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Statement on the Status of Tanzania Climate in 2011

TANZANIA METEOROLOGICAL AGENCY
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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 Tanzania 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 requires concerted efforts in monitoring the current state of climate and establishing communication strategies that ensure the public, policy makers, the government and all stakeholders are well informed about the state of the climate and the associated socio-economic implications on regular basis. In order to ensure that public awareness on weather, climate and climate change is enhanced and that the Government, Policy makers, scientific communities and all stakeholders are provided with up-to date and reliable information about the status of the National Climate, Tanzania Meteorological Agency is launching a bulletin titled "TMA statement on the status of the National Climate". This bulletin will be published on annual basis and will provide comprehensive information on the status of climate in Tanzania focusing on extreme events with the associated climatic features and socio-economic impacts during the year. TMA statement on the status of the National Climate in 2011 is therefore the first issue in a series of issues, which will be published annually. The current statement summarizes the status of climate in 2011. Spatial and temporal distribution of rainfall anomalies, maximum and minimum temperature anomalies in 2011 are described. Severe weather and extreme climatic events and their associated socio-economic implications in 2011 are discussed.

TMA would like to encourage all stakeholders, including the general public to follow and utilize information from the bulletin and contribute on reporting extreme weather events occurring in their respective regions. We would like to welcome comments and suggestions for the improvement of the statement. Please be assured that all comments, suggestions and contributions received will be used for the improvement of this bulletin.

Dr. Agnes Kijazi

Director General

Tanzania Meteorological Agency

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1 INTRODUCTION

Spatial and temporal distributions of rainfall and temperature from January to December, 2011 were analyzed to characterize the status of climate in 2011. The baseline climatological period used in the comparison is 1971-2000. Monthly and annual rainfall and temperature anomalies were computed and analyzed. Incidences of severe weather and extreme climate events with the associated climatic features and its socio-economic impacts were also discussed.

Detailed discussion on temperature anomalies for the year 2011 are presented in section 2. In this case, mean annual maximum and minimum temperature anomalies as well as mean monthly maximum and minimum temperature anomalies were computed and analyzed to provide an overview of the temperature anomalies in 2011. Rainfall anomalies on monthly basis were analyzed and presented in section 3. The incidences of severe weather and extreme climatic events in 2011 and the associated climatic features with the socio-economic impacts are presented in section 4. Section 5 provides a general conclusion on the status of Tanzania climate in 2011.

2 TEMPERATURE ANOMALIES IN 2011

This section presents an overview of spatial and temporal distribution of mean annual and mean monthly temperature anomalies for the year 2011.

2.1 Mean Annual Maximum Temperature Anomalies

The analysis of maximum temperature indicates that the year 2011 was anomalously warmer in most parts of the country with positive temperature anomalies greater than 0.5^{0}C (see Figure 1). Warming was more pronounced in Northern, Eastern and Western parts of the country. However, some parts of central and Southern Tanzania were cooler with negative temperature anomalies less than -1.5^{0}C.

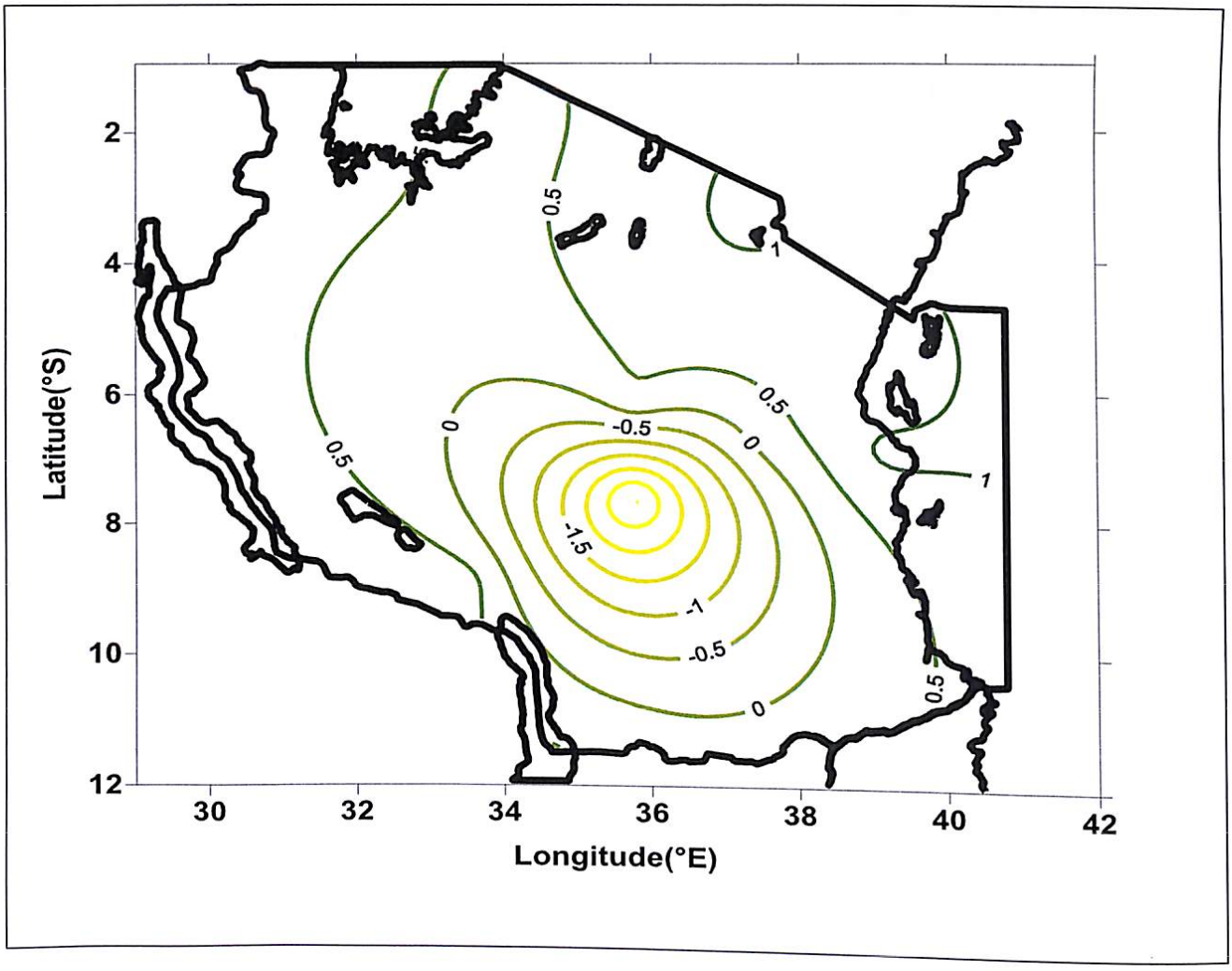

Figure 1: Annual maximum temperature anomaly in 2011

2.2 Mean Annual Minimum Temperature Anomalies

The analysis of minimum temperature indicates that the year 2011 was anomalously warmer over most parts of the country with higher values centered over the northern coast (Figure 2). Comparison of figure 1 and 2 indicate that the annual mean minimum temperature anomalies were higher than annual mean maximum temperature anomalies over the coastal areas of Tanzania. This implies that nocturnal warming is increasing at higher rate than day time warming. However, over the northern and western parts of the country the mean annual maximum temperature anomalies seem to be higher than mean minimum temperature anomalies.

