REPUBLIC OF KENYA

MINISTRY OF ENVIRONMENT & FORESTRY

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CLIMATE OUTLOOK FOR JANUARY 2023, REVIEW FOR DECEMBER 2022 AND SEASONAL PERFORMANCE OF OCTOBER-DECEMBER 2022 "SHORT-RAINS"

1. HIGHLIGHTS

1.1. The Climate Outlook for January 2023

The outlook for January 2023 indicates that most parts of the country will experience dry weather conditions. However, few areas over the Highlands West of the Rift Valley, the Lake Victoria basin, the Central and Southern Rift valley, the Highlands East of the Rift Valley, the South-eastern lowlands and the Coastal strip are likely to experience occasional rainfall.

1.2. The Outlook for The Next Three Months (January – February- March)

Sunny and dry weather conditions are expected to prevail over most parts of the country. However, a few areas over the western sector especially those around the Lake Victoria Basin and Southern Rift Valley, the Highlands East of the Rift Valley and South-eastern lowlands may experience a few rainy days during the forecast period. Temperatures are expected to be warmer than average over most parts of the country except over some areas over the western sector where temperatures are expected to be near average.

1.3. Review of December and October-December 2022 "Short-Rains" Seasonal Performance

1.3.1. December 2022 rainfall review

The western sector of the country recorded near to above average rainfall except Nakuru that recorded below average rainfall. Depressed rainfall was recorded over the Coast, Nairobi, northwest, a few stations over the Highlands East of the Rift Valley, and most stations over the northeast and south-eastern lowlands. Kakamega, Eldoret and Kericho are the only stations that recorded above average rainfall. Kisumu, Narok, Moyale, Kisii, Mandera, Meru, Makindu, Kitale and Nyeri recorded near average rainfall while all the other stations recorded less than 75% of their December Long Term Mean.

1.3.2. October-December 2022 "Short-Rains" Seasonal Performance

An analysis of the OND 2022 seasonal rainfall up to 28th December indicates that depressed rainfall was received over North-western, North-eastern, Coast, most stations over the South-eastern lowlands, several stations over the Highlands East of the Rift Valley including Nairobi County and a few stations over the Highlands West of the Rift Valley and Central Rift Valley. Kakamega, Kericho, Kisii, Narok, Eastleigh, Thika, Makindu, Nyahururu, Kisumu, Embu and Kitale recorded near average rainfall. All the other stations recorded below average rainfall.

The start of the seasonal rains (onset) was well within the predicted times over several parts of the country. However, the onset was delayed over a few areas in the south-eastern lowlands while over the coast and the southern Rift Valley, there was a false onset that was followed by long dry spells. In some stations such as Machakos and Msabaha meteorological stations, the onset criteria were not met. The rainfall distribution both in time and space was poor throughout the country especially in the months of October and December. In November, the distribution was good over several parts of the country except over the northern sector and parts of the south-eastern lowlands (Machakos) where distribution was poor.

2. Synoptic Features in the Month of January 2023

The rainfall forecast for January 2023 is mainly based on the evolution of Sea Surface Temperature (SST) gradients and the SST patterns over the global oceans (Indian, Pacific, Atlantic) as well as upper air circulation patterns. The SST patterns in the Indian and Pacific Oceans were mainly considered. The outlook for January 2023 is mainly based on empirical statistical models developed from expected evolution of global Sea Surface Temperature (SST) anomalies and the Southern Oscillation Index (SOI). The SST anomaly patterns considered include the near average SSTs over the Equatorial Indian Ocean implying a neutral Indian Ocean Dipole. Equatorial sea surface temperatures (SSTs) are below average in the central to eastern Pacific Ocean and above average in the far Western Pacific which implies that La Niña conditions are present. This usually results in below average rainfall over Kenya.

2.3. The Rainfall Outlook for January 2023

The forecast indicates that mainly sunny and dry conditions are expected to prevail for most of the month over most parts of the country. However, a few parts of the country are likely to experience occasional rainfall during the month. These include a few areas in western Kenya, especially those around the Lake Victoria basin (Siaya, Busia, Kisumu, Homa Bay, Migori, Kisii, Nyamira, Vihiga, Kakamega), Southern Rift Valley (Bomet, Kericho, Narok), the south-eastern lowlands (Kajiado, Kitui, Makueni, Machakos and Taita Taveta), parts of the Highlands East of the Rift Valley including Nairobi County (Nyandarua, Nyeri, Kirinyaga, Murang'a, Kiambu, Meru, Embu and Nairobi) and parts of the coastal region. **Figure 1** portrays the expected rainfall pattern during January 2023.

