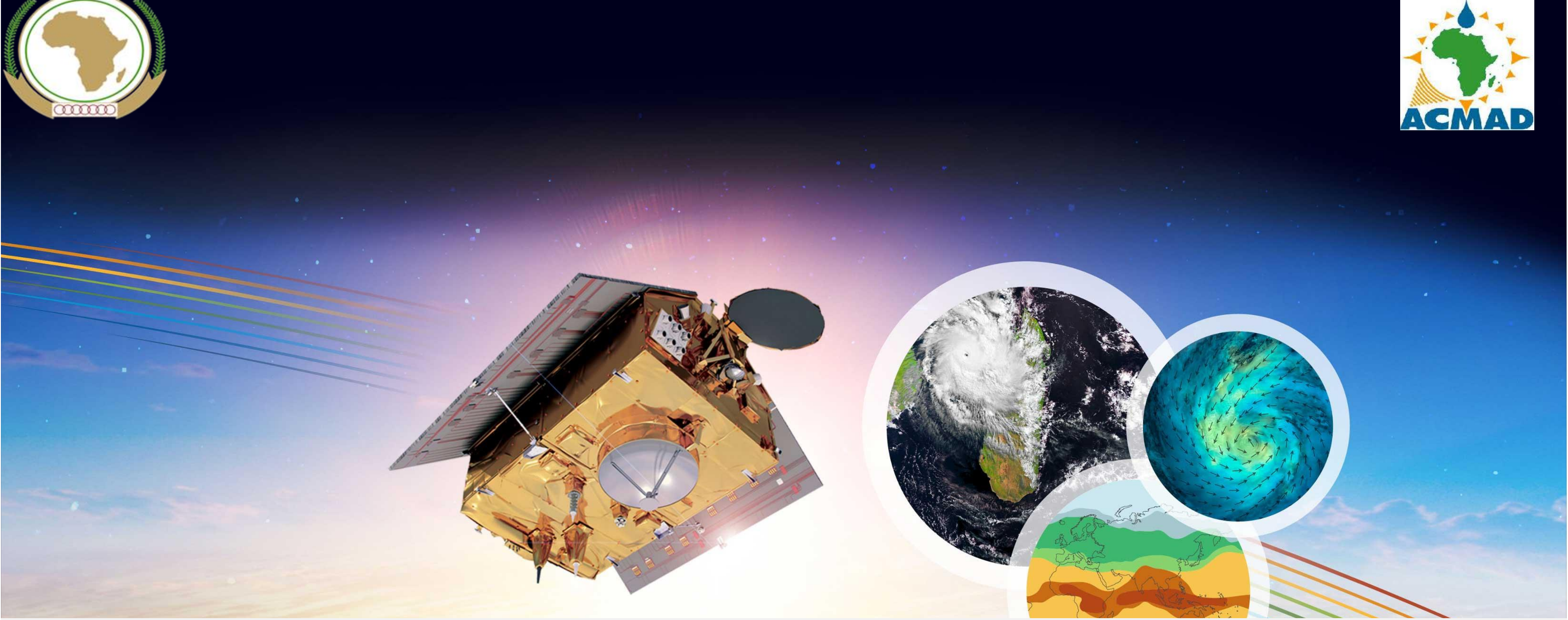


A Post COP15 Webinar

(Theme: The Paris Agreement and the Kunming-Montreal Global Biodiversity Framework (GBF) Nexus- Promoting Coherence Between Climate Actions and Biodiversity Strategies)

How to align efforts towards achieving the targets in the commitment – the various Plans (NDCs, NBSAP, etc.) and Business support: From a Climate Change Perspectives

Venue: Online,
Date: June 14, 2023

Organized by:
Sustainable Environment Food and Agriculture Initiative, Lagos, Nigeria.

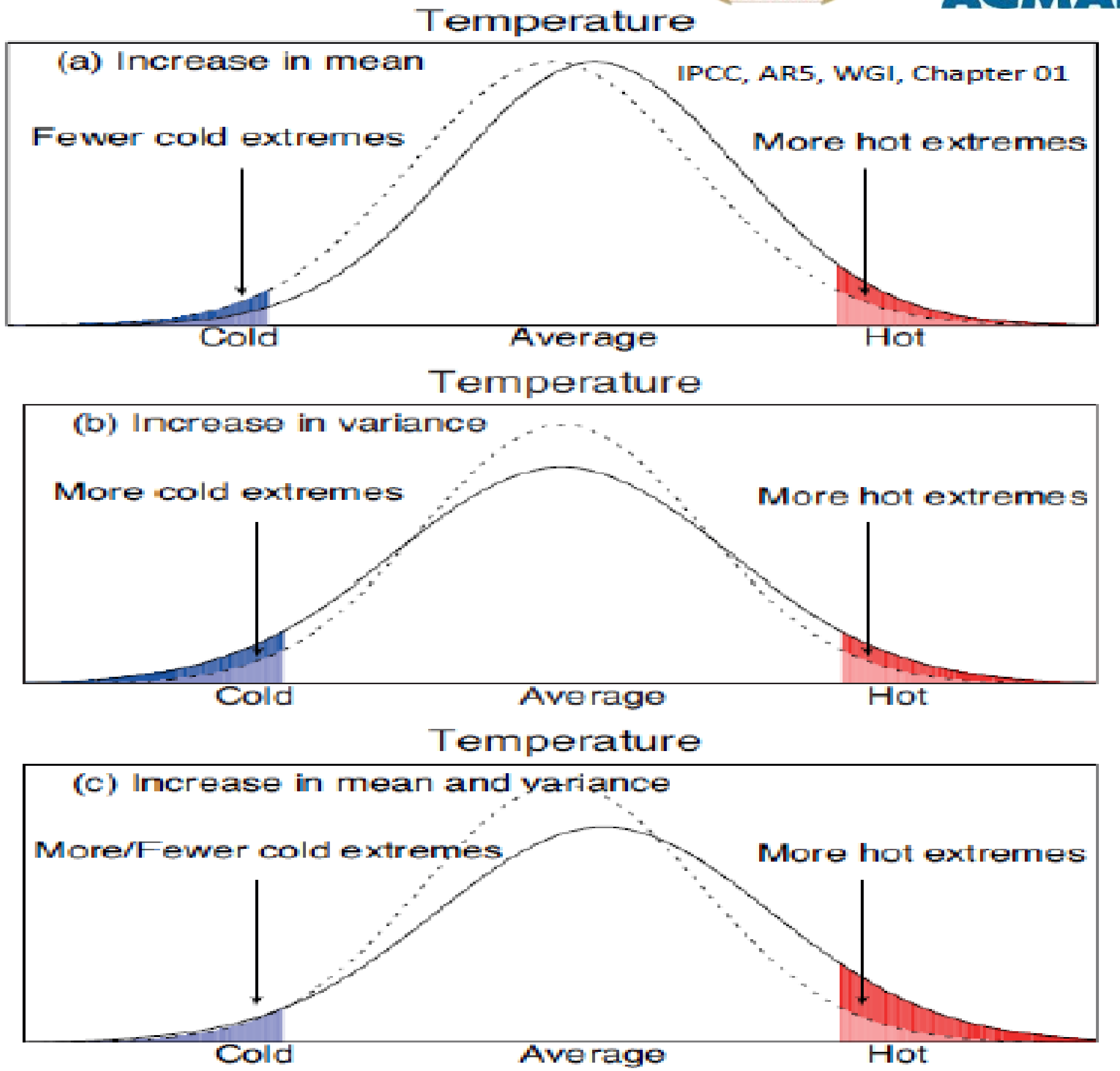
	Name	Position
Prepared by	Dr. Kamoru Abiodun LAWAL	Climate Change Expert
Contributed by	ACMAD ClimSA Team	
Contributed and Supervised by	Dr. Andre Kamga FOAMOUHOUE	Ag. Director General, ACMAD

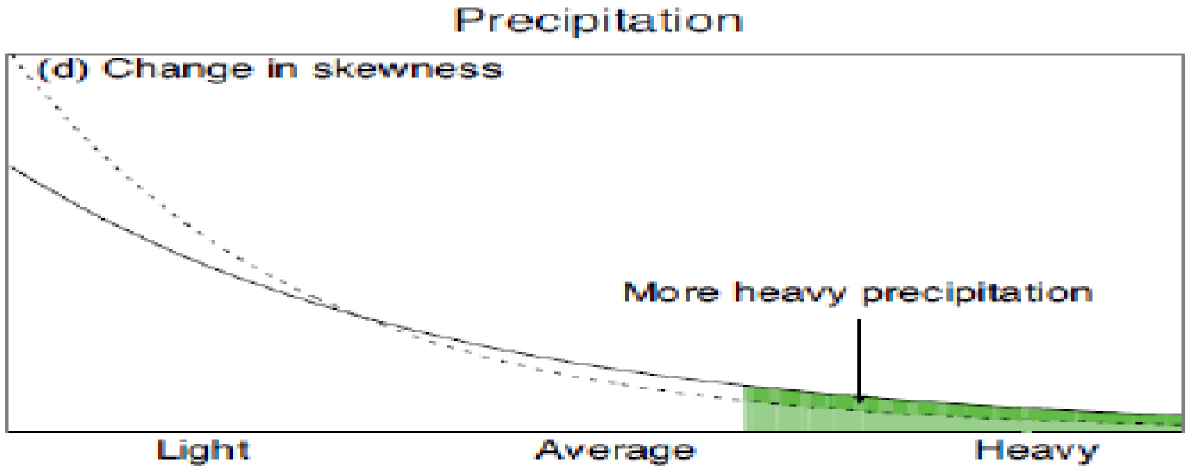
- ✓ **These slides are targeted at discussing the climate crisis that are becoming recognized as national security crisis in some countries.**

- ✓ **The slides tackle these crisis by raising scientific awareness on impacts of climate, specifically, on critical national infrastructures, socio-economic sectors and ecosystems, as well as businesses.**

- ✓ **It advocates the development and use of Early Warning and Early Action for all.**

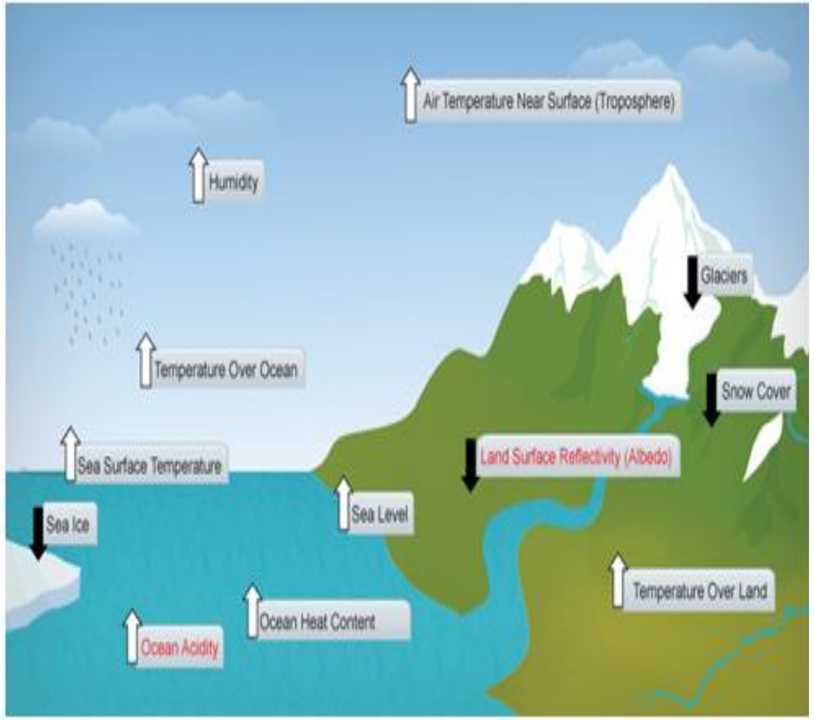
Coping with a changing climate and changes in extreme weather and climate events have significant impacts; and are among the most serious challenges to our societies and ways of life.



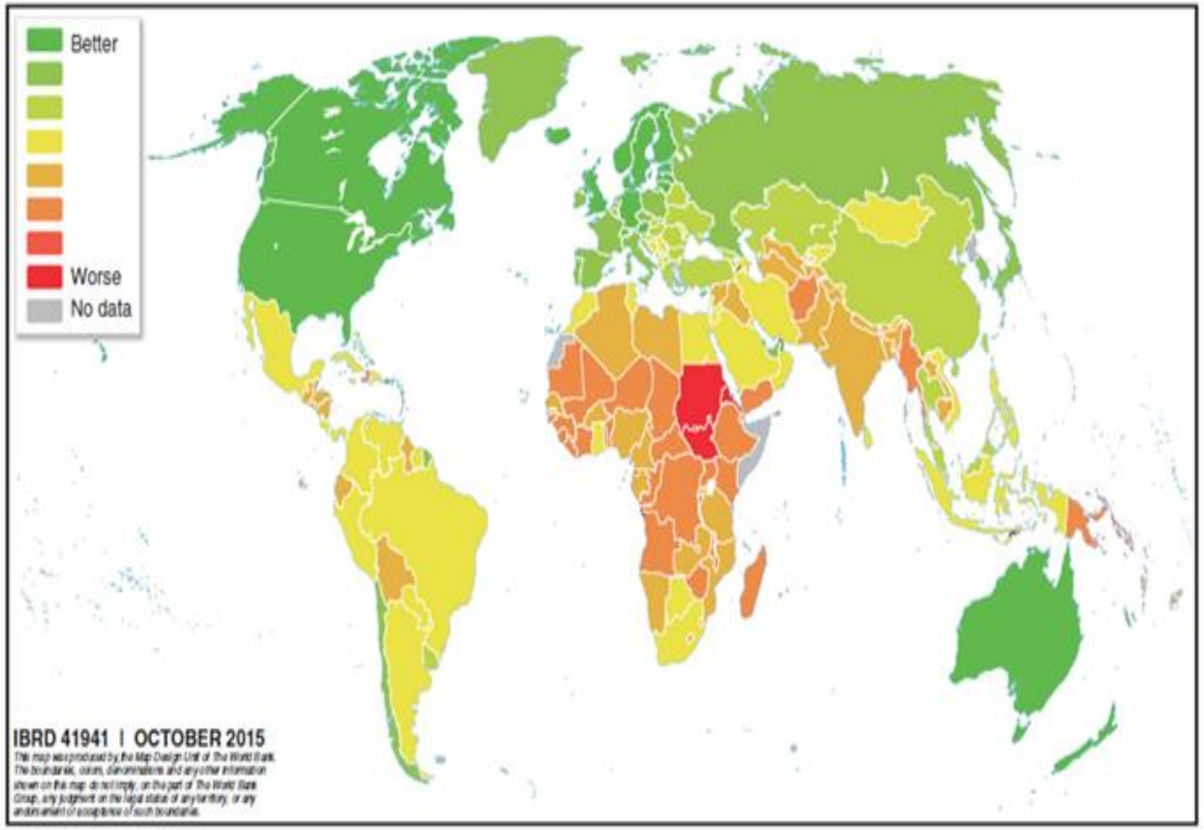


Key Indicators of a Changing Climate System

- **Temperature:** Global mean temperature is 0.8°C above pre-industrial levels
- **Ocean warming:** Oceans have warmed 0.09°C since the 1950s
- **Sea level rise:** Has risen 15-20 cm since pre-industrial times
- **Precipitation:** Increasing upward & downward trends
- **Ice melt:** Glaciers are melting at unprecedented rate

