CLIMATE FORECAST FOR THE RAINY SEASON 2024, NEXT YEARS PROJECTIONS, AND DECADAL TRENDS

FOR WEST AND CENTRAL AFRICA

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ACTION AGAINST HUNGER
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INTRODUCTION

West and Central Africa are among the most vulnerable regions in the world to climate change. The alarming frequency of extreme droughts, floods, heatwaves, and their impacts in the last 30 years demonstrates the gravity of the situation [1].

However, such irregularity and anomalous events are also the results of a series of atmospheric teleconnections that play an important role in modulating the regional climate, and thus can be used to describe the interannual climate variability observed in African continent.

Among them is the El Niño Southern Oscillation (ENSO). ENSO is an irregularly recurring coupled ocean-atmosphere pattern characterized by anomalous sea surface temperatures, wind, and rainfall patterns. Two phases alternate during the ENSO cycle: a drier and warmer phase known as El Niño and a wetter and colder phase called La Niña. The pattern shifts back and forth irregularly every two to seven years and it is a major component of the Earth's climate globally [2].

ENSO most intensely impacts the tropics, including the West and Central Africa, and the Sahel region. Sahel extreme precipitation variability is, in fact, mainly linked to this climatic event [3].

PREDICTION FOR THE COMING SEASON

Based on the last updated NOAA analysis of May 2024, a transition from El Niño to ENSO-neutral is likely in the next month. Afterwards, La Niña may develop in June-August (49% chance) or July-September (69% chance) [4].

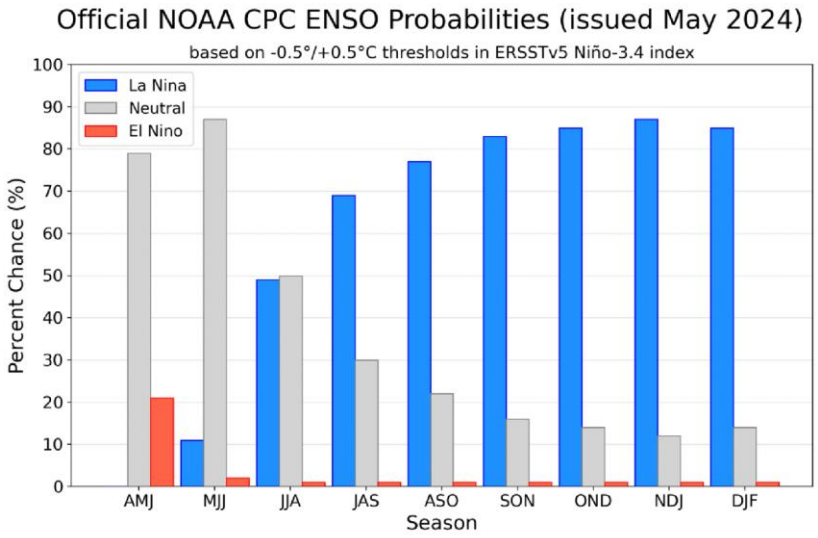

Figure 1 – Official NOAA CPC ENSO Probabilities, April 2024. The graph displays the probability of different ENSO phases occurring from March 2024 to January 2025, May 2024 (Source: NOAA)[4]

[1] M. Niasse et al., Réduire la vulnérabilité de l'Afrique de l'Ouest aux impacts du climat sur les ressources en eau, les zones humides et la désertification, Available, https://portals.iucn.org/library/sites/library/files/documents/Climate-impactsF-prelims.pdf
[2] O. Alizadeh, 2023, A review of ENSO teleconnections at present and under future global warming - Alizadeh - 2024 - WIREs Climate Change - Wiley Online Library, https://wires.onlinelibrary.wiley.com/doi/10.1002/wcc.861?af=R
[3] M. Diakhaté et al., 2019, Oceanic Forcing on Interannual Variability of Sahel Heavy and Moderate Daily Rainfall in: Journal of Hydrometeorology Volume 20 Issue 3 (2019) (ametsoc.org), https://journals.ametsoc.org/configurable/content/journals$002fhydr$002f20$002f3$002fjhm-d-18-0035_1.xml?t:ac=journals%24002fhydr%24002f20%24002f3%24002fjhm-d-18-0035_1.xml
[4] Climate Prediction Center/NCEP/NWS, 9th of May 2024, El Nino/Southern Oscillation (ENSO) diagnostic discussion, https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.shtml

PRECIPITATION LEVELS

With the predicted onset of La Niña, above average rainfall occurrence is expected across the Sahel [5], as well as in West and Central Africa during the period June-August [6].

