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REVIEWER'S REPORT

Manuscript No.: IJAR-59045

Title: Evaluation des paramètres agro-climatiques d'un terroir sahélien: Cas de la Commune Rurale de Dungass (Zinder, Niger).

Recommendation:
Accept as it is .....
Accept after Major revision.....
Accept after Minor revision
Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity			✓	
Significance			✓	

Reviewer Name: Dr. ANAPANA GOPAL

Reviewer's Comment for Publication.

General Comments

The manuscript investigates the temporal variability of rainfall and agricultural-season characteristics in Dungass Rural Commune, Zinder Region, Niger, using daily rainfall data for 1981–2024 from CHIRPS V2.0, complemented by a socioeconomic survey of 81 respondents and qualitative interviews. The study examines interannual rainfall variability, rainfall regime changes, onset and cessation of the rainy season, dry-spell characteristics, seasonal typology and perceived impacts on local populations.

The topic is highly relevant for Sahelian agricultural planning, climate-risk management and adaptation. The manuscript also attempts to combine quantitative climatic analysis with local perceptions, which is a useful approach.

The manuscript contains potentially valuable results, particularly the reported 1997 rainfall-regime break, the recent wet conditions, changes in seasonal timing and the reported increase in flood-related impacts.

However, several important methodological and statistical issues must be addressed before the manuscript can be considered for publication. The most significant concern is the treatment and terminology of the Standardized Precipitation Index (SPI/IPS), together with insufficient statistical evidence for several reported trends. The manuscript also needs substantial improvement in the description of rainfall-data processing, seasonal calculations, survey methodology, figures, references and English/French language presentation.

Therefore, I recommend **Minor Revision**.

1. Originality and Scientific Contribution

The manuscript addresses an important local climate issue: increasing rainfall variability and associated flood risks in Dungass.

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The combination of:

- long-term rainfall data;
- rainfall-regime analysis;
- agricultural-season characterization;
- dry-spell analysis; and
- local perceptions of climatic impacts

provides a potentially useful multidisciplinary framework.
However, the manuscript should explain more clearly what is new compared with previous studies from Zinder and the wider Sahel.
The authors cite previous research showing rainfall recovery and changing seasonal characteristics in Niger and West Africa.
The revised Introduction should therefore clearly state:

1. What previous studies have established.
2. What remains unknown specifically for Dungass.
3. Why Bangaza/Dungass provides an important case study.
4. What methodological or empirical contribution this study makes.
5. How the findings advance climate-adaptation planning.

At present, the contribution is more case-study descriptive than explicitly demonstrated as novel.

2. Title

The title is relevant but could be made more precise.
The phrase **"terroir sahélien"** is understandable in the regional context, but an international journal may prefer a more explicit geographical and scientific formulation.
For example:
"Assessment of Agro-Climatic Variability and Agricultural Constraints in Dungass Rural Commune, Zinder Region, Niger"
or:
"Rainfall Variability, Agricultural Season Dynamics and Climate-Related Constraints in Dungass, Zinder Region, Niger"
The authors may retain the existing title if it conforms to the target journal's style.

3. Abstract

The Abstract provides the study period, data sources, principal findings and general implications. It appropriately reports the 1997 break detected using the Pettitt test and the recent wet conditions.
However, several statements require greater precision.
The authors should:

- state the number of survey respondents in the English Abstract;
- mention that rainfall data were derived from **CHIRPS V2.0**;
- specify the location of the socioeconomic survey;
- briefly state the criteria used to determine rainfall onset and cessation;
- report the statistical significance level or Pettitt test statistic where appropriate;
- avoid claiming an "intensification of extremes" unless extreme rainfall indices were actually calculated;
- distinguish between increasing rainfall totals and increasing rainfall intensity.

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The Abstract states that recent SPI values exceed 3.0 and indicate exceptionally wet conditions. This interpretation depends critically on how the SPI was calculated and therefore needs methodological clarification.

