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Impact of the ITF Relationship and the Onset of Rainfall on Precipitation in the Republic of Guinea

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Republic of Guinea is one of the West African countries which share form a border with the southern. The rainfall onset in this country is one of the major problems that the farmers face. For it, we determined with more precision, the rainy season onset in eight synoptic stations in Republic of Guinea: Boke, Conakry, Faranah, Kankan, Koundara, Labe, Mamou and NZerekore. Then, we

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studied the InterTropical Front (ITF) position compared to each station at the onset date. This work better analyses the atmospheric dynamics leading to rainfall particularity. We used the daily rainfall data provided by the National Meteorological Service of Guinea for (1991-2020) years and the dekadal (10-day) ITF position data produced by the National Oceanic and Atmospheric Administration (NOAA) for (1990-2021) years. Using these daily rain of the eight stations and the ITF data, we calculated, the dekadal, monthly and annual rain amount, then we established a relation between the ITF position and the precipitation for each station. Results obtained show that the rainy season begins on May 18th, April 20th, May 4th, May 14th, June 8th, May 12th, April 28th and March 20th in Boké, Conakry, Faranah, Kankan, Koundara, Labe, Mamou and NZerekore regions, respectively. Compared to these dates, the ITF is located 2247.77 km north of Boke, 2136.13 km north of Conakry, 2121.24 km north of Faranah, 2136.13 km north of Kankan, 2236.61 km north of Koundara, 2247.77 km north of Labe, 2236.61 km north of Mamou and 2136.13 km north of NZerekore. The good correlation is obtained between the ITF position and the monthly precipitations for eight regions. This study will allow farmers to know with more precision the rainfall onset in Republic of Guinea.

Keywords: Rainfall; onset; intertropical front; precipitation; ITF position.

1. INTRODUCTION

In West African countries, the socio-economic sector is rain-fed agriculture driven (Djossou 2017). Agriculture is the main source of income for people, and it depends on water availability (Gupta 2022a). Most of the rivers are dried up in the non- monsoon period due to climate change (Kumar 2021). The researchers have indicated that global warming is one factor that highly influences rainfall patterns at a regional scale and worldwide (Umakanth 2021). The rainfall is a major factor that determines crop choice and yield (Mensah 2016). In tropical Africa and Atlantic during the West African Monsoon, rainfall come from convective systems with a wide range of proprieties (stormy, squall lines) (Kante 2020). Accorging to Dione 2013, deep convection in West Africa exhibits important variability by local thunderstorms or smaller convective systems, but also by convective mesoscale systems (squall lines). The planting (sowing) dates, crop growth, yield and food production have been affect by the variability of rainfall onset and duration (Amekudzi 2015, Owusu 2009). There is the need to investigate the variability of the onset and duration of the rainfall season over the West African Climate (Manzanas 2014). In Guinea Republic, as in other West African countries, the knowledge on past and present onset and duration of the rainy season will inform prediction and planning of appropriate interventions towards ensuring yield stability. According to Djossou 2017, the farming which feeds the majority of the populations in Africa, depends on the regularity of the rainfall during a season of the year, in the most of the regions situated above of 7°N. Amekudzi 2015, over the country using the rainfall amount and rainy days approach, extensively studied the variability of rainfall onset, cessation and growing season. Without doubt, it is not necessary to recall the importance of water for life, health and human activities. Water is a limiting factor for development in the Sudano-Sahelian regions of West Africa. As development basis in many African countries, this importance can only increase with the priority now given to agriculture (Carbonnel 1992). The non-respect of the rainfall onset can lower the harvests or to the best of the cases drive to the leakages of seed totaling 25% (Marteau 2009). According to experts, global warming is one element. that significantly impacts regional and global rainfall pattern (Cupta 2022b, 2021a, 2021b). According to Omar 2023, Water scarcity is a pressing global issue exacerbated by climate change and population growth. The available water, liable to could become a resource, comes from precipitation, and these ones are ill-known (Carbonnel 1992). Several researchers have also focused on the question of the rainfall onset and methods of its determination have been proposed. Some criteria have been developed by several researchers. According to Djossou et al., 2017 «the date from April 1st with collected at least 20 mm rain amount on 7 consecutive days, without more than 7 days dry sequences in the 30 days that follow». In agro-climatic study context, Laux et al., (2007) define the rainfall onset on different regions of Ghana and Burkina Faso, while taking into account the physiological aspects of plants. from climatic criteria, other authors define the beginning of the rainfall onset from the first rainy event indicating the apparition of an organized conversion. The rainfall onset is based on a frequently criteria and corresponds to the date or 80% of the stations in a location of 300 km register a significant rain (>1 mm) on 2 consecutive days (Balme 2005).