In particular, average to above average precipitation levels are expected in Senegal, Gambia, Mauritania, Mali, Burkina Faso, Niger, Chad, Central African Republic and DRC. Similar conditions are forecasted for northern Nigeria. Additionally, heavier precipitations are expected in some areas of eastern Chad, eastern Burkina Faso, and the central area of DRC.

In Sierra Leone, Liberia and Ivory Coast, precipitation levels will be average to below average, while significant below-average precipitation is projected for Cameroon and southern Nigeria.

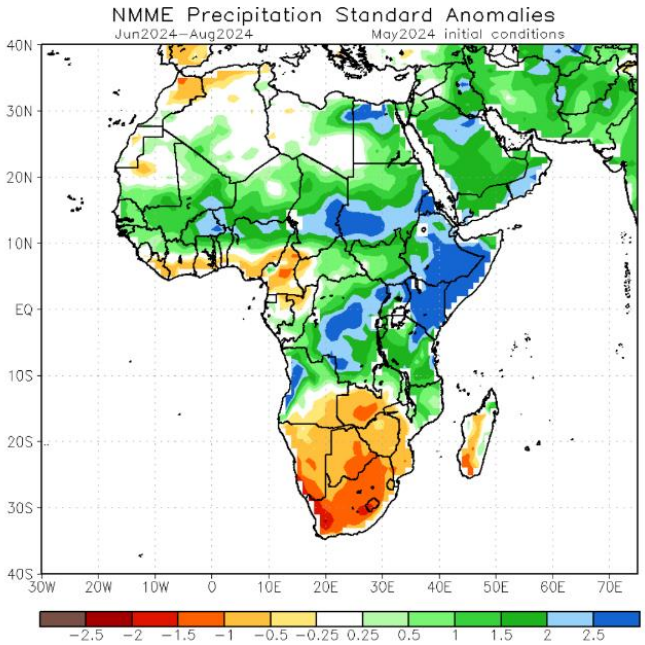

Figure 2 – Africa nmme seasonal precipitation standard anomalies for the period June-August 2024, May 2024 (Source: NOAA) [6]

START OF THE SEASON

According to ACMAD projections of April 2024 [5], the commencement of the rainy season is anticipated to be delayed in the central Sahel, while remaining close to the norm in other areas of the region. This alignment has been substantiated by NOAA [7] (Figure 3) for the initial fortnight of May, except for Burkina Faso, where the rainy season has already started, with precipitation levels slightly exceeding the norm. Future forecasts from NOAA [8] (Figure 4) indicate promising overall patterns regarding the onset of the rainy season across West and Central Africa, with some exceptions noted for Senegal, Mauritania, and the western regions of Mali.

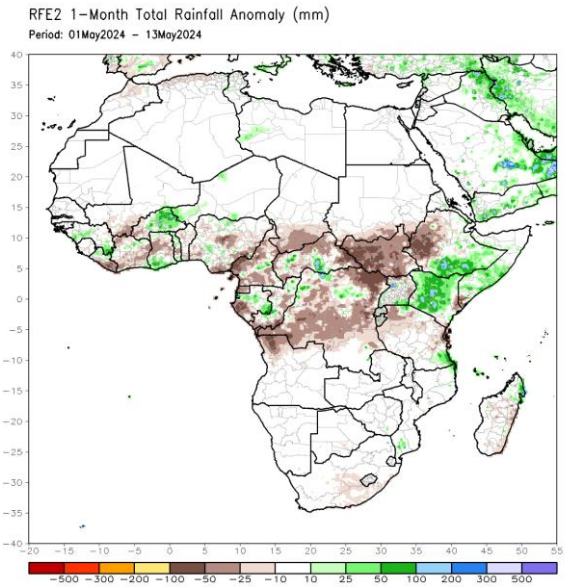

Figure 3 – Precipitations observed for the first two weeks of May 2024 (Source: NOAA)[7]