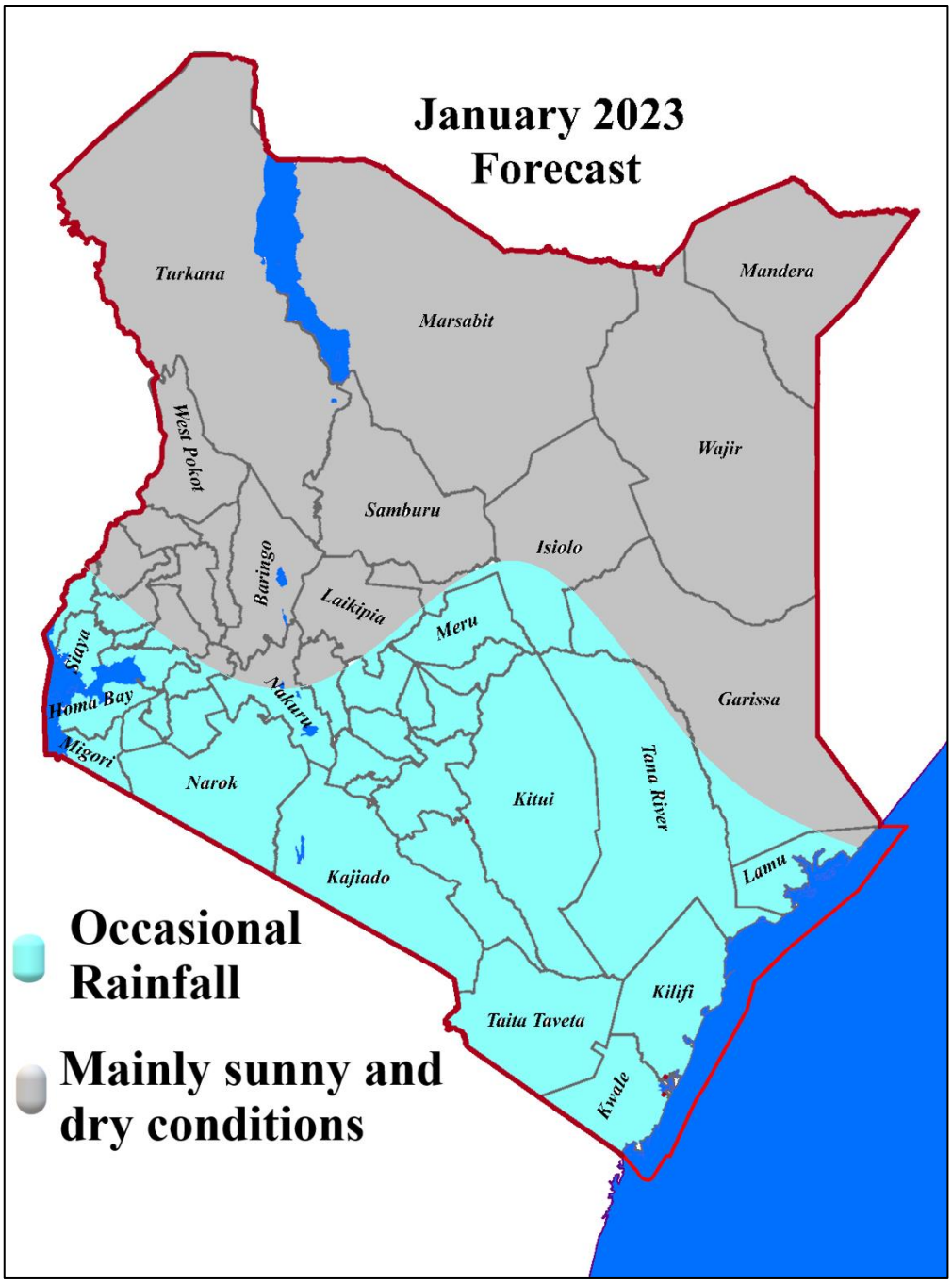

Figure 1: January 2023 Rainfall Forecast

2.4. Specific Outlook for Individual Areas

2.4.1. The Lake Victoria Basin, parts of the Highlands West of the Rift Valley and South Rift Valley (Siaya, Kisumu, Homa Bay, Migori, Kisii, Nyamira, Nandi, Narok, Kericho, Bomet, Kakamega, Vihiga, and Busia): are likely to experience generally dry conditions for most of the month. However, Occasional light to moderate rainfall is expected over few areas during the second half of the month.