The seasons in West Africa are schematically determined by the position of the Intertropical Convergence Zone (ITCZ), the surface formed by the convergence of Saharan and oceanic air masses (Akpo 2015 and Yoboue 2005). The ITF is a fundamental characteristic of atmospheric circulation in West Africa (Lélé 2010). The wet season starts when the position of the Intertropical Front reaches rather high latitudes (Lebel 2009). It allows the south air masses, loaded with moisture of Atlantic Ocean, to move northward and push the Saharan hot and dry air masses. This moisture transport is a key factor for the monsoon system in West Africa (Lebel 2009). Many researchers reported on these processes. According to Lele (2010), Lothon (2008) and Hall (2006), when in December the ITF is located near Atlantic Ocean, all West Africa is covered by Saharian dry air masses. The Long Dry Season settles. The Northward motion of ITF further cloud formations and precipitations follow in the moving direction of ITF. The onset of rainy season is also progress from lower lattitudes in the South, Northward. It is known that the ITF, during the year migrates from the Atlantic Ocean in January and reaches its most northerly position which is around of the latitude 20°N towards August (Djossou 2017). The convergence zone between the Harmattan and monsoon flows on the continent constitutes a frontal zone called InterTropical Convergence Zone (ITCZ) or ITF. In West Africa, the ITCZ position allows to define the climate type observed (Sultan 2003). The movement of the ITCZ conducted of along with that of the different air masses (harmattan and monsoon flows), implies strong seasonal climatic variations, inducing the dry season and the wet season (Akpo 2015 and Sultan 2003). The ITF is a quasi-stationary front that is to say that its movements are slow (Djossou 2017). In this context of rainfall onset in West Africa, the joining between the ITF seasonal movement and the implementation of African Easterly Jet (AEJ) has been well documented (Omotosho 1992, Citeau 1989). According to Freon 1988, the North-West African coastal is subject to the influence of three air masses. Two of these air masses, of boreal origin, are separated from the third, of southern origin, by intertropical front, surface of discontinuity in wind, temperature and humidity. The intertropical front (ITF) is discontinuity surface between two air masses with very different characteristics: tropical, continental, warm and dry air of harmattan and the tropical, maritime, cool and humid air of the monsoon (Suraud, 1954). In January, the ITF occupies her southernmost position. Its average position passes a little to the North of CONAKRY, then extends parallel to the coast of the Gulf of Guinea (Suraud, 1954).

However, the Impact of the ITF relationship and the onset of rainfall on precipitation is not yet studied in Republic of Guinea. It is in this perspective, that we performed a climatological approach by studying this relationship between Inter-Tropical Front and Rainy Season Onset in Guinea by considering at least one synoptic station ineach geophysical region.

For this purpose, we propose to base our research work on the rainfall data of the whole regions (Lower-Guinea, Middle Guinea, Upper Guinea and the Forest- Guinea) of Guinea. As part of this work, we consider eight synoptic stations (Boke, Conakry, Faranah, Kankan, Koundara, Labe, Mamou and NZerekore) of Guinea from four geophysical regions. Each geophysical region has at least one synoptic weather stations. For it, our research work is based on the rainfall data of the eight synoptic stations of the years (1991-2020) and the ITF position data (1990-2021) produced by NOAA to:

1- study the variability of rainfall from in Guinea Republic from the monthly and decadal scales;
2- study the average decadal latitudinal position of ITF;
3- determine the average distance of ITF at the rainfall onset for the different synoptic stations;
4- find the correlation between precipitation and the ITF position.

This information will serve a guide to the farmers and other people in different sectors of the national economy in Guinea Republic.

2. METHODOLOGY

2.1 Site Descriptions

Republic of Guinea, country situated in the southwest of West Africa covers an area of 245,857 km², is located between latitudes 7°05 and 12°51 and longitudes 7°30 et 15°10. It is limited in the West by the Atlantic Ocean, in the South by Sierra Leone and Liberia; in the East by Ivory Coast and Mali; and in the North by Guinea Bissau, Senegal and Mali (Fig.1). The eight synoptic stations stand as follow: Boke (latitude 10° 55' 53' North, longitude 14° 17' 21' West and 156 m altitude) ; Conakry (latitude 9° 32' 53' North, longitude 13° 40' 14' West and 146 m altitude) ; Faranah (latitude 10° 02' 00' North, longitude 10° 44' 00' West and 456 m altitude) ; Kankan (latitude 10° 23 North, longitude 9° 18 West and 250 m altitude); Koundara (latitude 12° 29' 00" North, longitude 13° 18' 00' West and 260 m altitude) ; Labe (latitude 11° 19 North, longitude 12° 17 West and 1025 m altitude) ; Mamou (latitude 10°22' 31.66" North, longitude 12° 05' 00' West and 746 m altitude) ; and NZerekore (latitude between 7°32 and 8°22 North, longitude 9°04 West and 560 m altitude) (Fig.1). The observations of these stations are representative of the climate of these zones. The climate type on the different stations is wet tropical in Boke, tropical in Conakry, dry winter savannah (Aw) in Faranah, Sub-Sudanese in Kankan, tropical, hot and dry in Koundara, tropical savannah with dry winter in Labe, wet and dry tropical in Mamou, and Equatorial guinean in NZerekore (Kante 2019). According to Kante et al., 2020, the naming of geophysical regions is consistent with their climate and topography.

2.2 Data

Two types of data have been used in thisstudy:

- the daily rain data for each station have been collected on 30 years (1991- 2020). These data have been supplied by the National MeteorologicalService of Guinea;
- the ITF data are those produced by NOAA, and are available on the site www.cpc.ncep.noaa.gov (ftp.cpc.ncep.noaa.gov/fews/itcz) from 1990 to 2021. These data are dekadal (10-day) from Avril to October. The data from November to March are notavailable on the site, but they have been obtained by extrapolation to themeridians of interval 10°W. Since Guinea is situated between 7° and 15°W, we calculated the average of longitudes 5° and 15°Wfrom 1990 to 2021.

2.3 Methods of Data Analysis

The methods and data processing used in this study are the same as those used in Djossou 2017. We calculated the dekadal (10-day), monthly and annual

cumulative as well as theirs average, using the daily rain data for eight stations in Guinea Republic. We also calculated cumulative, average and standard deviation.

