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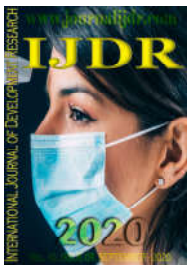

RESEARCH ARTICLE OPEN ACCESS

INVESTIGATING THE HYGROSCOPIC DEGRADATION IN DIFFERENT GEOGRAPHICAL AREAS OF CAMEROON AND ITS IMPACTS ON AGRICULTURAL ACTIVITIES

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ABSTRACT

Climatic change has put the whole humanity under permanent stress whose consequences should be very catastrophic. A good knowledge of the past and today climates should enable us a well management of the future and a successful prevention of those catastrophes like hunger. This article concerns the nearer past hygroscopic regime at different areas of Cameroon. The comparison of the obtained results with the today regime has permitted us to appreciate the ongoing degradation and has enabled us to quantify it.

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INTRODUCTION

The world ongoing climatic change has attracted attention of almost the whole humanity as its estimated consequences should be catastrophic for everybody. For a better management of the future, a precise knowledge on the past and today climates is needed. Many investigations in this direction have been done in developed countries. In the developing ones in general and african countries in particular, many is still to be done. It could be said that this work has not yet started because of very few meteorological stations and the absence of needed data. In these countries, everybody feels and speaks about the climatic changes, but only qualitatively. The intensity of this degradation is ignored. Quantitative information is needed to help authorities to take better and on time decisions in order to prevent these catastrophes. This study concerns the hygroscopic regime and its time tendencies in different areas of Cameroon and their impacts on agricultural activities. So, our attention should be paid to pluviometry and evapotranspiration as they play an important role in agriculture. The data collected mostly before year 1970 is presented in tabular forms of monthly means. Unfortunately there is no information on how the evapotranspiration was calculated. The authors think that either the formulas of Boucher or Le Turc were used as the most encountered in many african countries. Hopefully that the initial chronological series were regular and sufficiently long to generate representative climatic monthly means. As Cameroon is vast with different climatic zones, it was divided into four geographical areas namely the sahelian zone where are the localities of Kaele and Garoua, the savannah zone with the locality of Koundja, the littoral zone with the localities of Douala and Kribi and at last the forestry zone with the localities of Batouri and Lomié. These localities were chosen because of the availability of data. We should not forget the horrible hungry disaster due to a very severe dryness of the 1980s in Ethiopia and Sudan which caused the death of millions of human beings and mobilized the compassion of the whole world. Nowadays and for the same cause, many areas of

Cameroon are under food international assistance for already many years. Some neighboring countries are also under similar assistance. Clearly that something should be urgently done to avoid such former catastrophes. Whence the importance of this work. This investigation has two main parts. In the first one the yearly variation of the two parameters is studied. This has enabled us to determine the duration and time tendencies of the dry and rainy seasons in each locality and to compare them. In the second part, both parameters were combined in the same coordinate axes in order to analyze their points intercept and deduce the period of agricultural activities based on the estimated soil water reserve in each locality. Recalling recent works has enabled us to diagnose and estimate the intensity of the hygroscopic degradation in some localities. This paper has five sections. The first and present one introduces the problem. The second exposes the data and methodology. The analysis is presented in the third section and the conclusion and acknowledgements- in the fourth. At last the references in alphabetic order are in the fifth section.

DATA AND METHODOLOGY

Data: The areas of study are such situated in Cameroon. The sahelian zone is in the northern part because of its proximity to the desert of Sahara. Here the main activities of the populations are livestock and fishery. Peanuts are also cultivated there. The savannah is in the middle part of the country. Here are many varieties of activities, livestock and agriculture between others. Many cultural species are cultivated here. Every week, foods are transported from here to other cities and neighboring countries as Chad, Central African Republic, Congo, and Gabon.

