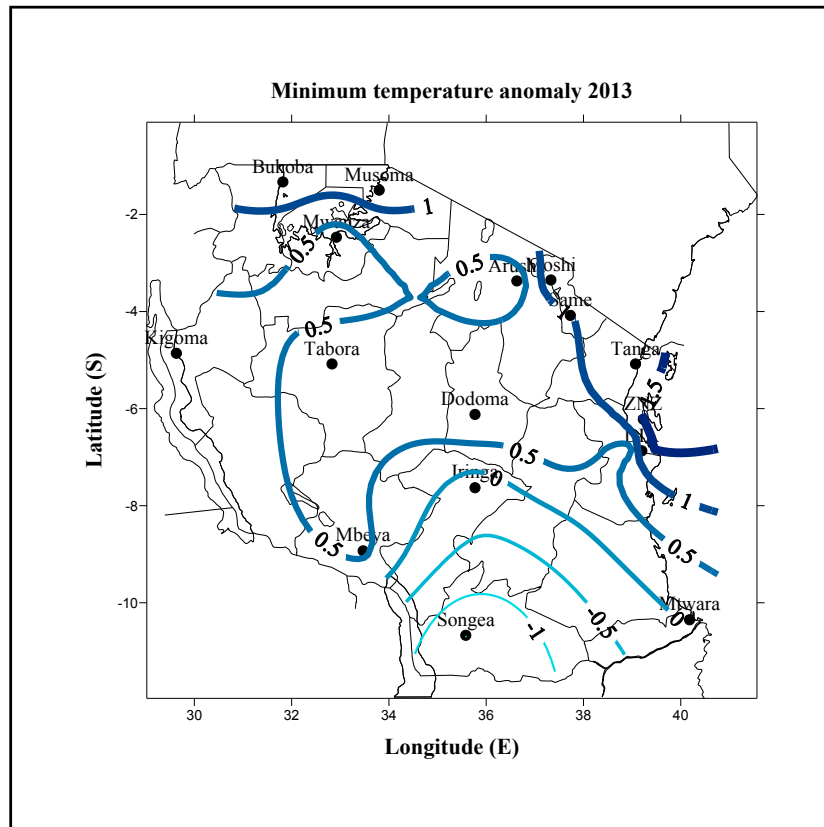


Figure 3: Annual minimum temperature departures (°C) from long-term average of 1971-2000

### 2.4 Monthly Minimum Temperature Anomalies

Monthly minimum temperature anomalies indicate positive temperature anomalies over the most parts of the country during January to December except in May where negative minimum temperature anomalies were observed. Strong positive minimum temperature anomalies were observed in February, April and October at Arusha, Musoma and Zanzibar respectively. Strong negative temperature anomalies were also observed in April at Songea, Iringa, and Arusha; in May at Arusha, Iringa, Mwanza and Songea; and in July at Songea, (Figures 4a and 4b).



