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CLIMATE OUTLOOK FOR THE "LONG RAINS" (MARCH-MAY) 2024 SEASON AND REVIEW OF THE OCTOBER-DECEMBER 2023 "SHORT RAINS" SEASON

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1 HIGHLIGHT

1.1 Outlook for March-April-May (MAM) 2024

Above-average rainfall is expected over the Lake Victoria Basin, Highlands West of the Rift Valley, Central, Northern and Southern Rift Valley, Highlands East of the Rift Valley (including Nairobi County), Northeastern, Southeastern Lowlands, and Northwestern regions. Generally, near-average rainfall with a tendency to above average rainfall is expected over the Coastal region and parts of the Southeastern lowlands. Occasional storms are also likely to be experienced in some parts of the country. The temperature forecast suggests that for the larger part of the country, the season is likely to be warmer than average.

1.2 Review of the October-November-December (OND) 2023 Rainfall Season

Most stations across the country recorded above average rainfall except isolated stations over the Central Rift Valley (Nakuru), Highlands East of the Rift Valley (Nyahururu), South-eastern lowlands (Voi), Highlands West of the Rift Valley (Kitale) and Northwest (Lodwar) that recorded near average rainfall. The onset of the seasonal rainfall was during the third to fourth week of October except over a few areas over the Coast and Southeastern lowlands where onset was during the first week of November and the Highlands west of the Rift Valley, Lake Basin and parts of the central and South Rift Valley where rainfall continued from September. The distribution was good in October and November and poor in December. The season was characterized by severe storms over the Coastal region, Southeastern lowlands, Highlands East of the Rift Valley and Northeastern Kenya.

2 FORECAST FOR MARCH-APRIL-MAY 2024 "LONG-RAINS" SEASON

2.1 Climatology

The March to May period is the major rainfall season (long rains) over most parts of Kenya and much of equatorial Eastern Africa. The highest seasonal rainfall amounts (greater than 300mm) are normally received over the Lake Victoria Basin, the Highlands West of the Rift Valley, the Central and South Rift Valley, the Highlands East of the Rift Valley (including Nairobi County) and the Coastal Strip. **Figure 1a** illustrates the rainfall climatology during the March to May rainfall season.

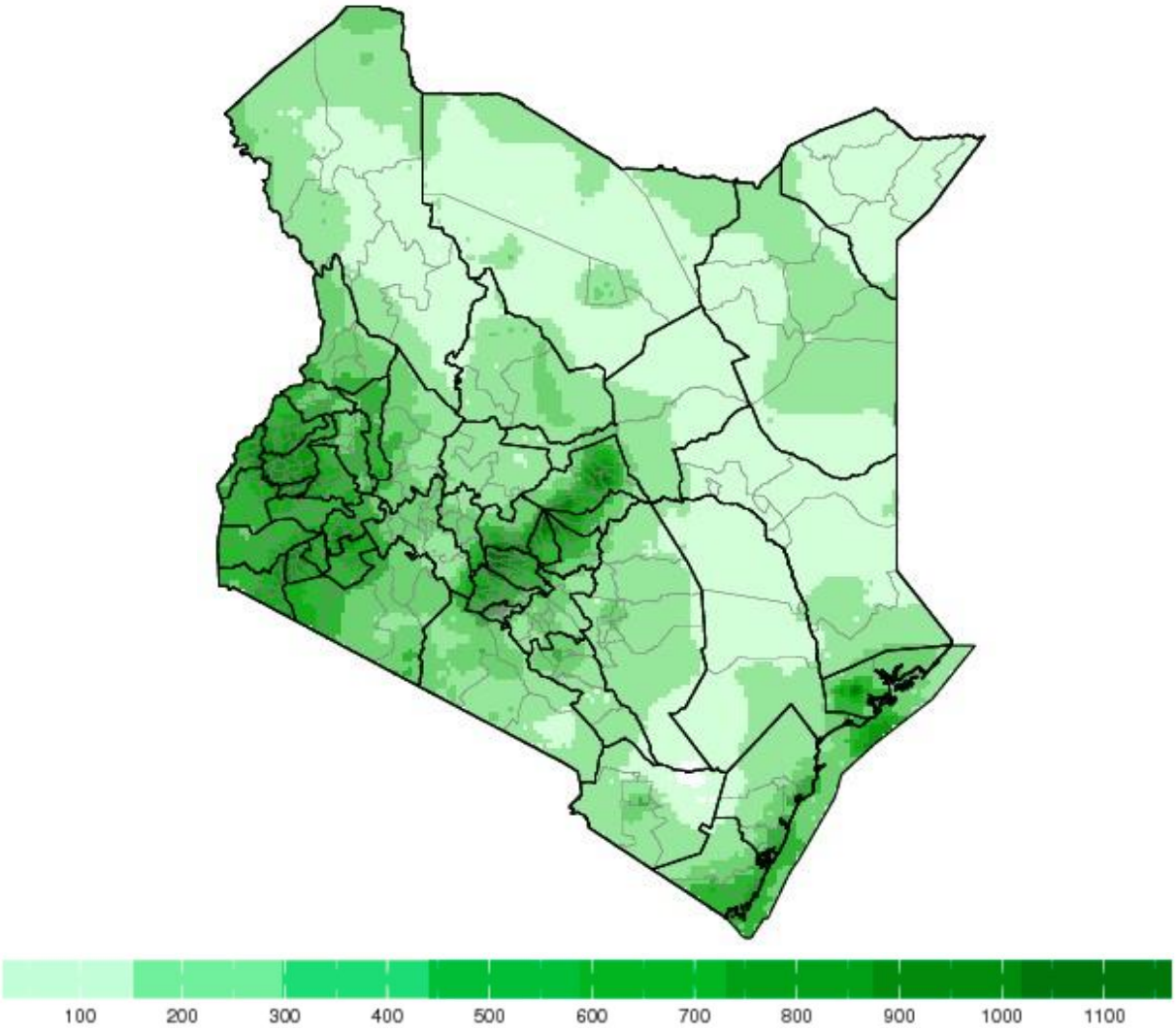

Figure 1a: Rainfall climatology during the March to May rainfall season

2.2 Rainfall Outlook for March-April-May 2024 "Long-Rains" Season

The forecast for March-April-May 2024 "Long-Rains" season is based on the prevailing and expected evolution of Sea Surface Temperature Anomalies (SSTAs) over the Pacific, Indian, and Atlantic Oceans as well as the synoptic, mesoscale, and local factors that affect the climate of Kenya. These factors were assessed using various tools, including ocean-atmosphere models, statistical models, satellite-derived information, and expert interpretation. The global drivers considered included the Indian Ocean Dipole (IOD), El Niño Southern Oscillation (ENSO), Quasi-Biennial Oscillation (QBO), Western North Pacific (WNP), and Madden-Julian Oscillation (MJO).

The forecast, as shown in **Figure 1b** indicates that the anticipated above-average rainfall is forecasted across various regions including the Lake Victoria Basin, Highlands West of the Rift Valley, Central, Northern and Southern Rift Valley, Highlands East of the Rift Valley (including Nairobi County), Northeastern and Southeastern Lowlands, and Northwestern regions. Generally, near-average rainfall with a tendency to above average rainfall is expected over the Coastal region. The peak of the rains is expected to be in April for most regions, except over the Coastal Strip where it may not be realized until May. Additionally, the temperature forecast indicates that for most of the country, the season is expected to be warmer than average.

