Article

Seasonal Variations of the Depletion Factor during Recession Periods in the Senegal, Gambia and Niger Watersheds

Jean-Claude Bader [1,*], Honoré Dacosta [2] and Jean-Christophe Pouget [1]

[1] G-EAU, IRD (AgroParisTech, Cirad, IRSTEA, MontpellierSupAgro, Univ Montpellier), BP5095, 34196 Montpellier, France; jean-christophe.pouget@ird.fr
[2] Département de Géographie, FLSH-UCAD, BP 5005, Dakar-Fann, Senegal; honore.dacosta@ucad.edu.sn
* Correspondence: jean-claude.bader@ird.fr

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Text S1: Variations of the daily depletion factor *K* as a function of time or discharge in different conceptual recession models

Variations of K with the generalized Coutagne formula

It is assumed here that the discharge Q verifies the following relationship, where Q_0 is the discharge at time $T = 0$ (beginning of the recession), W is the theoretical minimum value of discharge reached after an infinite time and n and σ are positive parameters:

$$Q(T) = W + (Q_0 - W)/(1 + \sigma T)^n \quad \text{(S1)}$$

The daily depletion factor K and its temporal derivative K' then verify the relationships below:

$$K(T) = \frac{Q(T+1)}{Q(T)} = (W + (Q_0 - W)(1 + \sigma + \sigma T)^{-n})/(W + (Q_0 - W)(1 + \sigma T)^{-n}) \quad \text{(S2)}$$

$$K'(T) = \frac{n\sigma(Q_0 - W)}{Q^2(T)}\left(\frac{W + (Q_0 - W)(1 + \sigma + \sigma T)^{-n}}{(1 + \sigma T)^{n+1}} - \frac{W + (Q_0 - W)(1 + \sigma T)^{-n}}{(1 + \sigma + \sigma T)^{n+1}}\right) \quad \text{(S3)}$$

$$K'(T) = \frac{n\sigma(Q_0 - W)\big(\sigma(Q_0 - W) + W((1 + \sigma + \sigma T)^{n+1} - (1 + \sigma T)^{n+1})\big)}{(1 + \sigma T)^{n+1}(1 + \sigma + \sigma T)^{n+1}Q^2(T)} \quad \text{(S4)}$$

With n and σ positive and W inferior to Q_0, the variations of K therefore differ according to the following cases for a positive T:

If W is positive or zero then: $K' > 0$; K increases over time and decreases with discharge; K tends towards 1 when T tends towards infinity and when discharge tends towards W

If W is negative, then there are positive times T_x and T_y verifying, with $T_y > T_x$:

$$(1 + \sigma + \sigma T_x)^{n+1} - (1 + \sigma T_x)^{n+1} = \sigma(W - Q_0)/W \quad \text{(S5)}$$

$$T_y = \big(((W - Q_0)/W)^{1/n} - 1\big)/\sigma \quad \text{(S6)}$$

If $T < T_x$ then: $K' > 0$; K increases over time and decreases with discharge

If $T = T_x$ then: $K' = 0$; K reaches its maximum value

If $T_x < T < T_y$ then: $K' < 0$; K decreases with time and increases with discharge

If $T = T_y$ then: Q=0

Variations of K with the generalized Maillet formula

It is assumed here that discharge Q verifies the following relationship, where Q_0 is discharge at time $T = 0$, W is a value lower than Q_0 and α is a positive parameter:

$$Q(T) = W + (Q_0 - W)e^{-\alpha T} \quad \text{(S7)}$$

The daily depletion factor K and its temporal derivative K' therefore verify the following relationships:

$$K(T) = Q(T+1)/Q(T) = (W + (Q_0 - W)e^{-\alpha(T+1)})/(W + (Q_0 - W)e^{-\alpha T}) \quad \text{(S8)}$$

$$K'(T) = \alpha(Q_0 - W)W(e^{-\alpha T} - e^{-\alpha(T+1)})/Q^2(T) \quad \text{(S9)}$$

The variations of K therefore differ according to the value of W:

If W =0 then: K'= 0; K is constant and is $e^{-\alpha}$

If W is positive, then: $K' > 0$; K increases over time and decreases with discharge; K tends towards 1 when T tends towards infinity and when the flow rate tends towards W

If W is negative then: $K' < 0$; K decreases over time and increases with discharge; discharge is zero at time $T = -\text{Log}(W/(W - Q_0))/\alpha$

Variations of K with the Horton formula

It is assumed here that the discharge Q verifies the following relationship, where Q_0 is the discharge at time $T = 0$ and p and β are positive parameters:

$$Q(T) = Q_0 e^{-\beta T^p} \quad \text{(S10)}$$

The factor K and its temporal derivative K' then verify the following relationships:

$$K(T) = Q(T+1)/Q(T) = e^{-\beta((T+1)^p - T^p)} \quad \text{(S11)}$$

$$K'(T) = -p\beta\left((T+1)^{p-1} - T^{p-1}\right) e^{-\beta((T+1)^p - T^p)} \quad \text{(S12)}$$

The variations of K then differ according to the value of p:

If $p = 1$ then: $K'=0$; K is constant and is $e^{-\beta}$

If $p > 1$ then: $K'<0$; K decreases over time and increases with discharge; K tends towards 0 when T tends towards infinity and when the discharge tends towards 0

If $p < 1$ then: $K'>0$; K increases over time and decreases with discharge; K tends towards 1 when T tends towards infinity and when the discharge tends towards 0

Conclusion concerning the variations of K according to the conceptual model used

The results can be summarized as follows:

With the generalized Coutagne formula: if W is positive or zero then $K'(T)$ is positive, otherwise $K'(T)$ is positive for $T<T_x$, zero for $T=T_x$ and negative for $T_x<T<=T_y$, with $Q(T_y)=0$;

With the generalized Maillet formula: if W is zero then K is constant, otherwise the sign of $K'(T)$ is constant and identical to that of W;

With the Horton formula: if p is equal to 1 then K is constant, otherwise the sign of $K'(T)$ is constant and identical to that of $1-p$

Among the classical conceptual models of recession, only the generalized Coutagne formula therefore makes it possible to represent a non-monotonic variation of K as a function of time. To do this, this formula must be used with a negative value of W. It then gives a $K(T)$ increasing for $T<T_x$ and $K(T)$ decreasing for $T>T_x$, with time T_x verifying equation (S5).