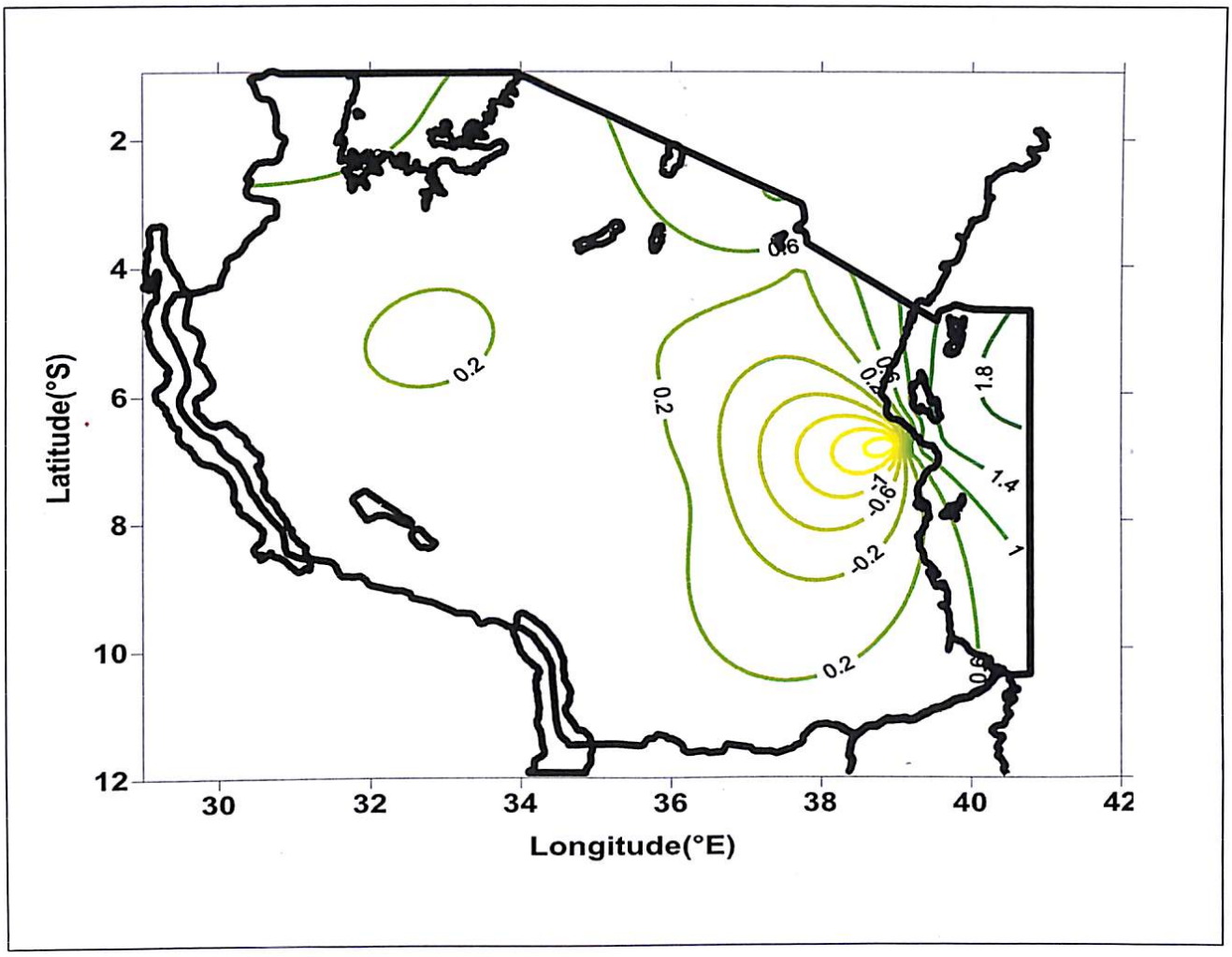

Figure 2: Annual minimum temperature anomalies in 2011

2.3 Mean Monthly Maximum Temperature Anomalies

January to December, 2011 mean monthly temperature anomalies are shown in figure 3, 4 and 5. January maximum temperature were anomously warmer over the coast region, central parts, southern and northern coast. Negative maximum temperature anomalies were observed over Southweastern highland, eastern and around lake Victoria basin. In February, March, and June most parts of the country experienced anomously warmer temperature.

September had positive temperature anomalies over most parts of the country with the exception of Eastern side of the Lake Victoria basin and some parts of western Tanzania. October was the coolest month; especially in the eastern side of the Lake Victoria basin, and the Northeastern highlands, which reported negative temperature anomalies.

