Sensitivity of the Guinea and Sudano-Sahelian Ecological Zones of Nigeria to Climate Change

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Abstract

The aim of this study is to assess the sensitivity of Guinea and Sudano-Sahelian Ecological Zones of Nigeria to climate change. Data used comprises of observed and simulated temperature and precipitation data. The observed data are that of Climate Research Unit (CRU TS 4.2) and the simulated data are that of CMIP5 both found in the Royal Netherland Meteorological Institute archive Known as KNMI database. Climate change analysis was performed based on three IPCC's scenarios. Three climatic periods of (2019-2048), (2049-2078) and (2071-2100) with reference to two baseline periods of (1959-1988) and (1989-2018) were considered. Findings reveal that Guinea and Sudano-Sahelian Ecological Zones of Nigeria is highly sensitive to climate change. This is noticed from the rise in temperature from 1°C in the first climatic period (2019-2048) to as high as 6°C in the third climatic period (2071-2100). Similar trend was observed for rainfall where there is increase in rainfall amount from 0.5mm/day to 2.5mm/day. This anticipated condition has serious implications on water resources, from increase in stream flow, rise in reservoirs, soil moisture changes and flooding.

Keywords: Sensitivity, Climate change, Ecological zones,

1. Introduction

It is known and established in literature that there is intrinsic relationship between climate change and water resources. This is even more so as empirical studies in recent past have shown the impact of the former on the later (Hagemann *et al.,* 2013 and Adam *et al.,* 2016). Water resources of the world in general and in Nigeria are under heavy stress due to increased impact of climate change but the severity of the impact varies from one region to another. According to the Intergovernmental Panel on Climate Change (IPCC) (2014), climate change is defined as "change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer". It refers to any change in climate over time, whether due to natural variability or as a result of human activity. This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), where climate change refers to a "change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods". However, this study adopts IPCC (2014) definition.

Climate change is increasing the frequency and severity of extreme hydrological events such as floods and droughts around the world (Guoyong *et al.*, 2016).Water is an indispensable element of life; the water resources of river basins are highly dependable and sensitive to climate variability and change; due to inter-connection between the climate system, hydrological cycle and water resources system. Thus, if the trends in climate contexts that took place over the last three decades continue to prevail unabatedly, West Africa will no doubt experience decreased freshwater availability (Ayansina *et al.*, 2018). Also, compared to previous decades, it is observed that since the early 1970s, the mean annual rainfall has decreased by 10% in the wet tropical zone to more than 30% in the Sahelian zone while the average discharge of the region's major river systems dropped by 40 to 60% (Yunana *et al.*, 2017). This sharp decrease in water availability will be complicated by greater uncertainty in the spatial and temporal distribution of rainfall and surface water resources (Guoyong *et al.*, 2016).

2. Literature Review

Climate change is a burning issue of the 21st century and its attendant consequences on different environmental components cannot be under estimated. A range of related literature has been reviewed. Gebre and Ludwig (2015) assessed the hydrological response of climate change of four catchments of the upper Blue Nile River basin in Ethiopia using new emission scenarios based on IPCC fifth assessment report (AR5). The future projection period were divided into two future horizons of 2030`s (2035-2064) and 2070`s (2071-2100). All the five GCMs projection showed maximum and minimum temperature increases in all months and seasons in the upper Blue Nile basin. The change in magnitude in RCP8.5 emission is more than RCP4.5 scenario as expected. There is considerable average monthly and seasonal precipitation change variability in magnitude and direction. Ahmed *et al.* (2017) assessed climate change impact on surface water resources in the Rheraya catchment, Morocco. An ensemble of five regional climate models from the Med-CORDEX initiative was considered to evaluate future changes in precipitation and temperature, according to the two emissions scenarios RCP4.5 and RCP8.5. The future projections for the period 2049–2065 under the two scenarios indicate higher temperatures (+1.4°C to +2.6°C) and a decrease in total precipitation (−22% to −31%). Gneneyougo *et al.* (2017) examined climate change and its impact on water resources in the Bandama Basin, Côte D'ivoire. Simulation results for future climate from HadGEM2-ES model under representative concentration pathway RCP4.5 and RCP8.5 scenarios indicate that the annual temperature may increase from 1.2°C to 3°C. These increases will be greater in the north than in the south of the basin. The monthly rainfall may decrease from December to April in the future. During this period, it is projected to decrease by 3% to 42% at all horizons under RCP4.5 and by 5% to 47% under RCP8.5.