Text S2: Deformation of the hydrograph $Q(T)$ between distinct recession sequences, depending on the model used

In this paragraph, we note i and j the rows of two distinct recession sequences and $Q(D,i)$ and $Q(D,j)$ the discharge after a period of D days elapsed since the previous 15 September during the sequences concerned.

Models 1 and 3 express K as a function of D

These models give:

$$Q(D+1,i)/Q(D,i) = Q(D+1,j)/Q(D,j) = K(D) \quad \text{(S13)}$$

$$Q(D+1,i)/Q(D+1,j) = Q(D,i)/Q(D,j) \quad \text{(S14)}$$

The relationship (S14) shows that the ratio $Q(D,i)/Q(D,j)$ remains constant when D varies, with a value S depending only on the ranks i and j of the recession sequences. The hydrograph $Q(D,i)$ of period i therefore corresponds to the hydrograph $Q(D,j)$ of period j deformed by slope homothety S:

$$Q(D,i) = Q(D,j) \times S \quad \text{(S15)}$$

Models 2 and 4 express K as a function of Q

These models give:

$$Q(D+1,i)/Q(D,i) = K\big(Q(D,i)\big) \quad \text{(S16)}$$

Let times D_0 and T_r be as follows:

$$Q(D_0+T_r,i) = Q(D_0,j) \quad \text{(S17)}$$

Applied to the rank sequence i at time D_0+T_r and to the rank sequence j at time D_0, the relationship (S16) gives:

$$Q(D_0+T_r+1,i)/Q(D_0+T_r,i) = K\big(Q(D_0+T_r,i)\big) \quad \text{(S18)}$$

$$Q(D_0+1,j)/Q(D_0,j) = K\big(Q(D_0,j)\big) \quad \text{(S19)}$$

The combination of the relationships (S17) to (S19) gives:

$$Q(D_0+T_r+1,i)/Q(D_0+1,j) = Q(D_0+T_r,i)/Q(D_0,j) = 1 \quad \text{(S20)}$$

Therefore, if $Q(D_0+T_r,i)$ is equal to $Q(D_0,j)$, then $Q(D_0+T_r+1,i)$ is equal to $Q(D_0+1,j)$. The same reasoning reproduced by iteration shows that for any D:

$$Q(D+T_r,i) = Q(D,j) \quad \text{(S21)}$$

The hydrograph $Q(D,j)$ of period j therefore corresponds to the hydrograph $Q(D,i)$ of period i, deformed by time translation of duration T_r depending only on the ranks i and j of the recession sequences.

Model 0 according to the Maillet formula

With a constant value of K, this model is a special case of models expressing K as a function of time, as well as models expressing K as a function of discharge. With this model, the hydrograph $Q(D,i)$ of period i therefore corresponds to the hydrograph $Q(D,i)$ of period j, deformed by time translation or homothety.

Table S1. results concerning model 0 (and secondarily model 2).