2.4.2. The North Rift, Central Rift Valley and parts of the Highlands West of the Rift Valley (Bungoma, Trans Nzoia, Uasin Gishu, Elgeyo Marakwet, West Pokot, Baringo, Nakuru, Central and Western parts of Laikipia are likely to experience generally sunny and dry conditions throughout the month though a few days may experience light rainfall.

2.4.3. **North-western Region (Turkana, West Pokot and Samburu):** Sunny and dry conditions are expected in the month of January. High day time (Maximum) temperatures (30°C - 40°C) are expected to prevail in most places during the month.

2.4.4. **Highlands East of the Rift Valley and Central Kenya (Nairobi, Nyandarua, Nyeri, Kirinyaga, Murang'a, Kiambu, Meru, Embu, Tharaka-Nithi and eastern parts of Laikipia):** are likely to experience mainly sunny and dry conditions for most of the month. However, occasional light to moderate rainfall is expected during the first half of the month.

2.4.5. **North-eastern Region (Wajir, Garissa and Isiolo, Mandera and Marsabit):** are likely to experience sunny and dry conditions during the month. However, occasional light rainfall is expected over few areas during the first week of the month. High day time (Maximum) temperatures (30°C - 40°C) are expected to prevail throughout the month.

2.4.6. **South-eastern Lowlands (Kajiado, Kitui, Makueni, Machakos and Taita Taveta):** are likely to experience mainly sunny and dry conditions for most time of the month. However, occasional light to moderate rainfall is expected during the first half of the month.

2.4.7. **The Coastal Strip (Mombasa, Tana River, Kilifi, Lamu and Kwale**): are likely to experience mainly sunny and dry conditions for most time of the month. However, occasional light to moderate rainfall is expected during the first half of the month.

2.5. Potential impacts

The following are the likely impacts during the month of January 2023:

2.5.1. Agriculture and Food Security

The dry weather conditions expected during the month are likely to worsen the food security over the northern and parts of the eastern sectors of the country as availability of food, water and pasture for human as well as livestock use is expected to decline further. The national and local governments as well as humanitarian organisations are advised to take necessary action to avert any loss of lives.

2.5.2. Disaster Management

The current drought being experienced over the northern and parts of the eastern sectors of the country is expected to exacerbate. Relevant authorities are advised to put in place measures to avert any loss of lives and livelihoods. The limited pasture and water over the ASAL areas may lead to resource-based conflicts among the pastoral and farming communities.

2.5.3. Water Resources Management and Energy

The expected dry conditions in January 2023 may impact negatively on the major river catchment areas for the country's hydroelectric power generating dams. Careful reservoir management and continuous monitoring of water level is therefore recommended to ensure stable power supply. Water availability for both human and livestock needs is expected to decline further especially over the ASAL areas. Relevant authorities are advised to carry out water trucking to identify the most vulnerable members of the community and provide them with water. The public is advised to invest in water harvesting practices/techniques to harness the rainwater in areas where occasional rainfall is expected.

2.5.4. Environment

Human wildlife conflicts may escalate in the ASAL areas as wildlife migrate in search of water and pasture. Relevant authorities are advised to provide fodder and watering points to the wildlife to minimize such incidences. The dry conditions expected in January may result in reduced water levels in reservoirs, lakes, and ponds. It is also likely to lead to loss of wetlands and occurrence of wildfires in forests, parks and reserves. The public should therefore be alert while putting in place measures to conserve the environment.

2.5.5. Health

The high temperatures expected during the month of January in most parts of the country may lead to heat stress and heat related discomforts such as headaches and fatigue. The public is therefore advised to hydrate appropriately and avoid working in the open especially in the afternoons. Malnutrition related diseases are likely to increase over the northern sector of the country. Plans should therefore be put in place to provide food and food supplements to the most vulnerable communities.

3. OUTLOOK FOR JANUARY-MARCH 2023

The outlook for the next three months indicates that most parts of the country are likely to experience sunny and dry weather conditions throughout the forecast period. However, a few areas over the western sector and especially those around the Lake Victoria region and Southern Rift Valley may experience occasional rainfall in January and February. In March, the rainfall is expected to spread to several places. This rainfall is expected to be near to below the January- February- March LTMs. The Highlands East of the Rift Valley and the South-eastern lowlands are expected to remain generally sunny and dry though a few days may experience rainfall that is expected to be near the January to March LTMs. The Coastal region is expected to be generally dry throughout the forecast period but may experience occasional rainfall during the first half of January and towards the end of March. The northeast and northwest regions are expected to remain generally hot and sunny

throughout the forecast period though a few areas may experience light rainfall at the beginning of January.