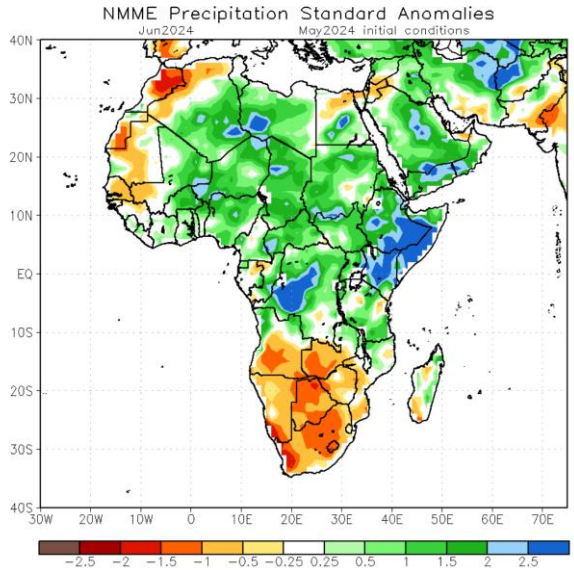

Figure 4 – Precipitation Standard Anomalies forecast of the month of June 2024 (Source: NOAA)[8]

[5] CILSS, ACMAD, April 2024, Forum 2024 des Prévisions Saisonnières des caractéristiques Agro-hydro-climatiques de la saison des pluies pour les zones Soudaniennes et Sahéliennes de l'Afrique l'Ouest (PRESASS, 2024), https://agrhymet.cilss.int/wp-content/uploads/2024/04/COMMUNIQUE-FINAL_PRESASS_2024_EN_VF.pdf

[6] NOAA, April 2024, Africa nmme seasonal precipitation standard anomalies, https://www.cpc.ncep.noaa.gov/products/international/nmme/html_seasonal/precip_stdanom_africa_body.html

[7] NOAA, 2024, Month Total Rainfall Anomaly (mm), https://www.cpc.ncep.noaa.gov/products/international/africa_rfe/africa_rfe_May2024-May2024_af_anom.gif

[8] NOAA, May 2024, NMME Precipitation Standard Anomalies, https://www.cpc.ncep.noaa.gov/products/international/nmme/plots_monthly/africa_nmme_prec_sdan_MayIC_Jun2024.png

DRY SPELLS

Short to average dry spells are anticipated at the onset of the lean season, in the western regions of the Sahelian and Sudanian belts of West Africa, especially over southern Mauritania, the southern half of Mali, Senegal, the Gambia, Guinea Bissau, Guinea, northern regions of Sierra Leone and Ivory Coast, as well as in the northwestern part of Ghana and the western part of Burkina Faso.

In contrast, the western half of Burkina Faso, the agricultural zones of Niger and Chad, the north-east of Ghana and the northern parts of Togo, Benin, and Nigeria, are expected to experience average to prolonged dry spells during the initial phase of the season [5].

TEMPERATURES

While the La Niña phase is typically linked with cooler temperatures, global temperature trends indicate an overall increase worldwide. Therefore, although La Niña may lead to a slight decrease in temperatures in some regions, the ongoing impact of global warming persists on a global scale [9].

In fact, NOAA predictions indicate above-average temperatures throughout the entire West and Central Africa regions during the June-August 2024 period [10].

Some areas, particularly northern Mauritania, northern Mali, northern Niger, and northern Chad, as well as Sierra Leone, Liberia, eastern Ivory Coast, southern Nigeria, Cameroon, west Central African Republic and southern DRC, are expected to experience even more extreme heat events.

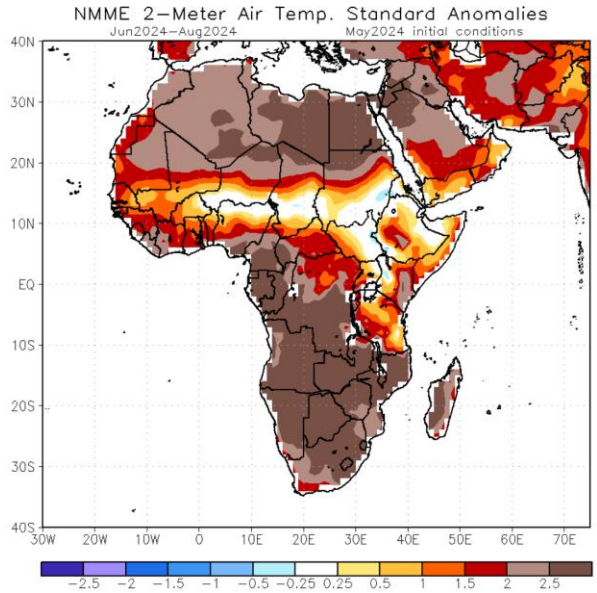

Figure 5 – Africa NMME seasonal 2m air temperature standard anomalies for the period of June-August 2024, may 2024 (source: noaa)

CONCLUSION

In West and Central Africa, encompassing the Sahel region, the outlook for the upcoming rainy season appears promising overall, with anticipated precipitation levels ranging from average to above average across the region.