station			global period						period 1		period 2			period 3		
rank	**river**	**name**	K_m	K_0	N	R_a	min($g(Q)$)	max($g(Q)$)	K_m	N	**first date**	K_m	N	**first date**	K_m	N
1	Bafing	Pont km17	0.9443	0.9123	200	5	0.8117	0.979	0.9532	137	March 1976	-	63	-	-	0
2	Samenta	Doureko	0.9743	0.9647	3393	5	0.8863	0.9837	0.9766	1064	March 1976	0.9733	2329	-	-	0
3	Kioma	Teliko	0.9765	0.9803	3274	5	0.8188	0.988	0.9809	1108	March 1976	0.9743	2166	-	-	0
4	Kioma	Salouma	0.9707	0.9576	2988	5	0.8916	0.9794	0.9733	966	March 1976	0.9696	1937	December 1994	-	85
5	Téné	Bebele	0.965	0.9689	1082	5	0.9	0.976	0.9691	622	March 1976	0.9608	442	December 1994	-	18
6	Bafing	Balabori	0.9726	0.9696	1698	5	0.9254	0.9805	0.9737	845	March 1976	0.9722	622	December 1994	0.9699	231
7	Bafing	Boureya	0.9625	0.9556	505	5	0.9252	0.9751	0.9643	184	March 1976	-	0	December 1994	0.9614	321
8	Bafing	Daka Saidou	0.9714	0.9697	10966	5	0.8798	0.9801	0.9739	3546	March 1976	0.9689	3228	December 1994	0.9712	4192
9	Bafing	Makana	0.9667	0.9743	7792	5	0.7662	0.982	0.97	1052	March 1972	0.9606	2551	December 1994	0.9696	4189
10	Bafing	Soukoutali	0.9675	0.9684	2206	5	0.8202	0.9769	0.9713	943	March 1972	0.9646	1263	-	-	0
11	Bafing	Dibia	0.9624	0.9598	3732	5	0.7549	0.9764	0.9674	2043	March 1972	0.9565	1689	-	-	0
12	Faleme	Moussala	0.9468	0.9503	2116	5	0.8331	0.9615	-	0	-	0.9458	1785	March 1989	0.9524	331
13	Faleme	Fadougou	0.9572	0.9612	4751	5	0.8288	0.9726	0.9634	993	March 1968	0.9567	1664	March 1989	0.9547	2094
14	Faleme	Gourbassy	0.9537	0.9462	8193	5	0.85	0.9716	0.9603	2161	March 1968	0.9482	2499	December 1994	0.9535	3533
15	Faleme	Kidira	0.9412	0.9111	6094	5	0.7565	0.9661	0.9457	1103	March 1968	0.9311	2049	December 1994	0.9466	2942
16	Bakoye	Toukoto	0.957	0.9623	5035	5	0.8673	0.97	0.9619	3494	March 1976	0.946	1541	-	-	0
17	Baoule	Siramakana	0.9022	0.8826	939	5	0.786	0.9291	0.927	319	March 1976	0.8894	620	-	-	0
18	Bakoye	Oualia	0.9444	0.9532	7927	5	0.8787	0.9586	0.9573	3833	March 1976	0.9188	1423	December 1994	0.9396	2671
19	Bakoye	Kalé	0.9589	0.9543	736	5	0.7845	0.9764	0.9589	736	-	-	0	-	-	0
20	Senegal	Galougo	0.9686	0.9598	7477	5	0.8675	0.9785	0.972	4460	March 1972	0.9636	3017	-	-	0
21	Senegal	Gouina	0.963	0.9611	5382	5	0.8409	0.9773	0.9682	3222	March 1972	0.9553	2160	-	-	0
22	Senegal	Kayes	0.9651	0.9601	5126	5	0.8081	0.9755	0.9678	3174	March 1972	0.9607	1952	-	-	0
23	Senegal	Bakel	0.9641	0.9582	7785	5	0.8461	0.9779	0.9695	4559	March 1971	0.9566	3226	-	-	0
24	Senegal	Matam	0.9697	0.9673	6410	4	0.7184	0.9877	0.9737	4203	March 1969	0.9621	2207	-	-	0
25	Senegal	Kaédi	0.9677	0.974	5076	4	0.7475	0.9896	0.9756	2955	March 1969	0.9567	2121	-	-	0
26	Sili	pont routier	0.9381	0.9447	1017	5	0.638	0.9579	0.9328	262	March 1979	0.937	477	November 1994	0.9448	278
27	Diarha	pont routier	0.9394	0.9105	1888	5	0.7367	0.9575	0.9418	571	March 1979	0.9377	721	March 1988	0.9391	596
28	Tiokoye	pont routier	0.9359	0.9175	1718	5	0.7178	0.9534	0.9394	722	March 1979	0.925	510	November 1989	0.9421	486