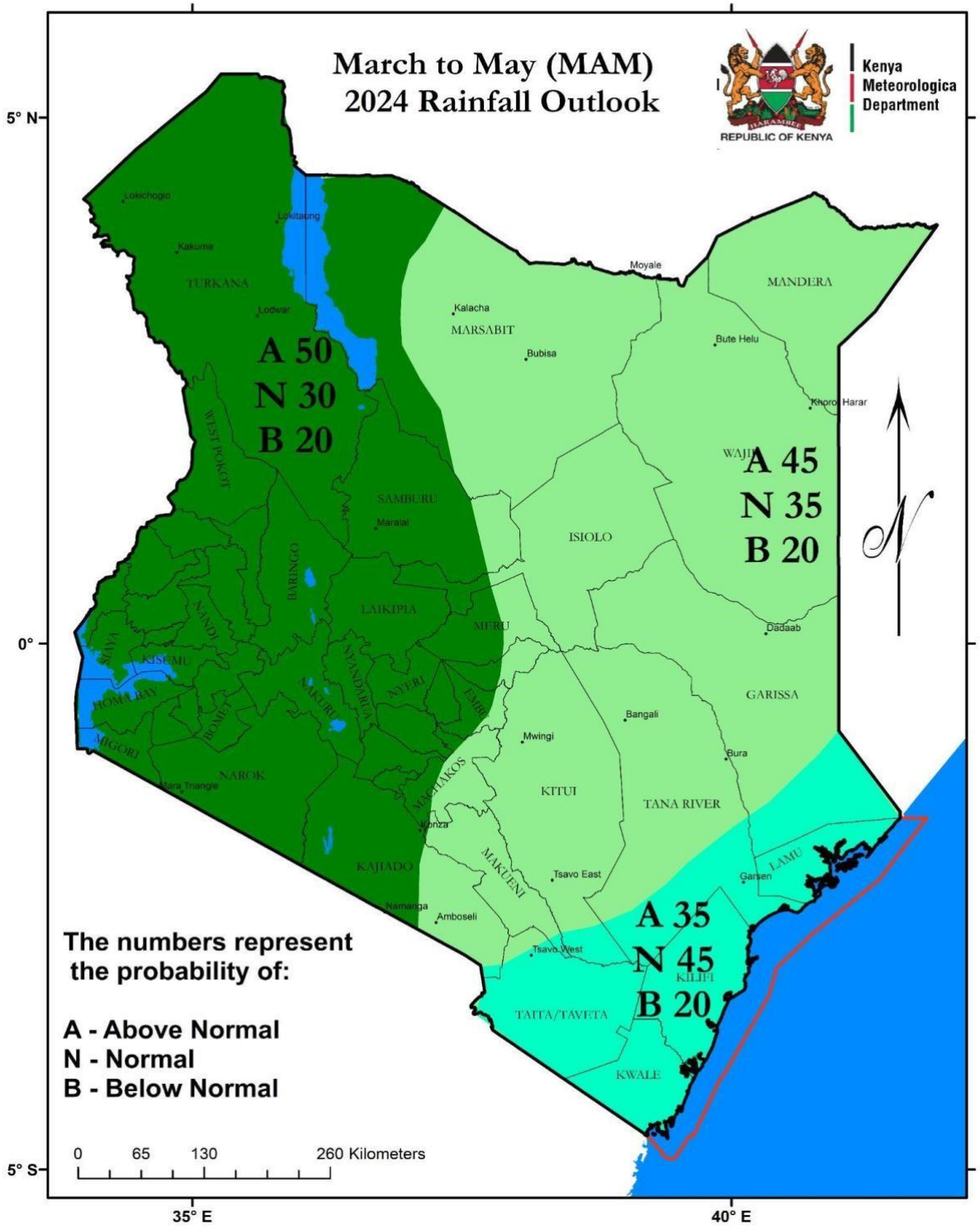

Figure 1b: March-April-May (MAM) 2024 "Long-Rains" Season Outlook

2.3 Specific Outlook for the March to May 2024 "Long-Rains" Season

The specific outlook for March to May 2024 "Long-Rains" Season is as follows:

2.3.1 **The Highlands West of the Rift Valley, Lake Victoria Basin, Central and South Rift Valley (Siaya, Kisumu, Homa Bay, Migori, Kisii, Nyamira, Baringo, Uasin Gishu, West Pokot, Elgeyo Marakwet, Nandi, Kericho, Bungoma, Kakamega, Busia, Trans Nzoia, Vihiga, Laikipia (Laikipia West), Nakuru and Narok**): Rainfall in these counties is expected to continue throughout the season. The expected rainfall is likely to be above the long-term average amounts for the season (enhanced rainfall). The distribution of the rainfall is likely to be good in both time and space.

2.3.2 **Northwestern Counties (Turkana and Samburu):** These counties are likely to experience occasional rainfall during the season. The expected rainfall amount is likely to be above the long-term average for the season (enhanced rainfall). The distribution of the rainfall is likely to be poor, tending to fair in both time and space.

2.3.3 **The Highlands East of the Rift Valley** (**including Nairobi County**) – (Nyandarua, Nyeri, Kirinyaga, Murang'a, Kiambu, Embu, Meru, Tharaka Nithi, and eastern parts of Laikipia): These counties are likely to experience rainfall during the season. Rainfall amounts are expected to be above the season's long-term average. The distribution of the rainfall is likely to be fair to good in both time and space.

2.3.4 **The Southeastern Lowlands** (Kitui, Makueni, Machakos, Kajiado and Taita Taveta): The expected rainfall amount is likely to be above the long-term average for the season. However, Taita Taveta and the Southern parts of Kitui and Makueni Counties are likely to experience near average with a tendency to above average rainfall. The distribution of the rainfall is likely to be fair to good in both time and space.

2.3.5 **The Northeast Counties (Mandera, Marsabit, Wajir, Garissa, Isiolo and parts of Tana River**): These areas are expected to experience occasional rainfall during the season. The expected rainfall amount is likely to be above the long-term average for the season. The distribution of the rainfall is likely to be poor to fair in both time and space.

2.3.6 **The Coastal Strip** (Mombasa, Tana River, Kilifi, Lamu and Kwale counties): Rainfall amounts are likely to be near to above the long-term average amounts for the season. The distribution of the rainfall is likely to be fair to good in both time and space.

2.4 Onset, Cessation, and Distribution of Rainfall

2.4.1 Distribution

The predicted onsets, cessations, and distribution of rainfall were derived from 5 Global Climate Model (GCMs) runs as well as statistical analyses of past years which showed similar characteristics to the current year and are as indicated in Table 1. The analogue (similar) years chosen are 1998, 2010 and 2016. The season is expected to experience an early to normal onset, especially over the Western half of the country.

2.4.2 Onset and Cessation Dates

The expected onset and cessation dates for the various counties are as indicated in **Table 1**.