The littoral zone in the southern west part of the country is closer to the Atlantic Ocean. Trade and industrial activities are the most developed here. At last the forestry zone is inside the land in the southern east part of the country. Here forests exploitation is very intensive and cacao culture is also well-developed. All over the country, these activities are under climatic stresses. Pluviometry was obtained using pluviometer while evapotranspiration was estimated using empirical formulas. Data are not primary, but already treated sufficiently long chronological series of daily observations and presented in tabular forms of monthly means whose accuracy should not have doubt.

METHODOLOGY

Firstly, the curves of pluviometry and evapotranspiration for all the localities were plotted in the same coordinate axes in order to analyze their yearly trends and to compare their intensities between localities. Secondly, both curves of pluviometry and evapotranspiration were plotted in the same coordinate axes for each locality in order to fix, analyze and determine the distance, in months, between their points intercept.

Thus, the periods and durations of agricultural activities in each locality were estimated. These periods corresponded to the time where pluviometry was more than evapotranspiration. Recalling and comparing the present results to the recent ones obtained after similar studies in some of these areas have permitted us to highlight and quantify the ongoing hygroscopic degradation in the concerned zones.

RESULTS AND ANALYSIS

The curves of pluviometry for all the localities, Figure 3.1, show a yearly one modal distribution of rainfall in Kaele, Garoua, Koundja, Douala and a bimodal distribution in Kribi, Batouri and Lomié. Moreover, rainfall was registered all over the year in Kribi, Lomié, Batouri and Douala. In Koundja, the dry season did not stay for long, about two months, in January and December. In Kaele and Garoua, the dry season has taken almost five months. Rainfall was maximal around mid-August in Douala and Garoua with about 810 and 225 mm of monthly pluviometry, respectively. In other localities this maximum was observed around mid-September in Kribi with about 500 mm monthly pluviometry, Koundja with about 400 mm monthly pluviometry, Lomié with about 270 mm monthly pluviometry and around mid-October in Batouri with about 270 mm monthly pluviometry. Thus, rainfall was registered almost all over the year in the littoral and forestry zones. The dry season in the savannah zone was shorter compare to the north where this duration was progressively increasing even up to three firsts and two lasts months of the year. Figure 3.2 indicates that evapotranspiration was intense in the sahelian zone with values between 125-250 mm per month. Maximums were registered between January and June. The absolute maximum, around 240 mm per month, was observed in April and the absolute minimum, around 125 mm per month, in September in Kaele and Garoua. For the other localities, these values were concentrated in a narrow interval, between 90-125 mm per month.

Curves of pluviometry and evapotranspiration plotted in the same coordinate axes for each locality enabled us to fix, analyze their points intercept and determine the periods of agricultural activities. Figure 3.3 for Kaele shows the first point intercept at mid-June and the second one - earlier October, about five months distance between them, corresponding to the period of agricultural activities as pluviometry was greater than evapotranspiration. Koundja represented by Figure 3.5 has its points intercept at the end of March and November, respectively, giving eight months period of agricultural activities, almost the double of the sahelian zone. Thus, species with at most three months vegetative cycle could be cultivated here twice in a year against only once in the precedent zone.

For Douala, Figure 3.6, its points intercept occurred in February and December, giving eleven months period for the agricultural activities, almost the whole year. Species with at most three months vegetative cycle could be cultivated here even up to four times in a year. Figure 3.7 for Kribi indicates the points intercept in March and November, giving almost ten months period for agricultural activities. Thus, species with three months vegetative cycle could be cultivated here three times in a year. Attention should be paid to July when the pluviometry and evapotranspiration were almost equal.

For Batouri, Figure 3.8, these points intercept occurred in March and November, for a nine months period of agricultural activities. Species with at most three months vegetative cycle could be cultivated here three times in a year. For the same reason like in Kribi, care should be taken in July. At last, the points intercept for Lomié, Figure 3.9, occurred in March and November for a nine months period of agricultural activities, like in Batouri, distant for about 200 kms. Much attention should be paid in July in Lomié as the pluviometry was sensibly less than the evapotranspiration.