station			global period						period 1		period 2			period 3		
rank	**river**	**name**	K_m	K_0	N	R_a	min($g(Q)$)	max($g(Q)$)	K_m	N	**first date**	K_m	N	**first date**	K_m	N
29	Diaguery	pont routier	0.9213	0.9182	1388	5	0.8156	0.9425	0.9259	400	March 1979	0.9103	621	December 1994	0.9351	367
30	Niokolokoba	pont routier	0.8845	0.8844	893	5	0.8218	0.9095	0.9072	462	March 1980	0.8297	217	December 1994	0.8909	214
31	Koulountou	Gué du PNNK	0.9528	0.9415	744	5	0.8591	0.9684	0.9628	408	March 1977	0.9456	271	March 1988	-	65
32	Koulountou	Missira Gonasse	0.9607	0.9503	3430	5	0.929	0.9756	0.9649	1425	November 1979	0.9566	1128	March 1988	0.9593	877
33	Gambia	Kedougou	0.9557	0.966	5351	5	0.8205	0.9776	0.9572	1586	March 1979	0.9549	2361	December 1994	0.9551	1404
34	Gambia	Mako	0.956	0.9534	4438	5	0.8244	0.9749	0.9497	1062	March 1979	0.9574	2325	December 1994	0.9593	1051
35	Gambia	Simenti	0.9549	0.9408	4231	5	0.9024	0.9718	0.958	1187	March 1977	0.9508	2068	December 1994	0.9595	976
36	Gambia	Wassadou amont	0.9588	0.9399	4808	5	0.8686	0.9743	0.9634	1242	March 1977	0.9576	1904	March 1989	0.9566	1662
37	Gambia	Wassadou aval	0.9578	0.9456	3931	5	0.9177	0.9753	0.9647	503	March 1977	0.958	1931	March 1989	0.9551	1497
38	Sankarani	Selingue	0.9699	0.9663	2523	5	0.9559	0.9767	0.9717	1070	October 1970	0.9685	1453	-	-	0
39	Niger	Banankoro	0.9685	0.9673	4944	3	0.965	0.977	0.9706	1356	March 1983	0.9661	1994	December 1994	0.9697	1594
40	Niger	Koulikouro	0.9711	0.9703	5359	4	0.9382	0.9803	0.973	3464	March 1969	0.9677	1895	-	-	0
41	Niger	Ke Macina	0.9623	0.9744	3667	3	0.8944	0.9986	0.9619	1989	March 1968	0.9629	1678	-	-	0
42	Degou	Manankoro	0.9561	0.9555	2699	4	0.9361	0.9686	-	0	-	0.9537	862	March 1990	0.9572	1837
43	Banifing	Kolondieba	0.9246	0.9407	1447	4	0.8721	0.9589	0.9436	370	March 1977	0.9074	433	December 1994	0.9253	644
44	Baoulé	Madina Diassa	0.9607	0.9613	4511	3	0.9379	0.9783	0.9644	1552	March 1981	0.9572	893	March 1990	0.9595	2066
45	Baoulé	Dioila	0.9552	0.9701	8199	4	0.7287	0.9782	0.9642	2922	October 1970	0.9512	3078	March 1990	0.9486	2199
46	Bani	Douna	0.9682	0.9699	10440	4	0.9092	0.9801	0.9763	3491	October 1970	0.9674	4119	March 1990	0.9595	2830
47	Bani	Beneny Kegny	0.9688	0.9716	6828	4	0.9266	0.9855	0.976	2695	March 1971	0.962	1368	March 1989	0.9651	2765
48	Bani	Sofara	0.972	0.9777	9995	4	0.8496	0.9923	0.9782	3731	November 1973	0.9675	3498	March 1991	0.9694	2766
49	Niger	Mopti	0.9729	0.9794	4654	3	0.838	0.9946	0.9761	2879	March 1968	0.9678	1775	-	-	0
50	Niger	Akka	0.9751	0.9842	2418	5	0.7852	0.9933	0.976	1514	October 1970	0.9736	904	-	-	0
51	Niger	Diré	0.9724	0.9826	5136	3	0.9504	0.9961	0.9738	3327	October 1970	0.9698	1809	-	-	0
52	Niger	Koryoumé	0.9798	0.9816	605	5	0.934	0.9932	0.9876	234	October 1970	0.9749	371	-	-	0
53	Niger	Tossaye	0.9743	0.98	3364	4	0.9535	0.996	0.9776	1844	October 1970	0.9703	1520	-	-	0
54	Niger	Ansongo	0.9737	0.9835	2732	4	0.8609	0.9962	0.9797	1975	October 1970	0.9579	757	-	-	0

