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Thesis title: Agroclimatic Characterisation of the Coastal Regions of Guinea-Bissau Considering Recent Climate Change and Its Impact on Mangrove Rice Production.

Presentation title: Variability and Trends of the Onset and Cessation of the Rainy Season in West Africa. A Case Study of Guinea-Bissau

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Research project: Mangroves, mangrove rice and populations: sustainably improving rice production, ecosystems and livelihoods (funded by the European Union under the DeSIRA Program)

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PRESENTATION PLAN

1- INTRODUCTION and OBJECTIVES

2 - METHODOLOGY

3 – RESULTS AND

4 - CONCLUSION

INTRODUCTION

In West Africa, agriculture is predominantly rain-fed.
In this region, variability is observed in:

- ✓ Precipitation
- ✓ Onset date
- ✓ End dates and
- ✓ Duration of the wet season

- ❑ Significant impact on the planning of agricultural activities;
- ❑ Challenges for farmers in optimising planting times;
- ❑ Influences production,

In Guinea-Bissau, rice is the main agricultural product, yet its production faces challenges from climate variability, particularly irregular rainfall, associated with rising consumption due to population growth.

To aid farmers in managing the uncertainties of the rainy season's onset, researchers have developed various methods and criteria such as:

- *Agronomic or agroclimatic criterion*: based on consistent rainfall over consecutive days; (more used in WA)
- *Climatic criterion*: focused on the first significant rainfall within a 300km radius;
- *Hydrological criterion*: determined by rainfall surpassing a specified threshold.

These criteria aid in making informed decisions in agricultural planning, particularly in selecting crop types, taking into account rain behavior.

OBJECTIVES

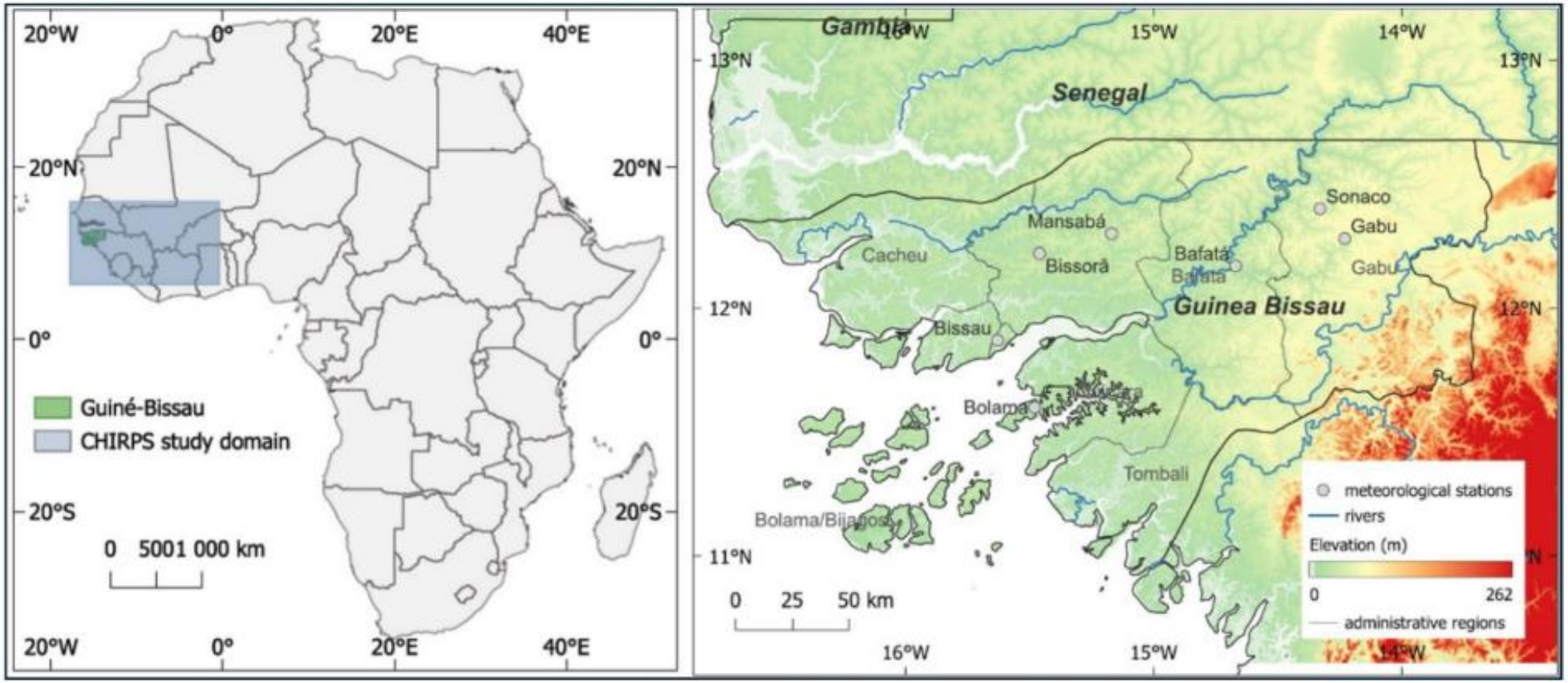
The objectives of this research are two:

1st - To determine the average onset and end dates of the rainy season in West Africa and, more particularly, in Guinea-Bissau;

2nd - Analyze the evolutionary trends of the rainy season in Guinea-Bissau (changes in its beginning, end and duration).

2. DATA AND METHODS

2.1. Study area



2. DATA AND METHODS

2.2. CHIRPS version 2.0

The CHIRPS (Climate Hazards Group InfraRed Precipitation with Station data) version 2.0 dataset (Funk et al., 2014) was utilised.

This dataset provides daily precipitation records by combining satellite estimates with ground-based observations from weather stations

2.3. Observation data

Daily precipitation observation data from 1981 to 2020, coming from the National Meteorological Institute of Guinea-Bissau database.

2. DATA AND METHODS

2.4. Criteria for calculating the start and end date of the rainy season

Start date (agronomic criteria)

The date on which, starting on May 1st :

(i) the record of precipitation for one or two consecutive days equal or greater than 20 mm and;

(ii) no dry spell more than seven days within the following 30 days (Sivakumar, 1988; Stern, 1981).

End date (water balance)

The date on which, from September 1st, the water balance between the water contained in the soil and evaporation becomes less than 0.05 mm, is considered as the end date of the rainy season.

Conditions: Daily evaporation of 5 mm; Useful soil reserve of 70mm (Dekoula et al., 2018; Stern et al., 2006; Yao et al., 2020);

Duration of the rainy season = End date - Start date

2. DATA AND METHODS

Analysis Tools

Instat+ and R-Instat (Akinseye et al., 2016; Sivakumar, 1988)

CDO operators (Climate Data Operators) to calculate the annual rainfall totals

QGIS for interpolation modeling using IDW method.

