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**Research Article**

# DETERMINING THE RAINFALL CHARACTERISTICS AND ANALYZING ITS TIME TENDENCIES OVER THE DECADE 1976-1986 IN DSCHANG DIVISION, WEST REGION – CAMEROON

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**Abstract**

Primary daily rainfalls data were used to fulfill this work. Each month was divided into six equal five days sub periods, except the sixth one with either 3 or 4 days for the February month and 5 or 6 days for the remaining ones. Sub period and monthly statistical characteristics have been determined, namely the numbers of rainy days, the cumulative rainfalls and estimated daily rainfalls with their correspondent standard deviations. These characteristics calculated for the years and the rainy seasons apart have enabled us to estimate the beginnings and ends of rainy seasons as from March to October, respectively. Some reduction of this duration has been detected particularly at the beginning which tended to occur later in April. Concerning the quantities of water fallen during a rain, it has been observed that the rainfalls were slowly decreasing from year to year, confirming the degradation of the rainy regime in the area. These diminutions could be easily quantified based on the present work.

**Keywords:** Daily rainfalls, Sub periods, Sub period characteristics, Numbers of rainy days, Cumulative rainfalls, Estimated daily rainfall, Standard deviations, Beginning of the rainy season, End of the rainy season, Degradation of the rainy season.

## INTRODUCTION

For many decades, it has been reported frequent disturbances of the rainy regime in the western part of Cameroon. Same phenomena have been also reported in neighboring areas and countries. This situation has seriously impacted many activities, mostly agriculture, between others important ones. Relatively to agriculture, the main difficulties are the estimation of the beginning and end of the rainy season. Regularly during every rainy season, it starts intensively raining almost every day making farmers thinking that there is already time for agricultural activities. This situation used to stay for one and half month long and even more in some localities. Thus, farmers run to the fields for cultivating and seeding. When young plants start growing it suddenly stops raining for a long period exceeding sometimes more than a month. In this dry moment, plants terribly suffer of severe water reserve deficit which drastically impacts the biomass formation leading the yields usually to its minimum quantities. Whence the hunger in many localities. Sometimes, inverse phenomena occurred. In fact, when plants in the fields are already matured and do not need again much water, it intensively rains creating on plants some diseases, between others mildew, which also considerably reduces yields. In many localities in the western region of Cameroon, up to three agricultural yields used to be made inside a rainy season. For example, earlier at the beginning of the raining season, farmers seed maize and groundnuts. After harvesting these ones, they seed beans and others. By the end of the rainy season they plant again maize. In former days, the agricultural calendar was scrupulously respected as the regularity of the rainy season did not suffer of any disturbances. At the same time, yields were abundant. Nowadays, things have profoundly changed.

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Farmers do not master anymore neither the beginning of the rainy season, nor its end. The goal of this investigation is to solve this problem. Whence its great importance as its results should provide users clear understandings on the ongoing situation. In this work are determined the main statistical characteristics of the rainfall in Dschang, i.e. their means values and corresponding standard deviations calculated or different laps of time over the decade 1976-1986 included. They will help users mastering the time variabilities of rainfall and rulers taking appropriate and on time decisions to avoid humanitarian catastrophes like hunger, between others. Some investigations have been done before on the rainy regime in different areas. Between others, the next more recent ones could be pointed out. An easy realizable method of rain forecast based on the exploitation of the virtual temperature of the air has been elaborated for some localities in Chad, (Njipouakouyou *et al.,* 2019). The time distribution of rainfall in Bissau has been investigated, (Njipouakouyou, March 2019). The frequent disturbances observed these last years in the rainy regime and their worst consequences on agricultural activities have led to the studies on the determination of the best time for the beginning of agricultural activities in some localities, (Njipouakouyou *et al.,* April 2020, Njipouakouyou *et al.,* August 2021). The frequencies of the numbers of rainy days and an attempt of modelling the rainfall have been made, (Njipouakouyou *et al.,* Moussa Mahamat Saleh *et al.,* April 2025). These investigations have enabled us to roughly understand some of their particularities and how to avoid some undesirable consequences. The main difference between the precedent and present works is that the formers were done on the base of monthly means of meteorological data, i.e. already treated data. It is clear that such data cannot permit researcher to reach all the needed details. These ones should be easily obtained using daily data. This paper is divided into five sections. The first and present one introduces the problematic of the research. The second exposes the data and the used methodology. In the third section are presented the results of

the data treatments and their analyses. The conclusion and some recommendations are found in the fourth section and the references in the fifth one.

## DATA AND METHODOLOGY

### Data

The data used to fulfill this work was registered at the Institute of Agricultural Researches, a state institution, one of the biggest in this domain in the country. Here many researchers in various branches work together. Knowing that atmospheric conditions have great impacts on their activities, this center is equipped with a big meteorological station and very modern equipment. Well-trained personal and conscientious specialists work there. Thus, it is obvious that our data is very representative and chronological series have no missing. Dschang is situated in the West Region of Cameroon, on the side of highlands turned to the Atlantic Ocean which is some 400 kilometers away in the south. It is some 1410 meters above the sea level. It is a very rich agricultural zone where many and various species are cultivated, between others, Irish potatoes, plantains, cassava, ground nuts, arabica coffee and tea. Various livestock is also found there. Formerly, its climate was very appreciated with moderate air temperature and regular constant rainy seasons. It was a very nice agricultural zone with various species, let us say a very green city. The used data concerns the daily rainfall over the decade from 1976 to 1986. The rainfall was registered using the stationary pluviometry installed according to the international prescriptions. Regular observations were made days and nights during the dry and rainy seasons. These are primary none previously treated data.

### Methodology

The methodology applied is as follows.

The first step has consisted of dividing every month into six equal sub periods of five days each with the particularity that the sixth sub period has six days for the months of 31 days and five days for the ones of 30 days. The particularity of February is that its sixth sub period mostly has 28 days and a few-29 days.

The second step was the calculation of the rainfall sub period and monthly statistical characteristics, in particular the number, $n_i$, of rainy days, the sub period cumulative rainfall, $R_i$ in mm, registered during these effective rainy days and the estimated daily rainfall, $\overline{R_i}$ in mm per day, assuming that the cumulative rainfall was equally dispatched over all the days in a sub period. All these characteristics were also calculated for the whole month and in this case, n represented the number of rainy days in the considered month, R in mm -the sub periods cumulative rainfall and $\bar{R}$ in mm per day-the estimated daily rainfall calculated relatively to the sub periods. The results of treatments are presented in tabular forms. They have enabled us to have accurate estimations of the beginning and end of the rainy season. This should lead to a best planning of agricultural activities in the locality.

The third step consisted of calculating each sub period only rainy season statistical characteristics, i.e. $n_i$, $R_i$ et $\overline{R_i}$just for the determined rainy season.The results were presented in a tabular form where the numbers in the parentheses are their corresponding standard deviations. These results have led to a good appreciation of the time trends of rainfalls during the whole period of investigation. At the fourth step the number of rainy days and the estimations of daily rainfalls with corresponding standard deviation were estimated for the whole year. The results were presented in a tabular form. This has enabled us to confirm whether the period of agricultural activities was correctly estimated. At last, yearly rainfalls with their standard deviations were estimated. All these results have permitted to point out the periods of both seasons in general, and the time of accuracy of deep dryness and maximum rainfalls in particular.

## RESULTS AND ANALYSIS

The results in tabular forms and their analysis are as follows.

The monthly sub period statistical characteristics of the rainy regime over the year are progressively presented in Tables 3.1-3.12 for year 1976 to year 1986 respectively. In these tables, $P_i$, $n_i$, $R_i$ and $\overline{R_1}$, are respectively the sub period numbers of rainy days, sub period cumulative rainfalls and estimated daily rainfalls if the rain was fallen every day in the sub period, i-indicates the order of the sub period with i=1 corresponding to the first one, i.e. days from 1 to 5; i=2- the second one, days from 6 to 10; i=3- the third one, days from 11 to 15; i=4- the fourth one, days from 16 to 20; i=5- the fifth one, days from 21 to 25 and i=6 the sixth one, days from 26 to either 28, or 29, or 30 and or 31.In these tables, the last raw, P, represents the monthly characteristics calculated relatively to the sub periods. For example, considering Table 3.1 and month of April, raw $P_3$ is for the third sub period, i.e. days from 11 to 15, $n_3$=4 means there were 4 effective rainy days. The cumulative sub periods rainfall during these days was $R_3$=33.7 mm and the estimated daily rainfall $\overline{R_3}$= 6.7 mm/day. Relatively to the whole month of April, the number of rainy days was n=19 days, the sub periods cumulative rainfall R=212.9 mm and the estimated daily rainfall relatively to the sub periods$\overline{R_1}$ =7.1 mm/day.This last result tells us that if rain was registered every day, the estimated rainfall should be 7.1 mm each day of the sub period. For a sub period to be declared as rainy, we arbitrary set up that its estimated daily rainfall should be around at least 5 mm/day. The next analysis will be done on this base. Thus, following the above hypothesis and going through Tables 3.1-3.11, it is obvious that in general, the rainy season in Dschang and surroundings should run as from March to October. This beginning occurred late in years 1977 where only 2.1 mm/day of rainfall were registered in March, 1978 with only 3.7 mm/day, 1979 with 3.0 mm/day, 1980 with 2.6 mm/day and 1983 with 1.0 mm/day. These values indicate that rainfall was decreasing during the considered period. Table 3.8 shows a serious disturbance in the beginning of the rainy season in 1983 as there was almost no rain in March. Clearly that the beginnings of the rainy seasons tended to occur later confirming the degradation of this season, Tables 3.(2,3,4,5, and 8). Going forward and based on the above hypothesis of at least 5.0 mm/day of rainfall, again from Tables 3.1-2.11, it is clear that the rainy season should finish by the end of October as the estimated daily rainfall was less than 3.5 mm/day from November. The estimated daily rainfalls relatively to the sub periods, $\bar{R}$,were as follows: 3.4 mm/day in 1976, 0.0 mm/day in 1977, 0.9 mm/day in 1978, 1.3 mm/day in 1979, 2.3 mm/day in 1980, 0.9 mm/day in 1981, 0.7 mm/day in 1982, 0?6 mm/day in 1983 and 1984, 3.2 mm/day in 1985 and 1.8 mm/day in 1986, conferred Tables 3.1-3.11.