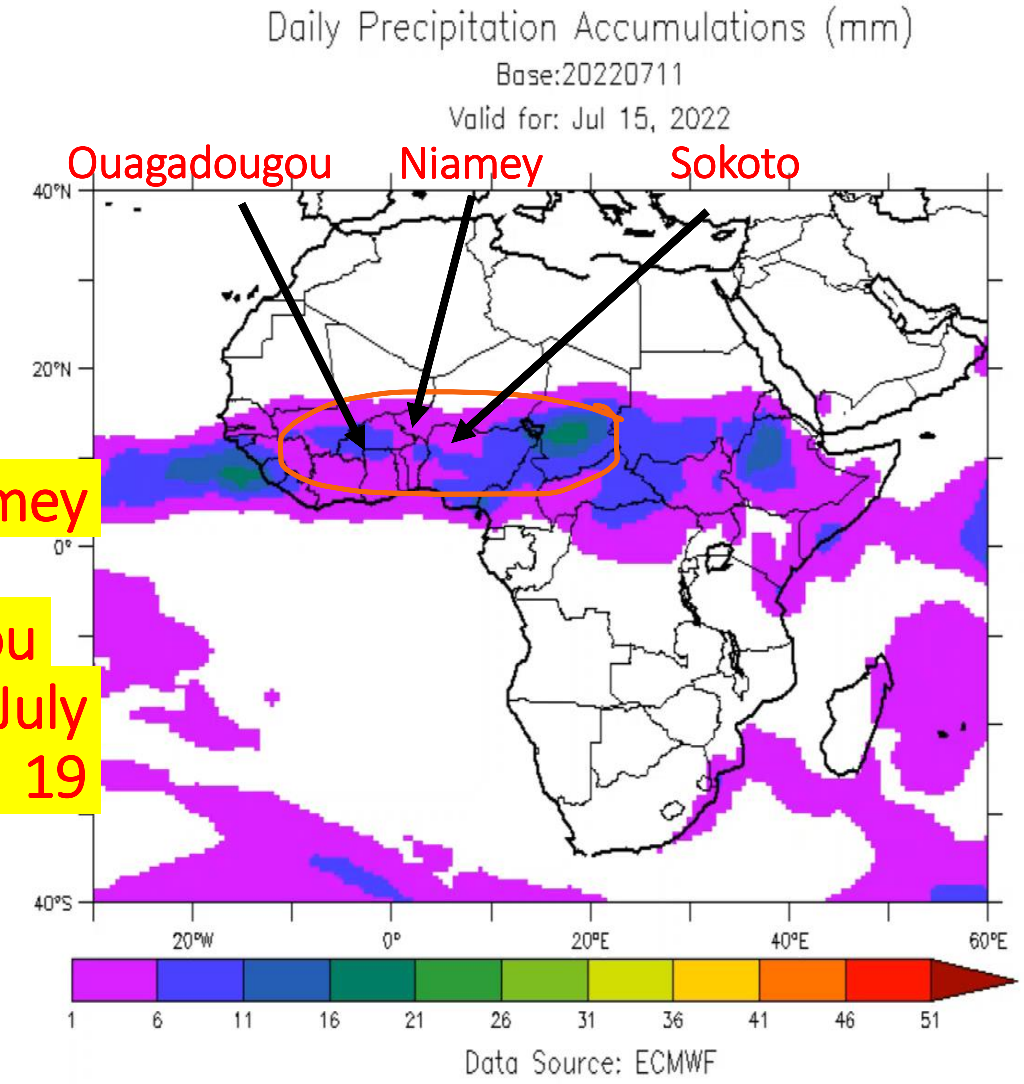


Depending on Location, Countries Face Differing Levels of Vulnerability to Climate Change

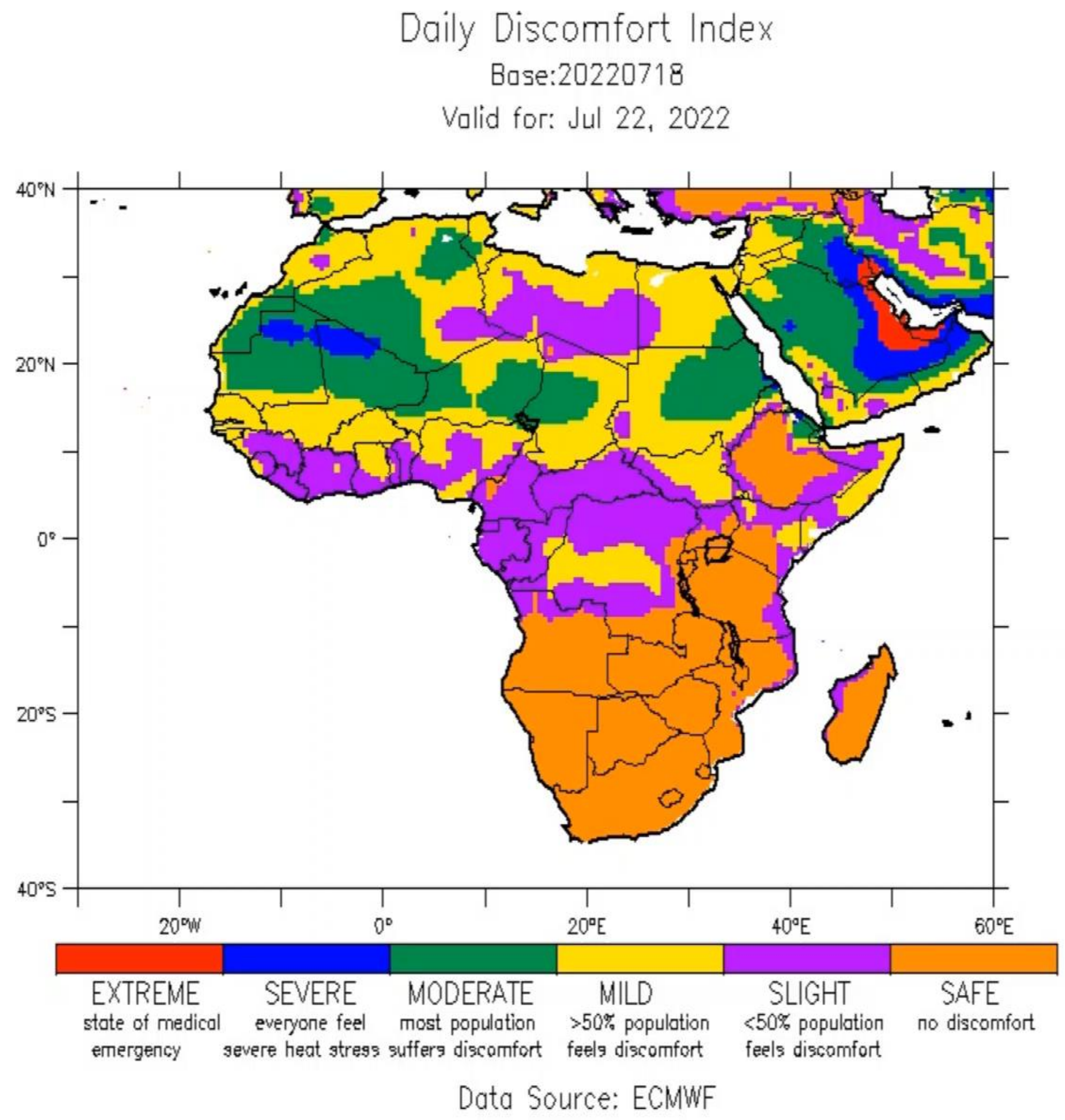


Indeed, ”confidence has increased that some extremes will become more frequent, more widespread and/or more intense during the 21st century” (IPCC, 2007).

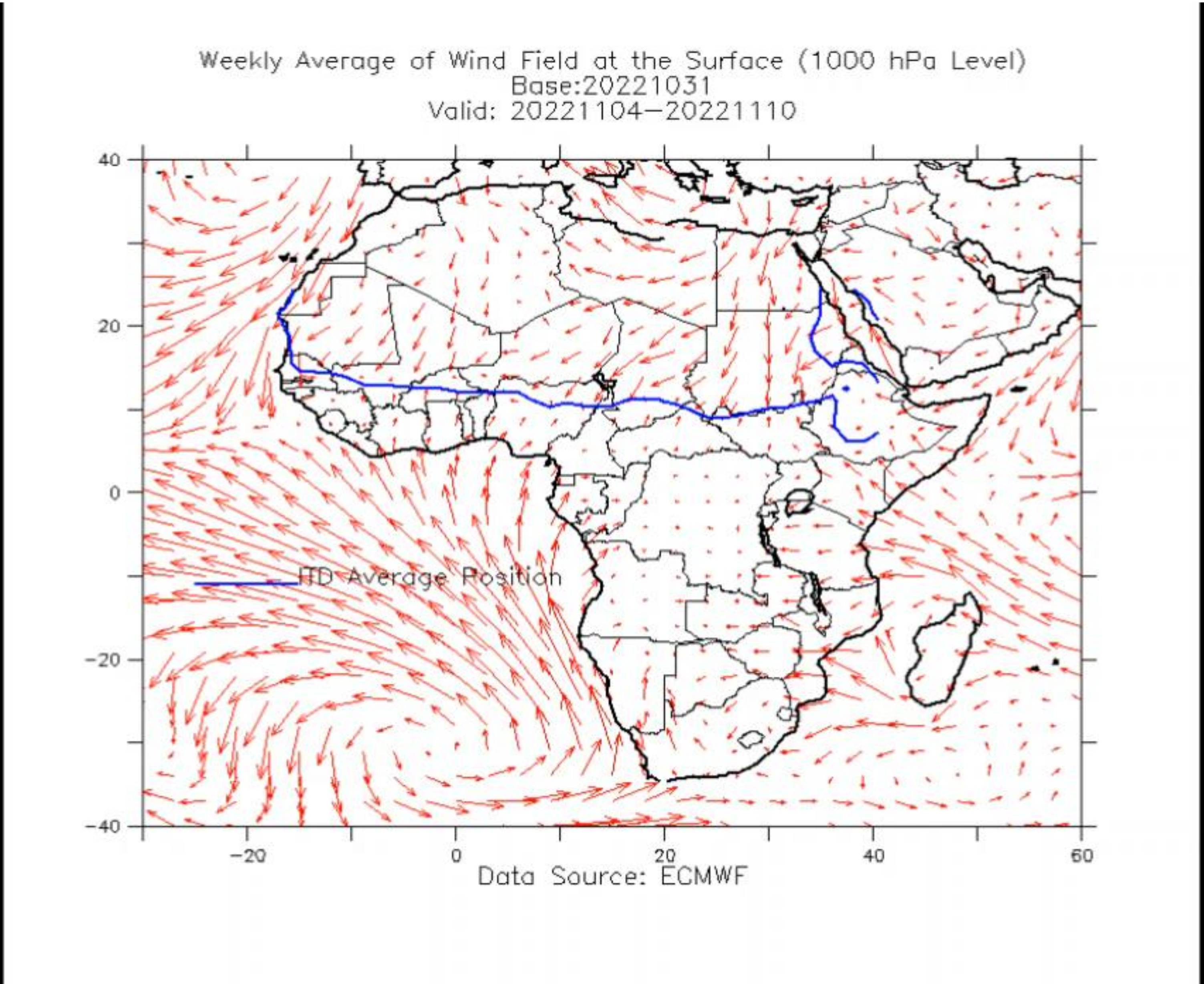
Sokoto, Niamey and Ouagadougou floods of July 17, 18 and 19 2022 respectively.



Therefore, the demands for information services on weather and climate extremes are growing.



Meteorologists are therefore poised to generate new climate products to support socio-economic activities



Extreme heat events, vis-à-vis persistently high temperatures, are gateways to devastations, ecological wise.

For examples………

- **Regions may witness possible extinction of some species of plants in several nature reserves due to high temperatures.**
- **Studies found that high temperatures are inversely proportional to the oxygen-carrying capacity of water in Lakes……, presenting a serious implication for the population of fishes in Lakes, vis-à-vis food security.**
- **High temperatures have the capability to induce droughts, render environments inhabitable and agriculturally unproductive.**
- **High temperatures present favorable atmospheric conditions for vectors of both communicable (e.g. cholera and tuberculosis) and non-communicable (e.g. malaria, dengue fever, chronic respiratory and cardiovascular diseases) diseases.**

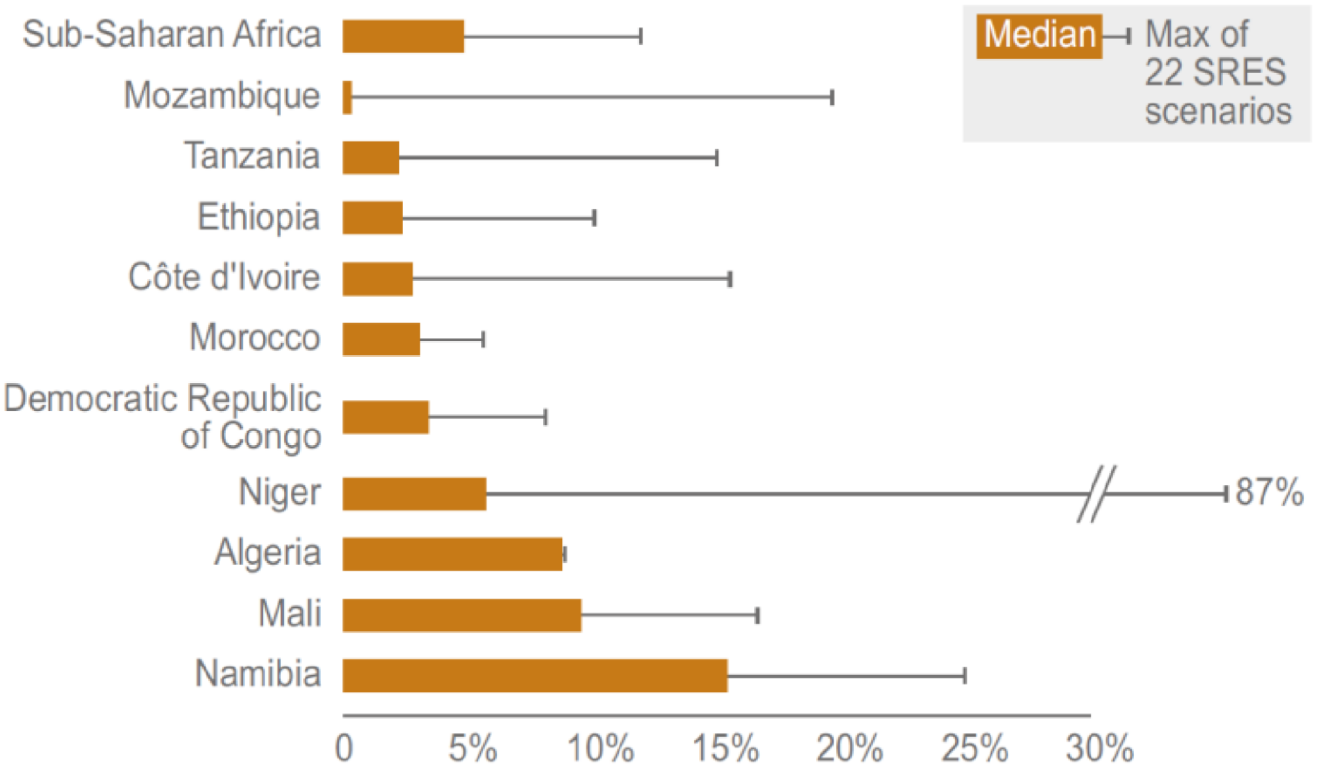
Extremes (excess or deficit) in the inter-annual variations of seasonal rainfall always result in environmental, societal, agricultural and economical damages and loss of lives.

It has been established that the socio-economic activities in Africa also strongly depend on the seasonal rainfalls.

Therefore, any effort to sustainably increase agricultural production, reduce poverty, enhance food security, protect ecosystems and livelihoods in West Africa must account for irregularity in the seasonal rainfalls.

- Nations spend enormous resources to build and maintain infrastructures.

- Nations will continue to spend more enormous resources to protect infrastructures from extreme and hazardous climate events.



Percentage of 2021 Gross Domestic Product of some African countries needed to repair and maintain road infrastructure in future changing climate. (Source IPCC, Trisos et al., 2022)

WHAT WE DID IN ACMAD

We adopted the use of Climate Change Detection Indices (ETCCDI) which were globally adopted for detecting Precipitation & Temperature extremes in 1997 at a WMO CLIVAR/GCOS workshop.

The climate change detection indices, i.e. ETCCDI, are used for detecting climate variability and extremes by assessing days in which temperature or precipitation observation are above or below specified thresholds.

These are 27 altogether but 22 were adopted here because of their relevance to African climate.