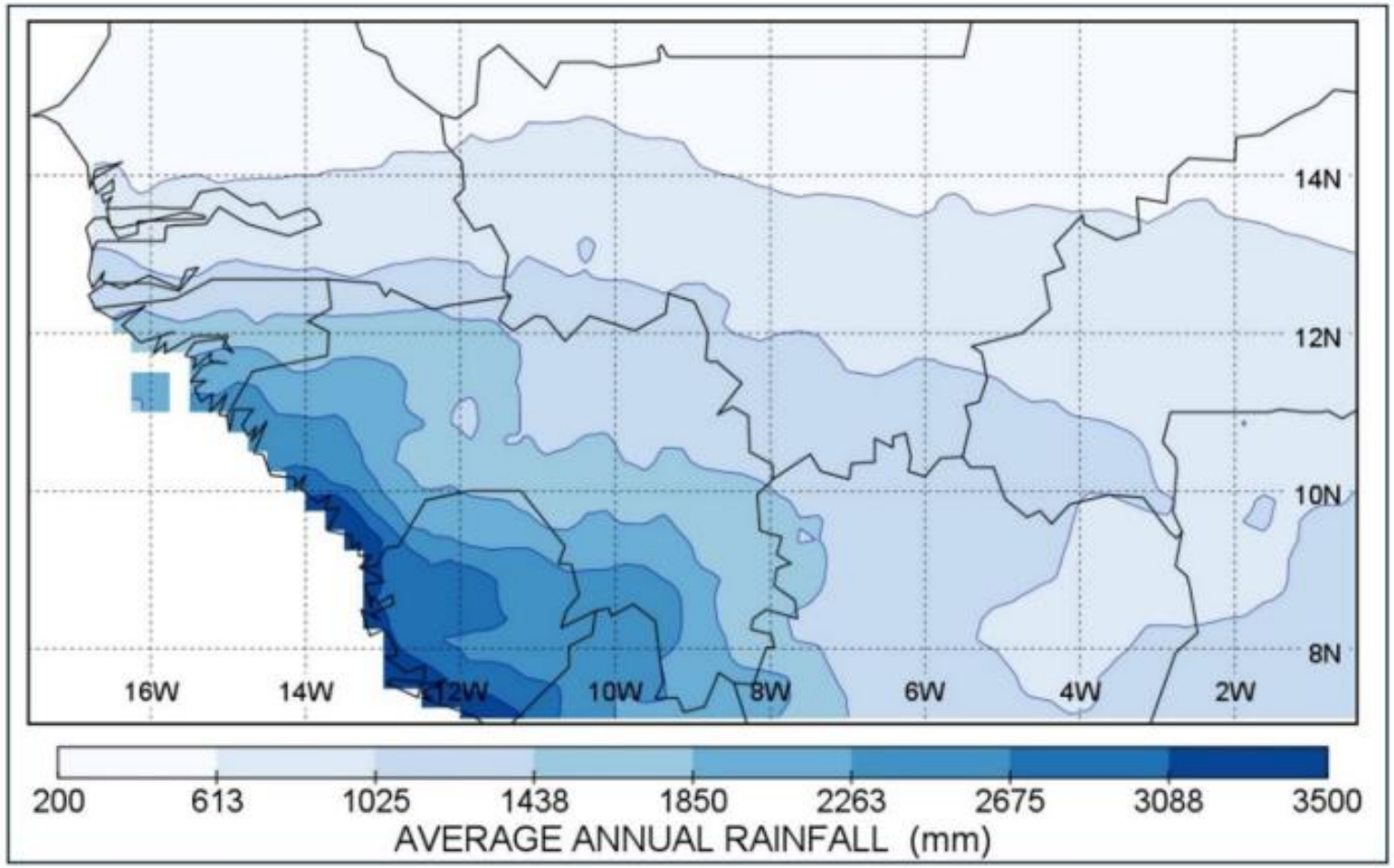
Mann-Kendall non-parametric test to evaluate trends (Makesens excel template)

Sen's slope estimator to assess the magnitude of trends (5% significance level) (Rathnayaka et al., 2021; Sen, 1968).

3. RESULTS

The mean annual precipitation (1981- 2020)

The annual average ranges from 230 mm in the northernmost part to ≈3,500 mm in the southwestern extremity of the study area



