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RESEARCH ARTICLE

ANALYSIS OF THE HYDROLOGICAL REGIME OF THE KONKOURÉ RIVER IN THE REPUBLIC OF GUINEA: IMPLICATIONS FOR WATER RESOURCES MANAGEMENT

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ABSTRACT

Effective water resource management is a major challenge for sustainable development and population well-being in the Republic of Guinea. In this context, the present study provides and in-depth analysis of the hydrological regime of the Konkouré River, one of the country's main watercourses. Based on a comprehensive set of observational data and modern hydrological modeling techniques, we examine the evolution of rainfall, river discharge, and water levels over a representative period. These results reveal pronounced seasonal and interannual trends in the hydrological regime of the Konkouré River. The main sources of variability identified include seasonal precipitation patterns, the natural variability of river discharge, as well as anthropogenic influences such as irrigation and dam operations. These results reveal pronounced seasonal and interannual trends in the hydrological regime of the Konkouré River. The main sources of variability identified include seasonal precipitation patterns, the natural variability of river discharge, as well as anthropogenic influences such as irrigation and dam operations. The study also assesses the potential impacts of climate change on the hydrological behavior of the river, particularly in terms of flood and drought risks. This in-depth analysis of the hydrological regime of the konkouré river provides valuable insights for the integrated management of water resources in the region. The findings offer scientific support to decision-makers for the development of rational water management strategies, the reduction of hydrological risks, and the promotion of the socio-economic development of riparian communities. This study highlights the importance of regional and subregional cooperation in the management of transboundary river basins, in order to ensure long-term water and environmental security in the Republic of Guinea.

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INTRODUCTION

The Konkouré River, one of the most important watercourses in the Republic of Guinea, plays a crucial role in the country's socio-economic development. Extending approximately 303 kilometers and draining a watershed of 16,800 km², the Konkouré flows through several regions before discharging into the Atlantic Ocean. This river is particularly vital for various uses, including hydroelectric power generation, agriculture, fisheries, and drinking water supply. Guinea, often referred to as the "water tower of West Africa," possesses considerable hydroelectric potential, and the Konkouré River is a major illustration of this. The Kaléta and Souapiti hydroelectric dams, located on this river, are key infrastructures for electricity production in the country. However, the management of this river and its water resources faces numerous challenges. The analysis of the hydrological regime of the Konkouré River is essential for understanding flow variability, seasonal impacts, and the effects of climate change on this vital resource. This analysis also allows for the assessment of implications for water resource management, particularly in terms of flow regulation, meeting water demands for irrigation, industry, and domestic uses, as well as the preservation of aquatic ecosystems. The central issue of this study is to understand how seasonal variations in the hydrological regime of the Konkouré River influence the availability and sustainable management of water resources. It also aims to identify the most appropriate strategies to optimize this management in a context increasingly affected by the impacts of climate change. By examining these various aspects, this study aims to formulate concrete recommendations for the integrated and sustainable management of the Konkouré River's water resources. It analyzes strategies to optimize water use, reduce conflicts among different users, and enhance the basin's resilience to climatic variations.

Theoretical Study

Geographical Location of the Konkouré River: The Konkouré is a river in Guinea. It is the main coastal river of Maritime Guinea and is often referred to as Bramaya in older publications. Stretching over 303 km, the Konkouré lies between latitude 9°48'21" N and longitude 13°45'27" W.

It originates in the Fouta Djallon highlands, near the town of Konkouré. One of its tributaries is the Kokoulo River. After its 303 km course, it flows into the Sangaréya Bay (Atlantic Ocean), north of Conakry. The Kakrima River is its main tributary. The Konkouré River crosses two natural regions of Guinea: Middle Guinea and Lower Guinea and is the focus of a development program that includes the construction of hydroelectric dams at Garafiri, Kaléta, Souapiti, and Amaria [1].