Exceptions are noted along the West African coast, stretching from Liberia to Nigeria, and in much of Cameroon. Such predicted conditions could yield several potential benefits, with rainfall strengthening the crop season and biomass production.

Nevertheless, extreme precipitation events could heighten the likelihood of potential adverse effects, such as flooding, and the proliferation of water borne disease.

Therefore, special attention is necessary in areas including the Gambia Basin, the Upper Senegal, Basin (in Mali, Senegal and Guinea), the upper Niger River basin (in Guinea, Ivory Coast and Mali), the Inner Niger River Delta (in Mali), the Nigerien and Nigerian portions of the middle Niger River basin, the Komadougou Yobé, the Logone basin, the upper Volta basin (in Ivory Coast, Ghana, Togo and Burkina Faso), Comoé (in Ivory Coast and Burkina Faso) and Bandama (in Ivory Coast).

[9] NOAA, Data: NCEI, CPO, https://www.climate.gov/news-features/understanding-climate/el-ni%C3%B1o-and-la-ni%C3%B1a-frequently-asked-questions
[10] NOAA, April 2024, Africa nmme seasonal 2m air temperature standard anomalies, https://www.cpc.ncep.noaa.gov/products/international/nmme/html_seasonal/tmp2m_stdanom_africa_body.html

PROJECTIONS FOR THE COMING YEARS

The global atmospheric teleconnections of ENSO vary substantially with the seasonal cycle, on the decadal timescale, and under the influence of global warming [11]. Hence, predictions on climate trends for the medium and long term are hard to make.

However, according to NOAA[12], it's typical for La Niña to last for two years or more. Therefore, for next couple of years, it is likely that the Sahel region will experience increased precipitation.

Afterwards, a return to a very probable El Niño phenomenon characterized by increased heat and exacerbation of drought will need to be considered [13], exacerbated by climate change and with even more significant consequences for vulnerable populations[14].

Historical trends in the ENSO cycle indicate that El Niño events typically last for one year, although there have been instances of longer lasting El Niño events in past years.

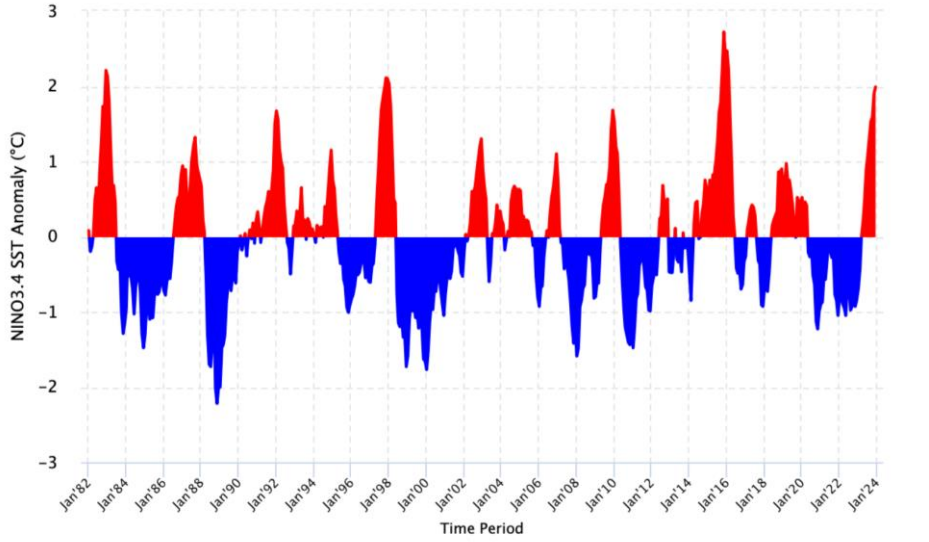

Figure 6 – Historical Nino Sea Surface Temperature Anomaly[15]

In the long term, in addition to cyclical climate phenomena, it will also be necessary to account for the impacts of climate change [16] when forecasting future weather conditions in West and Central Africa.