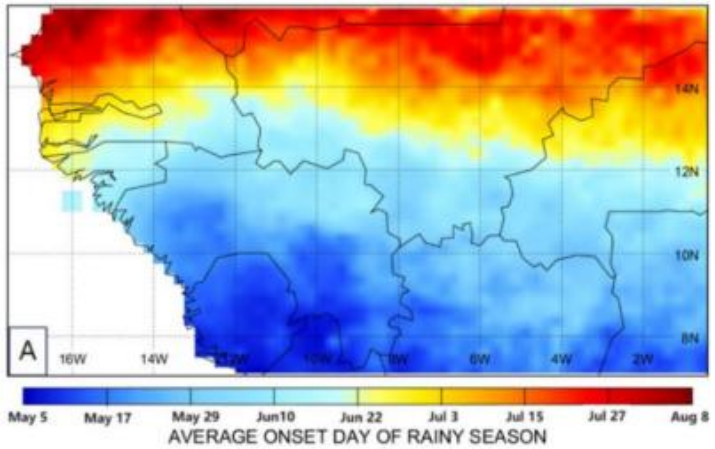
3. RESULTS

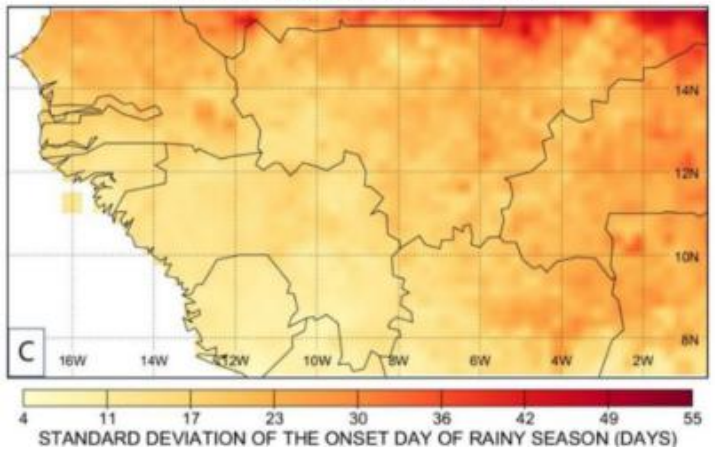
West Africa domain:

Average onset Average cessation day of the rainy season (1981-2020)

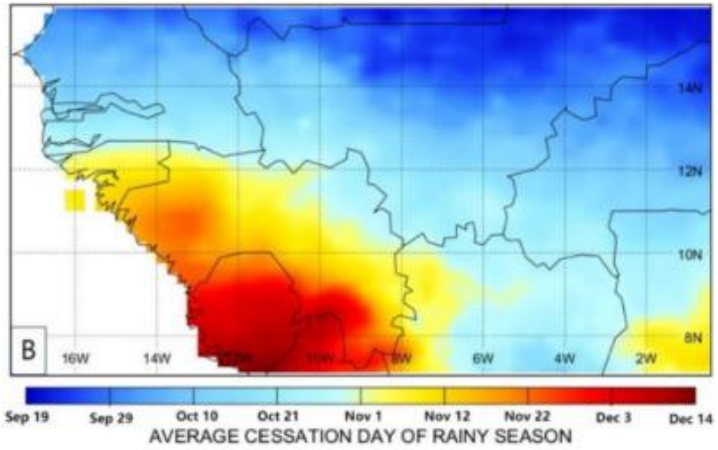
Average onset day of the rainy season (1981-2020)

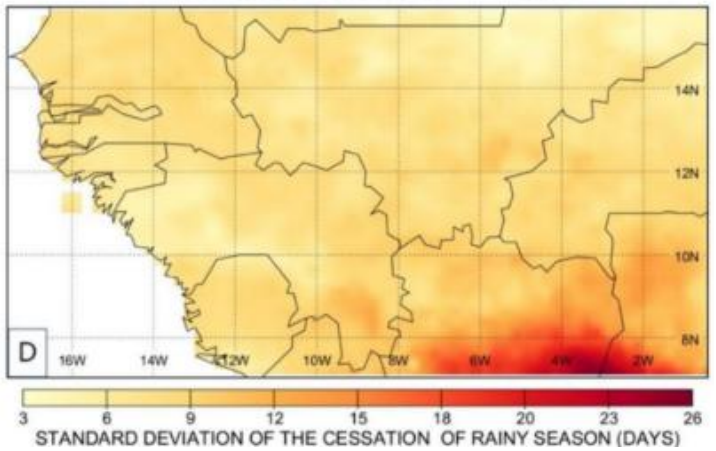
The average onset of rainy season is May in the South and July in the North, following the movement of the intertropical Discontinuity (ITD)





Average cessation day of the rainy season (1981-2020)