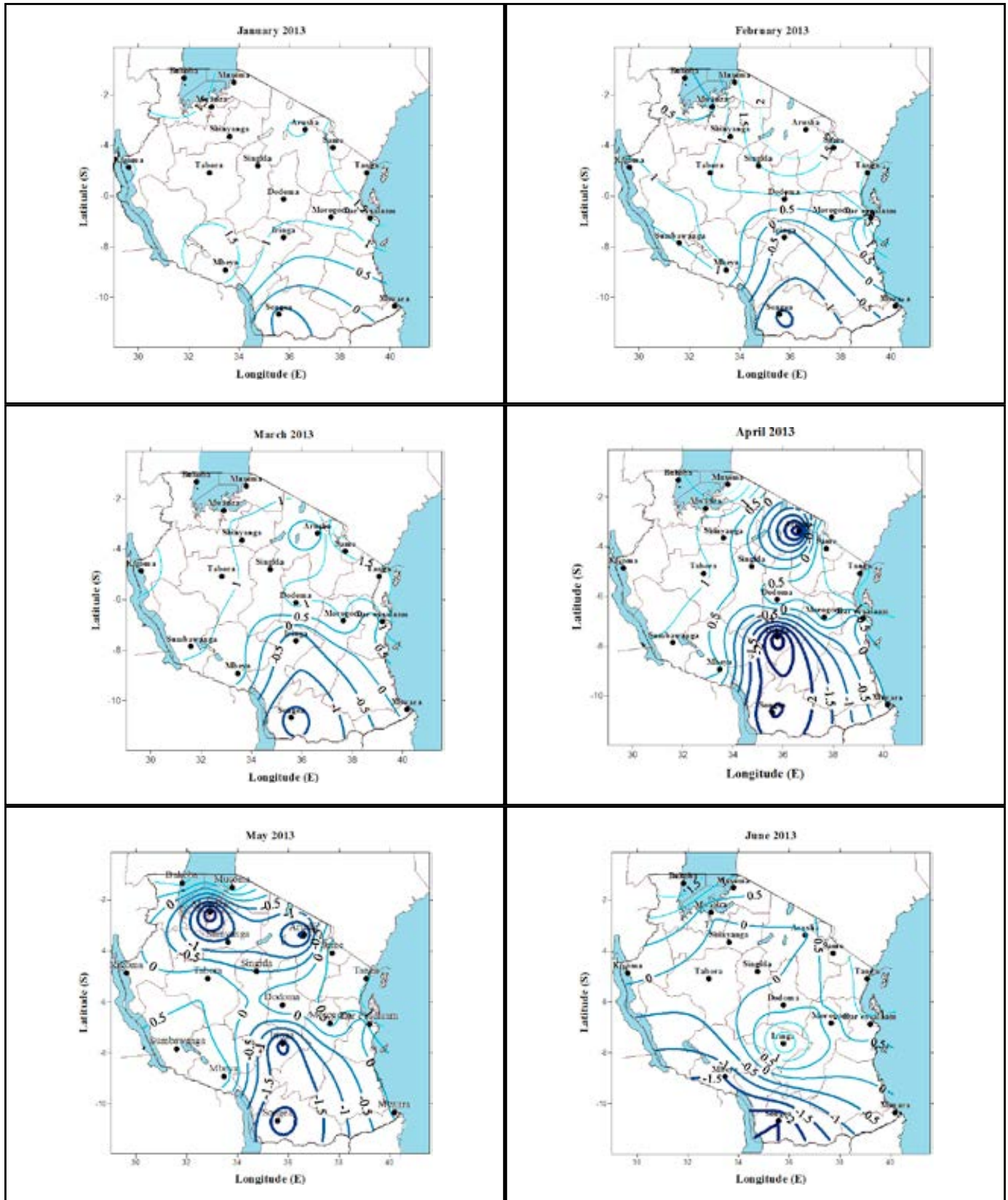


Figure 4a: Monthly minimum temperature departures ( $^{\circ}\text{C}$ ) from long-term average of 1971-2000 from January - June

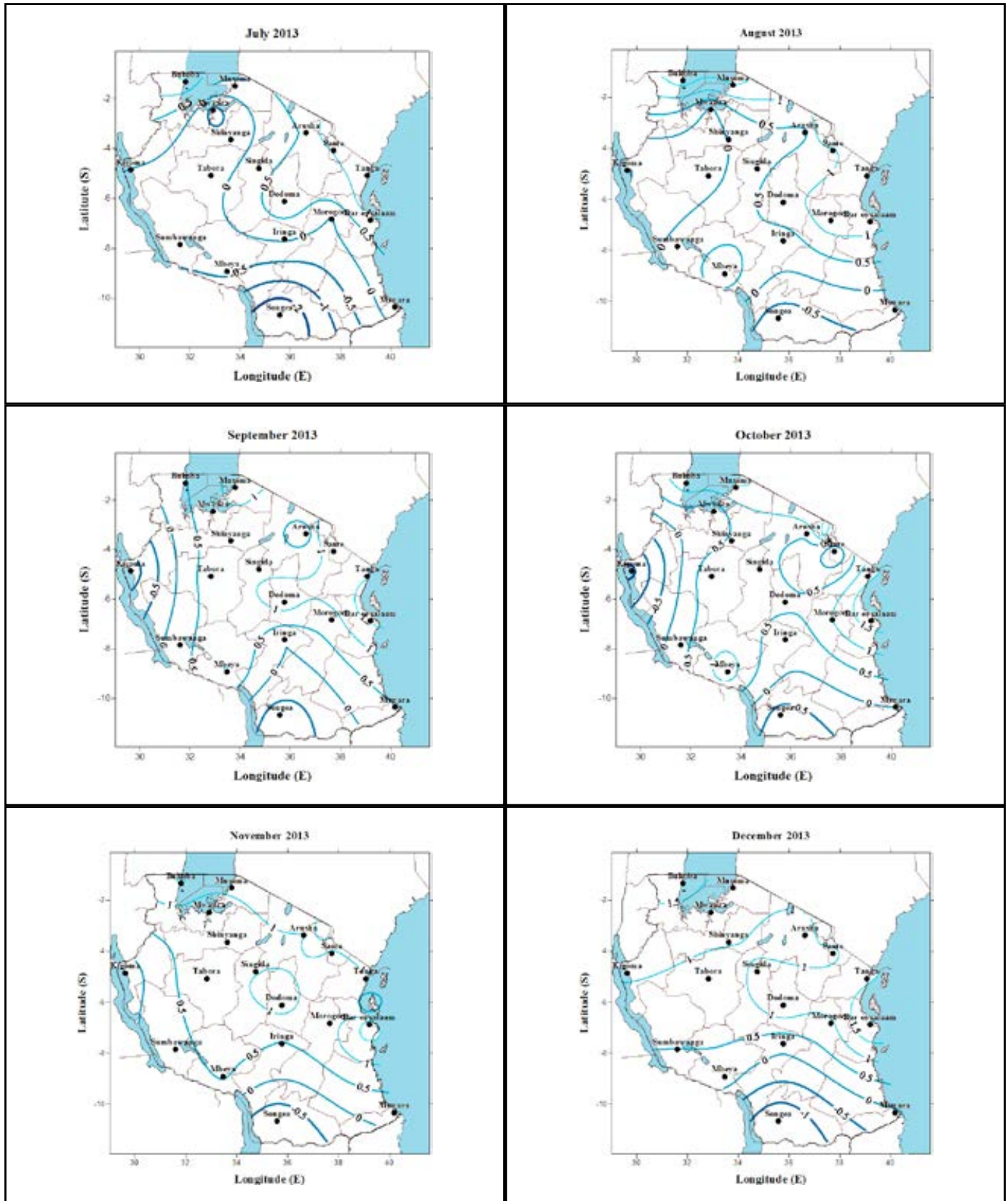


Figure 4b: Monthly minimum temperature departures ( $^{\circ}\text{C}$ ) from long-term average of 1971-2000 from July - December

### 3.0 RAINFALL DISTRIBUTION IN 2013

#### 3.1 Annual Rainfall Distribution As Percentage Of The Long-Term Average (1971 - 2000)

A summary of the rainfall distribution in 2013 as a percentage of the long term average is presented. The long term average is computed from the baseline period of 1971-2000. Percentages between 0 and 50 indicate extremely below average rainfall, 51 and 74 below average rainfall, 75 and 125 average rainfalls while percentages greater than 125 indicate above average rainfall.