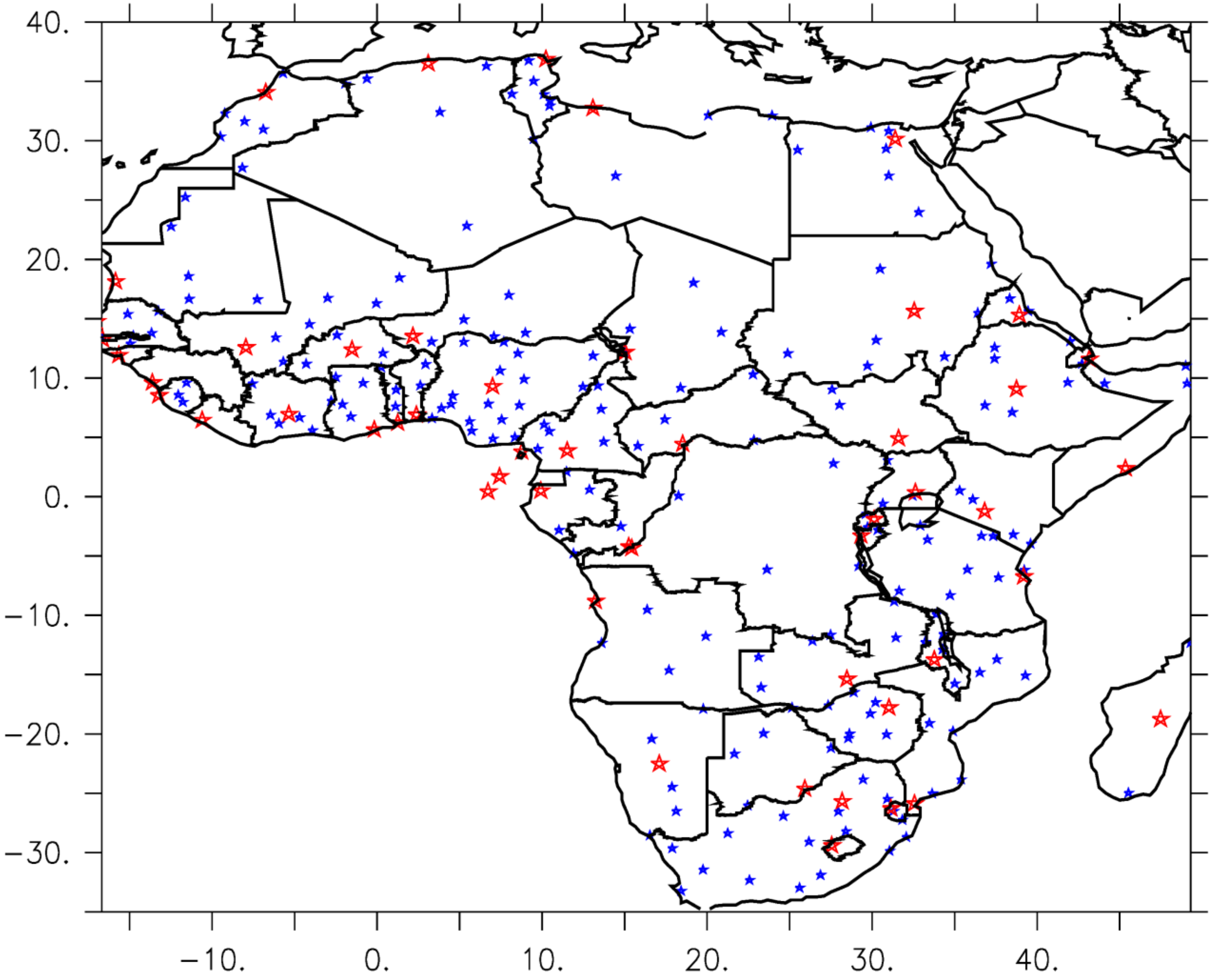
These indices are relevant to climate change monitoring and detection in Africa

Climate Change Detection Indices adopted for detecting Precipitation & Temperature extremes

Indicator Name	Indicator Definition for Precipitation	Indicator Name	Indicator Definition for Temperature
PRCPTOT	Annual total precipitation (RR > = 1mm)	Max Tmax	Maximum Temperature (Tx)
PRCPTOT99p	Annual total precipitation when RR>99p	Max Tmin	Maximum values of maximum temperature
R99p	Extremely wet-days when RR>99p	Min Tmax	Minimum values of maximum temperature
PRCPTOT95p	Annual total precipitation when RR>95p	Min Tmin	Minimum Temperature (Tn)
R95p	Very wet-days when RR>95p	Max Tmax	Maximum values of minimum temperature
CWD	Consecutive wet-days when RR>1mm	Max Tmin	Minimum values of minimum temperature
CDD	Consecutive dry-days when RR<1mm	DTR	Diurnal temperature range
R20mm	Very heavy precipitation days when RR>20mm	SU30	Summer days (Tx>30 deg. C)
R10mm	Heavy precipitation days when RR>10mm	TR20	Tropical nights (Tn>20 deg. C)
RX1mm	Wet days when RR>1mm	FD	Frost days (Tn<0 deg. C)
SDII	Simple daily intensity index	TN10p	Cool nights (Tn<10 deg. C)

Observations

Here..., we analyzed the observed climate change detection indices for more than 1,000 African cities using the World Meteorological Organization (WMO) recommended climate change detection algorithms, e.g. ETCCDI.



We utilized the 9km-resolution ERA5-Land reanalysis dataset (temperature and precipitation parameters), from ECMWF, for the observed climate over Africa (1950-2020).

Interannual Analyses of Extreme Precipitation Indices

Nigeria_ABUJA

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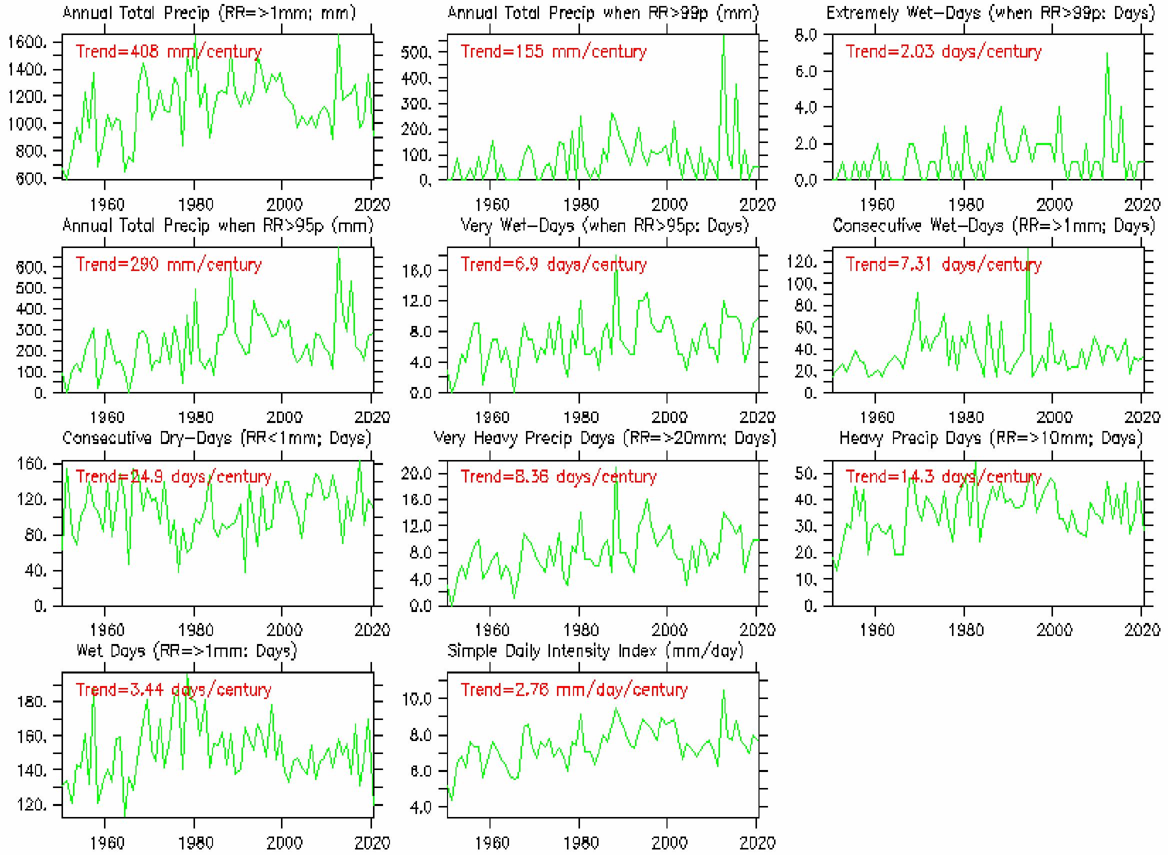

Interannual Analyses of Extreme Temperature Indices

Nigeria_ABUJA

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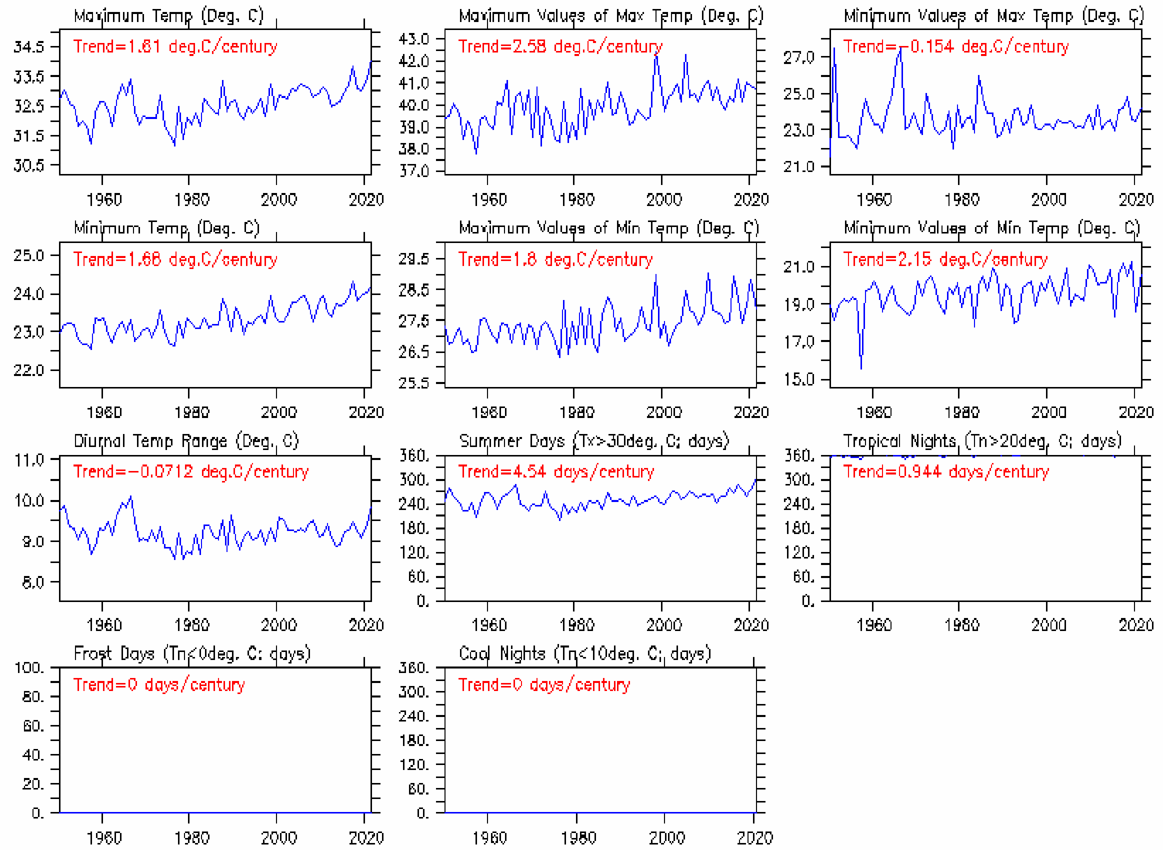

Decadal Analyses of Extreme Precipitation Indices
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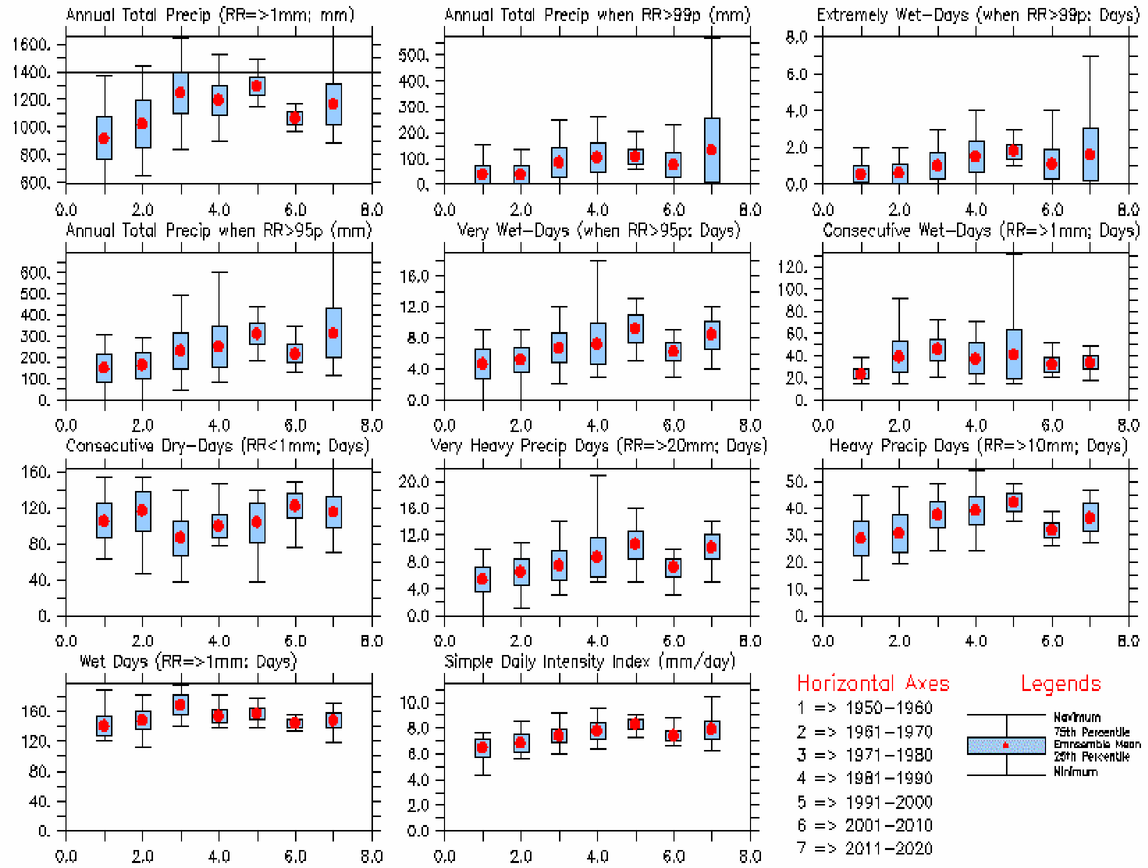

Decadal Analyses of Extreme Temperature Indices
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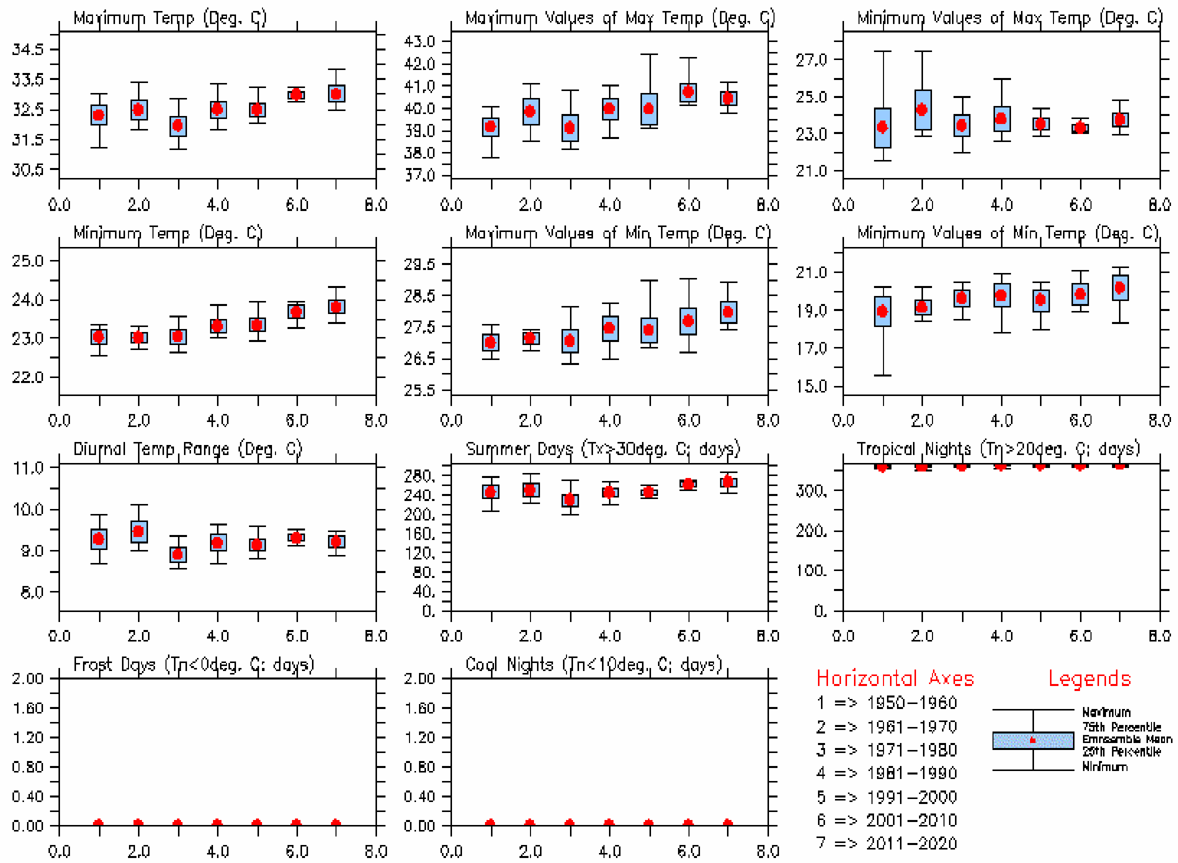


Future Scenarios

- We evaluated and analyzed the climate change detection indices for **<u>future scenarios (2030 - 2100)</u>** over Africa by using simulation dataset from 15 climate models for temperature and precipitation parameters for various Representative Concentration Pathways (RCPs) - **RCP2.6, RCP4.5, RCP6.0, and RCP8.5**.

