

# INTERGOVERNMENT OCEANOGRAPHIC COMMISSION OF (UNESCO)

## SEA LEVEL MEASUREMENT AND ANALYSIS IN THE CAMEROON OCEAN AND RIVER (WOURI)

### NATIONAL REPORT CAMEROON

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## **I- INTRODUCTION**

### **1- Position**

The Republic of Cameroon lies to the North-East of the Gulf of Guinea, between longitude 008° and 016° East of Greenwich and 02° and 13° North of the Equator.

It has frontiers with:

- Nigeria to the West
- Chad to the North
- Central African (Former Empire) to the East
- Congo Republic (Brazaville), Gabon and Equatorial Guinea to the South.

It coastline stretches from RIO-DEL-REY near CALABAR in Nigeria, down to CAMPO near the pat land of Equatorial Guinea.

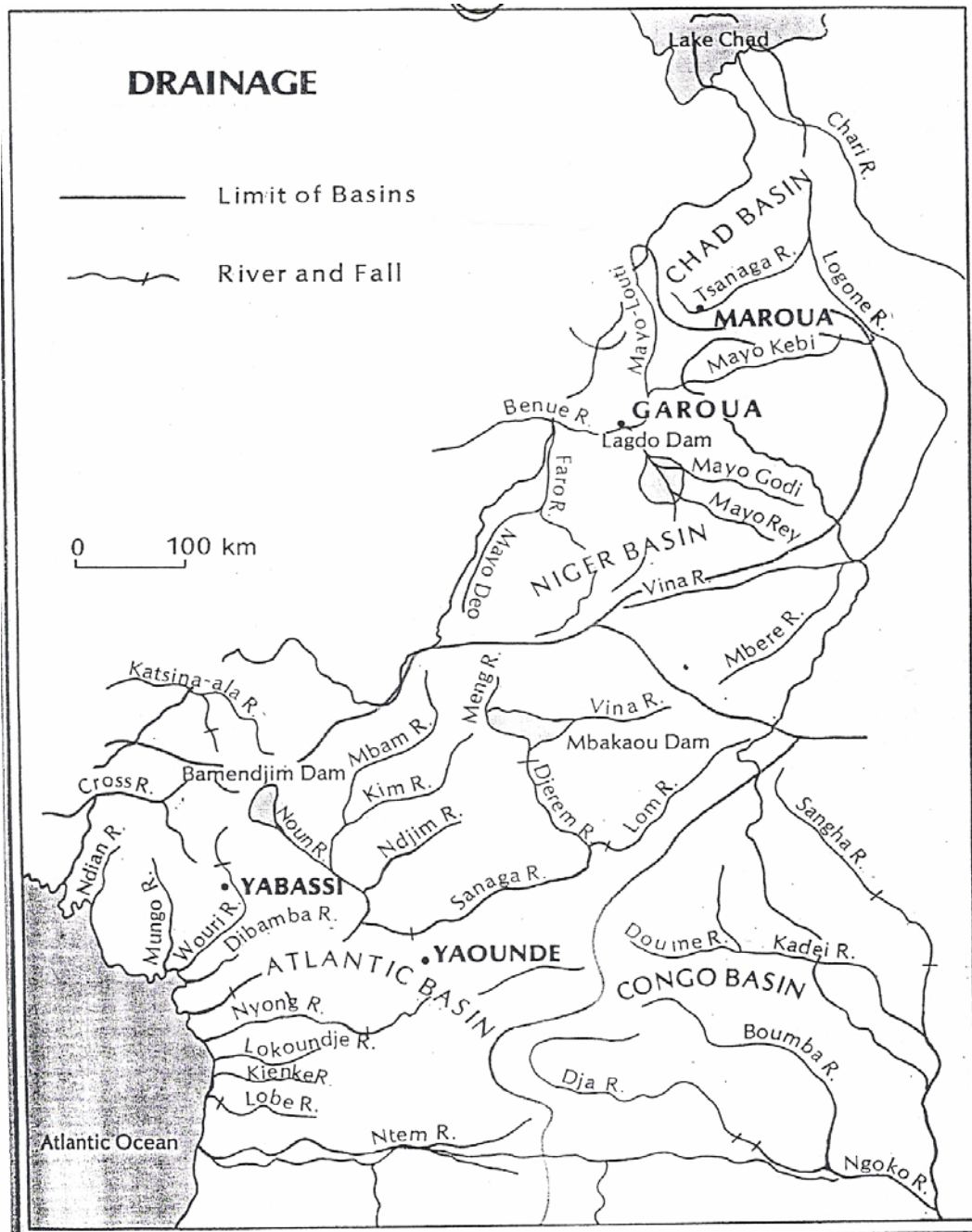


Figure.1: Cameroon: Main rivers and drainage

## 2- Size

The total area of the Republic is 475422 square kilometers with a population of almost 16 millions divided into 250 tribes and more than 240 dialects.