Explanation: mean value K_m, optimum value K_0 and number N of the observed values of K; rank R_a of classification of model 0 among the 5 models tested (equal to 1 for maximum C_{NSE0} and 5 for minimum C_{NSE0}, with C_{NSE0}=0 for model 0); minimum and maximum values of K as a function of flow (model 2: $K = g(Q)$)

Warning: the average values K_m over the successive periods 1, 2 and 3 are indicated only for N numbers greater than 100

Table S2. results concerning the calibration of model 1.

rank	river	station	period	N	A_0	A_1	A_2	A_3	A_4	A_5	A_6	D_{min}	D_{max}	C_{NSE0}	R_a
1	Bafing	Pont km17	1967−1984	200	8.1475×10^{-1}	2.9455×10^{-3}	-1.5719×10^{-5}	1.9017×10^{-8}	-	-	-	4	178	0.391	4
2	Samenta	Doureko	1969−1991	3393	8.9724×10^{-1}	1.7464×10^{-3}	-1.0123×10^{-5}	1.6296×10^{-8}	-	-	-	2	256	0.351	1
3	Kioma	Teliko	1969−1991	3274	8.9495×10^{-1}	1.8017×10^{-3}	-1.0299×10^{-5}	1.6531×10^{-8}	-	-	-	2	256	0.339	3
4	Kioma	Salouma	1969−2007	2988	9.2459×10^{-1}	1.1163×10^{-3}	-6.4797×10^{-6}	1.0049×10^{-8}	-	-	-	2	256	0.189	1
5	Téné	Bebele	1970−2007	1082	9.3600×10^{-1}	3.8118×10^{-4}	2.1752×10^{-6}	-1.7602×10^{-8}	-	-	-	2	254	0.243	2
6	Bafing	Balabori	1969−2009	1698	9.3879×10^{-1}	5.9370×10^{-4}	-2.4703×10^{-6}	2.3052×10^{-9}	-	-	-	2	256	0.209	3
7	Bafing	Boureya	1969−2010	505	9.2683×10^{-1}	1.2701×10^{-3}	-9.2884×10^{-6}	1.7397×10^{-8}	-	-	-	2	256	0.249	1
8	Bafing	Daka Saidou	1952−2016	10966	9.3222×10^{-1}	6.5578×10^{-4}	-1.8962×10^{-6}	-1.7494×10^{-9}	-	-	-	2	256	0.347	2
9	Bafing	Makana	1961−2016	7792	9.3065×10^{-1}	1.0046×10^{-3}	-5.3242×10^{-6}	4.5920×10^{-9}	-	-	-	2	256	0.238	3
10	Bafing	Soukoutali	1967−1983	2206	9.4787×10^{-1}	4.4779×10^{-4}	-1.7588×10^{-6}	-5.5379×10^{-10}	-	-	-	2	256	0.182	3
11	Bafing	Dibia	1956−1986	3732	9.4566×10^{-1}	1.6075×10^{-4}	3.3155×10^{-6}	-2.0131×10^{-8}	-	-	-	2	256	0.287	3
12	Faleme	Moussala	1972−1992	2116	8.8173×10^{-1}	2.1651×10^{-3}	-1.7985×10^{-5}	4.0051×10^{-8}	-	-	-	2	193	0.208	2
13	Faleme	Fadougou	1952−2016	4751	8.8605×10^{-1}	2.0842×10^{-3}	-1.4633×10^{-5}	2.6744×10^{-8}	-	-	-	2	256	0.308	2
14	Faleme	Gourbassy	1954−2016	8193	8.8448×10^{-1}	1.8199×10^{-3}	-1.0962×10^{-5}	1.5277×10^{-8}	-	-	-	2	256	0.359	3
15	Faleme	Kidira	1951−2016	6094	8.7560×10^{-1}	2.2949×10^{-3}	-1.7781×10^{-5}	3.2131×10^{-8}	-	-	-	2	224	0.225	3
16	Bakoye	Toukoto	1950−1992	5035	9.4755×10^{-1}	2.1914×10^{-4}	1.4863×10^{-7}	-6.2951×10^{-9}	-	-	-	2	256	0.078	3
17	Baoule	Siramakana	1972−1992	939	8.4278×10^{-1}	2.5220×10^{-3}	-3.0572×10^{-5}	1.2935×10^{-7}	-	-	-	2	125	0.091	3
18	Bakoye	Oualia	1954−2016	7927	9.1775×10^{-1}	1.0836×10^{-3}	-1.5985×10^{-5}	1.1120×10^{-7}	-2.7954×10^{-10}	-	-	2	256	0.11	2
19	Bakoye	Kalé	1951−1960	736	9.1675×10^{-1}	4.9227×10^{-4}	3.8274×10^{-6}	-2.8372×10^{-8}	-	-	-	2	256	0.636	1
20	Senegal	Galougo	1951−1986	7477	9.3453×10^{-1}	6.8480×10^{-4}	-2.9467×10^{-6}	2.0760×10^{-9}	-	-	-	2	256	0.242	3
21	Senegal	Gouina	1955−1986	5382	9.2965×10^{-1}	9.9987×10^{-4}	-5.8461×10^{-6}	7.0744×10^{-9}	-	-	-	2	256	0.33	3
22	Senegal	Kayes	1950−1986	5126	9.4725×10^{-1}	1.9088×10^{-4}	2.2656×10^{-6}	-1.4527×10^{-8}	-	-	-	2	256	0.332	2
23	Senegal	Bakel	1950−1986	7785	9.4780×10^{-1}	-4.6486×10^{-5}	3.4760×10^{-6}	9.3367×10^{-8}	-1.5317×10^{-9}	7.0538×10^{-12}	-1.0548×10^{-14}	2	256	0.182	3
24	Senegal	Matam	1950−1986	6410	9.7969×10^{-1}	-7.3367×10^{-4}	1.3289×10^{-7}	2.8413×10^{-7}	-3.4739×10^{-9}	1.5267×10^{-11}	-2.2977×10^{-14}	2	256	0.044	3
25	Senegal	Kaédi	1950−1986	5076	9.7521×10^{-1}	1.2956×10^{-3}	-7.6536×10^{-5}	1.3718×10^{-6}	-1.0538×10^{-8}	3.6275×10^{-11}	-4.6065×10^{-14}	2	256	0.132	3
26	Sili	pont routier	1974−2001	1017	8.2327×10^{-1}	4.5735×10^{-3}	-5.2505×10^{-5}	2.0077×10^{-7}	-	-	-	2	124	0.285	3
27	Diarha	pont routier	1972−2003	1888	8.2300×10^{-1}	3.5639×10^{-3}	-3.0395×10^{-5}	8.1644×10^{-8}	-	-	-	2	154	0.413	3
28	Tiokoye	pont routier	1971−2003	1718	8.2772×10^{-1}	3.2789×10^{-3}	-2.6846×10^{-5}	6.6896×10^{-8}	-	-	-	2	158	0.297	3
29	Diaguery	pont routier	1974−2002	1388	8.5626×10^{-1}	1.1155×10^{-3}	1.0363×10^{-5}	-1.3037×10^{-7}	-	-	-	2	134	0.236	3
30	Niokolokoba	pont routier	1971−2002	893	8.2428×10^{-1}	7.6579×10^{-4}	1.8472×10^{-5}	-1.3850×10^{-7}	-	-	-	2	140	0.208	1