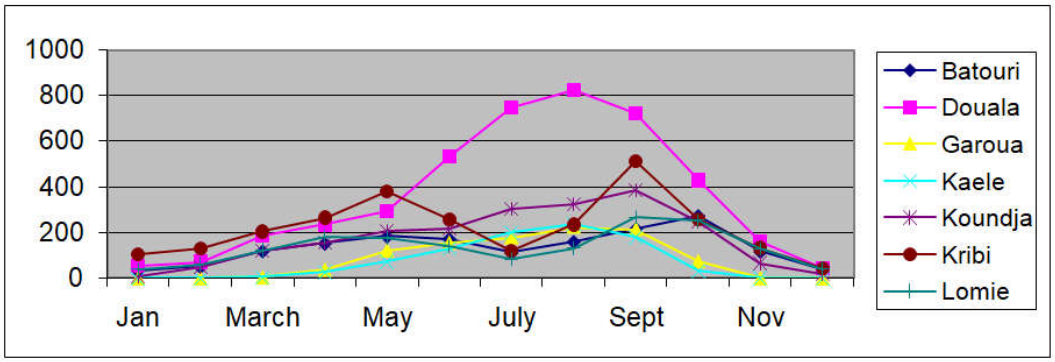

Figure 3.1. Monthly pluviometry in different geographical zones of Cameroon

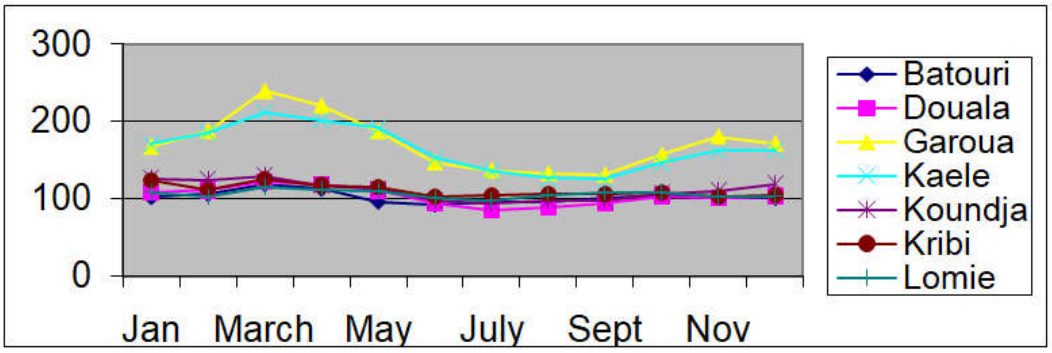

Figure 3.2: Monthly evapotranspiration in different geographical zones of Cameroon

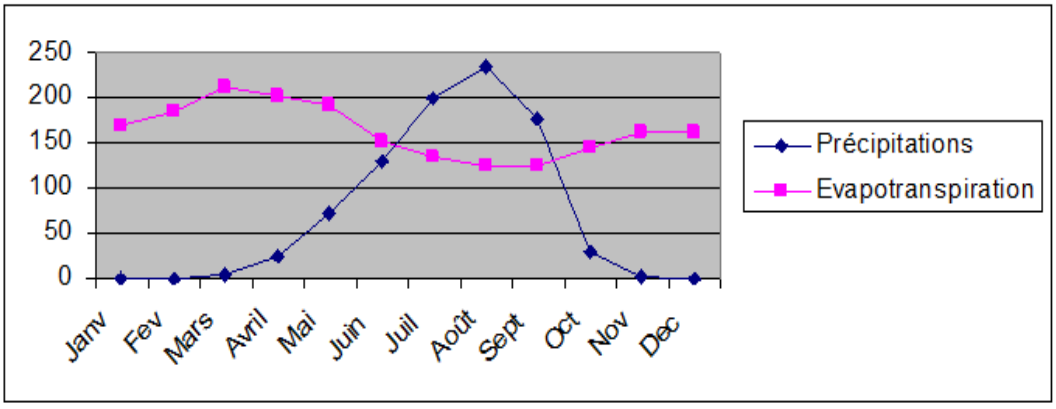

Figure 3.3: Curves of pluviometry and evapotranspiration in Kaele.