Temperatures are expected to be warmer than average over most parts of the country except over some areas over the western sector where they are expected to be near average. Daytime (Maximum) temperatures over northeast and northwest are expected to be high and may occasionally rise beyond 37^0C.

4. Rainfall Review for December 2022 and OND 2022 Season

4.3. Review of December 2022 Rainfall Performance

The month of December marks the cessation of the October to December (OND) seasonal rainfall. An analysis of rainfall up to 28th December 2022 indicates that the western sector of the country recorded near to above average rainfall except Nakuru that recorded below average rainfall. Depressed rainfall was recorded over the Coast, Nairobi, Northwest, a few stations over the Highlands East of the Rift Valley and most stations over northeast and southeastern lowlands. Kakamega, Eldoret and Kericho are the only stations that recorded above average rainfall at 162.1%, 148.7% and 140.6% respectively. Kisumu, Narok, Moyale, Kisii, Mandera, Meru, Makindu, Kitale, Nyeri and Nyahururu recorded near average rainfall at 124.4%, 121.4%, 109.8%, 95.2%, 89.4%, 85.7%, 82.7%, 82.5%, 81.1% and 78.1% respectively. All the other stations recorded less than 75% of their December LTM.

The highest monthly total rainfall of 167.1mm was recorded at Kericho station followed by Kakamega at 166.5mm. Kisumu, Kisii and Meru and recorded 156.6mm, 143.3mm and 138.6mm respectively. All the other stations recorded less than 100mm with Garissa recording the least amount of rainfall at 0.6mm. The month was characterized with isolated storms over the Highlands West of the Rift Valley, the Lake Victoria Basin, the Highlands East of the Rift Valley and the South-eastern lowlands. For instance, Butere station in Kakamega recorded 58.7mm in twenty-four hours on 8th December. On the same day, Masii station in Machakos recorded 42.8mm while Kisumu recorded 39.9mm on 10th. Tseikuru Agricultural office, Makayaa and Mutha chief's camp all in Kitui recorded 59.0mm, 48.9mm and 42.0mm respectively on 11th. On 12th, Masongaleni station in Makueni recorded 105.4mm while Managia station in Embu recorded 45.9mm on the same day. On 27th, Eldoret International Airport and Wath Onger station in Migori recorded 53.4mm and 57.8mm respectively.

Figure 2a shows the December 2022 rainfall performance (%) while **Figure 2b** shows total rainfall amount recorded in December (Blue bars) in comparison with the December LTMs (Red bars)