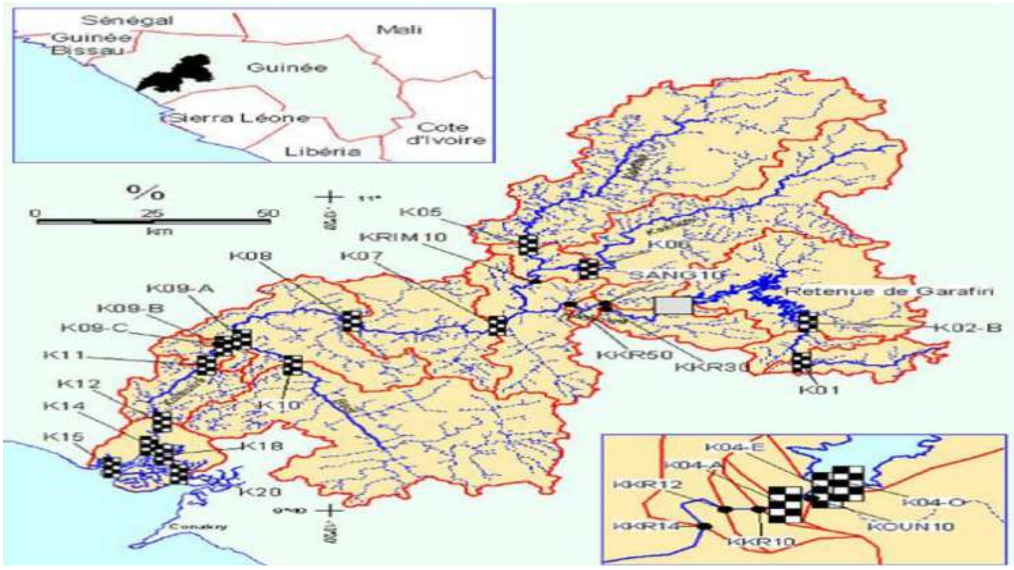

Figure 1. Map of the Konkouré River [2]

Rainfall Data Used: For this study, we utilized rainfall data provided by the National Directorate of Meteorology. These data pertain to the watershed of the Konkouré River and cover a 42-year observation period from 1981 to 2022. All the collected data are presented in Table 1.

Table 1. Monthly Rainfall of the Konkouré River (1981–2022) in mm/h

Year/ month	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1981	0	0	0	0	5.27	10.55	36.91	21.09	15.82	5.27	0	0	94.91
1982	0	0	0	0	10.55	21.09	15.82	31.64	15.82	10.55	5.27	0	110.74
1983	0	0	0	0	5.27	10.55	21.09	26.37	10.55	10.55	5.27	0	89.65
1984	0	0	0	0	5.27	15.82	15.82	5.27	10.55	5.27	0	0	58
1985	0	0	0	0	0	10.55	15.82	21.09	21.09	5.27	0	0	73.82
1986	0	0	0	0	5.27	10.55	10.55	26.37	31.64	10.55	0	5.27	100.2
1987	0	0	0	0	5.27	10.55	15.82	10.55	21.09	15.82	0	0	79.1
1988	0	0	0	0	0	5.27	21.09	15.82	15.82	5.27	0	0	63.27
1989	0	0	0	0	0	10.55	21.09	26.37	21.09	5.27	5.27	0	89.64
1990	0	0	0	0	5.27	15.82	15.82	21.09	10.55	5.27	0	0	73.82
1991	0	0	0	0	0	10.55	21.09	15.82	10.55	21.09	0	0	79.1
1992	0	0	0	0	10.55	10.55	31.64	26.37	15.82	10.55	5.27	0	110.75
1993	0	0	0	0	5.27	15.82	21.09	21.09	15.82	5.27	5.27	0	89.63
1994	0	0	0	0	5.27	15.82	21.09	21.09	26.37	21.09	10.6	0	121.28
1995	0	0	0	0	5.27	10.55	21.09	15.82	15.82	5.27	0	0	73.82
1996	0	0	0	0	5.27	10.55	10.55	26.37	10.55	5.27	0	0	68.56
1997	0	0	0	5.27	5.27	15.82	15.82	21.09	10.55	5.27	0	0	79.09
1998	0	0	0	0	0	10.55	10.55	31.64	21.09	5.27	0	0	79.1
1999	0	0	0	0	5.27	15.82	15.82	26.37	15.82	10.55	0	0	89.65
2000	0	0	0	0	0	10.55	10.55	21.09	10.55	5.27	0	0	58.01
2001	0	0	0	0	0	5.27	10.55	15.82	5.27	0	0	0	36.91
2002	0	0	0	0	0	5.27	5.27	10.55	5.27	0	0	0	26.36
2003	0	0	0	0	0	5.27	5.27	21.09	5.27	0	0	0	36.9
2004	0	0	0	0	0	5.27	10.55	15.82	5.27	0	5.27	0	42.18
2005	0	0	0	0	0	10.55	15.82	21.09	10.55	10.55	0	0	68.56
2006	0	0	0	0	0	5.27	10.55	21.09	10.55	5.27	0	0	52.73
2007	0	0	0	0	0	5.27	15.82	15.82	10.55	0	0	0	47.46
2008	0	0	0	0	0	5.27	10.55	26.37	15.82	5.27	0	0	63.28
2009	0	0	0	0	0	15.82	10.55	47.46	26.37	5.27	0	0	105.47
2010	0	0	0	5.27	0	5.27	26.37	21.09	15.82	5.27	0	0	79.09
2011	0	0	0	0	0	5.27	10.55	10.55	10.55	5.27	0	0	42.19
2012	0	0	0	0	0	15.82	42.19	36.91	15.82	5.27	5.27	0	121.28
2013	0	0	0	0	5.27	21.09	26.37	47.46	21.09	10.55	0	0	131.83
2014	0	0	0	0	5.27	21.09	15.82	21.09	15.82	10.55	0	0	89.64
2015	0	0	0	0	5.27	15.82	47.46	31.64	21.09	5.27	0	0	126.55
2016	0	0	0	0	0	36.91	68.55	31.64	31.64	5.27	0	0	174.01
2017	0	0	0	0	5.27	10.55	36.91	47.46	10.55	5.27	5.27	0	121.28
2018	0	0	0	0	0	10.55	26.37	42.19	26.37	5.27	5.27	0	116.02
2019	0	0	0	0	0	5.27	52.73	52.73	15.82	10.55	5.27	0	142.37
2020	0	0	0	0	10.55	5.27	31.64	26.37	10.55	10.55	0	0	94.93
2021	0	0	0	0.13	4.77	13.23	54.18	53.36	26.75	15.09	0.92	0	168.43
2022	0	0	0	0.05	2.9	6.95	37.34	44.5	18.24	11.85	1.84	0.19	123.86

