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Temperatures Projections for the Centre-West Region of Burkina Faso Over the Period 2000 to 2100

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Abstract:- Contemporary climate change is one of the many barriers to the socioeconomic development of populations (Niang, 2009, cited by Bambara et al., 2016, p. 36). Advances in information technology and the development of numerical models have significantly enhanced the understanding and characterization of climate phenomena (Dipama J M., 2014, p. 36), particularly in Burkina Faso. The Central-West region of Burkina Faso lies between two climatic zones, the Sudano-Sahelian and Sudanian zones, whose climatic variability greatly impacts irrigated agriculture. Analyzing climate trends is crucial for a better understanding of the region's climate phenomena. This paper aims to examine climate parameters in the Central-West region, analyze their variability, and propose appropriate adaptations for the local population's survival.

I. INTRODUCTION

Understanding climate trends requires the projection of key parameters (precipitation and temperature). Burkina Faso's climate, influenced by its geographic position, is closely linked to the dynamics of the Azores High in the Northern Hemisphere and the St. Helena High in the Southern Hemisphere, which occur within the Intertropical Convergence Zone (ITCZ) (Ouédraogo, 2015, p. 54, cited by Ouédraogo I et al., 2024, p. 124). Climate trends in Burkina Faso indicate alarming increases in average temperatures, projected to rise by 0.8℃ by 2025 and 1.7℃ by 2050, alongside a decline in rainfall by 3.4% in 2025 and 7.3% in 2050 (PANA, 2007, cited by Bognini S., 2010, p. 08). These trends, driven primarily by temperature and precipitation changes, severely impact irrigated agriculture. This paper provides a holistic understanding of temperature projections for the Central-West region of Burkina Faso from 2000 to

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2100, highlighting climatic challenges and their effects on irrigated agriculture.

II. METHODOLOGICAL APPROACH

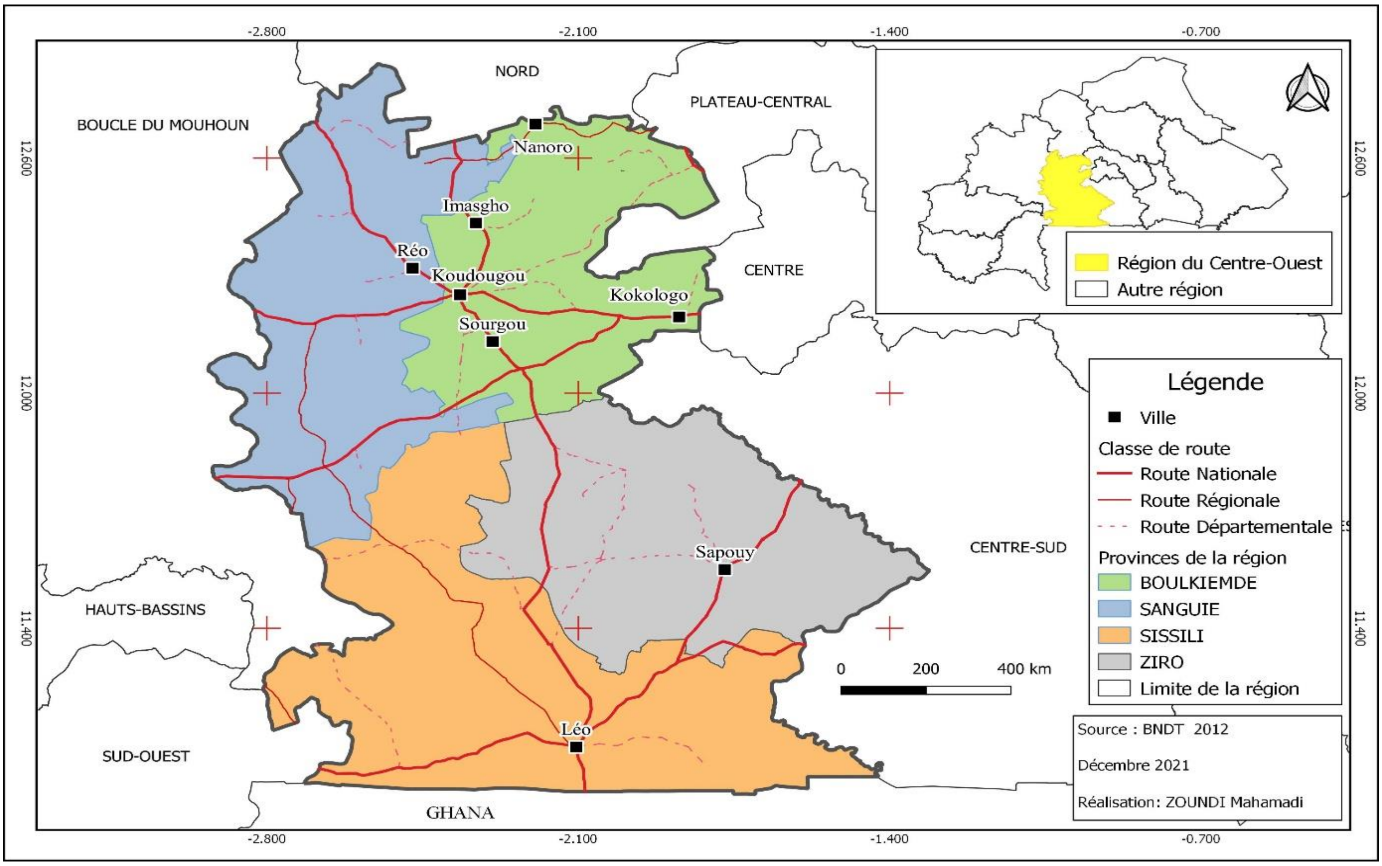
The methodological approach used consists of two steps: the characterization of the study area and the definition of an approach for the collection, processing and analysis of serial data.

A. Presentation of the Central - West Region

The Centre-West region is one of the thirteen regions of Burkina Faso, and is located between 11° and 12°50 north latitude and between 1°30 and 3° west longitude. Its capital, the city of Koudougou, is located 100 km from Ouagadougou, the capital of Burkina Faso. The region covers an area of 21,891 km², which represents 8% of the national territory (M ZOUNDI et al., 2024, p 688).

It is bordered to the south by the Republic of Ghana, to the north by the North region, to the east by the Centre-South and Central regions, to the west by the Boucle du Mouhoun and South-West regions, and to the north-east by the Central Plateau region (see Map 1).

The Centre-West region has four provinces, including Boulkiemdé, Sanguié, Sissili and Ziro, with the cities of Koudougou, Réo, Léo and Sapouy respectively as capitals. It has four (4) urban communes, thirty-four (34) rural communes and 590 administrative villages.



Map 1: Geographical location of the Centre-West Region

In terms of climate, the Centre-West region is subject to two types of climate depending on the latitude. The northern Sudanese climate characterizes the northern part and covers the provinces of Boulkiemdé and Sanguié, and part of Ziro and Sissili. The South Sudanese climate characterizes the southern part of the provinces of Sissili and Ziro. Average temperatures vary from 12°C from December to January, to 38° from March to May. Rainfall is between 600 mm and in the Sudanian-type climatic zone, and between and in the South Sudanian zone. In general, rainfall has been characterized by a poor spatio-temporal distribution over the entire region in recent decades, affecting the performance of agro-sylvo-pastoral, fisheries and wildlife production. 1000 mm800 mm1200 mm.

B. Data Collection, Processing and Analysis Approach

The methodological approach is based on a projected climate analysis of the Central-West region. Climate projections are crucial for understanding the challenges the region may face in the future. The analysis of future climate trends is derived from data provided by the World Bank's "Climate Change Knowledge Portal" and contributions from specialized researchers. These projection data are obtained from climate models and scenarios. The IPCC defines climate models as "extremely sophisticated computer programs that encompass our understanding of the climate system and simulate, as faithfully as possible, the complex interactions between the atmosphere, ocean, land surface, snow and ice, global ecosystem, and various chemical and biological processes."

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In this paper, projected climate parameters analyzed focus on temperature data.

III. RESULTS

A. Projected Temperatures from 2000 to 2100

Projected temperatures for the Central-West region between 2000 and 2100 were analyzed based on Shared Socioeconomic Pathways (SSPs). Projections were conducted using a multi-model ensemble under five scenarios.

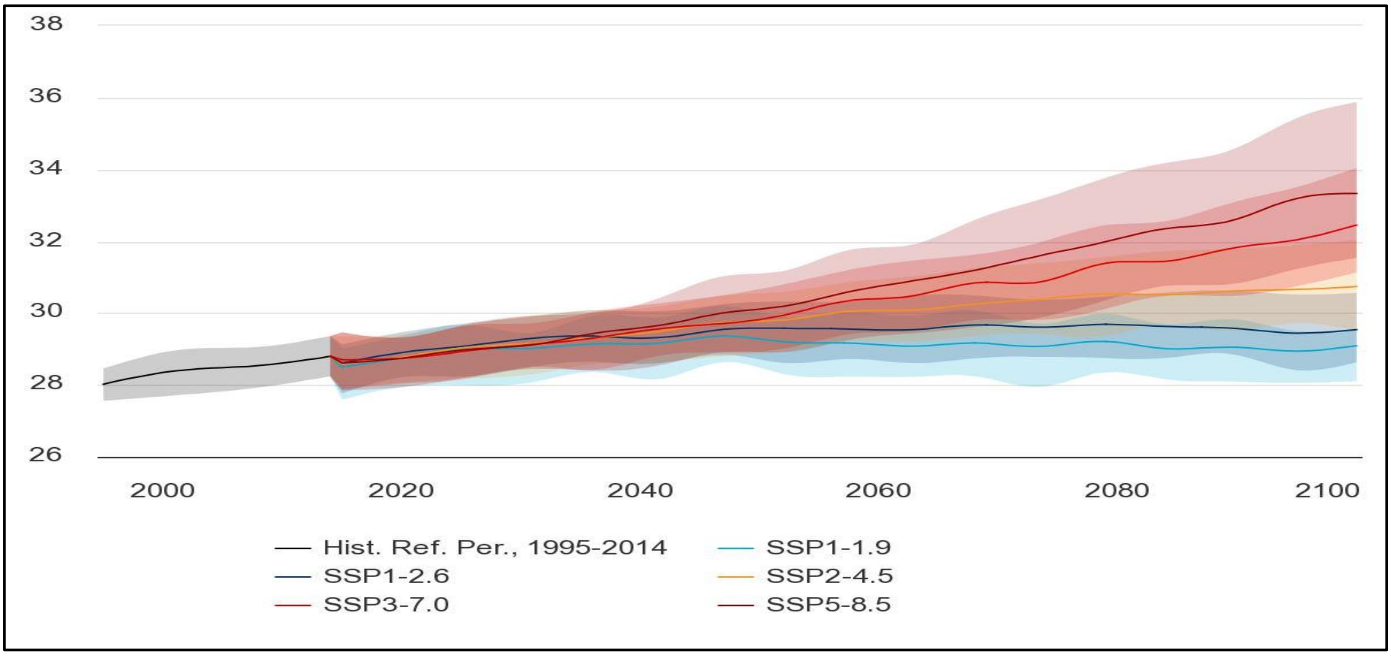
PHCs are trajectories used to explore possible futures based on human policies and behaviors. They are needed to understand how different mitigation and adaptation strategies may influence future climate.