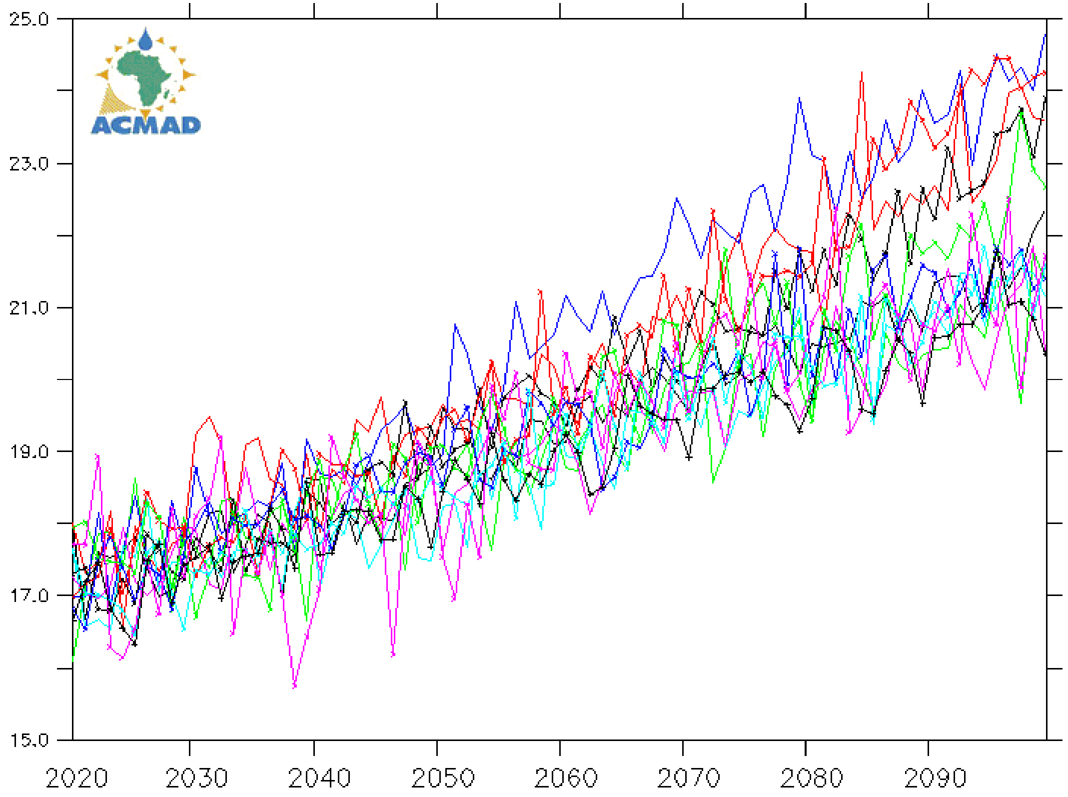
- **RCPs are greenhouse gas concentrations trajectory adopted by Intergovernmental Panel on Climate Change (IPCC) used for climate modelling and research.**

- After the processes of **<u>bias-corrections</u>**, we proceed to evaluate the projection of future climate scenarios (reference period: 1991 - 2020) for all the RCPs over selected African cities with population threshold of 300,000 person.

The Cause of Global Warming: Atmospheric CO_2 is Now Higher than It's Been for 650, 000 Years and Increasing Rapidly

Climate models used for future scenarios

Dataset	Full name	Resolution	Period
bcc-csm1-1-m	Beijing Climate Center Climate System Model version 1.1	1.12^{O} x 1.13^{O}	1861-2099
CCSM4	Community Climate System Model version 4	85km x 85km	1861-2099
CNRM-CM5	National Center for Meteorological Research- Coupled Model Intercomparison Project phase 5	50km x 50km	1861-2099
CSIRO-Mk3-6-0	Commonwealth Scientific and Industrial Research Organization Model	1.9^{O} x 1.9^{O}	1861-2099
FGOALS-g2	Flexible Global Ocean-Atmosphere-Land System Model-Grid point version 2	1^{O} x 1^{O}	1861-2099
GFDL-CM3	Geophysical Fluid Dynamics Laboratory-Climate Model version 3	100km x 100km	1861-2099
GFDL-ESM2M	Geophysical Fluid Dynamics Laboratory-Earth System Model	100km x 100km	1861-2099
HadGEM2-ES	Hadley Center Global Environment Model version 2-Earth System	1.875^{O} x 1.25^{O}	1861-2099
IPSL-CM5A-LR	Institute Pierre Simon Laplace – Climate Model version 5 -Low Resolution	1.25^{O} x 2.5^{O}	1861-2099
IPSL-CM5A-MR	Institute Pierre Simon Laplace – Climate Model version 5 -Low Resolution- Medium Resolution	1.25^{O} x 2.5^{O}	1861-2099
MIROC5	Model for Interdisciplinary Research on Climate version 5	85km x 85km	1861-2099
MIROC-ESM-CHEM	Model for Interdisciplinary Research on Climate-Earth System Model-	85km x 85km	1861-2099
MPI-ESM-LR	Max Planck Institute for Meteorology-Earth System Model-Low Resolution	103km x 103km	1861-2099
MRI-CGCM3	Meteorological Research Institute	2.25^{O} x 1.125^{O}	1861-2099
NorESM1-M	Norwegian Earth System Model	2^{O} x 2^{O}	1861-2099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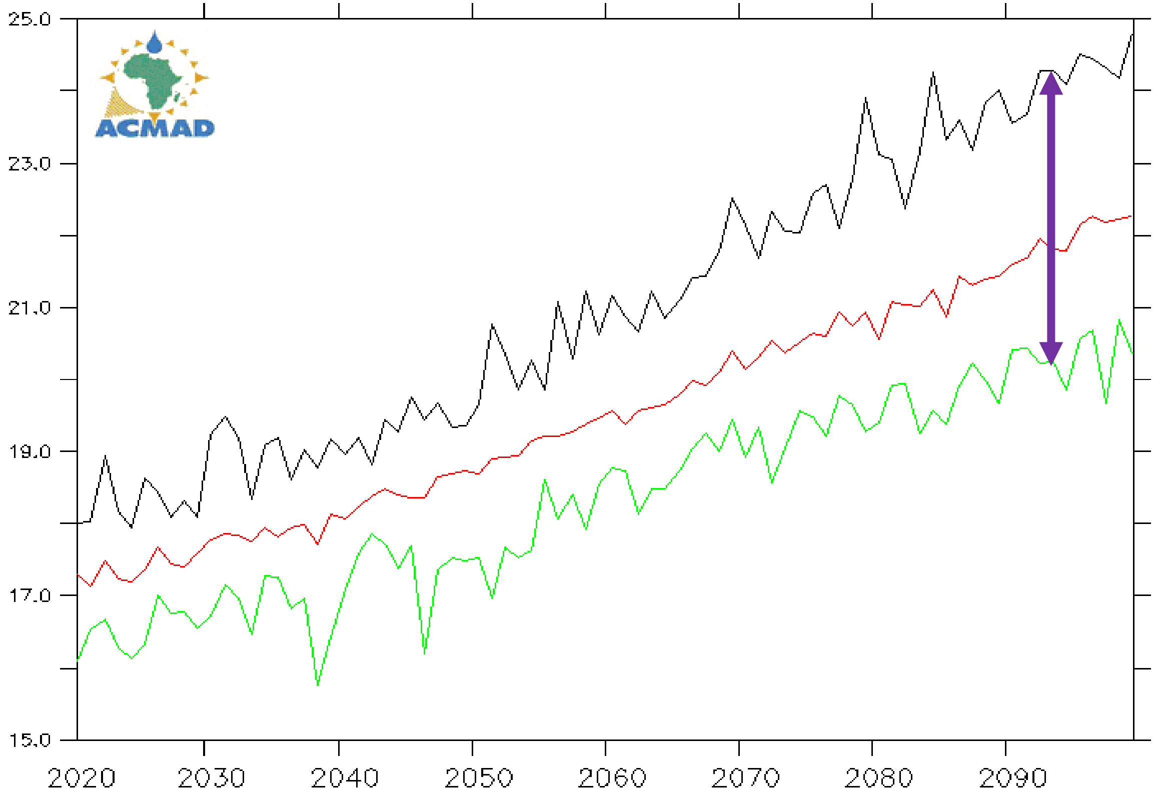
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Projected Changes in Extreme Precipitation Indices (RCP26)

Nigeria_ABUJA

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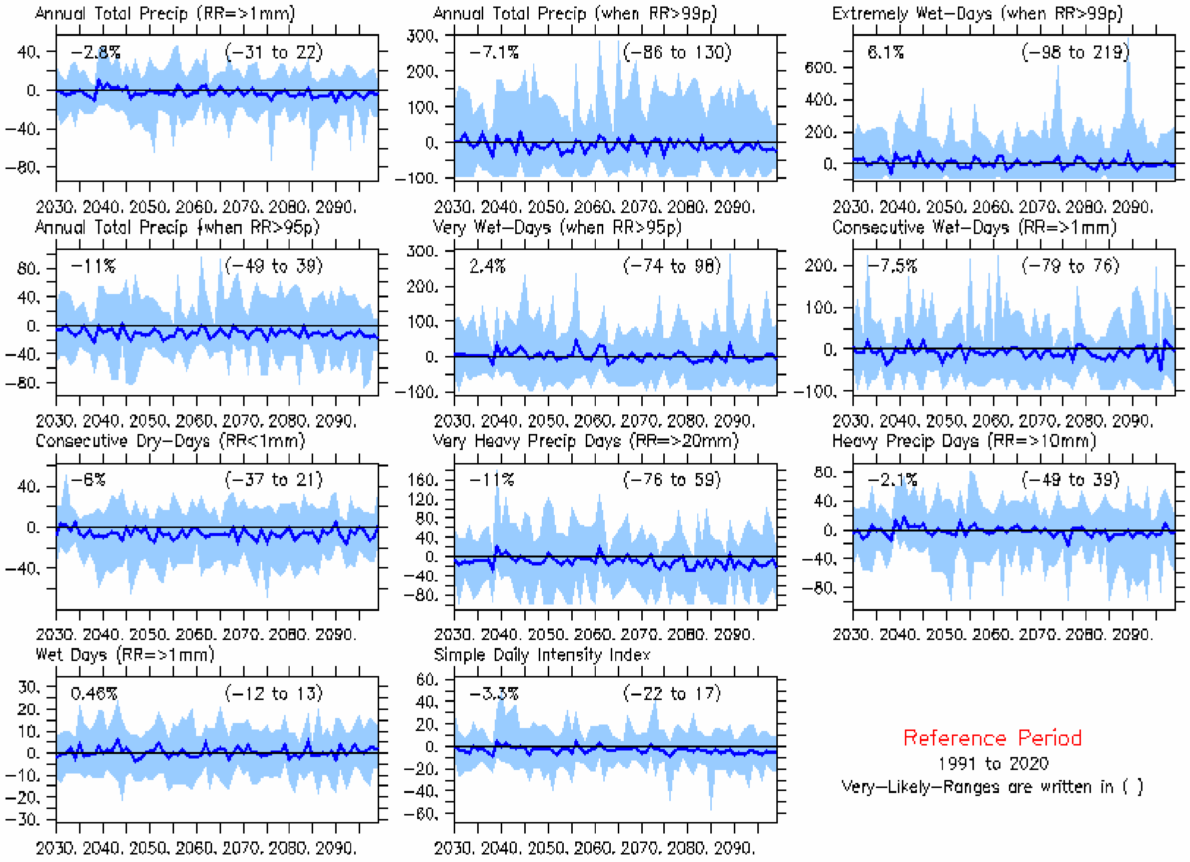

Projected Changes in Extreme Temperature Indices (RCP26)

Nigeria_ABUJA

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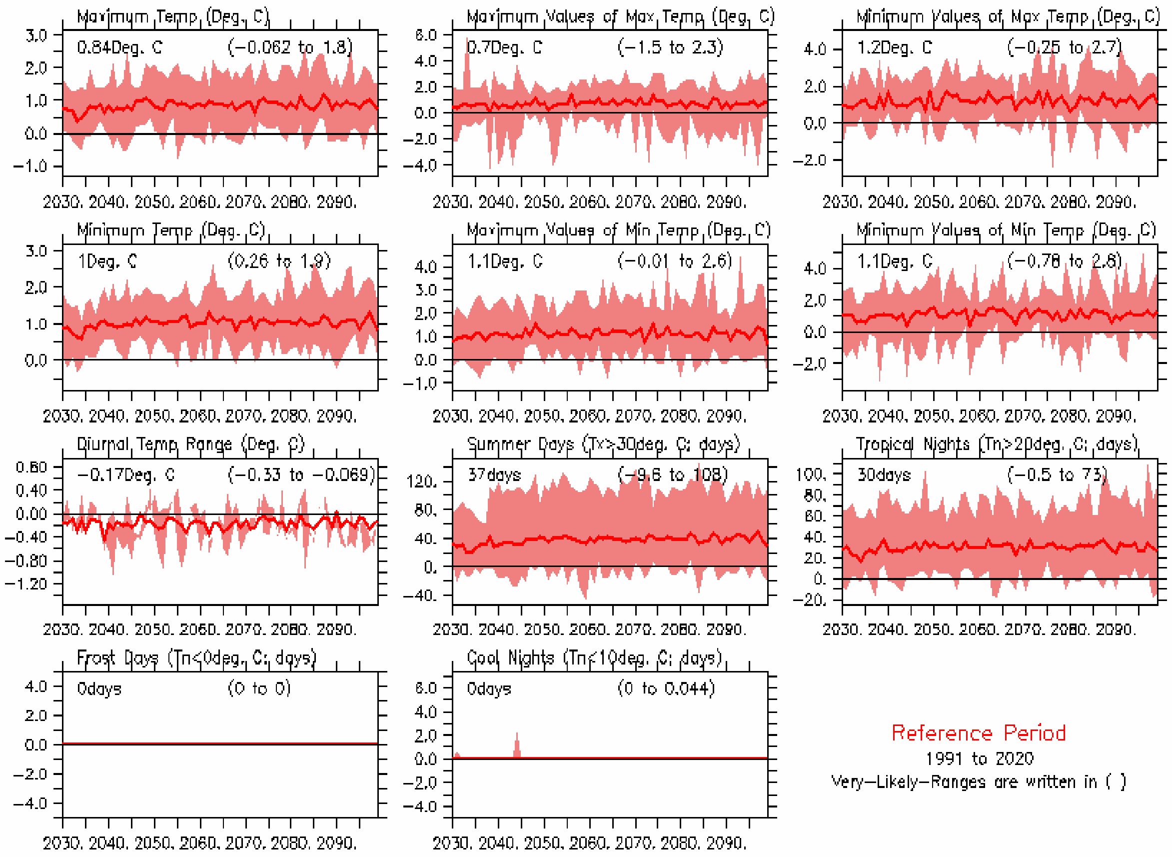

Projected Changes in Extreme Precipitation Indices (RCP45)

Nigeria_ABUJA

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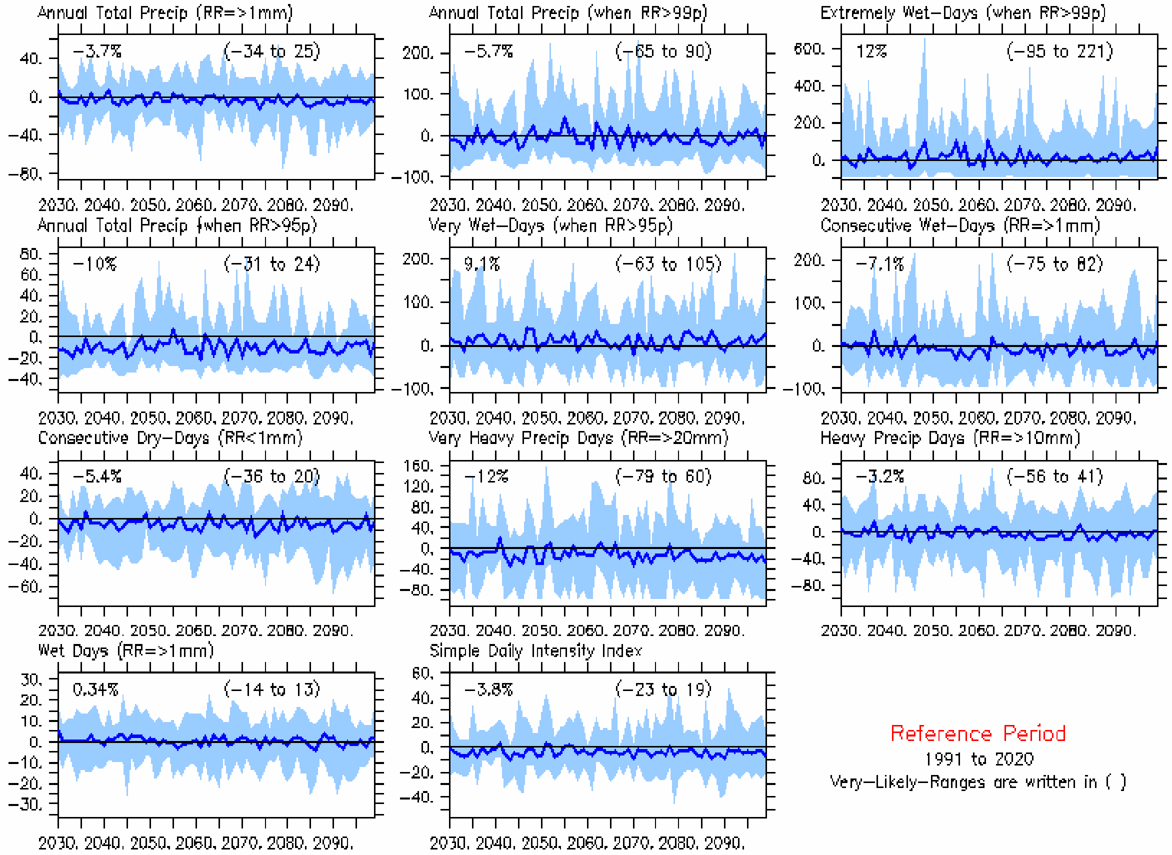