rank	river	station	period	N	A_0	A_1	A_2	A_3	A_4	A_5	A_6	D_{min}	D_{max}	C_{NSE0}	R_a
31	Koulountou	Gué du PNNK	1974−2001	744	8.8389×10^{-1}	1.1168×10^{-3}	-1.6138×10^{-6}	-1.5491×10^{-8}	-	-	-	7	207	0.211	4
32	Koulountou	Missira Gonasse	1970−2000	3430	9.6008×10^{-1}	-2.1177×10^{-3}	7.4893×10^{-5}	-9.0403×10^{-7}	4.5622×10^{-9}	-8.2004×10^{-12}	-	2	213	0.177	2
33	Gambia	Kedougou	1970−2003	5351	8.6976×10^{-1}	2.3896×10^{-3}	-1.5130×10^{-5}	2.2257×10^{-8}	-	-	-	2	256	0.449	2
34	Gambia	Mako	1970−2003	4438	8.8979×10^{-1}	1.6535×10^{-3}	-8.0339×10^{-6}	2.6421×10^{-9}	-	-	-	2	256	0.449	2
35	Gambia	Simenti	1970−2003	4231	9.1044×10^{-1}	1.1946×10^{-4}	2.7533×10^{-5}	-3.6534×10^{-7}	1.6935×10^{-9}	-2.7706×10^{-12}	-	2	256	0.305	2
36	Gambia	Wassadou amont	1970−2003	4808	9.3353×10^{-1}	-3.4953×10^{-4}	1.1647×10^{-5}	1.4160×10^{-7}	-3.2006×10^{-9}	1.6803×10^{-11}	-2.7654×10^{-14}	2	256	0.25	3
37	Gambia	Wassadou aval	1974−2003	3931	9.4139×10^{-1}	-1.5863×10^{-3}	5.2192×10^{-5}	-4.2244×10^{-7}	6.2306×10^{-10}	4.3287×10^{-12}	-1.1948×10^{-14}	2	256	0.295	2
38	Sankarani	Selingue	1964−1980	2523	9.9428×10^{-1}	-1.5441×10^{-3}	2.5447×10^{-5}	-1.4601×10^{-7}	2.6466×10^{-10}	-	-	2	256	0.2	1
39	Niger	Banankoro	1967−2006	4944	9.8214×10^{-1}	-4.4530×10^{-4}	3.6555×10^{-6}	-8.5684×10^{-9}	-	-	-	2	256	0.035	2
40	Niger	Koulikouro	1950−1980	5359	9.9691×10^{-1}	-1.2649×10^{-3}	1.8204×10^{-5}	-9.7438×10^{-8}	1.7090×10^{-10}	-	-	2	256	0.094	2
41	Niger	Ke Macina	1953−1980	3667	9.9667×10^{-1}	-1.0443×10^{-3}	1.3272×10^{-5}	-7.4304×10^{-8}	1.4156×10^{-10}	-	-	2	256	0.06	2
42	Degou	Manankoro	1982−2005	2699	9.7833×10^{-1}	-1.8614×10^{-3}	3.3570×10^{-5}	-2.0804×10^{-7}	4.1648×10^{-10}	-	-	2	210	0.087	1
43	Banifing	Kolondieba	1972−2003	1447	9.7717×10^{-1}	-2.4461×10^{-3}	3.3338×10^{-5}	-1.5446×10^{-7}	-	-	-	2	146	0.121	2
44	Baoulé	Madina Diassa	1971−2006	4511	9.9437×10^{-1}	-1.9044×10^{-3}	2.8208×10^{-5}	-1.5173×10^{-7}	2.6728×10^{-10}	-	-	2	256	0.059	2
45	Baoulé	Dioila	1953−2007	8199	9.8471×10^{-1}	-6.4986×10^{-4}	7.7486×10^{-6}	-4.6258×10^{-8}	7.4414×10^{-11}	-	-	2	256	0.165	3
46	Bani	Douna	1950−2004	10440	9.8502×10^{-1}	-4.5506×10^{-4}	3.6862×10^{-6}	-9.3999×10^{-9}	-	-	-	2	256	0.034	3
47	Bani	Beneny Kegny	1951−2003	6828	9.9139×10^{-1}	-7.2965×10^{-4}	6.6571×10^{-6}	-1.7951×10^{-8}	-	-	-	2	256	0.08	2
48	Bani	Sofara	1952−2004	9995	9.9466×10^{-1}	-4.9472×10^{-4}	3.3648×10^{-6}	-7.5199×10^{-9}	-	-	-	2	256	0.049	2
49	Niger	Mopti	1950−1980	4654	9.8423×10^{-1}	6.6459×10^{-4}	-1.5575×10^{-5}	9.7870×10^{-8}	-1.9142×10^{-10}	-	-	2	256	0.157	2
50	Niger	Akka	1955−1980	2418	9.9917×10^{-1}	-3.1097×10^{-5}	-7.8847×10^{-7}	-	-	-	-	38	286	0.425	2
51	Niger	Diré	1950−1980	5136	9.3797×10^{-1}	1.4510×10^{-3}	-1.1229×10^{-5}	2.2903×10^{-8}	-	-	-	63	296	0.376	2
52	Niger	Koryoumé	1963−1978	605	9.6905×10^{-1}	6.0857×10^{-4}	-3.8528×10^{-6}	2.6936×10^{-9}	-	-	-	63	244	0.769	2
53	Niger	Tossaye	1955−1980	3364	9.5460×10^{-1}	1.0311×10^{-3}	-7.8013×10^{-6}	1.5012×10^{-8}	-	-	-	63	310	0.455	2
54	Niger	Ansongo	1952−1979	2732	9.6301×10^{-1}	5.5966×10^{-5}	7.3273×10^{-6}	-6.0323×10^{-8}	1.1759×10^{-10}	-	-	85	307	0.315	2

