ACMAD
African Center of Meteorological Applications for Development
Centre Africain pour les Applications de la Météorologie au Développement

www.acmad.ne

Climate change and sustainable development in Africa

Climate services in Africa: Best practices and lessons learnt from ACMAD

12th June 2023

Keynote presentation

Prepared and presented by:
Andre Kamga F., ACMAD, Niamey, Niger

OUTLINE PLAN

1. *Needs for sustainable Development*
2. *Climate Services Requirements*
3. *Climate science support for Services*
4. *Practices and lessons learnt from ACMAD*
5. *Concluding remarks*

BRIEF ON ACMAD MISSION

Created trough resolution 540 of the UNECA Conference of Ministers in April 1985 following the droughts of the 70s and 80s , ACMAD is established in Niamey-Niger since October 1992

Continental Weather and Climate Watch Centre for Africa with Monitoring, *forecasting* and *early warning for* droughts, floods, tropical cyclones and other extreme events as functions .
ACMAD is a WMO designated RCC since Congress in May 2015 and a Continental MultiHazards Advisory Centre since October 2022

Institution of excellence for the Applications of meteorology for sustainable development with capacity building, methods, tools and products development, contribution to global weather and climate programs, promotion of database , research and innovation as functions

Needs for Sustainable Development

- climate change increases the frequency and intensity of extreme weather events and **Early warning for key sectors for development in Africa is a priority (AMHEWAS, UN and partners Early warning for all, G7, CREWS, REAP, SOFF, ClimSA…)**

- **Socio-economic growth(for sector agriculture, infrastructure, education and health, security and peace)**

- **Reduction in Extreme poverty and hunger (food security)**

- **Environmental protection (i.e pollution control, GHG mitigation, ecosystem preservation and conservation)**
- **Users**

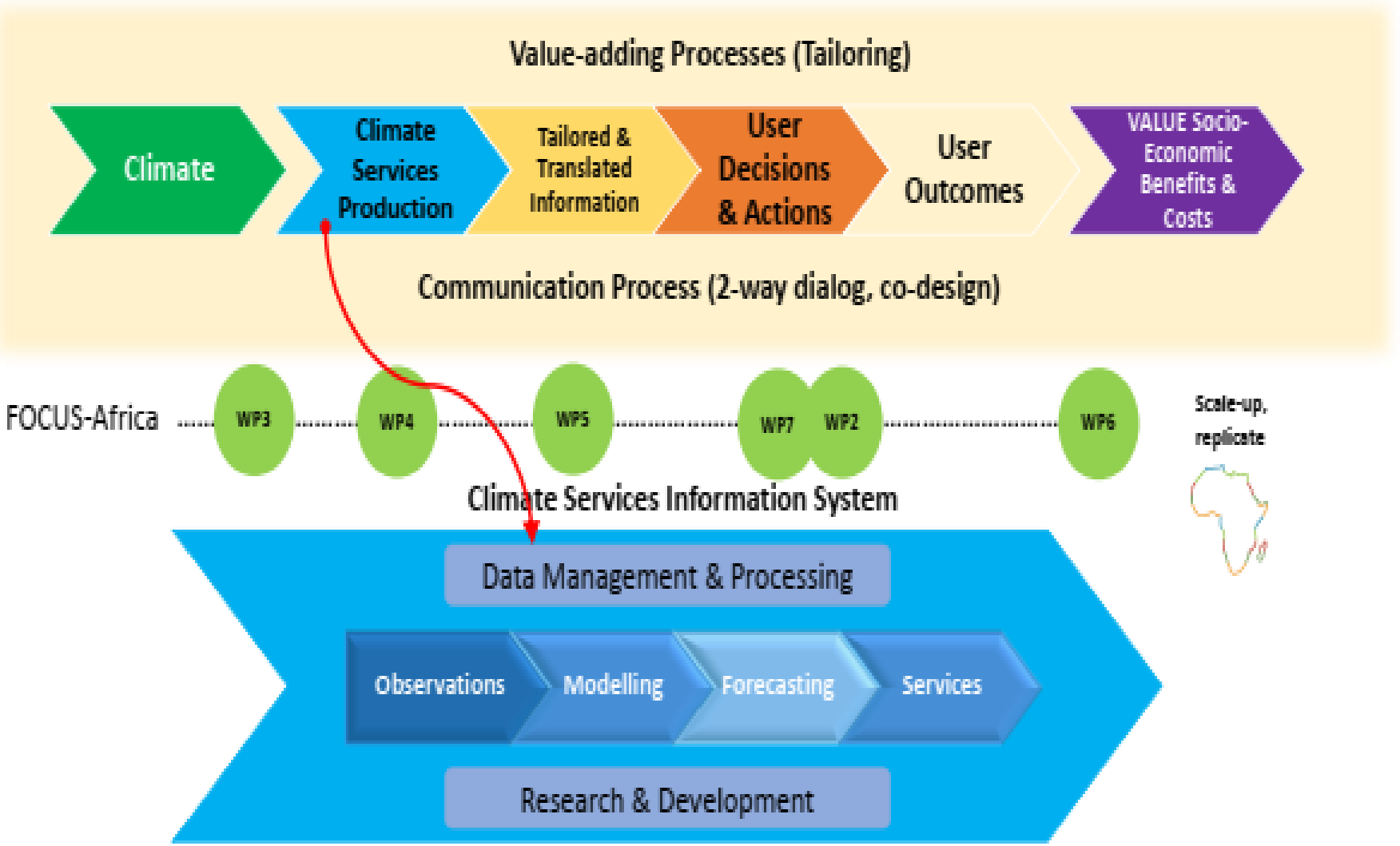
- **Experts in meteorology,**
- **Experts from impacted sectors ,**
- **Decision and policy makers are key levels of users**

MOVE FROM CONVENTIONAL TO EMERGING APPROACHES TO ACCELERATE DEVELOPMENT OUTCOMES AND IMPACTS

Towards new approach

Conventional Approach	Emerging Approach
Focus on the NMHS system / the public sector	Focus on national hydromet value chain - Public, Private and Academic Sectors as well as NGOs/CSOs
Modernization of infrastructure Institutional Strengthening Service Delivery	**Service Delivery by integrating with sectoral solutions** Institutional Strengthening Fit-for-purpose infrastructure Development
Predominantly national projects	National projects + regional approach

Climate Services Requirements: The Value Chain



Climate Services Requirements for early warning

- **Hazards intensity, frequency and location scenarios analyses for impact assessment, risk profiling, resilience and adaptation planning**
- **Hazards observations, monitoring, understanding and modeling, prediction, forecasting**
- **Hazards outlooks, advisories, vigilance, watches and warnings for communication and emergency preparation and response**

Ministero degli Affari Esteri e della Cooperazione Internazionale

ITALIAN AGENCY FOR DEVELOPMENT COOPERATION

UNDRR UN Office for Disaster Risk Reduction

cima RESEARCH FOUNDATION

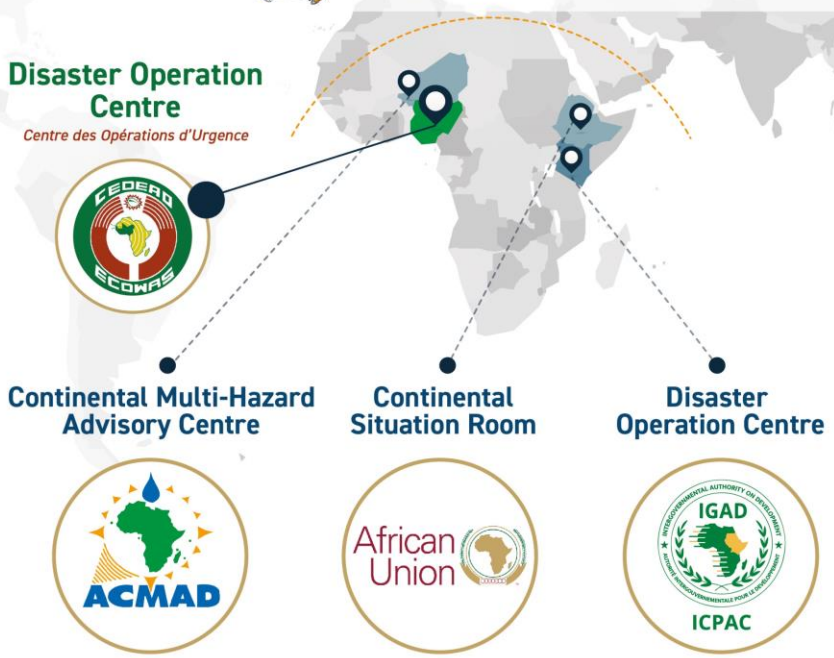
AMHEWAS

Africa **M**ulti-**H**azard **E**arly **W**arning and **A**ction **S**ystem for Disaster Risk Reduction

THE SITUATION ROOMS
LES SALLES DE SITUATION

myDEWETRA

Disaster Operation Centre
Centre des Opérations d'Urgence
ECOWAS



#EarlyWarning4All

GO TO WEBSITE!

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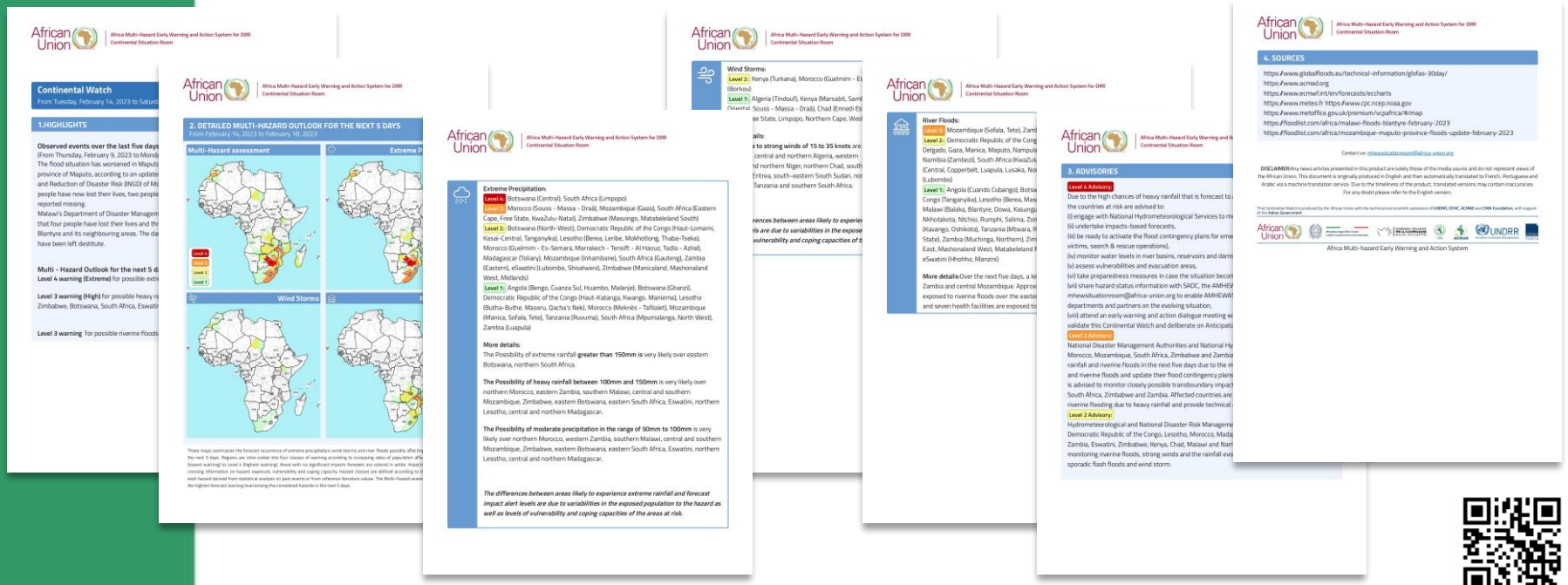
myDEWETRA world

CONTINENTAL WATCH



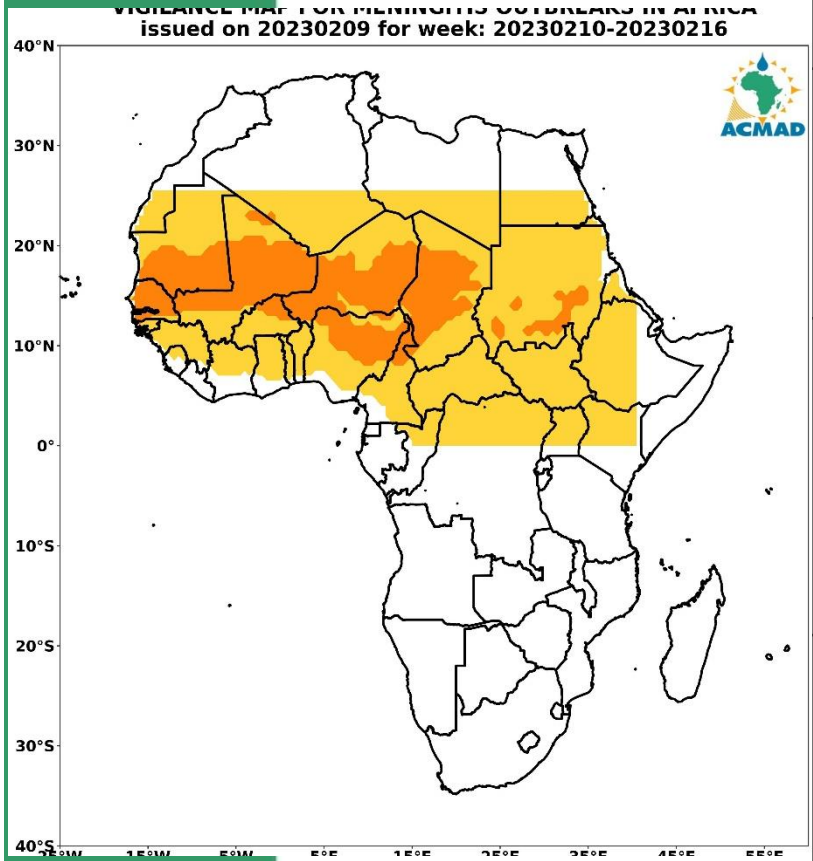
#EarlyWarning4All

GO TO WEBSITE!