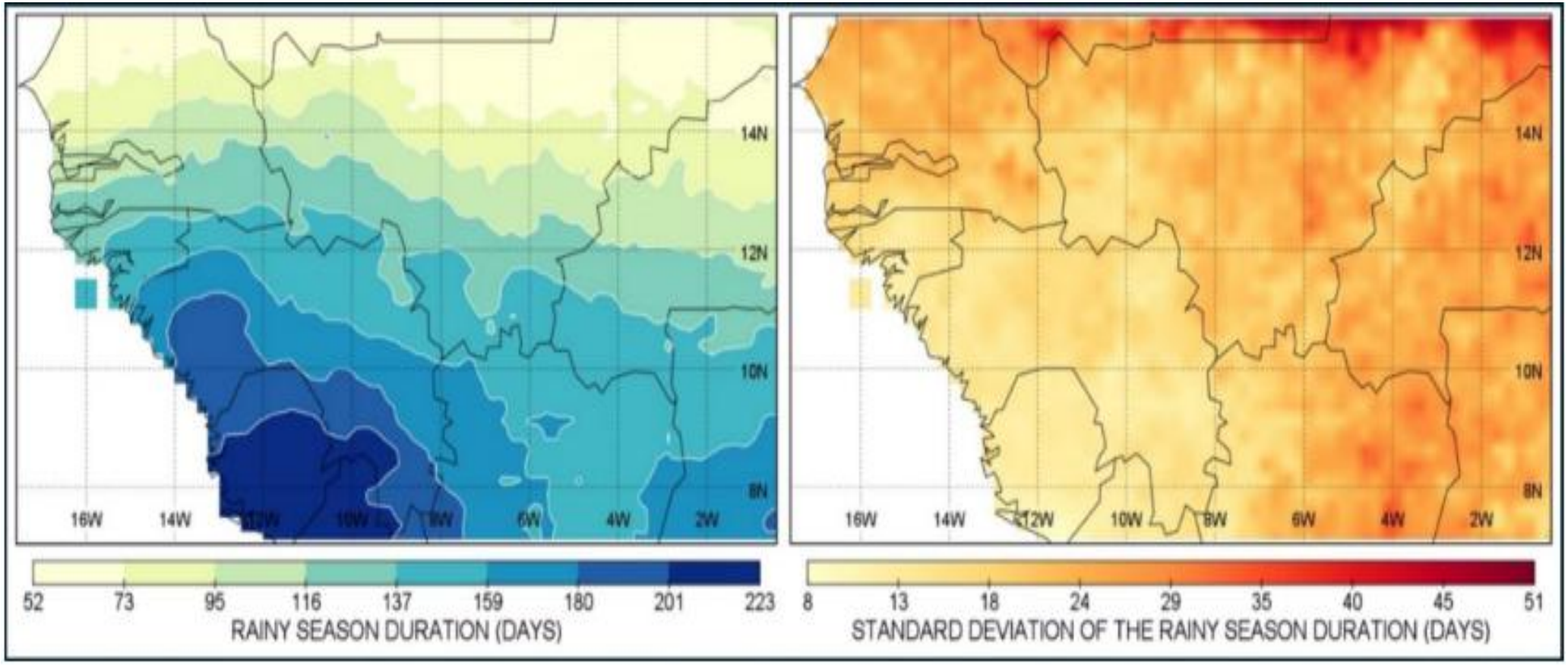


The average end date of the rainy season is September in the North and November in the south with the return of the ITD to the South