Cameroon is divided into 10 provinces:

- Far North (Capital: Maroua)
- North ( " : Garoua)
- Adamawa ( " : Ngaoundéré)

- North West ( “ : Bamenda)
- West ( “ : Bafoussam)
- East ( “ : Bertoua)
- Centre ( “ : Yaoundé)
- South ( “ : Ebolowa)
- Littoral ( “ : Douala)
- South West ( “ : Buea)

The Cameroon coastline is approximately 400km in length and far aesthetic, recreational and economic measures.

### **3- Relief and Drainage (Fig 1)**

The structure of Cameroon may be divided in to four major regions.

- 1) The Chad Lowland
- 2) The High plateau and Cameroon highlands
- 3) The low plateau
- 4) The Coastal lowland

The Coastal Lowland is stretch from Nigeria border (Rio Del Rey) through Limbe, Tiko, Douala, Kribi and Campo down to Equatorial Guinea.

This relatively low-lying region, interrupted by Mount Cameroon (4100m) is crossed by many swiftly rivers.

The region varies width and is marked by estuary of the Wouri River (the approach to the Port of Douala).

The Cameroon Coast may be divided into two (Fig 2 & 3):

a) The Rocky Coast which occurs where Mount Cameroon meet the sea and stretches from Idenau to Bimbia.

It is characterized by bays, Nachtigal rocky islands and cliffs.

b) The low-lying coast, which occurs in two different places.

-Between Idenau and estuary of the rivers Akpa Yafe in the North.

- Bimbia and Campo in the South.

Cameroon has a dense network of rivers and most of these rivers courses are interrupted by falls and rapids.

The regimes of these rivers are never regular. They reduce in size in the dry season and greatly increase (0,30m) in the rainy season.