4. Introduction

The Introduction appropriately establishes climate change and rainfall variability as important challenges for Niger and the Sahel. It also explains the vulnerability of Dungass and its population to climatic disturbances.

However, the Introduction is somewhat broad and repetitive.

It should be reorganized into a clearer progression:

Sahelian climate variability → Niger → Zinder → Dungass → specific research gap → objectives.

The final paragraph should explicitly formulate the research questions.

For example:

- Has annual rainfall significantly changed between 1981 and 2024?
- Is there a statistically significant change point?
- Has rainfall onset become earlier?
- Has rainfall cessation become later?
- Have maximum dry spells changed?
- How do local perceptions compare with instrumental/reanalysis rainfall data?
- What are the major socioeconomic consequences?

This would give the study a stronger analytical framework.

5. Study Area

The manuscript provides the geographic coordinates and neighboring communes of Dungass.

The map on page 3 provides the location of Dungass within Niger/Zinder and identifies Bangaza as the study site.

However, the study-area description is insufficient for an agro-climatic paper.

The authors should add information on:

- annual average rainfall;
- mean annual temperature;
- elevation;
- soil types;
- vegetation;
- dominant crops;
- agricultural calendar;
- drainage characteristics;
- major flood-prone areas;
- population and settlement characteristics.

This information would help explain why rainfall variability translates into specific agricultural and flood-related impacts.

6. Rainfall Data and CHIRPS Methodology

The manuscript uses daily rainfall data from **1981–2024** obtained from CHIRPS V2.0.

This is a reasonable dataset for a Sahelian rainfall study.

However, the methodology requires considerably more detail.

The authors should specify:

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1. The exact CHIRPS grid cell(s) used.
2. Whether a single grid cell or spatially averaged rainfall was used.
3. The spatial resolution of the extracted data.
4. The extraction procedure.
5. Whether the CHIRPS data were validated against a local rain gauge.
6. Whether missing values were present.
7. How missing values were treated.
8. Whether the rainfall series represents a point or area average.
9. The reason CHIRPS was selected instead of available station observations.

This is especially important because the study makes detailed conclusions about rainfall trends at the local scale.

7. Minor Methodological Concern: SPI/IPS Calculation

This is the **most important methodological issue in the manuscript**.

The manuscript defines the index using:

Ii = (Xi − X) / S

where Xi is annual rainfall, X is the mean and S is the standard deviation.

This is essentially a **standardized rainfall anomaly/z-score**, not the conventional SPI methodology of McKee et al.

The conventional SPI involves fitting a probability distribution to precipitation, traditionally a gamma distribution, followed by transformation to a standard normal distribution.

Therefore, the manuscript should **not automatically refer to the simple z-score as SPI**.

The authors should either:

Option A: Recalculate the SPI using a recognized SPI methodology/software/package.

OR

Option B: Rename the index as:

Standardized Rainfall Anomaly Index

or an equivalent appropriate term, if they intentionally use the z-score method.

This issue is particularly important because the manuscript's major conclusion about values exceeding +3.0 depends on this index.

The authors should also carefully distinguish **mean** from **median**. The manuscript states that positive values indicate precipitation above the median, although the formula uses the mean.

This terminology must be corrected.

8. Pettitt Change-Point Analysis

The manuscript identifies **1997 as a significant rainfall-regime break** using the Pettitt test.

However, only the year of the break is reported.

The revised manuscript should provide:

- Pettitt test statistic;
- p-value;
- confidence/significance level;
- interpretation of the pre- and post-break periods;
- rainfall means before and after 1997;
- possibly effect magnitude.

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The authors should also explain whether the test was applied only to annual rainfall or to additional seasonal indices.
The statement that the 1997 break indicates a **common factor rather than a local phenomenon** is too strong based on a single local time series.
A single time series cannot establish regional synchronization.
The statement should instead be written cautiously, for example:
"The detected change point may be consistent with broader regional changes in Sahelian rainfall documented in previous studies."