**Table 3.1. Sub period characteristics of the rainfall in Dschang and surroundings in 1976**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 0 | 2 | 2 | 5 | 4 | 5 | 5 | 3 | 4 | 4 | 4 | 0 |
| | $R_1$ | 0 | 9.6 | 15.9 | 91.2 | 39.3 | 26.6 | 75.9 | 14.4 | 58.3 | 100.2 | 34.4 | 0 |
| | $\overline{R_1}$ | 0 | 1.9 | 3.2 | 18.2 | 7.9 | 5.3 | 15.2 | 2.9 | 11.7 | 117 | 6.9 | 0 |
| $P_2$ | $n_2$ | 0 | 2 | 3 | 5 | 3 | 5 | 4 | 4 | 4 | 5 | 3 | 0 |
| | $R_2$ | 0 | 15.5 | 71.3 | 78.2 | 17.3 | 26.4 | 15.0 | 17.9 | 13.0 | 52.7 | 32.6 | 0 |
| | $\overline{R_2}$ | 0 | 3.1 | 14.3 | 15.6 | 3.5 | 5.3 | 3.0 | 3.6 | 2.6 | 10.5 | 6.5 | 0 |
| $P_3$ | $n_3$ | 0 | 0 | 3 | 4 | 2 | 4 | 3 | 4 | 5 | 5 | 1 | 0 |
| | $R_3$ | 0 | 0 | 29.4 | 33.7 | 12.8 | 89.4 | 53.5 | 55.7 | 128.9 | 75.9 | 20.9 | 0 |
| | $\overline{R_3}$ | 0 | 0 | 5.9 | 6.7 | 2.6 | 17.9 | 10.7 | 11.1 | 25.8 | 15.2 | 4.2 | 0 |
| $P_4$ | $n_4$ | 1 | 1 | 1 | 2 | 4 | 1 | 5 | 4 | 5 | 5 | 2 | 0 |
| | $R_4$ | 0.4 | 22.8 | 1.2 | 1.4 | 26.9 | 7.0 | 96.9 | 39.5 | 36.6 | 111.8 | 13 ?0 | 0 |
| | $\overline{R_4}$ | 0.1 | 4.6 | 0.2 | 0.3 | 5.4 | 1.4 | 19.4 | 7.9 | 7.3 | 22.4 | 2.6 | 0 |
| $P_5$ | $n_5$ | 0 | 1 | 2 | 1 | 4 | 4 | 4 | 4 | 4 | 3 | 0 | 0 |
| | $R_5$ | 0 | 29.5 | 10.0 | 1.2 | 54.2 | 107.4 | 41.9 | 31.8 | 40.4 | 84.7 | 0 | 0 |
| | $\overline{R_5}$ | 0 | 5.9 | 2.0 | 0.2 | 10.8 | 21.4 | 8.4 | 6.4 | 8.1 | 16.9 | 0 | 0 |
| $P_6$ | $n_6$ | 0 | 2 | 3 | 2 | 4 | 2 | 5 | 6 | 5 | 2 | 0 | 0 |
| | $R_6$ | 0 | 5.1 | 38.1 | 7.2 | 26.9 | 11.3 | 17.2 | 71.9 | 47.1 | 2.9 | 0 | 0 |
| | $\overline{R_6}$ | 0 | 0.9 | 6.4 | 1.2 | 4.5 | 1.9 | 2.9 | 12.0 | 7.9 | 0.5 | 0 | 0 |
| P | n | 1 | 7 | 14 | 19 | 21 | 21 | 26 | 25 | 27 | 24 | 10 | 0 |
| | R | 0.4 | 82.5 | 165.9 | 212.9 | 177.4 | 267.7 | 300.4 | 231.2 | 324.3 | 428.2 | 100.9 | 0 |
| | $\bar{R}$ | 0.0 | 2.7 | 5.7 | 7.1 | 5.7 | 8.9 | 9.7 | 7.5 | 10.8 | 13.8 | 3.4 | 0 |

**Table 3.2. Sub period characteristics of the rainfall in Dschang and surroundings in 1977**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 2 | 1 | 1 | 3 | 4 | 3 | 5 | 5 | 5 | 5 | 0 | 0 |
| | $R_1$ | 15.3 | 2.8 | 15.3 | 29.8 | 22.1 | 43.5 | 33.4 | 29.3 | 22.1 | 70.7 | 0 | 0 |
| | $\overline{R_1}$ | 3.1 | 0.6 | 3.1 | 6.0 | 4.4 | 8.7 | 6.7 | 5.9 | 4.4 | 14.1 | 0 | 0 |
| $P_2$ | $n_2$ | 0 | 2 | 0 | 3 | 3 | 3 | 4 | 5 | 5 | 4 | 0 | 0 |
| | $R_2$ | 0 | 17.4 | 0 | 3.5 | 103.6 | 34.0 | 28.6 | 20.8 | 61.7 | 58.1 | 0 | 0 |
| | $\overline{R_2}$ | 0 | 3.5 | 0 | 0.7 | 20.7 | 6.8 | 5.7 | 4.2 | 12.3 | 11.6 | 0 | 0 |
| $P_3$ | $n_3$ | 0 | 0 | 0 | 3 | 1 | 4 | 2 | 5 | 5 | 5 | 0 | 1 |
| | $R_3$ | 0 | 0 | 0 | 28.3 | 23.0 | 26.0 | 19.9 | 52.7 | 163.0 | 70.2 | 0 | 7.5 |
| | $\overline{R_3}$ | 0 | 0 | 0 | 5.7 | 4.6 | 5.2 | 4.0 | 10.5 | 32.6 | 14.0 | 0 | 1.5 |
| $P_4$ | $n_4$ | 1 | 0 | 0 | 2 | 3 | 5 | 5 | 4 | 5 | 4 | 0 | 0 |
| | $R_4$ | 11.8 | 0 | 0 | 13.9 | 31.5 | 52.1 | 50.5 | 29.8 | 23.6 | 43.4 | 0 | 0 |
| | $\overline{R_4}$ | 2.4 | 0 | 0 | 2.8 | 6.3 | 10.4 | 10.1 | 6.0 | 4.7 | 8.7 | 0 | 0 |
| $P_5$ | $n_5$ | 0 | 0 | 2 | 5 | 4 | 5 | 5 | 5 | 5 | 0 | 0 | 0 |
| | $R_5$ | 0 | 0 | 51.0 | 23.2 | 30.2 | 68.2 | 93.7 | 122.6 | 42.1 | 0 | 0 | 0 |
| | $\overline{R_5}$ | 0 | 0 | 10.2 | 4.6 | 6.0 | 13.6 | 18.7 | 24.5 | 8.4 | 0 | 0 | 0 |
| $P_6$ | $n_6$ | 0 | 0 | 0 | 3 | 4 | 4 | 2 | 5 | 5 | 0 | 0 | 0 |
| | $R_6$ | 0 | 0 | 0 | 58.6 | 119.8 | 34.1 | 45.0 | 45.6 | 62.3 | 0 | 0 | 0 |
| | $\overline{R_6}$ | 0 | 0 | 0 | 11.7 | 20.0 | 6.8 | 7.5 | 7.6 | 12.5 | 0 | 0 | 0 |
| | n | 3 | 3 | 3 | 19 | 19 | 24 | 23 | 29 | 30 | 18 | 0 | 1 |
| P | R | 27.1 | 20.2 | 66.3 | 157.3 | 330.2 | 257.9 | 271.1 | 300.8 | 374.8 | 242.4 | 0 | 7.5 |
| | $\bar{R}$ | 0.9 | 0.7 | 2.1 | 5.2 | 10.7 | 8.6 | 8.7 | 9.7 | 12.5 | 7.8 | 0 | 0.2 |