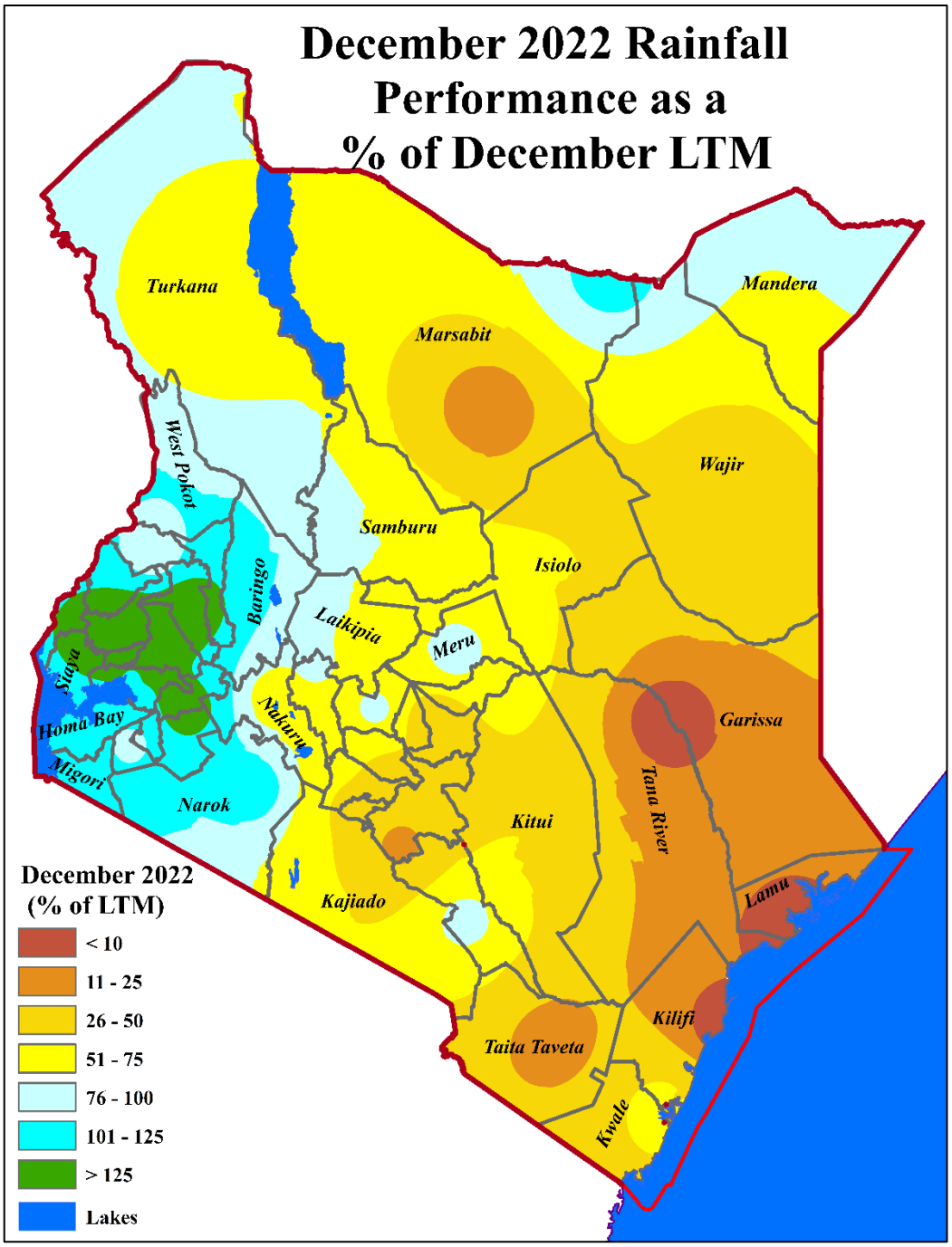

Figure 2a: December 2022 Rainfall Performance (%) Against December LTM

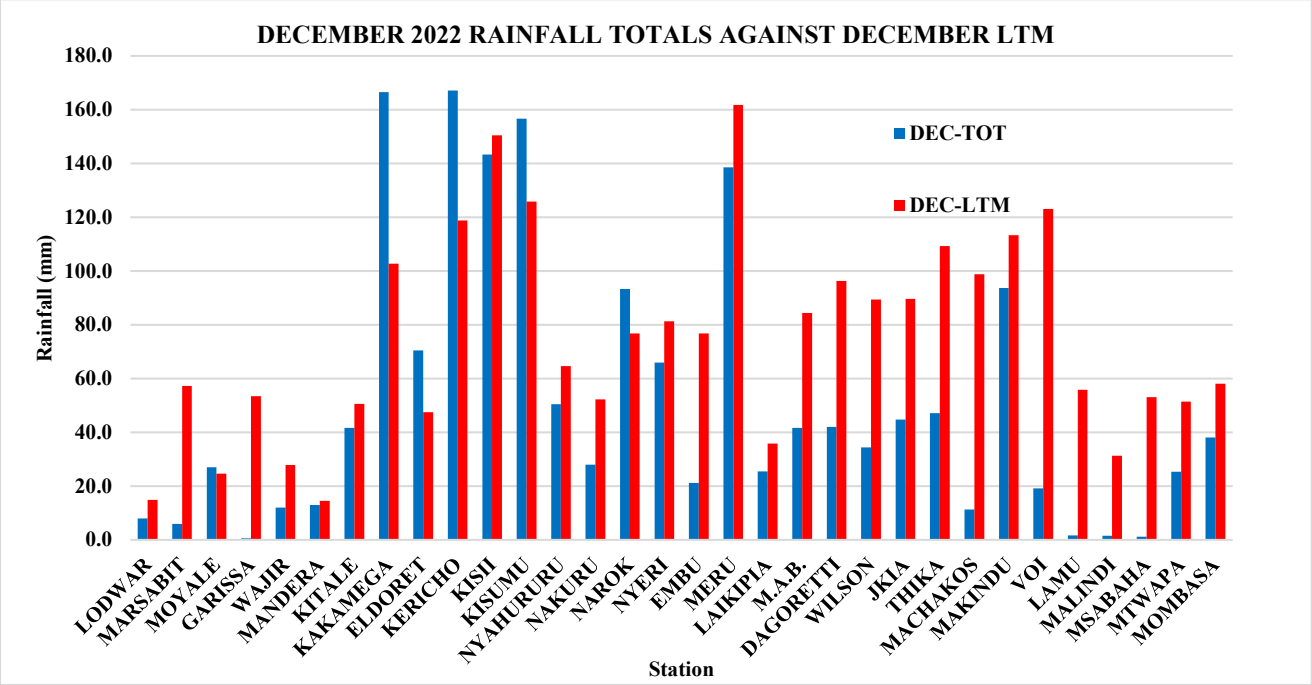

Figure 2b: December 2022 Monthly Rainfall Totals against December LTM

4.4. Review Of October-December 2022 "Short-Rains" Seasonal Performance

The start of the seasonal rains (onset) was well within the predicted times over several parts of the country. However, the onset was delayed over a few areas in the south-eastern lowlands while over the coast and parts of the southern Rift Valley, there was a false onset that was followed by long dry spells. In some stations such as Machakos and Msabaha meteorological stations, the onset criteria were not met. The rainfall distribution both in time and space was poor throughout the country especially in the months of October and December. In November, the distribution was good over several parts of the country except over the northern sector and parts of the south-eastern lowlands (Machakos) where distribution was poor. The poor rainfall performance over several parts of the country was mainly as a result of the La Nina conditions owing to the prevailing cooler than average Sea Surface Temperatures (SSTs) in the central and eastern Equatorial Pacific Ocean and the warmer than average Sea Surface Temperatures in the Western Equatorial Pacific Ocean. The Indian Ocean dipole (IOD) remained negative in October and November and was neutral in December.