9. Trend Analysis
The manuscript repeatedly describes increasing or decreasing trends:

- increasing annual rainfall;
- earlier onset;
- later cessation;
- increasing rainy days;
- decreasing maximum dry spells.

However, the manuscript appears to rely mainly on visual inspection and linear trend lines.
A linear trend alone does not establish that a trend is statistically significant.
The authors should consider appropriate trend tests such as:

- Mann–Kendall test;
- modified Mann–Kendall test where autocorrelation is present;
- Sen's slope estimator.

For each major climatic variable, report:

Variable	Trend slope	Test statistic	p-value	Significance
Annual rainfall				
Onset date				
Cessation date				
Season length				
Rainy days				
Maximum dry spell				

This would substantially strengthen the paper.

10. Definition of Rainy-Season Onset
The manuscript applies agronomic criteria beginning from 1 May, requiring at least 20 mm over 1–3 consecutive days without a subsequent dry spell exceeding seven days during the following 30 days.
This criterion should be described more precisely.
The authors should explain:

- whether 20 mm must occur on one day or across several days;
- whether the criterion is exactly 1–3 days or "within" 1–3 days;
- how the subsequent seven-day dry period was calculated;
- whether the criterion was applied automatically using daily CHIRPS data;
- whether alternative onset criteria were tested.

Because onset dates are highly sensitive to the threshold used, a sensitivity analysis would improve confidence in the results.

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11. Definition of Rainy-Season Cessation

The cessation methodology is less convincing.

The manuscript states that the end of the rainy season is determined from 1 September when the useful soil-water reserve in the upper 60 cm is completely exhausted through evapotranspiration.

However, the manuscript does not provide the necessary soil-water-balance inputs.

For such a calculation, the authors would need to explain how they obtained:

- soil water-holding capacity;
- initial soil moisture;
- root-zone depth;
- evapotranspiration;
- crop coefficient or equivalent parameters;
- infiltration/runoff;
- soil texture.

If these data were not actually used, the cessation criterion should be reconsidered or fully clarified.

This is a **Minor methodological issue** because the later conclusion about a delayed cessation and longer agricultural season depends on it.

12. Agricultural-Season Classification

The manuscript classifies seasons as:

- normal;
- early;
- late;
- long;
- short.

The definitions are based on mean onset and cessation dates.

However, the classification needs clarification.

For example, the manuscript states that a normal season corresponds to onset between 16 June and 20 July and cessation between 2 and 18 September, while Table 2 reports:

03 July ±17 days

10 September ±8 days.

The authors should clearly explain how these boundaries were derived.

There also appears to be a conceptual inconsistency between the definitions and the numerical boundaries.

The classification should be presented in a reproducible mathematical form.

13. Dry-Spell Analysis

The manuscript defines a dry spell as consecutive days without rainfall ≥0.5 mm and analyses June–September.

This is appropriate for assessing intra-seasonal rainfall variability.

The figures on page 11 show maximum dry-spell values for June, July, August and September, with visually decreasing trend lines.

However, the authors should provide quantitative statistics rather than relying primarily on visual trends.

Please report:

- slope;

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- p-value;
- trend test;
- mean maximum dry spell;
- minimum/maximum;
- interannual variability.

The statement that the decrease is "significant" should be avoided unless statistical significance has actually been tested.

14. Number of Rainy Days

The manuscript reports an increase from **23 rainy days in 1984 to 72 rainy days in 2024**.

This is an interesting result, but comparing two individual years is insufficient to demonstrate a long-term trend.

The authors should provide:

- annual rainy-day series;
- trend slope;
- statistical significance;
- definition of a rainy day;
- whether the 0.5-mm threshold was used consistently.

Also, Figure 6 is captioned:

"Augmentation du nombre des jours des pluies"

while the preceding section discusses **length of the rainy season**.

The figure numbering/captioning and interpretation should be checked carefully.