3. RESULTS

West Africa domain

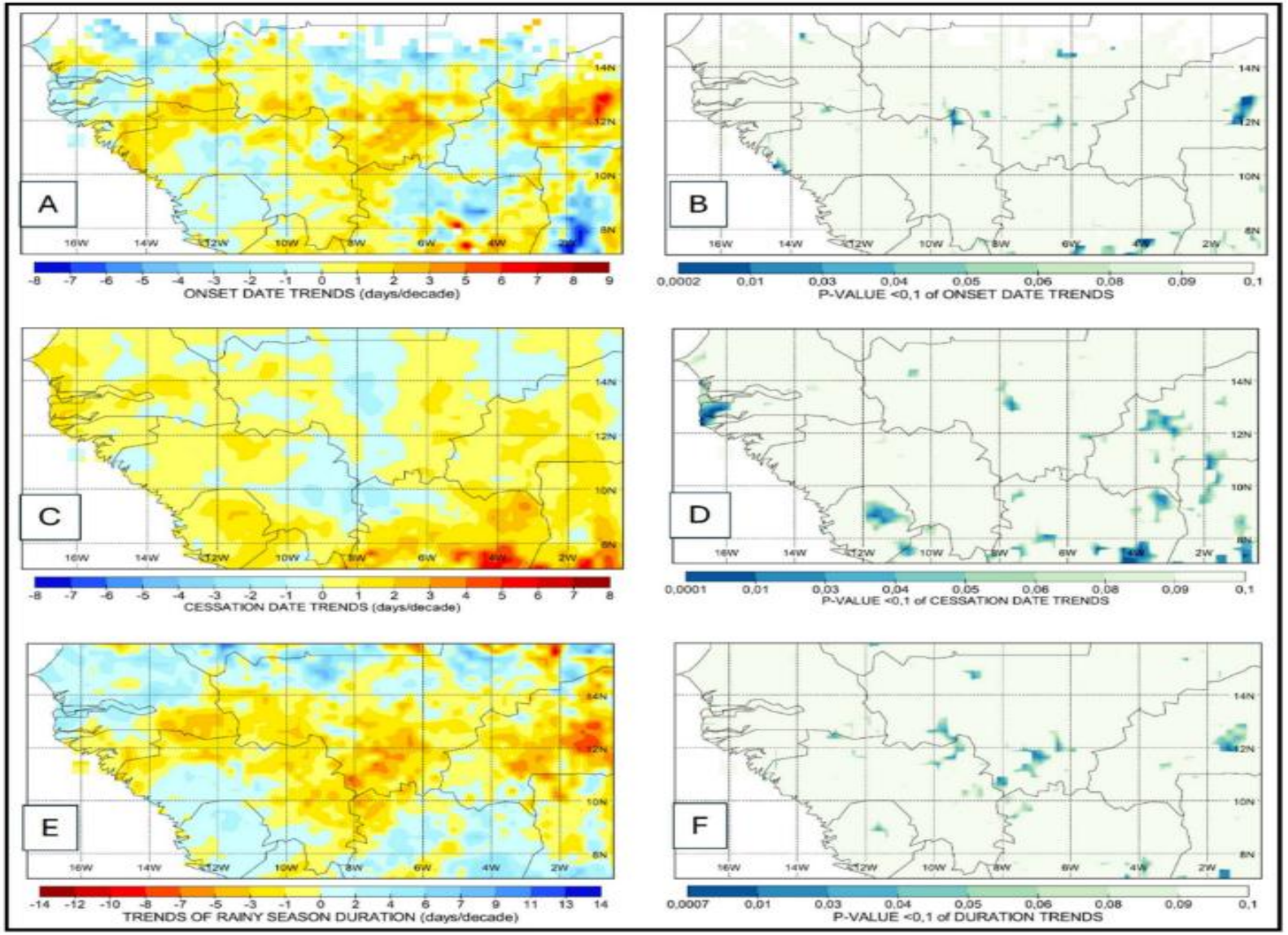
Average duration of the rainy season and his standard deviation (1981-2020)