- **SSP1-1.9**: A scenario where global CO2 emissions peak around 2020, followed by significant reductions to near-zero levels by 2050.
- **SSP1-2.6**:A sustainability-focused scenario with low challenges for adaptation and mitigation, involving moderate emission reductions.
- **PSS2-4.5** An intermediate scenario with moderate emission reductions and medium adaptation and mitigation challenges.
- **SSP3-7.0**: A fragmented world scenario with regional rivalries, high emissions, and significant adaptation and mitigation challenges.
- **SSP5-8.5** A scenario based on fossil fuel-driven development, leading to very high emissions and extreme adaptation and mitigation challenges.

SSP1-1.9 represents the most optimistic scenario, with strong greenhouse gas emission reductions and successful climate change adaptation. Conversely, SSP5-8.5 is the most pessimistic scenario, assuming a steep rise in greenhouse gas emissions and limited adaptation efforts.

The graph below analyzes the projected temperatures of the Centre-Ouest region from 2020-2100.

The coloured bands on the graph represent the uncertainties associated with each scenario. The dark lines indicate the median projection, i.e. the most likely value. The light bands represent the range of uncertainties, showing possible variations around the median.



Graph 1: Projected Annual Mean Temperature from 2000 to 2100 according to a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

Analysis of the graph indicates that the average temperature in the region is increasing continuously and significantly over the 21st century, regardless of the SSP scenario considered. The graph shows a general trend of increasing average temperatures in all scenarios, but with significant variations across emission trajectories.

SSP1-2.6 predicts a relatively more moderate temperature rise, reflecting efforts to reduce emissions. The average temperature could increase by about 1.5 to 2°C by 2100. This increase is more marked for SSP2-4.5 with average temperatures of up to 2.5 to 3°C. SSP3-7.0 predicts a significant and gradual increase in temperatures to reach 3.5 to 4°C by 2100. The most extreme scenario (SSP5-8.5 C) indicates temperature increases that could exceed 4.5°C in 2100. It shows that there are uncertainties around temperature projections, represented by the shaded areas around each median line. The uncertainty is greater for the most extreme scenarios (SSP1-1.9 and SSP5-8.5) than for the intermediate scenarios (SSP1-2.6, SSP2-4.5 and SSP3-7.0). It reveals that depending on the SSP scenario chosen, the average temperature in the region could vary between about 28°C and 36°C in 2100. This represents an increase of 2°C to 12°C compared to the historical reference period (1995-2014).

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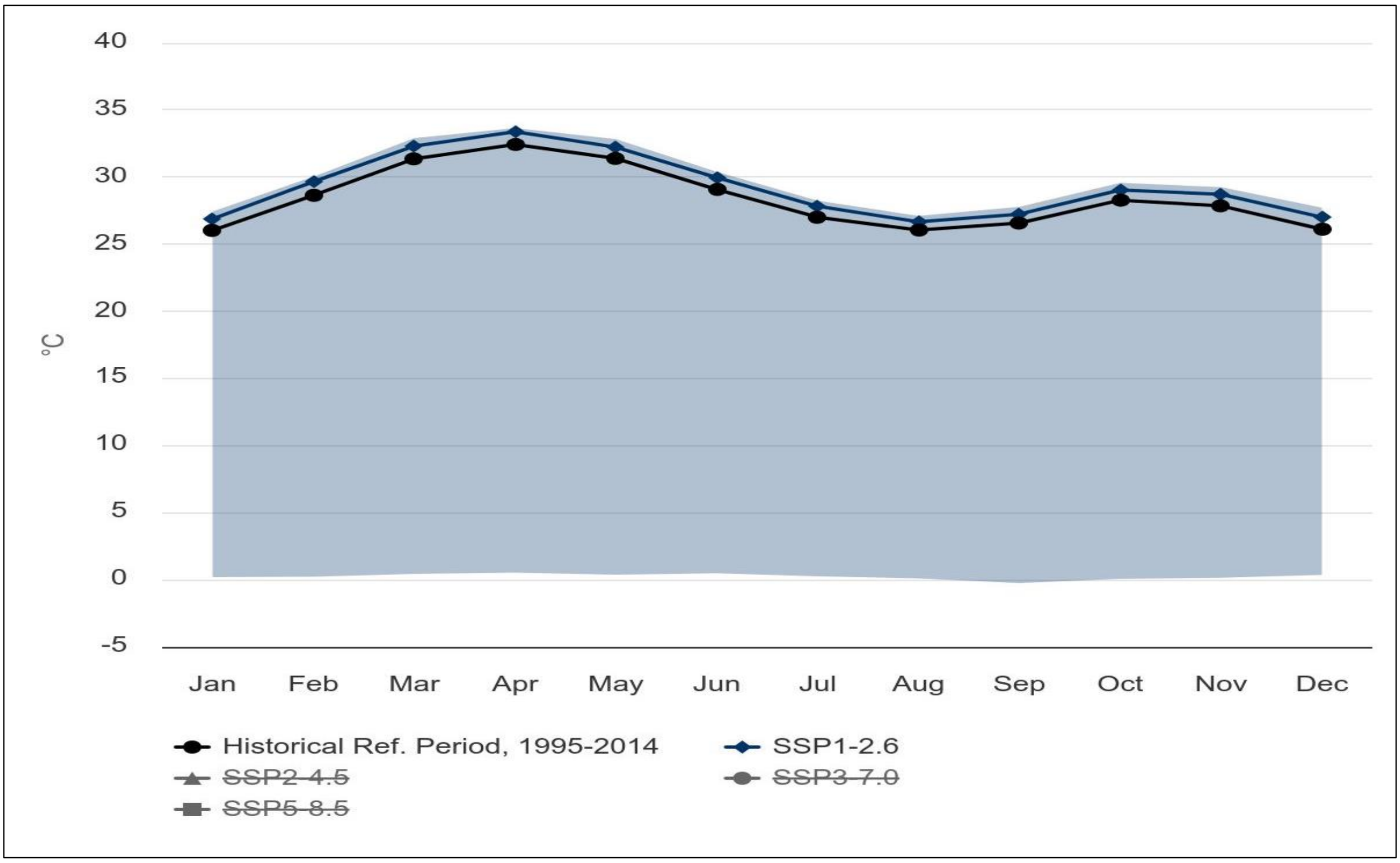
These uncertainties are due to several factors, including natural variations in climate, limitations of climate models, and uncertainties in future greenhouse gas emissions. The region, which is already facing challenges related to drought, floods, strong winds and epidemics, could be further affected by significant consequences from temperature changes. Indeed, climate change could affect food security by increasing the vulnerability of irrigated agriculture, health, water resources, ecosystems and socio-economic development.

➢ *Temperature Projection for the Period 2020 to 2039*

The monthly average changes in future temperatures are analyzed for the period from 2020 to 2100 according to extreme and moderate scenarios of a multi-model set.

- *Temperature Projection based on the SSP1-2.6 Scenario*

This optimistic scenario analyzes projected average temperature trends, illustrated in the graph below.



Graph 2: Projected Annual Mean Temperature from 2000 to 2100 based on an SSP1-2.6 of a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

The graph compares projected monthly average temperatures for 2020–2039 with historical data from 1995–2014. Historical data indicate monthly averages ranging from 25°C in January to approximately 30°C in April and May. These values serve as a reference for assessing future changes.

- **During the period 2020-2039**, the projected monthly average temperatures evolve in a similar way to those of the baseline, and will increase slightly. They will reach around 32°C in April and May. This scenario shows a moderate increase in temperatures compared to the reference period. According to IPCC (2014b, p.67) representative concentration scenarios show varying temperature increases depending on greenhouse gas emissions, with significant impacts on ecosystems and human communities. For Niang I. et al. (2014 p.1202), projections for Africa show more pronounced temperature increases under high-emission scenarios, requiring robust adaptation strategies.

- *Temperature Projection based on the SSP2-4.5 Scenario*

This intermediate scenario, where emission reduction efforts are moderate, analyses the projected average temperature trends through the graph below:

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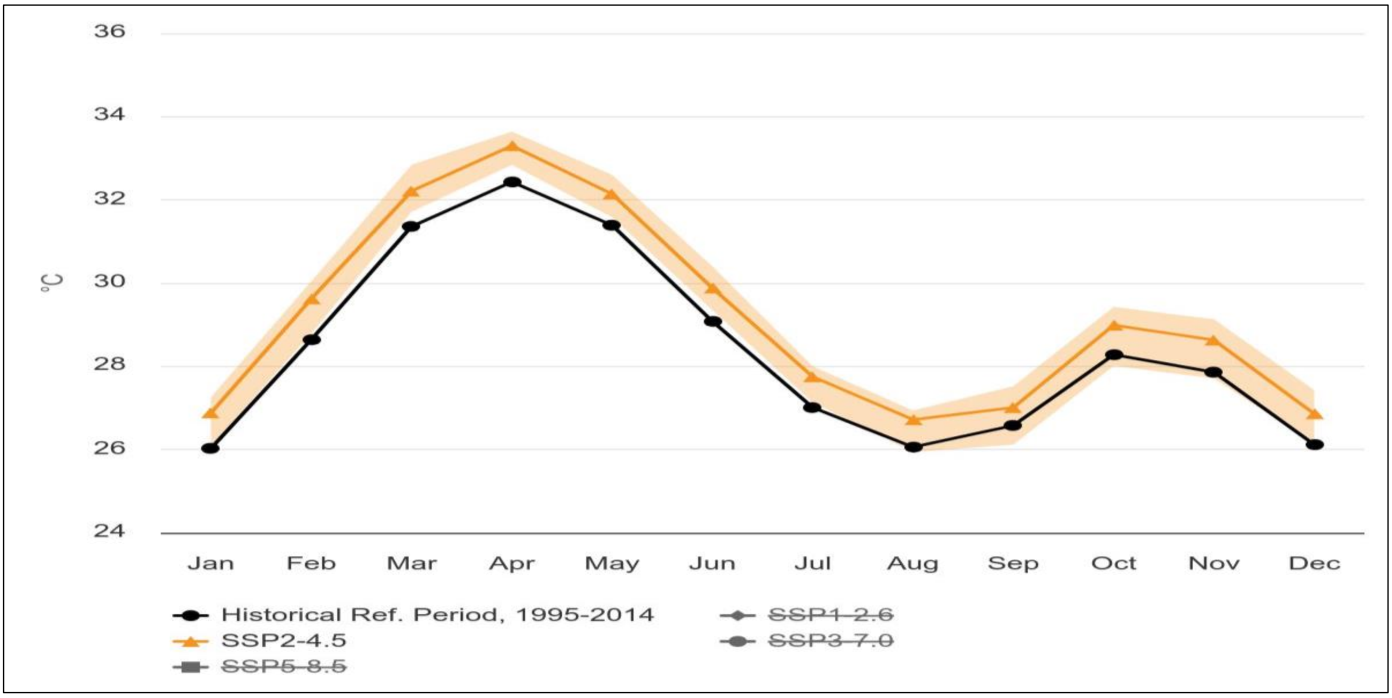
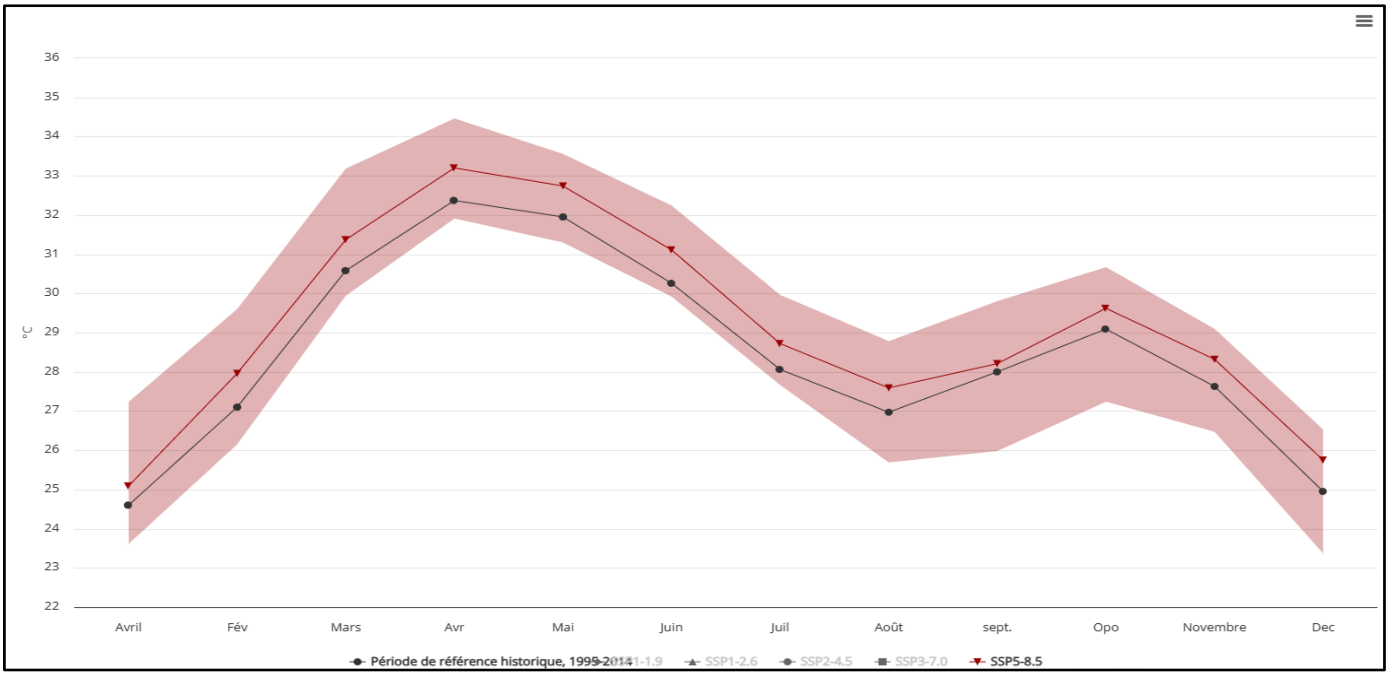


Graph 3: Projected Annual Mean Temperature from 2000 to 2100 based on an SSP2-4.5 of a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

The graph shows the projected monthly average temperatures for the period 2020–2039, compared to the historical period of 1995–2014. It shows average monthly temperatures that increase slightly, reaching around 33°C in April and May. It will gradually decrease to an average of 26.8°C in August. It will increase again from August until around 29°C in October. This scenario shows a moderate increase in temperatures relative to the reference period, and quite pronounced compared to the SSP1-2.6 projections. This trend is supported by Nicholson S. E. (2001, p.45), Hulme M. (2001, p.112), IPCC (2014b, p.67) and Niang I. et al. (2014, p.1202) who confirm this increase in average annual temperatures in West Africa, with potential impacts on ecosystems and populations.

- *Temperature Projection based on the SSP5-8.5 Scenario*

The graph below analyses the monthly average temperatures according to the SSP5-8.5 scenario.



Graph 4: Projected Monthly Mean Temperature from 2020 to 2039 by the SSP5-8.5 Scenario of a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

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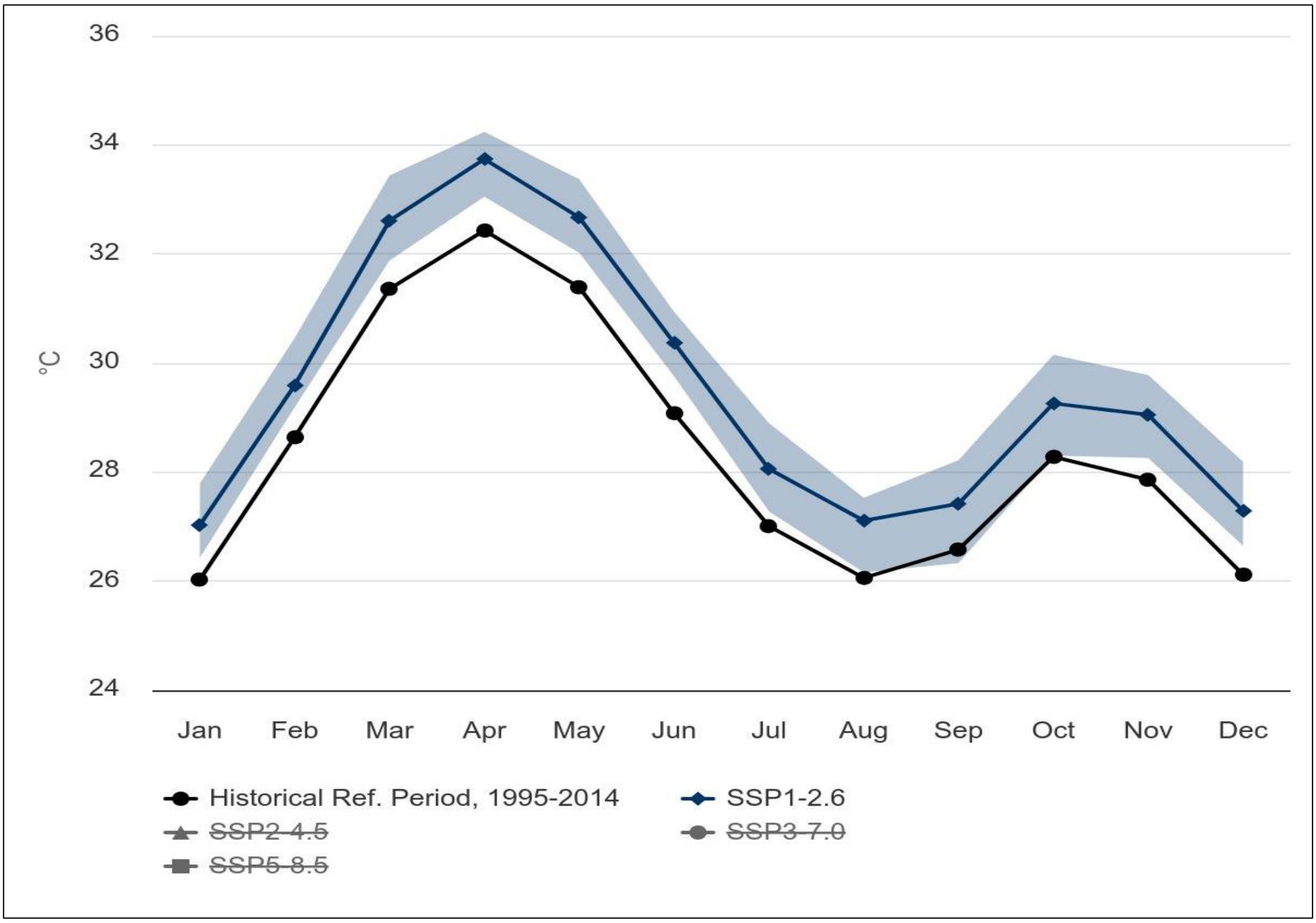
The graph shows the monthly mean temperature changes for PSS5-8.5 following a multi-model set from January to December for the period 2020 to 2039. It shows a similar trend between the baseline and analytical periods (2020-2039). It has two modes. The first starts in January with an average temperature of 25℃, followed by a gradual increase to reach an average maximum of 33℃ in April, then decreases to 27.7℃ in August. The second starts in August and reaches an average temperature of 29.7℃ in October, then decreases to 25.7℃ in December. The uncertainty or a confidence interval indicated by the shaded area, highlights the variability of the data and possible measurement errors. This uncertainty may reflect interannual variations due to climatic phenomena such as El Niño.

- *Temperature Projection from 2040 to 2059*

Projected temperatures for the period 2040 to 2059 are analyzed according to the extreme and moderate scenarios.

- *Temperature Projection based on the SSP1-2.6 Scenario*

The temperature analysis for SSP1-2.6 is done by the following graph.



Graph 5: Projected Monthly Mean Temperatures from the Period 2040 to 2059, Scenario SSP1-2.6 (ref. Period: 1995-2014) of a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

It shows the monthly mean temperature changes for SSP1-2.6 following a multi-model set from January to December for the period from 1995 to 2014. It shows a similar trend between the baseline and analytical periods (2040-2059). It has two distinct modes. The first starts in January with an average temperature of 27℃, followed by a gradual increase to reach a maximum average of 33.7℃ in April, then decreases to 27℃ in August. The second starts in August and reaches an average temperature of 29.1℃ in October, then decreases to 27.1℃ in December.

- *Temperature Projection based on the SSP2-4.5 Scenario*

The temperature projection data used in this analysis come from a set of climate models that are based on specific socio-economic scenarios. The temperature projections following the SSP2-4.5 scenario are analysed by the graph below. The SSP2-4.5 scenario represents an intermediate socio-economic path with moderate efforts to mitigate greenhouse gas emissions.