The cumulative X is obtained by the arthimetical sum of X_i

$$X = \sum_1^n X_i, \text{ n whole, n} \geq 1;$$

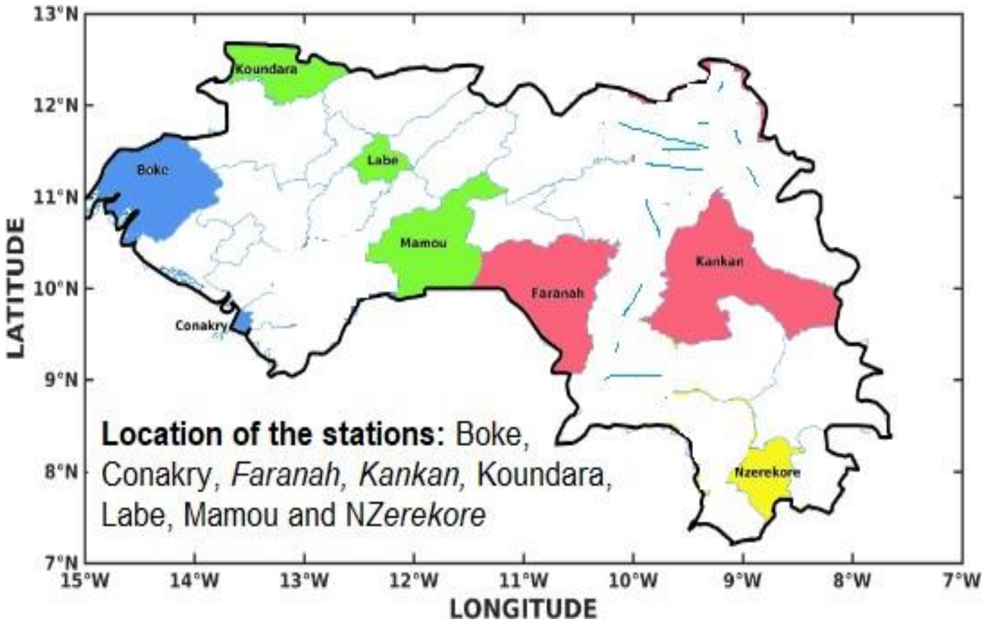


Fig. 1. Location of the stations of Boke, Conakry, Faranah, Kankan,Koundara, Labe, Mamou and N'Zerekore

- The average: $\bar{X} = \frac{1}{N}\sum_{1}^{n} X_i$;
- The standard deviation σ(x) reveals the dispersion of the values around of the average. It is equivalent to the square root of the variance
- $\sigma(x) = \sqrt{V} = \sqrt{\frac{\sum_{1}^{n}(X_i - \bar{X})^2}{N}}$
- The ITF distance D is determined by:
- **D = L.α**; where L is the latitude and α = 1° = 111.319 km.

2.4 Rainfall Onset Criteria

The detection method should be based on the mechanisms of general circulation of the atmosphere in West African region. We worked here specifically on the displacement in latitude of monsoon system, not on the modulation of its precipitating intensity. For this, we used databases from different stations. Some characteristic variables beyond rainfall within the study regions are identified, namely the rainfall onset in different stations as well as the averages of pluviometric cumulative (annual, monthly, dekadal) of whole Guinea Republic on the period 1991-2020. In this study, the new criterion used is one elaborated by Djossou 2017:

«the date from April 1st with collected at least 20 mm rain amount on 7 consecutive days, without more than 7 days dry sequences in the 30 days that follow». Then, we determined the date of Rainy Season Onset in each city. The results obtained are presented in section 3.2.

3. RESULTS AND DISCUSSION

3.1 Variability of the Rainfall from Different Stations of Benin

Rainfall variability was analyzed using daily rainfall data in Guinea republic on the period 1991-2020. Fig. 2 shows the average monthly precipitation cycles of the eight stations (Boke, Conakry, Faranah, Kankan, Koundara, Labe, Mamou and NZerekore) from 1991 to 2020. Monthly cumulative averages vary from 0.9 to 930.437 mm in Boke, 2.07 to 1713.08 mm in Conakry, 3.48 to 561.317 mm in Faranah, 0.08 to 507.9 mm in Kankan, 0 to 530.995 mm in Koundara, 1.77 to 590.935 mm in Labe, 3.523 to 674.694 mm in Mamou and 21.33 to 480.55 mm in NZerekore.

The peak rainfall month over Boke, Conakry, Faranah, Kankan, Koundara, Labe, Mamou and NZerekore are August, August, September, August, August, August, August and August months, respectively. In eight region, the precipitation curve shows one season. On the eight stations, the monthly precipitation curves show the same unimodal shape with the peaks of precipitation in September at Faranah, in August at Boke, Conakry, Kankan, Koundara, Labe, Mamou and NZerekore. These different analyses allow us to say that NZerekore city knows a long rainy season and short dry season while Boke, Conakry, Faranah, Kankan, Koundara, Labe and Mamou cities know a long rainy season and a long dry season. The results obtained on the rainy and dry season are in accordance with those obtainedby Chavance 1999.

The Table 1 below presents the season types observed and the annual cumulative of pluviometric. This annual average rain amount is 3599.183 mm at Boke, 5594.715 mm at Conakry, 2459.347 mm at Faranah, 2157.495 mm at Kankan, 1742.026 mm at Koundara, 2357.850 mm at Labe, 2834.634 mm at Mamou and 2848.695 mm at NZerekore. The results obtained in these different regions of the Republic of Guinea confirm what has been highlighted in these cities by Kante et al., 2020.