**Table 3.3. Sub period characteristics of the rainfall in Dschang and surroundings in 1978**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 0 | 0 | 2 | 2 | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 0 |
| | $R_1$ | 0 | 0 | 60.8 | 14.4 | 29.4 | 48.3 | 43.2 | 13.6 | 57.8 | 22.3 | 25.8 | 0 |
| | $\overline{R_1}$ | 0 | 0 | 12.2 | 2.9 | 5.9 | 9.7 | 8.6 | 2.7 | 11.6 | 4.5 | 5.2 | 0 |
| $P_2$ | $n_2$ | 0 | 0 | 2 | 4 | 3 | 5 | 3 | 5 | 4 | 5 | 0 | 0 |
| | $R_2$ | 0 | 0 | 14.6 | 10.0 | 59.6 | 80.2 | 45.2 | 54.0 | 18 .2 | 39.7 | 0 | 0 |
| | $\overline{R_2}$ | 0 | 0 | 2.9 | 2.0 | 11.9 | 16.0 | 9.0 | 10.8 | 3.6 | 7.9 | 0 | 0 |
| $P_3$ | $n_3$ | 0 | 0 | 1 | 5 | 4 | 3 | 2 | 3 | 4 | 4 | 0 | 0 |
| | $R_3$ | 0 | 0 | 0.7 | 50.6 | 29.3 | 59.3 | 23.2 | 63.5 | 76.4 | 25.5 | 0 | 0 |
| | $\overline{R_3}$ | 0 | 0 | 0.1 | 10.1 | 5.9 | 11.9 | 4.6 | 12.7 | 15.3 | 5.1 | 0 | 0 |
| $P_4$ | $n_4$ | 2 | 2 | 1 | 3 | 1 | 5 | 3 | 5 | 5 | 4 | 0 | 0 |
| | $R_4$ | 12.8 | 12.8 | 4.6 | 76.0 | 41.7 | 59.4 | 31.9 | 35.2 | 51.5 | 33.9 | 0 | 0 |
| | $\overline{R_4}$ | 2.6 | 2.6 | 0.9 | 15.2 | 8.3 | 11.9 | 6.4 | 7.0 | 10.3 | 6.8 | 0 | 0 |
| $P_5$ | $n_5$ | 0 | 0 | 3 | 5 | 2 | 5 | 4 | 5 | 5 | 3 | 0 | 0 |
| | $R_5$ | 0 | 0 | 21.8 | 65.5 | 10.0 | 57.8 | 24.0 | 135.8 | 30.9 | 29.6 | 0 | 0 |
| | $\overline{R_5}$ | 0 | 0 | 4.4 | 13.1 | 2.0 | 11.6 | 4.8 | 27.2 | 6.2 | 5.9 | 0 | 0 |
| $P_6$ | $n_6$ | 0 | 1 | 2 | 2 | 2 | 2 | 3 | 4 | 5 | 5 | 0 | 0 |
| | $R_6$ | 0 | 0.2 | 11.6 | 10.7 | 2.1 | 26.8 | 7.1 | 96.5 | 47.5 | 41.8 | 0 | 0 |
| | $\overline{R_6}$ | 0 | 0.0 | 1.9 | 2.1 | 0.4 | 5.4 | 1.2 | 16.1 | 9.5 | 7.0 | 0 | 0 |
| P | n | 2 | 3 | 11 | 21 | 16 | 24 | 18 | 25 | 27 | 25 | 3 | 0 |
| | R | 12.8 | 13.0 | 114.1 | 227.2 | 172.1 | 331.8 | 174.6 | 398.6 | 282.3 | 192.8 | 25.8 | 0 |
| | $\bar{R}$ | 0.4 | 0.5 | 3.7 | 7.6 | 5.6 | 11.1 | 5.6 | 12.9 | 9.4 | 6.2 | 0.9 | 0 |

**Table 3.4. Sub period characteristics of the rainfall in Dschang and surroundings in 1979**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 0 | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 4 | 0 |
| | $R_1$ | 0 | 6.7 | 37.2 | 38.9 | 65.4 | 36.3 | 11.2 | 20.8 | 79.6 | 70.5 | 12.0 | 0 |
| | $\overline{R_1}$ | 0 | 1.3 | 7.4 | 7.8 | 13.1 | 7.3 | 2.2 | 4.2 | 15.9 | 14.1 | 2.4 | 0 |
| $P_2$ | $n_2$ | 0 | 0 | 2 | 3 | 5 | 3 | 4 | 5 | 4 | 5 | 2 | 0 |
| | $R_2$ | 0 | 0 | 4.6 | 17.9 | 49.3 | 37.3 | 31.2 | 31.2 | 39.9 | 33.8 | 3.4 | 0 |
| | $\overline{R_2}$ | 0 | 0 | 0.9 | 3.6 | 9.9 | 7.5 | 6.2 | 6.2 | 8.0 | 6.8 | 0.7 | 0 |
| $P_3$ | $n_3$ | 0 | 1 | 1 | 3 | 1 | 5 | 5 | 5 | 4 | 0 | 3 | 0 |
| | $R_3$ | 0 | 0.7 | 2.6 | 17.0 | 0.5 | 110.1 | 58.9 | 60.0 | 58.4 | 0 | 14.1 | 0 |
| | $\overline{R_3}$ | 0 | 0.1 | 0.5 | 3.4 | 0.1 | 22.0 | 11.8 | 12.0 | 11.7 | 0 | 2.8 | 0 |
| $P_4$ | $n_4$ | 1 | 2 | 0 | 2 | 3 | 5 | 4 | 4 | 5 | 3 | 0 | 0 |
| | $R_4$ | 9.7 | 24.4 | 0 | 33.7 | 10.4 | 78.3 | 20.1 | 27.2 | 18.4 | 4.0 | 0 | 0 |
| | $\overline{R_4}$ | 1.9 | 4.9 | 0 | 6.7 | 2.1 | 15.7 | 4.0 | 5.4 | 3.7 | 0.8 | 0 | 0 |
| $P_5$ | $n_5$ | 1 | 5 | 4 | 3 | 3 | 3 | 3 | 5 | 2 | 4 | 1 | 0 |
| | $R_5$ | 3.5 | 51.4 | 30.0 | 32.7 | 18.5 | 17.2 | 68.0 | 98.1 | 60.9 | 40.3 | 7.4 | 0 |
| | $\overline{R_5}$ | 0.7 | 10.3 | 6.0 | 6.5 | 3.7 | 3.4 | 13.6 | 19.6 | 12.2 | 8.1 | 1.5 | 0 |
| $P_6$ | $n_6$ | 0 | 1 | 3 | 4 | 2 | 3 | 5 | 5 | 5 | 4 | 1 | 0 |
| | $R_6$ | 0 | 5.4 | 19.8 | 31.2 | 7.2 | 49.9 | 68.7 | 17.6 | 38.3 | 34.3 | 1.8 | 0 |
| | $\overline{R_6}$ | 0 | 1.1 | 3.3 | 6.2 | 1.2 | 10.0 | 11.5 | 2.9 | 7.7 | 5.7 | 0.4 | 0 |
| P | n | 2 | 13 | 13 | 19 | 17 | 23 | 25 | 28 | 24 | 20 | 11 | 0 |
| | R | 13.2 | 88.6 | 94.2 | 171.4 | 151.3 | 329.1 | 268.1 | 254.9 | 295.5 | 182.9 | 38.7 | 0 |
| | $\bar{R}$ | 0.4 | 3.2 | 3.0 | 5.7 | 4.9 | 11.0 | 8.3 | 8.5 | 9.9 | 6.1 | 1.3 | 0 |