Table 1: Onset and cessation dates

	Region	Onset Dates	Cessation	Distribution
1	Counties in Highlands West of the Rift Valley, Lake Victoria Basin, Central, and South Rift Valley: (*Bungoma, Trans Nzoia, Uasin Gishu, West Pokot, Elgeyo-Marakwet, Nandi, Kakamega, Vihiga, Bomet, Kericho, Kisii, Nyamira, Homa Bay, Migori, Kisumu and Busia, Baringo, Nakuru, Western Laikipia and Narok).*	Continues from February	Continues to June	Good
2	Highlands East of the Rift Valley including Nairobi County: *(Nyeri, Kirinyaga, Murang'a, Embu, Meru, Kiambu, Nyandarua, Nairobi and eastern parts of Laikipia)*	Continues from February followed by dry spell till third to fourth week of March	Fourth week of May to first week of June	Fair to Good
3	Southeastern Lowlands (*Kajiado, Kitui, Makueni, Machakos, Tana River and Taita Taveta),*	Continues from February followed by dry spell till third to fourth week of March	Second to third week of May	Fair to good
4	North Coast region (*Lamu, Malindi, Coastal parts of Tana River, and Kilifi)*	Rainfall is expected from the fourth week of March to the first week of April	Continues into June	Fair to Good
5	South Coast region *(Mombasa, Kwale)*	Rainfall is expected from the third to fourth week of March	Continues into June	Fair to Good
6	The Northwest: (*Turkana, Samburu*)	Rainfall is expected from the fourth week of March to the first week of April (occasional rainfall in the first week of March)	Second to third week of May	Poor to Fair
7	The Northeast (*Wajir, Isiolo, Garissa, Mandera and Marsabit*)	Rainfall is expected from the fourth week of March to the first week of April	Second to third week of May	Poor to Fair