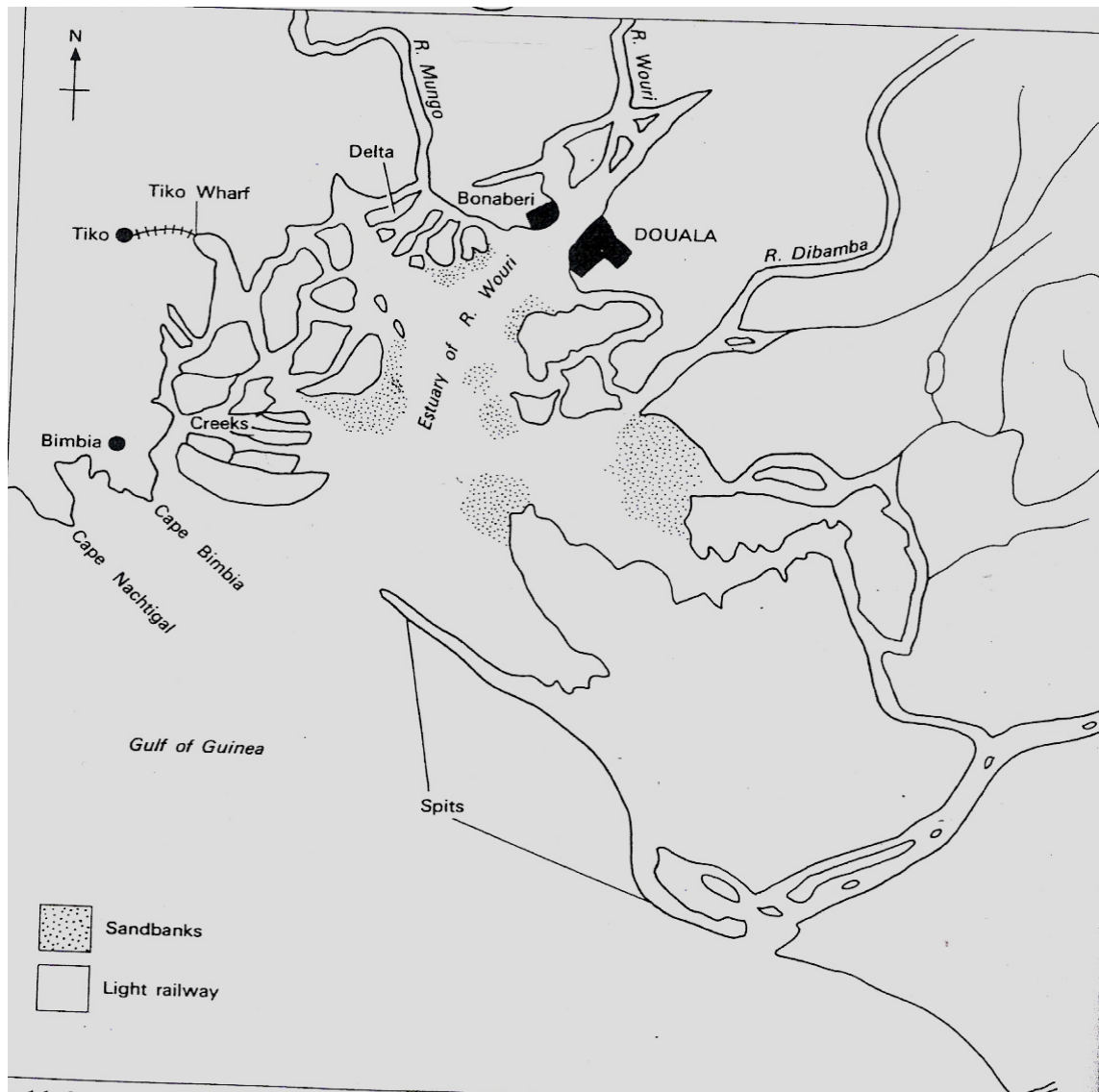


Fig 2: Cameroon low coast (from Bimbia to the mouth of SANAGA)  
 Cameroon has one major watershed, which is the ADAMAWA plateau,  
 from the ADAMAWA highlands, rivers flow to:

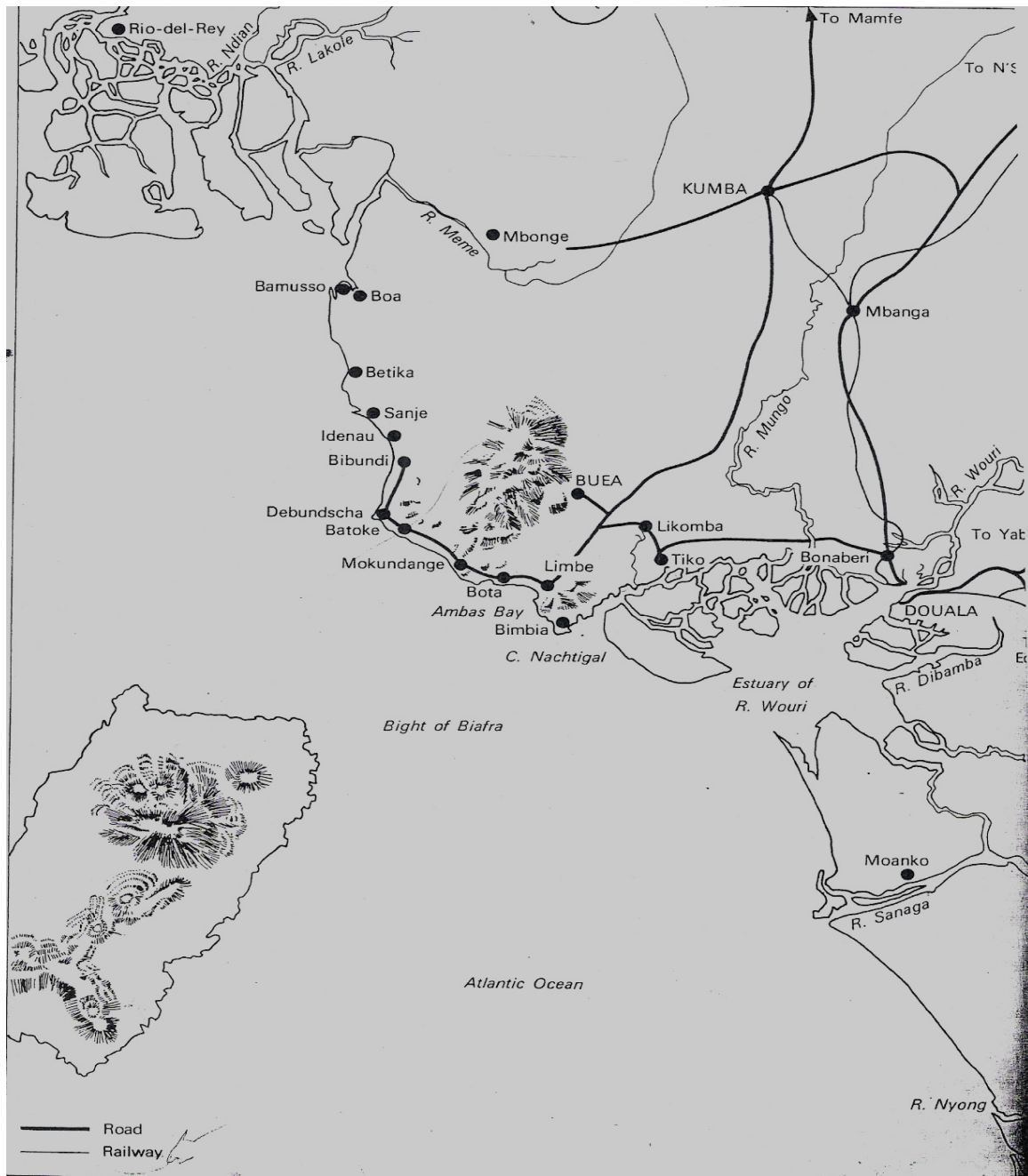


Fig 3: Cameroon coastal regions

- North into Lake Chad
- South-East into the Ngoko and Sangha
- North-West into the Benue
- South-West into the into the Atlantic Ocean and West ward into Nigeria.

These rivers drain into our drainage basins namely:

- a) The Chad
- b) The Niger Basin

- c) The Congo Basin
- d) The Atlantic Basin

A part from Benue, the Logone and Chari, and Wouri which are navigable especially in the rainy season, the rest of the rivers are imbued with rapids and falls which hinder navigation.

On the other hand, these falls are of great importance as regards the generation of hydro-electric power.