The seasonal rainfall analysis from 1st October to 28th December shows that depressed rainfall was received over North-western, North-eastern, Coast, most stations over the South-eastern lowlands, several stations over the Highlands East of the Rift Valley including Nairobi County and a few stations over the Highlands West of the Rift Valley and Central Rift Valley. Kakamega, Kericho, Kisii, Narok, Eastleigh, Thika, Makindu, Nyahururu, Kisumu, Embu and Kitale recorded near average rainfall at 124.7%, 123%, 95.7%, 95.1%, 88.7%, 81.9%, 81.1%, 79.1%, 77.4%. 77.2% and 76% respectively. All the other stations recorded less than 75% of their OND LTMs with Lodwar recording the lowest percentage at 15.2%.

The highest seasonal total rainfall amount of 588.2mm was recorded at Kericho Meteorological station. Other stations that recorded significant amounts of rainfall are Kakamega (532.6mm), Kisii (514.2mm), Meru (404.9mm), Embu (383.1mm), and Thika (319.0mm). The other stations recorded between 100-295mm except Machakos, Marsabit, Mandera, Msabaha, Wajir and Lodwar that reported 60.6mm, 53.5mm, 52.5mm, 47.1mm, 30.2mm and 8.5mm respectively. **Figure 3a** shows the OND 2022 rainfall performance (%) while Figure **3b shows** total rainfall amount recorded in OND 2022 (Blue bars) in comparison with the OND LTMs (Red bars)