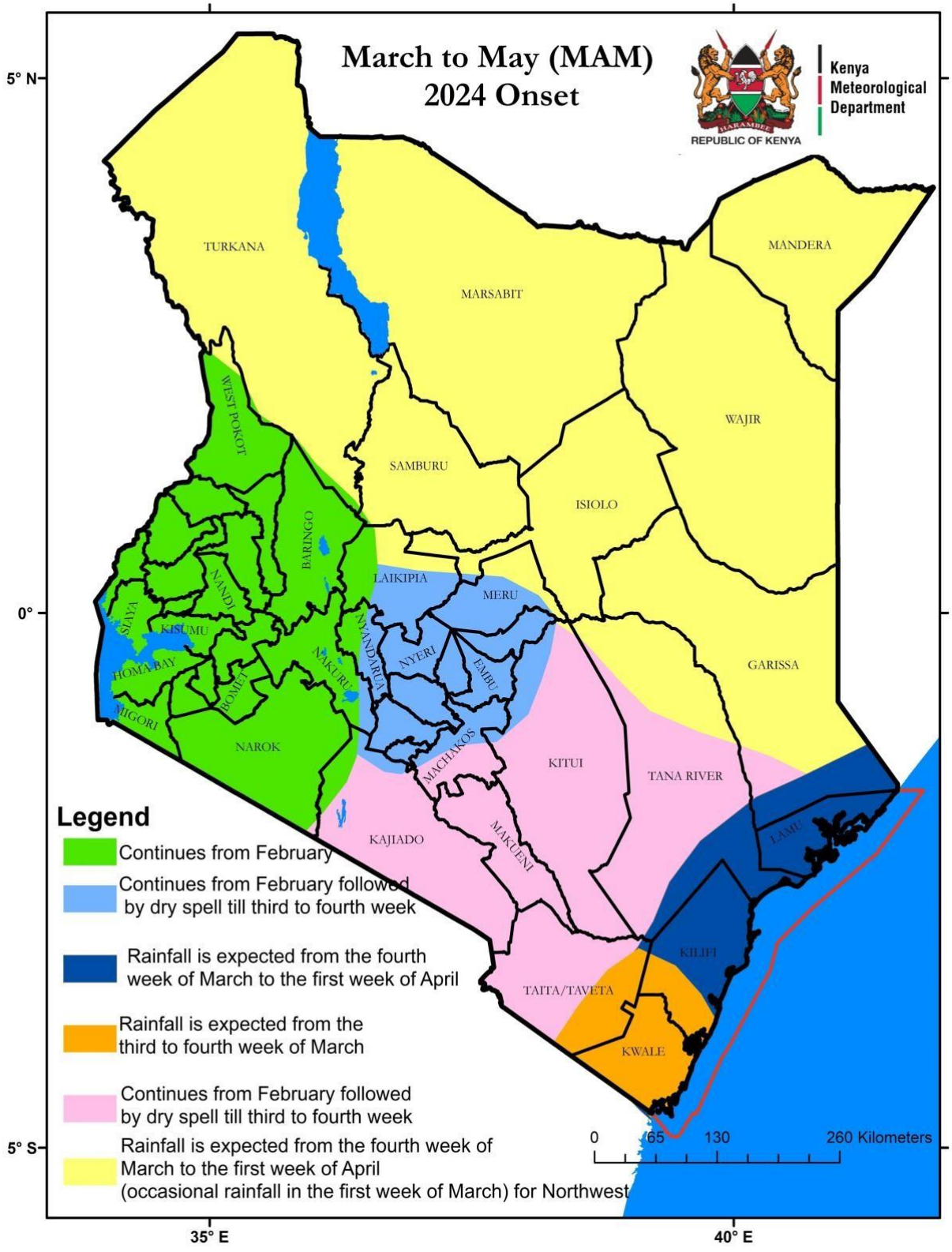

Fig. 1c: MAM 2024 Rainfall Onset

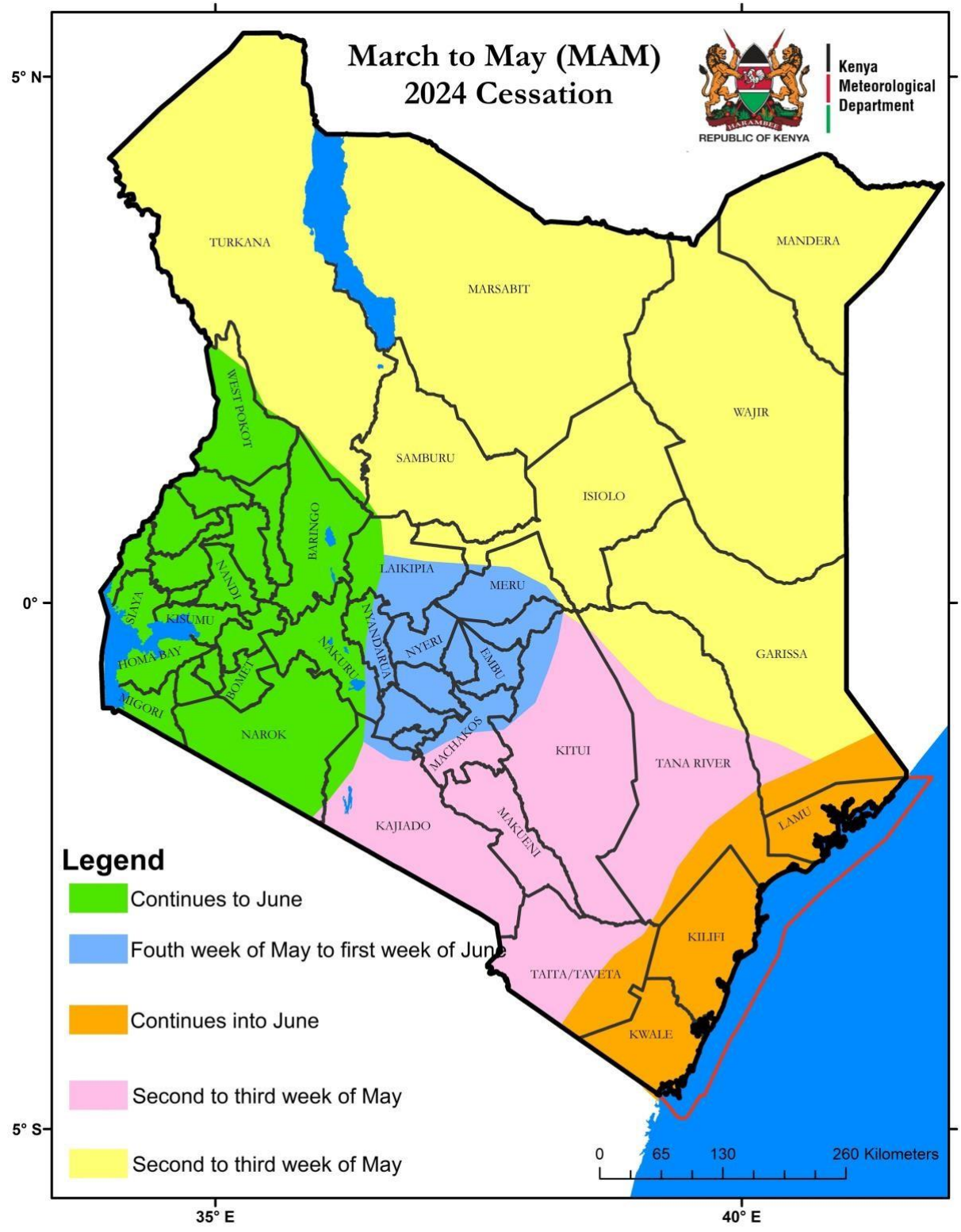

Fig. 1d: MAM 2024 Rainfall Cessation

2.5 Temperature Forecast

Warmer than average temperatures are expected over the whole country, with increased probabilities over the Coastal and Northern parts, as shown in **Figure 2**.

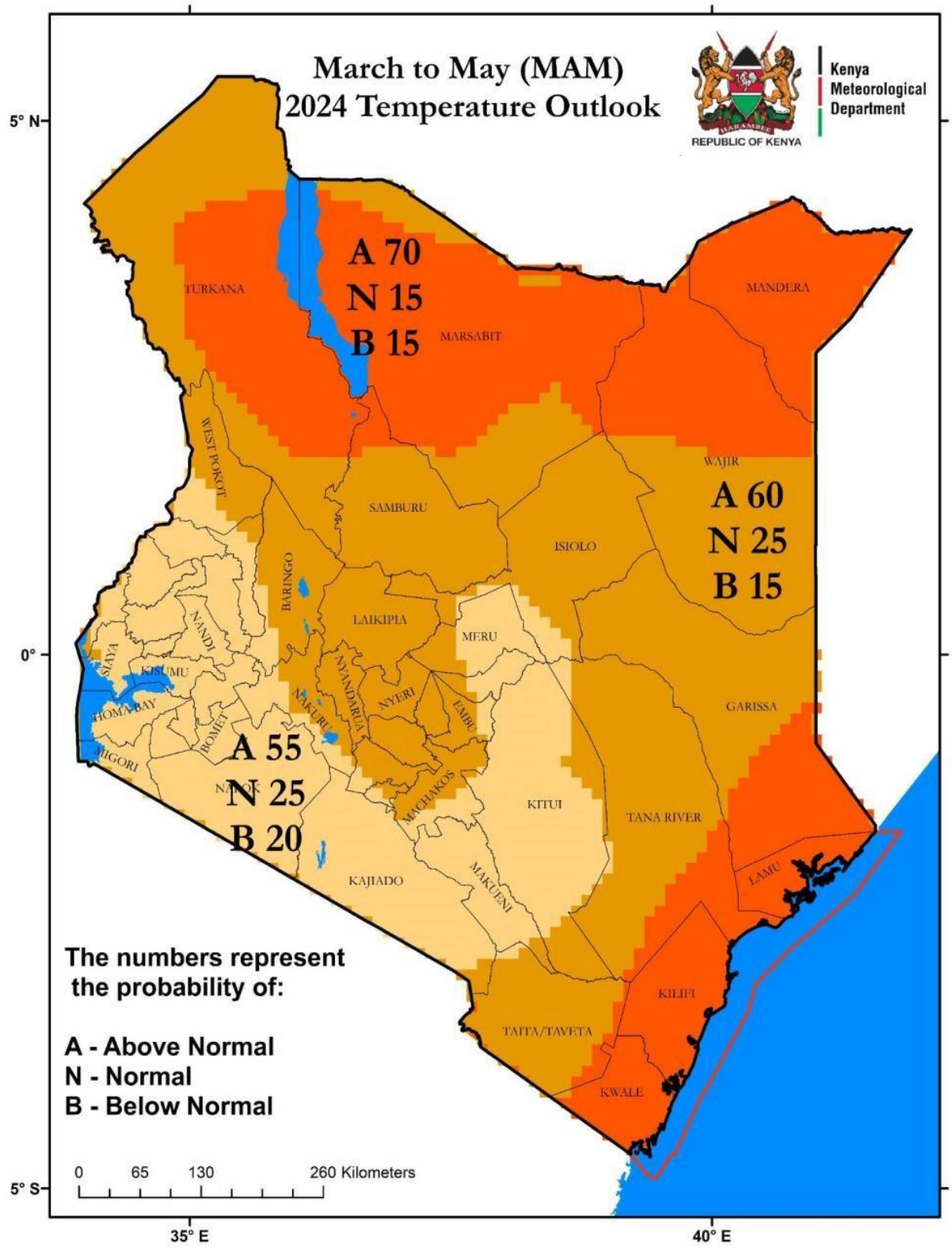

Figure 2: MAM 2024 Temperature Outlook

3.0 POTENTIAL IMPACTS OF THE MAM 2024 RAINS

The potential impacts likely to be experienced were co-produced with the various sector leads as indicated.

3.1 Agriculture, Food Security and Livestock Development Sectors

Positive Impacts

- Enhanced agricultural production which will increase accessibility to food, lower the prices of food commodities and improve nutrition .
- Pasture rejuvenation will increase the productivity of livestock.
- Enhanced rainfall will improve water for irrigation.

Negative impacts

- Water logging, soil erosion and nutrient leaching may lead to land degradation
- Crops and livestock pests and diseases are likely to increase due to high humidity, coupled with warmer than average temperatures
- Excess moisture may lead to pre and post harvesting losses and contamination
- Increased weed proliferation which may increase the cost of farm management
- Damage to agricultural infrastructure and roads. This may impede farm operations and Development

Advisories

- Encourage farmers to expand crop and pasture production
- Implement effective marketing strategies to ensure value addition of surplus feeds and fodder; food conservation and market access
- Promote good agricultural practices such as soil and water conservation as well as sustainable land management
- Promotion of essential infrastructure for both pre and post-harvest processes, including efficient drying, cooling, and storage facilities to reduce loses and contamination
- Prevention and control of diseases and pests for both crops and livestock through vaccination and vector control

3.2 Disaster Management Sector

Positive Impacts

- The enhanced rainfall is likely to minimize resource-based conflicts.

Negative Impacts

- Floods and flash floods are likely over several parts of the country especially over the Coast, Southeastern lowlands, Lake Victoria Basin, parts of the Central and South Rift Valley, Northeast and Northwestern parts of the country and urban centers with poor drainage systems. This could lead to destruction of property, loss of lives, displacement of people and damage of critical infrastructure, resulting in limited access to essential goods and services.
- Landslides and mudslides are likely over some parts of the Highlands West and East of the Rift Valley, Central and South Rift Valley and the Southeastern lowlands.
- Lightning strikes are highly probable over the western parts of the country especially in Narok, Kisii, Kisumu, Nandi, Kakamega and Bungoma (Mt. Elgon areas) counties.
- Heavy rainfall could lead to rising water levels in rivers, lakes and dams as well as lake back flows.