IMPACT FORECASTING AND MEASURES FOR MENINGITIS DISEASE CONTROL BY WHO IN AFRICA WITH WMO GLOBAL MEDIUM RANGE DETERMINSTIC AND S2S PRODUCTS CENTRES

Valid From 10 to 16 February 2023

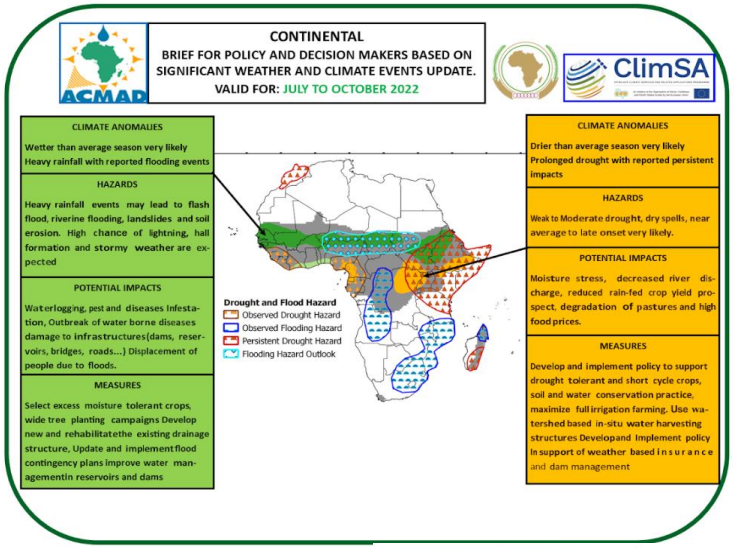
HIGHLIGHT: Meningitis cases likely in Mauritania, Senegal, Mali, Algeria, Niger, Burkina Faso, Nigeria, Cameroon and Sudan.

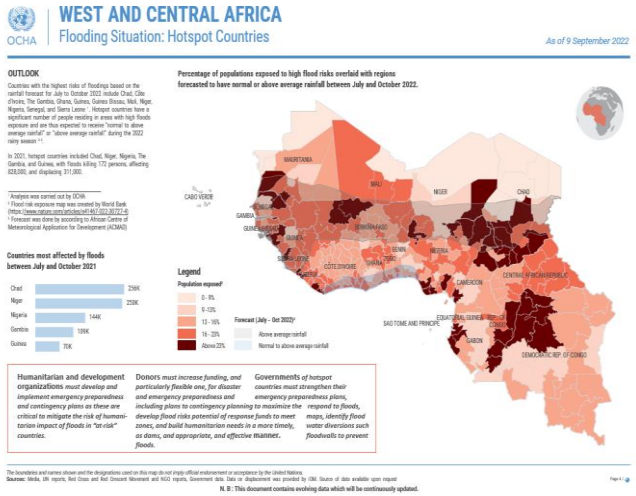


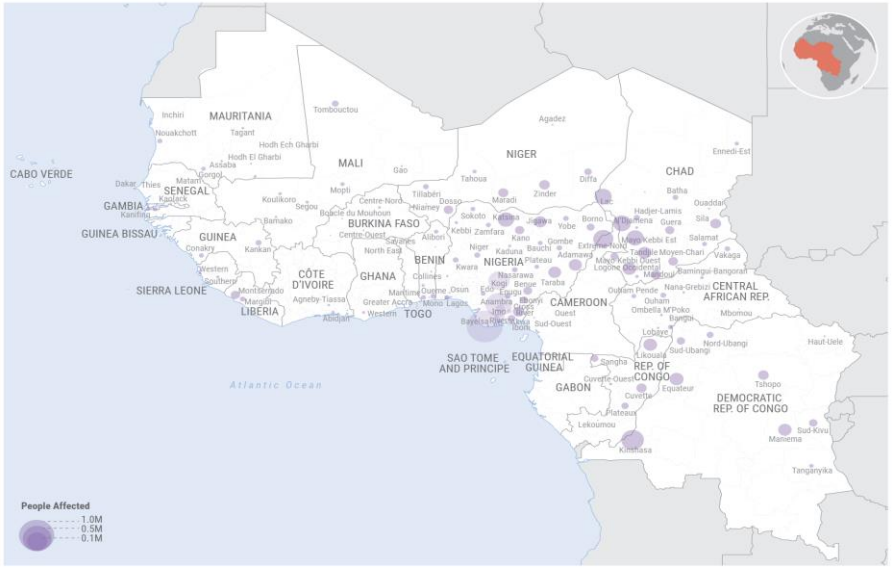
	Phenomenon	Hazard	Potentials Impacts	Advisory / Measures
	- Dust concentration below 150µg/m^3 - Relative humidity above 40% - Temperature below 27°C	Emergence of Meningitis cases not likely	Potential pressure on the health system	Routine surveillance systems at regional and national levels
	- Dust concentration between 150 to 400µg/m3 - Relative humidity between 20 & 40% - Temperature above 27°C	Emergence of Meningitis cases very likely	Loss of life, pressure on the health system	Activation of surveillance systems at regional and national levels
	- Dust Concentration at least 400µg/m3 and above - Relative humidity less than 20% - Temperature above 30°C	Emergence of Meningitis cases very likely and epidemic status possible	Loss of life, increased pressure on the health system	Strengthen and increase meningitis surveillance systems at both regional and national levels