**Table 3.5. Sub period characteristics of the rainfall in Dschang and surroundings in 1980**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 0 | 0 | 0 | 2 | 2 | 4 | 1 | 5 | 5 | 5 | 3 | 0 |
| | $R_1$ | 0 | 0 | 0 | 23.6 | 30.0 | 62.9 | 3.0 | 30.1 | 34.4 | 73.2 | 41.0 | 0 |
| | $\overline{R_1}$ | 0 | 0 | 0 | 4.7 | 6.0 | 14.0 | 0.6 | 6.0 | 6.9 | 14.6 | 8.2 | 0 |
| $P_2$ | $n_2$ | 0 | 0 | 2 | 4 | 3 | 3 | 4 | 4 | 5 | 5 | 3 | 1 |
| | $R_2$ | 0 | 0 | 4.8 | 19.2 | 18.3 | 28.0 | 31.2 | 33.4 | 82.1 | 41.3 | 10.1 | 2.1 |
| | $\overline{R_2}$ | 0 | 0 | 1.0 | 3.8 | 3.7 | 5.6 | 6.2 | 6.7 | 16.4 | 8.3 | 2.0 | 0.4 |
| $P_3$ | $n_3$ | 0 | 0 | 4 | 1 | 2 | 4 | 3 | 4 | 5 | 4 | 3 | 0 |
| | $R_3$ | 0 | 0 | 15.9 | 1.8 | 34.3 | 145.4 | 9.6 | 59.4 | 58.3 | 42.1 | 16.9 | 0 |
| | $\overline{R_3}$ | 0 | 0 | 3.2 | 0.4 | 6.9 | 29.1 | 1.9 | 11.9 | 11.7 | 8.4 | 3.4 | 0 |
| $P_4$ | $n_4$ | 0 | 0 | 0 | 2 | 4 | 5 | 4 | 5 | 3 | 5 | 2 | 0 |
| | $R_4$ | 0 | 0 | 0 | 9.5 | 107.3 | 17.1 | 68.7 | 53.6 | 57.0 | 72.5 | 2.4 | 0 |
| | $\overline{R_4}$ | 0 | 0 | 0 | 1.9 | 21.5 | 3.4 | 13.7 | 10.7 | 11.4 | 14.5 | 0.5 | 0 |
| $P_5$ | $n_5$ | 2 | 1 | 5 | 3 | 2 | 3 | 5 | 4 | 5 | 5 | 0 | 0 |
| | $R_5$ | 20.3 | 6.2 | 28.6 | 23.1 | 12.5 | 24.8 | 41.1 | 19.7 | 96.6 | 61.2 | 0 | 0 |
| | $\overline{R_5}$ | 4.1 | 1.2 | 5.7 | 4.6 | 2.5 | 5.0 | 8.2 | 3.9 | 19.3 | 12.2 | 0 | 0 |
| $P_6$ | $n_6$ | 0 | 2 | 3 | 2 | 4 | 1 | 4 | 6 | 5 | 2 | 0 | 0 |
| | $R_6$ | 0 | 2.3 | 32.2 | 19.0 | 68.7 | 3.6 | 33.9 | 89.4 | 20.5 | 16.2 | 0 | 0 |
| | $\overline{R_6}$ | 0 | 0.6 | 5.4 | 3.8 | 11.5 | 0.7 | 5.7 | 14.9 | 4.1 | 2.7 | 0 | 0 |
| P | n | 2 | 3 | 14 | 14 | 17 | 20 | 21 | 28 | 28 | 26 | 11 | 1 |
| | R | 20.3 | 8.5 | 81.5 | 96.2 | 271.1 | 288.8 | 187.5 | 285.6 | 348.9 | 306.5 | 70.4 | 2.1 |
| | $\bar{R}$ | 0.7 | 0.3 | 2.6 | 3.2 | 8.7 | 9.6 | 6.0 | 9.2 | 11.6 | 9.9 | 2.3 | 0.1 |

**Table 3.6. Sub period characteristics of the rainfall in Dschang and surroundings in 1981**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 0 | 0 | 1 | 3 | 3 | 3 | 4 | 4 | 5 | 3 | 2 | 0 |
| | $R_1$ | 0 | 0 | 26.8 | 26.4 | 8.5 | 28.4 | 19.4 | 37.1 | 34.2 | 30.0 | 2.0 | 0 |
| | $\overline{R_1}$ | 0 | 0 | 5.4 | 5.3 | 1.7 | 5.7 | 3.9 | 7.4 | 6.8 | 6.0 | 0 ?4 | 0 |
| $P_2$ | $n_2$ | 0 | 0 | 2 | 1 | 5 | 4 | 4 | 5 | 5 | 2 | 2 | 0 |
| | $R_2$ | 0 | 0 | 25.4 | 23.9 | 49.5 | 10.1 | 76.6 | 36.3 | 35.9 | 2.5 | 24.3 | 0 |
| | $\overline{R_2}$ | 0 | 0 | 5.1 | 4.8 | 9.9 | 2.0 | 15.3 | 7.3 | 7.2 | 0.5 | 4.9 | 0 |
| $P_3$ | $n_3$ | 0 | 0 | 2 | 1 | 2 | 3 | 2 | 5 | 5 | 5 | 0 | 0 |
| | $R_3$ | 0 | 0 | 1.0 | 7.2 | 14.9 | 42.9 | 40.5 | 62.3 | 54.0 | 59.9 | 0 | 0 |
| | $\overline{R_3}$ | 0 | 0 | 0.2 | 1.4 | 3.0 | 8.6 | 8.1 | 12.5 | 10.8 | 12.0 | 0 | 0 |
| $P_4$ | $n_4$ | 0 | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 | 2 | 0 | 0 |
| | $R_4$ | 0 | 0.5 | 31.2 | 4.1 | 61.2 | 49.1 | 72.9 | 139.2 | 68.1 | 15.1 | 0 | 0 |
| | $\overline{R_4}$ | 0 | 0.1 | 6.2 | 0.8 | 12.2 | 9.8 | 14.6 | 27.8 | 13.6 | 3.0 | 0 | 0 |
| $P_5$ | $n_5$ | 1 | 1 | 5 | 4 | 5 | 2 | 4 | 5 | 5 | 5 | 0 | 0 |
| | $R_5$ | 2.5 | 2.7 | 67.3 | 67.1 | 26.5 | 32.0 | 23.2 | 80.2 | 118.3 | 35.7 | 0 | 0 |
| | $\overline{R_5}$ | 0.5 | 0.5 | 13.5 | 13.4 | 5.2 | 6.4 | 4.6 | 16.0 | 23.7 | 7.1 | 0 | 0 |
| $P_6$ | $n_6$ | 0 | 0 | 5 | 3 | 2 | 4 | 4 | 6 | 4 | 3 | 0 | 0 |
| | $R_6$ | 0 | 0 | 51.7 | 28.8 | 15.1 | 28.3 | 13.7 | 46.1 | 35.6 | 12.3 | 0 | 0 |
| | $\overline{R_6}$ | 0 | 0 | 8.6 | 5.8 | 2.5 | 5.7 | 2.3 | 7.7 | 7.1 | 2.1 | 0 | 0 |
| P | n | 1 | 2 | 17 | 14 | 20 | 19 | 22 | 30 | 29 | 20 | 4 | 0 |
| | R | 2.5 | 3.2 | 203.4 | 157.5 | 175.4 | 190.8 | 246.3 | 401.2 | 346.1 | 155.5 | 26.3 | 0 |
| | $\bar{R}$ | 0.1 | 0.1 | 6.6 | 5.3 | 5.7 | 6.4 | 7.9 | 12.9 | 11.5 | 5.0 | 0.9 | 0 |

**Table 3.7. Sub period characteristics of the rainfall in Dschang and surroundings in 1982**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 0 | 0 | 3 | 1 | 4 | 5 | 4 | 4 | 5 | 5 | 2 | 0 |
| | $R_1$ | 0 | 0 | 31.0 | 30.4 | 54.4 | 111.7 | 71.1 | 40.3 | 21.9 | 26.8 | 0.5 | 0 |
| | $\overline{R_1}$ | 0 | 0 | 6.2 | 6.1 | 10.9 | 22.3 | 14.2 | 8.1 | 4.4 | 5.4 | 0.1 | 0 |
| $P_2$ | $n_2$ | 0 | 0 | 0 | 4 | 3 | 3 | 5 | 5 | 5 | 4 | 2 | 0 |
| | $R_2$ | 0 | 0 | 0 | 45.2 | 56.3 | 26.6 | 95.3 | 65.9 | 80.1 | 61.8 | 0.5 | 0 |
| | $\overline{R_2}$ | 0 | 0 | 0 | 9.0 | 11.3 | 5.3 | 19.1 | 13.2 | 16.2 | 12.4 | 0.1 | 0 |
| $P_3$ | $n_3$ | 0 | 0 | 2 | 3 | 3 | 3 | 4 | 5 | 5 | 4 | 0 | 0 |
| | $R_3$ | 0 | 0 | 35.6 | 28.3 | 53.8 | 39.1 | 84.9 | 28.7 | 34.0 | 67.7 | 0 | 0 |
| | $\overline{R_3}$ | 0 | 0 | 7.1 | 5.7 | 10.8 | 7.8 | 17.0 | 5.7 | 6.8 | 13.5 | 0 | 0 |
| $P_4$ | $n_4$ | 0 | 0 | 2 | 3 | 2 | 4 | 3 | 2 | 5 | 5 | 0 | 0 |
| | $R_4$ | 0 | 0 | 4.8 | 35.0 | 8.8 | 29.7 | 28.0 | 54.4 | 56.7 | 56.5 | 0 | 0 |
| | $\overline{R_4}$ | 0 | 0 | 1.0 | 7 .0 | 1.8 | 5.9 | 5.6 | 10.9 | 11.3 | 11.3 | 0 | 0 |
| $P_5$ | $n_5$ | 3 | 3 | 5 | 3 | 4 | 5 | 3 | 4 | 5 | 4 | 0 | 0 |
| | $R_5$ | 36.7 | 66.5 | 44.3 | 37.1 | 12.8 | 96.3 | 25.4 | 94.0 | 79.4 | 29.0 | 0 | 0 |
| | $\overline{R_5}$ | 7.3 | 13.3 | 8.9 | 7.4 | 2.6 | 19.3 | 5.1 | 18.8 | 15.9 | 5.8 | 0 | 0 |
| $P_6$ | $n_6$ | 0 | 2 | 1 | 2 | 5 | 5 | 6 | 5 | 5 | 6 | 2 | 0 |
| | $R_6$ | 0 | 23.4 | 14.2 | 23.9 | 50.3 | 31.7 | 78.5 | 72.4 | 108.8 | 54.5 | 20.7 | 0 |
| | $\overline{R_6}$ | 0 | 5.9 | 2.8 | 4.8 | 10.1 | 6.3 | 13.1 | 12.1 | 21.8 | 9.1 | 4.1 | 0 |
| P | n | 3 | 5 | 13 | 16 | 21 | 25 | 23 | 28 | 30 | 28 | 6 | 0 |
| | R | 36.7 | 89.9 | 129.9 | 199.9 | 206.4 | 335.1 | 383.2 | 355.7 | 380.9 | 296.3 | 21.7 | 0 |
| | $\bar{R}$ | 1.2 | 3.2 | 4.2 | 6.7 | 6.7 | 11.2 | 12.4 | 11.5 | 12.7 | 9.6 | 0.7 | 0 |