The duration of the rainy season is between 52 -227 days in the year

3. RESULTS

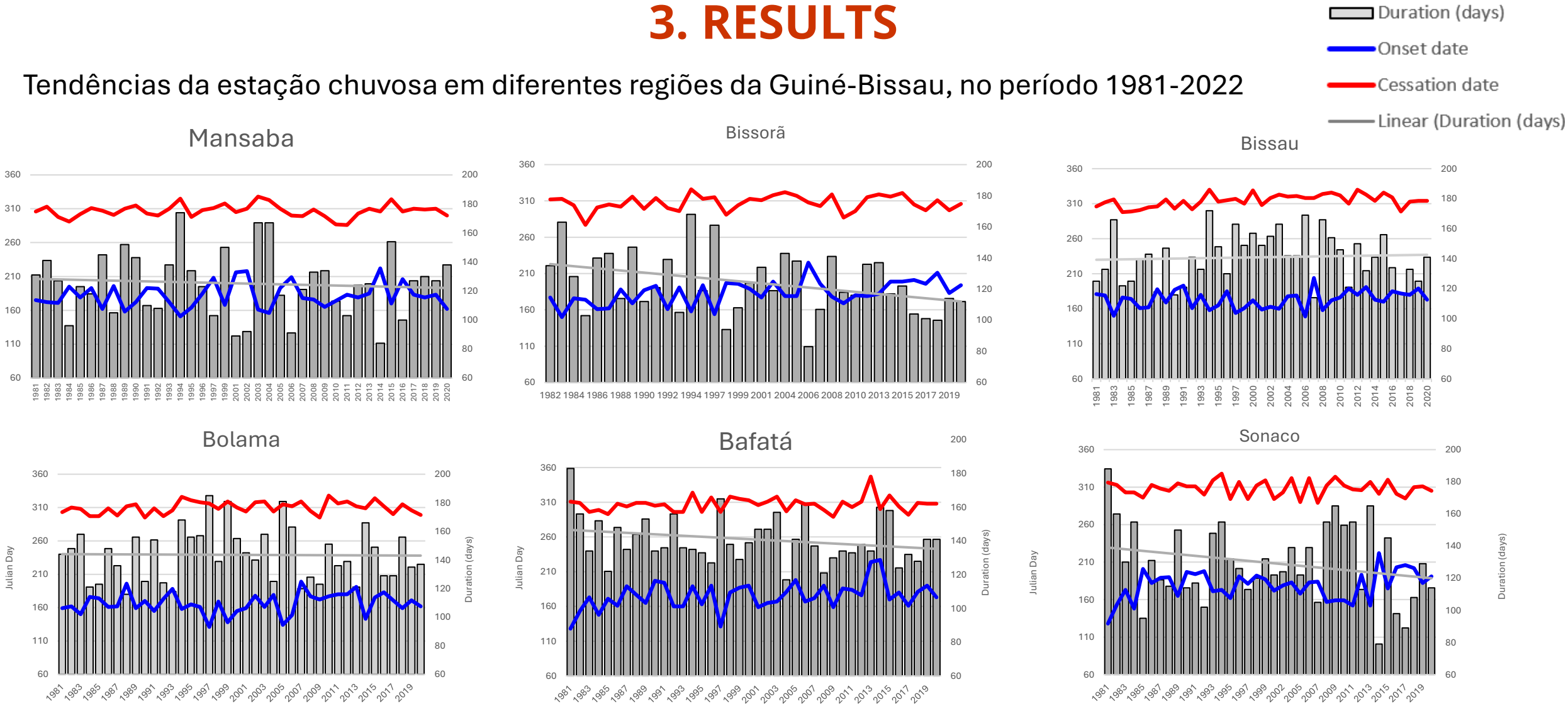
Trends of the onset , cessation and duration of the rainy season and their significance in West Africa



The trends of the onset, cessation and duration of the rainy season are specific across the study area.

3. RESULTS

Tendências da estação chuvosa em diferentes regiões da Guiné-Bissau, no período 1981-2022



The onset dates of the rainy season display greater interannual variability than the end dates across the all Country

3. CONCLUSION

The rainy season in West Africa begins from May to July, moving from South to North with the Intertropical discontinuity (ITD) and ends from September to November, reversing in a North-South direction.

This results in significant variability in the rainy season's duration:

- 52-106 days in the far North;
- 116-180 days in the central Areas, and;
- 180-223 days in the South.

Knowledge about the start, end and duration dates of the rainy season is of great importance and allows farmers to choose the type of seed variety to minimize risks.

In Guinea-Bissau, the average duration of the rainy season varies from 124 to 148 days across the all territory.

Considering this information and the results of seasonal forecasts produced annually by the main climate centres in West Africa (AGRHYMET - CCR-AOS and ACMAD), farmers can make informed decisions regarding the type of cropping cycle to use, by taking into account the behaviour of the rains (onset, cessation, and duration), they can avoid yield losses while simultaneously increasing production

Thank you for your attention

(this paper was submitted to Agricultural and Forest Meteorology)