- There may be emergence of desert locusts over some parts of the country.
- Infrastructural damage to key installations
- Disruption of social economic activities such as education, agriculture and supply chain
- Mental health issues

Advisories:

- Advise against driving or walking through flooded areas or crossing flooded rivers to prevent loss of lives.
- Disseminate early warning information through various channels, including radio, newspapers, TV, and social media, ensuring inclusivity for all demographics.
- Implement proactive measures such as mapping and prepositioning of essential items to address flood-related issues.
- Conduct thorough risk assessments, including flood risk assessments and Kenya Interagency rapid assessments.
- Map high-risk areas prone to flooding and mobilize funds and resources to mitigate flood risks.
- Identify relocation sites for communities living in low-lying flood-prone areas.
- Enhance emergency preparedness and response capabilities through training and resource allocation.
- Strengthen engagement with stakeholders to enhance collaboration and coordination in flood response efforts.
- Activate emergency operation centers and toll-free emergency numbers for swift response to flood emergencies.
- Inspect critical infrastructure and monitor water levels in reservoirs to ensure preparedness.
- Unclog drainage systems to prevent flooding.
- Advocate for Climate Smart Agriculture practices to mitigate flood impacts on agriculture.
- Establish community feedback mechanisms to facilitate communication and address humanitarian needs.
- Implement surveillance systems for pests and diseases.
- Develop an integrated logistics support plan to streamline response efforts

3.3 Health Sector

Positive Impacts

- The enhanced rainfall is likely to improve food availability which will in turn reduce nutrition related diseases

Negative Impacts

- Waterborne diseases, such as cholera, typhoid and diarrhoea are likely to increase as a result of contamination of drinking water sources occasioned by floods
- There may be an increase in vector-borne diseases such as malaria, Rift Valley fever and dengue fever as stagnant water from floods is expected to provide breeding grounds for vectors such as mosquitos
- Disruption of health services is likely due to floods submerging health facilities or destruction of access roads leading to such facilities.
- Mental health issues may arise in flood prone areas as a result of displacement and loss/destruction of property

Advisories

- Intensify Water and Sanitation Hygiene (WASH) interventions such as water treatment and provision of essential commodities e.g. chlorine granules
- Enhance disease surveillance and early detection systems for diseases
- Ensure the availability of the required healthcare infrastructure and commodities e.g. mosquito nets, drugs.
- Establish mental health support systems for communities affected by weather related hazards, such as floods

3.4 Transport and Public Safety Sector

Positive Impacts

- Lake transport navigation will be easier due to higher water levels

Negative Impacts

- The expected occasional flash floods may lead to destruction of transport systems, in parts of the Highlands West of the Rift Valley, the Lake Victoria Basin, South Rift Valley, Tana River Basin, Northeastern, Coast and parts of Southeastern lowlands, which may in turn lead to interruption of services.
- There may be an increase in road, marine and aviation accidents due to poor visibility. ● There may be delays or deviations at the airports during periods of heavy storms

Advisories

- Ensure roads are clearly marked and directions signs are in place
- Quick repair and restoration of damaged infrastructure
- Put in place hazard warnings during emergencies

3.5 Water and Energy Sectors

The anticipated enhanced rainfall during MAM 2024 in Kenya has implications for both the water and energy sectors.

3.5.1 Water Sector:

In the water sector, the implications and proposed key response measures are as follows:

Positive Impacts:

- Improved water resources:
  - Surface water resource improvement
  - Groundwater recharge leading to increased availability
  - Emergence of springs
  - Recharge of water reservoirs (dams, pans)
  - New water sources from excavated areas (e.g., quarries)
  - Roof catchment systems
- Reduction in water-related conflicts:
  - Particularly in Arid and Semi-Arid Lands (ASAL) areas
  - Mitigation of competition between different water users (e.g., agricultural vs. pastoral communities)
- Improved water quality:

- Dilution of chemical pollutants through washouts
- Rejuvenation of the ecosystem:
  - Increased surface and underground water resources
- Availability of water for domestic and livestock use
- Reduction of pollution loads through washouts.

Negative Impacts:

- Increased siltation and sedimentation of canals, water reservoirs, and rivers, reducing their capacity and impeding water distribution channels.
- Pollution and contamination of surface and groundwater.
- Various types of floods, such as river channel overflows, urban floods, and flash floods, affecting different regions.
- Damage and destruction to water and sanitation infrastructure, including water intake structures, weirs, bridges, sewer lines, latrines, and septic tanks.
- Specifically, flash floods occur in northeastern (NE) and southeastern (SE) regions, while urban flooding is prevalent in areas like Nairobi and Mombasa with inadequate drainage systems.
- The traditional flood-prone areas like Lower Nzoia, Lower Nyando, Narok, Sondu, Gucha/Migori, Lower Tana, Lower Sabaki, Lake Victoria backflow on landing beaches, and Lower Yala are susceptible to flooding.
- Pollution is exacerbated by siltation and sedimentation, reducing the capacity of water infrastructure and increasing soil erosion.
- Water contamination affects water facilities like boreholes, while surface water pollution results from plastics and solid waste transported into waterways, streams, and lakes.
- Destruction of monitoring equipment further complicates disaster response and management efforts.

Advisory

- Encourage rainwater harvesting and storage to boost water availability.
- Conduct desilting of dams and unclog drainages to maintain water infrastructure.
- Reinforce water and sanitation infrastructure while monitoring and improving wastewater and solid waste management.
- Separate stormwater and wastewater channels to prevent contamination.
- Distribute water treatment chemicals to maintain water quality.
- Improve and adequately disseminate flood early warning systems for timely alerts.
- Foster transboundary collaboration among riparian counties to prevent potential flood disasters.
- Constantly monitor water levels and efficiently manage floodplains, identifying hotspot areas prone to flooding.
- Implement evacuations and establish safe havens during flood emergencies.
- Install check dams and dykes, utilize membrane techniques, and manage solid waste to mitigate flood risks.
- Develop and conduct evacuation drills and simulations, supported by national and county flood contingency planning.
- Perform desiltation, drenching, and flashing of water infrastructure to maintain resilience.
- Increase vegetation cover to mitigate flood risks and soil erosion.

- Reinforce water infrastructure, including the rehabilitation of boreholes, to enhance resilience and sustainability.

3.5.2 Energy Sector:

Positive impacts

- Increased inflows into the hydropower reservoirs. This will enhance hydropower generation and reduce the use of thermal power plants
- Increased groundwater recharge for geothermal power production
- Increased feedstock availability for biogas production
- Increased availability of biomass for domestic use

Negative impacts

- Possible overflow of dams to downstream settlements could result in loss of lives and livelihoods as well as displacement of people and destruction of property
- Disruption in power supply may lead to social and economic losses
- Less use of solar power due to decreased irradiance

Advisories

- Careful monitoring and management of water levels in the dams
- Disseminating early warning to people living downstream to move to safer grounds ● Improve power transmission and distribution infrastructure

3.6 Environment and Forestry

Positive impacts

- It will provide sufficient soil moisture for widespread afforestation and reforestation efforts, thereby increasing the country's tree and forest cover.
- Availability of pasture and browse will reduce grazing pressure in forests.
- Above-average rainfall is expected to significantly decrease forest fire risks.
- Increased forest biodiversity will occur.
- Enhanced carbon sequestration will be facilitated.
- Business opportunities for establishing tree nurseries and raising stock for tree growing will emerge, supporting both nature-based enterprises and market activities.
- Job creation through tree growing will increase, benefiting both public and private forests.
- Widespread afforestation and reforestation efforts by citizens and partners will support the 15 billion initiative aimed at boosting the country's tree and forest cover.
- Water sources in arid and semi-arid areas, along with flora and fauna, will be replenished.
- Both flora and fauna in forests will experience improved biodiversity, enhancing wildlife food and reproduction.
- Enhanced carbon absorption will result from the expanded forest cover and vegetation.
- Improved food security will be achieved through the Plantation Establishment and Livelihood Improvement Scheme (PELIS) within forest areas.
- Human-wildlife conflicts will be reduced.