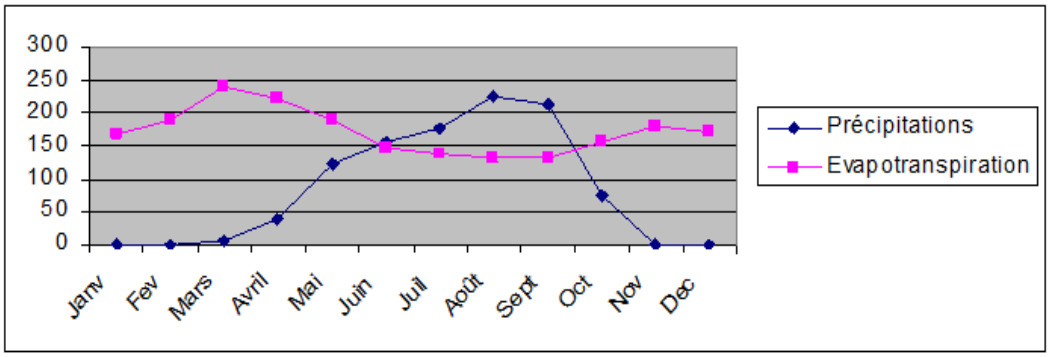

Figure 3.4: Curves of pluviometry and evapotranspiration in Garoua

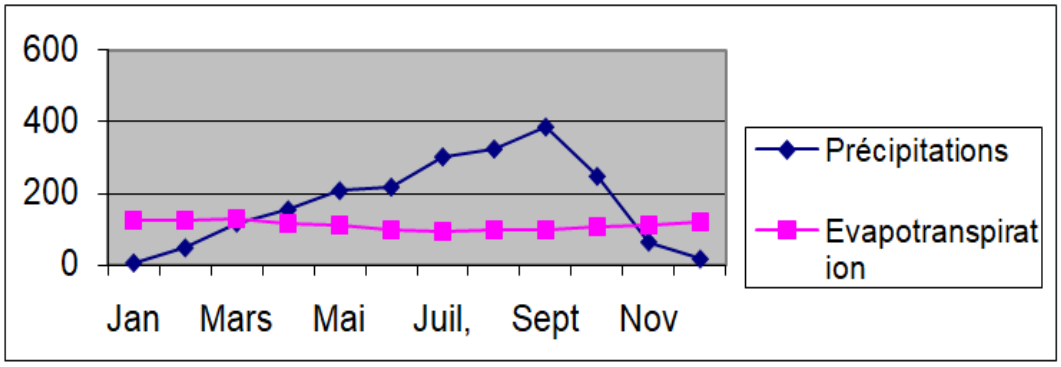

Figure 3.5: Curves of pluviometry and evapotranspiration in Koundja

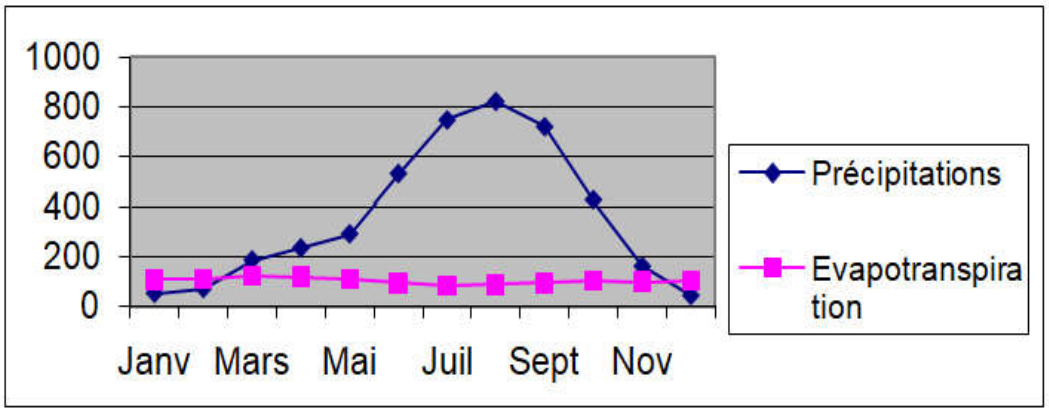

Figure 3.6: Curves of pluviometry and evapotranspiration in Douala

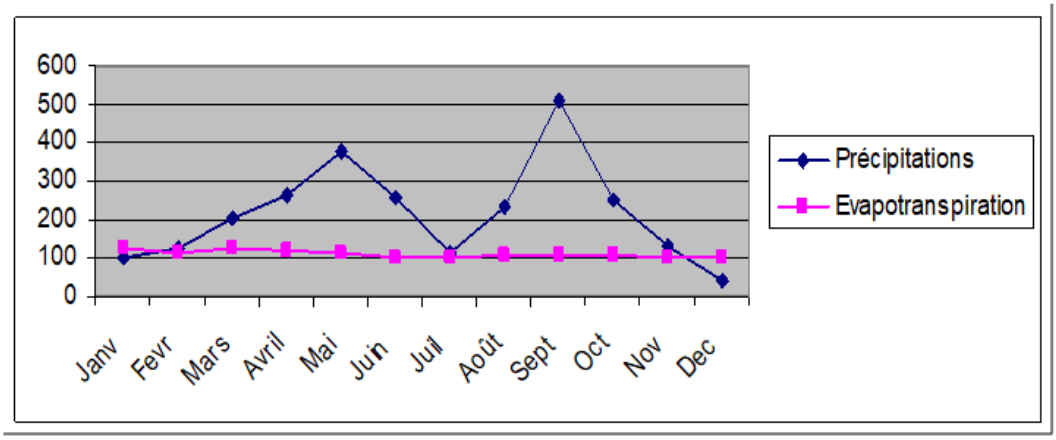

Figure 3.7: Curves of pluviometry and evapotranspiration in Kribi.