In 2013 most parts of the country experienced below to average rainfall of the long term average. The western part of Tanzania, Lake Victoria Basin, Northern and Southern cost featured average rainfall. However, the central and the southern parts featured above average rainfall. Singida Meteorological station recorded the highest rainfall percentage of 478%. However Sumbawanga, Dar es Salaam, Zanzibar, Arusha, Kibaha, Morogoro and Dodoma meteorological stations recorded the lowest rainfall percentages (44%, 55%, 56% , 60% , 63% , 69% , and 72% of the long term average respectively) and therefore they were among the driest regions in 2013 (Figure 5).

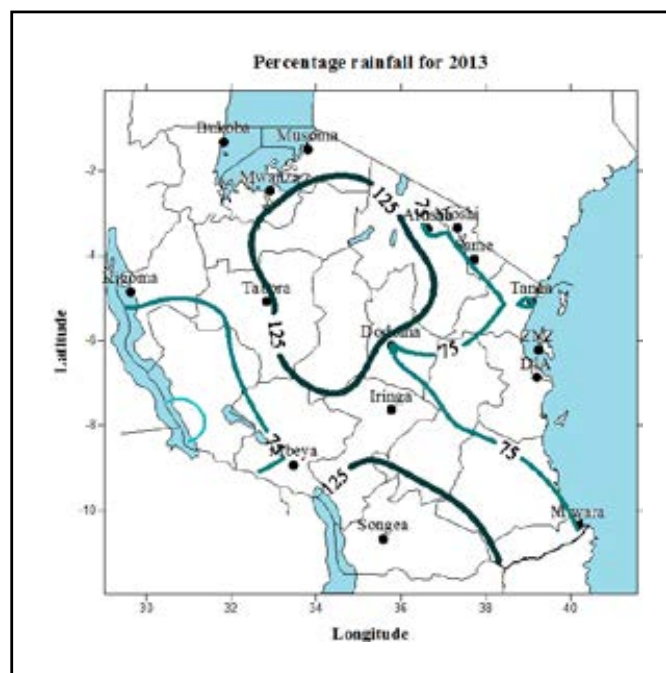


Figure 5: 2013 rainfall percentages of long term average of 1971 - 2000

#### 3.2 Monthly Rainfall Distribution As Percentage Of Long-Term Average Of (1971 - 2000)

Normal monthly rainfall dominated most parts of the country particularly in January, April, and October to December, while in March, July and September experienced above average rainfall of greater 125% of the long-term average. In contrast, extremely below average monthly rainfall percentages of less than 50 % were observed in February and June all over the country, Figures 6a and 6b.