Furthermore, Adefisan (2018) analysed climate change impact on rainfall and temperature distributions over West Africa from three IPCC Scenarios. The analysis considered two climatic periods which are 2000 to 2029 as present and 2070 to 2099 as future. The result showed that temperature increases over West Africa countries in all the months under each of the scenarios. Scenario A2 with the highest emission of 800 ppm shows the highest increase of temperature and rainfall over West Africa followed by scenario A1B with emission of 720 ppm and the least is that of B1 with the lowest emission of 550 ppm. The result also showed that rainfall increases over most part of West Africa in all the scenarios with the exception of coastline that a little decrease in amount of rainfall was estimated. Xiaoli *et al,* (2018) investigated potential impact of climate change to the future stream flow of Yellow River Basin based on CMIP5 data in China. During future period of 2021–2050, the seasonal precipitation presents a slightly increasing trend in spring and autumn, while a very slightly decreasing trend with the rate of 2.99 mm/day a in summer. During the period of 2021–2050, the basin average temperature shows an obviously increasing for two RCPs. The changing rate of seasonal temperature for RCP8.5 more than 0.4°C, which is higher than that of RCP4.5. Minsung *et al,* (2019) examined change in extreme precipitation over North Korea using multiple climate change scenarios. A comparison of regional averages in each future relative to the reference period showed that precipitation with a 20-year frequency precipitation was projected to increase as much as 43.4mm/year under RCP4.5 and 80.7mm/year under RCP8.5 in comparison with the reference period. Ruotong *et al,* (2019) evaluated the multi-model projections of climate change in different RCP scenarios in an Arid Inland Region, Northwest China. The maximum air temperature simulated by different GCMs exhibited an increasing trend in all the three RCP scenarios at different time scales, and the increase in autumn was the most obvious with a maximum amplification of 2.8°C. In contrast, the projected largest increase in the seasonal minimum air temperature occurred in summer, with the highest amplification of 2.5ºC.

The conclusion drawn from this review is that most of these studies undertaken at local scale in different countries are in tandem with global trend of continuous increase in temperature and evapotranspiration with a decrease in rainfall and surface runoff. However, the rate of change varies from one location to another. More so, the change in climatic elements has led to manifestation of extreme events such as drought and flood. Consequently, there is need to continuously undertake research in this area in order to unearth the likely impact of climate change. This will help in advancing timely adaptation strategies, mitigation measures and formulation of policies to tackle the effect of climate change. Hence, the aim of this study is to assess the sensitivity of Guinea and Sudano-Sahelian Ecological Zones of Nigeria to climate change.

3. Methodology

The study area lies between Longitudes 3°E to 15°E of the Greenwich meridian and Latitudes 8°N to 14°N of the equator. The area covers the Guinea and Sudano-Sahelian Ecological Zones of Nigeria. It is bordered to the north by Niger Republic, to the east by Republic of Cameroun, to the south by the tropical rainforest and to the west by Benin Republic (Figure 3.1). The two predominant air masses that influence the weather and climate of these zones are Tropical Continental (cT) air mass and Tropical Maritime air mass (mT) (AbdulKadir *et al.*, 2015). The former is dry and dusty which originates from Sahara desert, while the later is dense and moist which originates from Atlantic Ocean. The rainfall distribution shows a mean of 1100mm/year around the Guinea to about 700mm/year in the Sahel zone. The temperature show a range of 24°C to 30°C in Guinea to as high 44°C in the Sahel zones (Abdussalam, 2017).

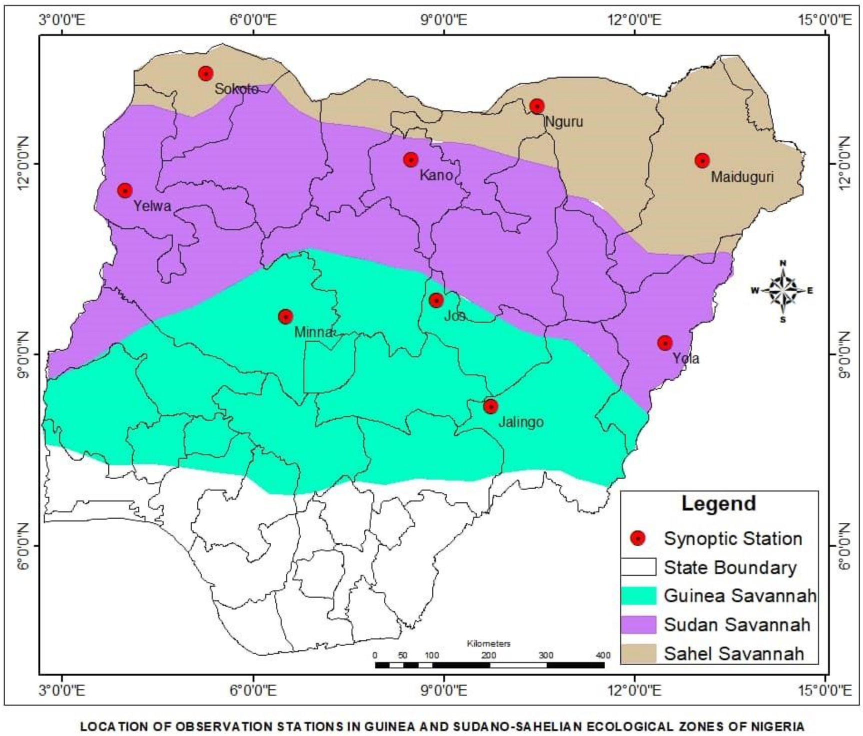


Figure 3.1: Study area

The present study concentrated on three basins namely: Kainji Lake Basin (KLB), Sokoto – Rima Basin (SRB) and Komadugu – Yobe Basin (KYB) spread across the Guinea and Sudano-Sahelian Ecological Zones of Nigeria. The daily temperature and precipitation data used were from archive of Royal Netherland Meteorological Institute Known as KNMI Climate Explorer. It comprises of observed and simulated temperature and precipitation data. The observed data are that of Climate Research Unit (CRU TS 4.2) and the simulated data are that of CMIP5 both found in the KNMI database. The respective coordinates of each basin was used to derive the observed and simulated rainfall and temperature records.