Projected Changes in Extreme Temperature Indices (RCP45)

Nigeria_ABUJA

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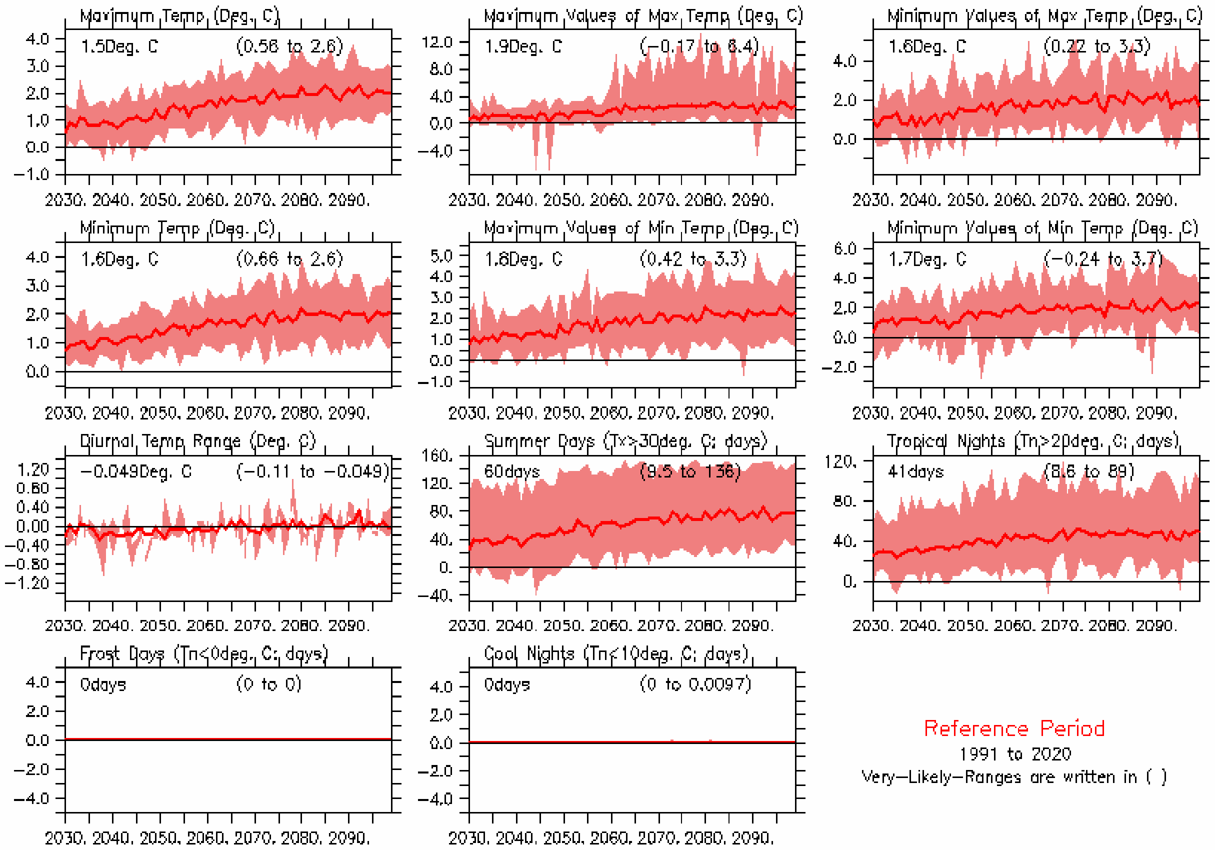

Projected Changes in Extreme Precipitation Indices (RCP60)

Nigeria_ABUJA

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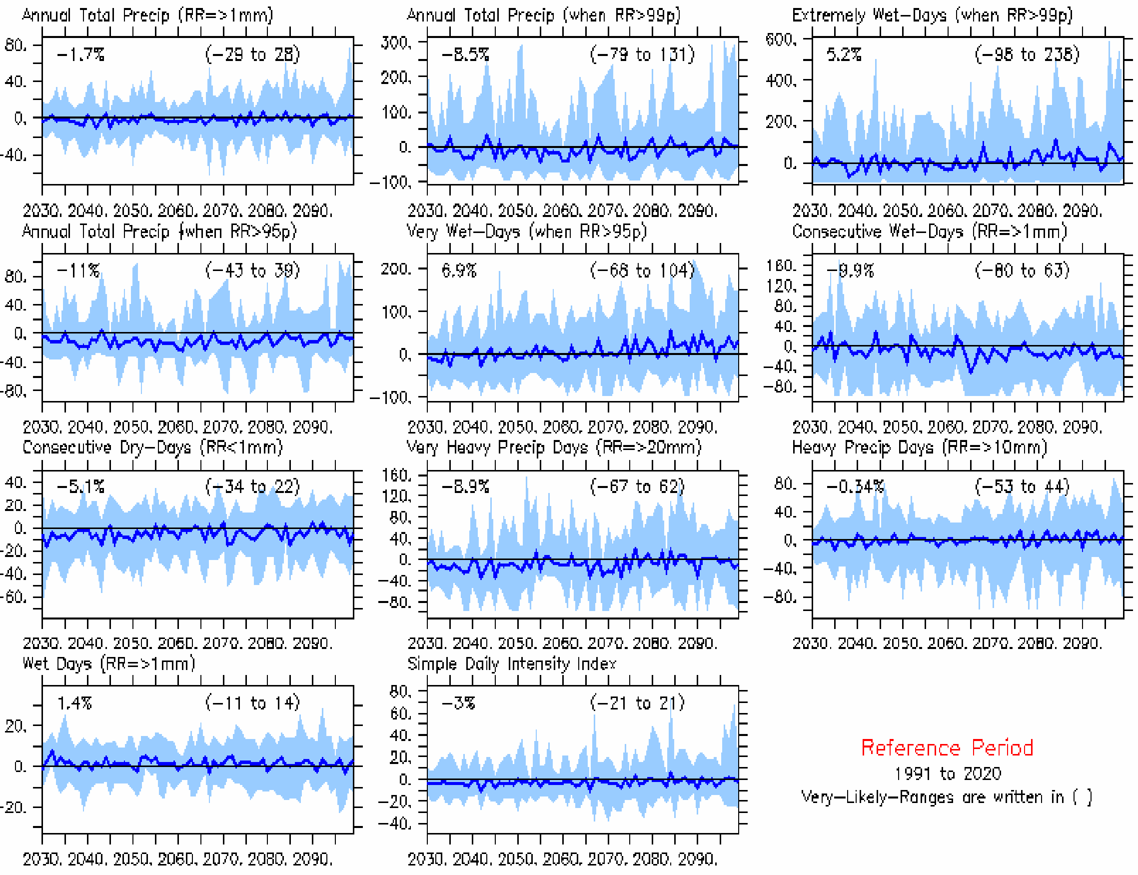
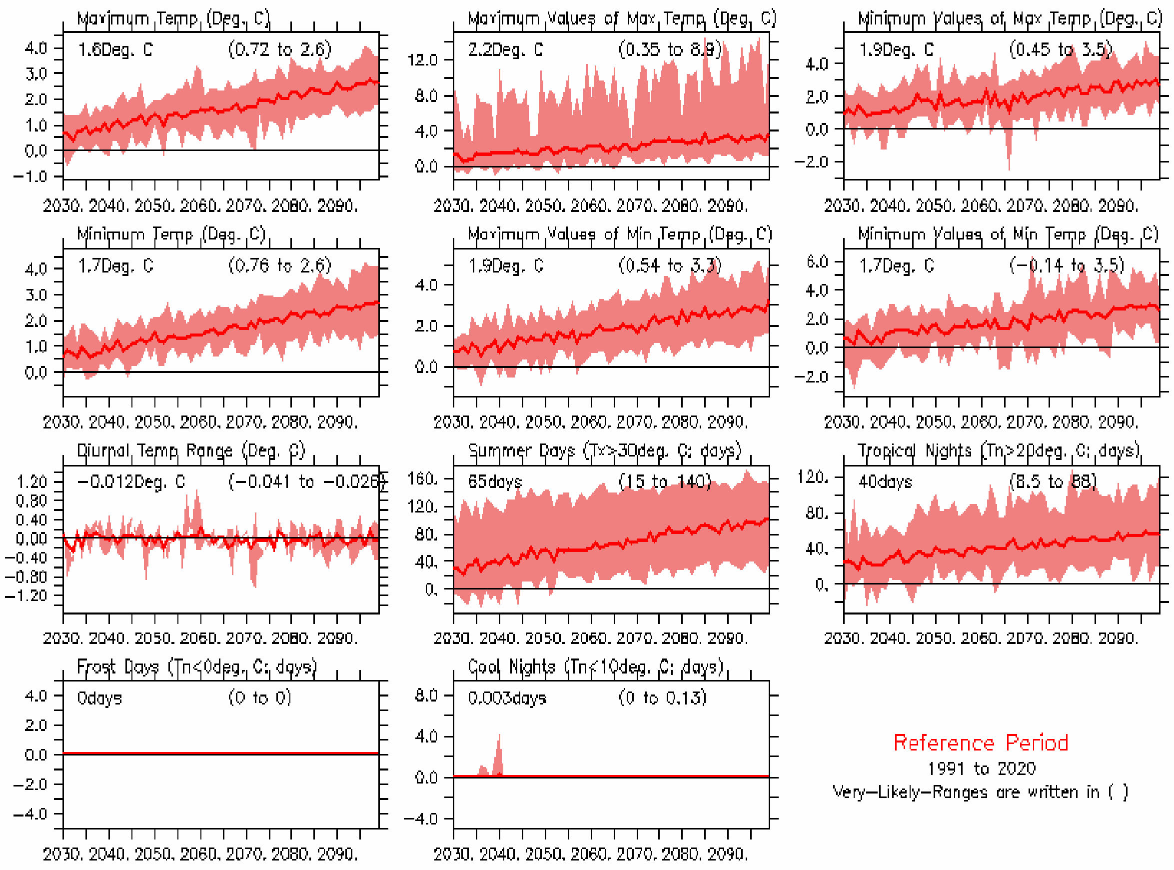


Projected Changes in Extreme Temperature Indices (RCP60)

Nigeria_ABUJA

Lon=7 : Lat=9.25



Projected Changes in Extreme Precipitation Indices (RCP85)

Nigeria_ABUJA

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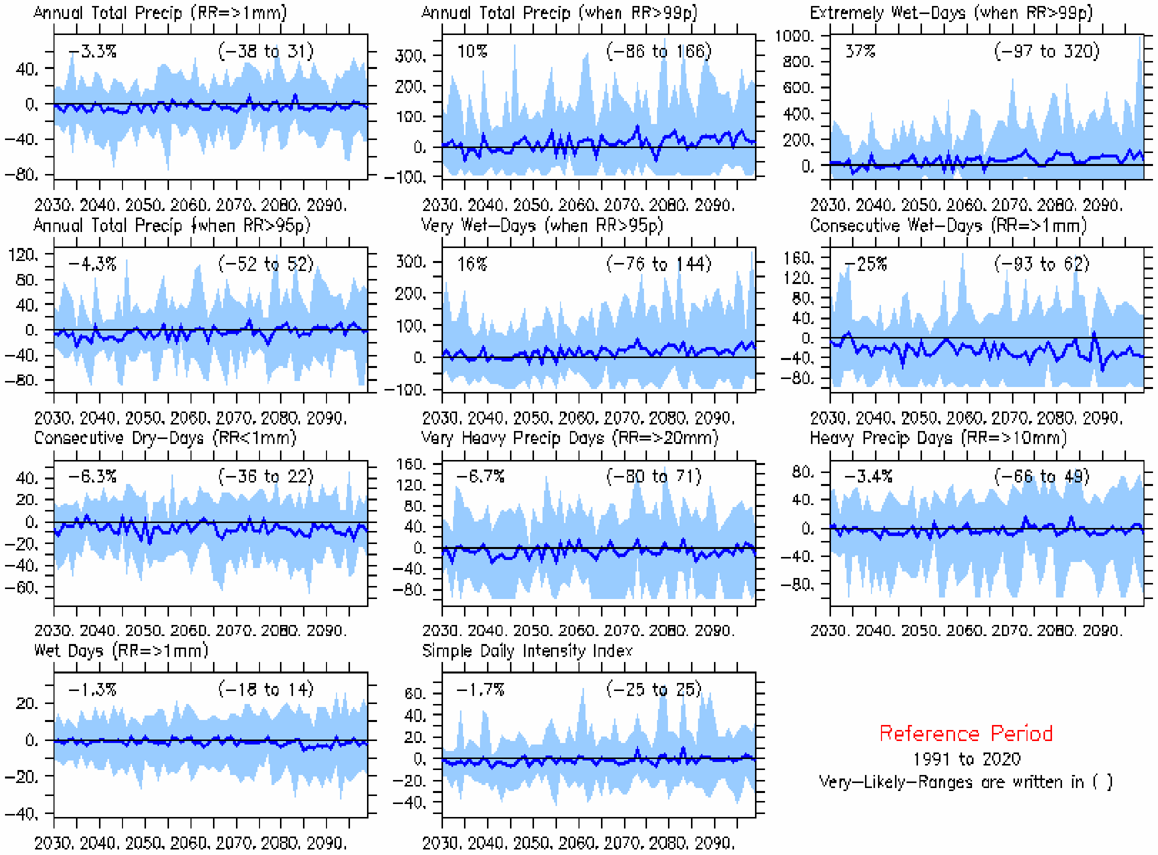
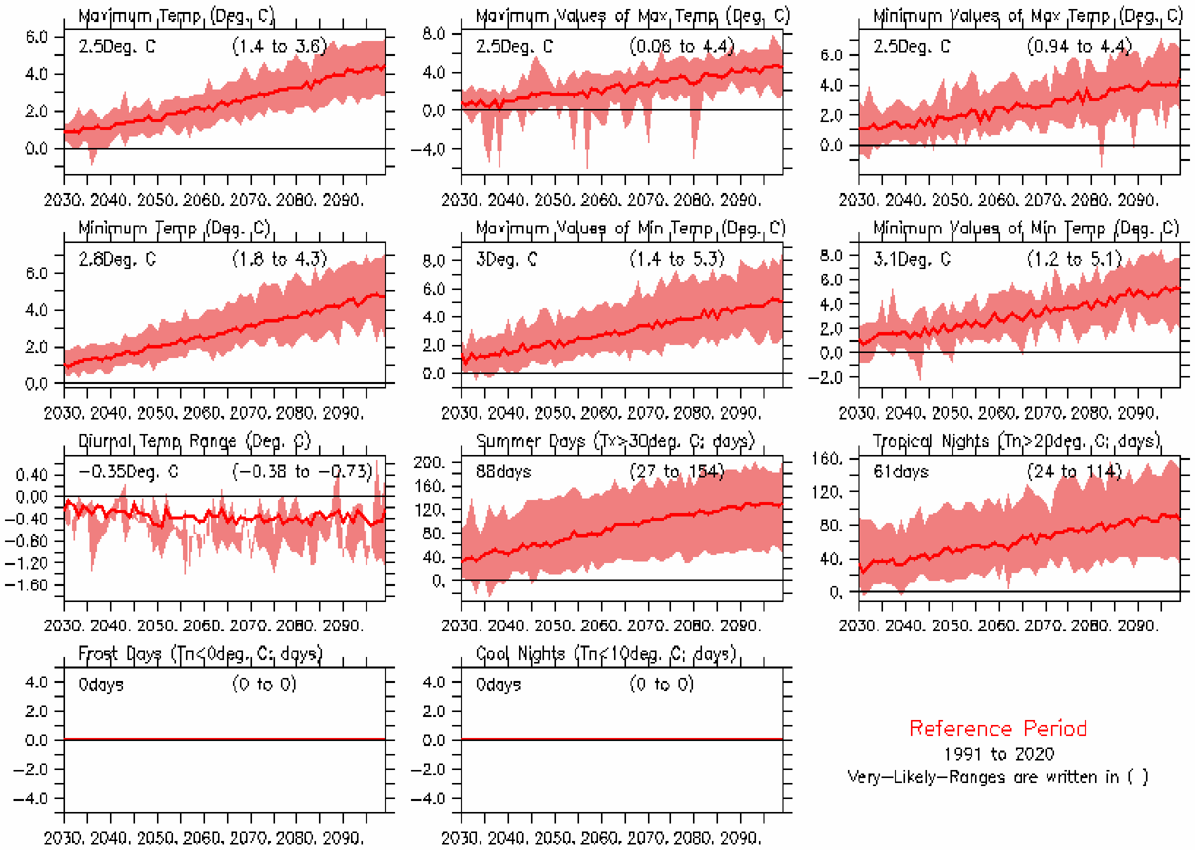