Negative Impacts

- Increased incidences of landslides and mudslides leading to land degradation.
- Damage to trees and forests caused by increased wind snap and wind throws.
- Harm to tree seeds and seedlings, compromising optimal production.

- Siltation and sedimentation of degraded mangrove areas, including the washing away of riverine forest seedlings.
- Higher forest harvesting costs due to infrastructure damage, particularly roads.
- Prevalence of moisture-related pests and diseases associated with changes in weather patterns.
- Spread of invasive alien species, adversely affecting forest health and productivity.
- Waterlogging of national parks, affecting wildlife health and mobility.

Advisories

- Educate communities on sustainable tree growing techniques and advocate for good agricultural practices, including soil conservation measures.
- Select diverse tree species and appropriate planting sites, focusing on increasing reforestation efforts to promote regeneration and biodiversity.
- Engage communities in educational programs that emphasize sustainable practices and establish early warning systems for environmental challenges.
- Regularly monitor and report on forest health, while also conducting capacity-building training programs to empower stakeholders.
- Implement site matching, planning, and diversification of tree species, particularly in dry lands, to optimize tree growth.
- Intensify afforestation and reafforestation efforts within forest areas to enhance regeneration, biodiversity, and support initiatives like the 15 billion tree-growing initiative.
- Provide education and advisory services to communities on innovative water harvesting methods in both forest and arid areas.
- Maintain infrastructure, such as road networks, in forests to facilitate access and management.
- Raise awareness of environmental conservation and integrate forest management strategies through increased partnerships and stakeholder involvement.
- Invest in sustainable tree growing technologies, such as agroforestry and drought-resistant trees, to adapt to climate change.
- Conduct research and ongoing monitoring to understand the performance of different tree species and sites under changing climate conditions.
- Continuously provide capacity building and training opportunities to enhance skills and knowledge.
- Implement disaster risk reduction measures through nature-based solutions like green roofs and rain gardens.

3.7 Media

Media organizations are strongly encouraged to procure, diligently track, and promptly share forecast and cautionary details as they emerge, ensuring that the populace can access them promptly. Moreover, they are urged to solicit expert guidance from pertinent sectors during the formulation, production, and circulation of weather advisories for end-users. Furthermore, the utilization of plain language is advocated when communicating with the community.

4.0 OCTOBER-NOVEMBER-DECEMBER 2023 CLIMATE REVIEW

4.1 Review of October-December 2023 "Short-Rains" Seasonal Performance

The start of the seasonal rains (onset) was realized during the third to fourth week of October over several parts of the country except over the Highlands West of the Rift Valley, Lake Victoria Basin and parts of Central and South Rift Valley where rainfall continued from September. However, over some parts of Central highlands and Nairobi, the onset during the third week of October was followed by a dry spell. Onset over isolated areas over the South-eastern lowlands (Makindu and Machakos Meteorological stations) was realized during the first week of November. The Coastal region received substantial amounts of rainfall during the first week of October as had been predicted but this was followed by a prolonged dry spell. Onset over most areas in the Coastal region was during the fourth week of October except over some areas in Lamu and Kilifi where onset was during the first week of November.

The rainfall distribution both in time and space was good in October and November and generally poor in December over most parts of the country. The good rainfall performance over most parts of the country was mainly as a result of the El Nino conditions owing to the prevailing warmer than average Sea Surface Temperatures (SSTs) in the central and eastern Equatorial Pacific Ocean and the cooler than average Sea Surface Temperatures in the Western Equatorial Pacific Ocean. The Indian Ocean dipole (IOD) remained positive throughout the season.

The season was characterized by severe storms over the Coastal region, south-eastern lowlands, Northeastern and Highlands East of the Rift Valley especially in November. For instance, Lower Chure Secondary school in Meru and Gitoro AWS also in Meru recorded 129.0mm and 120.0 mm on 1st November while Tarassa station in Tana River recorded 143.0 mm on 4th November. On 7th November, Kinna station in Isiolo recorded 140.3mm while Mavindini in Makueni recorded 142.0 mm on 10th November. NEMA in Isiolo recorded 124.0mm on 13th November. Kwale veterinary office in Kwale and Kasemeni Primary School also in Kwale recorded 160mm and 191.9mm respectively on 15th November. On 16th November, SOS Nyali in Mombasa and Mtepeni in Kilifi recorded 201.6mm and 196.5mm respectively. Kiguru Tharaka in Kitui recorded 127.9mm on 23rd November while Dzitoni Library in Kilifi recorded 177.7mm on 24th November.

In the recent OND (October, November, December) period, Lamu station recorded an impressive 294.77% of its Long-Term Mean (LTM), receiving a substantial rainfall amount of 636.1 mm. Mombasa also experienced above-average rainfall, registering 934.2 mm, equivalent to 288.56% of its LTM. Garissa, with 286.82%, Mandera with 266.57%, and Mtapa with 262.53% of their LTMs, respectively, also had noteworthy precipitation.

Wajir, Marsabit, and Msabaha stations reported rainfall amounts of 398.8 mm, 710.0 mm, and 567.5 mm, corresponding to 229.01%, 222.30%, and 212.19% of their LTMs, respectively. Kitui, Malindi, and Laikipia witnessed significant rainfall, with percentages of 202.18%, 194.73%, and 194.00% of their LTMs.

Other stations, such as Moyale, Meru, Machakos, and Makindu, experienced varying degrees of rainfall above their respective LTMs. In contrast, Narok, Wilson, Nyeri, and JKIA received rainfall slightly above 140% of their LTMs. Kakamega, Embu, and Nakuru recorded percentages ranging from 135.37% to 140.51%, while M.A.B., Kericho, Eldoret, Kisii, Kangema, and Thika observed rainfall between 125.99% and 129.77% of their LTMs.