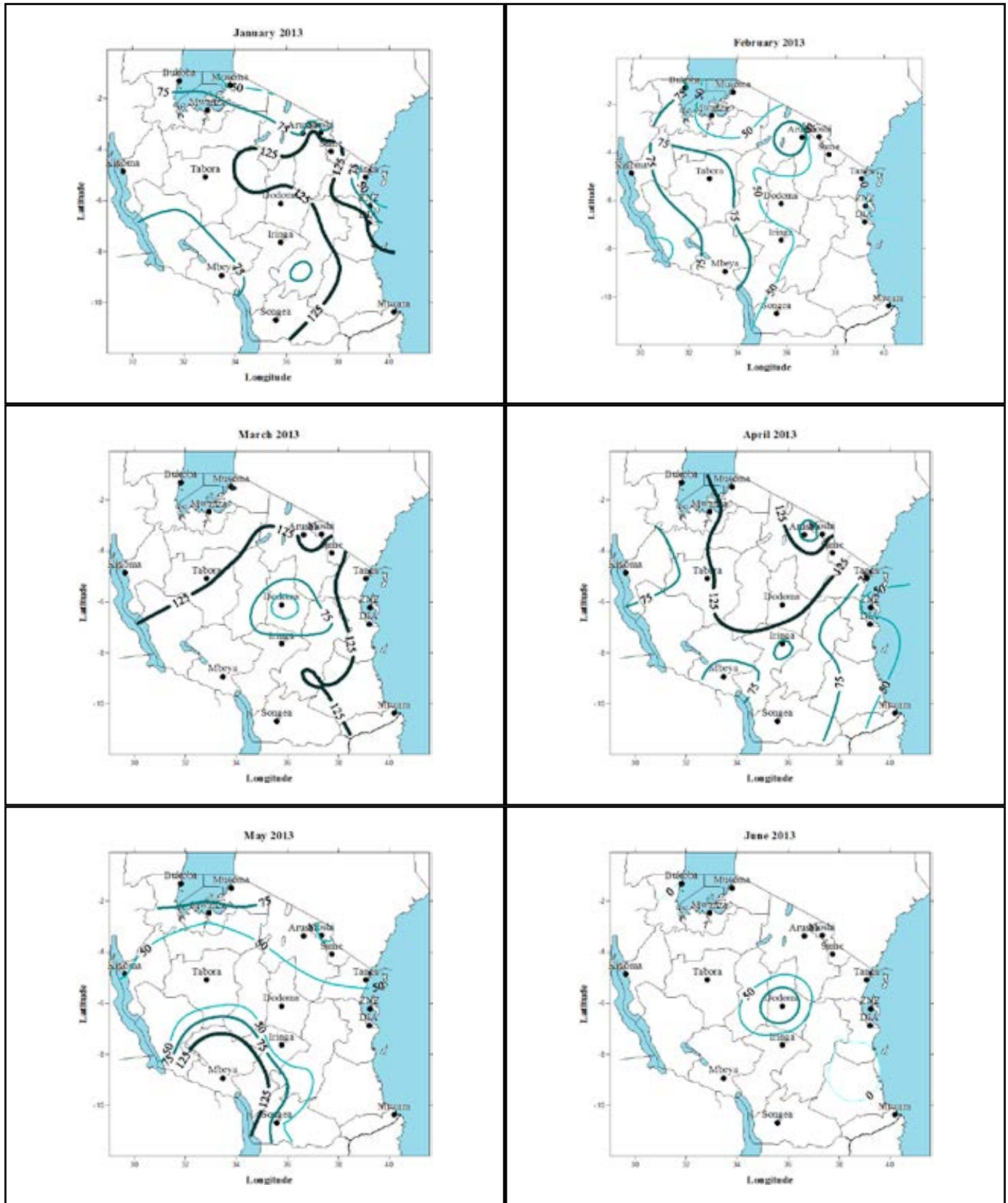


Figure 6a: Monthly rainfall as percentages of long term average of 1971-2000 from January - June



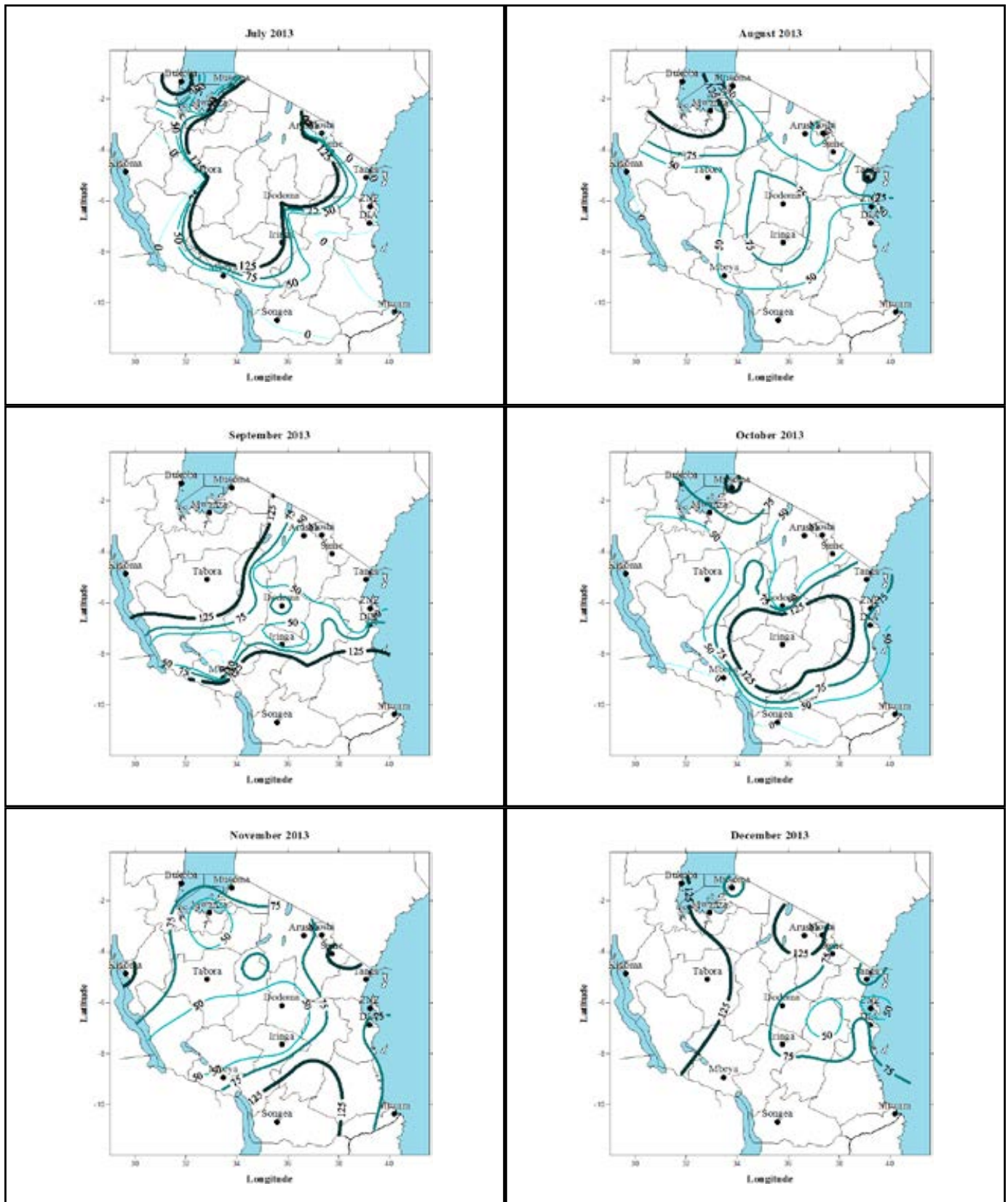


Figure 6b: Monthly rainfall as percentages of long term average of 1971-2000 from July - December

#### 4.0 METEOROLOGICAL DROUGHT MONITORING FOR THE YEAR 2012/2013

Meteorological drought is defined usually on the basis of the degree of dryness (in comparison to some “normal” or average amount) and the duration of the dry period. In this statement, meteorological drought is considered as a region which experienced below normal monthly cumulative rainfall when compared to long term average of 1971-2000.