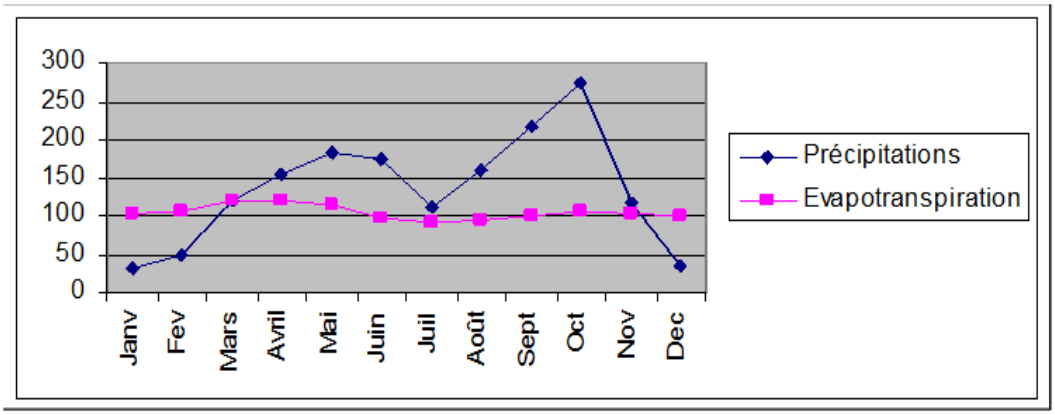

Figure 3.8: Curves of pluviometry and evapotranspiration in Batouri

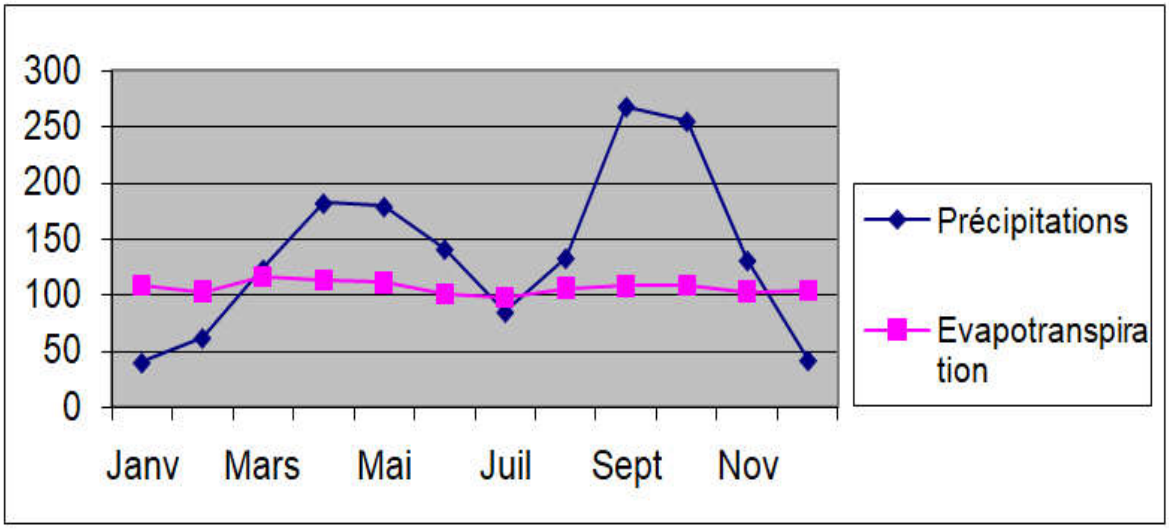

Figure 3.9. Curves of pluviometry and evapotranspiration in Lomié

The problem detected in July in Kribi, Batouri and Lomié was certainly due to the bimodal character of their yearly rainfall distribution. Recent studies done for some of these areas have permitted to diagnose other periods for agricultural activities based only on the pluviometry under the condition that its monthly amount should not be less than 40.0 mm. The estimated soil water reserve was not taken into account. The following results were obtained. For Ndjaména and surroundings, more northern than Garoua and Kaele, about averagely 450-550 kms between them, the period of agricultural activities run from May to October, six months period (Njipouakouyou et al., 2017) and for Foumbot and surroundings, not far away from Koundja, about 20 kms between both localities, from July to August, only two months period, (Njipouakouyou et al., 2020). Results in the present work were obtained under the condition that there should be at least averagely 100 mm of monthly pluviometry in a locality. So, the former condition of at least 40.00 mm of monthly pluviometry should give six and nine months periods of agricultural activities in the sahelian and savannah zones, respectively.

Logically, the periods of agricultural activities should decrease when moving to the north, what is not the case in the sahelian zone. This situation could be explained by the presence of the two rivers which cross Ndjaména and certainly have a great positive impact on its climate. Considering that Foumbot is at most 20 kms away from Koundja, it is obvious that both