IMPACT BASED FORECASTING AND VERIFICATION FOR SUMMER 2022

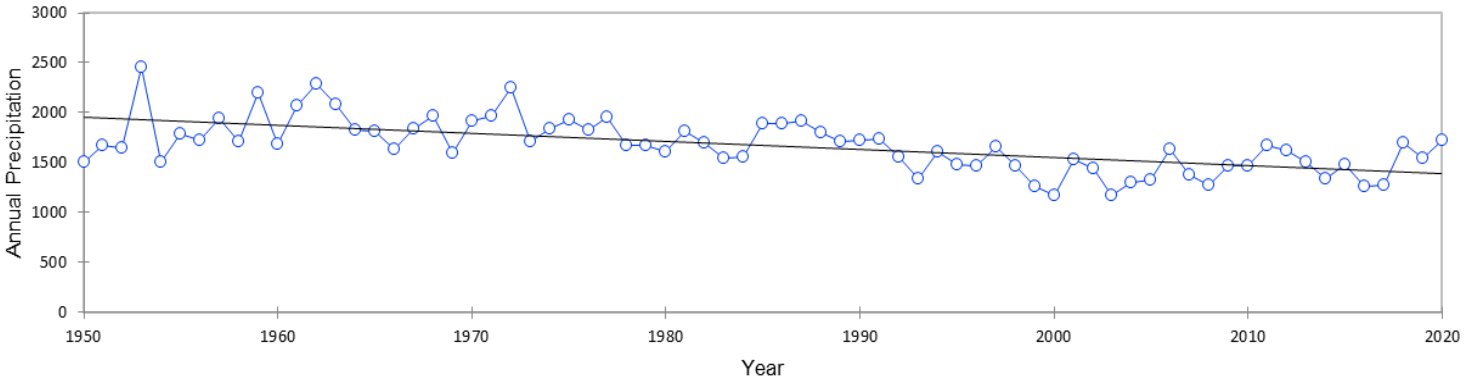
PEOPLE AFFECTED BY 2022 FLOODS



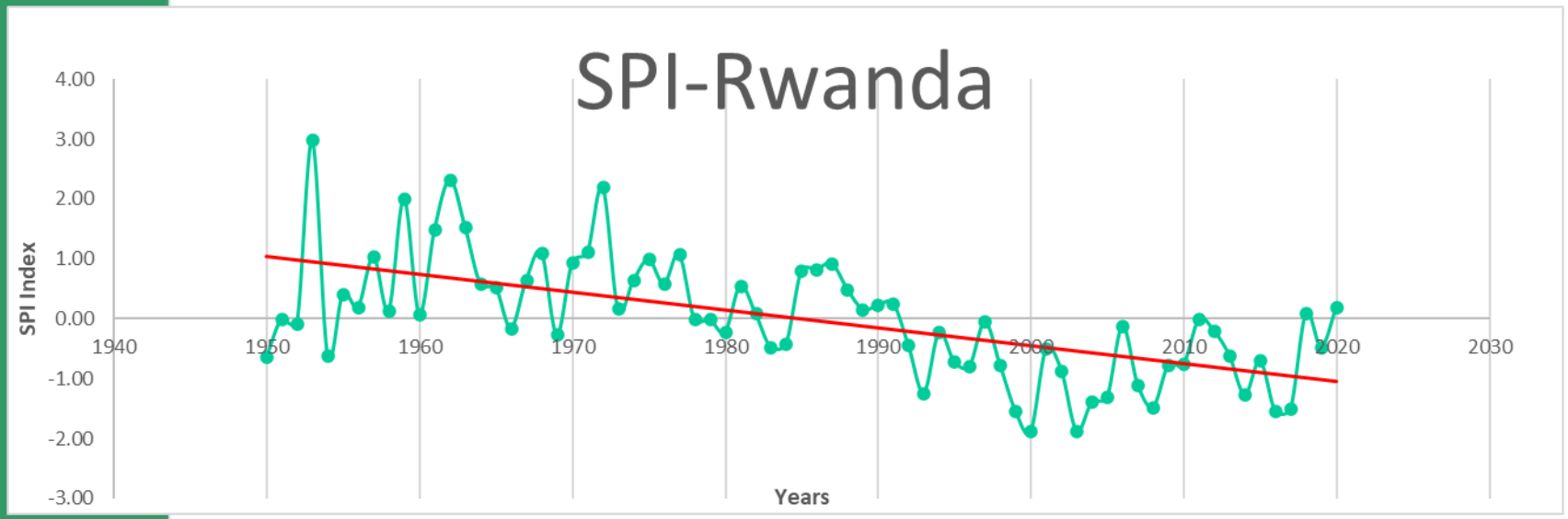




Annual Precipitation-Rwanda

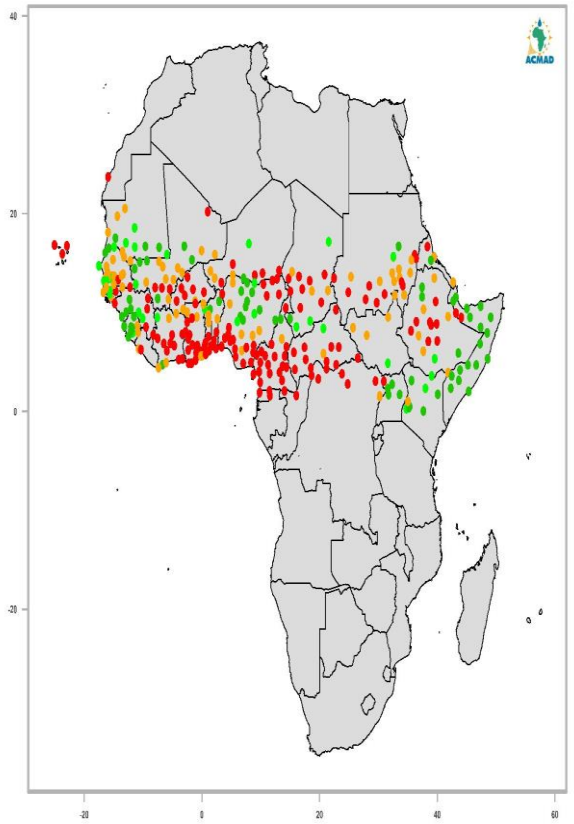


Drought monitoring Service with more actionable indicator

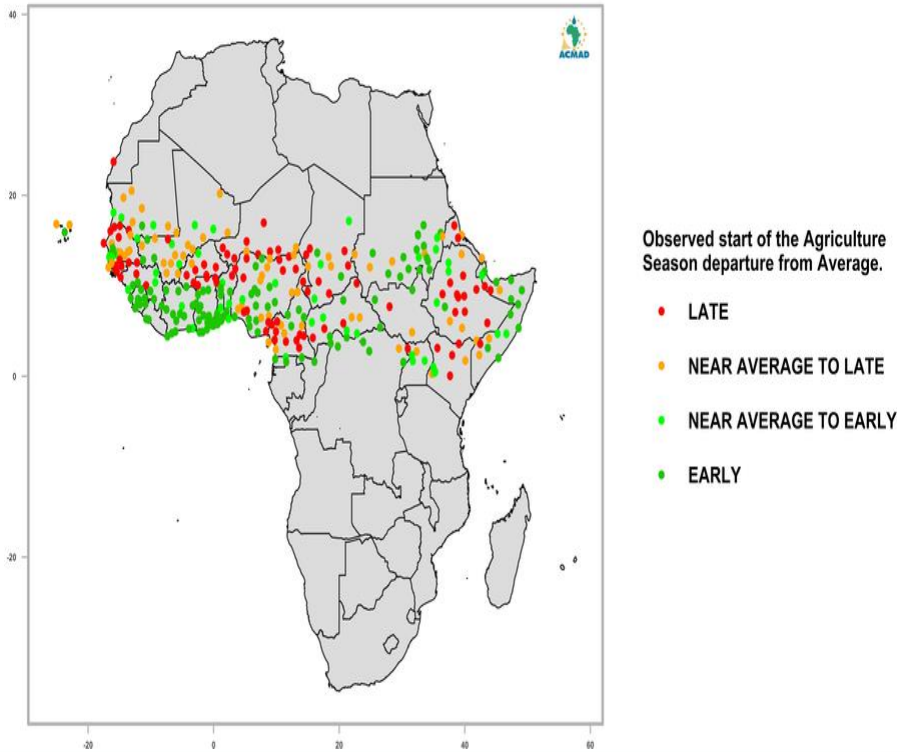


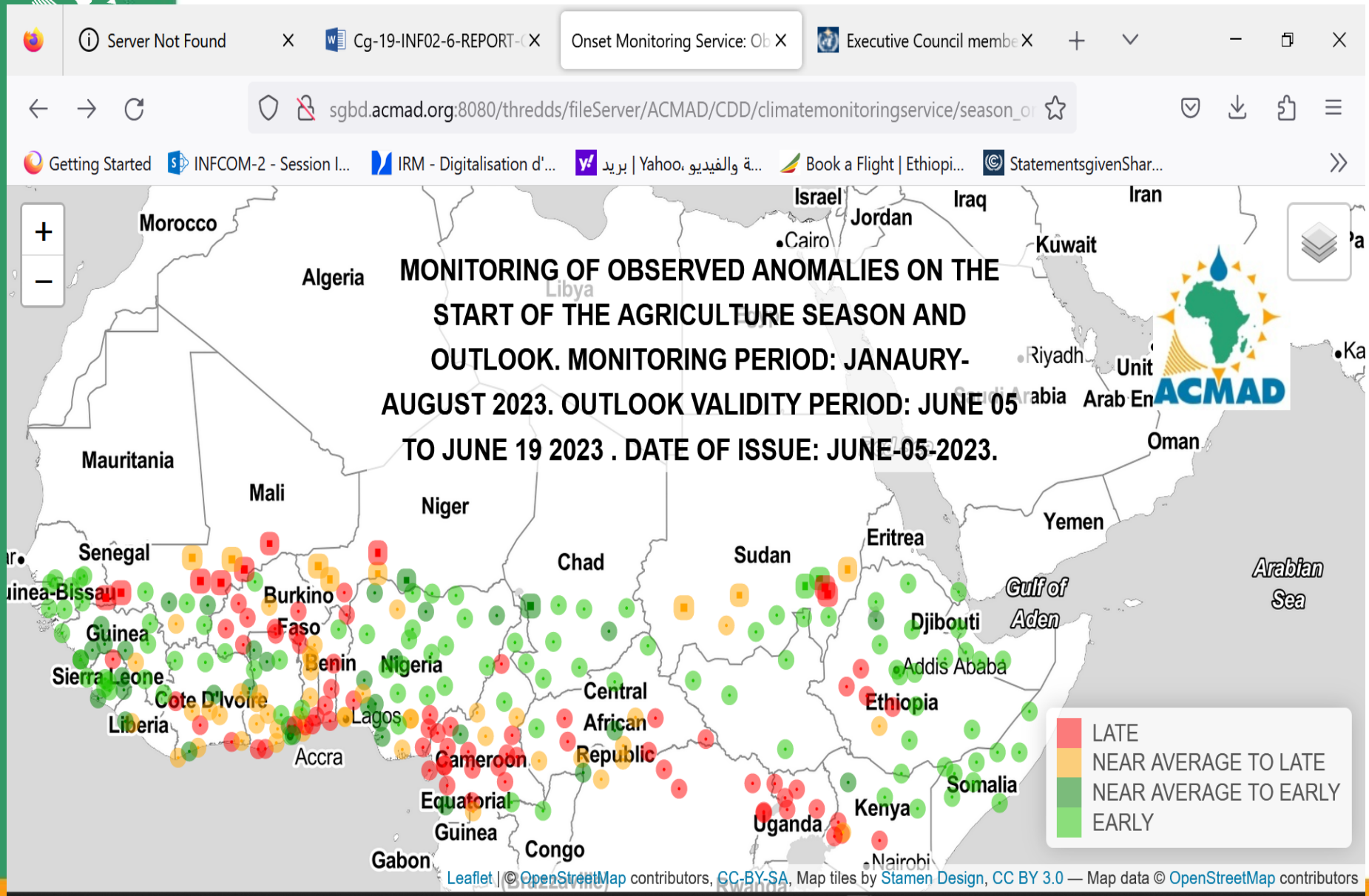
Research and innovation is promoted to intercompare Start of season definitions, products and compare with perceptions and findings of extension workers and subsistence farmers. Observations of disruptions on the start of season, processes and phenomena driving this event. Its predictability are essential research priorities for the African agriculture sector

START OF THE AGRICULTURE SEASON FROM JANUARY TO JULY IN 2020 OVER SUB-SAHARAN AFRICA.



START OF THE AGRICULTURE SEASON FROM JANUARY TO JULY IN 2021 OVER SUB-SAHARAN AFRICA.

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Getting Started
INFCOM-2 - Session I...
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Book a Flight | Ethiopi...
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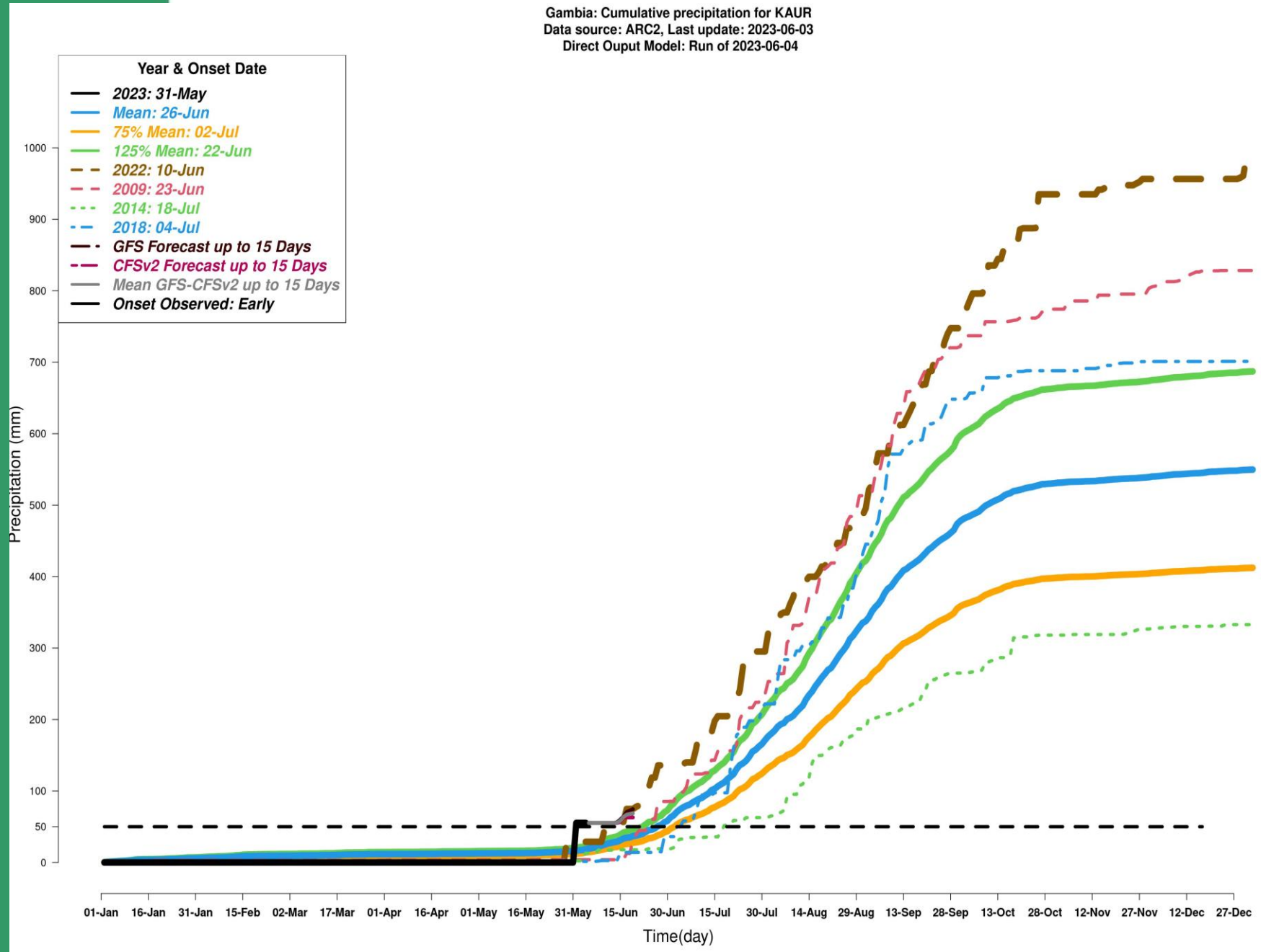
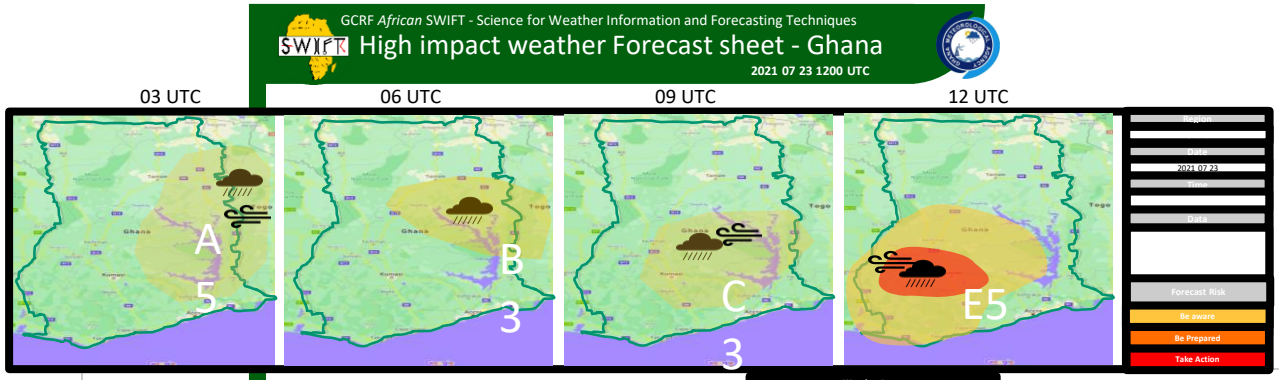
MONITORING OF OBSERVED ANOMALIES ON THE START OF THE AGRICULTURE SEASON AND OUTLOOK. MONITORING PERIOD: JANAURY-AUGUST 2023. OUTLOOK VALIDITY PERIOD: JUNE 05 TO JUNE 19 2023 . DATE OF ISSUE: JUNE-05-2023.
ACMAD
Morocco
Algeria
Libya
Israel
Jordan
Iraq
Iran
Cairo
Kuwait
Riyadh
Saudi Arabia
Oman
Yemen
Mauritania
Mali
Niger
Chad
Sudan
Eritrea
Senegal
Guinea-Bissau
Guinea
Sierra Leone
Liberia
Cote D'Ivoire
Burkina Faso
Benin
Nigeria
Lagos
Accra
Cameroon
Central African Republic
Equatorial Guinea
Gabon
Congo
Djibouti
Gulf of Aden
Arabian Sea
Addis Ababa
Ethiopia
Somalia
Kenya
Uganda
Nairobi
LATE
NEAR AVERAGE TO LATE
NEAR AVERAGE TO EARLY
EARLY
Leaflet | © OpenStreetMap contributors, CC-BY-SA, Map tiles by Stamen Design, CC BY 3.0 — Map data © OpenStreetMap contributors
38°C
Ensoleillé
Search
ENG
INTL
15:39
05-06-2023