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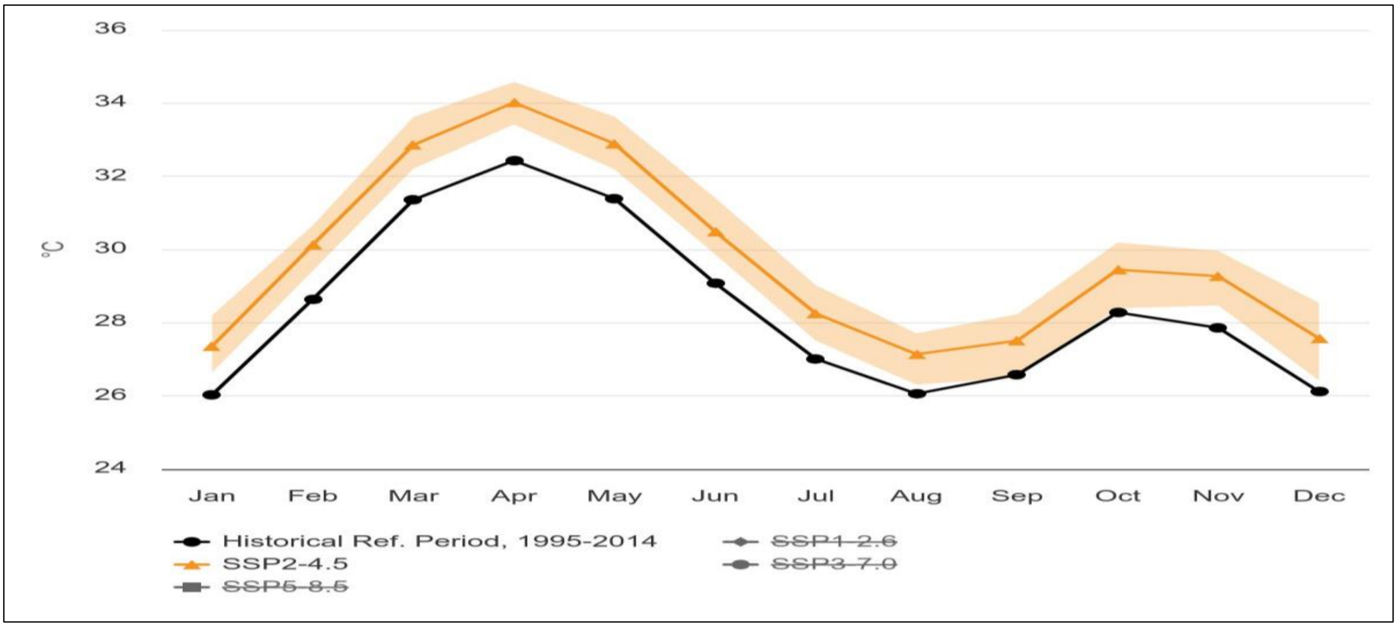


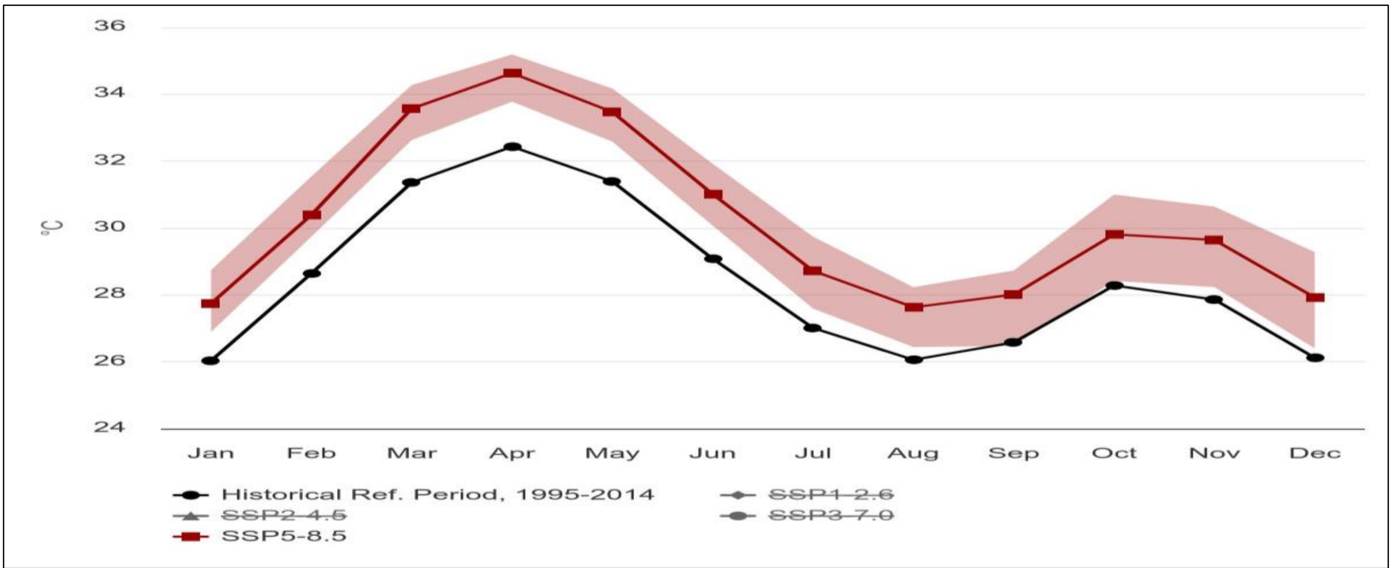
Graph 6: Projected Monthly Mean Temperatures from the Period 2040 to 2059, Scenario SSP2-4.5 (ref. Period: 1995-2014) from a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

The graph compares projected monthly mean temperatures for the period 2040-2059 with those of a historical reference period (1995-2014). Analysis of historical observations of monthly mean temperatures between 1995 and 2014 indicate typical seasonal variations with peaks in April and October, and troughs in August and December.

The projected temperatures follow a similar trend to the historical period but at a higher level. Projections suggest a general increase in monthly average temperatures. They show higher temperatures throughout the year, with increases particularly marked during the warmer months (April and October). This increase is consistent with global warming trends. Although temperatures are increasing overall, seasonal variability remains similar to that observed historically. High temperatures in April and October and low temperatures in August and December persist, which would mean that seasonal cycles will not be fundamentally altered, but amplified.

- *Temperature Projection based on the SSP5-8.5 Scenario*

The SSP5-8.5 scenario represents a socio-economic path characterized by higher global warming because it assumes a high dependence on fossil fuels and a significant increase in greenhouse gas emissions. The analysis of the temperature projections is given by the graph below.



Graph 7: Projected Monthly Mean Temperatures from 2040 to 2059, SSP5-8.5 scenario (ref. Period: 1995-2014) from a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

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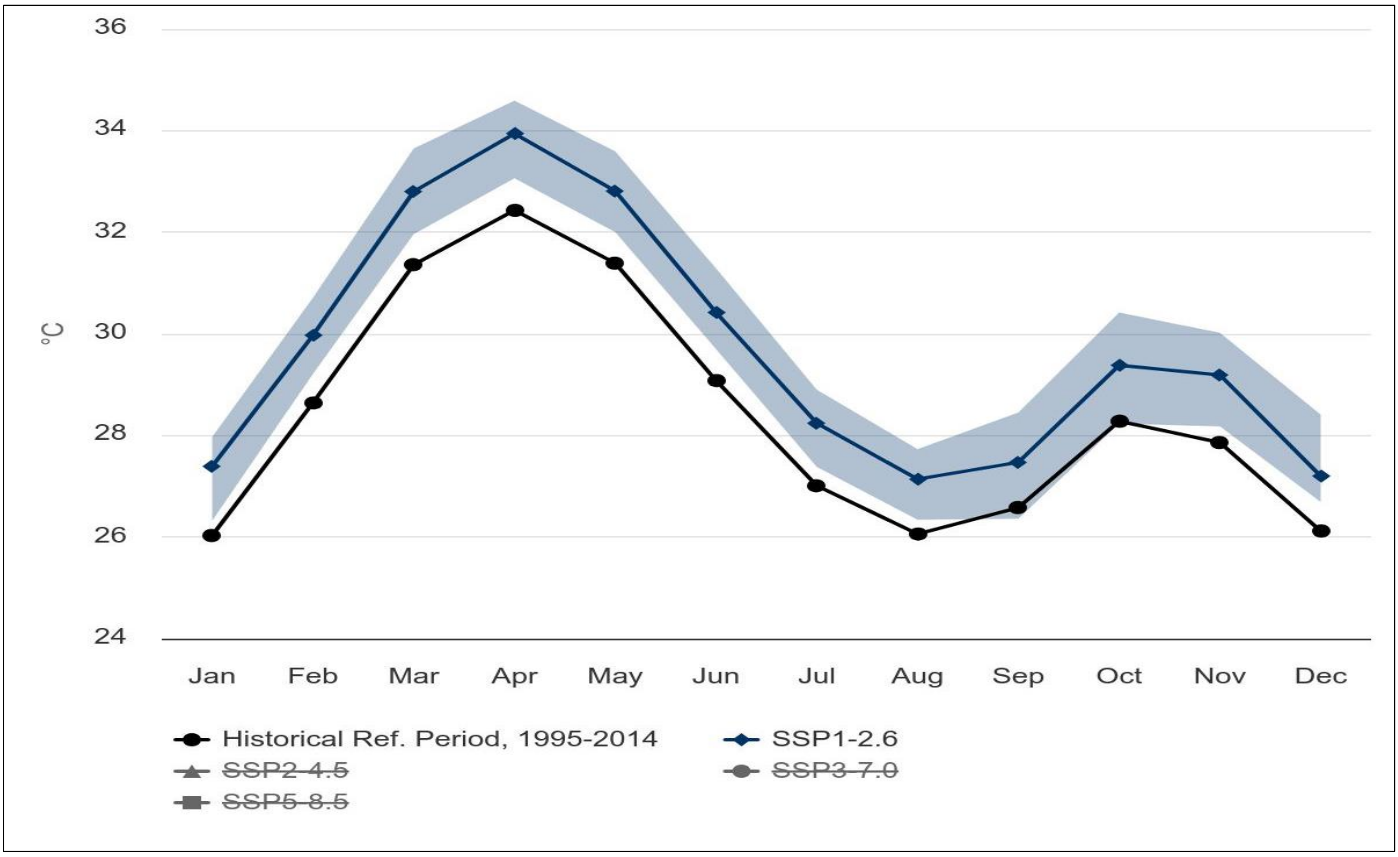
The graph shows historical monthly average temperatures that vary between around 24℃ and 34℃ with typical seasonal variations with peaks in April and October, and low values in August and December. The projected average temperature trends are similar to those of the historical period but at a much higher level. They show higher temperatures throughout the year, with increases particularly marked during the warmer months (April and October). The temperatures projected under SSP5-8.5 vary between about 26℃ and 36℃.

➢ *Temperature Projection from 2060 to 2079*

Projected temperatures from 2060 to 2079 are analyzed according to the extreme and intermediate scenarios of SSP1-2.6, SSP2-4.5 and SSP5-8.5.

- *Temperature Projection based on the SSP1-2.6 Scenario*

The attached graph analyzes the projected temperatures from 2060 to 2079 for an SSP1-2.6.



Graph 8: Projected monthly mean temperatures from 2060 to 2079, SSP1-2.6 Scenario (ref. Period: 1995-2014) from a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

The graph shows the monthly mean temperature projections for the period 2060–2079 in the Central West region, compared to the 1995–2014 reference period. There is a slight increase in the average temperature shown compared to the reference period. The months of March to May show a sharper, albeit moderate, increase compared to the higher emission scenarios.