Climate change analysis was performed based on three IPCC's scenarios. These scenarios are RCP8.5, RCP4.5 and RCP2.6 as defined by Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report. Three climatic periods of (2019-2048), (2049-2078) and (2071-2100) with reference to two baseline periods of (1959-1988) and (1989-2018) were considered. The sensitivity of each basin based on changes in rainfall mm/day and temperature in degree Celsius were then studied and compared. Seasonal changes of the dry season (November, December, January, February, March and April) denotes as NDJFMA, and wet season (May, June, July, August, September and October) denotes as MJJASO and were computed and compared for each of the three IPCC scenarios. The computation is as follows:

$$PI_1 = \left(\frac{t_n}{t_0}\right) 100 \quad (1)$$

Where PI_1= percentage impact for temperature t_n= temperature under a given scenario

t_0 = temperature of the reference period 100 = percentage

PI_2 is computed from the equation:

$$PI_2 = \left(\frac{p_n}{p_o}\right) 100 \quad (2)$$

Where PI_2= percentage impact for rainfall p_n = precipitation under a given scenario

p_o= precipitation from the reference period 100 = percentage

4. Results and Discussion

4.1: Evaluation of models performance for temperature and rainfall

The veracity of the CMIP5 multi-model ensemble mean simulation compare with observed rainfall and temperature in the Guinea and Sudano-Sahelian Ecological Zones of Nigeria was evaluated using statistical metrics. The metrics are root mean square error (RMSE), mean absolute error (MAE) and Nash-Sutcliffe efficiency (NSE) see table 4.1. The results indicate that for seasonal dry temperature, Sokoto – Rima Basin (SRB) has the highest error between the simulated and observed seasonal dry temperature given as RMSE (1.55)and MAE (1.45) while Kainji Lake Basin (KLB) has the least error given as RMSE (1.14) and MAE (1.05). As for NSE, KLB has the highest value (0.94) follow by Komadugu – Yobe Basin (KYB) (0.89) and then SRB (0.86). This implies that the CMIP5 multi-model ensemble mean is better able to reproduce the seasonal dry temperature in KLB than in the KYB and SRB respectively. Seasonal wet temperature in KYB has the highest error between the simulated and observed seasonal wet temperature given as RMSE (0.65)and MAE (0.55) while SRB has the least error given as RMSE (0.57) and MAE (0.55). As for NSE, all the three basins have the same value each given as (0.98). This implies that the CMIP5 multi-model ensemble mean reproduce the same seasonal wet temperature across the three basins.

Table 4.1 Evaluation metrics between historical observed and simulated seasonal temperature and rainfall (1959 – 1988)

TEMPERATURE	KLB			SRB			KYB		
	RMSE	MAE	NSE	RMSE	MAE	NSE	RMSE	MAE	NSE

Seasonal Dry	1.14	1.05	0.94	1.55	1.45	0.86	1.14	1.10	0.89
Seasonal Wet	0.60	0.55	0.98	0.57	0.55	0.98	0.65	0.55	0.98
RAINFALL									
Seasonal Dry	0.32	0.30	0.99	0.17	0.16	0.99	0.13	0.12	1
Seasonal Wet	1.29	1.05	0.94	0.78	0.60	0.98	0.96	0.95	0.96

Source: Author's Computation, 2019

Seasonal dry rainfall in KLB has the highest error between the simulated and observed seasonal dry rainfall given as RMSE (0.32)and MAE (0.30) while KYB has the least error given as RMSE (0.13) and MAE (0.12). As for NSE, KYB has the highest value (1.0) denoting perfect reproduction of seasonal dry rainfall in the basin. KLB and SRB have the least NSE value each (0.99). This implies that the CMIP5 multi-model ensemble mean is better able to reproduce the seasonal dry rainfall in KYB than in KLB and SRB. Seasonal wet rainfall across these basins reveals that KLB has the highest error between the simulated and observed seasonal wet rainfall given as RMSE (1.29)and MAE (1.05) while SRB has the least error given as RMSE (0.78) and MAE (0.60). As for NSE, SRB has the highest value (0.98) follow by KYB (0.96). This implies that the CMIP5 multi-model ensemble mean is better able to reproduce the seasonal wet rainfall in SRB than in the KYB and KLB respectively. On a general note, despite the variations in the ability of the CMIP5 multi-model ensemble mean to reproduce seasonal dry and wet temperature and rainfall across the three basins, the errors between the observed and simulated are within the acceptable threshold. The error mergins for temperature (0.57 - 1.55) and rainfall (0.13 - 1.29) are in tandem with (1.78 - 2.10) reported by Vera and Díaz (2013) for South America and also consistent with those found in most regions of the world (Kumar *et al.*, 2014). NSE of (0.8) threshold is in the range of 'very good values' as recommended by Moriasi *et al*. (2007) cited in (Miguel *et al.*, 2018) for general performance ratings. Thus, we can conclude that these CMIP5 multi-model ensemble mean is good at simulating the precipitation and temperature in Guinea and Sudano-Sahelian Ecological Zones of Nigeria.