The highest seasonal total rainfall amount of 1378.6mm was recorded at Kiguru Tharaka rainfall station in Kitui county followed by Meru Meteorological station with 1257.3mm. Other stations that recorded significant amounts of rainfall (>700mm) are shown in **Table 3**. The other stations recorded less than 700mm with Lodwar recording the least amount of 50.1mm. **Figure 3a** shows

the OND 2023 rainfall performance (%) while Figure **3b shows** total rainfall amount recorded in OND 2023 (Blue bars) in comparison with the OND LTMs (Red bars)

Table 2: Stations that recorded more than 700 mm of rainfall in OND 2023

S/NO	STATION	COUNTY	AMOUNT IN MM
1.	Gitii-Ngura Rainfall station	Embu	1100.3
2	Kasafari Rainfall station	Embu	1065.1
3	Nyaroya Rainfall station	Migori	1025.9
4	Lower Chure Sec. School Rainfall station	Meru	991.5
5	Kanga AWS Rainfall station	Migori	945.5
4	Nkondi Primary School Rainfall station	Tharaka Nithi	934
5	Mombasa Meteorological station	Mombasa	912.9
6	Mtwapa Meteorological station	Kilifi	890.4
7	Kwale Veterinary Rainfall station	Kwale	887
8	Kaanyanga Primary School Rainfall station	Tharaka Nithi	8337
9	Kangema Meteorological station	Muranga	8261.
10	Kina Rainfall station	Isiolo	825
11	Dzombo Primary School Rainfall station	Kwale	822.1
12	Mtepeni Rainfall station	Kilifi	820.2
13	Managia Rainfall station	Embu	817.7
14	Tharaka University Rainfall station	Tharaka Nithi	817
15	Ngerenyi FTC	Taita Taveta	810
16	Kitui Meteorological station	Kitui	798.6
17	Kirie Rainfall station	Embu	768.7
18	Castle Forest Rainfall station	Kirinyaga	768.1
19	Ndaka-ini Rainfall station	Muranga	767.2
20	Wote Nziu Rainfall station	Makueni	762.6
21	Kianamu Rainfall station	Embu	756.9
22	Kyome Rainfall station	Kitui	730.6
23	SOS Nyali Rainfall station	Mombasa	729.7
24	Korieko Rainfall station	Migori	723.3
25	Uwanja wa Ndege Rainfall station	Kwale	719.6
26	Kasemeni Primary School Rainfall station	Kwale	718.2
27	Marsabit Meteorological station	Marsabit	710.0
28	Miyare Rainfall station	Migori	707.1

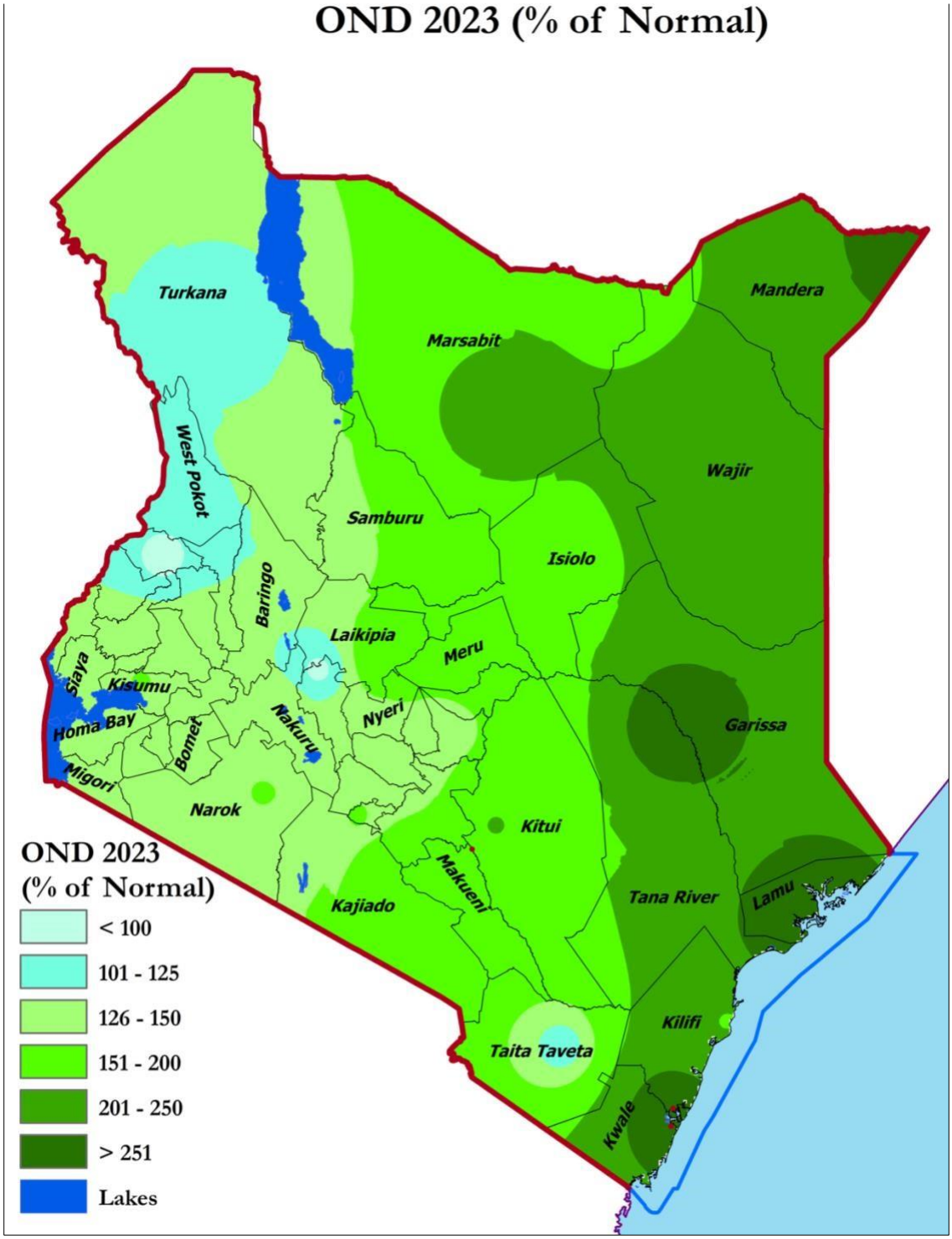

Figure 3a: October-December 2023 Seasonal Rainfall Performance (%) against OND LTM

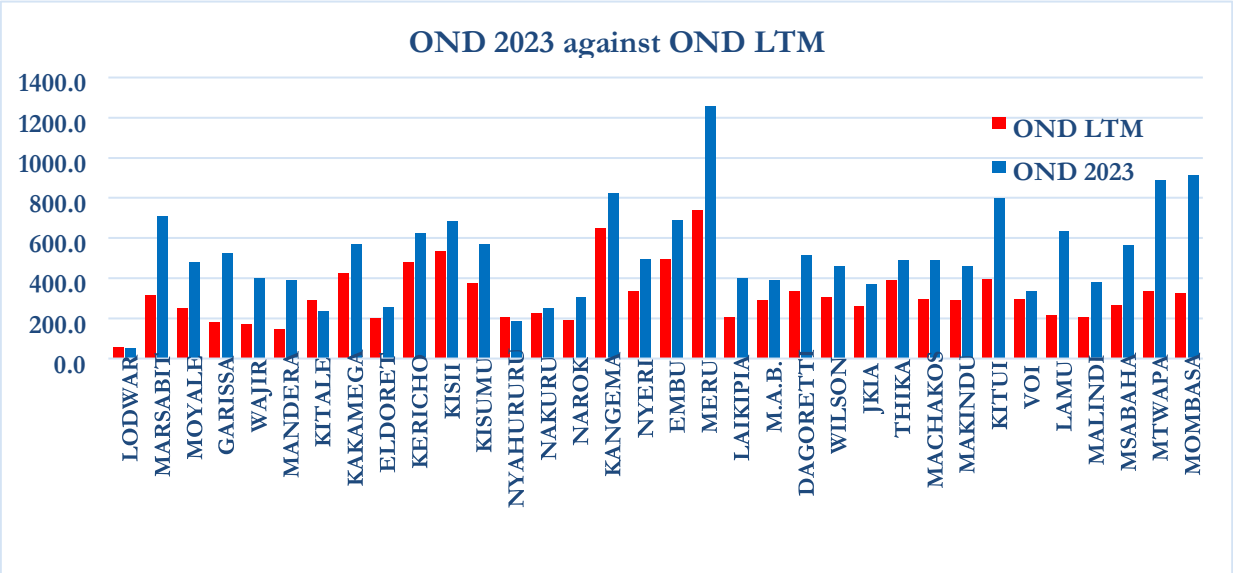

Figure 3b: October-December 2023 Seasonal Rainfall Totals against OND LTM

4.2 Experienced Impacts During the October-November-December Seasonal Rainfall

4.2.1 Agriculture and Food Security

Positive Impacts

- The enhanced rainfall was conducive for agricultural activities over the Highlands East and West of the Rift Valley, the Lake Basin, the Southeastern lowlands and the Coastal region. This led to increased crop production in these areas which in turn led to low prices of food commodities thus creating cost effective access to essential commodities.
- Increased agricultural production improved nutrition in various parts of the country thus positively impacting on public health and well-being.
- The enhanced rainfall led to pasture and browse regeneration especially over the Arid and Semi-Arid Lands (ASALs) which in turn increased livestock production