West and Central Africa are highly exposed to climate change, but the impacts vary across different regions. The Sahel will gradually become hotter, with some areas experiencing increased but erratic rainfall. Extreme weather events, including droughts and floods, are expected to intensify in this context, primarily caused by climate change due to human activities.

Several scenarios, called "Representative Concentration Pathways" (RCPs) [17] depending on the rate of emissions produced (optimistic RCP2.6 and more pessimistic RCP6.0), provide an overview of projected climate parameters and associated impacts on different sectors in the Sahel region by 2030.

[11] O. Alizadeh, 2023, A review of ENSO teleconnections at present and under future global warming - Alizadeh - 2024 - WIREs Climate Change - Wiley Online Library, https://wires.onlinelibrary.wiley.com/doi/full/10.1002/wcc.861
[12] NOAA, Data: NCEI, CPO, https://www.climate.gov/news-features/understanding-climate/el-ni%C3%B1o-and-la-ni%C3%B1a-frequently-asked-questions
[13] WHO, 2023, El Nino-Oscillation australe (ENSO), https://www.who.int/fr/news-room/fact-sheets/detail/el-nino-southern-oscillation-(enso)
[14] ACF, 2023, El Nino aggrave la faim dans le monde, https://www.actioncontrelafaim.org/a-la-une/el-nino-aggrave-la-faim-dans-le-monde/
[15] ENSO forecast, Janvier 2024, https://iri.columbia.edu/our-expertise/climate/forecasts/enso/2024-january-quick-look/
[16] Le Monde, 2024, Au Sahel, la vague de chaleur extrême est bien due au changement climatique, https://www.lemonde.fr/afrique/article/2024/04/18/au-sahel-la-vague-de-chaleur-extreme-est-bien-due-au-changement-climatique_6228465_3212.html
[17] UNHCR, Climate Risk Profile: Sahel, https://www.unhcr.org/sites/default/files/legacy-pdf/61a49df44.pdf

TEMPERATURES

In response to increasing greenhouse gas (GHG) concentrations, air temperature over the Sahel is projected to rise by 1°C by 2030. The highest increases are projected for northeastern Mauritania and northwestern Mali, with temperature increases of up to 1.25 °C in the period 2000–2030, under the RCP6.0 scenario. The lowest temperature increases are projected for western Senegal, where a 0.5°C increase is expected [18].

In correlation with the increase in average annual temperatures, the annual number of very hot days (days with a daily maximum temperature exceeding 35°C) is expected to significantly increase, particularly in northeastern Guinea and southwestern Mali. Under the medium to high emissions scenario RCP6.0, these regions are projected to experience an additional 30 very hot days per year by 2030. Consequently, adverse effects on agricultural production, human health, and animal health are expected[19,20].

As a result of the rising global temperatures, sea levels of the Atlantic coast of the Sahel and in the Gulf of Guinea are expected to rise. By 2030, each of the coastal regions is projected to face a 12 cm increase compared to the sea level in the year 2000[21]. This escalation in sea levels poses alarming threats, including coastal erosion, heightened risk of flooding, and contamination of water bodies, with far-reaching impacts on the economies, livelihoods, environment, and biodiversity of the affected countries.

Flooding and coastal erosion affect the entirety of the West African coast, with particularly high vulnerability observed in the northwestern sector (between Mauritania and Guinea-Bissau) and along the Gulf of Guinea coast (from Ivory Coast to Cameroon) [22].

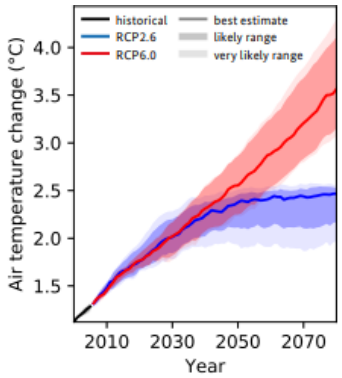

Figure 7 – Air temperature projections for the Sahel for different GHG emission scenarios