➢ *In Terms of Variability, We Note that:*

- From January to March, temperatures gradually rise, reaching a maximum sound in March.
- Between April and June, a slight decrease is observed in April.
- From July to September, temperatures remain relatively stable, with a slight decrease in August.
- From October to December, there is a further increase in October, followed by a gradual decrease until December.

The uncertainty indicates that this variability is more pronounced during the transition months (March and October).

- *Temperature Projection based on the SSP2-4.5 Scenario*

The graph below analyses the projected temperatures for SSP2-4.5, which reflects moderate efforts to limit global warming.

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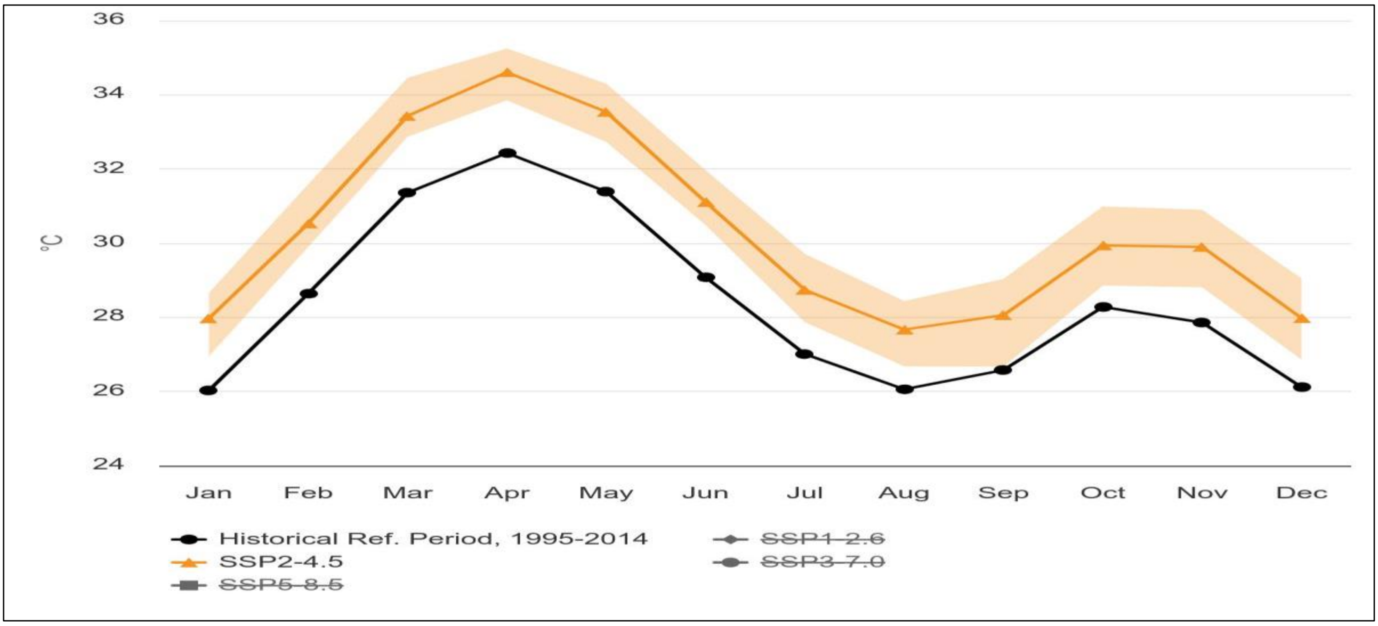
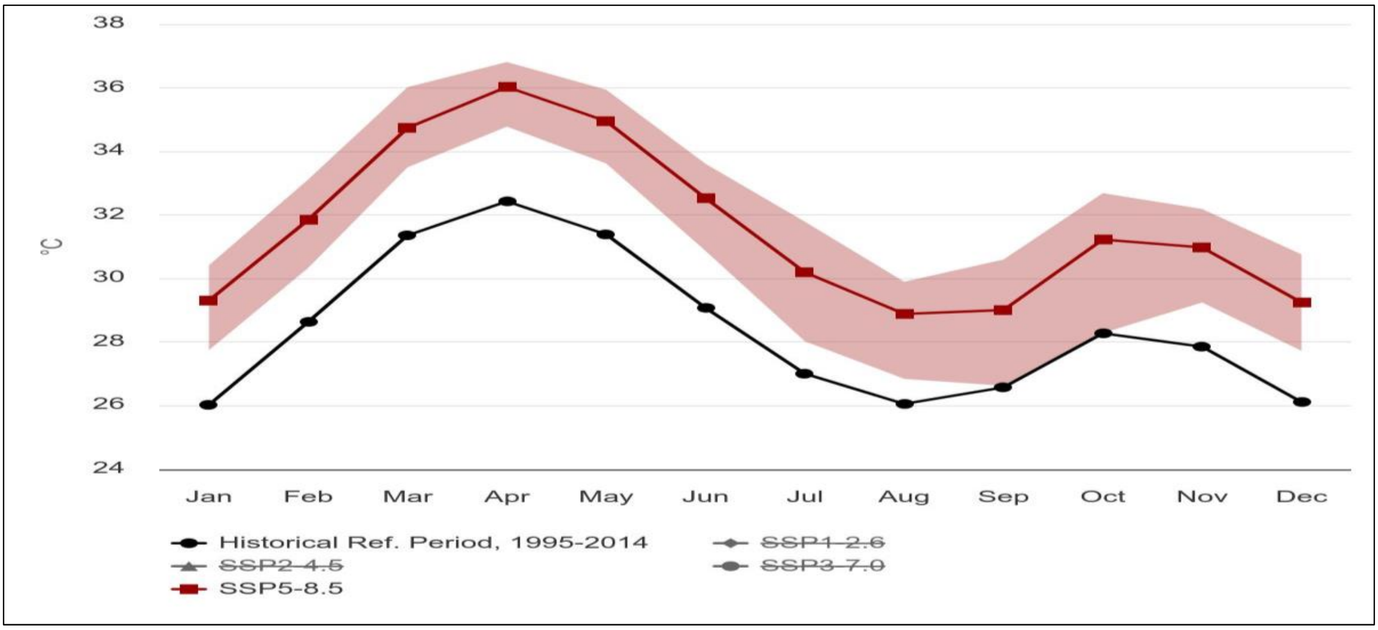


Graph 9: Projected Monthly Mean Temperatures from 2060 to 2079, SSP2-4.5 Scenario (ref. Period: 1995-2014) from a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

From the analysis of the graph, we can see a significant increase in the average temperature compared to the reference period. The warmest months remain March, April, May and show a more marked increase, although less pronounced than in the SSP5-8.5 scenario. There is also inter-monthly variability. Indeed, temperatures gradually increase from January to March, reaching a peak in March. A slight decrease is observed from April to June, followed by a stabilization in May and June. Temperatures from July to September remain relatively stable, with a slight decrease in August. The months of October to December will see a new phase of increase (October) and decrease (December) in the average temperature. The shaded areas around the projection line indicate the uncertainty of the models, which are more pronounced during the transition months (March and October), reflecting climate variability.

- *Temperature Projection based on the SSP5-8.5 Scenario*

The graph below analyzes the projected temperature trends and variabilities from 2060-2079 for a PSS5-8.5.



Graph 10: Projected Monthly Mean Temperatures from the Period 2060 to 2079, Scenario SSP5-8.5 (ref. Period: 1995-2014) from a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

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The SSP5-8.5 scenario shows a significant trend of increase in monthly mean temperatures compared to the reference period. This increase is most pronounced during the warmer months (March to May).

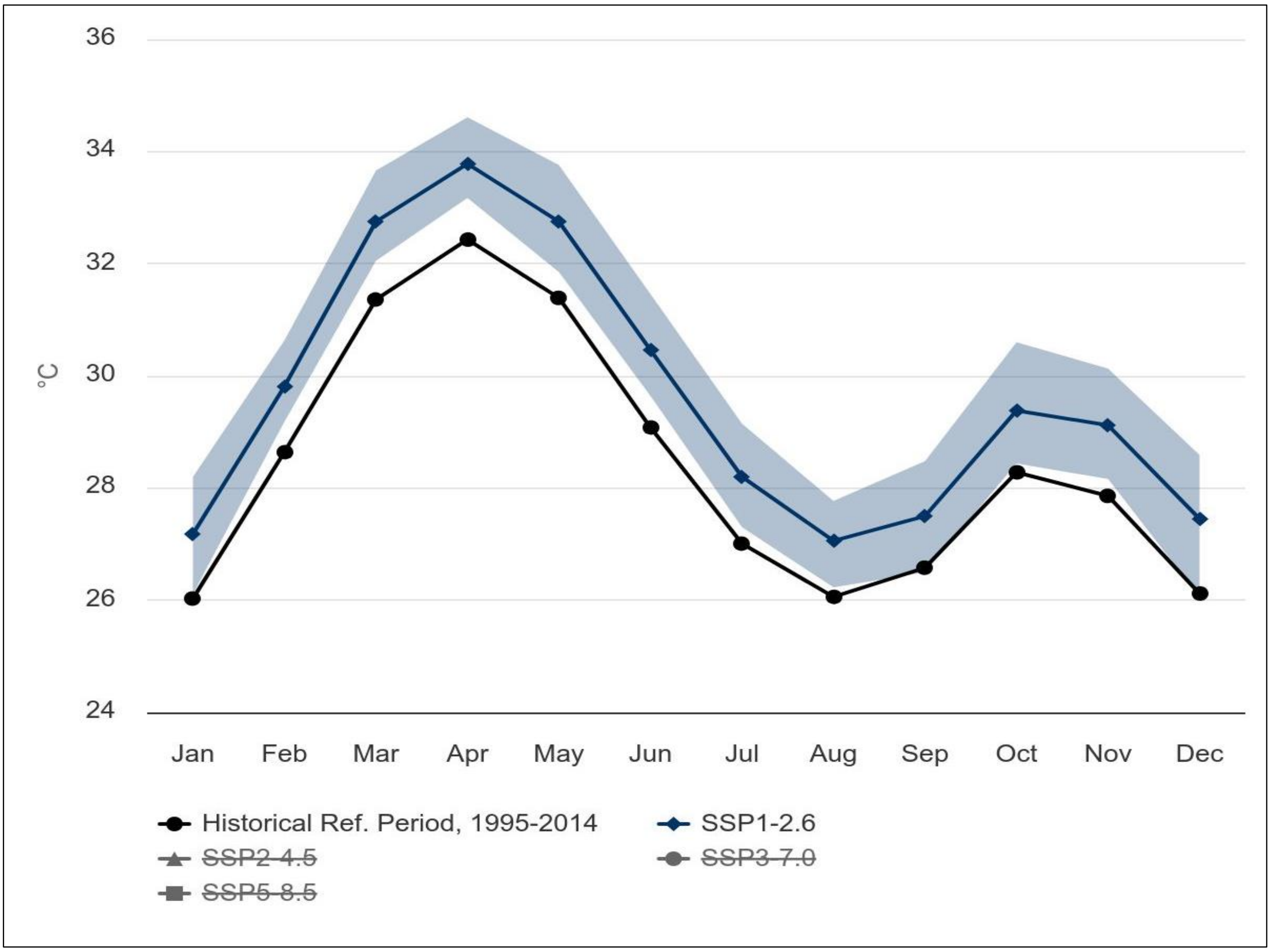
In terms of seasonal variability, the highest projected temperatures are observed during the months of March to May, while the lowest temperatures are observed in December and January. However, a significant increase is expected even during the colder months.