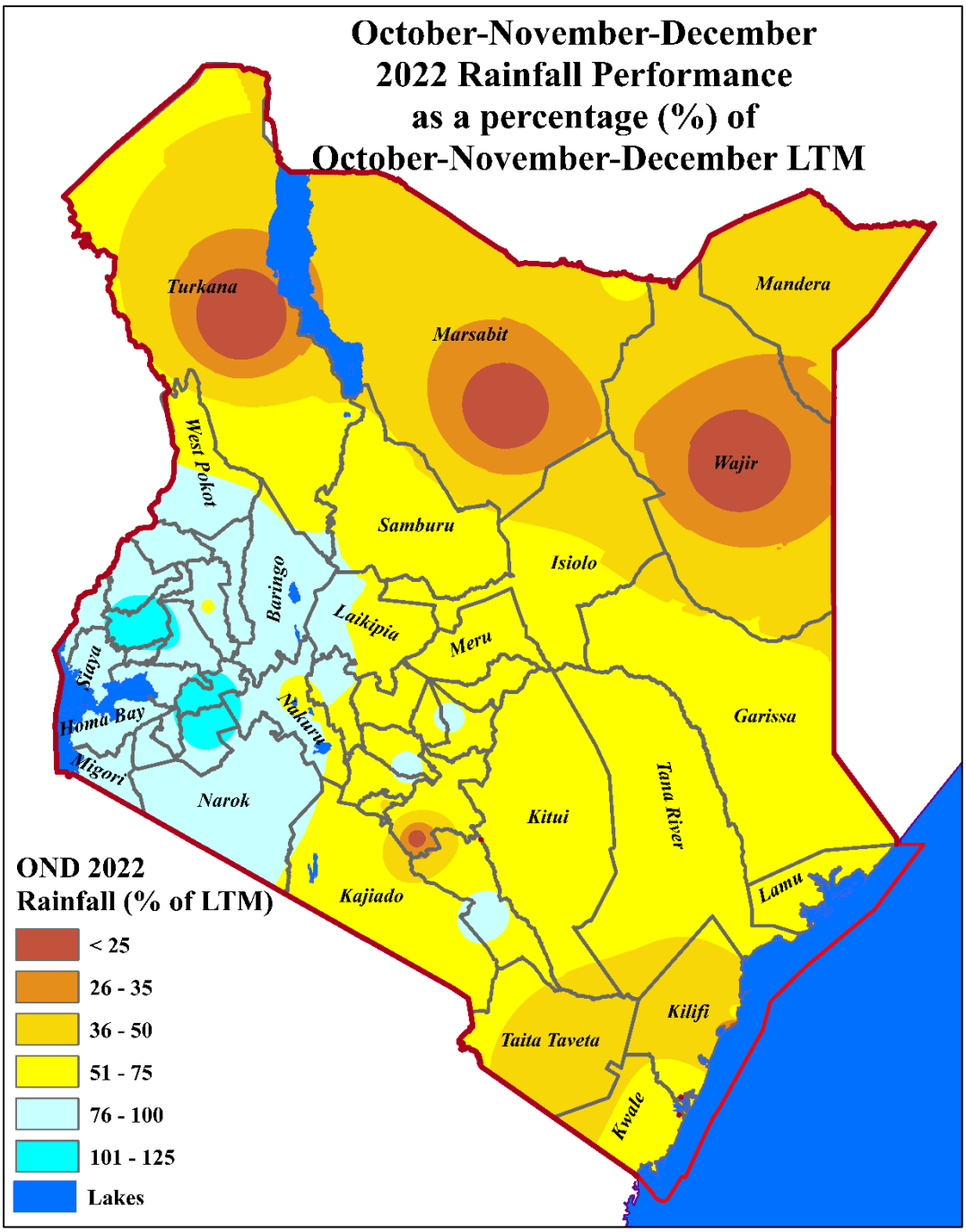

Figure 3a: October-December 2022 Seasonal Rainfall Performance (%) against OND LTM