4.2: Projected changes in seasonal temperature: dry season (NDJFMA)

The spatial distribution of seasonal dry **(**NDJFMA**)** temperature over KLB, SRB and KYB are shown on (figure 4.1 and 4.2) respectively. The first column is the projection for the first baseline period (1959-1988) while the second column is the projection for the second baseline period (1989-2018). The first, second and third row is respectively for (2019-2048), (2049-2078), and (2071-2100) future climatic periods. It is observed that temperature will increase from the first climatic period to the third climatic period with reference to the first and second baselines of (1959-1988) and (1989-2018) respectively in the KLB, SRB and KYB. Looking at the differences between first climatic period (2019-2048) and third climatic period (2071-2100) it shows that base on (1959-1988) baseline, seasonal dry temperature in KLB will increase for RCP8.5 from (1^{o}C to 5.8^{o}C), RCP4.5 from (1^{o}C to 2.5^{o}C) and RCP2.6 from (1^{o}C to 1.5^{o}C).

1959 – 1988 Baseline **1989 – 2018 Baseline**

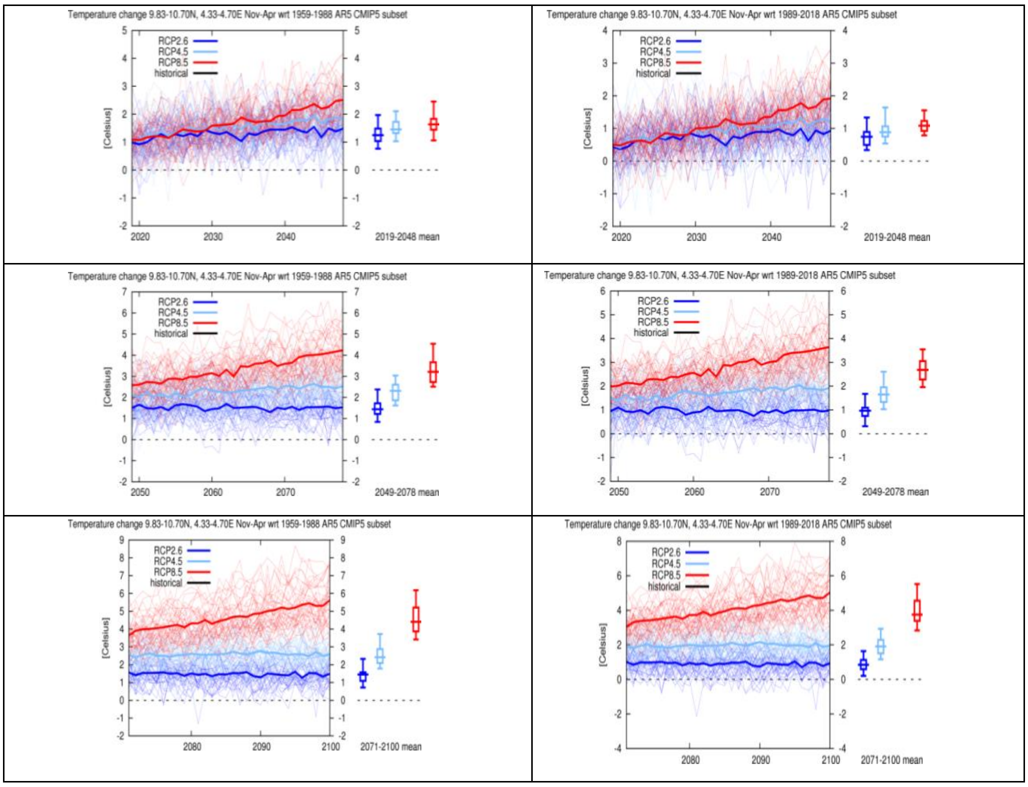
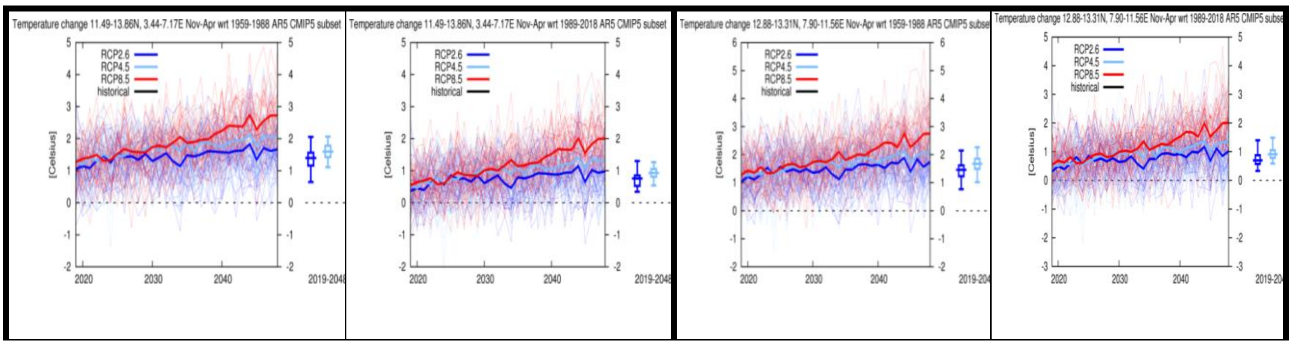


Figure: 4.1 Projected changes in seasonal temperature: dry season (NDJFMA) relative to (1959 – 1988) and (1989 – 2018) baselines for KLB