Application of the Rational Method for Basin Flow Estimation: For this study, the conversion of rainfall into river discharge was carried out using the so-called rational method. This approach is based on several simplifying assumptions, including:

- Spatial homogeneity of precipitation over the entire watershed,
- Equality between the frequency of rainfall events and the frequency of the resulting flows,
- Constancy of the watershed area at the riverbed level.

The rational method thus allows for the estimation of the maximum discharge using equation (1) [3-10]:

$$Q = K.C.I.A \tag{1}$$

Where:

Q : is the discharge in m³/s;
K : is the conversion factor, taken as 0.0028;
C : is the runoff coefficient, ranging between 0 and 1;
I : is the rainfall intensity in mm/h;
A : is the watershed area, which in this case is equal to 17000 km².

Determination of Exceedance Probability Using the Weibull Method: Extreme hydrological events that can cause problems are of various types (floods, snowstorms, ice storms, etc.). The exceedance probability is a key element in the analysis of extreme hydrological events that may lead to significant impacts, such as floods or the overtopping of flood control structures. In this context, risk assessment relies on the discharge value, for which exceedances can create critical situations.

The probability *P* of exceeding a given discharge is estimated using the Weibull formula [11, 12, 13]:

$$P\left(X \geq X_m\right) = \frac{m}{N+1} \tag{2}$$

Determination of the Flood Return Period: The return period ***T*** of an event is the inverse of the exceedance probability ***P***:

$$T = \frac{1}{P} \tag{3}$$

Statistical Parameters of Annual Discharges for the Assessment of Hydrological Variability

The indicators used for the frequency analysis of annual discharges, such as the flow index, standardized deviations, and exceedance probability, were established based on the following formulas [14]. The flow index *Ki* represents the ratio between the annual discharge of year **i** and the mean discharge of the entire series. It is defined as:

$$K_i = \frac{Q_i}{Q_{moy}} \tag{4}$$

Where ***Qi*** is the annual discharge for year **i** and Q_{moy} is the mean discharge over the series. This index allows for the characterization of the annual hydrological regime by determining whether a year is wet, normal, or dry compared to the average behavior of the river.