Gambia: Cumulative precipitation for KAUR
Data source: ARC2, Last update: 2023-06-03
Direct Ouput Model: Run of 2023-06-04
Year & Onset Date
2023: 31-May
Mean: 26-Jun
75% Mean: 02-Jul
125% Mean: 22-Jun
2022: 10-Jun
2009: 23-Jun
2014: 18-Jul
2018: 04-Jul
GFS Forecast up to 15 Days
CFSv2 Forecast up to 15 Days
Mean GFS-CFSv2 up to 15 Days
Onset Observed: Early
Precipitation (mm)
0
50
100
200
300
400
500
600
700
800
900
1000
01-Jan
16-Jan
31-Jan
15-Feb
02-Mar
17-Mar
01-Apr
16-Apr
01-May
16-May
31-May
15-Jun
30-Jun
15-Jul
30-Jul
14-Aug
29-Aug
13-Sep
28-Sep
13-Oct
28-Oct
12-Nov
27-Nov
12-Dec
27-Dec
Time(day)



Weather Forecasting Risk Table

Likelihood						
	Very high	E1	E2	E3	E4	E5
	High	D1	D2	D3	D4	D5
	Medium	C1	C2	C3	C4	C5
						B5
						A5
						Very High

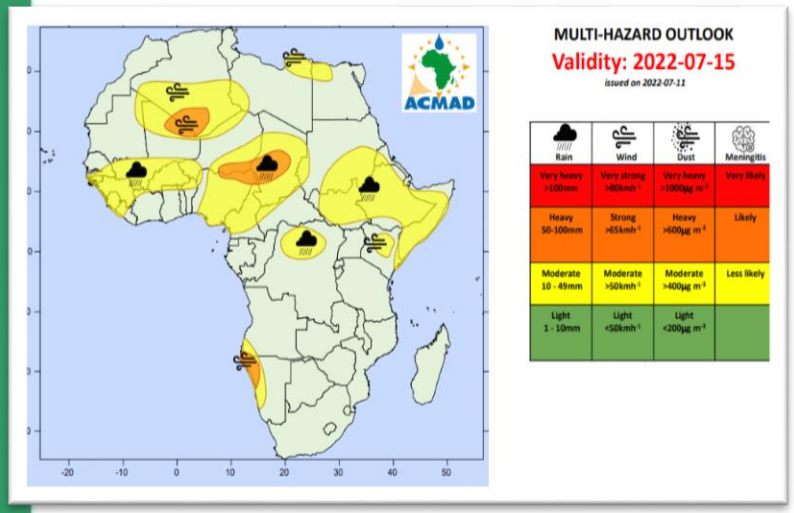
Take Action
Be Prepared
Be aware
Low risk

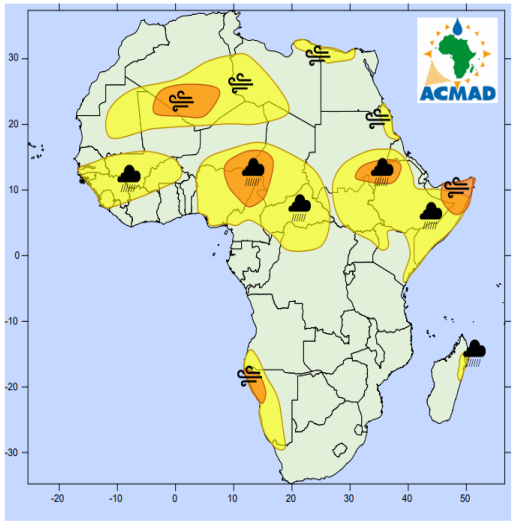
Which ensemble products have been used to determine the likelihood and forecast? ECWMF UKMO BOTH

Regions	12-15hrs	15-18 hrs	18-21 hrs	21-24 hrs
Coastline	▪ partly cloudy	▪ misty morning ▪ cloudy ▪ cool night temperatures	▪ misty morning ▪ cloudy ▪ cool night temperatures	▪ cloudy ▪ cool night temperatures
Slightly north of the coastline	▪ cloudy	▪ mist/fog patches ▪ slight rain /drizzle ▪ cool night temperatures	▪ mist/fog patches ▪ cloudy ▪ cool night temperatures	▪ mist/fog patches ▪ slight rain /drizzle ▪ cool night temperatures
Middle	▪ cloudy	▪ slight rain/drizzle	▪ slight rain/drizzle	▪ partly cloudy
Transition	▪ partly cloudy	▪ misty morning ▪ partly cloudy	▪ partly cloudy	▪ slight rain/drizzle
North	▪ slight/moderate rain	▪ slight/moderate rain	▪ slight/moderate rain	▪ partly cloudy

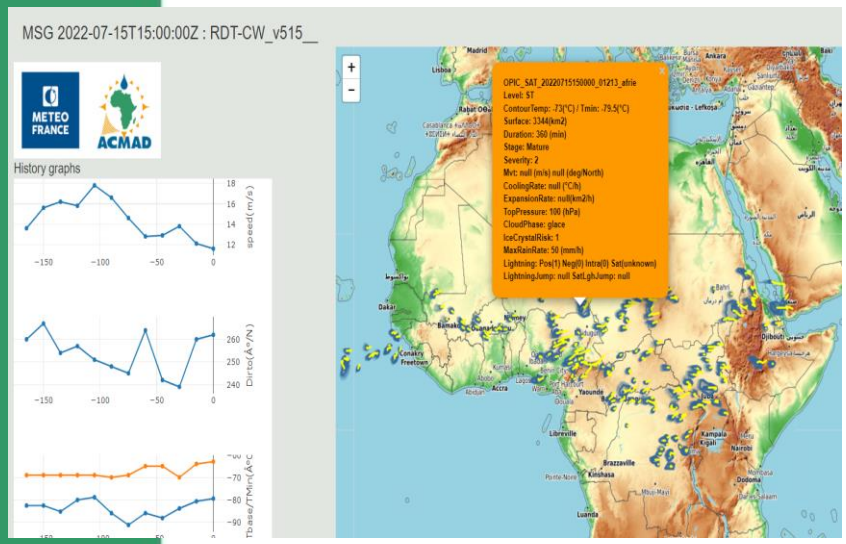
Summary of 12-24 hour forecast

A system currently located over north eastern borders of Ghana shows signs of intensifying and expanding to produce some heavy rains over Kumasi and its environs.

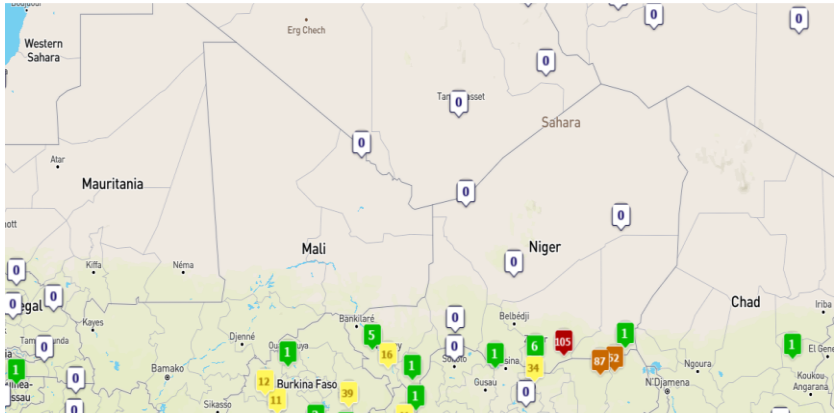




RAPID DEVELOPING THUNDERSTORMS PRODUCTS – VERIFICATION OF VIGILANCE SERVICES TO DRR SITUATION ROOM



Observed daily rainfall (mm) on: 16-juillet-2022



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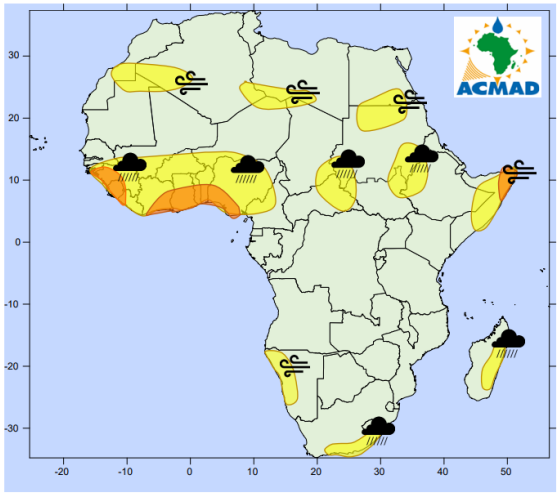


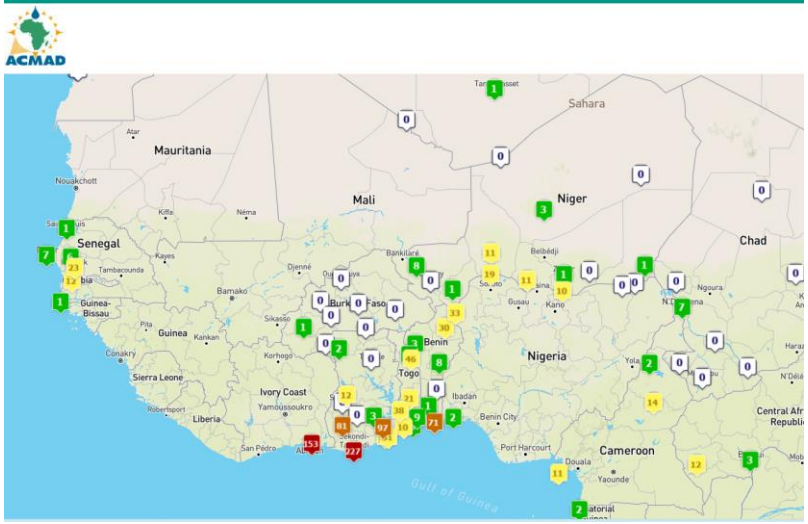
MULTI-HAZARD OUTLOOK

Validity: 2022-06-15

issued on 2022-06-13

Rain	Wind	Dust	Meningitis
Very heavy >100mm	Very strong >80kmh^{-1}	Very heavy >1000µg m^{-3}	Very likely
Heavy 50-100mm	Strong >65kmh^{-1}	Heavy >600µg m^{-3}	Likely
Moderate 10 - 49mm	Moderate >50kmh^{-1}	Moderate >400µg m^{-3}	Less likely
Light 1 - 10mm	Light <50kmh^{-1}	Light <200µg m^{-3}	

Observed daily rainfall (mm) on: 15-juin-2022

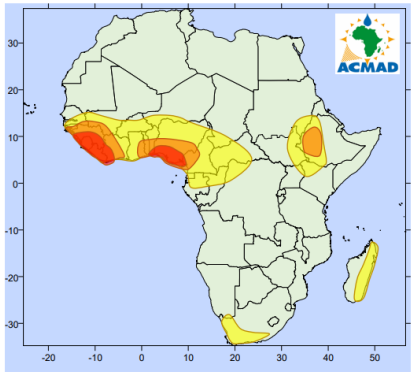


VIGILANCE MAP AND POLICY BRIEF FOR HEAVY RAINFALL AND STRONG WINDS

Valid From June 14 to 18, 2022

Issued on June 13, 2022

HIGHLIGHT: Heavy rainfall is expected Mali,Guinea-Bissau, Guinea Conakry, Sierra Leone, Liberia, Cote d'Ivoire, Ghana, Togo, Benin, Nigeria, Cameroon and Ethiopia.