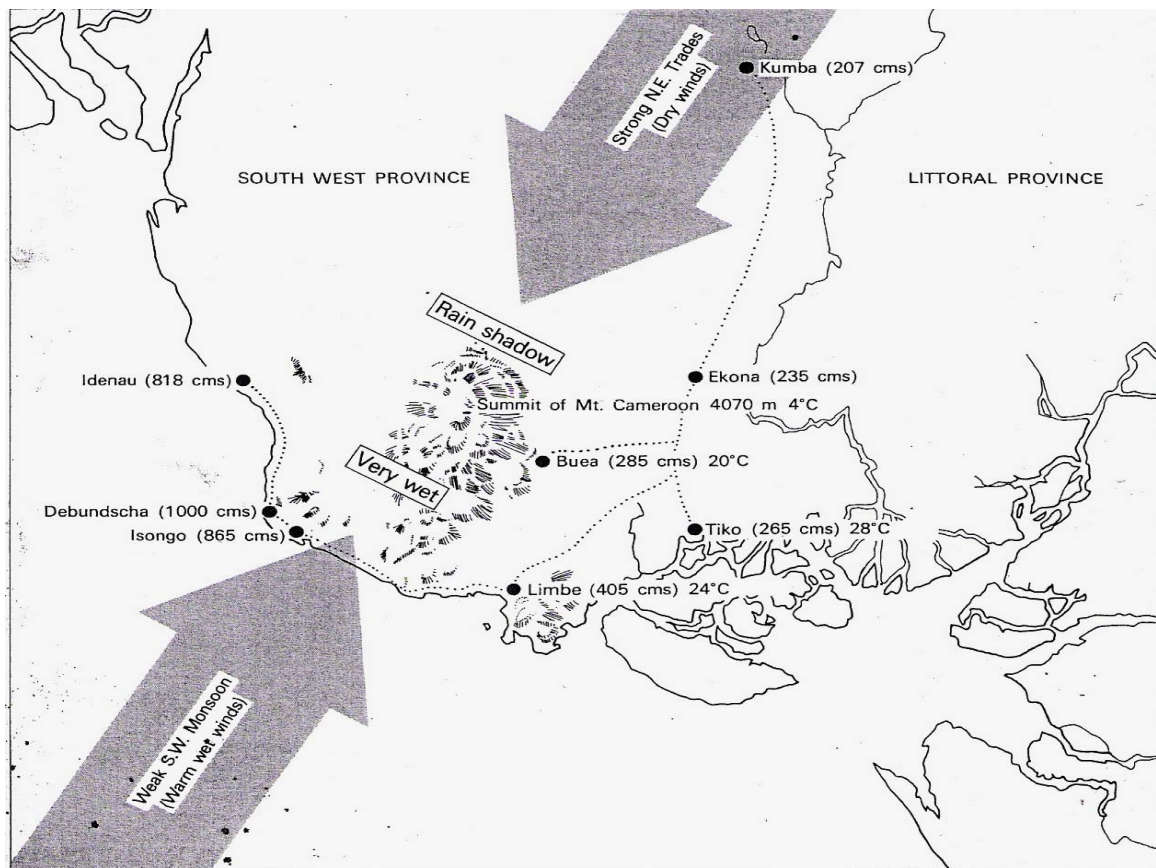


Fig.4: The rainiest area of Cameroon (Debundscha: 1000 cm)

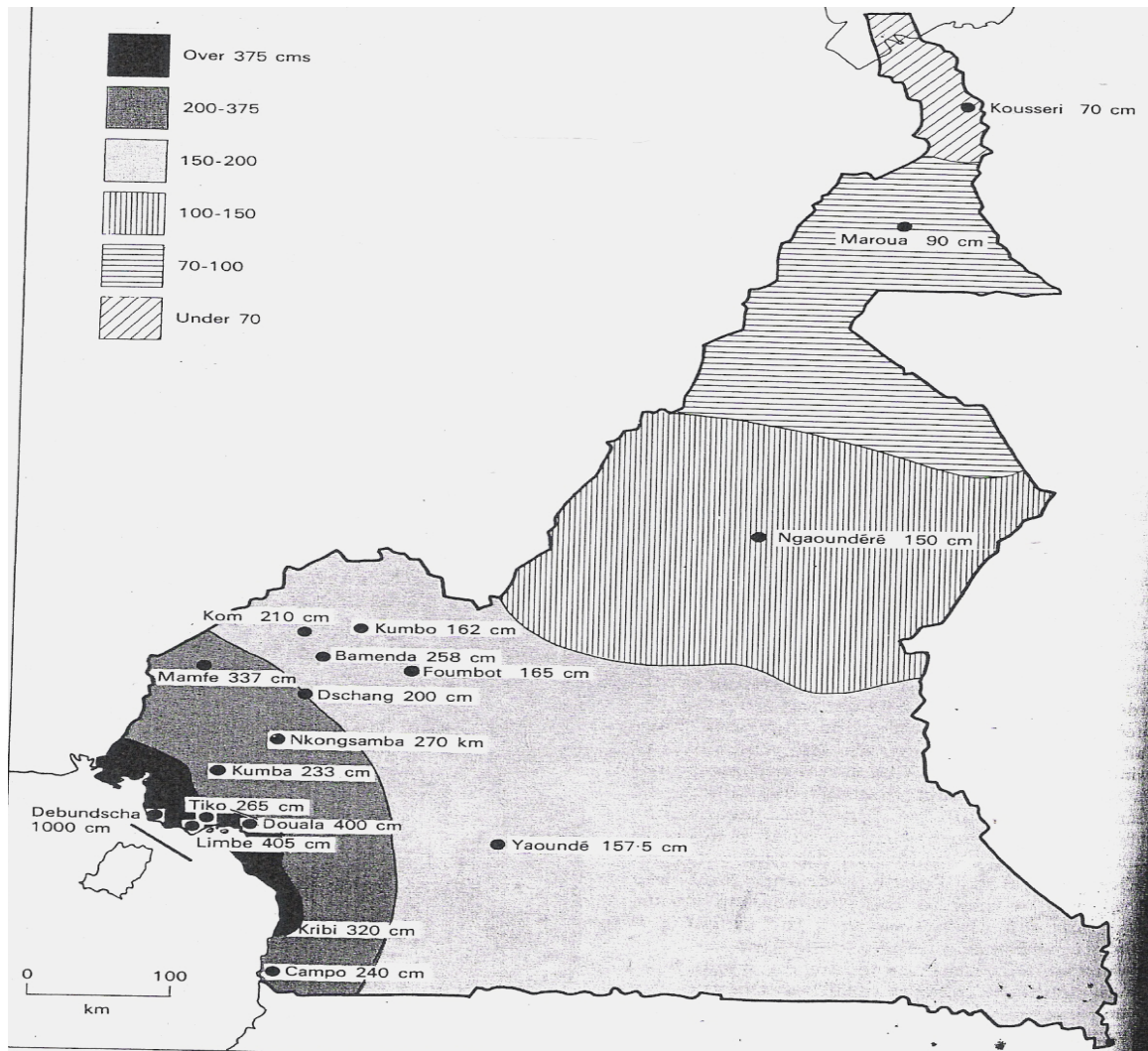


Fig 5: Distribution of annual rainfall and climate

The SANAGA is a major example of useful river for hydro-electric power generation: Four mighty hydro-electric stations are found on it:

- 1<sup>st</sup> at Edea
- 2<sup>nd</sup> at Song-Loulou
- 3<sup>rd</sup> at Lakdo
- 4<sup>th</sup> at Bemendjin

The most navigable river call Wouri, which is call the Nkam at it upper courses has a length of 250km and takes its rise from Bamileke plateau. The Wouri river wide at almost 1.5km drain into the Atlantic Ocean.



Fig 6: Sandbanks and creeks in the estuary of the River Wouri.

Most of Cameroon's population is concentrated around the Wouri's coast. The town is called Douala (more than 4 millions inhabitants).

The Douala Port (Lat 04° 03' North / Long 009° 41' East) is along the Wouri coastline. The shipping transport is one of the main sources of foreign exchange.

Douala port offers valuable services for both cargos and fishing vessels. To facilitate safe navigation for all vessels using the port and those on transit, many tide gauge were installed as follow:

## **II- TIDE GAUGE INSTALLATION**

### **A In Douala Port and along the Wouri river**

#### **1- During German and French colonization**

After the Portuguese, German started study the tide in Cameroon.

We found today some few documents confirmed it before 1914.

The lowest level of Wouri river was obtained by the graduated ladder.

The German map N° 119 of 1806 precised that on depth are referred to SPRINGNIEDRIGWASSER BEI.

A large-scale map of 10000° of 1915.



We can find in table I, the authors of those studies, the types of tide gauge and different results.

Table I: Historic of tide gauge study in Cameroon

<b>Authors</b>	<b>Years of study</b>	<b>Depth</b>	<b>Average level of the river</b>	<b>Type of tide gauge</b>
<i>German</i> <b>Mr NIKITENKO</b>	<i>1800 - 1940</i> <i>1939 - 1940</i>	<i>4m14</i> <i>4m14</i>	<i>1m49</i> <i>1m51</i>	<i>Graduated string</i>
<i>French</i> <b>Mr BONIN</b>	<i>1938</i>	<i>4m14</i>	<i>1m39</i>	<i>-/-</i>
<i>Capt SERRES of</i> <i>MV CASSIOPE</i>	<i>1921 -1925</i>	<i>4m35</i>	<i>1m50</i>	<i>-/-</i>
<b>Mr BRIEC</b>	<i>1948 -1949</i>	<i>4m092</i>	<i>1m51</i>	<i>-/-</i>
<b>Mr MANNEVY</b>	<i>1949</i>	<i>4m103</i>	<i>1m52</i>	<i>-/-</i>
<b>ONPC*</b>	<i>1970 -1977</i>	<i>4m102</i>	<i>1m49</i>	<i>-/-</i>
<b>ONPC + Canadian Government</b>	<i>1977 -1980</i>	<i>4m103</i>	<i>1m49</i>	<i>During the extension of the port, they used OTT R 16</i>
<b>PAD* (Hydrographic Service)</b>	<i>1981 -2006</i>	<i>4m103</i>	<i>1m49</i>	<i>OTT R 20 Four stations are operating now.</i>

ONPC\*: National Ports Office of Cameroon

PAD\*: Autonomous Port of Douala

## **B In others terminals**

Cameroon has four offshore terminals:

KOLE (Lat 04° 12' 21" North/ Long 008° 33' 31" East)

MUDI (Lat 04° 07' 00" North/ Long 008° 29' 11" East) in South West coast.

EBOME (Lat 02°48' 20.75" North / Long 009° 49' 3.85" East)

KKI (Lat 02° 56.5' North / Long 009° 44.2' East) in South coast.

Two dry cargo ports: Victoria and Kribi.

SONARA terminal (Lat 03° 59.5' North / Long 009° 07' 50" East) is in open sea.

Generally, all berthing, unberthing and unmooring are in according to the tide, on site, calculated from the reference tide of Douala Port.

SONARA or Cape Limboh terminal characteristics are:

	<b>Big Jetty</b>	<b>Small Jetty</b>
<b>LOA</b>	<b>160 to 247m</b>	<b>50 to 143m</b>
<b>Beam</b>	<b>17,5 to 45m</b>	<b>8,50 to 17,50m</b>
<b>SDWT</b>	<b>30000 to 95000 Tons</b>	<b>500 to 15000 Tons</b>
<b>Depth at lowest tide</b>	<b>17,00m</b>	<b>10,00m</b>
<b>SDRAFT</b>	<b>14,50m</b>	<b>8,50m</b>

This zone is under influence of two biggest currents:

- Benguela from South and Guinea Gulf from West coast during the high tide under current.