SRB **KYB**



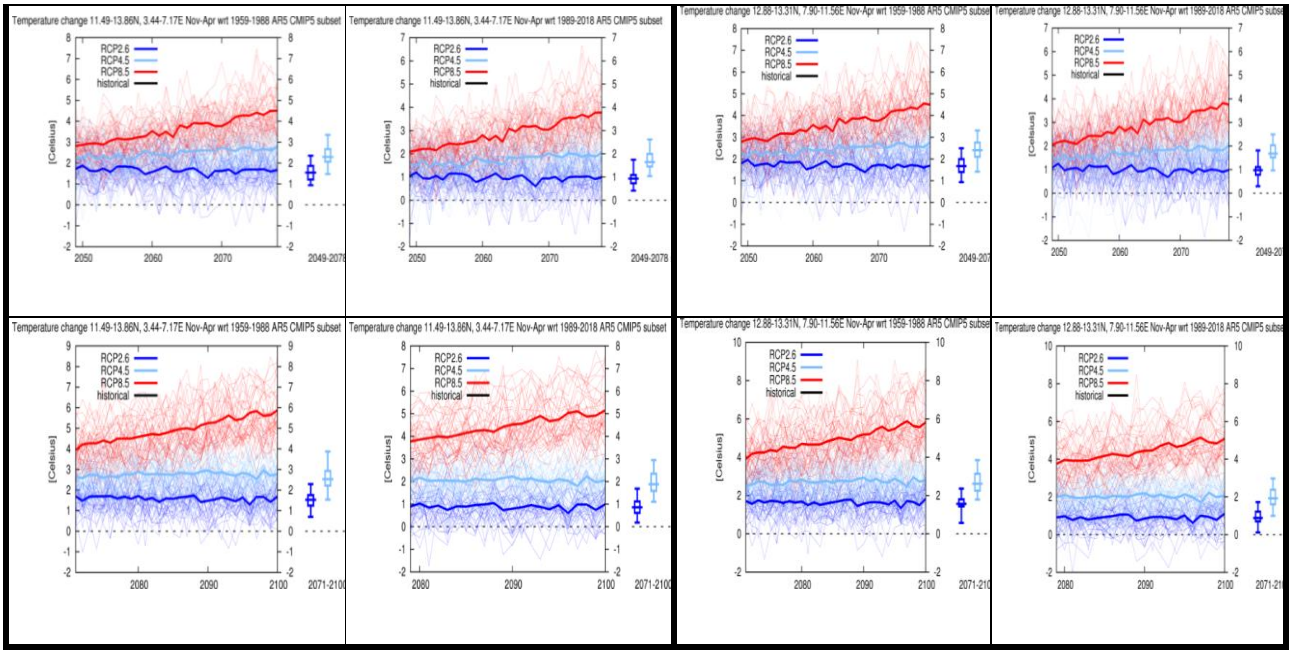


Figure: 4.2 Projected changes in seasonal temperature: dry season (NDJFMA) relative to (1959 – 1988) and (1989 – 2018) baselines for SRB and KYB

The respective values of these for (1989-2018) baseline are RCP8.5 from (0.4ºC to 5ºC), RCP4.5 from (0.5ºC to 2ºC) and RCP2.6 remain as (0.5ºC). As for the SRB it reveal that base on (1959-1988) baseline, seasonal dry temperature will increase for RCP8.5 from (1.2ºC to 5.9ºC), RCP4.5 from (1ºC to 2.9ºC) and RCP2.6 from (1ºC to 1.8ºC). The respective values of these for (1989-2018) baseline are RCP8.5 from (0.4ºC to 5.1ºC), RCP4.5 from (0.4ºC to 2ºC) and RCP2.6 from (0.4ºC to 1ºC). Similarly, those for KYB show that base on (1959-1988) baseline, seasonal dry temperature will increase for RCP8.5 from (1.2ºC to 5.9ºC), RCP4.5 from (1.2ºC to 2.8ºC) and RCP2.6 from (1.2ºC to 1.9ºC) in the KLB. The respective values of these for (1989-2018) baseline are RCP8.5 from (0.5ºC to 5ºC), RCP4.5 from (0.5ºC to 2ºC) and RCP2.6 from (0.5ºCto 1ºC). These findings are in agreement with the work of Adefisan (2018) that observed throughout the entire West Arica, there is a general temperature increase. Looking at the scenario A1B, the minimum temperature over Southern part of West Africa located at around 10°N (18°C) in the present (2000-2029) but has increased to (22°C) in the future (2070-2099). That the respective values of these for A2 are (18°C and 30°C) while those of B1 are (24°C and 26°C). Thus, it can be deduced that the warming trends observed in KLB, SRB and KYB between climatic periods (2019-2048), (2049-2078), and (2071-2100) are indications that obviously Guinea and Sudano-Sahelian Ecological Zones of Nigeria are sensitive to climate change.

4.1.3: Projected changes in seasonal temperature: wet season (MJJASO)

Distribution of seasonal wet (MJJASO) temperature over KLB, SRB and KYB are shown on (figure 4.3, and 4.4) respectively. The first column is the projection for the first baseline period (1959-1988) while the second column is the projection for the second baseline period (1989-2018). The first, second and third row is respectively for (2019-2048), (2049-2078), and (2071-2100) future climatic periods. Looking at the differences between first climatic period (2019-2048) and third climatic period (2071-2100) it show that base on (1959-1988) baseline, seasonal wet temperature in KLB will increase for RCP8.5 from (0.8°C to 5.1°C), RCP4.5 from (0.8°C to 2.5°C) and RCP2.6 from (0.8°C to 1.2°C). The respective values of these for (1989-2018)