**Table 3.8. Sub period characteristics of the rainfall in Dschang and surroundings in 1983**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 0 | 1 | 0 | 3 | 5 | 2 | 4 | 5 | 5 | 4 | 0 | 2 |
| | $R_1$ | 0 | 15.1 | 0 | 8.6 | 69.3 | 6.6 | 49.4 | 37.3 | 49.7 | 28.6 | 0 | 6.7 |
| | $\overline{R_1}$ | 0 | 3.0 | 0 | 1.7 | 13.9 | 1.3 | 9.9 | 7.5 | 9.9 | 5.7 | 0 | 1.3 |
| $P_2$ | $n_2$ | 0 | 0 | 0 | 3 | 2 | 5 | 4 | 5 | 5 | 4 | 1 | 1 |
| | $R_2$ | 0 | 0 | 0 | 11.5 | 10.0 | 51.4 | 93.4 | 70.7 | 24.3 | 53.0 | 17.2 | 1.7 |
| | $\overline{R_2}$ | 0 | 0 | 0 | 2.3 | 2.0 | 10.3 | 18.7 | 14.1 | 4.9 | 10.6 | 3.4 | 0.3 |
| $P_3$ | $n_3$ | 0 | 0 | 0 | 0 | 3 | 5 | 4 | 5 | 3 | 2 | 0 | 2 |
| | $R_3$ | 0 | 0 | 0 | 0 | 67.1 | 37.0 | 19.8 | 49.4 | 46.6 | 3.9 | 0 | 20.1 |
| | $\overline{R_3}$ | 0 | 0 | 0 | 0 | 13.4 | 7.4 | 4.0 | 9.9 | 9.3 | 0 .8 | 0 | 4.0 |
| $P_4$ | $n_4$ | 0 | 0 | 0 | 1 | 4 | 3 | 2 | 4 | 4 | 2 | 0 | 0 |
| | $R_4$ | 0 | 0 | 0 | 6.6 | 42.4 | 16.3 | 19.0 | 11.4 | 30.8 | 12.0 | 0 | 0 |
| | $\overline{R_4}$ | 0 | 0 | 0 | 1.3 | 8.5 | 3.3 | 3.8 | 2.3 | 6.2 | 2.4 | 0 | 0 |
| $P_5$ | $n_5$ | 0 | 1 | 0 | 5 | 2 | 4 | 4 | 5 | 5 | 1 | 0 | 0 |
| | $R_5$ | 0 | 4.2 | 0 | 25.9 | 6.9 | 23.4 | 13.4 | 41.9 | 58.6 | 17.0 | 0 | 0 |
| | $\overline{R_5}$ | 0 | 0.8 | 0 | 5.2 | 1.4 | 4.7 | 2.7 | 8.4 | 11.7 | 3.4 | 0 | 0 |
| $P_6$ | $n_6$ | 0 | 0 | 4 | 2 | 3 | 3 | 6 | 6 | 4 | 2 | 0 | 0 |
| | $R_6$ | 0 | 0 | 32.0 | 45.9 | 5.7 | 5.0 | 113.8 | 109.3 | 51.0 | 14.6 | 0 | 0 |
| | $\overline{R_6}$ | 0 | 0 | 5.3 | 9.2 | 1.0 | 1.0 | 19.0 | 18.2 | 10.2 | 2.4 | 0 | 0 |
| P | n | 0 | 2 | 4 | 14 | 19 | 22 | 24 | 30 | 26 | 15 | 1 | 5 |
| | R | 0 | 19.3 | 32.0 | 98.5 | 201.4 | 139.7 | 308.8 | 320.0 | 261.0 | 129.1 | 17.2 | 28.5 |
| | $\bar{R}$ | 0 | 0.7 | 1.0 | 3.3 | 6.5 | 4.7 | 10.0 | 10.3 | 8.7 | 4.2 | 0.6 | 0.9 |

**Table 3.9. Sub period characteristics of the rainfall in Dschang and surroundings in 1984**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 0 | 1 | 1 | 4 | 2 | 3 | 4 | 4 | 5 | 4 | 0 | 0 |
| | $R_1$ | 0 | 0.9 | 1.5 | 30.9 | 28.9 | 37.5 | 19.5 | 35.1 | 73.4 | 28.0 | 0 | 0 |
| | $\overline{R_1}$ | 0 | 0.2 | 0.3 | 6.2 | 5.8 | 7.5 | 3.9 | 7.0 | 14.7 | 5.6 | 0 | 0 |
| $P_2$ | $n_2$ | 0 | 1 | 4 | 3 | 2 | 3 | 5 | 3 | 4 | 2 | 1 | 0 |
| | $R_2$ | 0 | 16 | 37.8 | 3.5 | 16.1 | 13.6 | 25.5 | 52.3 | 24.2 | 20.1 | 3.3 | 0 |
| | $\overline{R_2}$ | 0 | 3.2 | 7.6 | 0.7 | 3.2 | 2.7 | 5.1 | 10.5 | 4.8 | 4.0 | 0.7 | 0 |
| $P_3$ | $n_3$ | 0 | 0 | 2 | 5 | 3 | 5 | 3 | 5 | 5 | 5 | 3 | 0 |
| | $R_3$ | 0 | 0 | 48.7 | 40.9 | 40.8 | 48.1 | 58.1 | 37.2 | 99.0 | 41.5 | 14.6 | 0 |
| | $\overline{R_3}$ | 0 | 0 | 9.7 | 8.2 | 8.2 | 9.6 | 11.6 | 7.4 | 19.8 | 8.3 | 2.9 | 0 |
| $P_4$ | $n_4$ | 0 | 0 | 4 | 2 | 2 | 3 | 4 | 5 | 5 | 5 | 0 | 0 |
| | $R_4$ | 0 | 0 | 32.2 | 21.7 | 10.5 | 8.9 | 18.8 | 73.2 | 89.9 | 45.4 | 0 | 0 |
| | $\overline{R_4}$ | 0 | 0 | 6.4 | 4.3 | 2.1 | 1.8 | 3.8 | 14.6 | 18.0 | 9.1 | 0 | 0 |
| $P_5$ | $n_5$ | 0 | 0 | 3 | 4 | 3 | 4 | 4 | 4 | 1 | 1 | 0 | 0 |
| | $R_5$ | 0 | 0 | 21.1 | 14.0 | 24.5 | 75.5 | 27.9 | 85.9 | 10.8 | 1.5 | 0 | 0 |
| | $\overline{R_5}$ | 0 | 0 | 4.2 | 2.8 | 4.9 | 15.1 | 5.6 | 17.2 | 2.2 | 0.3 | 0 | 0 |
| $P_6$ | $n_6$ | 0 | 0 | 3 | 1 | 5 | 4 | 5 | 5 | 4 | 4 | 0 | 0 |
| | $R_6$ | 0 | 0 | 22.5 | 6.9 | 40.9 | 59.2 | 13.7 | 68.5 | 98.4 | 16.0 | 0 | 0 |
| | $\overline{R_6}$ | 0 | 0 | 3.8 | 1.4 | 6.8 | 11.8 | 2.3 | 11.4 | 19.7 | 3.2 | 0 | 0 |
| P | n | 0 | 2 | 17 | 19 | 17 | 22 | 25 | 26 | 24 | 21 | 4 | 0 |
| | R | 0 | 16.9 | 163.8 | 117.9 | 161.7 | 242.8 | 163.5 | 352.2 | 395.7 | 152.5 | 17.9 | 0 |
| | $\bar{R}$ | 0 | 0.6 | 5.3 | 3.9 | 5.2 | 8.1 | 5.3 | 11.4 | 13.2 | 4.9 | 0.6 | 0 |