15. Interpretation of Increased Rainfall

The manuscript interprets increasing rainfall as a return toward wetter conditions and links this to increasing flood risk.

This is plausible, but increasing annual rainfall alone does not necessarily demonstrate increasing flood frequency or severity.

Flooding can depend on:

- rainfall intensity;
- rainfall duration;
- antecedent soil moisture;
- land cover;
- drainage;
- topography;
- wetland/cuvette characteristics;
- settlement expansion;
- channel modification.

The authors should therefore distinguish between:

increased annual rainfall

and

increased rainfall intensity/extreme-event frequency

unless the latter has actually been calculated.

If flood data are available, the paper would be substantially strengthened by relating flood occurrence to rainfall extremes.

16. Socioeconomic Survey

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The manuscript reports an individual survey of **81 people in Bangaza**, supplemented by collective interviews with elderly residents and administrative authorities.
This mixed-method approach is valuable.
However, the survey methodology requires much more detail.
Please provide:

- sampling method;
- survey dates;
- respondent demographic characteristics;
- sex distribution;
- age groups;
- occupations;
- sample-size justification;
- questionnaire structure;
- questions used to assess climate perceptions;
- method of qualitative data analysis;
- informed consent/ethical procedure, if applicable.

The manuscript should also clarify whether the 81 respondents represent farmers only or the general population.

17. Comparison Between Instrumental Data and Local Perceptions

The manuscript states that the population's perceptions are consistent with the climatic data and that all respondents reported observing more favorable rainfall conditions in recent years.
This is an interesting result, but the analysis is currently mostly descriptive.
The authors could strengthen this section by presenting:

- percentage of respondents reporting increased rainfall;
- percentage reporting increased flooding;
- percentage reporting earlier onset;
- percentage reporting later cessation;
- perceived changes by age/occupation/gender, if available.

If qualitative interviews were used, the analytical procedure should also be described.

18. Flooding and Cuvettes

The manuscript reports that more than **80 cuvettes** were identified during clearing activities in Bangaza in 2018 and that increased rainfall has resulted in flooding of many of these areas.
This is potentially important for understanding local hydrology.
However, the manuscript should distinguish clearly between:

- information obtained from the 2024 survey;
- observations from 2018 activities;
- authors' interpretation;
- respondents' perceptions.

If possible, a map showing the location of flood-prone cuvettes would add considerable value.

19. Discussion

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The Discussion contains a useful comparison with studies from Niger, Senegal and Burkina Faso. It also recognizes that the study's finding of decreasing dry spells differs from some previous regional observations.
This comparative approach is a strength.
However, the Discussion should be more analytical rather than repeating the Results.
The authors should discuss possible explanations for the differences with previous studies, including:

- spatial scale;
- rainfall dataset;
- observation period;
- onset/cessation definitions;
- dry-spell thresholds;
- local topography;
- methodological differences.

The manuscript itself already suggests that methodological and spatial differences may explain the contrasting dry-spell results.
This point should be developed further.

20. Important Contradiction Regarding Dry Spells

The manuscript reports decreasing dry spells in Dungass, while citing Ozer et al. (2017) as showing an increase in consecutive dry days and more intense rainfall events in Niger.
This is not necessarily a contradiction because the studies may use different:

- locations;
- periods;
- thresholds;
- indices;
- datasets.

However, the authors should explicitly explain why their results differ.
A methodological comparison table would be useful.

21. Statistical Presentation

The paper would benefit substantially from a dedicated statistical-results table.
At minimum, the authors should report:

- mean;
- standard deviation;
- minimum;
- maximum;
- trend slope;
- statistical test;
- p-value.

For the change-point analysis:

- change-point year;
- Pettitt statistic;
- p-value.

For seasonal parameters:

- onset trend;
- cessation trend;

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- season-length trend;
- dry-spell trend.

Currently, many conclusions are based on figures and qualitative descriptions rather than complete statistical evidence.