1959 – 1988 Baseline **1989 – 2018 Baseline**

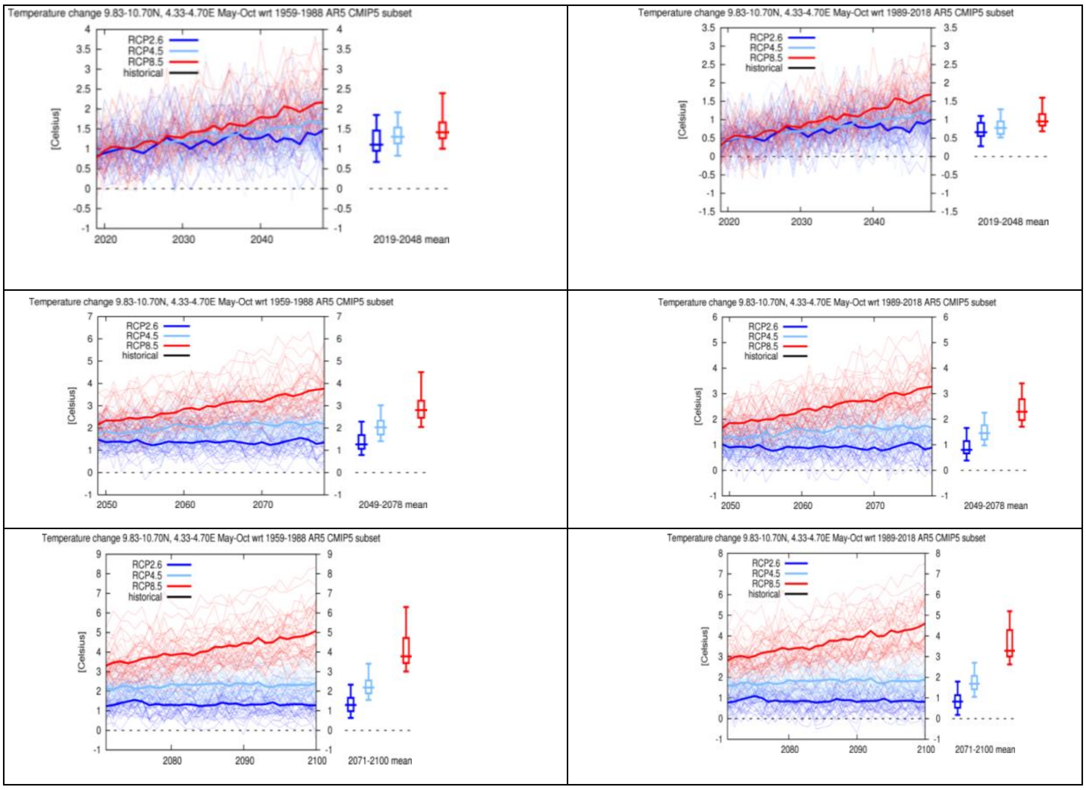
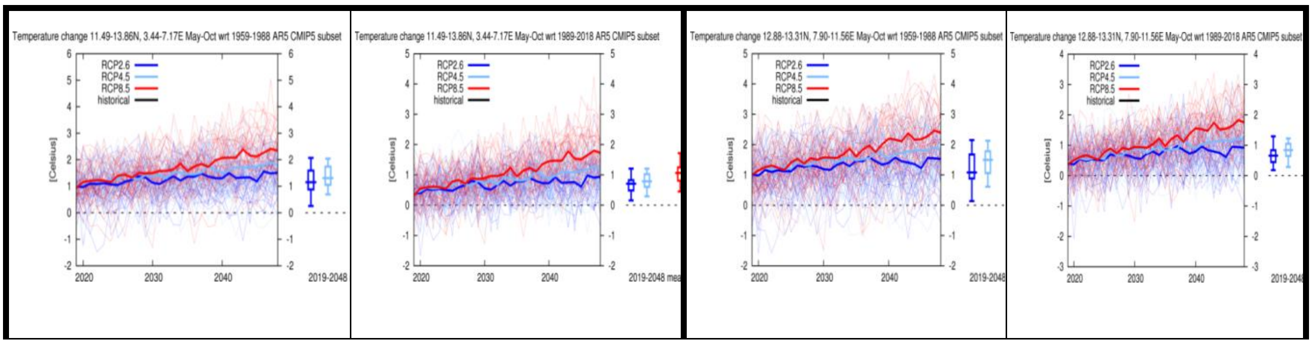


Figure: 4.3 Projected changes in seasonal temperature: wet season (MJJASO) relative to (1959 – 1988) and (1989 – 2018) baselines for KLB