**Table 3.10. Sub period characteristics of the rainfall in Dschang and surroundings in 1985**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 0 | 0 | 0 | 5 | 5 | 2 | 5 | 3 | 4 | 5 | 1 | 0 |
| | $R_1$ | 0 | 0 | 0 | 117.5 | 34.9 | 17.2 | 50.6 | 41.0 | 28.4 | 25.9 | 3.5 | 0 |
| | $\overline{R_1}$ | 0 | 0 | 0 | 23.5 | 7.0 | 3.4 | 10.1 | 8.2 | 5.7 | 5.2 | 0.7 | 0 |
| $P_2$ | $n_2$ | 1 | 3 | 0 | 1 | 4 | 4 | 3 | 3 | 5 | 5 | 4 | 0 |
| | $R_2$ | 9.3 | 13.3 | 0 | 3.5 | 13.1 | 72.7 | 23.6 | 54.6 | 42.2 | 11.5 | 58.8 | 0 |
| | $\overline{R_2}$ | 1.9 | 2.7 | 0 | 0.7 | 2.6 | 14.5 | 4.7 | 10.9 | 8.4 | 2.3 | 11.8 | 0 |
| $P_3$ | $n_3$ | 4 | 0 | 3 | 3 | 2 | 4 | 4 | 3 | 4 | 5 | 3 | 0 |
| | $R_3$ | 8.1 | 0 | 55.2 | 60.1 | 20.0 | 20.2 | 7.9 | 50.8 | 63.2 | 18.2 | 34.5 | 0 |
| | $\overline{R_3}$ | 1.6 | 0 | 11.0 | 12.0 | 4.0 | 4.0 | 1.6 | 10.2 | 12.6 | 3.6 | 6.9 | 0 |
| $P_4$ | $n_4$ | 1 | 0 | 1 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 0 | 1 |
| | $R_4$ | 1.9 | 0 | 14.0 | 46.6 | 17.0 | 28.3 | 5.3 | 89.6 | 41.8 | 6.7 | 0 | 4.4 |
| | $\overline{R_4}$ | 0.4 | 0 | 2.8 | 9.3 | 3.4 | 5.7 | 1.1 | 17.9 | 8.4 | 1.3 | 0 | 0.9 |
| $P_5$ | $n_5$ | 0 | 0 | 2 | 3 | 3 | 4 | 4 | 5 | 4 | 0 | 0 | 0 |
| | $R_5$ | 0 | 0 | 41.4 | 18.3 | 20.4 | 22.7 | 45.5 | 36.1 | 41.8 | 0 | 0 | 0 |
| | $\overline{R_5}$ | 0 | 0 | 8.3 | 3.7 | 4.1 | 4.5 | 9.1 | 7.2 | 8.4 | 0 | 0 | 0 |
| $P_6$ | $n_6$ | 1 | 0 | 4 | 3 | 5 | 4 | 4 | 5 | 4 | 2 | 0 | 0 |
| | $R_6$ | 5.5 | 0 | 57.8 | 10.2 | 21.7 | 68.6 | 52.6 | 31.9 | 44.2 | 2.7 | 0 | 0 |
| | $\overline{R_6}$ | 0.9 | 0 | 9.6 | 2.0 | 3.6 | 13.7 | 8.8 | 5.3 | 8.8 | 0.5 | 0 | 0 |
| P | n | 7 | 3 | 10 | 18 | 23 | 23 | 23 | 23 | 25 | 20 | 8 | 1 |
| | R | 19.3 | 13.3 | 168.4 | 256.2 | 127.1 | 229.7 | 185.5 | 304.0 | 261.6 | 62.3 | 96.8 | 4.4 |
| | $\bar{R}$ | 0.6 | 0.5 | 5.4 | 5.4 | 4.1 | 7.7 | 6.0 | 9.8 | 8.7 | 2.0 | 3.2 | 0.1 |

**Table 3.11. Sub period characteristics of the rainfall in Dschang and surroundings in 1986**

| $P_i$ | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 0 | 0 | 0 | 3 | 5 | 3 | 4 | 3 | 4 | 5 | 3 | 0 |
| | $R_1$ | 0 | 0 | 0 | 35.4 | 46.0 | 21.9 | 36.3 | 15.8 | 21.5 | 45.6 | 52.6 | 0 |
| | $\overline{R_1}$ | 0 | 0 | 0 | 7.1 | 9.2 | 4.4 | 7.3 | 3.2 | 4.3 | 9.1 | 10.5 | 0 |
| $P_2$ | $n_2$ | 3 | 3 | 2 | 3 | 3 | 5 | 5 | 4 | 5 | 3 | 1 | 0 |
| | $R_2$ | 30.0 | 42.2 | 79.6 | 31.3 | 10.2 | 35.1 | 44.4 | 99.3 | 91.9 | 37.6 | 2.2 | 0 |
| | $\overline{R_2}$ | 6.0 | 8.4 | 15.9 | 6.3 | 2.0 | 7.0 | 8.9 | 19.9 | 18.4 | 7.5 | 0.4 | 0 |
| $P_3$ | $n_3$ | 0 | 0 | 3 | 1 | 1 | 4 | 3 | 4 | 5 | 2 | 0 | 0 |
| | $R_3$ | 0 | 0 | 72.8 | 3.2 | 30.2 | 18.4 | 30.6 | 42.8 | 66.6 | 21.4 | 0 | 0 |
| | $\overline{R_3}$ | 0 | 0 | 14.6 | 0.6 | 6.0 | 3.7 | 6.1 | 8.6 | 13.3 | 4.3 | 0 | 0 |
| $P_4$ | $n_4$ | 0 | 0 | 4 | 3 | 3 | 3 | 5 | 4 | 2 | 4 | 0 | 0 |
| | $R_4$ | 0 | 0 | 54.0 | 31.0 | 26.5 | 33.5 | 49.2 | 40.5 | 14.0 | 16.5 | 0 | 0 |
| | $\overline{R_4}$ | 0 | 0 | 10.8 | 6.2 | 5.3 | 6.7 | 9.8 | 8.1 | 2.8 | 3.3 | 0 | 0 |
| $P_5$ | $n_5$ | 0 | 0 | 2 | 4 | 4 | 2 | 4 | 4 | 4 | 3 | 1 | 0 |
| | $R_5$ | 0 | 0 | 14.2 | 66.0 | 15.9 | 2.0 | 20.0 | 48.1 | 30.4 | 12.6 | 0.5 | 0 |
| | $\overline{R_5}$ | 0 | 0 | 2.8 | 13.2 | 3.2 | 0.4 | 4.0 | 9.6 | 6.1 | 2.5 | 0.1 | 0 |
| $P_6$ | $n_6$ | 0 | 1 | 4 | 2 | 3 | 2 | 6 | 5 | 5 | 4 | 0 | 0 |
| | $R_6$ | 0 | 2.8 | 26.7 | 25.0 | 37.3 | 13.9 | 29.6 | 95.7 | 69.5 | 26.8 | 0 | 0 |
| | $\overline{R_6}$ | 0 | 0.7 | 4.5 | 5.0 | 6.2 | 2.8 | 4.9 | 16.0 | 13.9 | 4.5 | 0 | 0 |
| P | n | 3 | 4 | 15 | 16 | 21 | 19 | 27 | 24 | 25 | 21 | 5 | 0 |
| | R | 30.0 | 45.0 | 247.3 | 191.9 | 166.1 | 124.8 | 210.1 | 342.2 | 293.9 | 160.5 | 55.3 | 0 |
| | $\bar{R}$ | 1.0 | 1.6 | 8.0 | 6.4 | 5.4 | 4.2 | 6.9 | 11.0 | 9.8 | 5.2 | 1.8 | 0 |

Severe dryness was registered in some sub groups in October, see $P_{5,6}$ in 1977 and $P_5$-in 1985, Tables 3.2 and 3.10. Thus, it is clear that the end of the rainy seasons started occurring earlier in October. Obviously, in Dschang the dry season generally runs from November to February, four months, and the rainy season occupies the remaining period, i.e. eight months. Over the whole period of investigation, the most-rainy period run from May to September, with maximum rainfalls frequently in July-August. Even inside this period, progressive time reductions of rainfalls were also observed. Thus, a conclusion on a progressively time decreasing of the duration of the rainy season in the locality has been detected. The five days sub groups approach, the smallest laps of time recommended in meteorological investigations, has enabled us to detect some details which should not be reached if ten days sub groups approach was considered. These results have confirmed the degradation of the rainy regime in this area. Table 3.12 presents the statistical characteristics of the rainfall calculated only for the estimated rainy season, i.e. period from March to October included. Note that $n_i$, $R_i$ and $\overline{R_t}$have conserved the same meanings as above. The numbers in the parentheses are the standard deviations which should lead us to a best judgment of the time variability of corresponding parameters.