➢ *Temperature Projection from 2080 to 2100*

The projected temperatures of 2080-2100 are analyzed according to the extreme and moderate SSPs of a multi-model set.

- *Temperature Projection based on the SSP1-2.6 Scenario*

The temperature projections following SSP1-2.6 are analysed in the graph below.



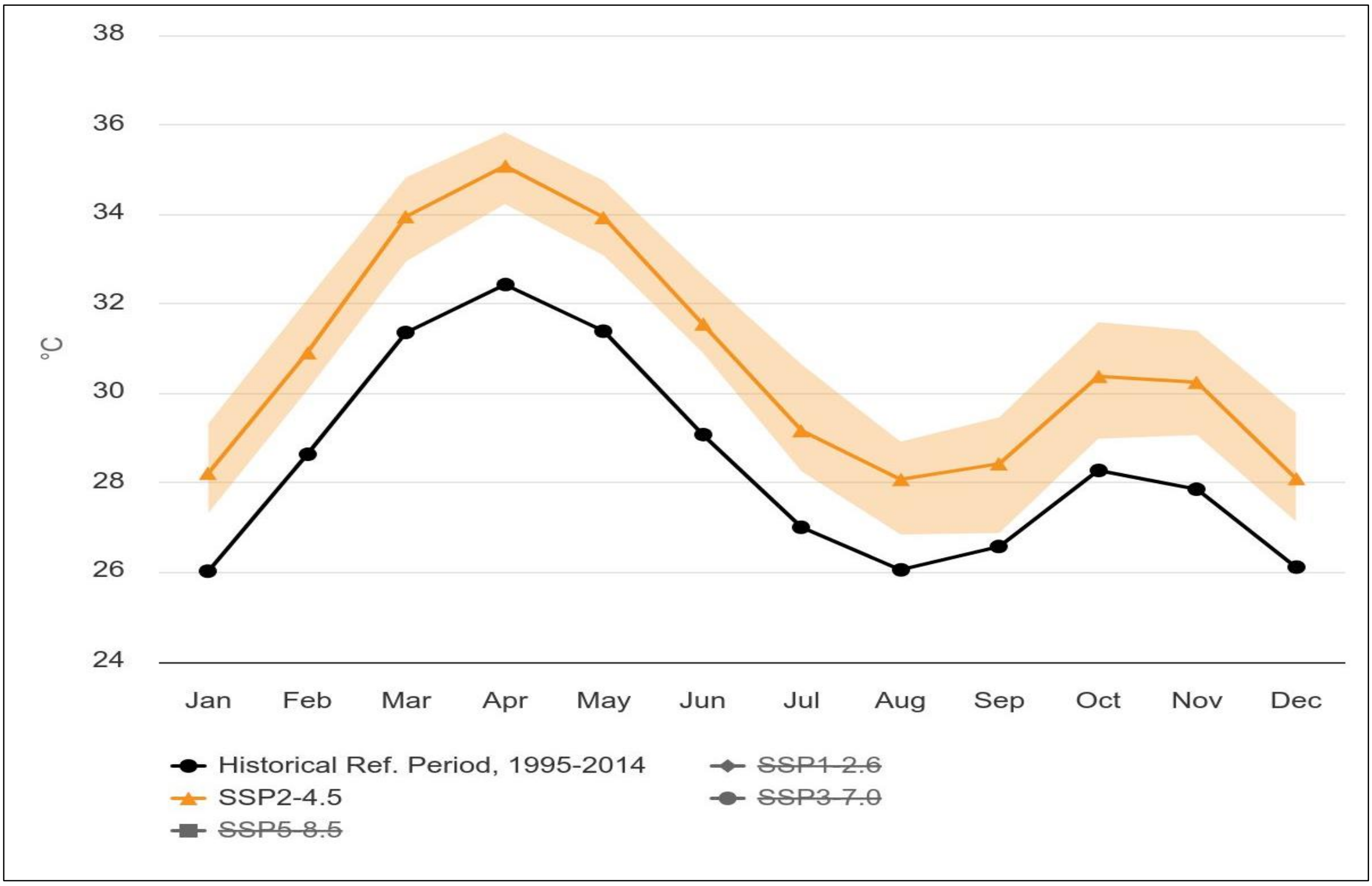
Graph 11: Projected Monthly Mean Temperatures from the Period 2080 to 2099, Scenario SSP1-2.6 (ref. Period: 1995-2014) from a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

Compared to the 1995-2014 reference period, there is a moderate increase in monthly mean temperatures for the SSP1-2.6 scenario. The average temperature rises from 26°C to around 28°C in January, an increase of 2°C.

In terms of variability, we deduce from the bimodal curve two periods of peak temperature. The first is the result of a gradual increase in temperatures from January, reaching the peak in April with about 34°C. It decreases from April to August (27°C). Temperatures remain relatively stable from July to September, with a slight decrease in August when it will rise again to reach the second peak in October with around 29.4°C, followed by a decrease until December.

- *Temperature Projection based on the SSP2-4.5 Scenario*

The graph below analyses the temperature projections for the Centre-West region developed by the SSP2-4.5 scenario.



Graph 12: Projected Monthly Mean Temperatures from 2080 to 2099, Scenario SSP2-4.5 (ref. Period: 1995-2014) from a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

The graph compares projected monthly mean temperatures for the period 2080-2099 with those of a historical reference period (1995-2014). Analysis of historical observations of monthly mean temperatures between 1995 and 2014 indicate typical seasonal variations with peaks in April and October, and troughs in August and December.

The projected temperatures follow a similar trend to the historical period but at a higher level. Projections suggest a significant increase in monthly mean temperatures compared to the reference period. Thus, in January, the average temperature drops from 26°C to around 28°C, an increase of 2°C.

They indicate higher temperatures over the years, with particularly marked increases during the warmest months of April and October. This increase is consistent with global warming trends.

The seasonal variability is clearly marked by the bimodal profile of the curve. As for inter-monthly variability, it is by a gradual increase in temperatures from January to April when the peak is reached with about 35.2°C of 3°C compared to the reference period. It decreases from April to August. During the period from July to September, temperatures remain relatively stable. It gradually increases again from August, reaching 30.2°C in October, where it decreases slightly to reach 28°C in December.

The uncertainty of the models indicated by the shaded areas around the projection lines is more pronounced during the transition months (March and October), and reflects climate variability.

- *Temperature Projection based on the SSP5-8.5 Scenario*

Projections of the monthly mean temperature for the period 2080-2099 in the Centre-West region are made according to the SSP5-8.5 scenario. This scenario represents a trajectory of high greenhouse gas emissions, often associated with rapid economic development without significant emission reduction measures is used. These projections are compared with data from the 1995-2014 reference period as shown in the graph below.

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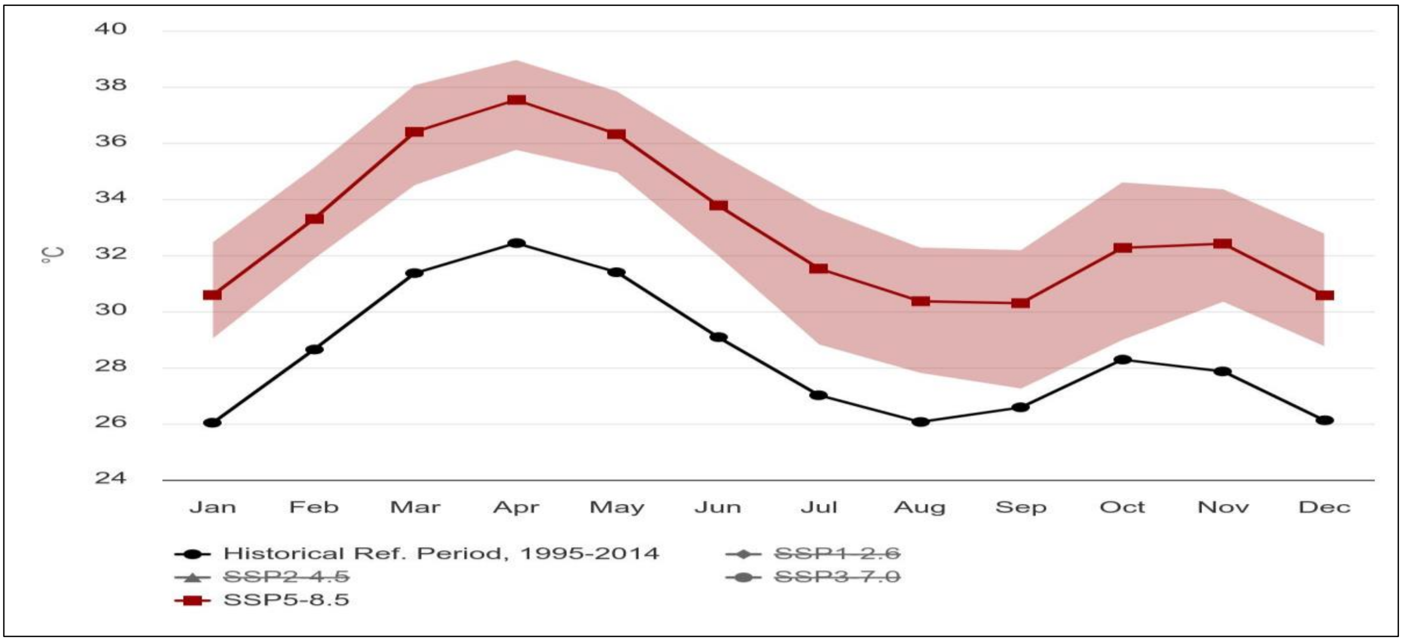