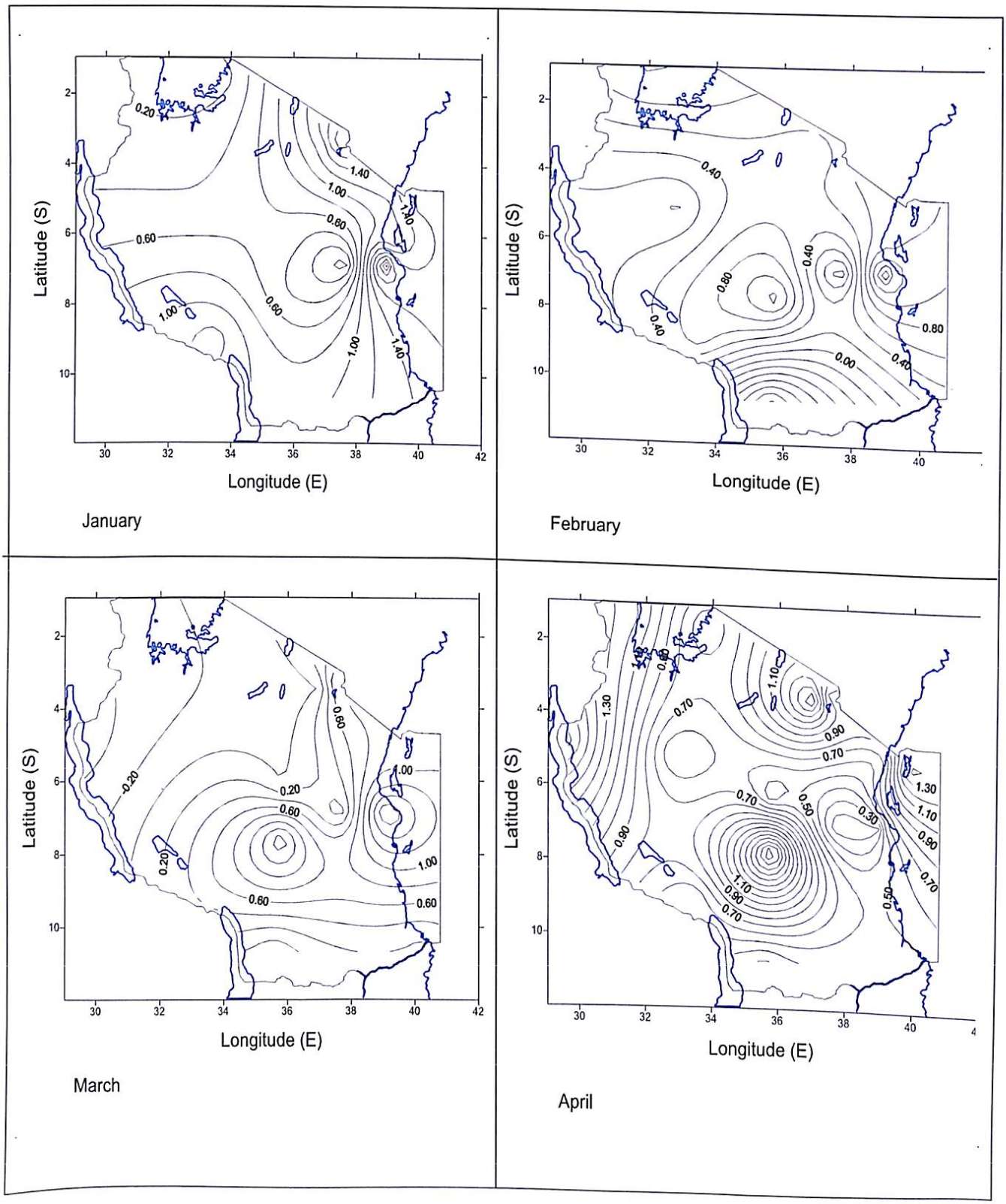

Figure 3: January-April maximum temperature anomalies in 2011

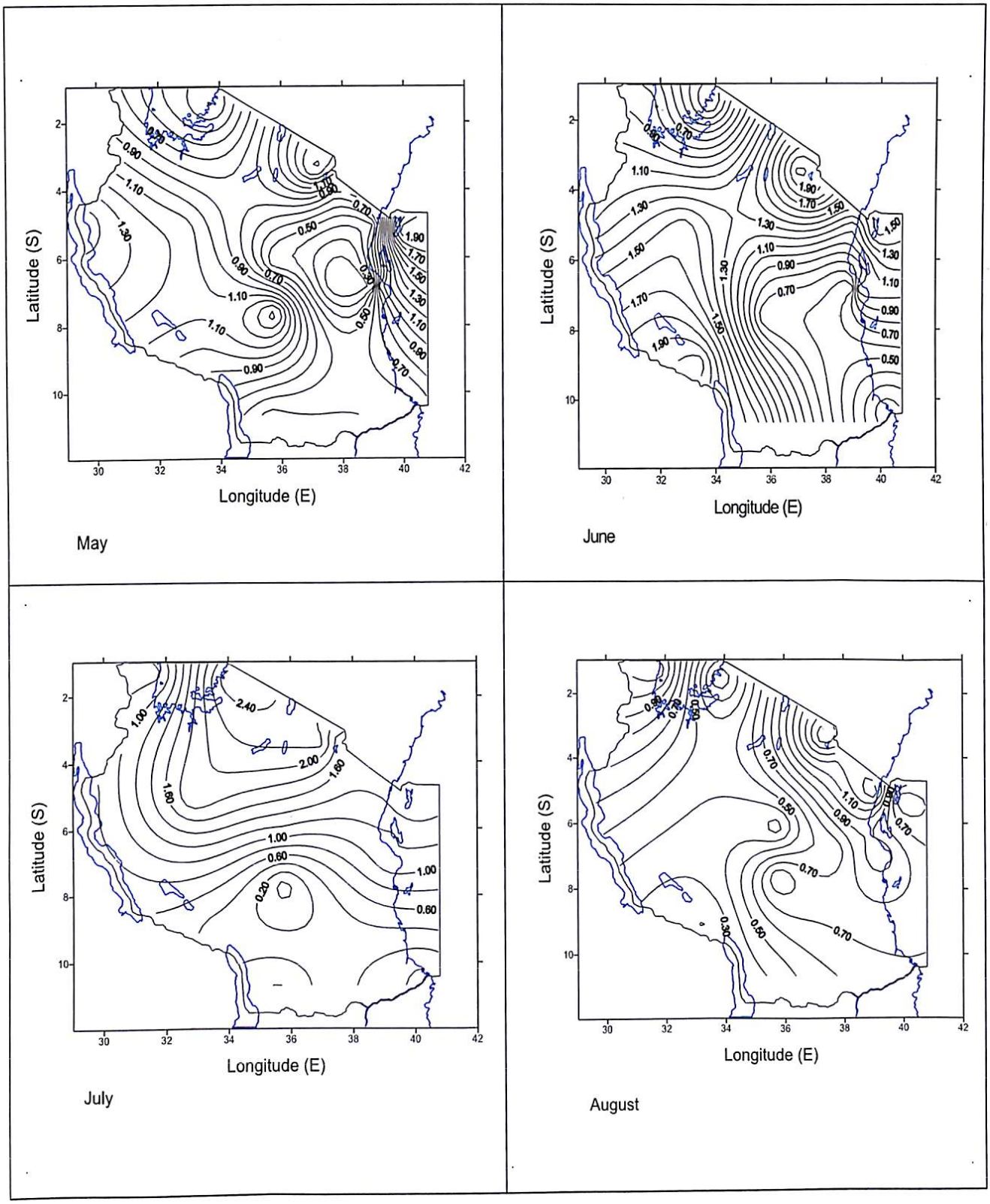

Figure 4: May-August maximum temperature anomalies in 2011

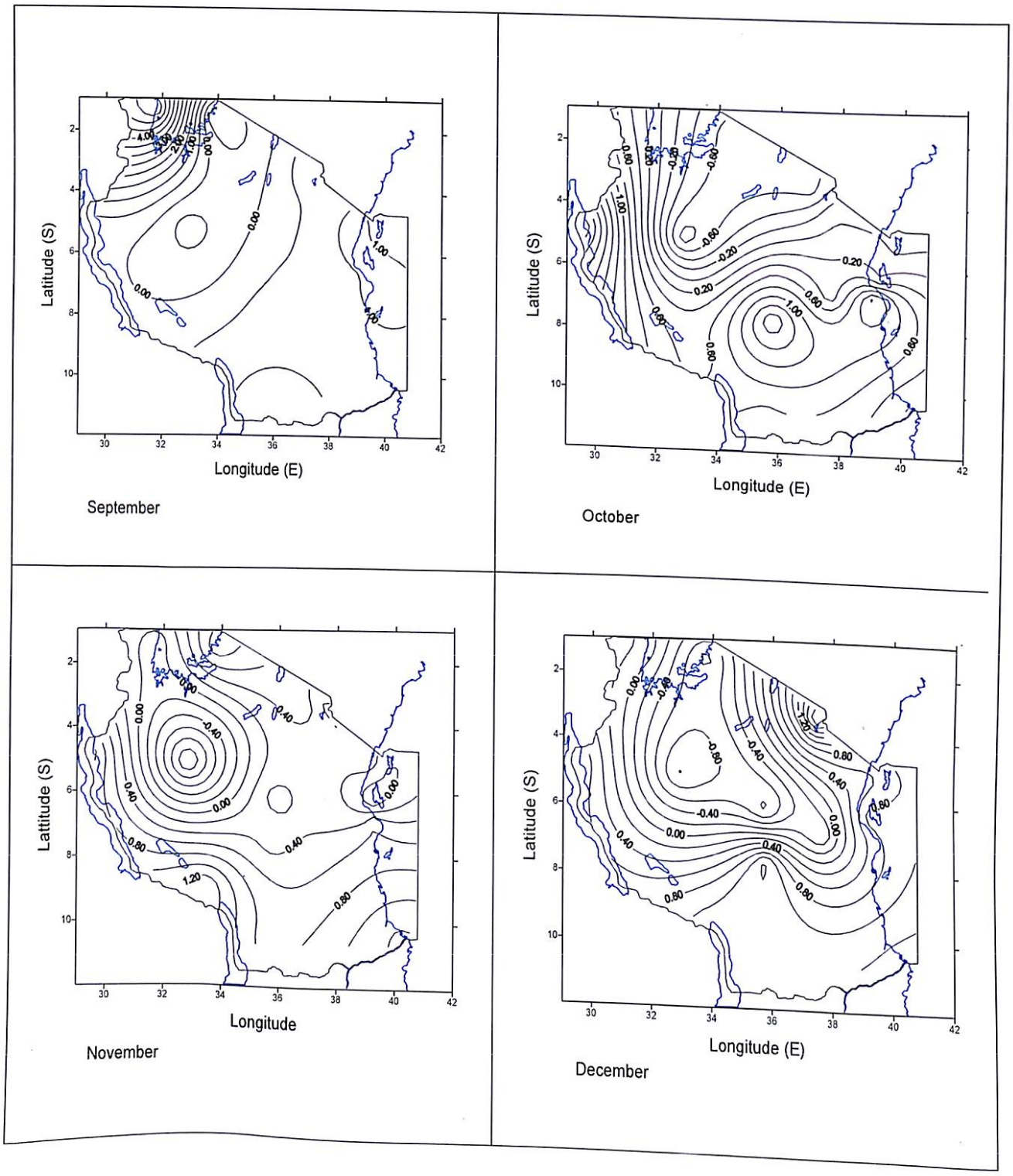

Figure 5: September-December maximum temperature anomalies in 2011

2.4 Monthly Minimum Temperature Anomalies

The year 2011 was dominated by positive minimum temperature anomalies over most parts of the country as illustrated in Figures 6, 7 and 8. The higher values of minimum temperature anomaly were more pronounced along the coastal region, particularly over the northern coast. This observation implies that the nights are slightly getting warmer leading to a decrease in the Diurnal Temperature Ranges (DTR) over the areas.