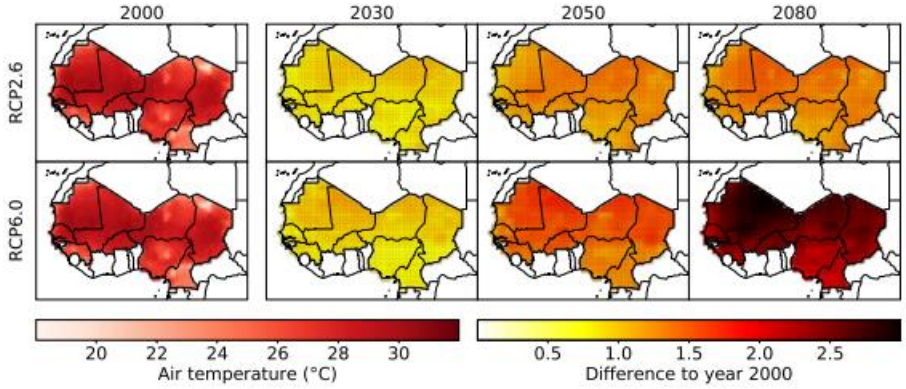

Figure 8 – Regional projections of air temperature for the Sahel for different GHG emission scenarios, relative to the year 2000

PRECIPITATIONS

Future precipitation projections are less certain than temperature change projections due to the high natural variability from year to year. Generally, for the upcoming years of the 2020s, it is likely that annual precipitation will increase in the Sahel by up to 20 mm/year. However, disparities in the magnitude of this change are observed across different regions.

An intensification of heavy precipitation events is also expected in many parts of the world due to the increased capacity of a warmer atmosphere to retain water vapor. Similarly, the number of days with heavy

[18] UNHCR, Climate Risk Profile: Sahel, https://www.unhcr.org/sites/default/files/legacy-pdf/61a49df44.pdf
[19] Christidis N., Mitchell D. and Stott P.A. 2019, Anthropogenic climate change and heat effects on health - International Journal of Climatology - https://rmets.onlinelibrary.wiley.com/doi/abs/10.1002/joc.6104
[20] Carleton T. and Hsiang S. 2016, Social and economic impacts of climate, Science, https://www.science.org/doi/10.1126/science.aad9837
[21] Niang I. et al. 2014, Chapter 22 Africa. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change https://www.researchgate.net/publication/309475977_Chapter_22_Africa_In_Climate_Change_2014_Impacts_Adaptation_and_Vulnerability_Part_B_Regional_Aspects_Contribution_of_Working_Group_II_to_the_Fifth_Assessment_Report_of_the_Intergovernmental_Panel_on_
[22] Dada O. A. et. al., 2024, Coastal vulnerability assessment of the west African coast to flooding and erosion, Nature, https://www.nature.com/articles/s41598-023-48612-5

precipitation events is expected to rise. Climate projections for the Sahel support this trend, indicating an overall increase in the number of days with heavy precipitation. In northern Chad and western Niger, an increase of approximately 4 days of heavy precipitation is projected by 2030, while in the western Sahel, particularly in Mauritania, Senegal, and northeastern Mali, a decrease in the number of days of heavy precipitation is anticipated. Furthermore, a reduction in the duration of the rainy season in the west due to a delayed onset should be considered. These precipitation changes will directly impact water availability and quality. Approximately 40% of the population in Sahelian countries lack basic access to water, and by 2040, countries like Burkina Faso will fall below the absolute water scarcity threshold [23]. Agricultural production, and consequently food security, will be severely affected, as well as sanitation and health.

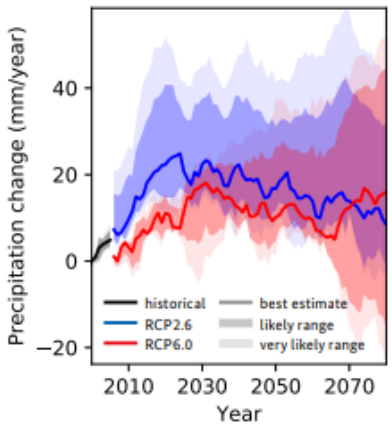

Figure 10 – Projection of the annual average precipitation for the Sahel region for different greenhouse gas emission scenarios, relative to the year 2000