	Phenomenon	Hazard	Potentials Impacts	Measures / Advices
	In next 5 days accumulated rainfall (50-100mm) is likely,	Moderate rainfall, flash flood, riverine flooding, landslides, soil erosion and lightning likely	Displacements of people due to floods, outbreak of water borne diseases, damage of infrastructures (roads, bridges, ...)	DRM authorities to keep informed about the development of the meteorological situation and raise awareness, taking action is more likely, the situation needs to be monitored closely with NHMSs
	In next 5 days accumulated rainfall (100 – 150mm) is very likely,	Heavy rainfall, flash flood, riverine flooding, landslides, soil erosion and lightning, strong winds,	Displacements of people due to floods, outbreak of water borne diseases, damage of infrastructures (roads, bridges, ...)	Update Flood contingency plans, Improve water management in reservoirs and dams, DRM authorities be ready to take adequate actions, DRM to be continuously in touch with NHMSs to be informed of the detailed expected meteorological conditions.
	In next 5 days accumulated rainfall (>150mm) is very likely,	Extreme precipitation, flash flood, riverine flooding, landslides, soil erosion and lightning, strong winds, severe thunderstorms	Loss of lives, Injuries, Displacements of people due to floods, outbreak of water borne diseases, damage of infrastructures (roads, bridges, ...)	Activate flood contingency plans, DRM authorities to be ready to take adequate actions (be prepared for emergency response and search & rescue operations as needed), Improve water management in reservoirs and dams, be in close touch with NHMSs for more details and identification of vulnerable areas.

Disclaimer: *The presentation of country boundaries on the map does not imply any opinion whatsoever on the part of ACMAD concerning the legal status of any country, territory or area, or concerning the delimitation of frontiers or boundaries.*

Ivory Coast – Landslide Kills 6 in Abidjan

17 JUNE, 2022 BY RICHARD DAVIES IN AFRICA, NEWS

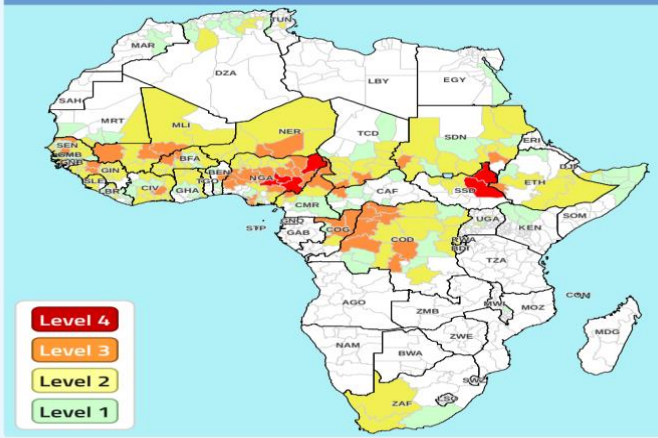
At least 6 people have died in a landslide Abidjan, Côte d'Ivoire (Ivory Coast), after heavy rainfall on 16 June 2022.

Landslide in Abidjan, Ivory Coast 16 June 2022. Photo: GSPM Sapeurs Pompiers

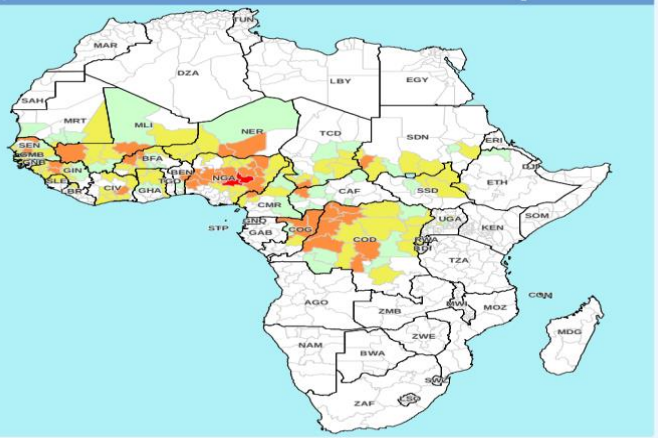
2. DETAILED MULTI-HAZARD OUTLOOK FOR THE NEXT 5 DAYS

From August 30, 2022 to September 3, 2022

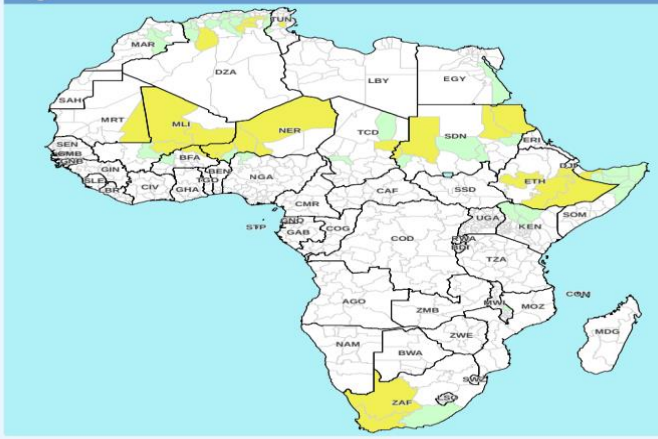
Multi-Hazard assessment



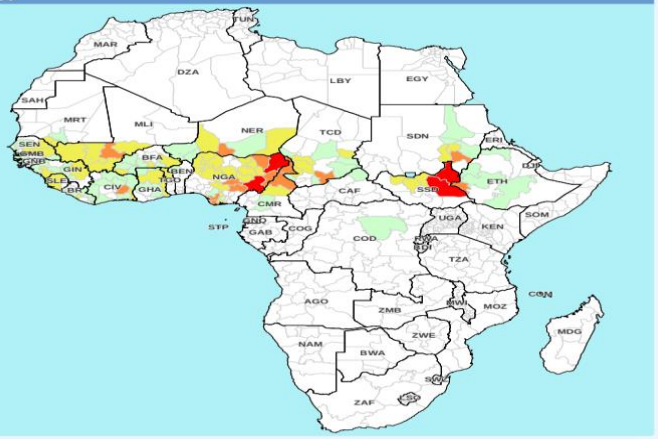
Extreme Precipitation



Wind Storms



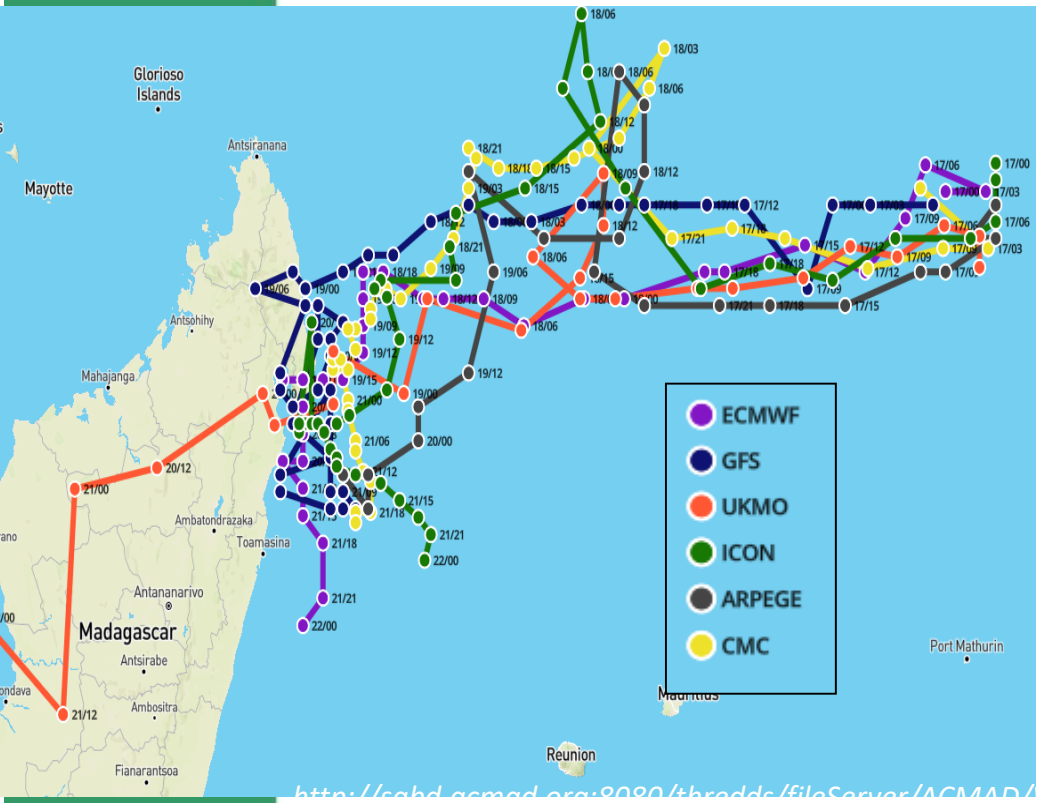
River Floods

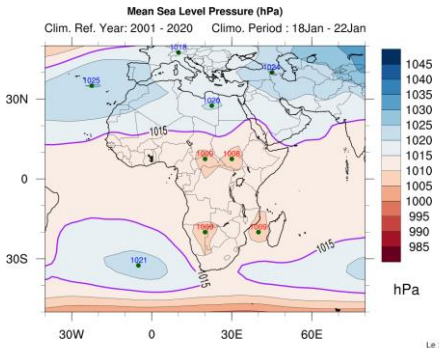


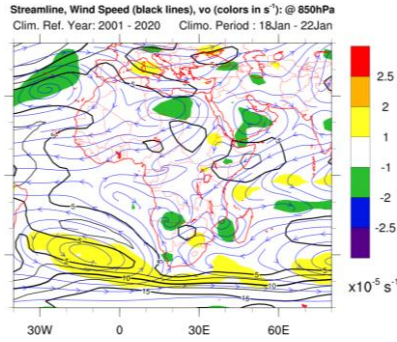
Tracks from: 17-01-2023, 00UTC to 22-01-2023, 00UTC

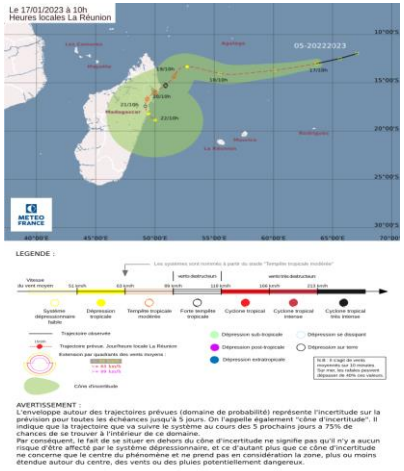
(Global deterministic models : ARPEGE, CMC, ECMWF, ICON, GFS and UKMO) – **Climatology of the forecast period** favors evolution towards the Mozambican channel

Need training on interpretation



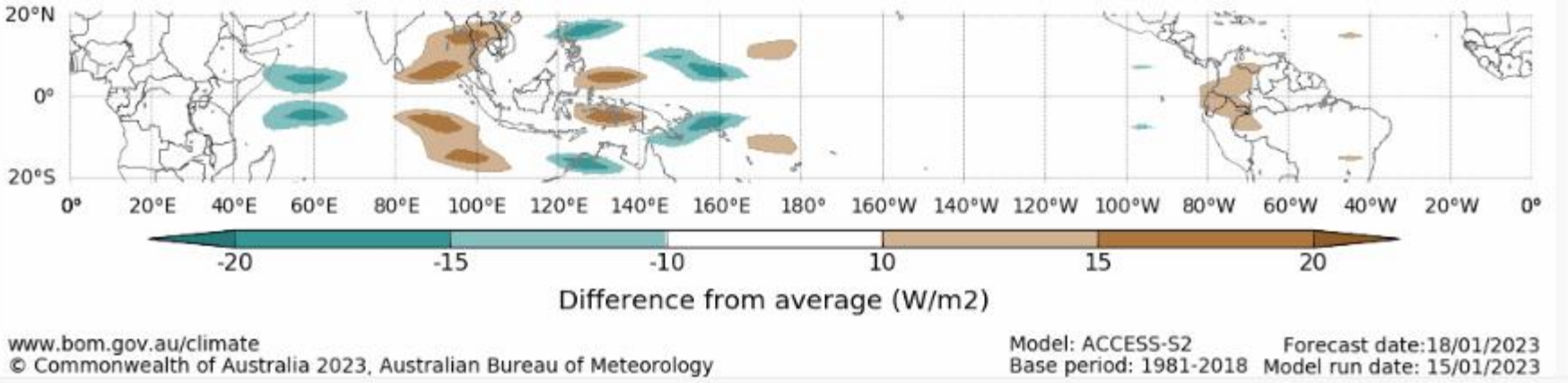




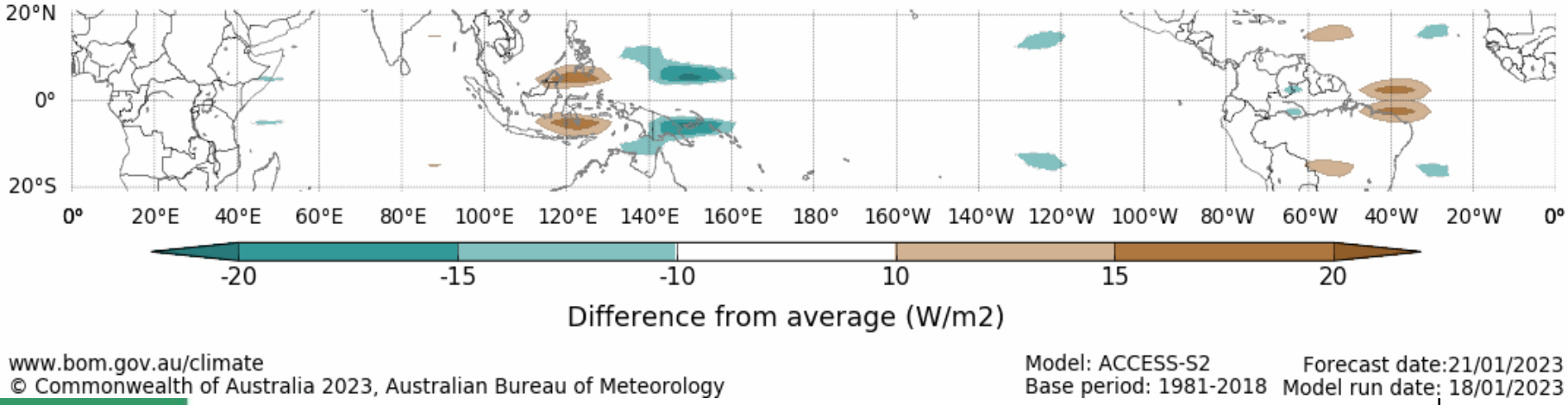


Equatorial Rossby and MJO waves

Equatorial Rossby wave evolving close to the equator expected to decay



Rossby Waves decaying leaving cyclone track driven by MJO in the Mozambican Channel