Explanation : parameters A_0 to A_6, period, number N and C_{NSE0} of calibration of the relationship $K=f(D)$ expressing the daily depletion factor K as a function of time D (day) elapsed since the previous 15 September, with the minimum values D_{min} and maximum values D_{max} of the time D used in calibration and the ranking R_a of model 1 among the 5 models tested (equal to 1 for maximum C_{NSE0} and 5 for minimum C_{NSE0})

The relationship $K=f(D)$ is expressed as follows, with $D_{min} \le D \le D_{max}$:

$$K = f(D) = \sum_{i=0}^{i=6} \left(A_i D^i\right) \qquad \text{(S22)}$$

Table S3. results concerning the calibration of model 2.

rank	river	station	period	N	B_0	B_1	B_2	B_3	B_4	B_5	B_6	Q_{min}	Q_{max}	Q_{lim}	C_{NSE0}	R_a
1	Bafing	Pont km17	1967−1984	200	8.9108×10^{-1}	-1.5789×10^{-1}	-3.8582×10^{-2}	3.1781×10^{-2}	-	-	-	0.1	2.9	-	0.397	2
2	Samenta	Doureko	1969−1991	3393	9.7974×10^{-1}	-2.5752×10^{-2}	-3.9283×10^{-2}	5.9379×10^{-3}	-	-	-	0.1	23.3	-	0.249	3
3	Kioma	Teliko	1969−1991	3274	9.8584×10^{-1}	2.5507×10^{-2}	-7.3730×10^{-2}	-5.9265×10^{-3}	-	-	-	0.1	38	-	0.436	1
4	Kioma	Salouma	1969−2007	2988	9.7750×10^{-1}	1.2132×10^{-2}	-1.7201×10^{-2}	-5.6439×10^{-3}	-	-	-	0.2	93	-	0.187	2
5	Téné	Bebele	1970−2007	1082	9.5645×10^{-1}	4.4939×10^{-2}	-2.7571×10^{-2}	1.9707×10^{-3}	-	-	-	0.2	288.5	-	0.127	3
6	Bafing	Balabori	1969−2009	1698	9.8763×10^{-1}	-2.6096×10^{-2}	2.4167×10^{-2}	-7.7193×10^{-3}	-	-	-	2.6	829	-	0.221	1
7	Bafing	Boureya	1969−2010	505	9.3726×10^{-1}	1.5229×10^{-2}	1.5894×10^{-2}	-7.0646×10^{-3}	-	-	-	0.7	1308.5	-	0.209	2
8	Bafing	Daka Saidou	1952−2016	10966	9.3929×10^{-1}	5.9734×10^{-2}	-2.2575×10^{-2}	5.5763×10^{-4}	-	-	-	0.2	1859.5	-	0.392	1
9	Bafing	Makana	1961−2016	7792	8.4501×10^{-1}	1.8366×10^{-1}	-7.3779×10^{-2}	7.7301×10^{-3}	-	-	-	0.4	1858	-	0.555	1
10	Bafing	Soukoutali	1967−1983	2206	9.0996×10^{-1}	1.0298×10^{-1}	-4.8155×10^{-2}	6.1841×10^{-3}	-	-	-	0.2	1693	-	0.451	2
11	Bafing	Dibia	1956−1986	3732	8.9898×10^{-1}	1.0586×10^{-1}	-4.2694×10^{-2}	4.2312×10^{-3}	-	-	-	0.1	2855.5	-	0.492	1
12	Faleme	Moussala	1972−1992	2116	9.4967×10^{-1}	2.8214×10^{-2}	-9.9274×10^{-3}	-9.0090×10^{-3}	-	-	-	0.1	259.7	-	0.262	1
13	Faleme	Fadougou	1952−2016	4751	9.3863×10^{-1}	5.0443×10^{-2}	-1.0667×10^{-2}	-6.5334×10^{-3}	-	-	-	0.1	870.3	-	0.356	1
14	Faleme	Gourbassy	1954−2016	8193	9.3974×10^{-1}	6.5766×10^{-2}	-3.4951×10^{-2}	1.6175×10^{-3}	-	-	-	0.1	1392	-	0.523	1
15	Faleme	Kidira	1951−2016	6094	9.0044×10^{-1}	1.1249×10^{-1}	-5.2703×10^{-2}	4.1821×10^{-3}	-	-	-	0.1	2478.5	-	0.524	1
16	Bakoye	Toukoto	1950−1992	5035	9.3490×10^{-1}	5.4380×10^{-2}	-2.3245×10^{-2}	1.6503×10^{-3}	-	-	-	0.1	802.7	-	0.277	1
17	Baoule	Siramakana	1972−1992	939	9.2644×10^{-1}	3.2471×10^{-2}	-9.6211×10^{-2}	3.1562×10^{-2}	-	-	-	0.1	248.7	-	0.257	1
18	Bakoye	Oualia	1954−2016	7927	9.3063×10^{-1}	3.9653×10^{-2}	-1.4185×10^{-2}	1.1274×10^{-4}	-	-	-	0.1	1222.5	-	0.183	1
19	Bakoye	Kalé	1951−1960	736	9.1270×10^{-1}	1.1009×10^{-1}	-5.4461×10^{-2}	5.7475×10^{-3}	-	-	-	0.2	955.5	-	0.618	2
20	Senegal	Galougo	1951−1986	7477	9.3378×10^{-1}	6.2449×10^{-2}	-2.4661×10^{-2}	1.9491×10^{-3}	-	-	-	0.2	4167.5	-	0.485	1
21	Senegal	Gouina	1955−1986	5382	9.1557×10^{-1}	6.7680×10^{-2}	-1.9297×10^{-2}	4.0472×10^{-4}	-	-	-	0.1	4328	-	0.698	1
22	Senegal	Kayes	1950−1986	5126	8.7907×10^{-1}	1.1772×10^{-1}	-4.2907×10^{-2}	4.0394×10^{-3}	-	-	-	0.3	4253.5	-	0.419	1
23	Senegal	Bakel	1950−1986	7785	9.2688×10^{-1}	4.5046×10^{-2}	-3.7446×10^{-2}	4.3794×10^{-2}	-2.3484×10^{-2}	4.9421×10^{-3}	-3.4428×10^{-4}	0.2	7042.5	-	0.369	1
24	Senegal	Matam	1950−1986	6410	7.9256×10^{-1}	2.8616×10^{-1}	3.2389×10^{-2}	-2.9777×10^{-1}	2.1143×10^{-1}	-5.9700×10^{-2}	6.0863×10^{-3}	0.3	3906.5	3300	0.499	1
25	Senegal	Kaédi	1950−1986	5076	9.0493×10^{-1}	1.0853×10^{-1}	-9.2894×10^{-2}	6.1553×10^{-2}	-2.3099×10^{-2}	3.2145×10^{-3}	-	0.2	2752.5	2350	0.559	1
26	Sili	pont routier	1974−2001	1017	9.2931×10^{-1}	-9.6844×10^{-2}	-1.3438×10^{-1}	-6.6941×10^{-2}	-	-	-	0.1	9.7	-	0.418	1
27	Diarha	pont routier	1972−2003	1888	9.5706×10^{-1}	-8.8039×10^{-3}	-3.6832×10^{-2}	-1.1223×10^{-2}	-	-	-	0.1	75.2	-	0.523	1
28	Tiokoye	pont routier	1971−2003	1718	9.5308×10^{-1}	6.9042×10^{-3}	-2.9462×10^{-2}	-1.8499×10^{-2}	-	-	-	0.1	88.8	-	0.416	1
29	Diaguery	pont routier	1974−2002	1388	9.4214×10^{-1}	9.3960×10^{-3}	-5.7626×10^{-2}	8.3126×10^{-3}	-	-	-	0.1	69.9	-	0.252	1
30	Niokolokoba	pont routier	1971−2002	893	9.0649×10^{-1}	-3.2093×10^{-2}	-7.4691×10^{-2}	4.4231×10^{-2}	-	-	-	0.1	101.3	-	0.097	3
31	Koulountou	Gué du PNNK	1974−2001	744	9.5718×10^{-1}	4.6198×10^{-2}	-5.1069×10^{-2}	7.7487×10^{-3}	-	-	-	0.1	180.3	-	0.315	1
32	Koulountou	Missira Gonasse	1970−2000	3430	9.6672×10^{-1}	-3.5807×10^{-3}	-6.6400×10^{-2}	1.7822×10^{-1}	-1.3753×10^{-1}	3.1557×10^{-2}	-	0.4	294.2	230	0.259	1