Table 1. Season types observed and the annual cumulative of pluviometricin each city

Cities	Rainy season	Dry Season	Annual cumulative ofpluviometric
Bobe	May to October	November to April	3599.183 mm
Conakry	May to October	November to April	5594.715 mm
Faranah	June to October	November to May	2459.347 mm
Kankan	May to October	November to April	2157.495 mm
Koundara	June to October	Nonember to May	1742.026 mm
Labe	May to October	November to April	2357.850 mm
Mamou	April to October	November toMarch	2834.634 mm
NZerekore	March to November	November toMarch	2848.695 mm

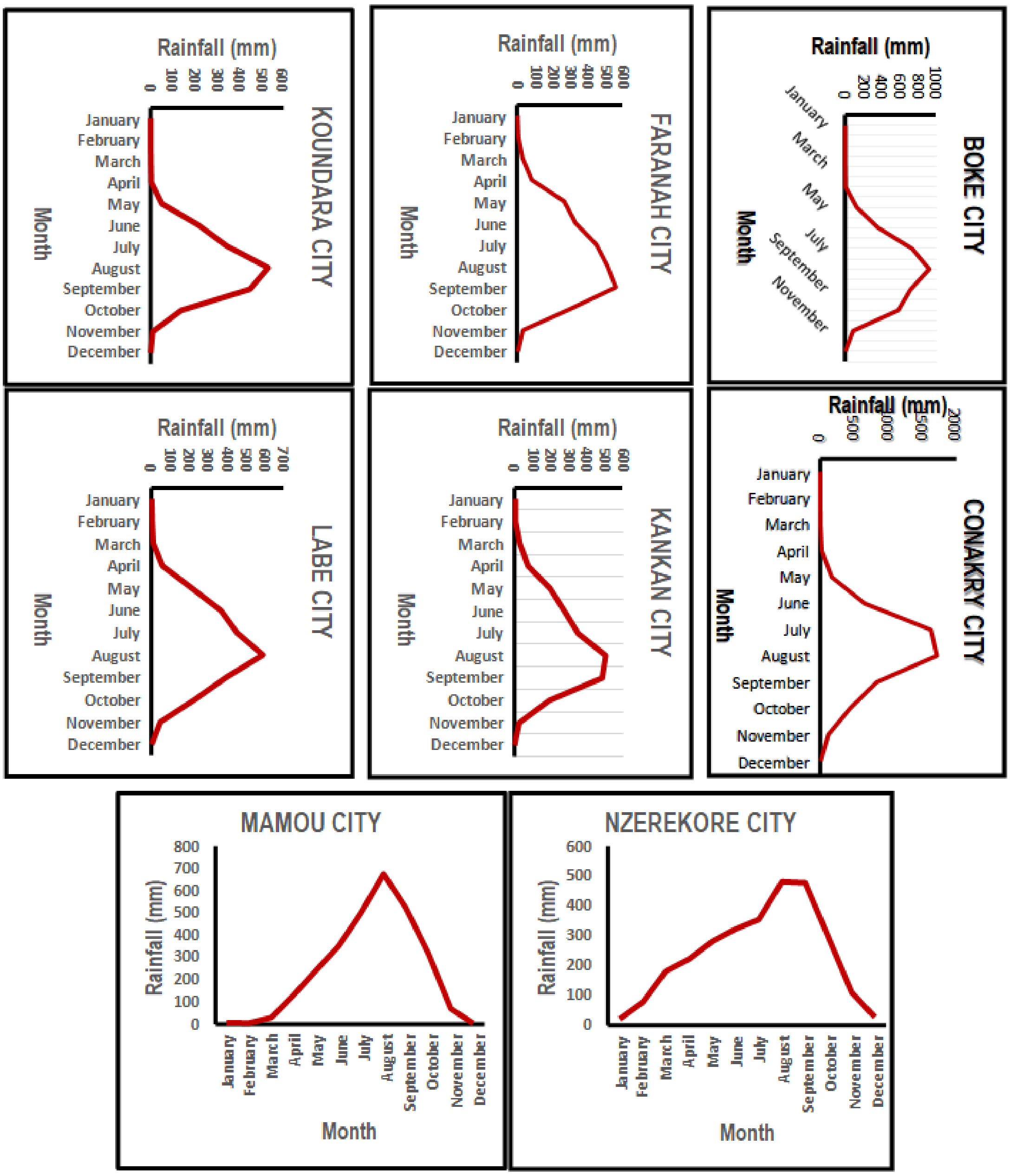


Fig. 2. Average cycle of the monthly precipitation in Boke, Conakry, Faranah,Kankan, Koundara, Labe, Mamou and NZerekore regions on the period 1991-2020

The Table 1 shows equally the evolution of the annual cumulative of pluviometric on the different stations. Conakry and Boke have the highest rain amount (5594.715 mm and 3599.183 mm, respectively) and Koundara the lowest (1742.026 mm). At NZerekore, Mamou, Faranah, Labe and Kankan, one record 2848.695 mm, 2834.634 mm, 2459.347 mm, 2357.850 mm and 2157.495 mm respectively. We also plotted the North-South gradient (Fig. 3). We oberved a precipitation decrease from Conakry to Koundara via Boke. This figure shows well the existence of North-South gradient of the precipitation.

3.2 Determination of Rainfall Onset

According to Omotosho 2000, the most important problems associated with rainfall variability as a result of changes in moisture availability are : the highly variable dates of onset of the rainy season at one station and from one station to another;

the temporal (monthly and annual) distribution of the precipitation at each station or over a small area ; and the cessation and length of the rainy/growing season.

As the onset dates are the most critical, we analyzed in this work, three criteria allowing us to know the rainy season onset in Guinea Republic. These criteria are:

- the three or four first precipitations registered of at least 10 mm no separated of more than 7 days (Omotosho 2000).
- the rainfall onset in the Saharian and Sudanian regions as date from May 1st collecting a water height of at least 20 mm on 3 consecutive days, without any dry sequences of more than 7 days in the 30 days that follow (Sivakumar 1988).
- the date from April 1st with collected at least 20 mm rain amount on 7 consecutives days, without more than 7 days dry sequences in the 30 days that follow (Djossou2017).

After this comparative analysis, we noticed that the standards deviations of the definite criterion in (Djossou 2017) are lower than those obtained in the two other. This great uncertainty between the three criteria, shows that the methods of Omotosho (2000) and Sivakumar (1988) does not suit to the regions studied.