Under current from South and from North West during the low tide. The tide in this country coastline is “Semi-diurnal” according to the many observations since 1910 and average sea level is 1m16 at Limbe and 1m49 at Douala.

Many graduated strings also confirm this.

Douala Port has become concerning the tide subject, the reference Port of the all region.

#### Douala Port restrictions

Draft:

- Wouri water is fresh water density
- Fresh water arrival/sailing draft may comply with tide level.
- Maximum fresh water draft in the channel is:  
6.50m – UKC + Tide level

UKC (Under Keel Clearance = 30cm)

Tide variance is between 0,30m at low water to 2,90m at high water.

Draft permitting vessel’s movements are fixed 1 hour before high tide for berthing or sailing; but not later than 1 hour after according to the draft.

For many years, Cameroon is trying to develop a sea observing network.

The three operating stations established in Wouri river help the vessel’s to come alongside Douala Port and to unberth safely.

The South West or the South coast tide is calculated according to Douala’s tide: i.e. Tide at Limbe (Victoria) is 1h20 before Douala tide and at Kribi almost 1h30 after.

Since our refinery company was looking for tide and sea current gauge, many times we have postponed tankers berthing or unberthing because of high sea strong current.

NOVEMBER / NOVEMBRE 2006				
	Hours		Height	
	h	min	m	
1 Wed	2	06	2,4	
	8	13	0,9	
	14	05	2,3	
	20	31	0,8s	
2 Thu	3	05	2,6	
	9	23	0,7	
	15	15	2,4s	
	21	37	0,7s	
3 Fri	3	51	2,7	
	10	26	0,6	
	16	09	2,6	
	22	38	0,7	
4 Sat	4	31	2,8	
	11	24	0,5	
	16	54	2,6s	
	23	33	0,6s	
5 Sun	5	09	2,8	
	12	15	0,4s	
	17	38	2,6s	
6 Mon	0	27	0,7	
	5	48	2,7s	
	12	59	0,4s	
	18	21	2,6	
7 Tue	1	09	0,7	
	6	27	2,7	
	13	39	0,4	
	19	05	2,5	
8 Wed	1	48	0,7	
	7	05	2,6	
	14	13	0,4s	
	19	49	2,5	
9 Thu	2	24	0,8s	
	7	40	2,4s	
	14	46	0,5	
	20	29	2,4	
10 Fri	3	01	0,9s	
	8	13	2,3s	
	15	18	0,6	
	21	09	2,2s	
11 Sat	3	41	1,0s	
	8	51	2,2	
	15	55	0,7	
	22	00	2,1s	
12 Sun	4	29	1,1s	
	9	43	2,0s	
	16	40	0,8s	
	23	20	2,1	
13 Mon	5	31	1,2	
	10	59	1,9s	
	17	41	0,9s	
14 Tue	0	24	2,1s	
	6	47	1,1s	
	12	27	1,9s	
	18	56	1,0	
15 Wed	1	20	2,2	
	7	55	1,0s	
	13	41	2,0	
	20	02	0,9s	
16 Thu	2	04	2,3	
	8	49	0,9	
	14	40	2,1s	
	20	55	0,8s	

NOVEMBER / NOVEMBRE 2006				
	Hours		Height	
	h	min	m	
17 Fri	2	41	2,4	
	9	36	0,7s	
	15	28	2,2s	
	21	41	0,8	
18 Sat	3	18	2,5	
	10	21	0,6s	
	16	10	2,3s	
	22	25	0,8	
19 Sun	3	53	2,5s	
	11	05	0,5s	
	16	51	2,4s	
	23	08	0,7s	
20 Mon	4	28	2,6	
	11	47	0,5	
	17	29	2,4s	
	23	51	0,7s	
21 Tue	5	02	2,6	
	12	28	0,4s	
	18	04	2,4s	
22 Wed	0	35	0,7s	
	5	37	2,6	
	13	07	0,4s	
	18	38	2,4s	
23 Thu	1	14	0,7	
	6	16	2,5s	
	13	44	0,4s	
	19	16	2,4s	
24 Fri	1	54	0,7s	
	6	58	2,5s	
	14	19	0,4s	
	19	59	2,4	
Rainfall / Pluviosité : 123.1 mm Frequency : 12 days				

Fig 7 : November 2006 Tide in Douala Port

Realizing the importance of sea level data for navigation and development ova roll, marine research, Cameroon agreed on 06/07/06 through Mr Charles Metouck, General manager of National Refining company. Ltd, the installation of tide gauge networks at Cape Limboh terminal.