SRB **KYB**



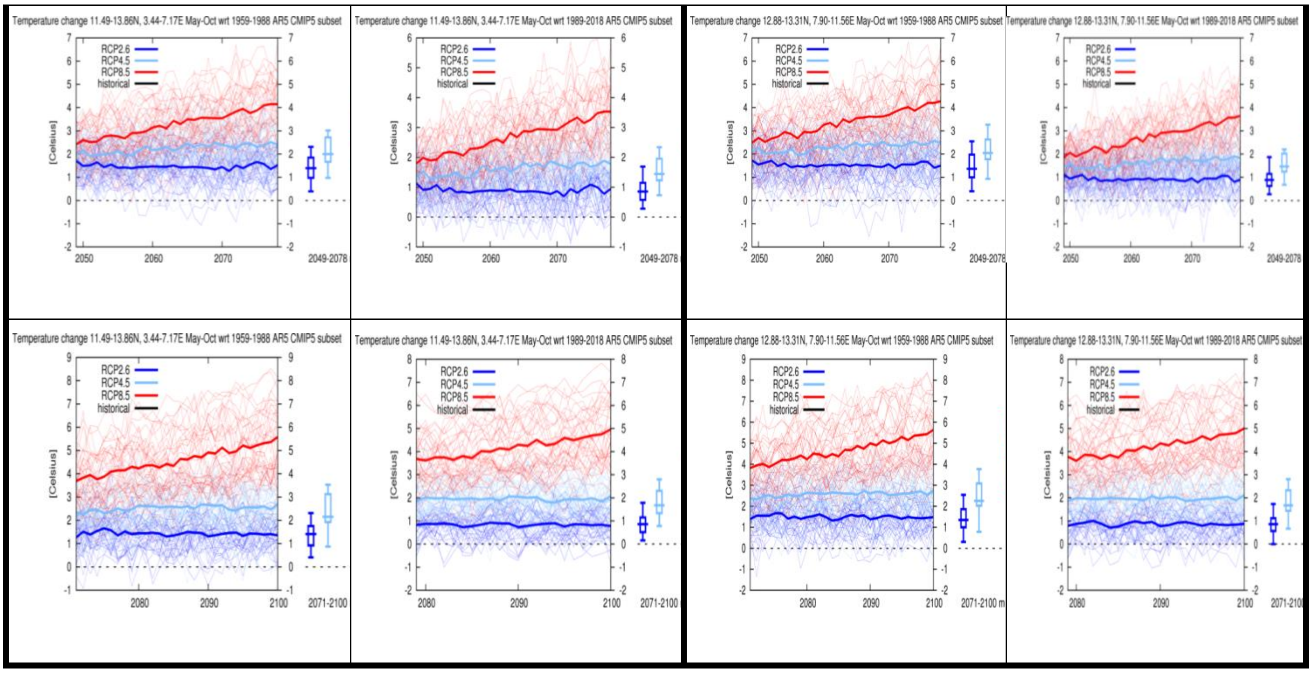


Figure: 4.4 Projected changes in seasonal temperature: wet season (MJJASO) relative to (1959 – 1988) and (1989 – 2018) baselines for SRB and KYB

baseline is RCP8.5from (0.4°C to 4.6°C), RCP4.5 from (0.5°C to 1.9°C) and RCP2.6 from (0.5°C to 0.9°C). As for the SRB it reveal that base on (1959-1988) baseline, seasonal wet temperature will increase for RCP8.5 from (1°C to 5.7°C), RCP4.5 from (1°C to 2.8°C) and RCP2.6 from (1°C to 1.2°C). The respective values of these for (1989-2018) baseline are RCP8.5 from (0.2°C to 5°C), RCP4.5 from (0.2°C to 2°C) and RCP2.6 from (0.2°C to 1.9°C).

Similarly, those for KYB show that base on (1959-1988) baseline, seasonal wet temperature will increase for RCP8.5 from (1°C to 5.8°C), RCP4.5 from (1°C to 2.9°C) and RCP2.6 from (1°C to 1.5°C). The respective values of these for (1989-2018) baseline are RCP8.5 from (0.4°C to 5°C), RCP4.5 from (0.4°C to 2°C) and RCP2.6 from (0.4°C to 1°C). This finding is in tandem with the work of Demircan *et al.* (2017) that between (2016 and 2099) it was expected that there will be an increase between 1°C and 6°C in seasonal wet temperature of Turkey. This is also consistent with that observed by Navneet (2017) in India where seasonal wet temperature compared to baseline for 2020s will be between 1.4 and 2.0°C, for 2050s it will range between 2.8 and 3.6°Cand for 2080s it will be 4.0 and 6.7°C. Thus, it can be deduced that the warming trends observed in KLB, SRB and KYB between climatic periods (2019-2048), (2049-2078), and (2071-2100) are indications that obviously Guinea and Sudano-Sahelian Ecological Zones of Nigeria are sensitive to climate change. More so, it is imperative to mention that despite the increasing trends of seasonal dry and wet temperature in the future years, the increase is slightly more in dry than wet season.

4.1.5: Projected changes in seasonal rainfall: dry season (NDJFMA)

Future seasonal dry rainfall projections comprising of November, December, January, February, March and April (NDJFMA) over KLB, SRB and KYB are considered (Table 4.2). Differences between and among the future first (2019-2048), second (2049-2078) and third (2071-2100) climatic periods relative to (1959-1988) and (1989-2018) baselines are found in the rainfall amounts (mm/day).