Negative Impacts

- Excessive rainfall led to floods which destroyed crops in Taita Taveta, Tana River, Homa Bay, Garissa, Lamu and Kitui counties.
- Livestock were washed away in Isiolo, Mandera, Marsabit, Wajir, Garissa, Turkana, Mombasa, Kilifi, Tana River, Lamu, Kwale, Taita Taveta, Makueni, Kitui, Homabay, Narok and Meru.
- A few cows were struck by lightning in Tapach village of West Pokot in October.
- Flooding, water logging, erosion and nutrient leaching affected soil health and led to degradation over the western and eastern sectors of the country
- The prolonged humidity fostered the spread of pests and diseases, posing threats to crops and livestock. Livestock diseases such as Contagious Caprine Pleuropneumonia (CCPP), Pestes Des Petits Ruminants (PPR), Foot and Mouth Disease (FMD), Rift Valley Fever and Lumpy Skin disease were reported in the northern, Southeastern lowlands and the Coastal regions of the country.
- The excess Moisture triggered challenges leading to spoilage, rotting and contamination leading to potential losses.
- Excess moisture led to increased weed proliferation necessitating weed management strategies which in turn increased production costs.

4.2.2 Disaster Management

- Several lives were lost over the Southeastern lowlands, parts of the Highlands East of the Rift Valley (Meru), the Coastal region, the northeast and over the Lake Victoria Basin (Migori) as residents of these areas attempted to cross flooded rivers. Three other people were killed in Mombasa, Kilifi and Busia after their houses caved in following heavy rains experienced in these areas.
- One person died and two others sustained injuries after they were struck by lightning while sheltering under a tree during a downpour in Chesilyot village, Sotik of Kericho county.
- Property including homes, schools and businesses were destroyed in several counties over the Coast, Southeastern lowlands, Northeast, Northwest, Lake Basin (Migori) parts of Central Rift Valley (Baringo) and parts of the Highlands East of the Rift Valley (Nyandarua and Meru).
- Thousands of families were displaced by floods over the Northeast, Coast, Southeastern lowlands, Lake Victoria Basin, parts of the Highlands East of the Rift Valley (Meru and Tharaka Nithi) and isolated areas over the Highlands West of the Rift Valley (Kisii).
- Landslides and mudslides were reported in Meru, Makueni and Kiambu counties destroying property and killing three people. In Igembe south a mudslide destroyed a building while several houses were destroyed by a mudslide in Kimandeni and Llima villages of Makueni County. In Kiambu county, several houses were destroyed by a mudslide in Site village. A child was killed in Llima village of Makueni county after their house was hit by a mudslide Two people were killed in Riara village of Kiambu county after a mudslide buried their house.

4.2.3 Water Resources Management and Energy

Positive Impacts

- Water availability over most parts of the country was enhanced following the above average rainfall experienced during the season.
- The seven fork hydro power generating dams registered above normal inflows leading to increased hydro power output.
- Increased output in the small hydro power generating stations.
- Increased underground water recharge for geothermal power sources
- Increased vegetative growth to support biomass for biofuels
- Increased feedstock availability for biogas production
- Most rivers over the Southeastern lowlands, Northeastern, Highlands East of the Rift Valley, Lake Victoria Basin and the Coast were full beyond their capacity.

Negative Impacts

- Most dams over the Southeastern lowlands and the Highlands East of the Rift Valley were also full beyond their capacity and were at risk of spilling.
- Structural damage to electricity transmission and distribution infrastructure that led to prolonged power outages
- Decreased efficiency of solar panels due to increased cloud cover and reduced irradiance
- Increased siltation in hydro-power dams which led to increased costs for operation and maintenance

4.2.4 Environment

Positive Impacts

- The enhanced rainfall provided sufficient soil moisture build –up for widespread afforestation and reforestation to increase the country's tree and forest cover
- Availability of pasture and browse reduced grazing in the forests and other planted sites
- Significantly reduced forest fire risks most prevalent in the Abardares during the dry season
- Enhanced carbon sequestration (carbon stocks for reduced GHG emissions
- Increased forest biodiversity both Flora and Fauna

Negative Impacts

- Landslides and mudslides were reported over the Southeastern lowlands (Makueni), Highlands West of the Rift Valley (Nandi and West Pokot) and several counties of the Highlands East of the Rift Valley (Meru, Tharaka Nithi, Kiambu and Muranga). These landslides and mudslides led to environmental degradation and soil erosion in the affected areas.
- Increased wind snap and wind throws damaged trees and vegetation due to prevailed weather changes
- Siltation and sedimentation of Mangroves ecosystem due to floods upstream

4.2.5 Health

- Health services across fifty two health centers in Lamu, Mombasa, Kwale, Tana River, Kilifi, Garissa, Isiolo, Mandera, Wajir and Migori were disrupted after heavy rains either marooned the facilities or roads leading to the facilities were destroyed by floods.
- Cholera cases were reported in Lamu and Tana River counties where four people succumbed to the disease as well as in Nairobi County.
- Malaria upsurges were experienced in Wajir County
- Rift Valley Fever was reported in Marsabit and Wajir Counties

4.2.6 Transport and Public Safety

- Transport services were disrupted over several counties in the Northeast, Northwest, Coast and Southeastern lowlands and a few areas over the Highlands East of the Rift Valley (Meru and Tharaka Nithi), Highlands West of the Rift Valley (Nandi and West Pokot) and South Rift Valley (Narok) after roads were either washed away by floods or were temporarily flooded.
- Transport along the Meru-Mikinduri-Maua road and Gitogoto road in Tharaka Nithi were disrupted after sections of the road were blocked by mudslides.
- Cargo transport along the Mombasa -Nairobi standard gauge railway line was suspended after a landslide occurred between the Mombasa Terminus and Mariakani. The landslide also caused delays in departure and arrival of passenger trains at the Mombasa Terminus. Rail transport was also disrupted along the Kikuyu-Nairobi railway line after floods and a mudslide blocked a section of the railway line in Thogoto.
- The heavy rains destroyed two bridges over the Coast and Highlands West of the Rift Valley. The Milima 10 bridge located at the border of Tambul and Chemelil location was destroyed by floods while the Mbogolo bridge which lies along the Mtwapa-Kilifi road was also washed by floods.

NB: All global models have a much lower skill in predicting the MAM season than the OND season. Additionally, there are other drivers of variability such as tropical cyclones and Madden Julian Oscillation (MJO) that are only predicable at shorter lead times. It is therefore imperative to keep up to date with subsequent forecasts.

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

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