Thus, when $K_i > 1$, the year is considered wetter than average, with discharges higher than the mean discharge. When $K_i = 1$, the year is considered normal, with the discharge equal to the mean discharge of the series. Conversely, if $K_i < 1$, the year is classified as dry, indicating discharges below the mean and thus a hydrological deficit. The relative deviation of the discharge from the mean, denoted $(K_i - 1)$, allows for quantifying how much the annual discharge deviates from the average.

$$\left(K_i - 1\right) = \left(\frac{Q_i}{Q_{moy}} - 1\right) \tag{5}$$

The quadratic deviation $(K_i - 1)^2$ is used for calculating the hydrological variability coefficient. The higher this value, the more the year is considered abnormal, whether it is particularly wet or dry.

$$\left(K_i - 1\right)^2 = \left(\frac{Q_i}{Q_{moy}} - 1\right)^2 \tag{6}$$

The exceedance probability ***P***, determined using the empirical Weibull method, is given by:

$$P = \frac{m}{n+1} \tag{7}$$

Where *m* represents the rank of the discharge arranged in descending order, and ***n*** is the total number of years in the series.

The exceedance probability, expressed as a percentage, is calculated as:

$$P = \frac{m}{n+1} \times 100 \quad (8)$$

RESULTS AND DISCUSSION

By applying equation (1) to the rainfall data presented in Table 1, we calculated the monthly discharges of the river. The obtained values are compiled and presented in Table 2.

Table 2. Monthly Discharges of the Observation Series for the Konkouré River (1981–2022) in m³/s

Year/ Month	Qjan	Qfeb	Qmar	Qapr	Qmay	Qjune	Qjuly	Qagust	Qsep	Qoct	Qnov	Qdec	Somme
1981	0	0	0	0.00	93.32	180.78	653.57	373.44	271.09	93.32	0.00	0.00	1665.53
1982	0	0	0	0.00	186.81	361.40	280.13	560.26	271.09	186.81	90.31	0.00	1936.80
1983	0	0	0	0.00	93.32	180.78	373.44	466.94	180.78	186.81	90.31	0.00	1572.39
1984	0	0	0	0.00	93.32	271.09	280.13	93.32	180.78	93.32	0.00	0.00	1011.96
1985	0	0	0	0.00	0.00	180.78	280.13	373.44	361.40	93.32	0.00	0.00	1289.07
1986	0	0	0	0.00	93.32	180.78	186.81	466.94	542.18	186.81	0.00	93.32	1750.16
1987	0	0	0	0.00	93.32	180.78	280.13	186.81	361.40	280.13	0.00	0.00	1382.57
1988	0	0	0	0.00	0.00	90.31	373.44	280.13	271.09	93.32	0.00	0.00	1108.29
1989	0	0	0	0.00	0.00	180.78	373.44	466.94	361.40	93.32	90.31	0.00	1566.19
1990	0	0	0	0.00	93.32	271.09	280.13	373.44	180.78	93.32	0.00	0.00	1292.08
1991	0	0	0	0.00	0.00	180.78	373.44	280.13	180.78	373.44	0.00	0.00	1388.59
1992	0	0	0	0.00	186.81	180.78	560.26	466.94	271.09	186.81	90.31	0.00	1943.00
1993	0	0	0	0.00	93.32	271.09	373.44	373.44	271.09	93.32	90.31	0.00	1566.01
1994	0	0	0	0.00	93.32	271.09	373.44	373.44	451.88	373.44	180.78	0.00	2117.40
1995	0	0	0	0.00	93.32	180.78	373.44	280.13	271.09	93.32	0.00	0.00	1292.08
1996	0	0	0	0.00	93.32	180.78	186.81	466.94	180.78	93.32	0.00	0.00	1201.95
1997	0	0	0	90.31	93.32	271.09	280.13	373.44	180.78	93.32	0.00	0.00	1382.39
1998	0	0	0	0.00	0.00	180.78	186.81	560.26	361.40	93.32	0.00	0.00	1382.57
1999	0	0	0	0.00	93.32	271.09	280.13	466.94	271.09	186.81	0.00	0.00	1569.38
2000	0	0	0	0.00	0.00	180.78	186.81	373.44	180.78	93.32	0.00	0.00	1015.14
2001	0	0	0	0.00	0.00	90.31	186.81	280.13	90.31	0.00	0.00	0.00	647.55
2002	0	0	0	0.00	0.00	90.31	93.32	186.81	90.31	0.00	0.00	0.00	460.74
2003	0	0	0	0.00	0.00	90.31	93.32	373.44	90.31	0.00	0.00	0.00	647.38
2004	0	0	0	0.00	0.00	90.31	186.81	280.13	90.31	0.00	90.31	0.00	737.86
2005	0	0	0	0.00	0.00	180.78	280.13	373.44	180.78	186.81	0.00	0.00	1201.95
2006	0	0	0	0.00	0.00	90.31	186.81	373.44	180.78	93.32	0.00	0.00	924.66
2007	0	0	0	0.00	0.00	90.31	280.13	280.13	180.78	0.00	0.00	0.00	831.35
2008	0	0	0	0.00	0.00	90.31	186.81	466.94	271.09	93.32	0.00	0.00	1108.47
2009	0	0	0	0.00	0.00	271.09	186.81	840.38	451.88	93.32	0.00	0.00	1843.48
2010	0	0	0	90.31	0.00	90.31	466.94	373.44	271.09	93.32	0.00	0.00	1385.41
2011	0	0	0	0.00	0.00	90.31	186.81	186.81	180.78	93.32	0.00	0.00	738.03
2012	0	0	0	0.00	0.00	271.09	747.07	653.57	271.09	93.32	90.31	0.00	2126.45
2013	0	0	0	0.00	93.32	361.40	466.94	840.38	361.40	186.81	0.00	0.00	2310.25
2014	0	0	0	0.00	93.32	361.40	280.13	373.44	271.09	186.81	0.00	0.00	1566.19
2015	0	0	0	0.00	93.32	271.09	840.38	560.26	361.40	93.32	0.00	0.00	2219.76
2016	0	0	0	0.00	0.00	632.49	1213.83	560.26	542.18	93.32	0.00	0.00	3042.07
2017	0	0	0	0.00	93.32	180.78	653.57	840.38	180.78	93.32	90.31	0.00	2132.47
2018	0	0	0	0.00	0.00	180.78	466.94	747.07	451.88	93.32	90.31	0.00	2030.29
2019	0	0	0	0.00	0.00	90.31	933.70	933.70	271.09	186.81	90.31	0.00	2505.92
2020	0	0	0	0.00	186.81	90.31	560.26	466.94	180.78	186.81	0.00	0.00	1671.91
2021	0	0	0	2.23	84.46	226.71	959.38	944.86	458.39	267.20	15.77	0.00	2958.99
2022	0	0	0	0.86	51.35	119.10	661.19	787.97	312.56	209.83	31.53	3.36	2177.75