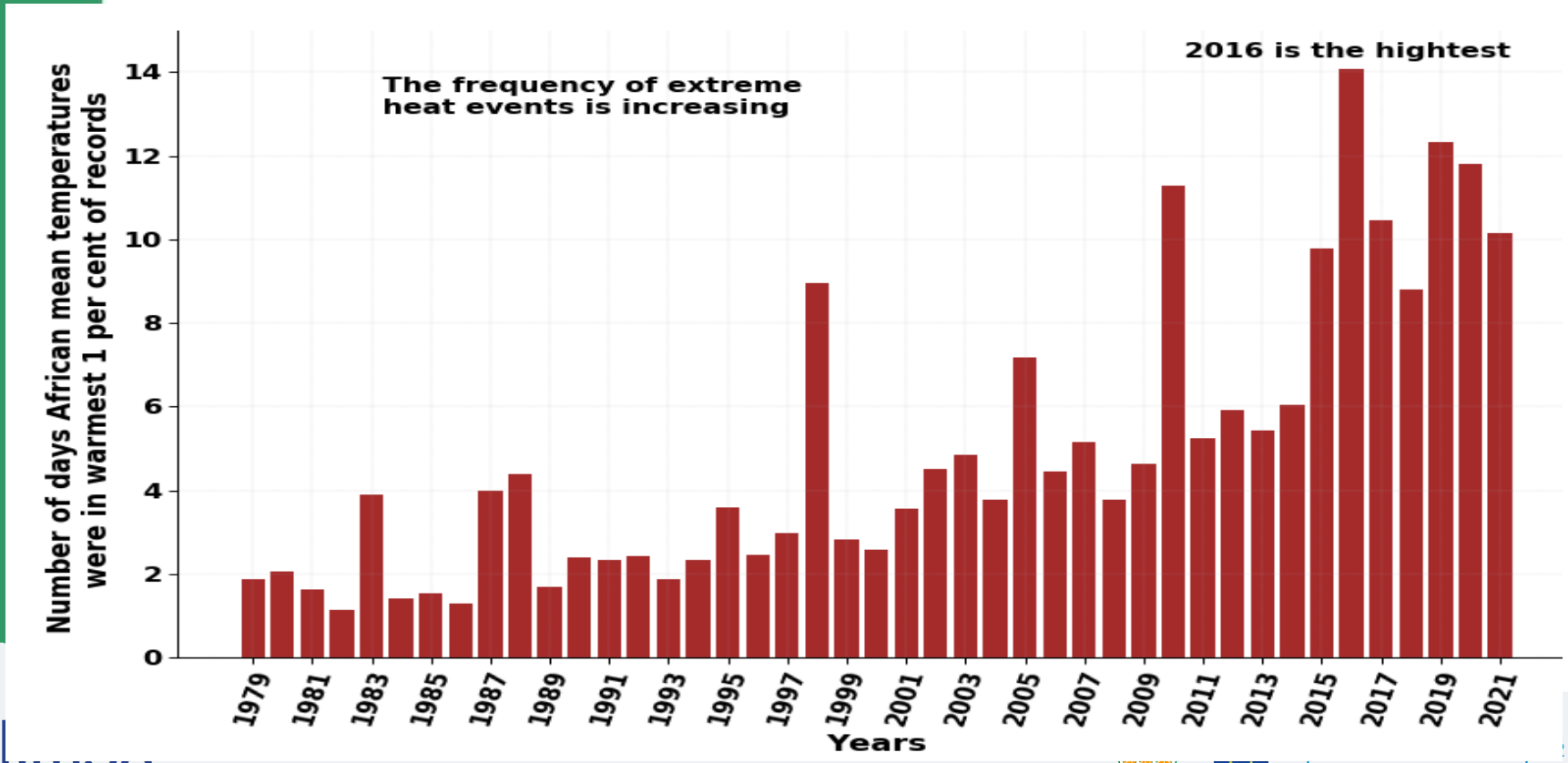


which triggere

By January 18th, 2023, convectively coupled MJO will dominate the development of the system

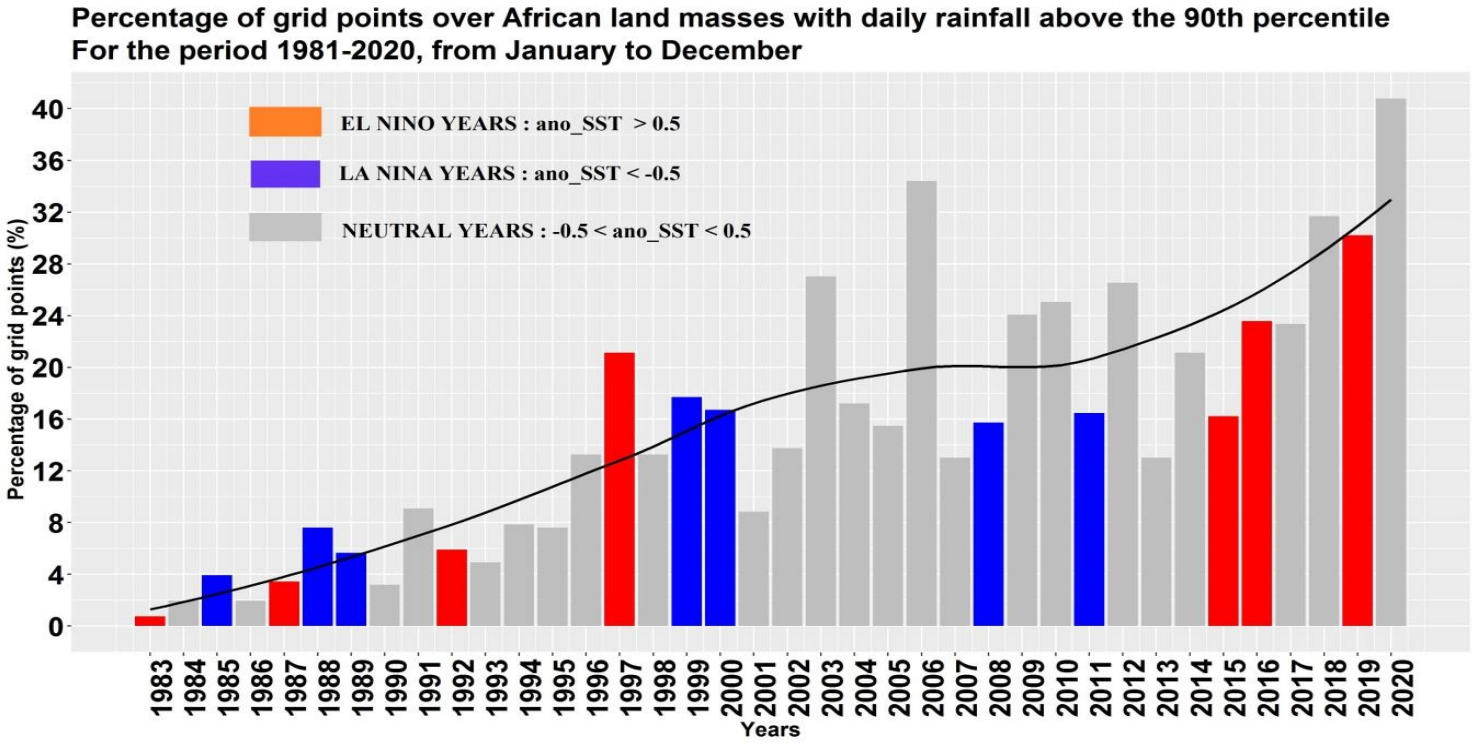
Trends on number of extreme hot days across Africa. 2016 was the warmest year on record globally.

Research on high frequency of very warm days impacts on agriculture, energy, infrastructure, health, water scarcity, disasters is a priority for sustainable development planning



06

Trends on the surface hit by heavy rainfall. A research on impacts of heavy rains at regional/local levels with emphasis on losses and damages to infrastructure, crops, major assets particularly in cities is essential for resilient development planning



MULTIDISCIPLINARY RESEARCH AND INNOVATION EXPECTED FOR **Impact based forecasting** with

Climate phenomenon – Hazards (location, severity) – potential impacts – consequences- preparation and response- BAMS June 2021