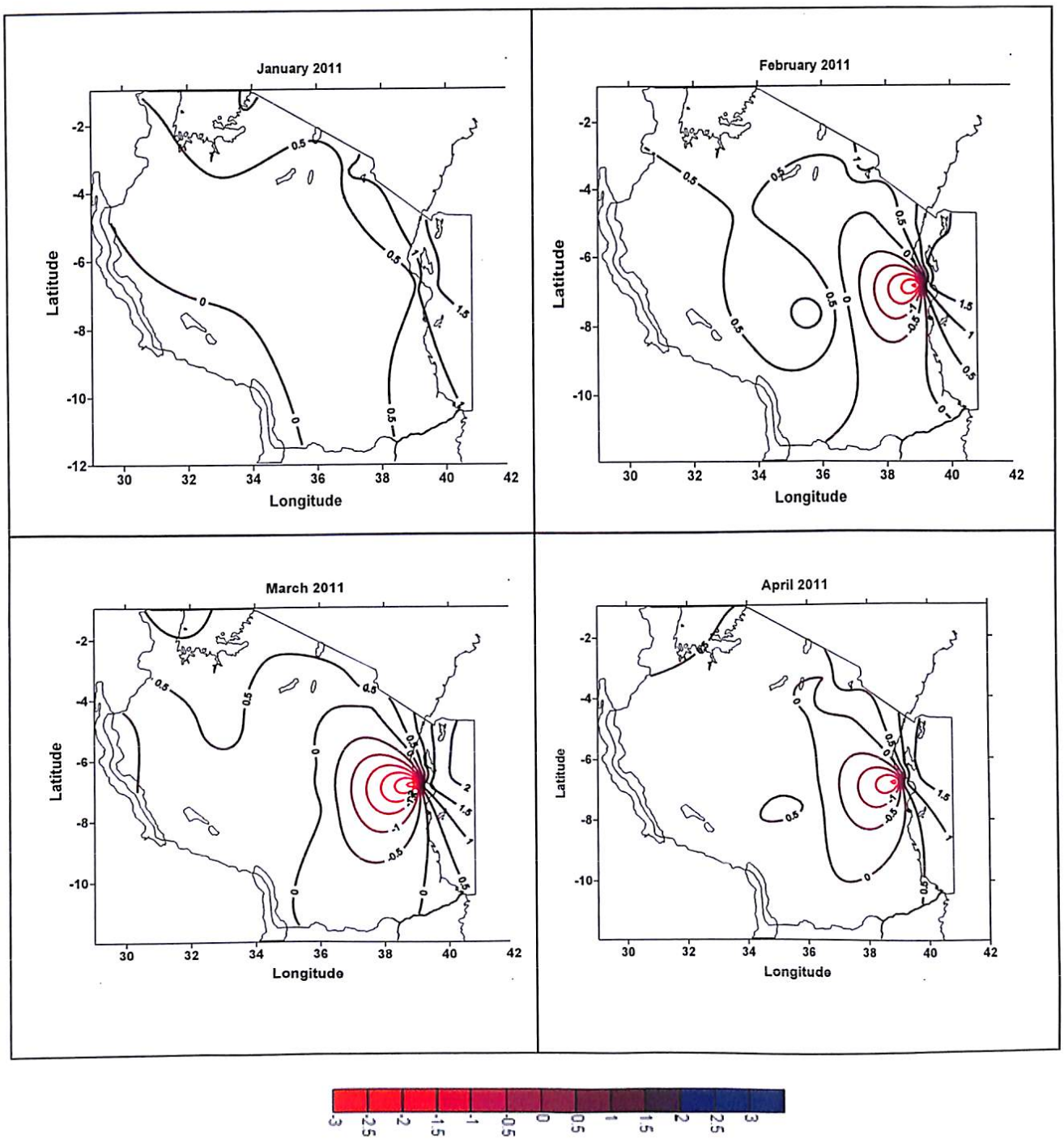

Figure 6: January-April minimum temperature anomalies in 2011

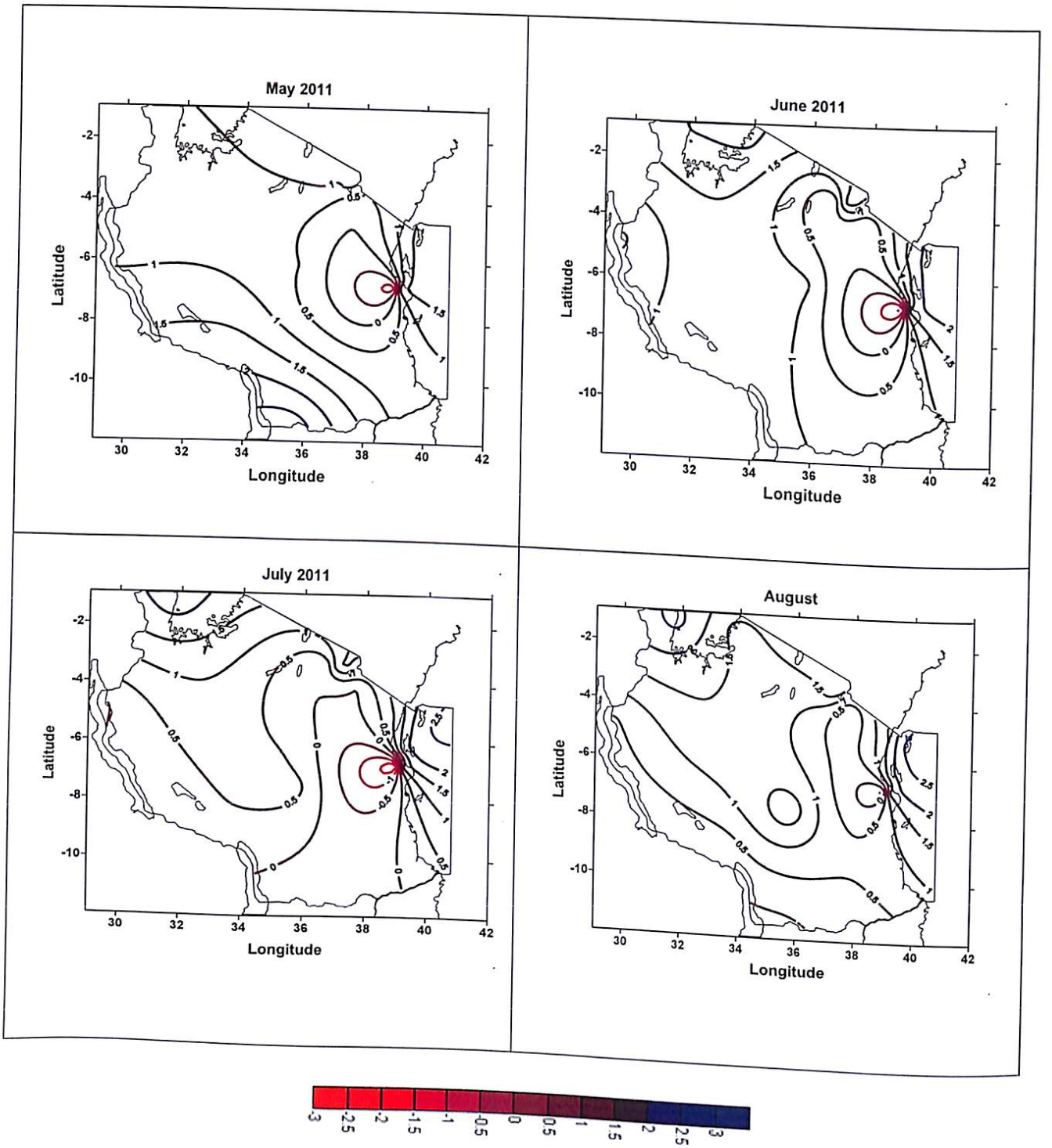

Figure 7: May-October minimum temperature anomalies in 2011

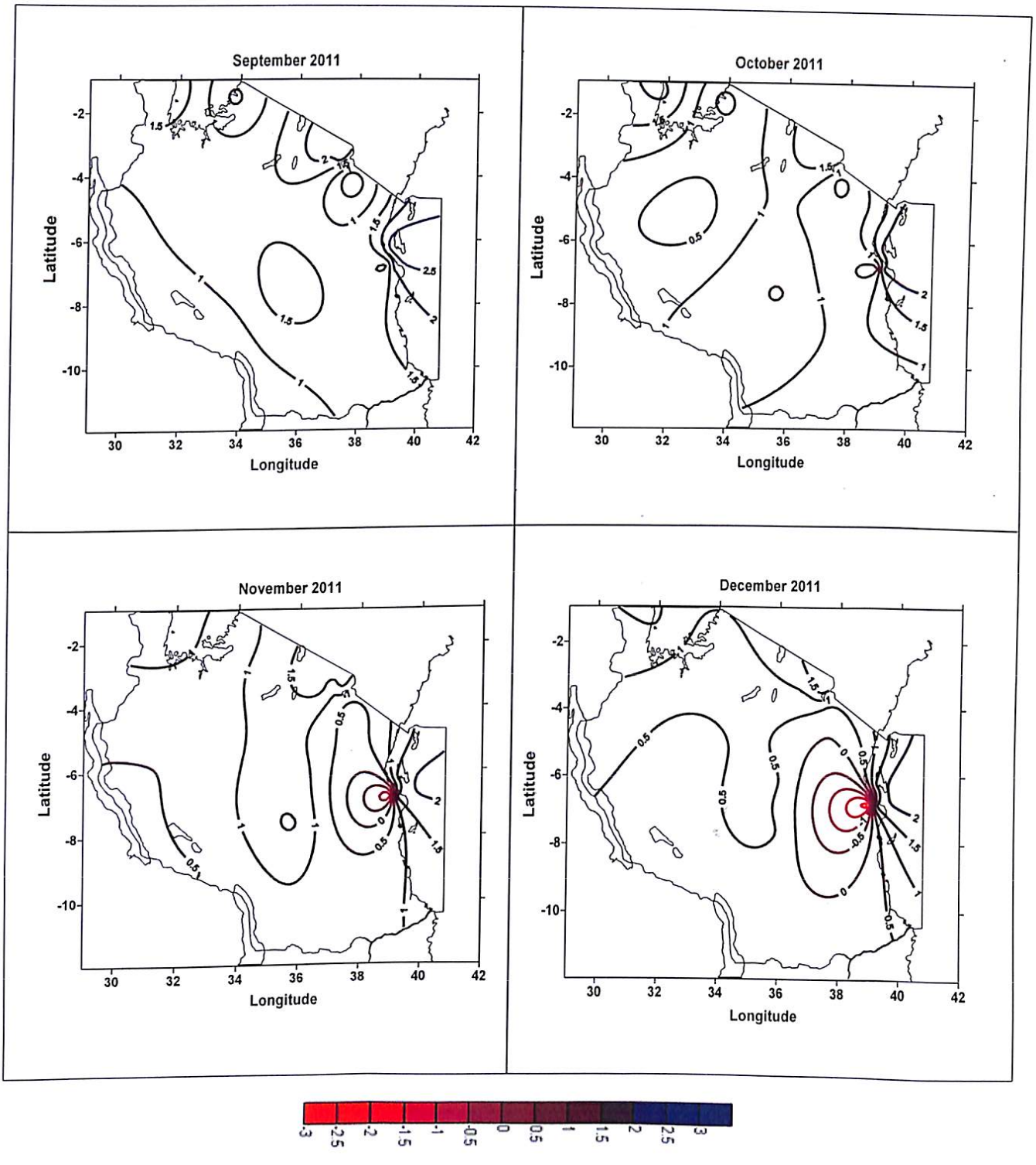

Figure 8: November-December minimum temperature anomalies in 2011

3 RAINFALL ANOMALIES IN 2011

This section presents the analysis of spatial and temporal distribution of mean annual and mean monthly rainfall anomalies in 2011.

3.1 Mean Annual rainfall anomalies in 2011

The spatial distribution of annual rainfall anomalies in 2011 is presented in figure 9. Above normal rainfall fell over large areas that includes, Northern, Eastern, Northern and Southern coast. Bellow average rainfall anomalies were observed over western, central and South-eastern high grounds.