In 2013 most parts of the country observed below average to average monthly cumulative rainfall, except North Eastern highland (Same) and Lake Basin (Mwanza) experienced above average cumulative rainfall. Generally in 2013 cumulative total rainfall indicated deficient total rainfall across the country and was an indication of drought conditions for the selected stations except in Same and Mwanza (Figure 7a to 7d).

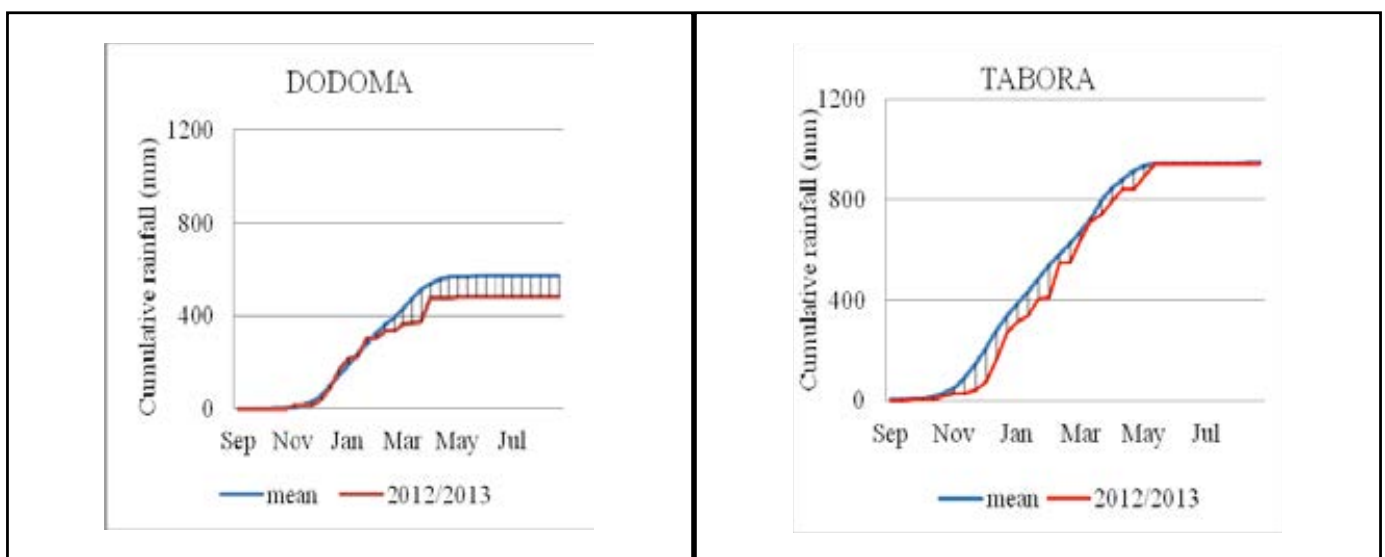


Figure 7a: Monthly cumulative rainfall for Central Tanzania

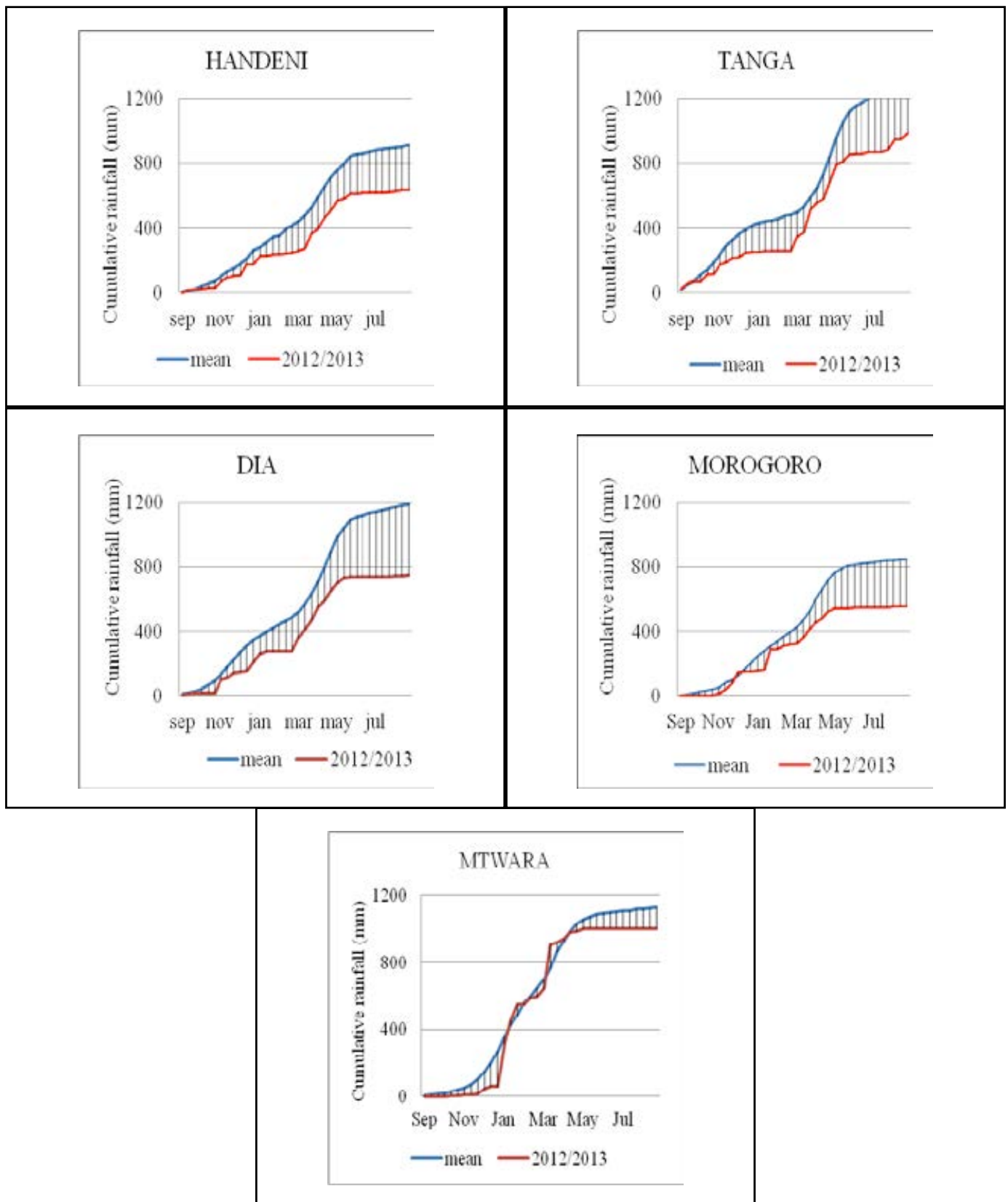


Figure 7b: Monthly cumulative rainfall for Northern and Southern Coast of Tanzania