Using the onset of rainy season criterion as definite by Djossou (2017), the starting dates for each year were obtained on the eight stations. This allowed us to determine the average rainfall onset on the study period. The results obtained for each station were presented in the Table 2. However, the criterion allow to the farmers to know with precision the rainfall onset of each region. This criterion will therefore be retained in our study zone.

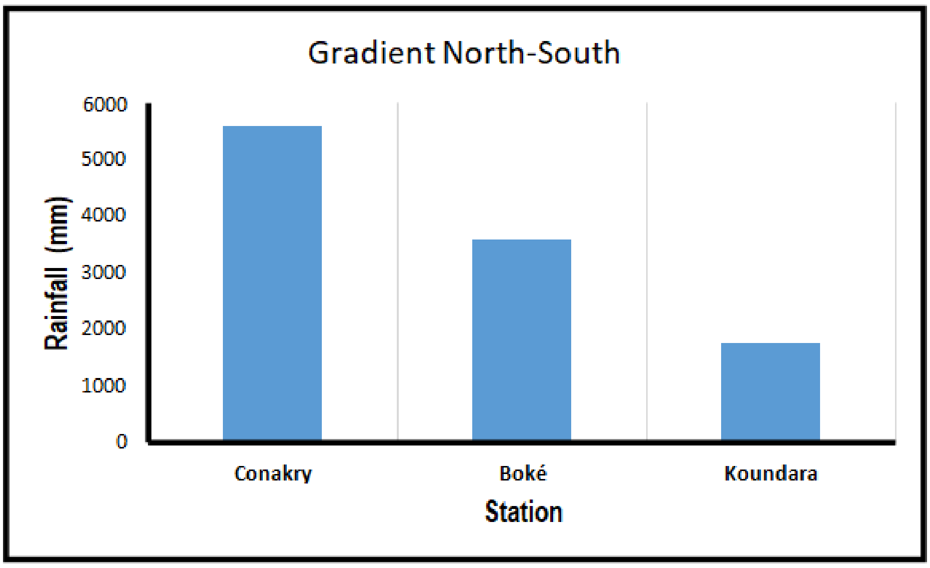


Fig. 3. Annual rainfall in the Conakry, Boke and Koundara stations from1991 to 2020

Table 2. Onset of rainy season

	Criterion of Djossou 2017	
Stations	**Date**	**Standard Deviation (Day)**
Boke	May 18th	10
Conakry	April 20th	18
Faranah	May 4th	15
Kankan	May 14th	22
Koundara	June 8th	14
Labe	May 12th	13
Mamou	April 28th	21
NZerekore	March 20th	27

3.3 Variability of the ITF Position

3.3.1 Variability of the ITF position to the dekadalscale on 10°W (1990-2020)

We analyzed the monthly variability of the ITF position. For this, we used the ITF dekadal data. The Fig. 4 shows the dekadal latitudinal position of ITF on the period 1991-2020. From latitude 7.5°N to 16.6°N, the graph illustrating the average position of ITF presents a slight growth of ITF from January to first dekad of June. From the late June to the first dekad of October, we observed a slight increase of ITF. From second dekad of October to December, we observe a rapid decline of ITF from 15°N to 9.5°N. According to Lebel (2009), Intertropical Front (ITF) has annual cycle in West Africa; its position is located Southern at latitudes (5-6) ° North, near Atlantic Ocean in December and, after, it slowly moves northward to (18°-20°) N and then retreates back.

3.3.2 ITF distance of the different sites to the rainfall onset (Monsoonperiod)

The ITF position in relation to the rainfall onset for each station was determined over the period 1991-2020. It consists to determine the latitudinal position of ITF to these dates, after wards to determine its position in relation to the different stations and finally to calculate the distance which separates the ITF of these sites taking into account the fact that 1 ° = 111.319 km to the equator (Djossou 2017). These positions are summarized in the Table 3. According to Lebel 2009, the wet season starts when the position of the Intertropical Front reaches rather high latitudes. Which allows the south air masses, loaded with moisture of Atlantic Ocean, to move northward and push the Saharan hot and dry air masses. This moisture transport is a key factor for the monsoon system in West Africa. All West Africa is covered by Saharian dry air masses, when in December the ITF is located near Atlantic Ocean (Lele 2010, Lothon 2008, Hall 2006). Which also explains the progression the onset of rainy season from lower lattitudes in the South, Northward. These results obtained in this study are near of those that have been obtained by Many researchers on the the ITF distance and the rainfall onset in West Africa.

3.3.3 ITF distance to the different sites for each dekad and the Correlation between precipitation and ITF position

The latitudes of the stations and the data produced by NOAA were used to determine the ITF distance in relation to each station for all dekad. On the eight stations, the maximal height of dekadal rain amount for the rainy seasons are measured during the dekad on Augustn10th in Boke, August 20th in Conakry, September 20th in Faranah, August 20th in Kankan, August 30th in Koundara, August 10th in Labe, August 30th in Mamou and August 20th in NZerekore, respectively. During these dates, the ITF situates at 2247.77 km from Boke, at 2136.13 km from Conakry, at 2121.24 km from Faranah, at 2136.13 km from Kankan, at 2236.61 km from Koundara, at 2247.77 km from Labe, at 2236.61 km from Mamou and at 2136.13 km from NZerekore. The ITF position is counted positively when the ITF is in the North of site and negatively when it is located in the South of site.