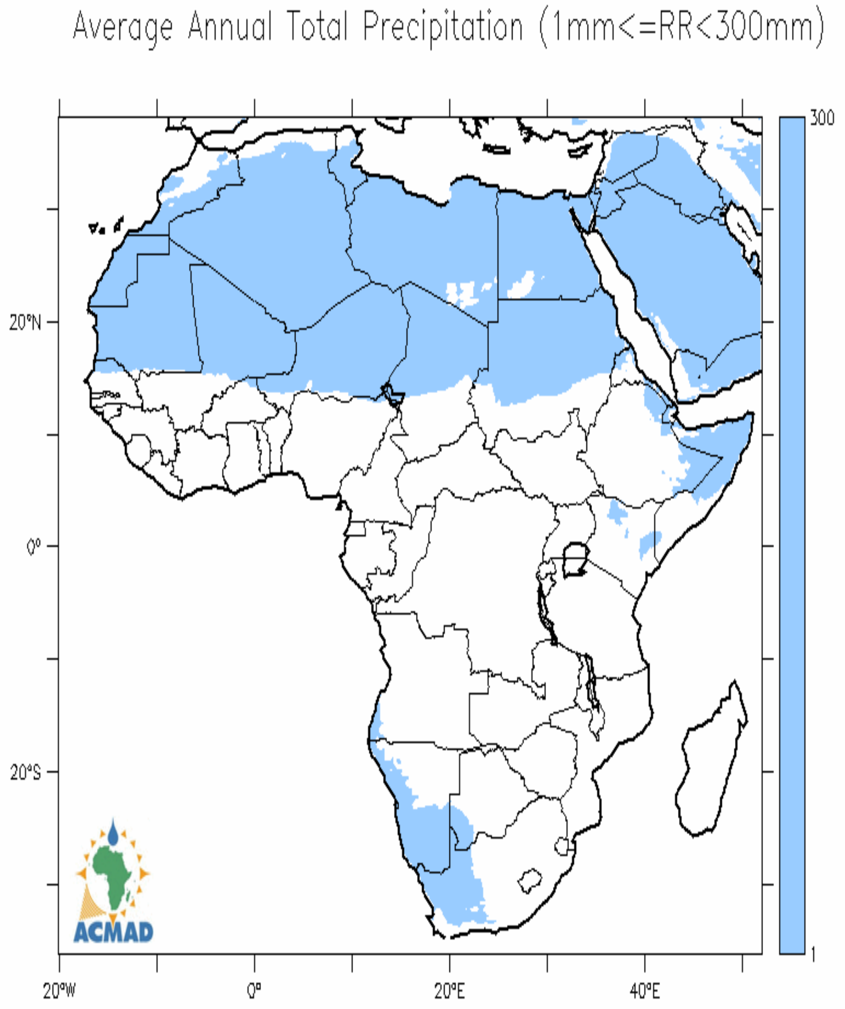
Projected Changes in Extreme Temperature Indices (RCP85)

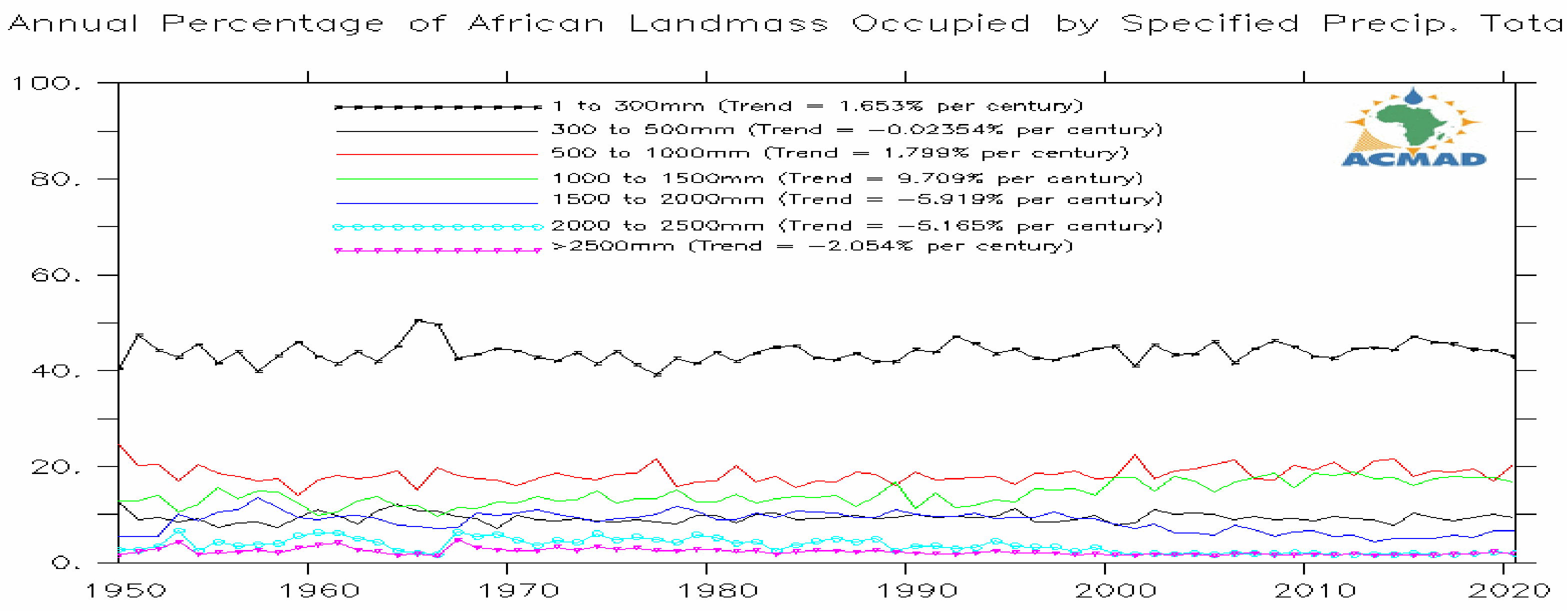
Nigeria_ABUJA

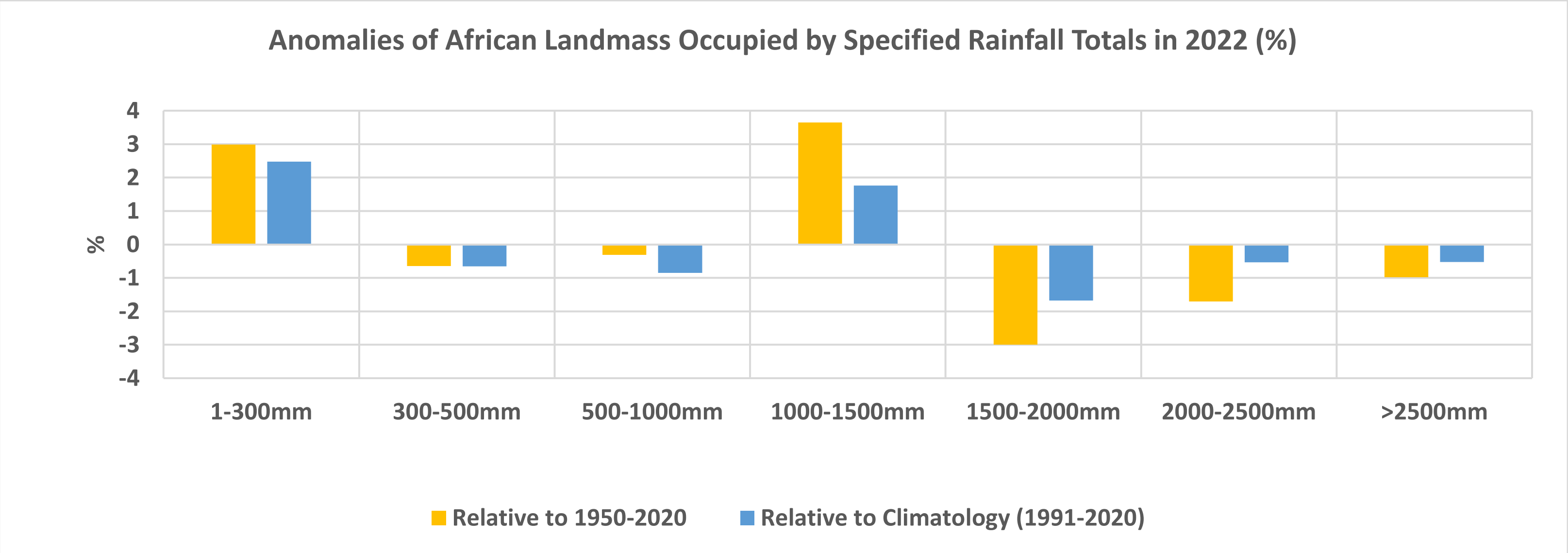
Lon=7 : Lat=9.25



Anomalies of African Landmass Occupied by Specified Rainfall Totals (and in 2022)







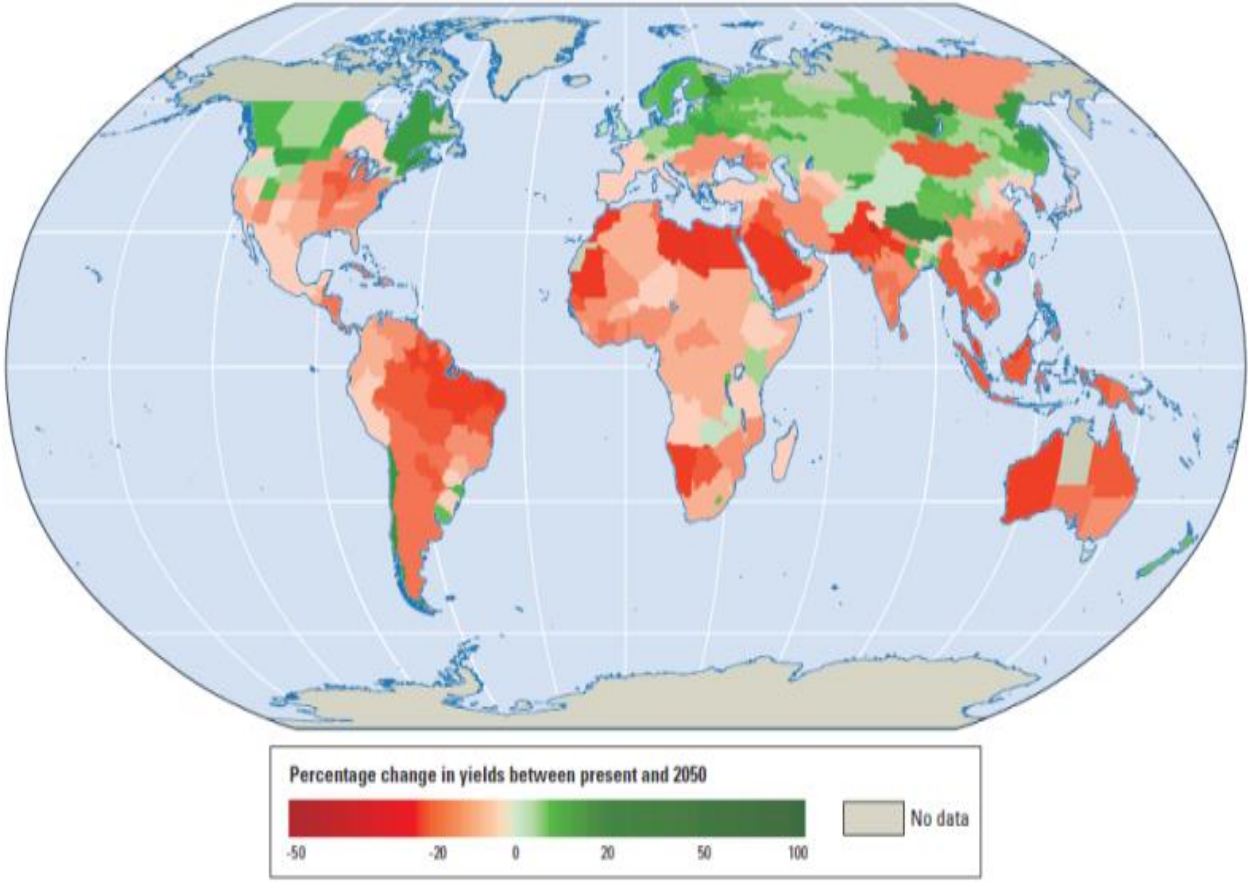
African Landmass occupied by arid zones (1mm<=RR<1500mm) are expanding while those of humid zones (RR>=1500mm) are shrinking.

In 2022 – Landmass occupied by arid zones (1mm<=RR<1500mm) expanded by almost 4% above normal while humid zones (RR>=1500mm) shrank by about 3% below normal.

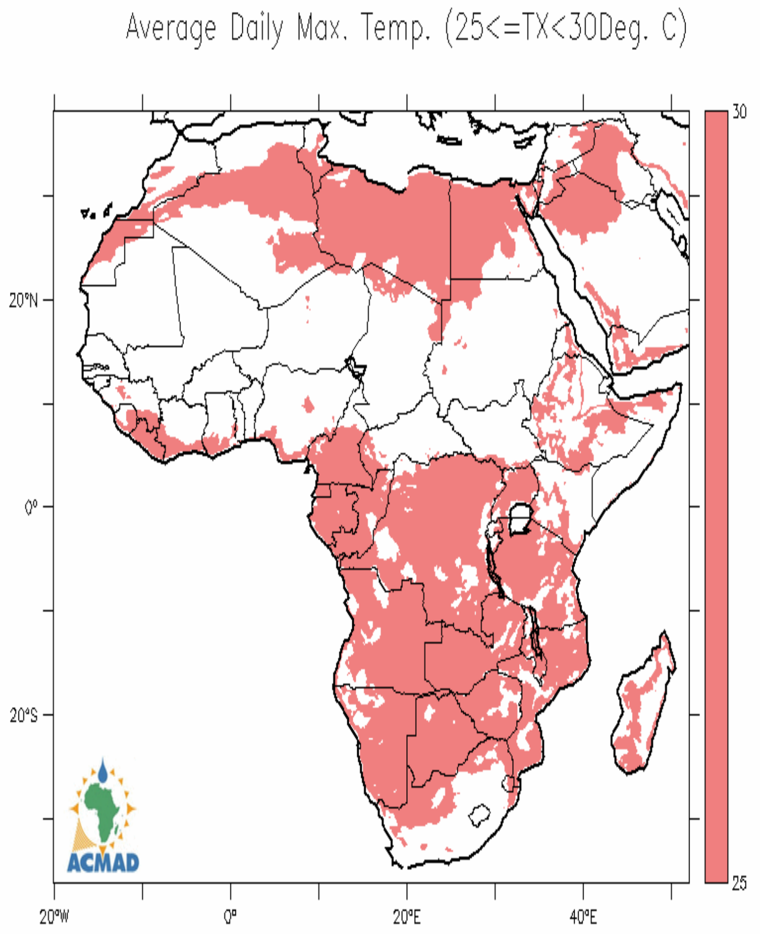
More places got lesser rainfall in 2022

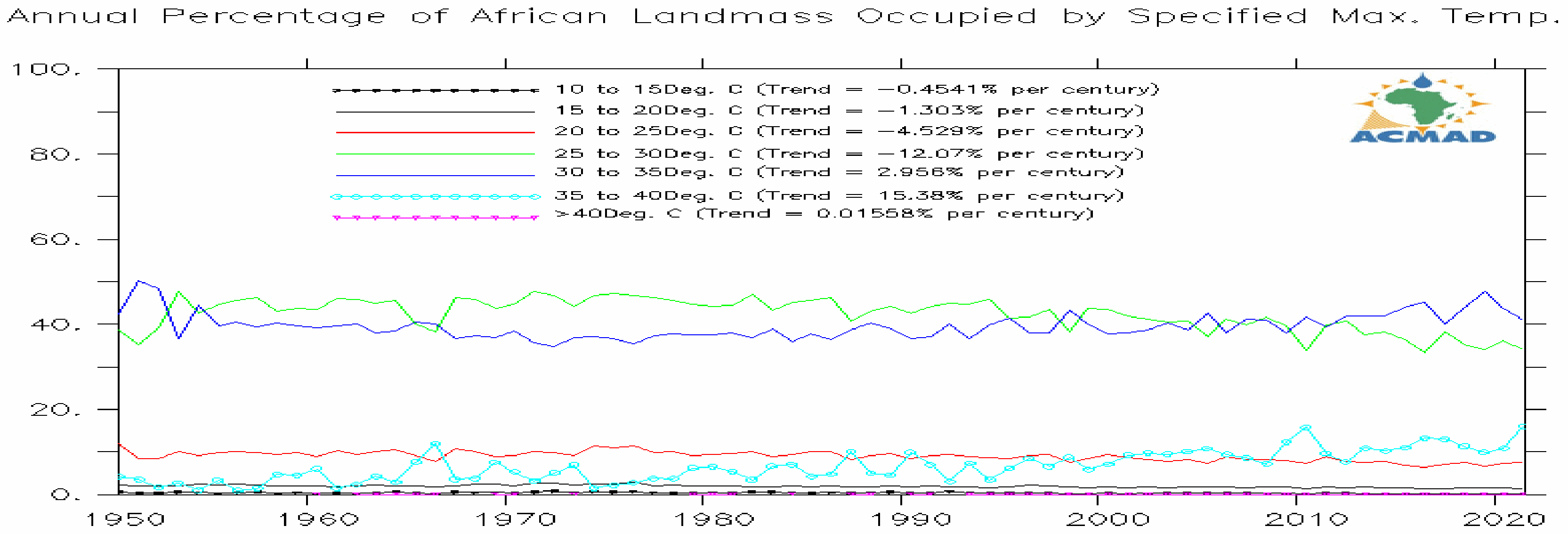
This will have great effect on our forest ecosystems and forest businesses, either positively or negatively.