Thus, Table 3.12 tells us that during the rainy season, the awaited sub period numbers of rainy days used to be either 3 or 4 days with corresponding standard deviations either 1 or 2 days for the whole period of investigation. Relatively to the first sub period, $P_1$, the seasonal cumulative rainfall varied from 210.8(9.0) mm in 1981 to 421.8(33.8) mm in 1976;for the second sub period, $P_2$, 193.1(15.1) mm in 1984 and 431.2(30.1) mm in 1982; for $P_3$, from 223.8(25.7) mm in 1983 to 479.3(37.4) mm in 1976; for $P_4$, from 138.5(19.1) mm in 198.3 to 440.9(42.1) mm in 1981; for $P_5$, from 187.1(19.1) mm in 1983 to450.0(33.1) mm in 1981, for $P_6$, from 222.6(23.5) mm in 1976 to434.3(32.8) mm in 1982. Concerning the estimated daily rainfalls, their statistical characteristics are contained in the following intervals: for $P_1$: from 5.3(1.8) mm/day in 1981 to 16.5(28.7) mm in 1977; for $P_2$: from 4.8(3.0) mm in 1984 to 10.8(10.8) mm in 1982; for $P_3$: from 5.6(5.1) in 1983 to 12.0(7.5) mm in 1976; for $P_4$: from 3.5(2.7) mm in 1983 to 11.0(8.4) mm in 1981, for $P_5$: from 4.7(3.8) mm in 1983 to 11.2(6.6) mm in 1981; and for $P_6$: from 4.6(4.0) mm in 1976 to 10.0(5.9) mm in 1982. Their standard deviations are one order less than the values of the rainfalls, but mostly of the same order. This indicates the high variability of rainy regime.

**Table 3.12. Statistical characteristics of the rainfall during the rainy seasons, March-October. Period from 1976 to 1986 included. Case of Dschang and surroundings – Cameroon**

| $P_i$ | Par | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $P_1$ | $n_1$ | 4(1) | 4(2) | 3(1) | 4(1) | 3(2) | 3(1) | 4(1) | 4(2) | 3(1) | 4(2) | 3(2) |
| | $R_1$ | 421.8 (33.8) | 265.5 | 289.8 | 359.9 | 263.8 | 210.8 | 391.6 | 249.5 | 254.8 | 315.5 | 222.5 |
| | | | (17.1) | (36.2) | (24.4) | (26.9) | (9.0) | (30.2) | (24.7) | (20.2) | (35.0) | (15.9) |
| | $\overline{R_1}$ | 10.6 | 16.5 | 7.3 | 9.0 | 6.6 | 5.3 | 9.7 | 6.2 | 6.4 | 7.4 | 5.5 |
| | | (6.7) | (28.7) | (3.8) | (4.9) | (5.4) | (1.8) | (6.0) | (4.9) | (4.1) | (7.2) | (3.2) |
| $P_2$ | $n_2$ | 4(1) | 3(2) | 4(1) | 4(1) | 4(1) | 4(2) | 4(2) | 4(2) | 3(1) | 3(2) | 4(1) |
| | $R_2$ | 291.8 | 310.3 | 320.5 | 245.2 | 258.3 | 260.2 | 431.2 | 214.3 | 193.1 | 221.2 | 429.4 |
| | | (26.8) | (34.4) | (24.9) | (13.8) | (23.0) | (23.3) | (30.1) | (33.1) | (15.1) | (26.2) | (32.3) |
| | $\overline{R_2}$ | 7.3 | 7.8 | 8.0 | 6.1 | 6.5 | 6.5 | 10.8 | 9.0 | 4.8 | 5.5 | 10.4 |
| | | (5.4) | (6.9) | (4.9) | (2.8) | (4.6) | (4.6) | (6.1) | (5.8) | (3.0) | (5.2) | (5.9) |
| $P_3$ | $n_3$ | 4(1) | 3(2) | « (1) | 3(2) | 3(1) | 3(2) | 4(1) | 3(2) | 4(1) | 4(1) | 3(2) |
| | $R_3$ | 479.3 | 383.2 | 328.5 | 307.5 | 366.8 | 282.7 | 372.1 | 223.8 | 414.3 | 295.6 | 285.5 |
| | | (37.4) | (51.2) | (25.4) | (39.8) | (45.6) | (24.4) | (19.2) | (25.7) | (20.2) | (22.4) | (23.8) |
| | $\overline{R_3}$ | 12.0 | 9.6 | 8.2 | 7.7 | 9.2 | 7.1 | 9.3 | 5.6 | 10.4 | 7.4 | 7.2 |
| | | (7.5) | (10.2) | (5.1) | (8.0) | (9.1) | (4.9) | (4.1) | (5.1) | (4.0) | (4.5) | (4.8) |
| $P_4$ | $n_4$ | 3(2) | 4(2) | 3(2) | 3(2) | 4(2) | 3(1) | 4(1) | 3(2) | 4(1) | 3(1) | 4(1) |
| | $R_4$ | 321.3 | 244.3 | 334.2 | 192.1 | 385.7 | 440.9 | 273.9 | 138.5 | 240.6 | 249.3 | 265.2 |
| | | (42.5) | (18.1) | (21.3) | (24.7) | (36.6) | (42.1) | (20.6) | (19.1) | (27.1) | (28.1) | (14.3) |
| | $\overline{R_4}$ | 8.0 | 6.2 | 8.4 | 4.8 | 9.6 | 11.0 | 6.9 | 3.5 | 7.5 | 6.2 | 6.6 |
| | | (8.5) | (3.4) | (4.3) | (4.9) | (7.3) | (8.4) | (4.1) | (2.7) | (6.0) | (5.6) | (2.8) |
| $P_5$ | $n_5$ | 3(1) | 4(2) | 4(1) | 3(1) | 4(1) | 4(1) | 4(1) | 3(2) | 3(1) | 3(2) | 3(1) |
| | $R_5$ | 371.6 | 431.0 | 375.4 | 365.7 | 307.6 | 450.0 | 418.3 | 187.1 | 261.2 | 226.2 | 209.2 |
| | | (35.6) | (39.8) | (40.4) | (28.0) | (27.9) | (33.1) | (32.8) | (19.1) | (30.9) | (15.6) | (21.2) |
| | $\overline{R_5}$ | 9.3 | 10.8 | 9.4 | 9.1 | 7.7 | 11.2 | 10.5 | 4.7 | 6.5 | 5.7 | 5.2 |
| | | (7.1) | (7.9) | (8.1) | (5.6) | (5.6) | (6.6) | (6.6) | (3.8) | (6.2) | (3.1) | (4.2) |
| $P_6$ | $n_6$ | 4(2) | 3(2) | 3(1) | 4(1) | 3(2) | 4(1) | ‘4(2) | 4(2) | 4(1) | 4(1) | 4(2) |
| | $R_6$ | 222.6 | 365.4 | 244.1 | 267.0 | 283.5 | 231.6 | 434.3 | 377.3 | 326.1 | 289.7 | 324.5 |
| | | (23.5) | (38.3) | (31.4) | (19.5) | (29.1) | (29.0) | (32.8) | (43.3) | (32.2) | (23.5) | (27.6) |
| | $\overline{R_6}$ | 4.6 | 8.3 | 5.5 | 6.1 | 6.1 | 5.2 | 10.0 | 8.3 | 7.5 | 6.5 | 7.2 |
| | | (4.0) | (6.6) | (5.3) | (3.6) | (4.7) | (2.6) | (5.9) | (7.2) | (6.4) | (4.4) | (4.9) |