cities should have almost a same duration of agricultural period. This is not the case. In fact the former duration of either eight months under the condition of at least 100 mm monthly pluviometry or nine months under 40.00 mm monthly pluviometry was nowadays reduced to only two months. So, the degradation of the climate is a real problem in that zone. No doubt that if this degradation will continue the same way, inhabitants should wait for a deep severe disaster in the nearest future. Thus, great measures should be urgently taken by authorities and specialists to eliminate the danger. Probably that such a degradation occurs in other localities.

Conclusion

This work has clarified what was the hygroscopic regime in different geographical zones of Cameroon in those old days. In the littoral and forestry zones, rainfall was registered almost during the whole year. In the sahelian one, rainfall was registered during almost five months. The agricultural periods were decreasing from the southern to the northern part of Cameroon. In general, in the southern part, these periods were up to 11 months while in the northern part - up to five months. Comparison with recent works indicates a deterioration of climate in some regions, and probably in all the country. This deterioration is severe in the savannah zone where the period of agricultural activities is reduced from 9 to 2 months, which is very considerable. The authors cease this opportunity to sincerely thank the laboratory LAPACE of the Department of Physics, Faculty of Pure and Applied Sciences of the University of Ndjaména which has graciously financed this work till its publication. They hope that this collaboration goes always forward.

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