In this study, the relation between the ITF position and the monthly cumulatives of precipitation for each station was established. For it, we associated to the monthly position of ITF compared to each station, to the monthly cumulatives of precipitation, in order to seek a correlation between the ITF position and the precipitations registered (Fig.5). The correlation is 0.93 in Boke, 0.76 in Conakry, 0.96 in

Table 3. ITF Position compared to the rainfall onset

Station	Latitude ofstation (°N)	Latitude of ITF(°N)	Position of FIT(km)
Boke	10.93	14.80	491.45
Conakry	9.33	13.30	441.21
Faranah	10.02	13.20	368.43
Kankan	10.23	14.30	459.60
Koundara	12.29	13.00	57.68
Labe	11.19	11.90	132.11
Mamou	10.28	12.90	338.65
NZerekore	7.32	10.20	312.60

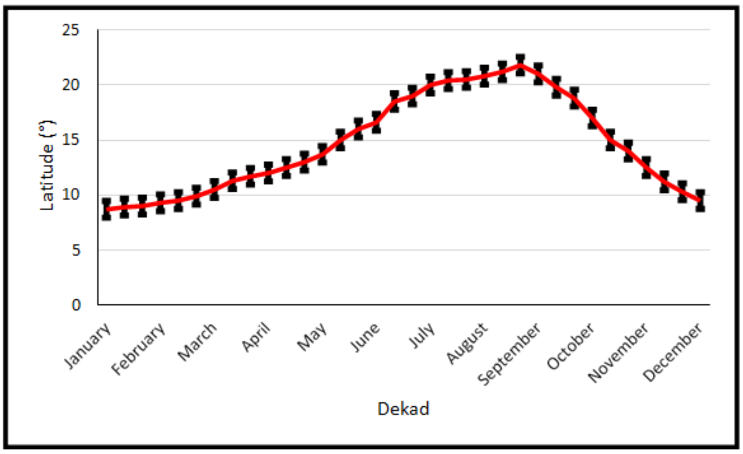
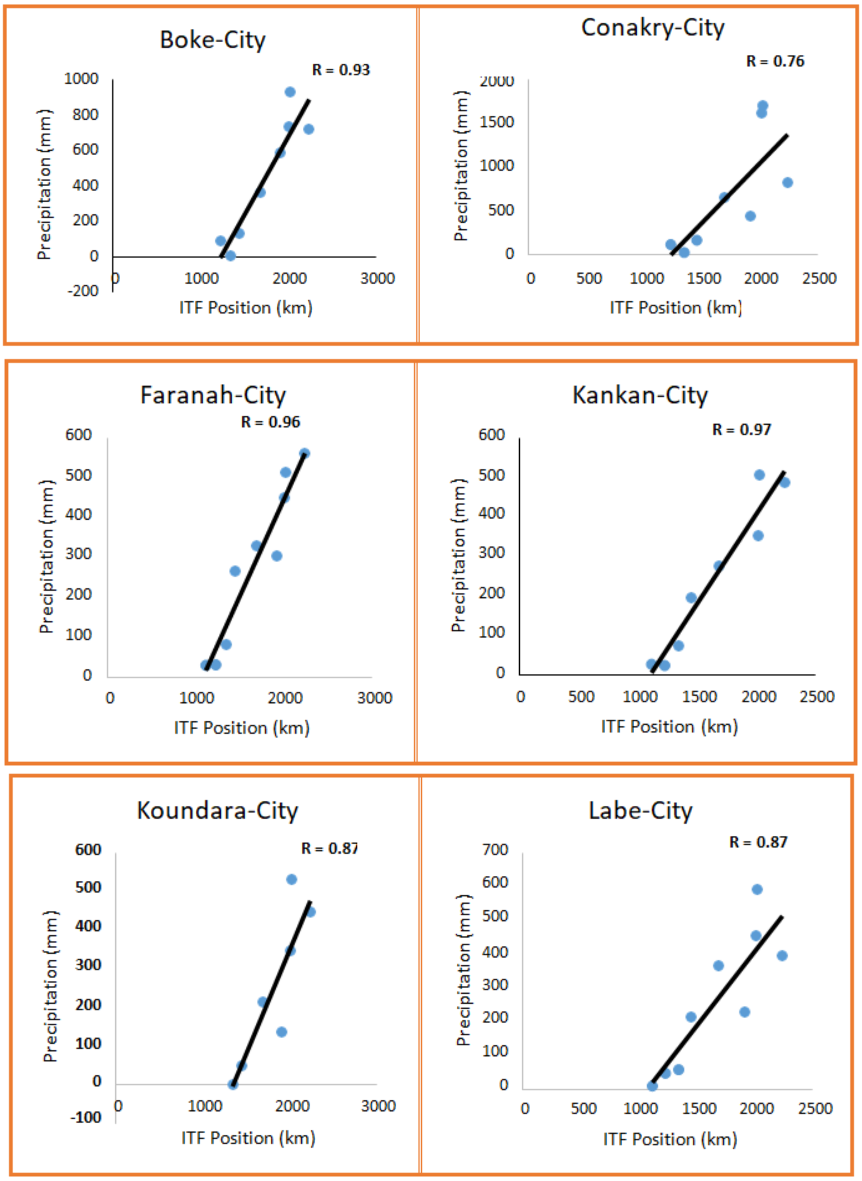


Fig. 4. Average dekadal latitudinal position of ITF on longitude 8°W (1990-2021)