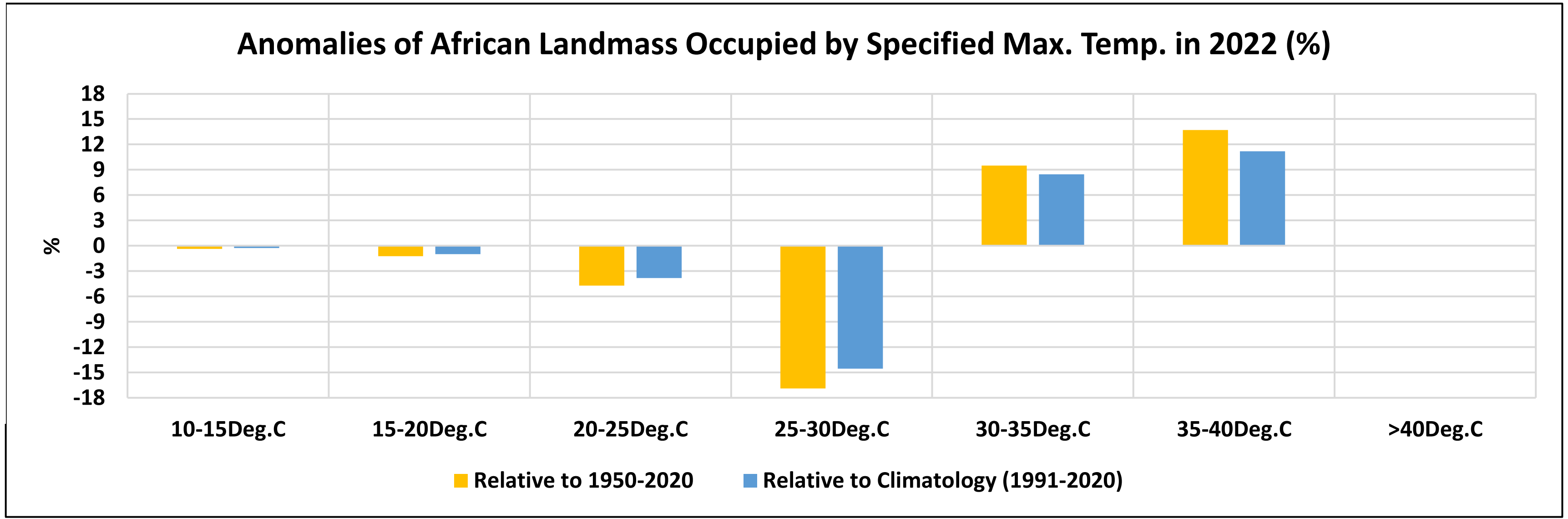
Agricultural Productivity Will Decrease in Many Regions and the Poor Will Suffer Most



Anomalies of African Landmass Occupied by Specified Max. Temp. (and in 2022)





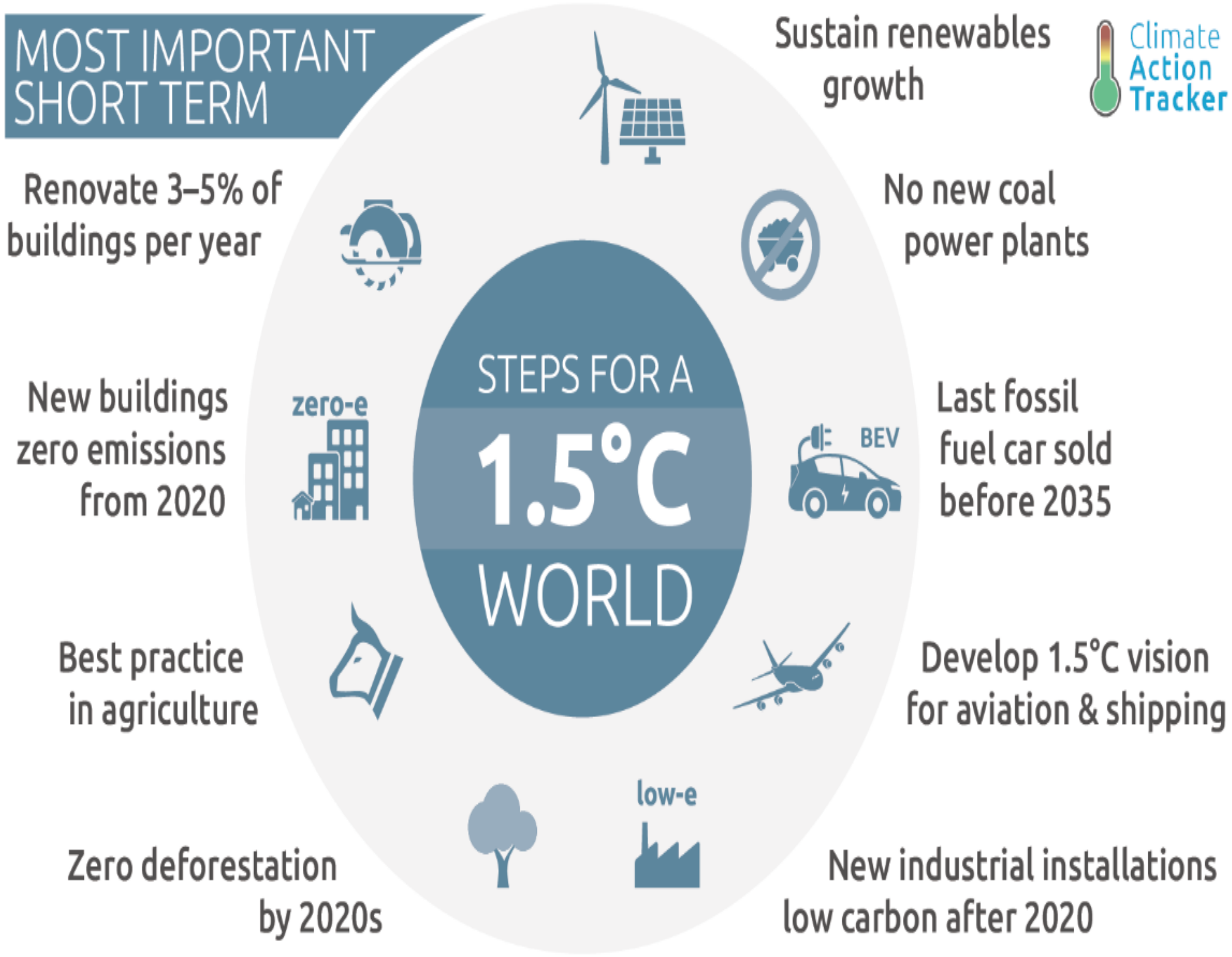


African Landmass occupied by max. temperatures >30deg.C are expanding while those of max. temperatures that are <30deg.C are shrinking.

In 2022 – Landmass occupied by max. temperatures >30deg.C expanded by 9 – 14% above normal while max. temperatures that are <30deg.C shrank by almost 16% below normal.

More places got warmer in 2022

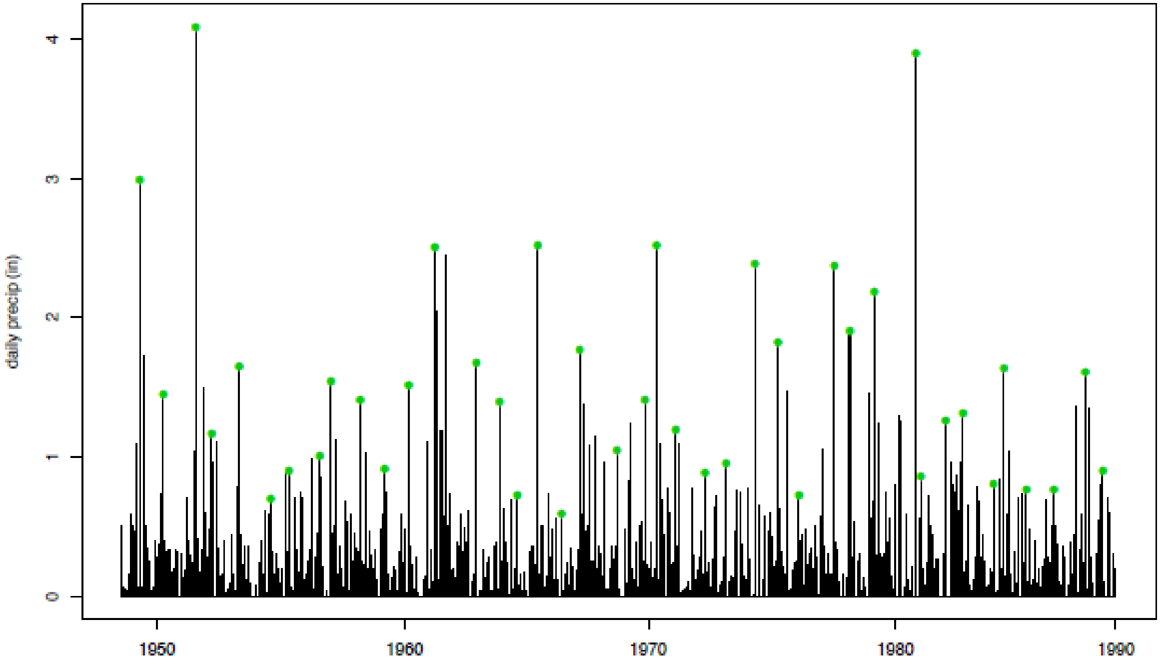
Though, more frequent and intense heatwaves will be accompanied with more heat-related health issues, e.g Meningitis, heat-stroke, etc., it will open doors for cooling and medical business outfits.

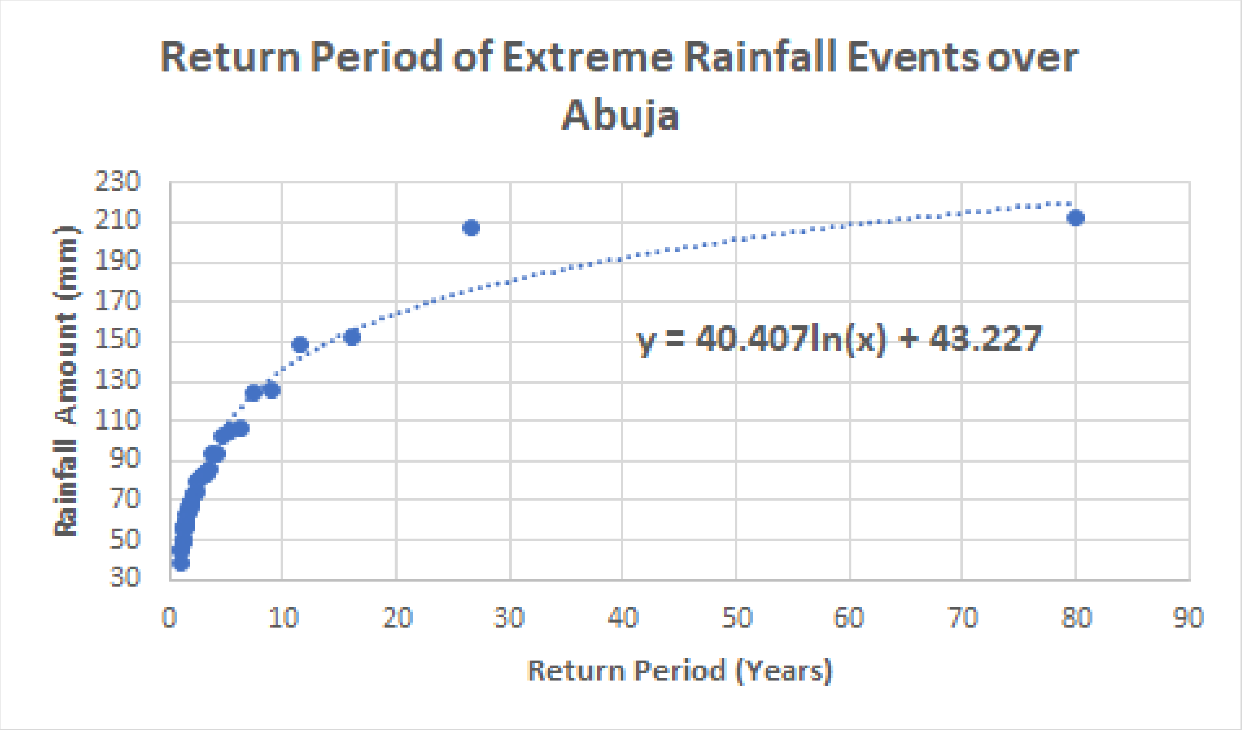


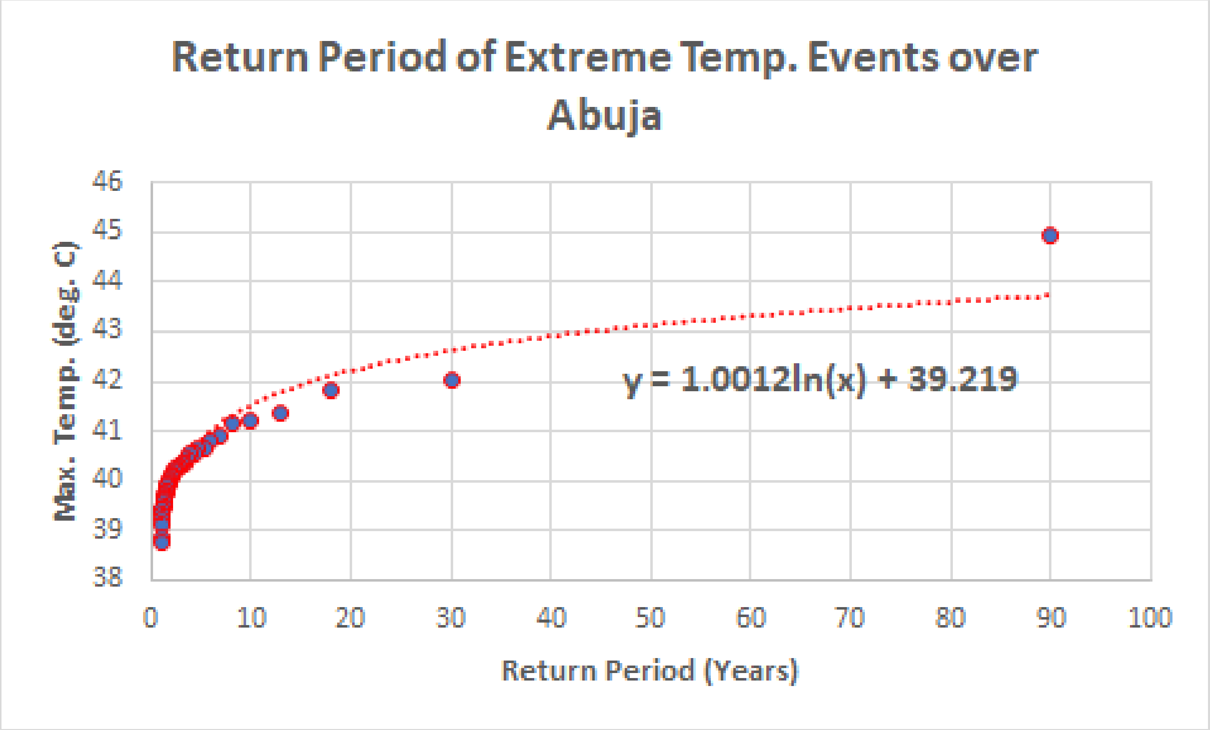
How exactly often are these extreme events likely to keep occurring?

Here, we calculate and display, graphically, the "Return Periods" - an estimated average time between events. Also known as a **recurrence interval** or **repeat interval.**

Approach used – extraction of annual maxima and fitting a model.