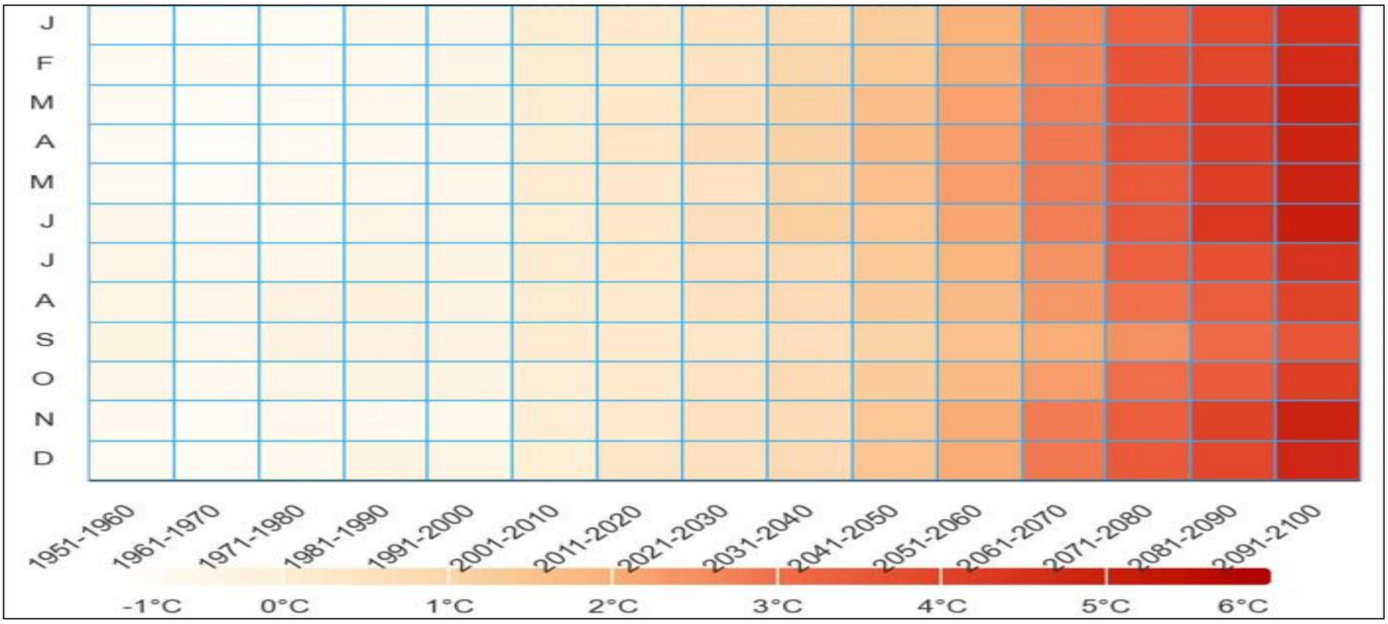
Graph 13: Projected Monthly Mean Temperatures from 2080 to 2099, Scenario SSP5-8.5 (ref. Period: 1995-2014) from a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

The analysis shows a marked increase and monthly variability in temperatures. Indeed, the SSP5-8.5 scenario reflects a significant increase in monthly mean temperatures compared to the reference period. In January, for example, the average temperature drops from 26°C to around 32°C, an increase of 6°C.

They remain variable throughout the years. During January to March, temperatures will increase gradually, reaching peaks in March (around 34°C), an increase of 8°C compared to the reference period. This will be followed by a slight drop in temperatures from April to June to reach around 33°C. Temperatures were relatively stable from July to September, with a slight decrease in August (around 32°C). During the period from September to December, there is again an increase in temperatures in October, followed by a gradual decrease until December when temperatures reach around 30.5°C.

B. Projected Temperature Variability from 2020 to 2100

The projected variability of temperatures makes it possible to complete the understanding of the evolution of temperatures and the related irrigation issues. Analyses of this variability are based on temperature anomalies. Indeed, the graph below analyzes the projected monthly average temperature from 1950 to 2100.



Graph 14: Projected Monthly Mean Temperature Anomalies for SSP5-8.5 following a Multi-Model Set from 1950 to 2100
Source : The Climate Change Knowledge Portal (CCKP)

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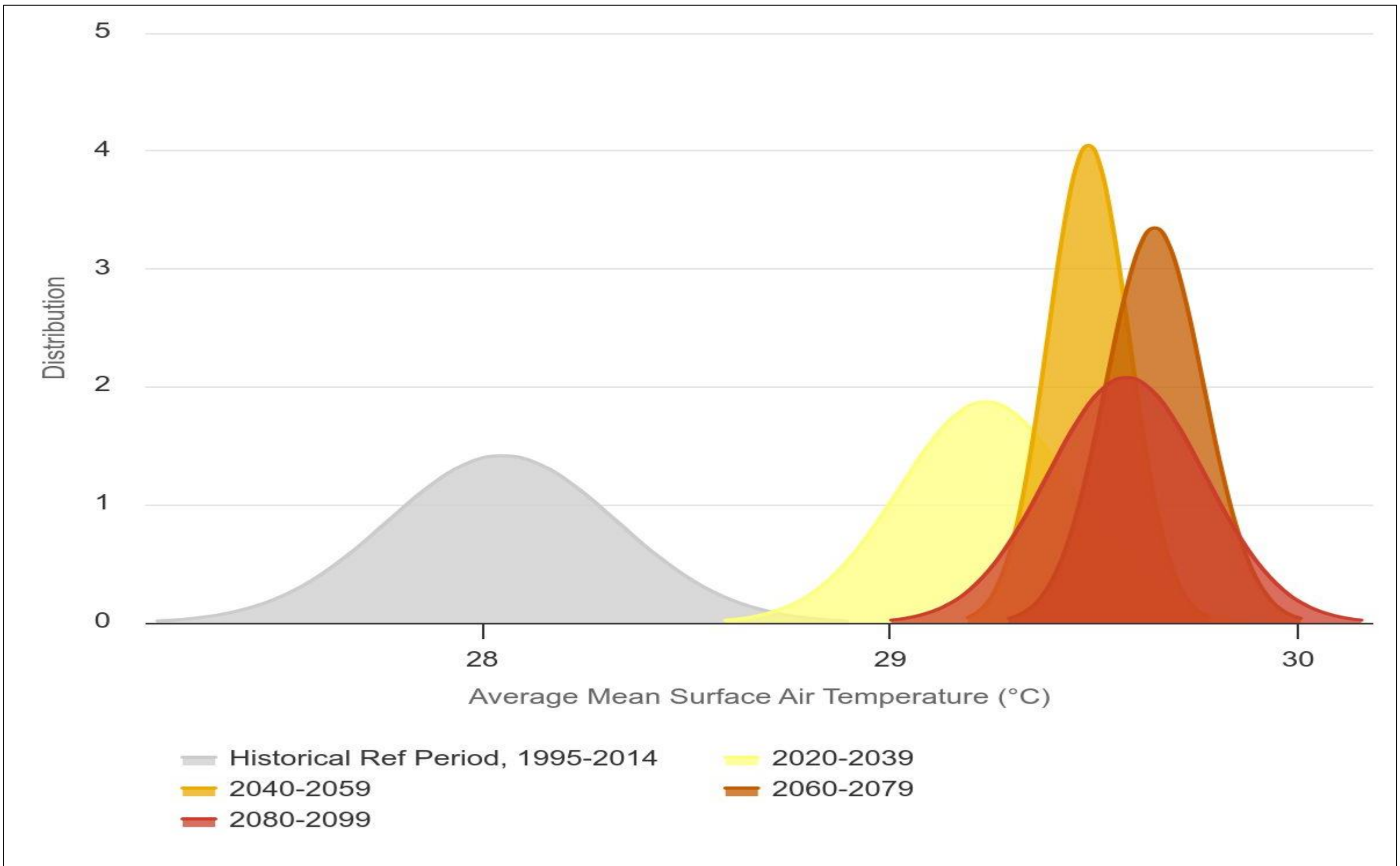
The graph shows the projected average temperature anomalies for the Centre-West region, with the reference period, 1995 – 2014. It is derived from the SSP5-8.5 scenario of a multi-model set. The colour scale ranges from -1°C to 6°C, where shades of light to very light red represent negative anomalies, i.e. colder than normal weather, and darker and darker shades of red represent positive anomalies (warmer than normal).

The graph shows a steady increase in temperature anomalies in the region over the decades. Indeed, before the 1980s, temperature anomalies were relatively small, hovering around 0°C. Between 1980 and 2000, there was a gradual increase in temperature anomalies, with values reaching 1°C to 2°C. After 2000, the increase in temperature anomalies accelerated, regularly exceeding 2°C and even reaching 4°C to 6°C by the end of the century. The most significant temperature anomalies usually occur during the dry season as indicated by the darker colors.

In short, the graph highlights a significant warming trend since the end of the twentieth century in the Centre-West region. This trend is expected to continue and intensify during the twenty-first century, with potentially significant consequences for agriculture, ecosystems and local populations.

- *Projected Change in the Distribution of Mean Temperature from 2020 to 2099 under the SSP1-2.6 Scenario*

The distribution of temperature anomalies over time tells us about temperature variability. This distribution is analyzed by the graph below for the period 2020 to 2099 according to the SSP1-2.6 scenario.



Graph 15: Projected Evolution of the Distribution of the Mean Surface Air Temperature from the Period 2020 to 2099, Scenario SSP1-2.6, (ref. Period: 1995-2014) of a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

The graph shows a historical period (1995-2014) that was marked by average surface temperatures mainly concentrated between 27.5°C and 28.5°C. This period was used as a reference for analysing future changes. Indeed, from these analyses, the following periods of variability can be observed:

- **From the period 2020-2039**, there is a visible shift towards slightly higher temperatures. The temperature range moves towards 28°C to 29°C, indicating an increase from historical data.
- **From the period 2040-2059**, the concentration of temperatures increases and migrates towards 29°C. This shows a continuing warming trend.

From the period 2060-2079, there is **a more marked increase, with temperatures concentrated between 29°C and 30°C.** This period indicates an acceleration of global warming, which can affect crop growth cycles and increase water stress.