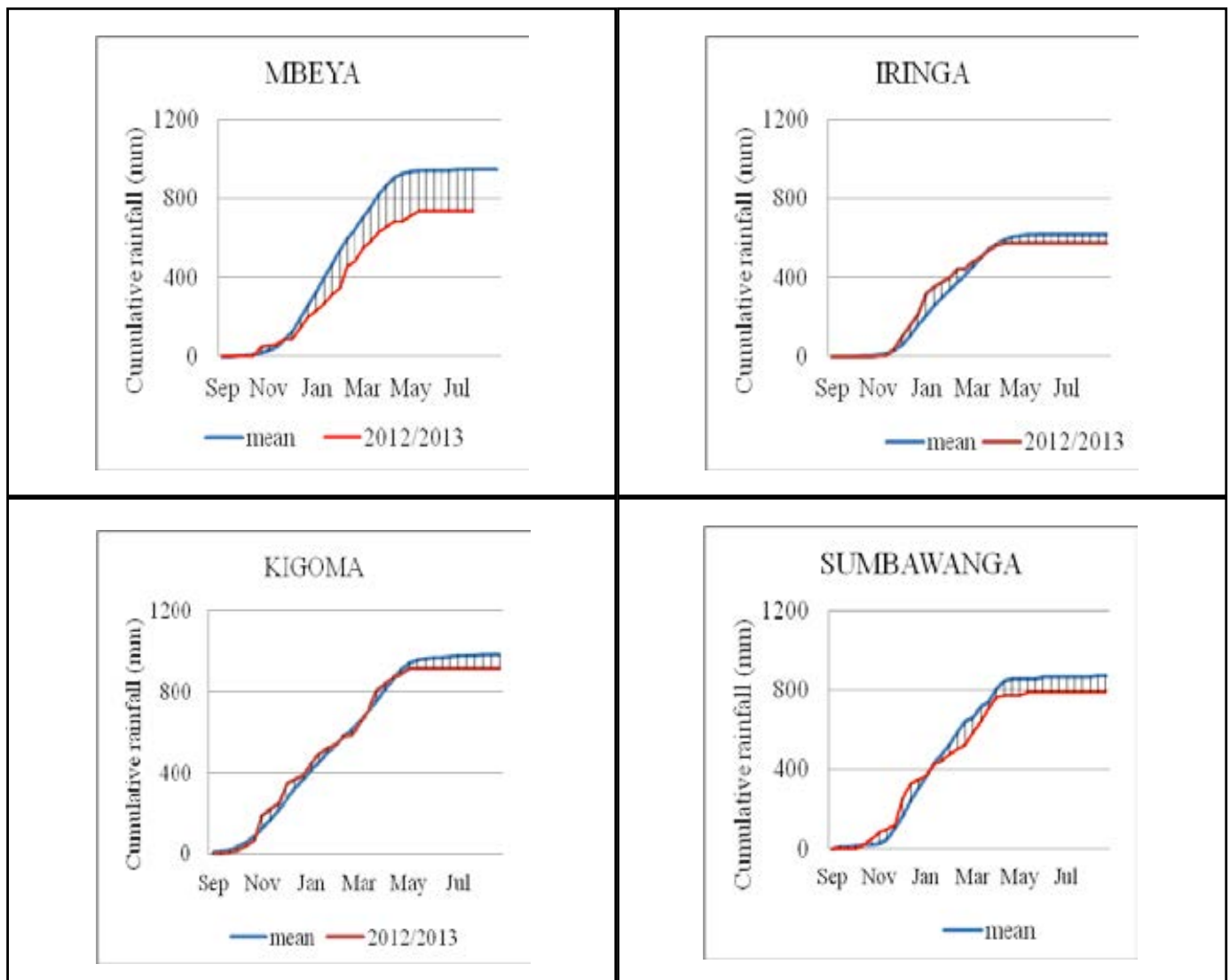


Figure 7c: Monthly cumulative rainfall for South-western highlands and Western region