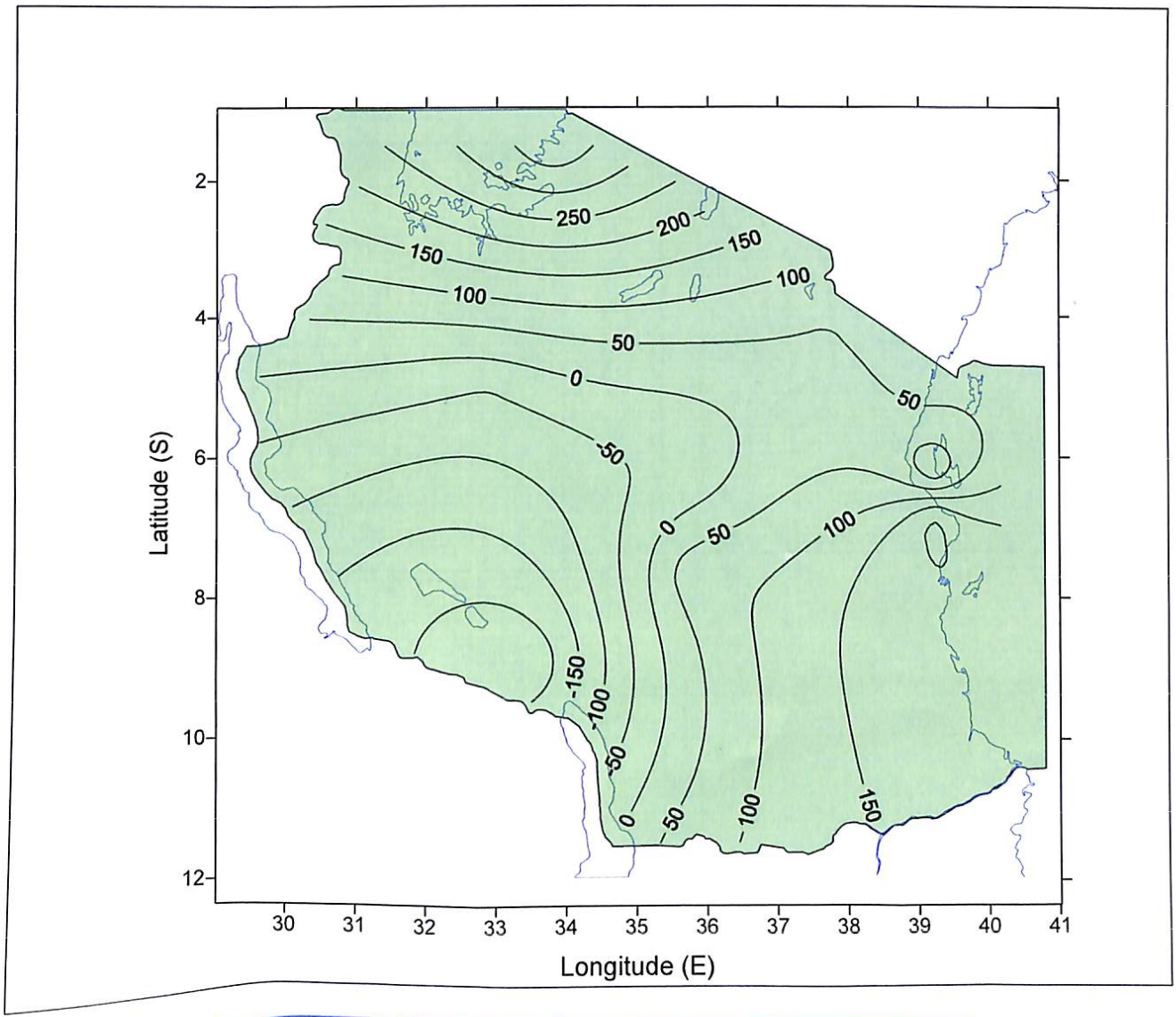

Figure 9: Annual rainfall anomalies in 2011

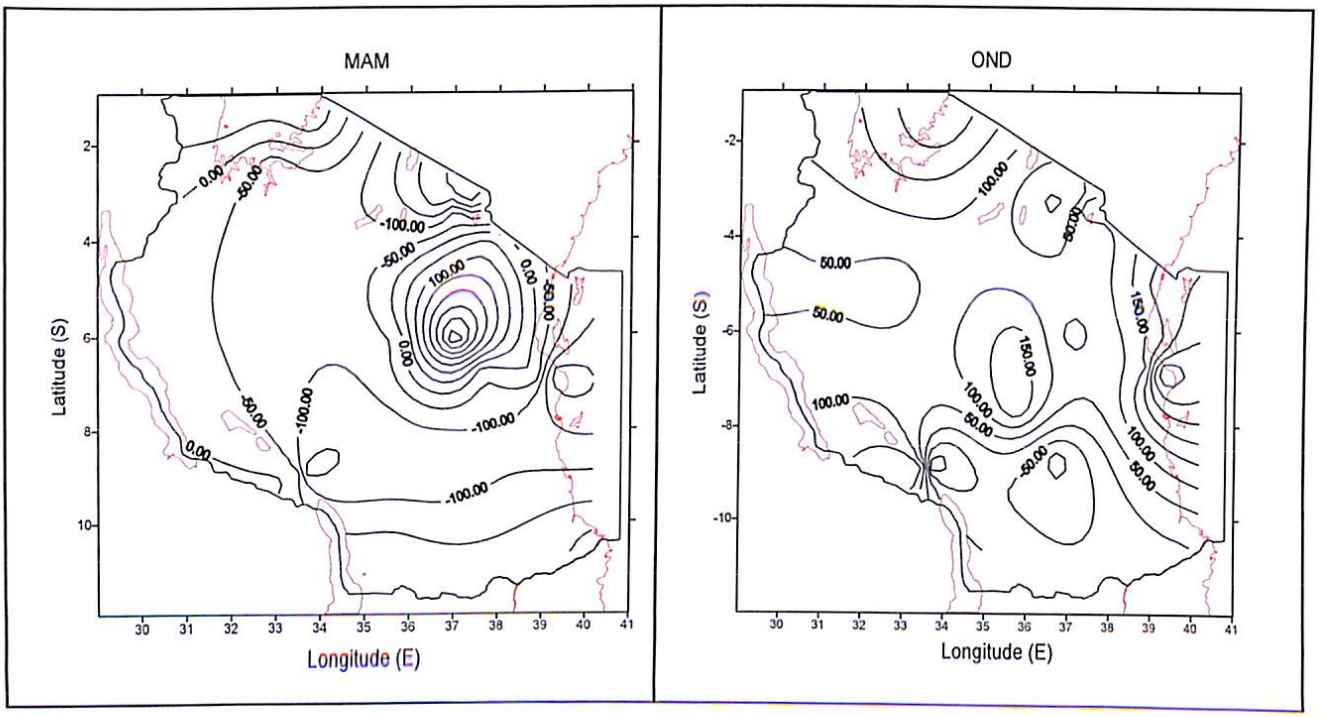

Figure 10: MAM and OND rainfall anomalies in 2011

A comparison of rainfall anomalies in March, April, May (MAM) and October, November, December (OND) seasons (Fig. 10) showed drier than normal condition in MAM and wetter than normal rainfall conditions in OND. Analysis also showed that in MAM, Mtwara, Bukoba, Musoma, Ilonga and Same experienced above normal rainfall anomalies while other regions experienced below normal rainfall anomalies. OND showed that Arusha, Songea, Mahenge, and Uyole had below normal rainfall anomalies while other parts of the country received above normal rainfall anomalies.

3.2 Monthly Rainfall Anomalies in 2011

In January, below average rainfall anomalies was observed over the coastal regions, including the Island of Pemba and Unguja, and some parts of Lake Victoria basin. The same event was observed over central region and some parts of North-eastern highlands. In February similar event was reported over northern coast (Dar es Salaam).

Coastal region, southern and South-western highlands reported above normal rainfall anomalies in February, March and April. From May to August, rainfall was below normal across the country. Above normal rainfall anomalies resumed in September and more pronounced in October, November and December (Figure 12 shows the details).

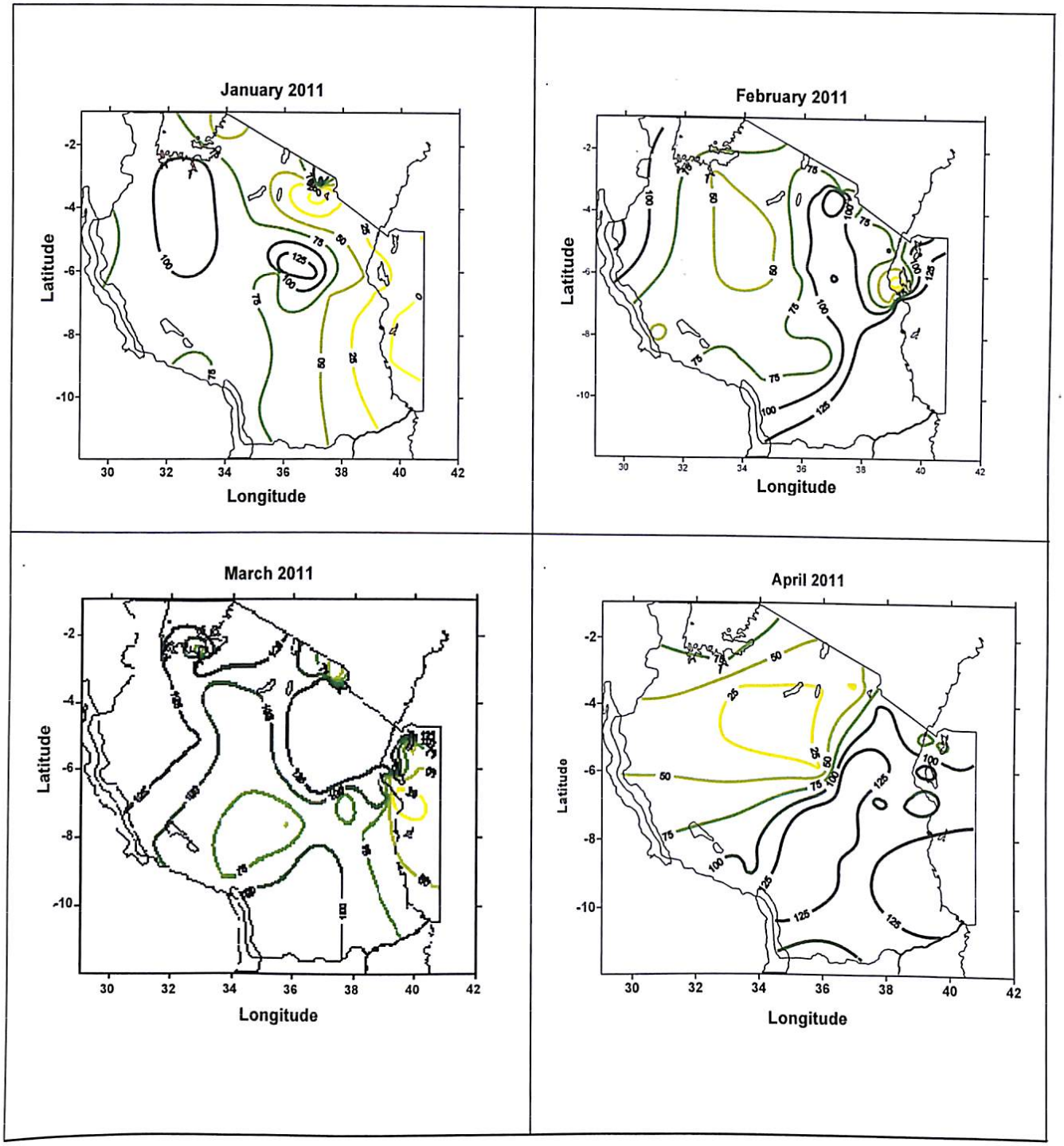

Figure 11: January-April rainfall anomalies in 2011.