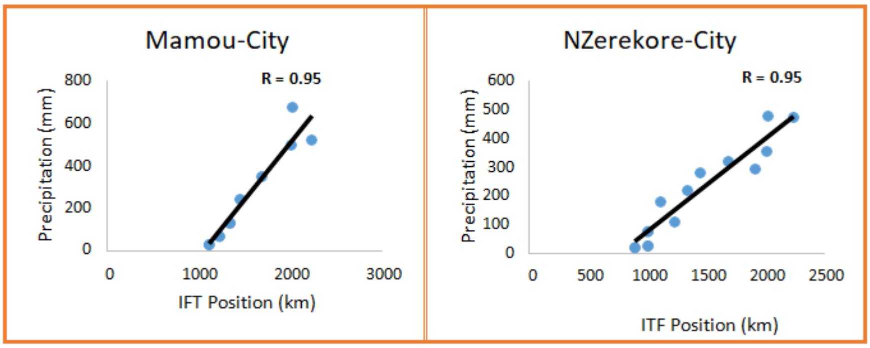


Fig. 5. Monthly precipitations in relation with the position of the ITF inaccordance with the eight station: Boke, Conakry, Faranah, Kankan, Koundara, Labe, Mamou and NZerekore

Faranah, 0.97 in Kankan, 0.87 in Koundara, 0.87 in Labe, 0.95 in Mamou and 0.95 in NZerekore, respectively. These value observed show a good correlation between these two greatness. For the eight sites, the correlations are very raised. Which reveals that the pluviometric regime in Guinea Republic is due to the ITF position. These results are near of those that have been obtained by Lélé (2010) on the ITF variability and the rain amount of precipitation in Sudano-Sahelian zones in West Africa.

4. CONCLUSION

In this study, we elaborated the Relation between the Inter-Tropical Front and Rainy Season Onset in Guinea Republic. For it, we have chosen at least one synotic station representative in each region: Forest-Guinea (Nzerekore), Upper-Guinea (Faranah, Kankan), Middle-Guinea (Koundara, Labe, Mamou) and Lower-Guinea (Boke, Conakry), of this Republic. Then, we studied the rainfall variability of each station on the period1991-2020. Finally, we found a correlation between the monthly position of ITF and monthly precipitation for each station. The results fromthis work show that:

- The annual average rainfall calculated during the study period (1991-2020) is 5594.715 mm for Conakry, 3599.183 mm for Boké, 2459.347 mm for Faranah, 2157.495 mm for Kankan, 1742.026 mm for Koundara, 2357.850 mm for Labe, 2834.634 mm for Mamou and 2848.695 mm for NZerekore.
- The existence of North-South precipitation gradient is noticed for Conakry, Koundara and Boke ;
- The rainy season starts on May 18th, April 20th, May 4th, May 14th, June 8th, May 12th, April 28th and March 20th in Boke, Conakry, Faranah, Kankan, Koundara, Labe, Mamou and NZerekore regions, respectively ;
- On these dates the ITF is located 2247.77 km north of Boke, 2136.13 km north of Conakry, 2121.24 km north of Faranah, 2136.13 km north of Kankan, 2236.61 km north of Koundara, 2247.77 km north of Labe, 2236.61 km north of Mamou and 2136.13 km north of NZerekore, respectively ;
- There is a good correlation between the ITF position and the monthly precipitation in Boké (0.93), Conakry (0.76), Faranah (0.96), Kankan (0.97), Koundara (0.87), Labe (0.87), Mamou (0.95) and NZerekore (0.95) regions.

This study will allow farmers to know with more precision the rainfall onset in the Republic of Guinea.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies suchas Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Akpo A., Galy-Lacaux C., Laouali D., Gardrat E. & Castera P. (2015). Five years study of rainwater chemistry and wet deposition in the wet savanna of Djougou, Benin (West Africa). *AtmEnv*, 115:110-123. http://dx.doi.org/10.1016/j.atmosenv.2015.04.064

Amekudzi, L.K., Yamba, E., Preko, K., Asare, E.O., Aryee, J., Baidu, M. & Codjoe, N.A.S. (2015). Variabilities in Rainfall Onset, Cessation and Length of Rainy Season for the Various Agro-Ecological Zones of Ghana. *Ecological Impacts of Climate Change*, 3, 416 434. http://dx.doi.org/10.3390/cli3020416.

Balme M., Galle S. & Lebel T. (2005). Démarrage de la saison des pluies au Sahel: Variabilité aux échelles hydrologique et agronomique, analysée à partir des données EPSAT Niger. *Sécheresse*, 16: 15-22.

Carbonnel J-P., & Hubert P. (1992). Pluviométrie en Afrique de l'Ouest soudano-sahélienne. https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers11-10/37348.

Chavance P., & Diallo a. (1999). La pêche côtière en Guinée : ressources et exploitation. https://core.ac.uk/download/pdf/39848781

Citeau J., Finaud L., Cammas J. P., & Gouriou Y. (1989). Questions about the ITCZ migration over the Tropical Atlantic, sea surface temperature in the Gulf of Guinea and Senegal River runoff. *Meteorological and Atmospheric Sciences,*41:181- 190.

Dione, C., Lothon, M., Badiane, D., Campistron, B., Couvreux, F., Guichard, F. & Sall, S.M. (2013). Phenomenology of Sahelian Convection Observed in Niamey during the Early Monsoon. *Quarterly Journal of the Royal Meteorological Society*, 140, 500-516. https://doi.org/10.1002/qj.2149

Djossou J., Akpo A., & Afféwé J. (2017). Dynamics of the inter tropical front and rainy season onset in Benin. *Curr. J. Appl. Sci. Technol*, *24*, 1–15. https://doi.org/10.9734/CJAST/2017/36832

Fréon P. (1988). Réponses et adaptations des stocks de clupeides d'Afrique de l'Ouest à la variabilité du milieu et de l'exploitation : analyse et réflexion à partir de

Gupta N., Banerjee A., & Gupta S.K. (2021a). Spatio-temporal trend analysis of climatic variables over Jharkhand, India. *Earth Syst Environ*, *5*(1) :71–86

Gupta N., Mahato P.K., Patel J., & Omar P.J. (2022a). Understanding trend and its variability of rainfall and temperature over Patna (Bihar). *Current Directions in Water Scarcity Research,* 7, 533-543. https://doi.org/10.1016/B978-0-323-91910-4.00030-3.