The project of Gloss/ODINAFRICA is well receipt in our country.

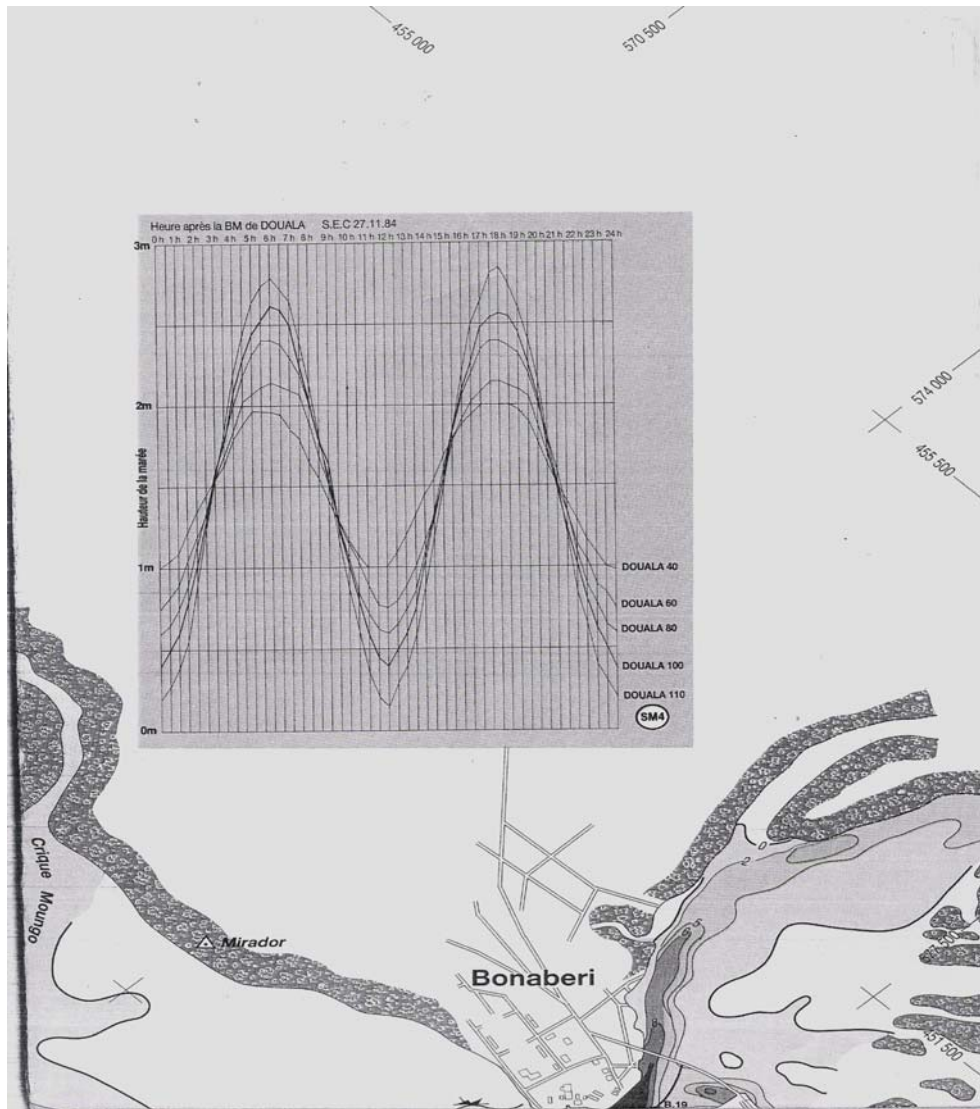


Fig 8: November 1984 tide in Douala Port.

### **RECOMMENDATIONS**

We expect and request:

- a) Regional or continental component of Gloss for cooperatives investigation also to encourage rapid development of sea level data acquisition and use within the region or continent.
- b) Appropriate strategies should be developed to respond to the need of the future.

## **SOURCES OF INFORMATIONS**

### **1) Maritime service SONARA**

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### **2) Fisheries research**

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### **3) P.A.D (Hydrographic service is responsible and perform maintenance for tide gauge stations.)**

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