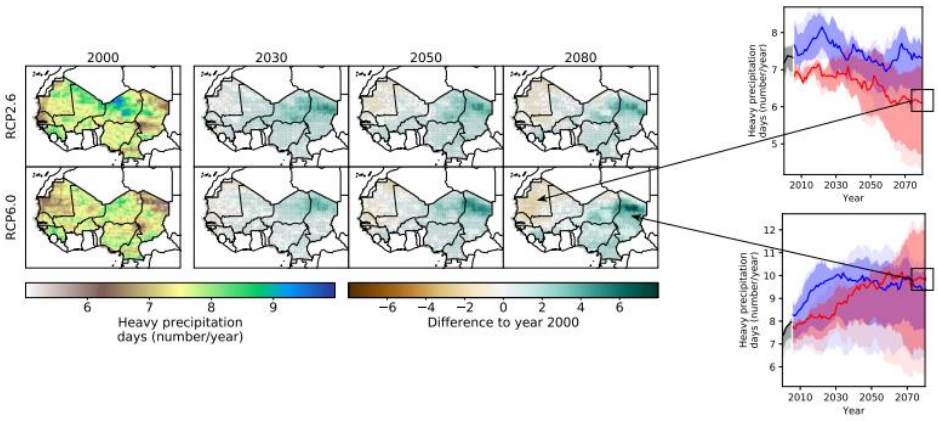

Figure 9 – Regional projection of the number of days with intense precipitation in the Sahel region for different greenhouse gas emission scenarios, relative to the year 2000

CONSEQUENCES OF CLIMATE CHANGE

The repercussions of climate change in West and Central Africa are substantial and affect several crucial areas. Decreased precipitation and rising temperatures jeopardize agricultural yields, putting food security at risk [21]. Traditional farming methods need adjusting to cope with these changing conditions, requiring an increasing adoption of water conservation techniques and crop diversification. In extreme situations, the degradation of local food systems and livelihoods, which rely on stable climates, leads to population displacement [24].

Simultaneously, these climate changes exacerbate the spread of diseases such as malaria and malnutrition, acting as catalysts for existing health issues, notably cardiovascular and respiratory diseases among the most vulnerable populations. Economically, losses due to climate-related disasters increase, impacting local economies and intensifying financial pressure on governments. The cost of climate disasters doubled in the poorest countries over the last decade, according to Kiswendsida Guigma from the Climate Centre of the Red Cross and Red Crescent in Burkina Faso, averaging 1.3% of GDP annually, four times the average of other emerging economies [25].

Moreover, the depletion of natural resources exacerbates pre-existing tensions, fuelling conflicts. When conflicts erupt, they exacerbate poverty, prompt population displacement, and expose people to the effects of climate change, creating a dangerous cycle of self-reinforcement [26].

Finally, it is worth noting that Chad and Nigeria are likely the two most vulnerable countries, already identified as at risk of climate disasters according to IPCC [27].

[23] Center for Preventive Action, 2022, Climate Change and Conflict in the Sahel.pdf (cfr.org)
[24] ONU, 2024, Le changement climatique est l'un des principaux facteurs de la crise de la faim dans le monde | ONU Info, https://news.un.org/fr/story/2024/03/1143946
[25] Le Monde, 2024, Au Sahel, la vague de chaleur extrême est bien due au changement climatique (lemonde.fr), https://www.lemonde.fr/afrique/article/2024/04/18/au-sahel-la-vague-de-chaleur-extreme-est-bien-due-au-changement-climatique_6228465_3212.html
[26] IRC, 2023, The Central Sahel: How conflict and climate change drive crisis | International Rescue Committee (IRC), https://www.rescue.org/eu/article/central-sahel-how-conflict-and-climate-change-drive-crisis
[27] IRC, 2023, 10 countries at risk of climate disaster | International Rescue Committee (IRC), https://www.rescue.org/eu/article/10-countries-risk-climate-disaster

CONCLUSION

These elements underscore the need to implement adaptation measures to reduce vulnerabilities among populations and mitigate the risks of violent conflicts in the region. It is paramount to deepen our understanding of climate change to effectively anticipate future challenges, develop cohesive projects, and devise appropriate strategies to support Sahelian communities in their adaptation processes. By enhancing the resilience of populations to climate change, we contribute to promoting a more sustainable future for the region.

ACRONYMES & ABREVIATIONS

DRC	Democratic Republic of Congo
ENSO	El Nino Southern Oscillation
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel for Climate Change
NMME	North America Multi-Model Ensemble
NOAA	National Oceanic and Atmospheric Administration
RCP	Representative Concentration Pathways

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