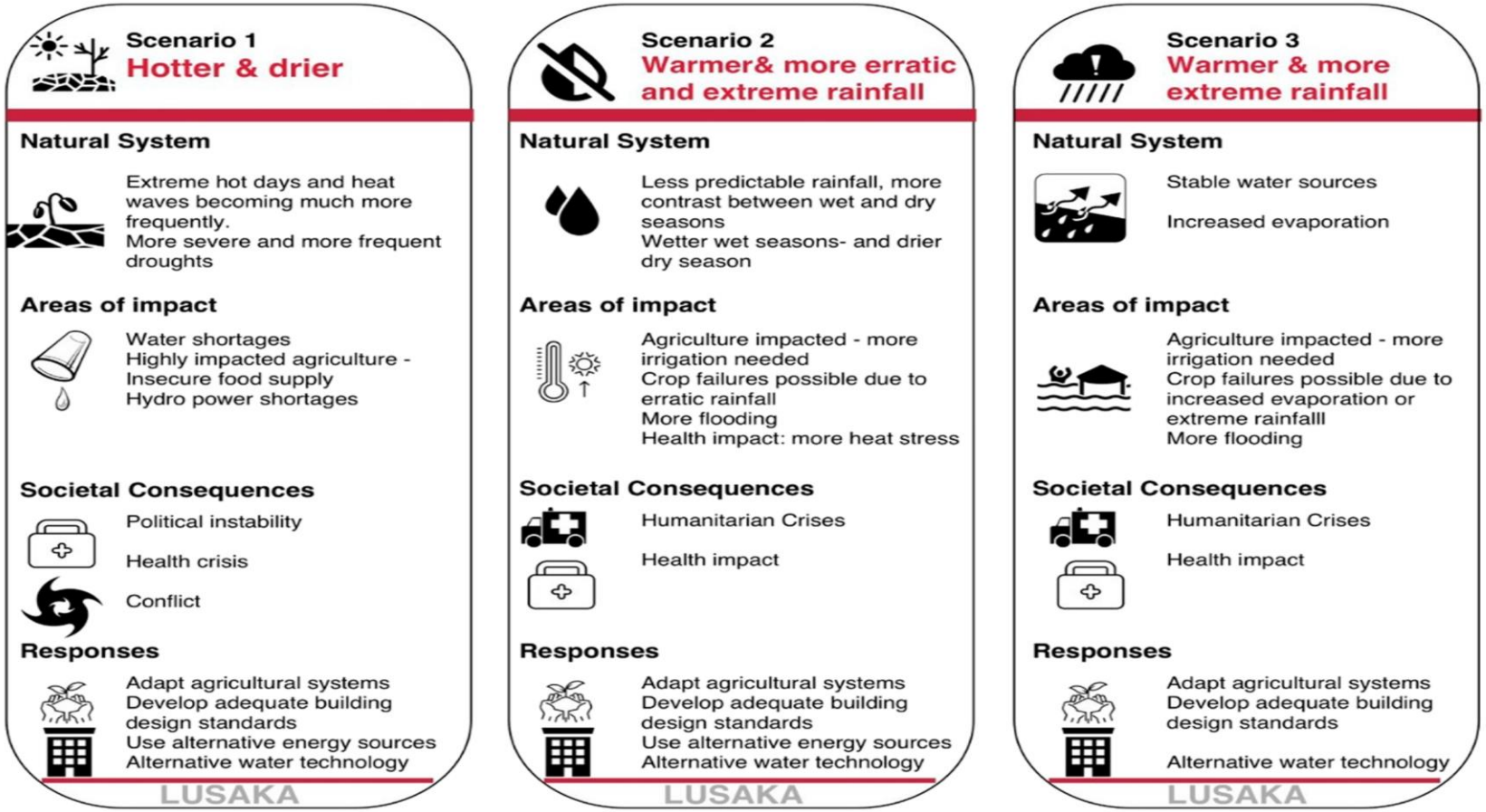
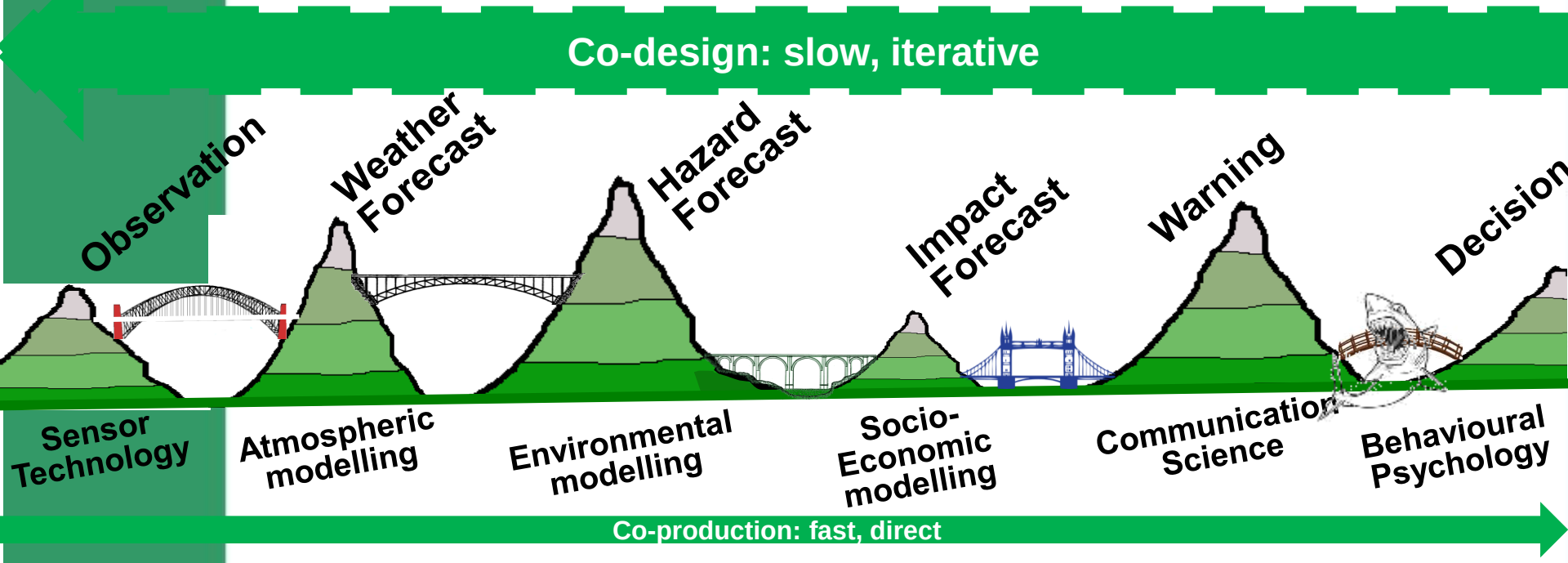


Fig. 5. Infographic summarizing three plausible future climate scenarios for Lusaka along with some key impacts, possible societal consequences, and responses.

RESEARCH along the warning value chain



Bridges represent necessary Research partnership
Mountains are needed expertise to operate warnings

Climate Services Requirements for socio-economic growth in agriculture, infrastructure , health

Number of heat wave days are actionable indicators for health. power shortages and brownouts, other Infrastructure and water in cities from high resolution urban climate model (UrbClim). Services for cities adaptation and resilient development planning require *research on fit for purpose high resolution observing campaigns for understanding, modeling, calibration, validation and verification , bias correction and other statistical post processing*

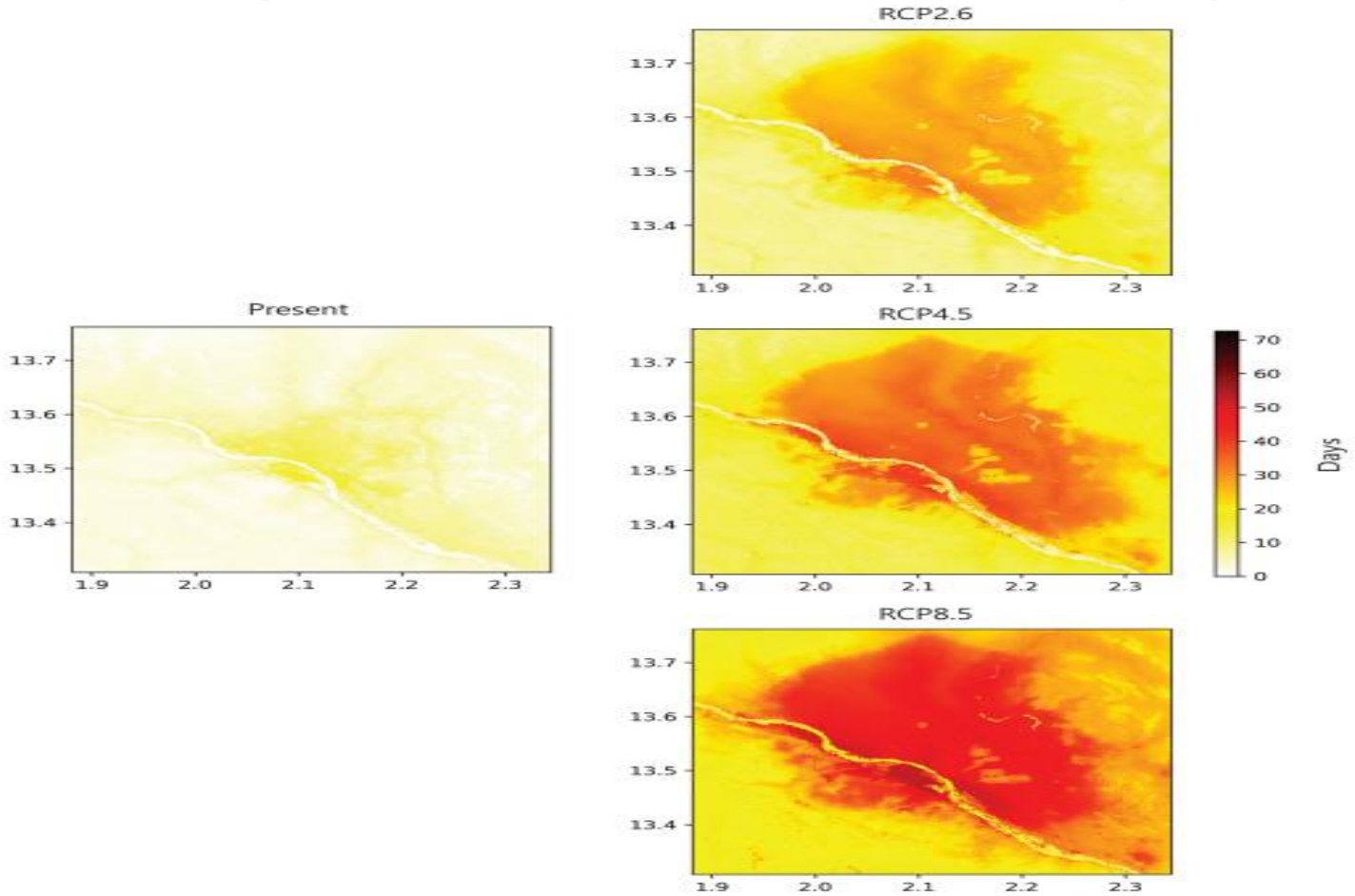


FIGURE 9 Number of heatwave days per year over Niamey in a present (2001-2020) and future scenarios (2041-2060).

Evidence of little extreme heat in a future under shadow from for example trees planting in the city climate change adaption action plan

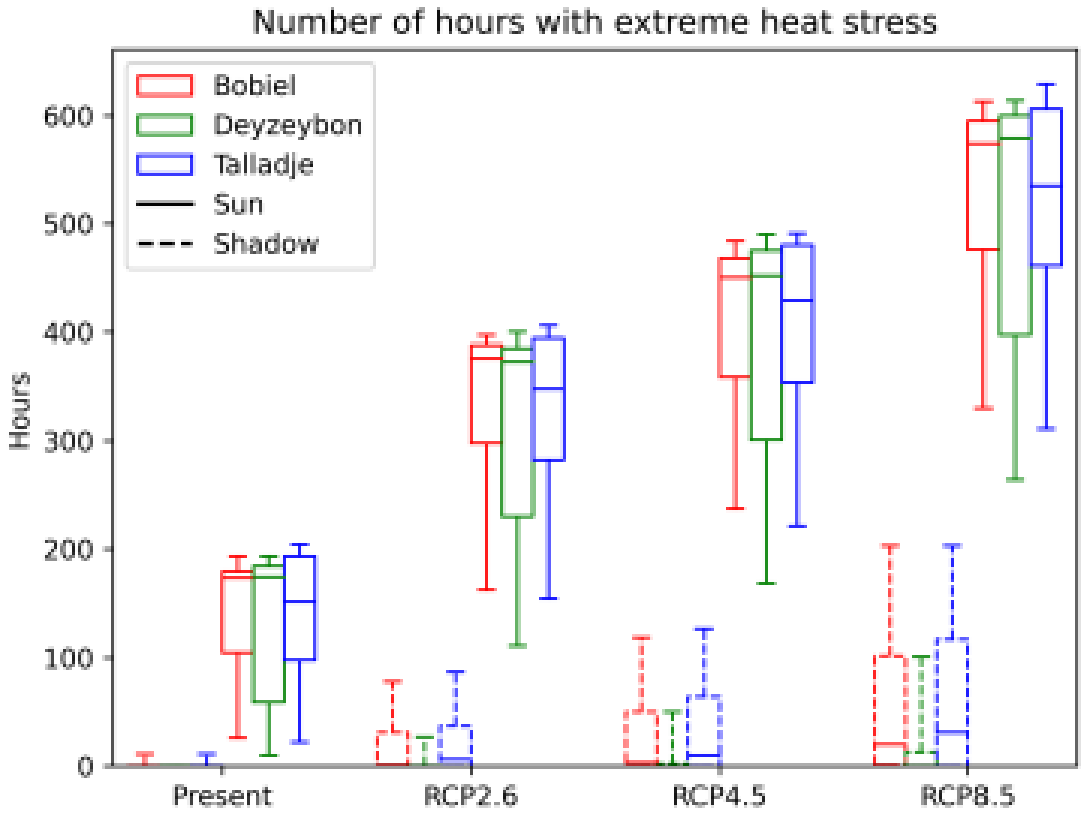
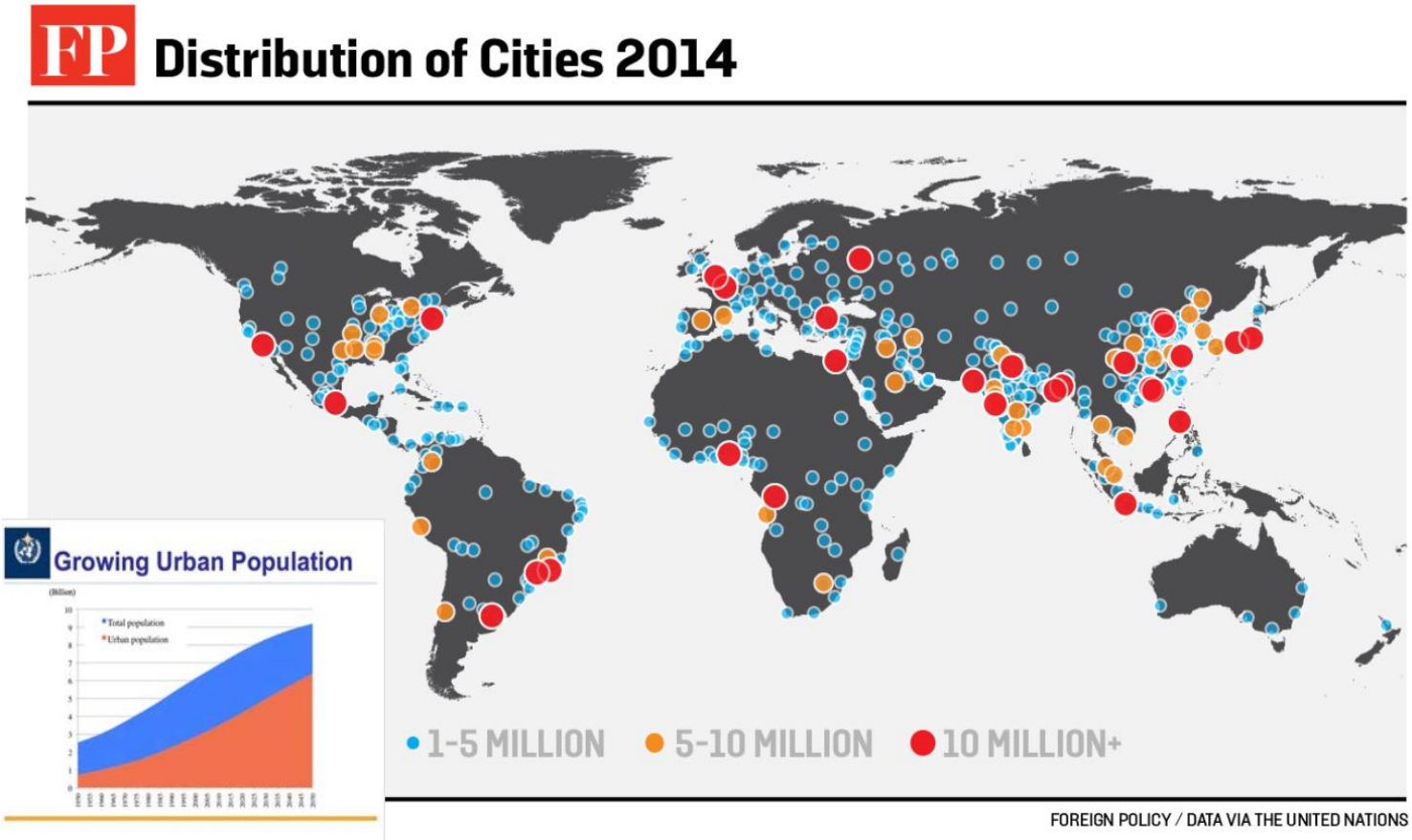