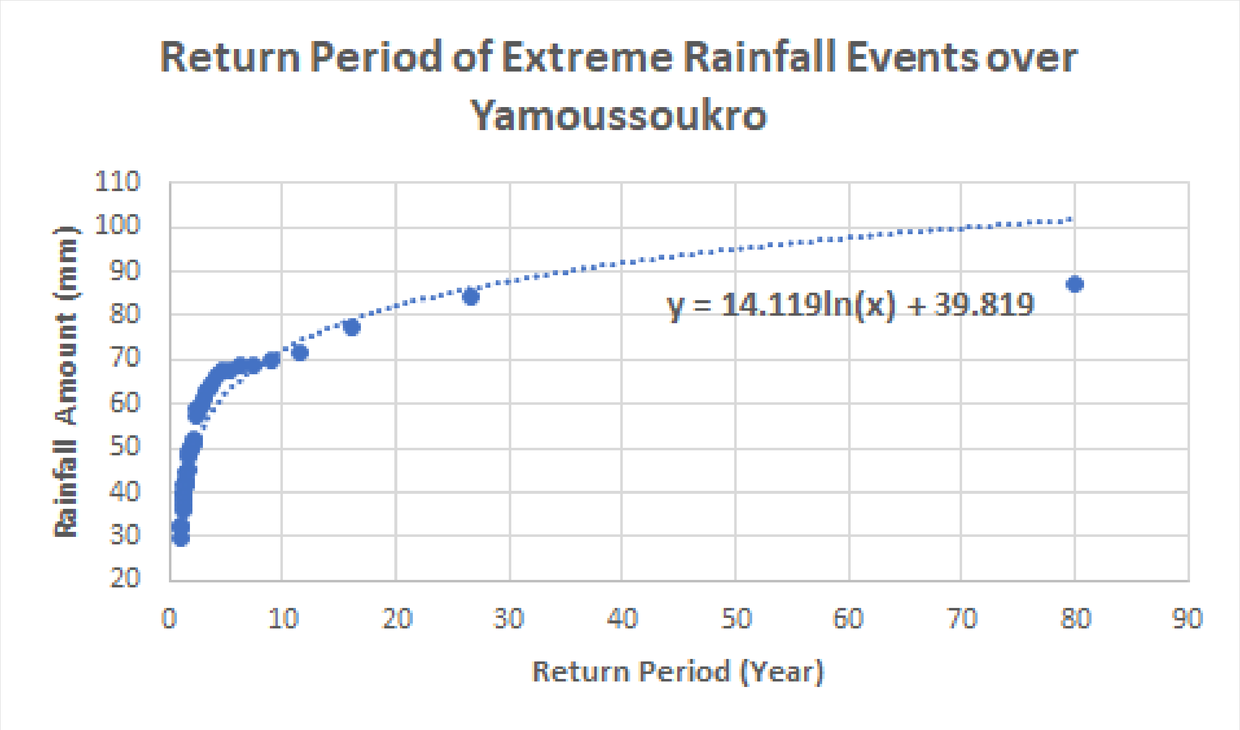


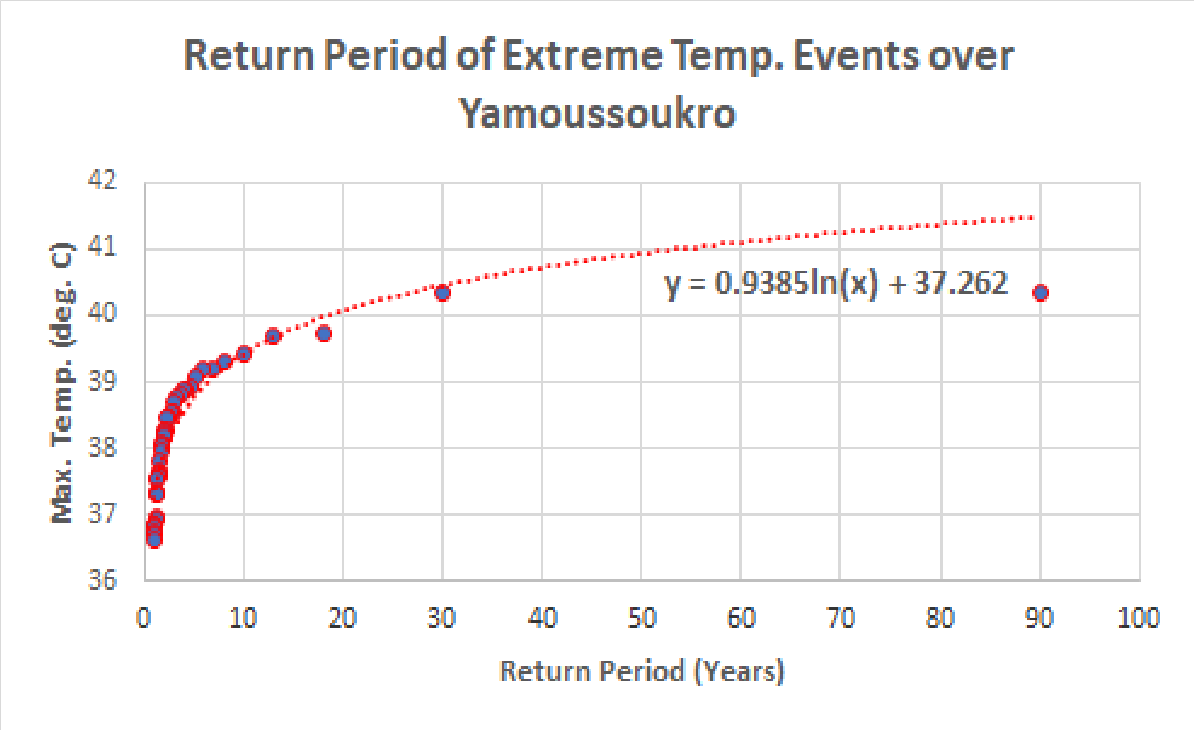
40 - 50mm daily rainfalls may likely become annual events.

50 - 130mm daily rainfalls may likely be reoccurring every 2 - 10years.

Daily temperatures of 38 – 40 deg. C are fast becoming annual events.

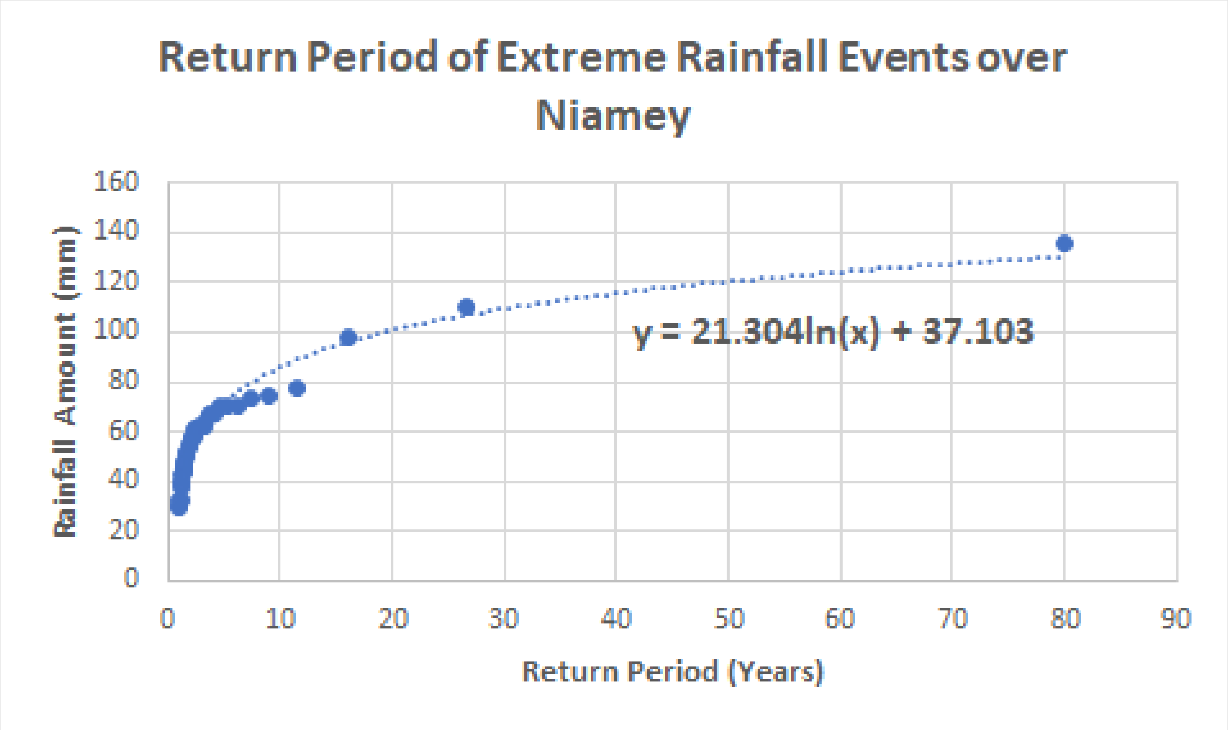
40 – 42 deg. C daily temperatures may likely be reoccurring every 3 - 30years.

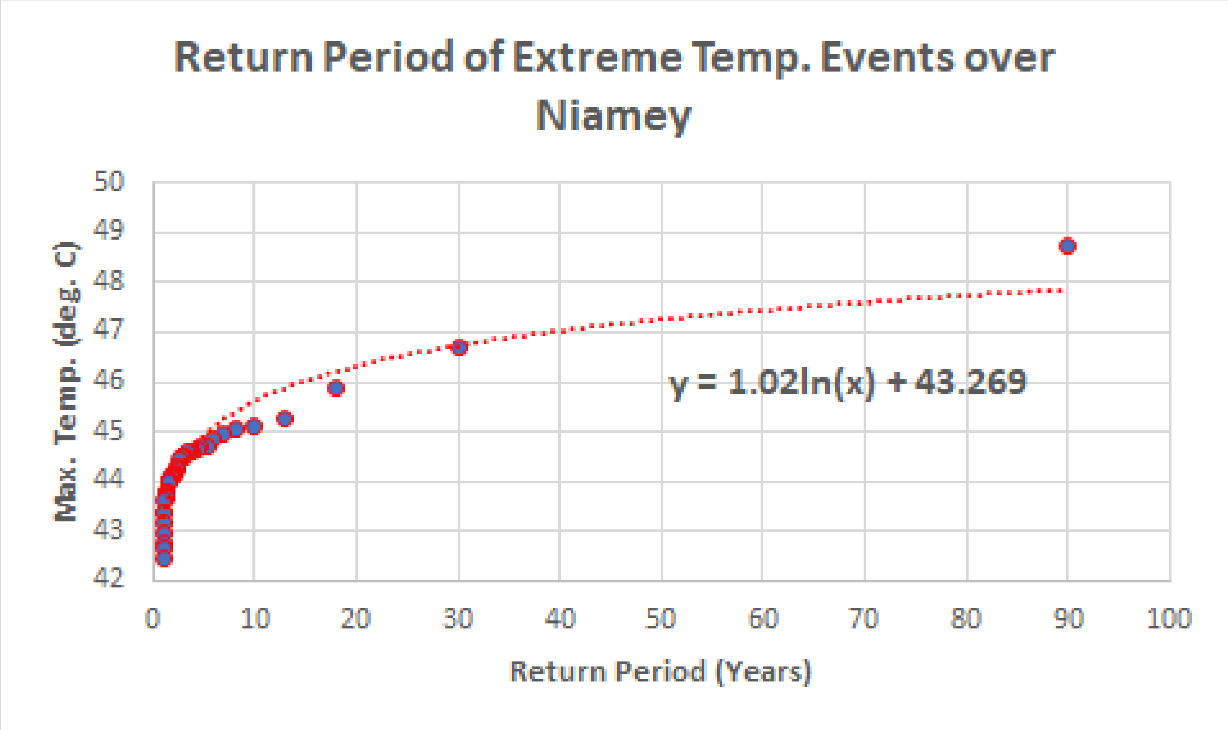




30 - 50mm daily rainfalls may likely become annual events.
60 - 80mm daily rainfalls may likely be reoccurring every 4 - 20years.

Daily temperatures of 36 – 38 deg. C are fast becoming annual events.
38 – 40 deg. C daily temperatures may likely be reoccurring every 3 - 20years.





30 - 60mm daily rainfalls may likely become annual events.

60 - 80mm daily rainfalls may likely be reoccurring every 2 - 12years.

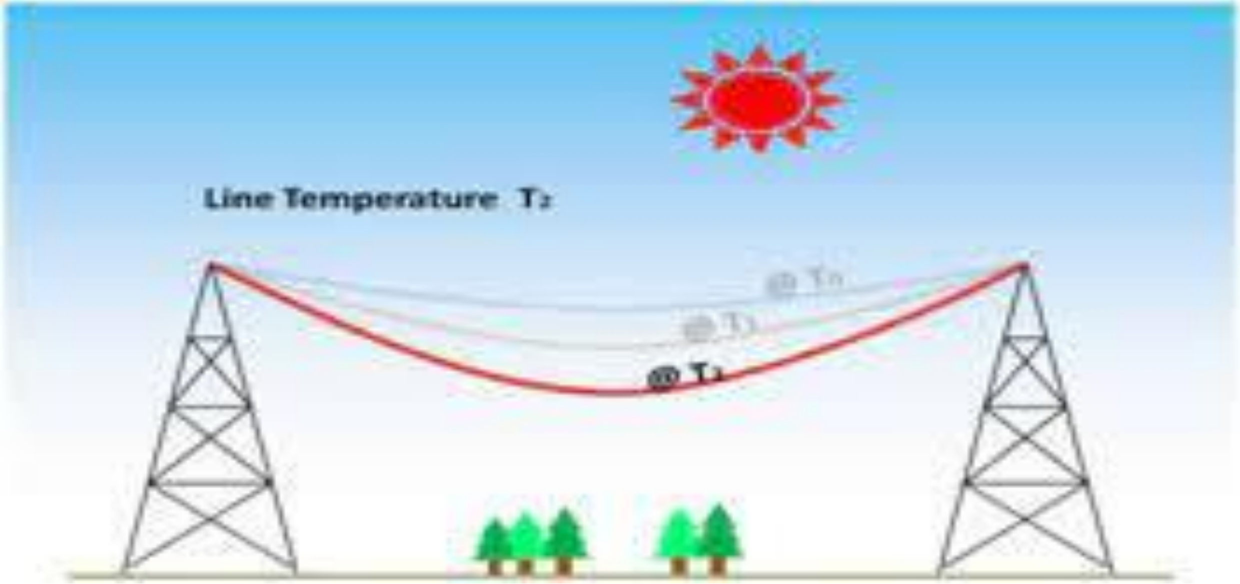
Daily temperatures of 42 – 44 deg. C are fast becoming annual events.

44 – 46 deg. C daily temperatures may likely be reoccurring every 2 - 18years.

Meteorologists are expanding the scope of climate services because the sustainability of economic development and living conditions depends on our ability to manage the risks associated with extreme events.

Likely effects of extreme temperature events on infrastructures and environments

Rail lines may buckle and bend under high temperatures (Source: BBC)



Power lines may sag under high temperatures, thereby increasing electrocution risks (Source: BBC)

Likely effects of extreme temperature events on infrastructures and environments

Asphalts / bitumen may deteriorate and melt under high temperatures (Source: Times of India)

Likely effects of extreme rainfall events on infrastructures and environments

Gwagwalada bridges in Abuja under threats of being washed away by flood in July 2020 (Source: Presenter)

Likely effects of extreme rainfall events on infrastructures and environments

A flooded village (Source: Presenter)

Likely effects of extreme rainfall events on infrastructures and environments

Stagnant water on the roof can enter into the structure through cracks and joints, ultimately damaging the structural strength (Source: Presenter)

A three-storey building about to be swallowed by gully erosion at Omabge Estate, Onitsha (Source: News Agency of Nigeria, 2011)

As Nations continue to spend more enormous resources to protect these infrastructures from extreme and hazardous climate events, businesses and ecosystems are not immuned from the adverse effects of extreme climate events.

The spatial sizes of our forests, together with their resources, are shrinking.

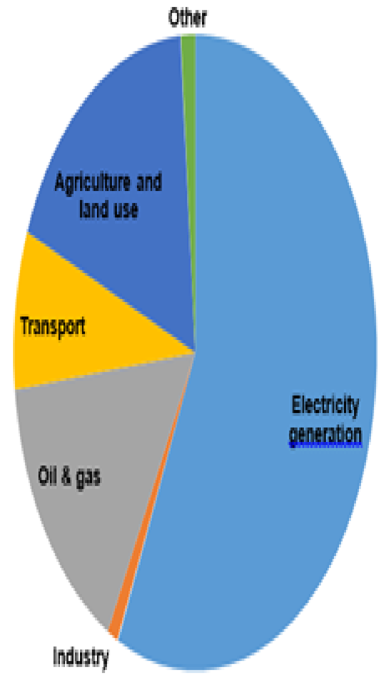
New business enterprises may spring up and the existing one may fold-up or diversify or recapitalize to expand.

Small scale entrepreneurs may not be really protected from the adverse climate related events but they also stand to gain if they heed warnings and embrace the culture of using climate forecasts to plan their businesses.

Key Mitigation Actions in Nigeria's Nationally Determined Contribution

- Work towards ending gas flaring by 2030
- Work towards Off-grid solar PV of 13GW (13,000MW)
- Efficient gas generators
- 2% per year energy efficiency (30% by 2030)
- Transportation shift from cars to buses
- Improve electricity grid
- Climate-smart agriculture and reforestation

Source of 2030 emission reductions by sector



Summary

- ✓ **Climate crisis are, in fact, becoming national security crisis in African countries (e.g. shrinking lakes and drying rivers aiding migration).**

- ✓ **Climatic effects on critical national infrastructures and ecosystems are becoming more and more negative (e.g. maintenance becomes more costly).**

- ✓ **Therefore, development of more weather and climate products are encouraged (e.g. massive capacity building, co-production and critical reasoning).**

- ✓ **We also advocate the development and use of Early Warning and Early Action for all (e.g. legal encouragement for the uptake of weather and climate products).**

Merci beaucoup

Thank You

INTRA-ACP CLIMATE SERVICES AND RELATED APPLICATIONS PROGRAMME

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