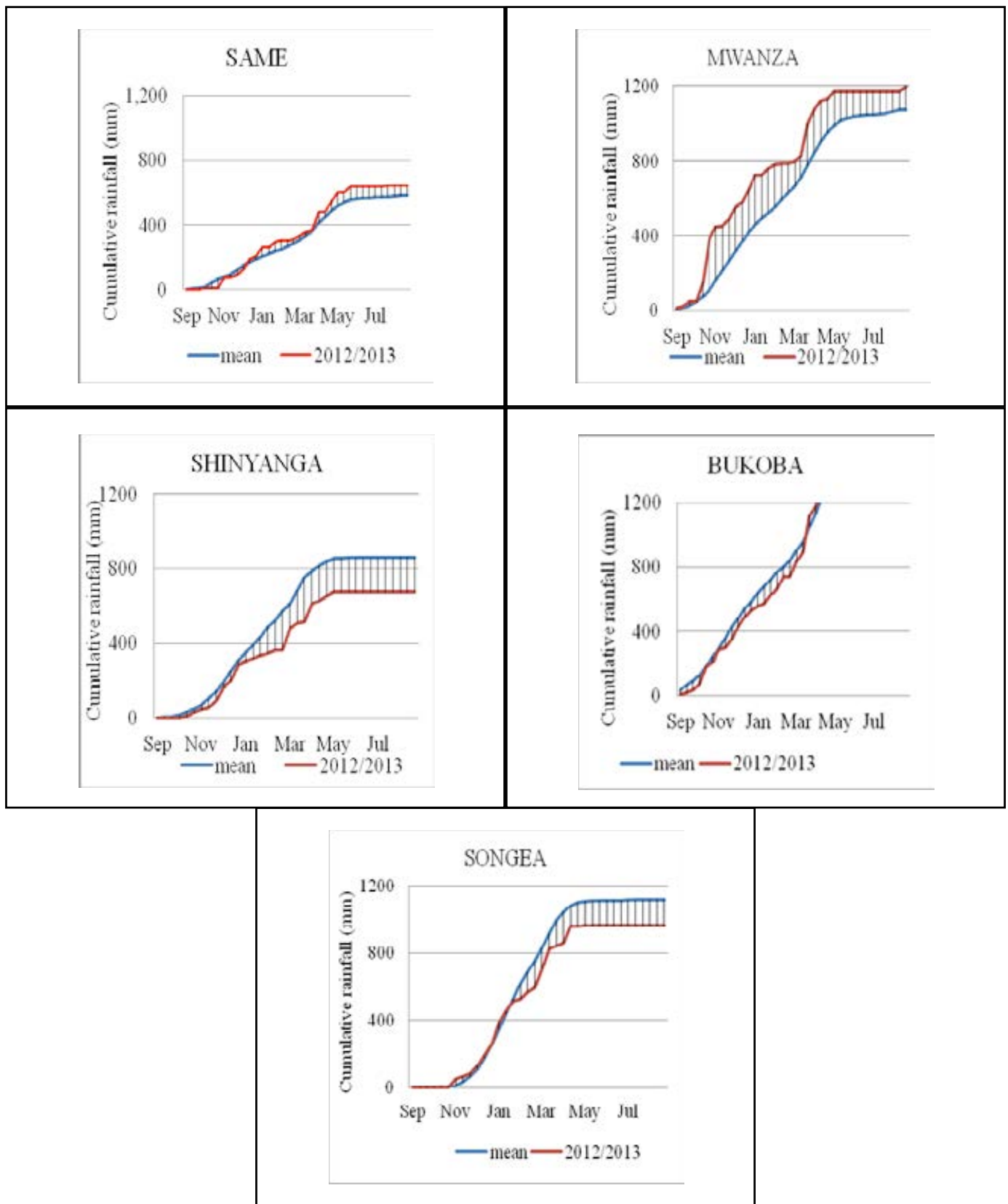


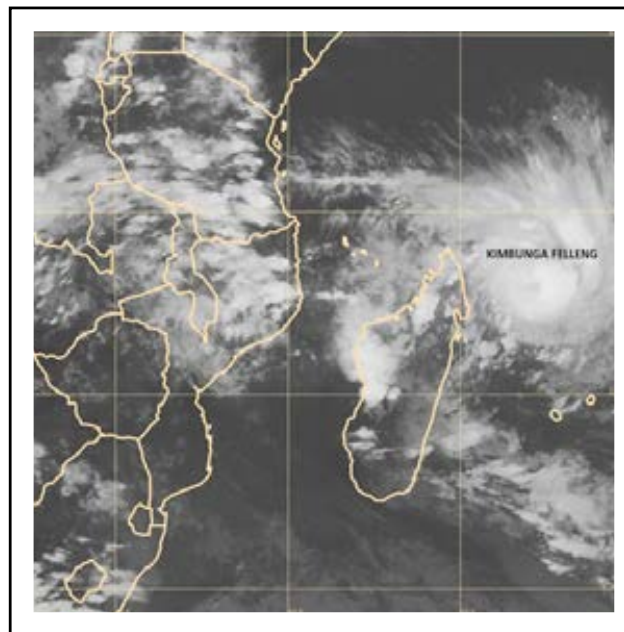
Figure 7d: Monthly cumulative rainfall for South-western highlands, Western region and Lake Zone

## 5.0 SEVERE WEATHER AND EXTREME CLIMATIC EVENTS 2013

In 2013 incidences of 24 hours extreme rainfall events of more than the threshold values of 50mm were reported in various parts of the country. For example, 4th May, 2013 Pemba reported the highest observed daily rainfall of 217.6 mm which was the second highest value on record since 1978 where 450.7 mm of rainfall was recorded. On 3rd of April 2013 Mahenge reported 157.6 mm of rainfall which was the fifth highest value on record since 1998 where the highest value was 207.1mm. The third highest extreme rainfall on record for 2013 was 126.3 mm of rainfall and was recorded in 28th of January at Singida and ranked highest daily rainfall on record since 2001 when the station was established. The fourth highest on record daily extreme rainfall for 2013 was 112.2 mm and was recorded in December 24th at Mtwara and ranked ninth daily rainfall on record since 1978 where 232.7 mm of rainfall was recorded. Tabora reported 93.5 mm of rainfall in 23rd December which was the seventh highest value on record since 1995 where the highest value was 155.5mm. Furthermore, on 30th January, 2013 Mbeya region experienced heavy rainfall of 90.5mm which was highest daily extreme rainfall on record since 1937 when the station was established.

## 6.0 FACTORS CONTRIBUTED TO SEVERE EXTREME CLIMATIC

Among of the factors contributed to severe extreme climate events in Tanzania includes the existence of Tropical cyclone “FELLENG” over the North-east of Madagascar which pulls moisture-rich air from Congo. This has contributed to heavy rainfall in Morogoro Rukwa, Iringa, Mbeya, Njombe, Ruvuma, Lindi, Singida, Pwani and Mtwara regions from 29th January 2013, Figure 8.



**Figure 8: Existence of Tropical cyclone “FELLENG” over the North-east of Madagascar  
(Source: Tanzania Meteorological Agency January 2013)**



Likewise, towards the end of November through December, 2013 slightly warmer SST over western Indian Ocean are among of the factors which contributed to enhance easterly to north-easterly winds thereby resulting into moisture influx towards the country. From the prevailing climate systems explained above, the November to December, 2013 rainfall was more significant north-eastern highlands, northern coast areas, Lake Victoria Basin and Kigoma region.