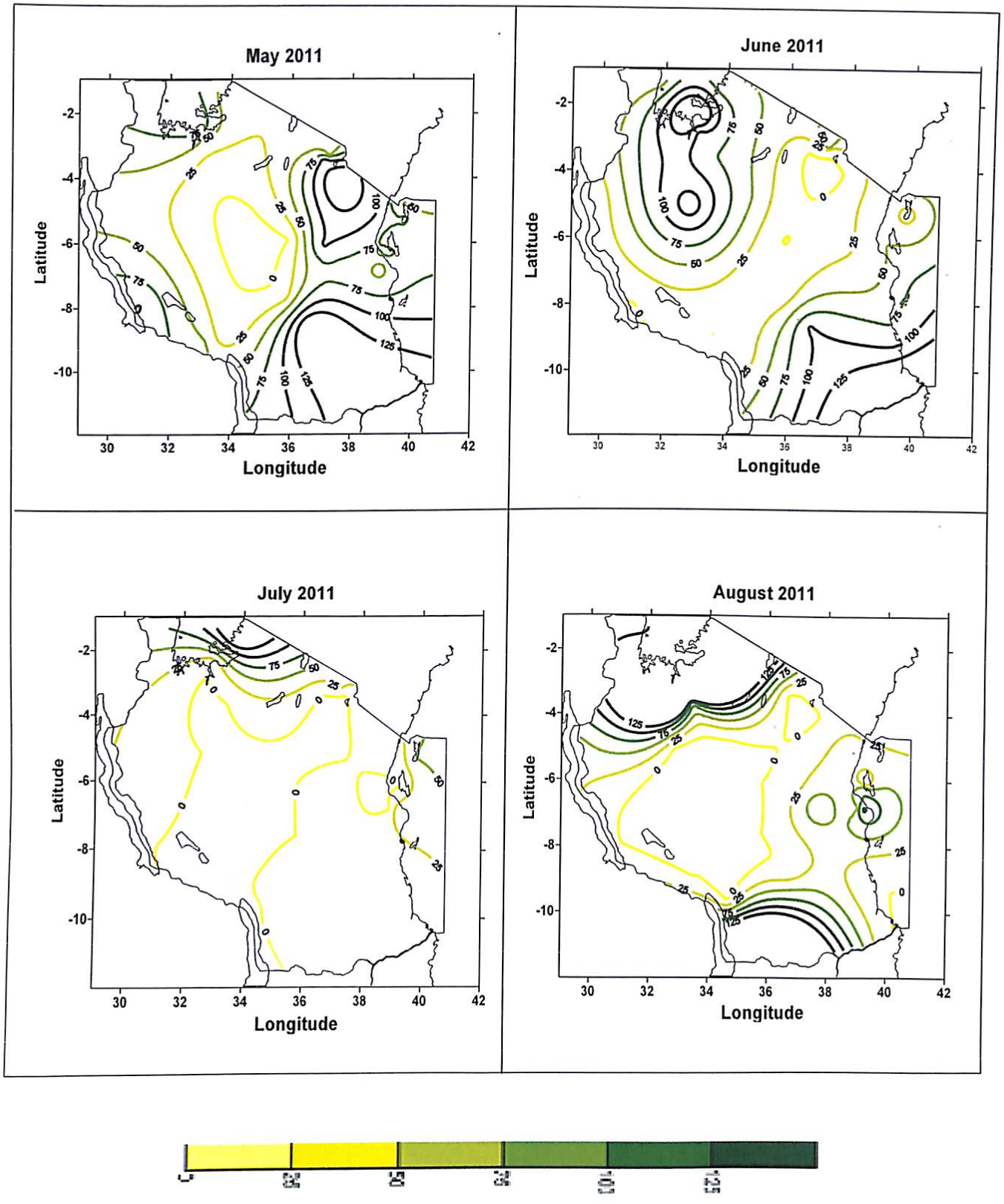

Figure 12: May-August rainfall anomalies in 2011.

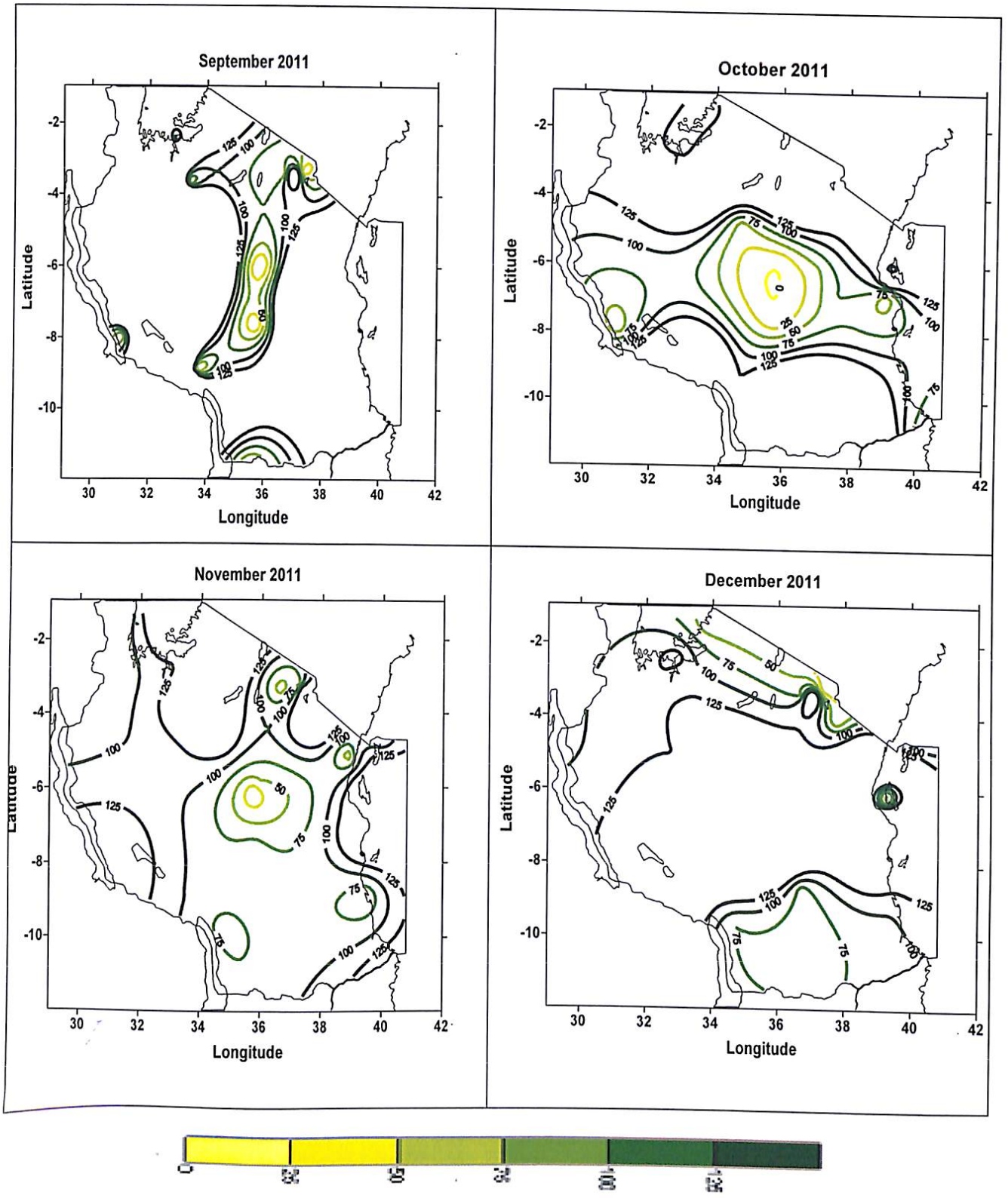

Figure 13: September-December rainfall anomalies in 2011.

4 SEVERE WEATHER AND EXTREME CLIMATIC EVENTS IN 2011

The year 2011 was characterized by incidences of extreme weather events. Various parts of the country recorded higher daily values of rainfall. Such 24 hours extreme values of rainfall were recordered at various parts in different time of the year. For example, Tukuyu station reported 232 mm on 9th May, Dar es Salaam reported 60mm on 19th, 156.4 mm on 20th and 43.8mm on 21st December 2011, the rainfall that lead to severe and catastrophic flooding, associated with loss of life and property. About 43 people were reported dead and thousands homeless. Iringa station reported 131 mm on 21st December, Kizimbani reported 130.2 mm on 19th April, Mtwara reported 100 mm on 18th February, Tanga reported 100.6 mm on 11th October and Zanzibar reported 133.8 on 19th April. The three highest annual total rainfalls observed for the year 2011 were 2074 mm in Bukoba, 2081 mm in Mahenge, and 1700.5 mm in Zanzibar. The highest rain days reported were 158 days in Bukoba, 152 days in Mahenge, and 139 days in Tukuyu Mbeya.

In 2011, some stations recorded below average total rainfall. For example, Lyamungo reported an annual rainfall total of 825 mm, which is 46% below the long term mean. Moshi reported 781.1mm which is 30.1% of long term mean, Ilonga reported 1536.8mm which is 33.6 % of long term mean.

In general in 2011, significant below normal rainfall was observed over central parts and above normal rainfall were observed over Lake Victoria basin and southern parts of the country. It should be noted that despite the severe flood that occurred in the country in 2011 some areas reported below average rainfall and this implies strong spatial and temporal distribution of rainfall in the country

4.1 Climatic Factors Associated with Severe Weather and Extreme Climatic Events in 2011

Catastrophic rainfall event in December 2011 could be linked to warming over the Northern Australia and the prevailed surface Westerly wind pushes warm surface water towards Western Indian Ocean. This warm surface water spread around western equatorial Indian Ocean coupled with significant warming developed over western Indian Ocean (coast of Dar es Salaam) on 20-26 November. This influenced strong moist low level easterly winds converge towards the country and enhances heavy rainfall over much parts of the country.