22. Figures and Tables

The manuscript contains numerous graphs, but the presentation requires considerable revision.

Specific problems include:

1. **Figure numbering inconsistency.** The map is identified as Figure 1, while a later schematic representation of seasonal types is also called Figure 1.
2. The dry-spell plots on page 11 are presented collectively but the caption reads "Plage des figures 1," which should be corrected.
3. Figure 6's caption should be checked against what the graph actually represents.
4. Axis labels and units should be standardized.
5. Figures should have readable fonts and complete captions.
6. Statistical trend lines should include slope and significance information where appropriate.
7. The rainfall graphs should clearly distinguish observed values from fitted trends.
8. The authors should ensure that all figures are cited sequentially in the text.

23. Language and Editorial Quality

The manuscript requires **substantial language editing** in both the French and English versions.

There are numerous typographical and spacing problems, for example:

- "caractériserles";
- "caractéristiques pluviométrique";
- "collectedes données";
- "ClimateHazards Group InfraRedPrecipitationwith";
- "Pettitt(PETTITT";
- "climatcorrespond";
- "juin,juillet, août".

The English Abstract also requires grammatical and stylistic improvement.

Examples include:

"Keywords:contraint"

and inconsistent terminology such as **"contraint/constraint"** and **"agro-climatic parameter."**

A professional academic language revision is strongly recommended before resubmission.

24. References

The reference list contains several relevant sources, including Pettitt, IPCC, CHIRPS-related methodological context, Sahel rainfall studies and previous work from Niger.

However, bibliographic formatting is inconsistent.

Examples include incomplete details for some references, such as:

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- BARKE et al. (2015);
- BANBARA et al. (2016);
- MALAM ABDOU et al. (2020);
- NICHOLSON et al. (1988);
- OZER et al. (2007).

The authors should verify every reference and provide, where applicable:

- complete journal name;
- volume;
- issue;
- page range;
- DOI;
- publisher;
- URL/access information where required.

The capitalization of author names and titles should also follow the target journal's reference style consistently.

25. Conclusion

The conclusion appropriately summarizes the reported transition toward wetter conditions, increased variability and flood-related vulnerability.

However, the conclusion currently makes some claims stronger than the statistical analysis presented.

The authors should avoid broad statements about:

"intensification of extremes"

unless extreme rainfall indices have been explicitly analyzed.

The conclusion should focus on what the data actually demonstrate:

- annual rainfall variability;
- detected change point;
- seasonal timing;
- dry-spell characteristics;
- local perceptions;
- flood-related consequences.

Strengths of the Manuscript

The manuscript has several important strengths:

1. **Highly relevant topic** for Sahelian climate adaptation and agricultural planning.
2. Uses a relatively long **1981–2024 rainfall period**.
3. Combines climatic data with **local socioeconomic perceptions**.
4. Uses daily rainfall data, allowing analysis of seasonal onset, cessation and dry spells.
5. Identifies a reported **1997 rainfall change point**.
6. Highlights recent exceptionally wet years, including 2024.
7. Examines both positive and negative consequences of rainfall changes.
8. Provides a useful discussion of flooding, agricultural losses and livelihood vulnerability.
9. Attempts to compare local findings with evidence from the wider Sahel.
10. Has practical relevance for climate adaptation and water-management strategies.

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Overall Recommendation

The manuscript addresses an important and timely issue and contains useful local climatic information. The long rainfall series, seasonal analysis and incorporation of community perceptions provide a good foundation for a publishable study.

However, the **methodological treatment of the SPI/IPS is a Minor concern**, and several important conclusions concerning trends are not supported by formal significance testing. The rainfall-season methodology, particularly cessation determination, also requires clarification. In addition, the socioeconomic survey needs better documentation, and the figures and language require substantial editorial improvement.

The manuscript has potential, but the current version requires substantial methodological and presentation-level revision before it can be accepted.

Recommendation: Minor Revision

Final Decision: MINOR REVISION