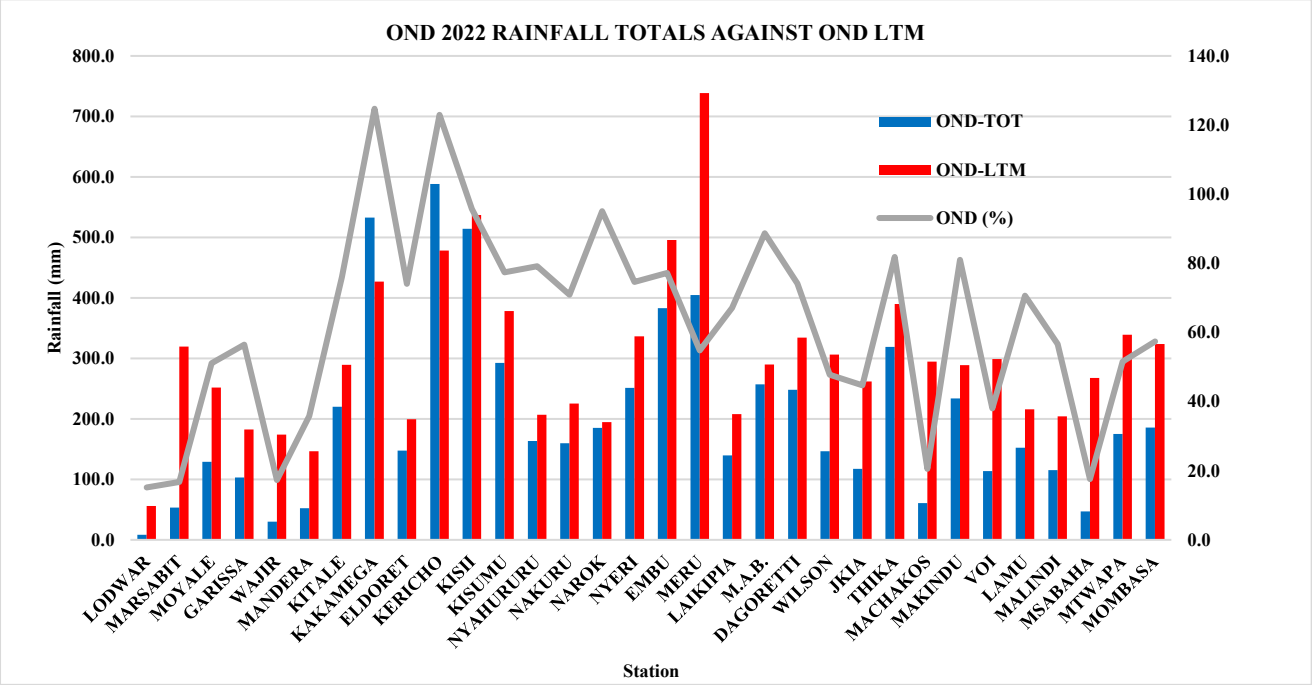

Figure 3b: October-December 2022 Seasonal Rainfall Totals against OND LTM

4.5. Experienced Impacts During the October-November-December Seasonal Rainfall

4.5.1. Agriculture and Food Security

In December, fall army worms invaded farms in parts of Machakos County and destroyed crops. During the months of October to December, dry conditions over the ASAL areas led to diminished pasture and water for livestock and food for human consumption. Residents in these areas were faced with acute food shortage where children, the elderly, pregnant and lactating mothers were severely malnourished. Livestock deaths were reported in the ASAL areas of the northern parts of the south-eastern lowlands and Coastal regions. The body conditions of the remaining livestock in these areas were poor and this affected milk production. Most pastoralist lost all their livestock thus affecting their livelihoods. The prices of the remaining livestock were very low due to the poor body condition. Crops withered in parts of Kitui County in November as a result of a false onset that was followed by a long dry spell. Fall army worms invaded farms in parts of Kitui and destroyed crops in November.

4.5.2. Disaster Management

A man drowned along the Kilgoris- Migingo road as he attempted to cross the swollen river Kongit in Narok on 25th December.

There were two cases of human wildlife conflicts in December over Kajiado County where two men were killed by rogue elephants.

Heavy rainfall that was experienced on 19th November in Garissa County led to displacement of people and destruction of infrastructure especially houses, roads and toilets. A woman drowned as she attempted to cross the swollen river Enziu in Kitui County on 17th November.

There were cases of resource-based conflicts in October along the Kitui Tana-River and Meru Isiolo borders where a man and a woman were killed respectively by camel herders who had invaded farms in search of pasture for their livestock.

4.5.3. Water Resources Management and Energy

The depressed rainfall received over the ASAL areas during most of the OND 2022 season led to reduced water resources especially in the months of October and December where residents and livestock were faced with acute water shortage. Water sources dried up in most ASAL regions and residents had to walk for long distances in search of water both for human and livestock consumption. However, the water situation improved slightly in November over isolated areas in the south-eastern lowlands, north-eastern (Garissa and Isiolo) and the coastal region as a result of the rainfall received during the month. Water shortage persisted over the north-western and most of the north-eastern regions.

4.5.4. Environment

Wildlife deaths were reported in the ASAL areas of northern and south-eastern lowlands as a result of lack of food and water in the conservancies and in the neighbouring areas during the season.

4.5.5. Transport and Public Safety

Traffic was temporarily disrupted along Kismayu road in Garissa following heavy rains that caused flooding on 19th November. Transport along Nguni – Nuu road along river Enziu in Kitui County was also temporarily disrupted following heavy rains that were experienced over the area on 15th and 16th November 2022.

NB: This outlook should be used together with the 24-hour, 5-day, 7-day, special forecasts and regular updates/advisories issued by this Department as well as Weekly and Monthly County forecasts developed and availed by County Meteorological Offices.

KEY OF SCIENTIFIC WORDS USED

Rainfall performance is generally categorized as follows:

- Below 75% of the LTM – Below Normal (Depressed) rainfall
- Between 75% and 125% of the LTM - Near normal rainfall
- Above 125% of the LTM – Above Normal (Enhanced) rainfall

Mr. Kennedy Thiong'o

For Director of Kenya Meteorological Department