By applying equation (2) to the cumulative discharge values, ranked in descending order, the exceedance probabilities were calculated and are presented in Table 3. Figure 2 shows the graphical representation of the annual cumulative discharges over the 42-year observation period, based on the data presented in Table 2. The figure indicates that the highest floods on the Konkouré River occurred in 2016 and 2021, with discharges of 3,042.078 m³/s and 2,958.99 m³/s, respectively. Based on the results presented in Table 3, we selected the two most representative flood years for predictive analysis on the Konkouré River, namely 2016 and 2021. The monthly discharges corresponding to these two years are listed in Table 4. The maximum discharges were observed in July, with 1,213.83 m³/s in 2016 and 959.38 m³/s in 2021. The figure (3) also highlights the low-flow periods, corresponding to months with very low discharges: seven months in 2016 and four months in 2021. Using equation (3), we successively calculated the two flood return periods for the Konkouré River watershed based on the observation years in our study. This calculation yielded return periods of T=44 years and T=22 years for 2016 and 2021, respectively. These results indicate that the flood observed in 2016 is expected to recur in 2060, while the flood observed in 2021 is expected to recur in 2043. Table 5 presents the annual discharges along with the statistical indicators used to analyze the irregularity of the hydrological regime and the frequency of wet or dry years. The analysis of the annual discharges presented in Table 5 highlights a strong interannual variability in the hydrological regime. The values of the index $Ki=Qi/Qmoy$ show significant fluctuations around the mean, with extremely wet years (Ki close to 2 in 2016, 2021, and 2019) and severely deficient years ($Ki < 0.5$ in 2011, 2004, 2001, 2003, and 2002). This indicates an alternation between surplus and dry years, reflecting a high sensitivity of the river to regional climatic variations. The deviations ($Ki-1$) and particularly their squares $(Ki-1)^2$, confirm the magnitude of this variability: extreme years such as 2016 or 2002 produce very high values, reflecting a significant departure from the average behavior. This dispersion highlights an irregular hydrological regime, characterized by strong fluctuations in discharge.