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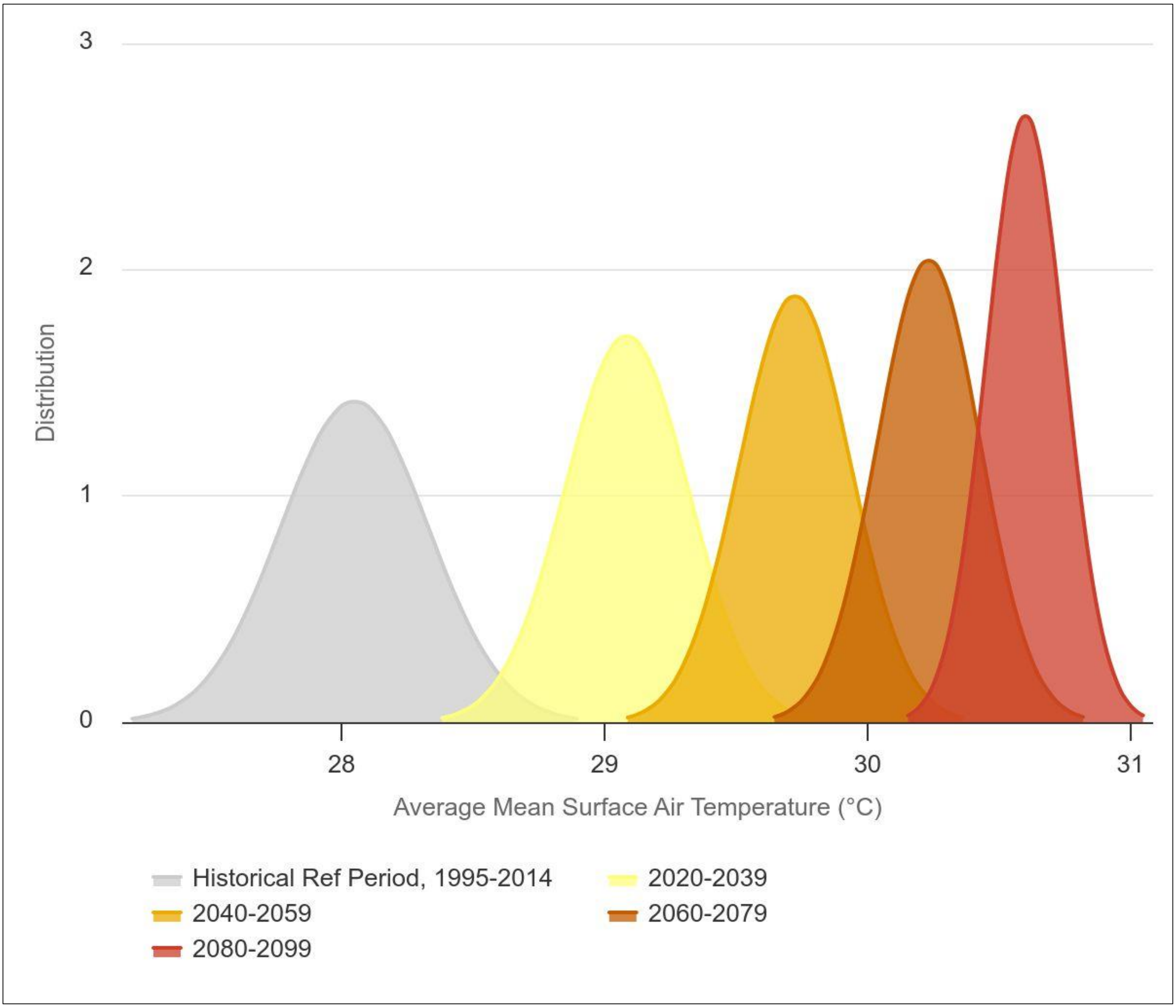
From the period 2080-2099**, average temperatures** would be the highest, between 29.5°C and 30.5°C. This indicates significantly warmer climatic conditions, with potential impacts on water availability, soil health, and the viability of some crops.

➢ *Projected Change in the Distribution of Mean Temperature from 2020 to 2099, SSP2-4.5 Scenario*

The analysis of the projected temperature variability from 2020 to 2099 in the Centre-West region, according to the SSP2-4.5 scenario, is given by the following graph.



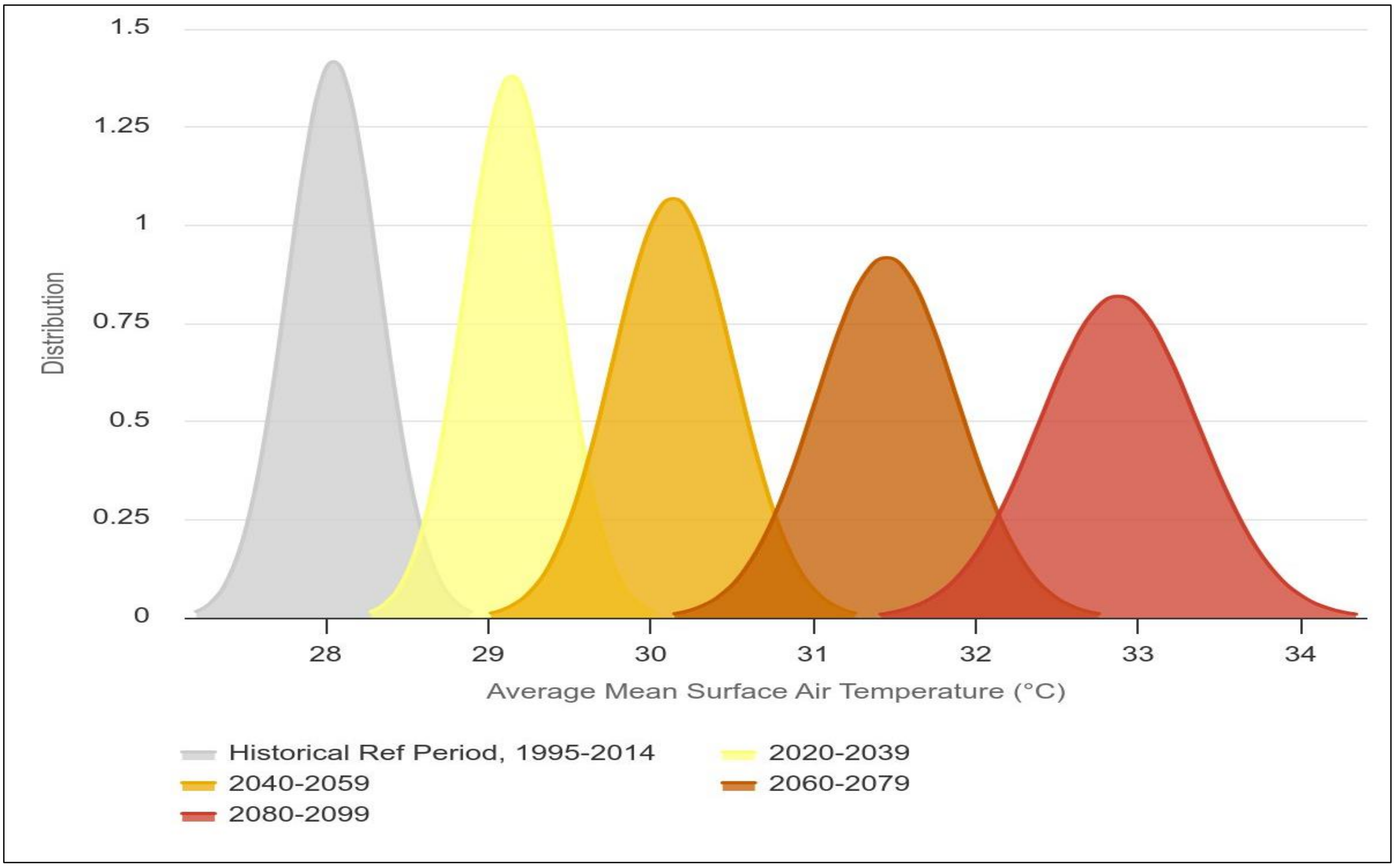
Graph 16: Projected Evolution of the Distribution of the Mean Surface Air Temperature from the Period 2020 to 2099, Scenario SSP2-4.5, (ref. Period: 1995-2014) of a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

Analysis of this graph shows a distribution of colors from light to dark red through the decades. This indicates a steady increase in the temperature anomaly, suggesting gradual warming over time. This warming will continue to reach anomalies of 6°C towards the end of the century (2071-2100), which is significantly warmer compared to the reference period.

This graph is essential for understanding the potential impacts of climate change, particularly in terms of the management of agricultural resources, biodiversity, and public health in the face of rising temperatures.

- *Projected Change in the Distribution of Mean Temperature from 2020 to 2099, Scenario SSP5-8.5*

The graph below shows the projections of the average surface air temperature through the SSP5-8.5 scenario, which represents a trajectory of high greenhouse gas emissions, compared to the historical reference period 1995-2014. Scenarios include the near future periods (2020-2039), the mid-century (2040-2059), and the end of the century (2080-2099).



Graph 17: Projected Evolution of the Distribution of Mean Surface Air Temperature from the Period 2020 to 2099, Scenario SSP5-8.5, (ref. Period: 1995-2014) of a Multi-Model Ensemble
Source : The Climate Change Knowledge Portal (CCKP)

The analysis of the graph indicates a trend of significant increase in annual mean temperatures compared to the reference period. The average temperature rises from 28°C to around 34°C by the end of the century, an increase of 6°C (Smith K. et al., 2023, p. 45). It also highlights a temporal variability of temperatures. Indeed, during the period 2020-2039, they increase slightly, with an average of around 30°C, an increase of 2°C compared to the reference period (Jones A. et al., 2022, p. 78). This increase becomes more marked at mid-century (2040-2059) with averages reaching around 32°C, an increase of 4°C compared to the reference period (Brown J. et al., 2021, p. 112). It is observed that at the end of the century, temperatures reach their maximum with an average of around 34°C, an increase of 6°C (Smith K. et al., 2023, p. 45).

C. Climate Impacts of Projected Temperatures in the Centre-Ouest Region

Climate projections indicate a trend of increasing temperatures in the Centre-West region of Burkina Faso. According to the work of IPCC (2014a, p. 112), the scenario of increasing greenhouse gas emissions predicts an average increase in temperature, with potential impacts on hydrological cycles and water needs. Indeed, the analysis of anomalies reflects impacts on water resources, agriculture and ecosystems.

- **In agriculture**, negative rainfall anomalies would reduce agricultural yields, thus affecting agricultural production, particularly irrigated production. This analysis is supported by the work of Rosenzweig C. and Tubiello F. N. (2007, p. 855) who suggest that higher temperatures and variations in rainfall can affect irrigated crop yields, thus requiring adaptations in agricultural practices. Farmers should adopt more drought-tolerant crops and farming practices adapted to new climatic conditions. In addition, temperature variability would lead to phenological changes. Crop growth cycles can be disrupted, affecting the sowing, flowering, and harvesting period. Some crops may no longer be viable in the most affected areas.
- **In Terms of Water Resources**, changes in rainfall patterns lead to a chain of impacts, including reduced rainy season length and rainfall, water shortages affecting water supplies for human consumption, and irrigation activities. This situation requires the adoption of sustainable water management practices such as adapted infrastructure, reservoirs and rainwater harvesting systems during dry periods.
- **In terms of Water Management**, reductions in rainfall during the rainy season can negatively affect the filling of water reservoirs, leading to water shortages for human consumption, livestock and irrigation. The construction of storage infrastructure such as reservoirs and runoff water collection basins (BCERs) would be necessary to support agricultural production during periods of drought.

- **Local Ecosystems** will be affected by changes in rainfall resulting in the disruption of biodiversity and ecosystem services. Rivers and wetlands are particularly vulnerable to rainfall reductions. Local ecosystems can be affected by changes in precipitation patterns, disrupting biodiversity and ecosystem services. Wetlands and rivers are particularly vulnerable to rainfall reductions.

IV. CONCLUSION

The results of the analyses show that temperature variations impact both irrigated agriculture activity and the availability of surface and groundwater resources. Indeed, temperature variations will have a direct impact on agriculture through the increase in water deficits (Rousset N. and Arrus R., 2007 p.01). Temperature therefore remains an essential and relevant data for a better understanding of climate change in sub-Saharan Africa and specifically in Burkina Faso. To this end, the analyses carried out in this article show an upward trend in temperatures, which will necessarily have an impact on the evapotranspiration of water points and an increase in plant water stress. And therefore unpromising agricultural yields as well as a change in the agricultural calendar and the types of seeds to be used

Annotality analysis highlighted the importance of policy choices and human actions in determining climate projections for the region. Mitigation and adaptation efforts are necessary to minimize the negative impacts of climate change, including the temperature anomalies projected under the SSP1-1.9 scenario.

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