Gupta N., Patel J., Gond S., Tripathi R. P., PJ Omar P. J., & PKS Dikshit P. K. S. (2022b). Projecting future maximum temperature changes in River Ganges Basin using observations and statistical Downscaling Model (SDSM). *River Dynamics and Flood hazards, Disaster Resilience and Green Growth*, https://doi.org/10.1007/978-981-19-7100-6_31

Gupta SK, Gupta N, & Singh VP (2021b) Variable-sized cluster analysis for 3D pattern characterization of trends in precipitation and change-point detection. J *Hydrol Eng*, *26*, 1 : 04020056

Hall N.M.J., Kiladis G.N., Thorncroft C.D. (2006). Three-dimensional structure and dynamics of African easterly waves. Part II: Dynamical modes. *J. Atmos. Sci*., 63 : 2231 – 2245. http://dx.doi.org/10.1002/wea.255.

Kante I.K., Sall S.M., Badiane D., & Diouf I. (2019). Seasonal Variability of Rainfall and Thunderstorms in Guinea over the Period 1981 to 2010. African *Journal of Environment Science and Technology*, 13, 324-341.

Kante, I.K., Sall, S.M., Badiane, D., Diouf, I., Dieng, A.L., Diaby, I. & Guichard, F. (2020). Analysis of Rainfall Dynamics in Conakry, Republic of Guinea. *Atmospheric and Climate Sciences*, 10, 120 https://doi.org/10.4236/acs.2020.101001.

Kumar V., Chaplot V., Omar P. J., Mishra S., & H Md. Azamathulla H. Md. (2021). Experimental study on infiltration pattern: opportunities for sustainable management in the Northern region of India. *Water Science and Technology*, 84, 10-11. https://doi:10.2166/wst.2021.171.

Laux P., Kunstmann H. & Bárdossy A. (2007). Predicting the regional onset of the rainy season in West Africa. *International Journal of Climatology*, 30:1014-25

Lebel T., Parker D., Bourles B., Flamant C., Marticorena B., Peugeot C., & Gaye A., Haywood J., Mougin E., Polcher J., Redelsperger J-L and Thorncroft C. D., (2010). The AMMA field campaigns: Multiscale and multidisciplinary observations in the West African region, *Quarterly Journal of the Royal Meteorological Society*, 136 (S1): 8-33. https://doi.org/10.1002/qj.486

Lélé I. M., & Lamb P. J. (2010). Variability of InterTropical Front (ITF) and Rainfall over West African Soudano-Sahel. *Journal of Climate*;

l'exemple du Sénégal. Paris : ORSTOM, 287 p. (Etudes et Thèses). *Th. : Sci. Nat.*, Aix-Marseille 2 : Marseille. 1986/06/11-13. ISBN 2-7099-0926-X. ISSN O767-2888.

Lothon M., Saïd F., Lohou F., & Campistron B. (2008). Observation of the Diurnal Cycle in the Low Troposphere of West Africa. *Monthly Weather Review*, 136 : 3477m 3500. https://doi.org/10.1175/2008MWR2427.1.

Manzanas, R., Amekudzi, L., Preko, K., Herrera, S. & Gutierrez, J. (2014). A Comparison of Methods to Determine the Onset of the Growing Season in Nigeria. *Climatic Change*, 124, 805-819.http://dx.doi.org/10.1007/s10584-014-1100-9.

Marteau R., Moron V. & Philippon N. (2009). Spatial coherence of monsoon onset over Western and Central Sahel (1950-2000). *Journal of Climate,* 22:1313-1324

Mensah C., Amekudzi L. K. , Klutse N. A. B. , Aryee J. N. A. & Asare K. (2016). Comparison of Rainy Season Onset, Cessation and Duration for Ghana from RegCM4 and GMet Datasets. *Atmospheric and Climate Sciences*, 6, 2.

Omar P. J., Gupta P., & Wang Q. (2023). Exploring the rise of AI-based smart water management systems. *AQUA—Water Infrastructure, Ecosystems and Society*, 2, 11. https://doi.org/10.2166/aqua.2023.005

Omotosho J.B. (1992). Long-range prediction of the onset and end of the rainy season in the West African Sahel. *International Journal of Climatology,* 12:369-382.

Omotosho J.B., Balogun A.A., & Ogunjobi K. (2000). Predicting monthly and seasonal rainfall, onset and cessation of the rainy season in the West Africa using only surface data. *International Journal of Climatology*, 20: 865-880.

Owusu, K. & Waylen, P. (2009). Trends in Spatio-Temporal Variability in Annual Rainfall in Ghana (1951-2000). *Weather*, 64, 115-120.

Sivakumar M.V.K. (1988). Predicting rainy season potential from the onset of rains in Southern Sahelian and Sudanian climate zones of West Africa. *Agriculture and Forest Meteorology*, 42: 295-305.

Sultan B., & Janicot S. (2003). The West Africa Monsoon Dynamics. Part II: The “Presonset” and “onset” of the Summer Monsoon. *Journal of Climate*, 16:3407-3427.

Suraud, P. (1954). Le front intertropical en Afrique occidentale Annuaire hydrologique de la France. https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers11-12/16841

Umakanth N., Satyanarayana G. C., & Naveena N. (2021). Statistical and dynamical based thunderstorm prediction over southeast India. *Journal of Earth System Science*, 130, 71.

Yoboué V., Galy-Lacaux C., Lacaux JP. (2005). Rainwater chemistry and wet deposition over the Wet Savanna Ecosystem of Lamto (Cote d'Ivoire). *Journal of atmospheric chemistry,* 52 : 117–141.

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