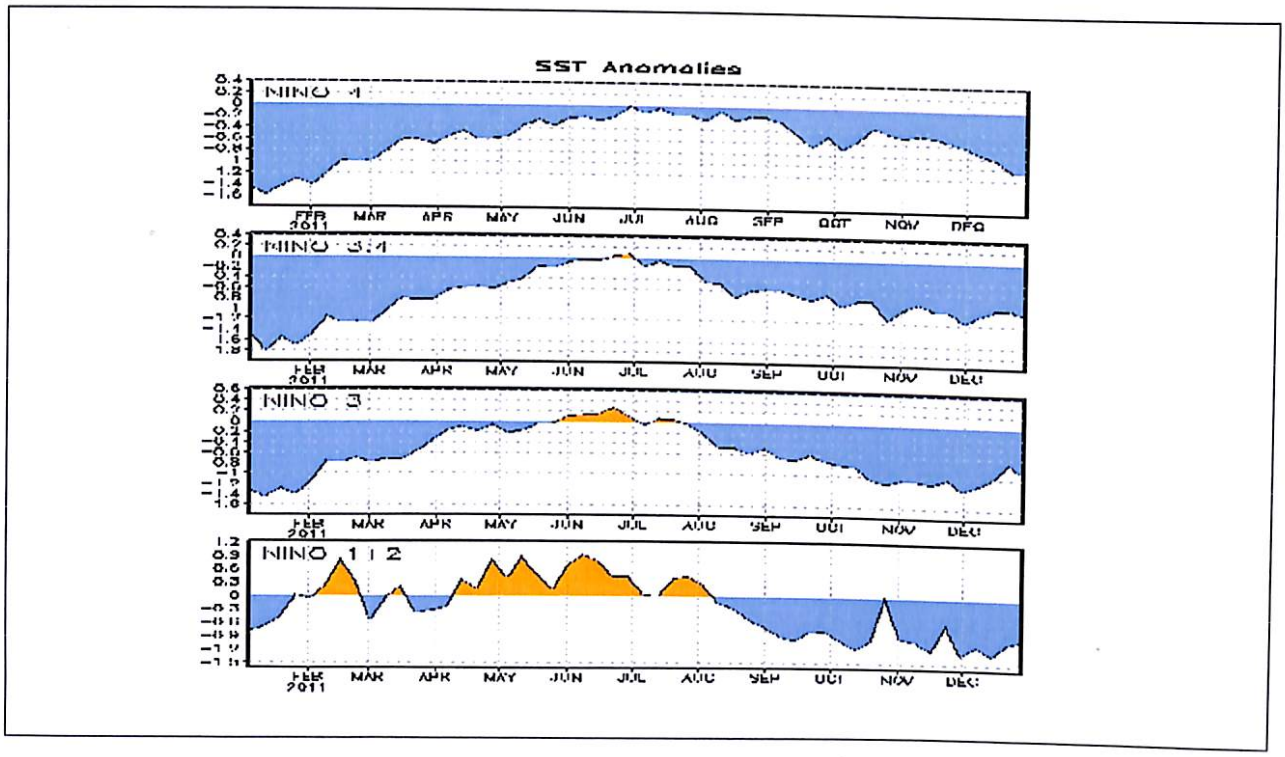

Figure 14: Time series of area-averaged sea surface temperature (SST) anomalies (°C) in the Niño regions [Niño-1+2 (0°-10°S, 90°W-80°W), Niño 3 (5°N-5°S, 150°W-90°W), Niño-3.4 (5°N-5°S, 170°W-120°W), Niño-4 (150°W-160°E and 5°N-5°S)].

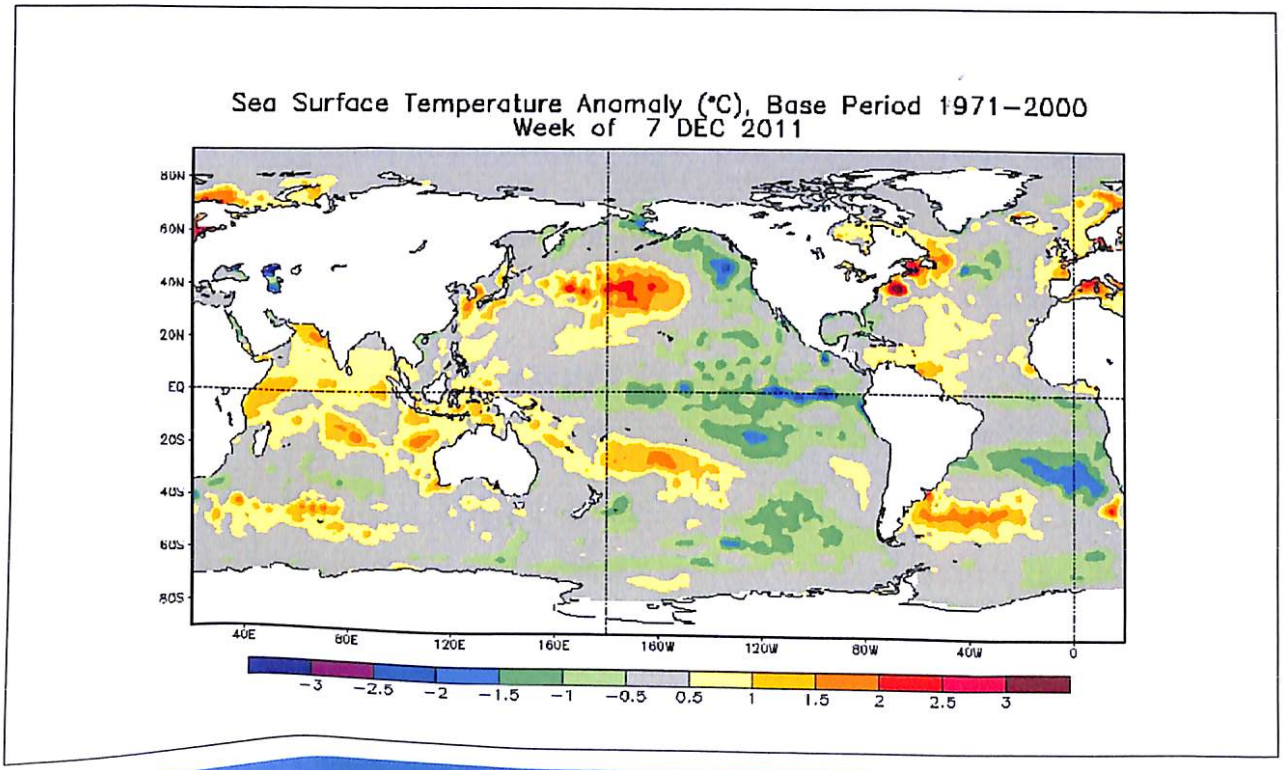

Figure 15: Sea surface temperature anomaly during the week of 14 December 2011.

4.2 Socio-economic Implications of Severe Weather and Extreme Events in 2011

In December 2011, Dar es Salaam city suffered one of the worst flood ever recorded since the 1950s. Forty three people were officially reported dead, and many were missing. Major parts of the city transportation networks were destroyed by the floods. Some bridges were completely swept out, while other bridges were completely covered by water paralyzing road transport. Many people over the low lying areas, for example, the Msimbazi flood plain, lost their homes and personal belongings. Figure 15 shows the detail on the impacts and rescue operation for the December 2011 extreme rainfall in Dar es Salaam.

Figure 16: Rescue operation during December 2011 flooding in Dar es Salaam

5 CONCLUSION

The climate situation of the year 2011 has been analyzed focusing on the spatial and temporal distribution of rainfall and temperature. Most part of the country experienced anomalously warmer temperature and incidence of severe flooding. The city of Dar es Salaam suffered severe catastrophic flooding that claimed the life of 43 people. However, the overall climate situation for the year 2011 was drier and hotter than average in the central parts of the country and wetter than average in some parts of Lake Victoria basin, western and southern Tanzania. Seasonal rainfall analysis indicate that, during the long rain (MAM) almost the entire country experienced drier than normal conditions with the exception of Mtwara, Bukoba, Musoma, Ilonga and Same regions which experienced wetter than normal conditions. In OND almost the entire country experienced wetter than normal conditions with the exception of Arusha, Songea, Mahenge, and Uyole that experienced drier than normal rainfall conditions.