**Table 3.13. Monthly sub periods average numbers of rainy days, n, and estimated daily rainfalls, $\overline{R}$ with correspondent standard deviations (in the parentheses)**

| Années | Par | Jan | Feb | Marc | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1976 | n | 0(0) | 1(1) | 2(1) | 3(2) | 4(1) | 4(2) | 4(1) | 4(1) | 5(1) | 4(1) | 2(2) | 0(0) |
| | $\overline{R}$ | 0.0 | 2.7 | 5.3 | 7.0 | 5.8 | 8.8 | 9.9 | 7.8 | 10.6 | 14.3 | 3.4 | 0.0 |
| | | (0.0) | (2.2) | (5.0) | (8.1) | (3.1) | (8.7) | (6.6) | (3.8) | (8.0) | (7.9) | (3.0) | (0.0) |
| 1977 | n | 1(1) | 1(1) | 2(1) | 3(1) | 3(1) | 4(1) | 4(2) | 5(0) | 5(0) | 3(2) | 0(0) | 0(0) |
| | $\overline{R}$ | 1.0 | 0.7 | 0.5 | 5.3 | 10.3 | 8.5 | 8.8 | 9.8 | 12.5 | 8.1 | 0.0 | 0.3 |
| | | (1.4) | (1.4) | (0.8) | (3.7) | (7.8) | (3.0) | (5.3) | (7.5) | (10.5) | (6.6) | (0.0) | (0.6) |
| 1978 | n | 0(1) | 1(1) | 2(1) | 4(1) | 3(1) | 4(1) | 3(1) | 4(1) | 5(1) | 4(1) | 1(1) | 0(0) |
| | $\overline{R}$ | 0.4 | 0.4 | 3.7 | 7.6 | 5.7 | 11.1 | 5.8 | 12.8 | 9.4 | 6.2 | 0.9 | 0.0 |
| | | (1.0) | (1.0) | (4.4) | (6.0) | (4.2) | (3.5) | (2.9) | (8.5) | (4.1) | (1.3) | (2.1) | (0.0) |
| 1979 | n | 0(1) | 2(2) | 2(2) | 3(1) | 3(1) | 4(1) | 4(1) | 5(1) | 4(1) | 3(2) | 2(2) | 0(0) |
| | $\overline{R}$ | 0.4 | 3.0 | 3.0 | 5.7 | 5.0 | 11.0 | 8.2 | 8.4 | 9.9 | 5.9 | 1.3 | 0.0 |
| | | (0.8) | (4.0) | (3.1) | (1.8) | (5.3) | (6.7) | (4.7) | (6.3) | (4.3) | (5.2) | (1.1) | (0.0) |
| 1980 | n | 0(1) | 1(1) | 0(1) | 2(1) | 3(1) | 3(1) | 4(1) | 5(1) | 5(1) | 4(1) | 2(2) | 0(0) |
| | $\overline{R}$ | 0.7 | 0.3 | 2.6 | 3.1 | 8.7 | 9.6 | 6.1 | 9.0 | 11.6 | 10.1 | 2.4 | 0.1 |
| | | (1.7) | (0.5) | (2.6) | (1.7) | (7.0) | (10.5) | (4.7) | (4.2) | (5.7) | (4.6) | (3.2) | (0.2) |
| 1981 | n | 0(0) | 0(1) | 3(2) | 2(1) | 3(1) | 3(1) | 4(1) | 5(1) | 5(0) | 3(1) | 1(1) | 0(0) |
| | $\overline{R}$ | 0.1 | 0.1 | 6.5 | 5.3 | 5.8 | 6.4 | 6.5 | 13.1 | 11.5 | 5.1 | 0.7 | 0.0 |
| | | (0.2) | (0.2) | (4.4) | (4.5) | (4.3) | (2.7) | (4.4) | (8.0) | (6.5) | (4.2) | (1.6) | (0.0) |
| 1982 | n | 1(1) | 1(1) | 2(2) | 3(1) | 4(1) | 4(1) | 4(1) | 5(1) | 5(0) | 5(1) | 1(1) | 0(0) |
| | $\overline{R}$ | 1.6 | 3.2 | 4.3 | 6.7 | 7.9 | 11.2 | 12.4 | 11.5 | 12.7 | 9.6 | 0.7 | 0.0 |
| | | (3.8) | (5.5) | (3.6) | (1.5) | (4.5) | (7.6) | (5.8) | (4.5) | (6.5) | (3.4) | (1.7) | (0.0) |
| 1983 | n | 0(0) | 0(1) | 1(2) | 2(2) | 3(1) | 4(1) | 4(1) | 5(1) | 4(1) | 1(1) | 0(0) | 1(1) |
| | $\overline{R}$ | 0.0 | 0.6 | 0.9 | 3.8 | 6.7 | 4.7 | 9.7 | 10.1 | 8.7 | 4.2 | 0.6 | 0.9 |
| | | (0.0) | (1.2) | (2.2) | (3.4) | (6.0) | (3.6) | (7.5) | (5.5) | (2.6) | (3.5) | (1.4) | (1.6) |
| 1984 | n | 0(0) | 0(1) | 3(1) | 3(2) | 3(1) | 4(1) | 4(1) | 4(1) | 4(2) | 4(2) | 1(1) | 0(0) |
| | $\overline{R}$ | 0.0 | 0.6 | 5.3 | 3.9 | 5.2 | 8.1 | 5.4 | 11.4 | 13.2 | 5.0 | 0.6 | 0.0 |
| | | (0.0) | (1.3) | (3.3) | (2.9) | (2.3) | (5.2) | (3.3) | (4.0) | (7.8) | (3.4) | (1.2) | (0.0) |
| )1985 | n | 1(2) | 1(1) | 2(2) | 3(1) | 4(1) | 4(1) | 4(1) | 4(1) | 4(1) | 3(2) | 1(2) | 0(0) |
| | $\overline{R}$ | 0.8 | 0.5 | 5.3 | 8.5 | 4.1 | 7.6 | 5.9 | 10.0 | 8.7 | 2.2 | 3.2 | 0.2 |
| | | (0.8) | (1.1) | (4.9) | (8.5) | (1.5) | (5.1) | (4.0) | (4.4) | (2.2) | (2.0) | (5.0) | (0.4) |
| 1986 | n | 1(1) | 1(1) | 3(2) | 3(1) | 4(2) | 3(1) | 5(1) | 4(1) | 4(1) | 4(1) | 1(1) | 0(0) |
| | $\overline{R}$ | 1.0 | 1.5 | 8.0 | 6.4 | 5.3 | 4.2 | 6.8 | 10.9 | 3.8 | 5.2 | 1.8 | 0.0 |
| | | (2.4) | (3.4) | (6.6) | (4.1) | (2.5) | (2.5) | (2.3) | (6.0) | (6.3) | (2.6) | (4.2) | (0.0) |

**Table 3.14. Yearly amounts of rainfalls during the investigation period**

| Années | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| R | 2808.0 | 1767.8 | 1893.5 | 1877.9 | 1866.1 | 1876.2 | 2287.4 | 1490.5 | 1750.1 | 1594.8 | 1736.8 |
| (mm/an) | (86.8) | (143.2) | (94.4) | (111.8) | (99.9) | (91.7) | (95.6) | (104.0) | (102.5) | (79.4) | (78.2) |

A carefully examination of Table 3.12 has led to the conclusion that in general, estimated daily rainfalls were decreasing with time, confirming again the degradation of the rainy regime in the locality. Table 3.13 gave us clear ideas on the yearly sub periods time trend of the average numbers of rainy days and estimated daily rainfalls. For example in May 1976 and $P_i$, i=1, 2, 3, 4, 5, 6, these average numbers were respectively 4 and 5.8 mm/day with standard deviations of 1 day and 3.1 mm/day, meaning that the awaited numbers of rainy days and daily rainfall should be respectively in the intervals 3-5 days and 2.7-8.9 mm/day. Small values of the standard deviations of these characteristics during the rainy season compare to the dry one inform us about the constancy of the rainfalls during that period. Table 3.14 has permitted us to conclude on the time variability of the rainy regime occurred in Dschang during the considered decade. Based on the time evolution of the rainfalls, it is evident that in general, they were decreasing. Thus, the degradation of the rainy regime is a real problem in the locality in particular, and the whole western region in general. Therefore, everyone and particularly the rulers and civil activists should take very important measures to reduce and stop this phenomenon. The high values of standard deviations confirm the high time variabilities of the atmospheric precipitations already detected before by former researchers. The cumulative amount of rainfall registered during this decade was 20949 mm for a yearly mean of 1904.5 mm/year and standard deviation of 361.1 mm. For a person who knew the city before, say around year 1980, he could easily remember that it was a green town, covered almost all over by fruit-trees, between others, mango-trees, guava-trees, avocado-trees, orange-trees, and various foods in the fields like maize, beans, cassava, just to name a few. With the arrival of the advanced school of agriculture as from 1980 and the creation of a full classic university with five academic faculties on campus in 1993, the populations of the city have drastically grown. The constructions of new houses has led to a wide destruction of the environment and vegetations. The former green landscape was progressively transformed to a savanna, grass-field, whence the climate change and the deterioration of the rainy season regime As the populations continue growing, these deteriorations has gone deeper and deeper, calling to the vigilance and attention of everybody, the city rulers in particular. Between many solutions which should be proposed, prior attention should be paid to the creation of many state parks in the city to restore its former greenness, special trees should be planted along the roads, say medicinal trees. All these structures should be under strict supervision and management of urban council and government authorities. They should also take great care on the cleanness of the city.

**Conclusion and recommendations**

This study has enabled us to confirm the degradation of the rainy regime in Dschang Division, West Region of Cameroon. It has provided us qualitative and quantitative details of this degradation. The importance of this work is obvious, this whole West Region being the main provider of various foods to Cameroon and neighboring countries as Chad, Central African Republic, Congo, Gabon. The creation of urban parks should surely break down the detected degradation.

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