FIGURE 10 Number of hours per year with extreme heat stress for present (2001-2020) and future scenarios (2041-2060).

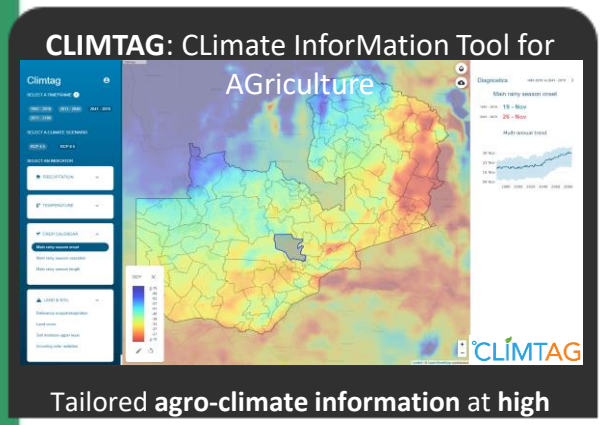
The Challenge of climate change impacts on energy needs in African Megacities current and emerging megacities
Actionable indicators at city level needed in NMHSs State of climate reports for the countries

– ACMAD supports capacity building on climate services for resilient energy sector across Africa



On GOING INIATIATIVE / PROJECTS OVERVIEW

AgraClim & KLIMPALA:



- **Web-based** climate service:
  - agro-climate indicators, e.g.
    onset rainy season
    occurrence drought spell
    …
  - **past** and **future** time horizons
    1981-2010 → **2040-'70-'100**

- High **resolution**:
  - **1km x 1km** maps
  - aggregated at **district** level

klimpala

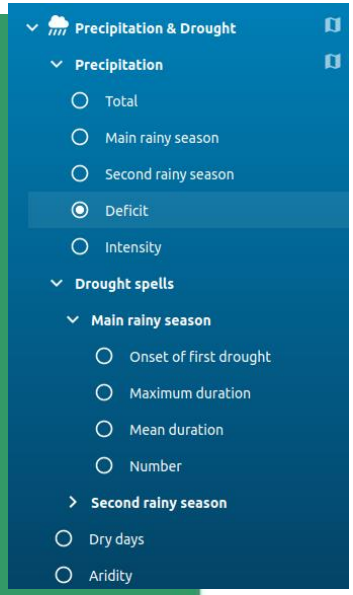
Climate Platform for Adaptation in the African Agricultural Sector

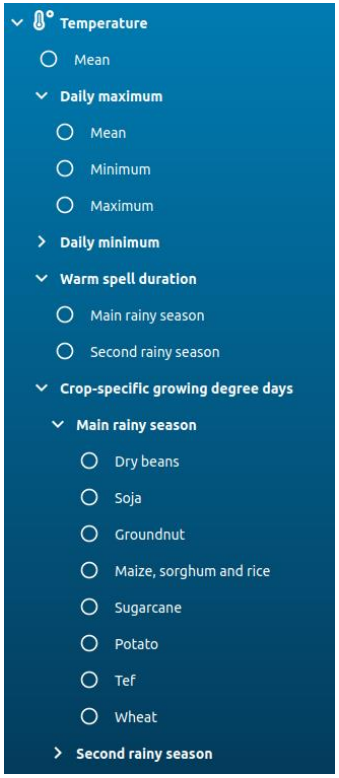
- Operating at country level for **22 countries**

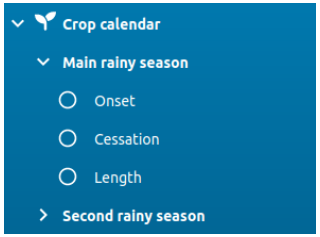
- Targeted **stakeholders:** National Met Services, policy makers, researchers, extension workers

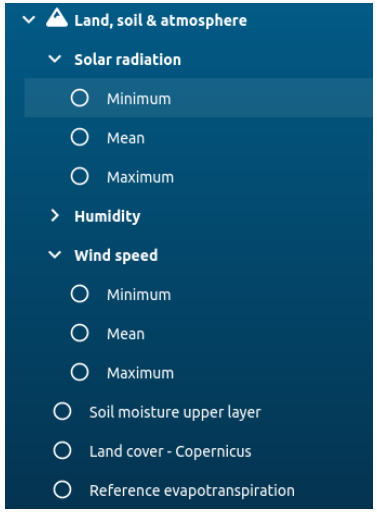
Find out more: https://klimpala.vito.be/en

34 Agro-climate INdicatorS in 4 categories









Use Case – ground nuts in Nioro du Rip – '*Bassin arachidier*' (SENEGAL)

USE CASE – GROUNDNUTS NIORO DU RIP – '*BASSIN ARACHIDIER*' (SENEGAL)

- Suitable climate conditions
  - Precipitation requirements
    - At least 500 mm precipitation during growing season for commercial production is required
  - Temperature:
    - Optimum average temperature around 28° C (between 25° C and 30° C / 22° and 28°)
  - Other relevant indicators:
    - Precipitation deficit
    - Aridity
    - Crop-specific growing degree days
    - Main rainy season length
- Focus on:
  - Current climate conditions (1981 – 2010)
  - For adaptation planning: trends towards medium term (2041-2070) according RCP8.5

USE CASE – GROUNDNUTS NIORO DU RIP – '*BASSIN ARACHIDIER*' (SENEGAL)

- **focus on:**
  - **Current climate conditions (1981 – 2010)**
  - **For adaptation planning: trends towards medium term (2041-2070) according RCP8.5**

Interpretation (need surface favorable for groundnouts production in 2041 -2060 or 2050 horizon
millet, sorghum. Maize, beans …. , coffee, tea in other parts of Africa

- **Groundnuts:**
  - Precipitation:
    - At least 500 mm precipitation during growing season (literature) for commercial production – but considerably less precipitation in northern parts of *bassin arachidier* (250 à 300 mm).
    - No significant decrease in precipitation in *bassin arachidier* expected as a result of climate change, but relevant increase in precipitation *deficit*.
    - Preliminary conclusion: Groundnut prodictivity may become marginal in northern parts of 'bassin' due to water stress
  - Temperature:
    - Optimum average temperature around 28° C (between 25° C and 30° C / 22° and 28°)– corresponds to average temperatures today in all parts of *bassin arachidier*.
    - In eastern parts of bassin increases to 32° C possible (RCP 8.5, 2041-2070)
    - Preliminary conclusion: Some parts of the 'bassin' may become unsuitable for commercial groundnut production as a result of high temperatures.

LESSONS AND WAY FORWARD

Follow up inclusion of RARS-Africa in the WMO Broadcast Network (ACMAD, WMO, EUMETSAT, ASECNA, SAWS …)

- Build capacity for African scientists on Digitalization, AI/ML, big data analytics satellite data assimilation in global and regional NWP (ACMAD, Universities, World Meteorological Centres …) to improve severity and precision forecasts, test bets, forecasts demonstrations
- Develop NWP and other applications based on RARS data in the framework of *ClimSA*, ***AMSAF***, *HYDROMET* and Other initiatives
- Organize fit for purpose observing field campaigns for hazards understanding, modeling and prediction
- Research on impact based forecasting and warming for food security, climate –Inflation-GDP, infrastructure losses or damages toward Cop 28 and beyond

Concluding remarks

ACMAD WILL CONTINUE AND ACCELERATE

- *African Weather research community engagement expanding partnerships established by the SWIFT project and increasing African participation in Working Groups*

- *Participate with more scientists in WMO WWRP and WCRP projects for 2024 -2027*
- *Promote more African Scientists in* **in DAOS, NMR, PDEF, JWGFVR**

Provide weather information, facilitate its use to raise awareness of stakeholders on threats and impacts, build capacity to act , measure benefits of actions Using disaster managers platforms

Concluding remarks : ACMAD with test bets and forecast demonstrations trough twining with NMHSs, RSMCs will:

- Provide ***multimodel ensemble and deterministic high resolution*** Analysis and forecasts supporting briefings preparation by countries
- ***Nowcasting and synoptic technical notes*** supporting operational forecaster's briefings at National level to facilitate anticipation and response to national emergencies (picture of Advisory Centre)
- ***Train forecasters from Met service*** on Met information ***for assistance to AFCON Game*** and for contributing to *national early warning for all initiative*
- Support countries ***establish and operate national early warning Information systems*** and DRR or humanitarian platform for emergency planning and implementation
- ***Disaster managers*** from continental to local levels should receive ***impact information*** of winds, heavy rains, dust, high temperatures forecasts on society and economy.
- Measures to ***reduce risks or exploit opportunity*** will be derived and implemented trough forecast based *integrated* emergency **planning** , **budgeting, financing** and **implementation**

Concluding Remarks

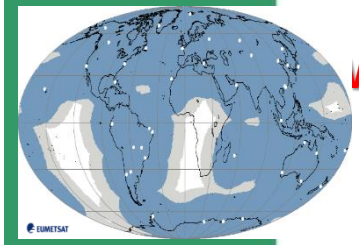
- **Africans in WWRP PDEF WG to accelerate development and operation of Confidence information associated with African High Impact weather Forecasts updating countries portal with Multimodel forecasts products developed by ACMAD**

- **ACMAD and WMO/WWRP to organize a conference to build Weather science network for Africa**


Continental
Multi-Hazard
Advisory Centre
ACMAD
Continental
Multi-Hazard
Advisory Centre
ACMAD
ClimSA

ACMAD SUPPORT PROVISION OF LEO DATA FOR ASSIMILATION IN HIGHJ RESOLUTION REGIONAL AND GLOBAL NWP

- 4 Regional Advanced Retransmission System for low earth orbiting satellite data contributing to implementation of **WMO and Africa space strategies and programmes, RARS data may unlock source of predictability in global and limited area models**
- **Contribute to research and development of Satellite Applications products for *tracking convection, MCS, strong winds, heavy rain rates, severe lightening and dust storms, very low visibility, air pollution, detecting severe thunderstorms***



ACMAD seeks more African memberships in DAOS, NMR, PDEF, JWGFVR, NCRP working Groups and Panels

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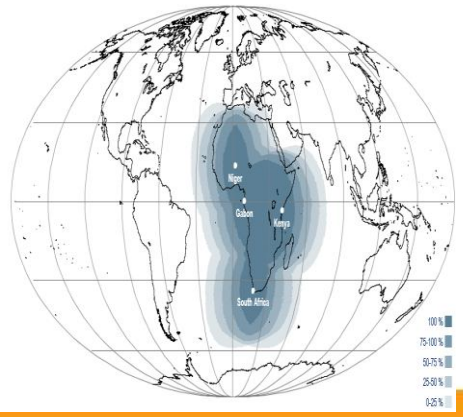

THANK YOU