Table 4.2 Projected changes in seasonal (dry) rainfall (mm/day) relative to (1959 – 1988) and (1989 –2018) baselines

Scenario	**RCP2.6**			**RCP4.5**			**RCP8.5**		
Basin	KLB	SRB	KYB	KLB	SRB	KYB	KLB	SRB	KYB
1959 – 1988 baseline average (mm/day)									
2019-2048	+0.6	+0.5	-0.2	+0.4	+0.4	+0.4	+0.7	+0.5	+0.2
2049-2078	+0.5	+0.6	-0.2	+0.6	+0.5	+0.2	+0.7	+0.6	+0.4
2071-2100	+0.6	+0.1	+0.2	+1.4	+0.5	-0.2	+0.9	+0.7	+0.4
1989 – 2018 baseline average (mm/day)									
2019-2048	+0.7	+0.4	+0.4	+0.3	+0.3	+0.1	+0.6	+0.5	-0.2
2049-2078	+1.2	+0.6	+0.4	+0.8	+0.7	+0.2	+0.8	+0.5	+0.6
2071-2100	+0.4	+0.5	+0.3	+1.5	+0.7	+0.2	+0.6	+0.6	+0.4

Source: KNMI Climate Explorer

The positive changes that signifies increase in rainfall amount is mostly observed over the three basins. This means that seasonal dry rainfall amount will increase in the future. As observed in the three climatic periods, the increase will be highest for the first climatic period such that RCP8.5 (+0.7mm/day), RCP4.5 (+0.4mm/day) and RCP2.6 (+0.6mm/day) while the second climatic period will be the least found as RCP8.5 (+0.5mm/day), RCP4.5 (+0.2mm/day) and RCP2.6 (+0.3mm/day). Furthermore, the differences with respect to the two baselines of (1959-1988) and (1989-2018) periods show that the seasonal dry rainfall will be higher with reference to (1989-2018) baseline when compared with (1959-1988) baseline. The (1989-2018) baseline found RCP8.5 (0.7mm/day), RCP4.5 (0.7mm/day) and RCP2.6 (0.6mm/day) compared with RCP8.5 (0.6mm/day), RCP4.5 (0.5mm/day) and RCP2.6 (0.1mm/day) for the (1959-1988) baseline. Across the three basins, seasonal dry rainfall will be highest in the KLB given as RCP8.5 (0.8mm/day), RCP4.5 (1.5mm/day) and RCP2.6 (1.2mm/day) follow by SRB given as RCP8.5 (0.7mm/day), RCP4.5 (0.7mm/day) and RCP2.6 (0.6mm/day). The least increase is in KYB given as RCP8.5 (0.6mm/day), RCP4.5 (0.4mm/day) and RCP2.6 (0.3mm/day).

4.1.6: Projected changes in seasonal rainfall: wet season (MJJASO)

Seasonal wet rainfall projections comprising months of May, June, July, August, September and October (MJJASO) over KLB, SRB and KYB are considered (Table 4.3).

Table 4.3 Projected changes in seasonal (wet) rainfall (mm/day) relative to (1959 – 1988) and (1989 –2018) baselines

Scenario	RCP2.6			RCP4.5			RCP8.5		
Basin	KLB	SRB	KYB	KLB	SRB	KYB	KLB	SRB	KYB
1959 – 1988 baseline average (mm/day)									
2019-2048	+3	-1.2	-0.8	+2	+0.2	+1.4	+1.5	+0.8	+1.5
2049-2078	+2.8	-0.8	-1	+3	+0.6	+1.2	+2	+1.2	+1.8
2071-2100	+1.2	+0.2	+1.2	+0.5	+0.4	+1	+4	+0.8	+2

1989 – 2018 baseline average (mm/day)									
2019-2048	+3.8	-1	+2.2	+2.1	+0.5	+2	+1.5	+0.8	+1.5
2049-2078	+1.4	-0.8	+0.8	+2.5	+2	+2	+2.1	+1.2	+1.8
2071-2100	+0.4	-1	+2	+1.2	+0.7	+2.5	+2.7	+1	+1.5

Source: KNMI Climate Explorer

Just like seasonal dry rainfall over these basins, the seasonal wet rainfall exhibit similar pattern of increasing rainfall up till the end of 21stcentury. The values for the KLB is found as 0.8mm/day, 0.8mm/day and 1.2mm/day for RCP8.5, RCP4.5 and RCP2.6 respectively during the seasonal dry rainfall while 2.1mm/day, 2.5mm/day and 1.4mm/day for RCP8.5, RCP4.5 and RCP2.6 respectively during the seasonal wet rainfall. The respective values for KY B is found as 0.6mm/day, 0.2mm/day and 0.4mm/day for RCP8.5, RCP4.5 and RCP2.6 respectively during the seasonal dry rainfall while 1.8mm/day, 2mm/day and 0.8mm/day for RCP8.5, RCP4.5 and RCP2.6 respectively during the seasonal wet rainfall. This shows that Guinea and Sudano-Sahelian Ecological Zones of Nigeria is sensitive to climate change resulting to increase in the seasonal wet rainfall amount (0.8mm/day to 4mm/day) between the first and third climatic periods.

5. Conclusion

Based on the findings of this study, it could be deduced that Guinea and Sudano-Sahelian Ecological Zones of Nigeria to climate change. This is noticed from the rise in temperature from 1°C in the first climatic period (2019-2048) to as high as 6°C in the third climatic period (2071-2100) being the end of 21st century. Similar trend is observed for rainfall where there is increase in rainfall amount from 0.5mm/day in first climatic period to 2.5mm/day in the third climatic period. This anticipated condition has serious implications on water resources, from increase in streamflow, rise in reservouir, soil moisture changes and flooding.

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Impact of Weather on Guinea Corn Production In Kaduna State, Nigeria

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ABSTRACT

Weather variations has become a topical issue in recent time because of its largely detrimental impacts on natural and human systems. The study examines the impact of weather on guinea core production in Kaduna State, it analyse the trend of rainfall and temperature over the past 20 years (1999-2018) and examine the impact of these weather variables on guinea corn production. Rainfall, temperature and guinea corn yield was acquired, data collected were