Table 3: Annual Cumulative Discharges in Descending Order and Exceedance Probability

Rank	Discharge [m^3/s]	Probability	Rank	Discharge [m^3/s]	Probability
2016	3042.07	0.023	1991	1388.59	0.512
2021	2958.99	0.047	2010	1385.41	0.535
2019	2505.92	0.070	1998	1382.57	0.558
2013	2310.25	0.093	1987	1382.57	0.581
2015	2219.76	0.116	1997	1382.39	0.605
2022	2177.75	0.140	1995	1292.08	0.628
2017	2132.47	0.163	1990	1292.08	0.651
2012	2126.45	0.186	1985	1289.07	0.674
1994	2117.40	0.209	1996	1201.95	0.698
2018	2030.29	0.233	2005	1201.95	0.721
1992	1943.00	0.256	2008	1108.47	0.744
1982	1936.80	0.279	1988	1108.29	0.767
2009	1843.48	0.302	2000	1015.14	0.791
1986	1750.16	0.326	1984	1011.96	0.814
2020	1671.91	0.349	2006	924.66	0.837
1981	1665.53	0.372	2007	831.35	0.860
1983	1572.39	0.395	2011	738.03	0.884
1999	1569.38	0.419	2004	737.86	0.907
1989	1566.19	0.442	2001	647.55	0.930
2014	1566.19	0.465	2003	647.38	0.953
1993	1566.01	0.488	2002	460.74	0.977

Figure 2. Interannual Cumulative Discharge Curves of the Observation Series

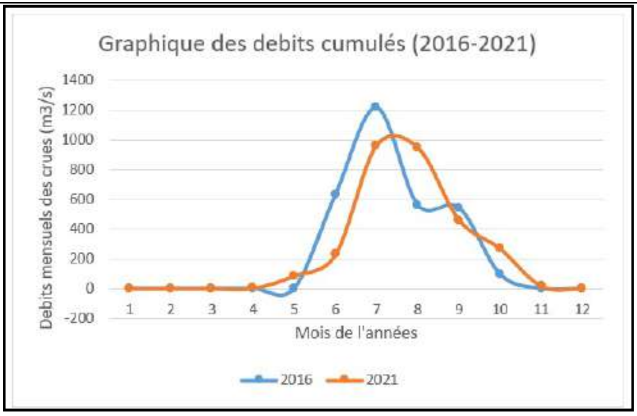

Figure 3. Monthly Flood Discharge Curves

Figure 2: Interannual Cumulative Discharge Curves of the Observation Series

Table 4. Monthly Discharges of the Two Main Flood Periods (2016–2021)

Year/ Month	Qjan	Qfeb	Qmar	Qapr	Qmay	Qjun	Qjuly	Qagust	Qsep	Qoct	Qnov	Qdec	Sommery
2016	0	0	0	0.00	0.00	632.49	1213.83	560.26	542.18	93.32	0.00	0.00	3042.07
2021	0	0	0	2.23	84.46	226.71	959.38	944.86	458.39	267.20	15.77	0.00	2958.99

Table 5. Annual Discharges and Their Associated Statistical Indicators

Years	Discharge	$Ki = Qi / Qmoy$	$(Ki - 1)$	$(Ki - 1)^2$	P= $(m/n+1)$	P=(m/n+1)*100
2016	3042.07	1.97	0.97	0.95	0.023	2.3
2021	2958.99	1.92	0.92	0.85	0.047	4.7
2019	2505.92	1.63	0.63	0.39	0.070	7.0
2013	2310.25	1.50	0.50	0.25	0.093	9.3
2015	2219.76	1.44	0.44	0.19	0.116	11.6
2022	2177.75	1.41	0.41	0.17	0.140	14.0
2017	2132.47	1.38	0.38	0.15	0.163	16.3
2012	2126.45	1.38	0.38	0.14	0.186	18.6
1994	2117.40	1.37	0.37	0.14	0.209	20.9
2018	2030.29	1.32	0.32	0.10	0.233	23.3
1992	1943.00	1.26	0.26	0.07	0.256	25.6
1982	1936.80	1.26	0.26	0.07	0.279	27.9
2009	1843.48	1.20	0.20	0.04	0.302	30.2
1986	1750.16	1.14	0.14	0.02	0.326	32.6
2020	1671.91	1.09	0.09	0.01	0.349	34.9
1981	1665.53	1.08	0.08	0.01	0.372	37.2
1983	1572.39	1.02	0.02	0.00	0.395	39.5
1999	1569.38	1.02	0.02	0.00	0.419	41.9