## 7.0 SOCIO-ECONOMIC IMPLICATIONS OF SEVERE WEATHER AND EXTREME EVENTS

Tanzania like other countries in the East and Central Africa region faces a range of severe weather and extreme events including drought, floods and strong winds. Additional factors such as climate variability and rapid population growth compound risks to populations by increasing their vulnerability to impact of severe weather. Socio-economic implications of severe weather and extreme events for 2013 included loss of lives and property and severe infrastructural damages. Mwananchi news paper reported that the three consecutive rainfall days in January 2013 resulted in flooding which damaged bridges and roads and destroyed houses in low-lying areas in Singida region. At least 6 people were reported dead and more 300 vehicles were stranded as shown in Figure 9



**Figure 9: Damaged Manung'una bridge at Msisi village in Singida due to flash floods (source: Mwananchi news paper 3rd January 2013)**

## 8.0 CONCLUSION

The state of climate in 2013 was characterized by incidences of severe and extreme weather events with significant socio-economic implications across the country. Most parts of the country, particularly western and northern coast (Dare es Salaam) areas were anomalously warmer with a temperature anomaly of 0.7 °C above the long term average of 1971-2000. However, the southern part of the country and north-eastern highlands maintained relatively lower minimum temperatures anomalies for the entire year; in other hand in 2013 most parts of the country experienced averaged rainfall with few areas observed above average rainfall. The climatic factors that could be attributed to enhanced rainfall and the observed flooding include existence of Tropical cyclone “FELLENG” over the North-east of Madagascar which pulls moisture-rich air from Congo and the slightly warming of the Sea Surface Temperature over the western Indian Ocean.

The Severe and extreme weather events including the flooding, and strong winds observed over some parts of the country caused loss of life and properties, severe infrastructural damage, destroyed crops, farms and building leaving some people homeless and affecting the livelihoods of the communities in surrounding areas.

Unfortunately the incidences of severe and extreme weather events are projected to increase under the changing climate as highlighted in the series of the IPCC reports. Loss of life and property could be much reduced if the forecast and warning issued by Tanzania Meteorological Agency will be closely followed and mainstreamed by the public in planning socio-economic activities. It is therefore recommended for more sensitization and awareness among the public on the importance of weather and climate information and the need to mainstream and factor in weather and climate information in daily life and planning socio-economic activities.