1989	1566.19	1.02	0.02	0.00	0.442	44.2
2014	1566.19	1.02	0.02	0.00	0.465	46.5
1993	1566.01	1.02	0.02	0.00	0.488	48.8
1991	1388.59	0.90	-0.10	0.01	0.512	51.2
2010	1385.41	0.90	-0.10	0.01	0.535	53.5
1998	1382.57	0.90	-0.10	0.01	0.558	55.8
1987	1382.57	0.90	-0.10	0.01	0.581	58.1
1997	1382.39	0.90	-0.10	0.01	0.605	60.5
1995	1292.08	0.84	-0.16	0.03	0.628	62.8
1990	1292.08	0.84	-0.16	0.03	0.651	65.1
1985	1289.07	0.84	-0.16	0.03	0.674	67.4
1996	1201.95	0.78	-0.22	0.05	0.698	69.8
2005	1201.95	0.78	-0.22	0.05	0.721	72.1
2008	1108.47	0.72	-0.28	0.08	0.744	74.4
1988	1108.29	0.72	-0.28	0.08	0.767	76.7
2000	1015.14	0.66	-0.34	0.12	0.791	79.1
1984	1011.96	0.66	-0.34	0.12	0.814	81.4
2006	924.66	0.60	-0.40	0.16	0.837	83.7
2007	831.35	0.54	-0.46	0.21	0.860	86.0
2011	738.03	0.48	-0.52	0.27	0.884	88.4
2004	737.86	0.48	-0.52	0.27	0.907	90.7
2001	647.55	0.42	-0.58	0.34	0.930	93.0
2003	647.38	0.42	-0.58	0.34	0.953	95.3
2002	460.74	0.30	-0.70	0.49	0.977	97.7

The ranking of discharges also allows for the determination of the exceedance probability

$$P = m/(n+1)$$

The wettest years, such as 2016 (*P=2.3%*), thus appear as rare events, occurring in less than 3% of cases. Conversely, the low discharges recorded in 2002 (*P=97.7%*) or 2003 (*95.3%*) correspond to frequent situations, revealing more recurrent drought conditions in the watershed. Overall, the table highlights a watershed characterized by strong hydrological irregularity and an asymmetric distribution of discharges, marked by a limited number of very wet years and a high frequency of deficient years. This configuration indicates a significant risk of dry years, which are much more recurrent than years with excess flows. This situation underscores the need to implement water resource management strategies adapted to these variations, particularly for sectors vulnerable to drought, such as agriculture, drinking water supply, and hydroelectric power generation.

CONCLUSION

This study made it possible to determine the discharges based on rainfall data collected from the National Directorate of Meteorology of the Republic of Guinea, covering forty-two years of observations. The two main flood years were selected to predict the potential recurrence of new floods in the Konkouré River watershed. The graphs of maximum monthly discharges reveal respective values of 1213,83 m³/s in July and 959,38 m³/s in August. The analysis of the *Ki* coefficients highlighted a significant variability of annual discharges relative to the mean, while the deviations (Ki−1) and their squares allowed for the identification of years with extreme discharges. The calculation of exceedance probabilities indicates the expected frequency of these events, providing a reliable basis for the hydrological management of the watershed. According to our forecasts, the 2016 flood could recur in 2060, while the one based on the 2021 period is expected in 2043. We also observed seven low-flow months in 2016 and four in 2021, highlighting the hydrological variability of the watershed. These disturbances can be attributed to several factors, including excessive logging along rivers and headwaters, climate disruption, siltation, and the production of clay bricks along the banks. To mitigate these impacts, we recommend a reforestation campaign of the main watershed's headwaters and its tributaries during each rainy season.

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