rank	river	station	period	N	B_0	B_1	B_2	B_3	B_4	B_5	B_6	Q_{min}	Q_{max}	Q_{lim}	C_{NSE0}	R_a
33	Gambia	Kedougou	1970−2003	5351	9.2964×10^{-1}	6.5746×10^{-2}	-8.2589×10^{-3}	-1.1003×10^{-2}	-	-	-	0.1	554.7	-	0.576	1
34	Gambia	Mako	1970−2003	4438	9.3514×10^{-1}	5.1585×10^{-2}	-4.1872×10^{-3}	-9.3149×10^{-3}	-	-	-	0.1	776.3	-	0.47	1
35	Gambia	Simenti	1970−2003	4231	9.4330×10^{-1}	5.7526×10^{-2}	-3.2247×10^{-2}	-2.2546×10^{-2}	4.3951×10^{-2}	-2.3208×10^{-2}	3.8155×10^{-3}	0.1	1289.5	-	0.384	1
36	Gambia	Wassadou amont	1970−2003	4808	9.5067×10^{-1}	2.6148×10^{-2}	-2.1234×10^{-2}	3.7344×10^{-2}	-2.4354×10^{-2}	2.7876×10^{-3}	5.5008×10^{-4}	0.1	1194.5	-	0.346	1
37	Gambia	Wassadou aval	1974−2003	3931	9.4346×10^{-1}	1.8031×10^{-2}	3.3096×10^{-2}	-1.2843×10^{-2}	-1.2323×10^{-2}	4.1463×10^{-3}	-	0.1	1119.5	-	0.376	1
38	Sankarani	Selingue	1964−1980	2523	1.0725	-1.6114×10^{-1}	-1.7888×10^{-1}	4.2588×10^{-1}	-2.6573×10^{-1}	6.8570×10^{-2}	-6.3748×10^{-3}	7.2	1826	1150	0.123	2
39	Niger	Banankoro	1967−2006	4944	9.6064×10^{-1}	3.5006×10^{-2}	-4.7201×10^{-2}	2.6450×10^{-2}	-5.1494×10^{-3}	-4.8755×10^{-4}	2.0022×10^{-4}	1.4	4715	3000	0.043	1
40	Niger	Koulikouro	1950−1980	5359	3.8739×10^{-1}	1.3551	-1.2573	5.7185×10^{-1}	-1.2626×10^{-1}	1.0788×10^{-2}	-	9.3	8958.5	6000	0.102	1
41	Niger	Ke Macina	1953−1980	3667	8.9357×10^{-1}	-1.5951×10^{-1}	7.3015×10^{-1}	-8.3766×10^{-1}	4.1920×10^{-1}	-9.6591×10^{-2}	8.3905×10^{-3}	1	5969	-	0.112	1
42	Degou	Manankoro	1982−2005	2699	9.5776×10^{-1}	-3.5958×10^{-2}	-8.0423×10^{-3}	7.9002×10^{-2}	-1.8496×10^{-2}	-3.3813×10^{-2}	1.3841×10^{-2}	0.1	69.3	-	0.078	2
43	Banifing	Kolondieba	1972−2003	1447	9.0753×10^{-1}	3.1065×10^{-2}	-3.9803×10^{-3}	6.5565×10^{-4}	-	-	-	0.1	99.3	-	0.211	1
44	Baoulé	Madina Diassa	1971−2006	4511	9.6541×10^{-1}	3.4165×10^{-3}	-1.2559×10^{-2}	6.0958×10^{-3}	-4.8276×10^{-3}	1.8731×10^{-3}	-	0.1	422.8	275	0.07	1
45	Baoulé	Dioila	1953−2007	8199	8.5520×10^{-1}	1.5847×10^{-1}	-3.3851×10^{-2}	-3.9630×10^{-2}	2.0601×10^{-2}	-2.6271×10^{-3}	-	0.1	1268.5	650	0.534	1
46	Bani	Douna	1950−2004	10440	9.3506×10^{-1}	4.6791×10^{-2}	-6.2968×10^{-4}	-1.6681×10^{-2}	6.0482×10^{-3}	-5.6484×10^{-4}	-	0.1	3547	2100	0.292	1
47	Bani	Beneny Kegny	1951−2003	6828	9.3743×10^{-1}	2.9297×10^{-2}	1.5104×10^{-2}	-1.1002×10^{-2}	-4.2316×10^{-3}	2.9502×10^{-3}	-3.6519×10^{-4}	0.1	2802	2100	0.302	1
48	Bani	Sofara	1952−2004	9995	9.5549×10^{-1}	-7.2643×10^{-3}	-7.9272×10^{-3}	8.9688×10^{-2}	-8.5897×10^{-2}	2.9026×10^{-2}	-3.2838×10^{-3}	0.1	1576.5	1300	0.259	1
49	Niger	Mopti	1950−1980	4654	7.2895×10^{-1}	5.9275×10^{-1}	-5.8875×10^{-1}	2.8915×10^{-1}	-6.9833×10^{-2}	6.6302×10^{-3}	-	1.7	3784.5	3400	0.25	1
50	Niger	Akka	1955−1980	2418	8.3606×10^{-1}	1.0015×10^{-1}	-1.9734×10^{-2}	-8.3357×10^{-3}	4.6441×10^{-3}	-5.5530×10^{-4}	-	0.3	4310.5	3300	0.702	1
51	Niger	Diré	1950−1980	5136	8.9171×10^{-1}	2.6820×10^{-1}	-3.2057×10^{-1}	1.5985×10^{-1}	-3.5790×10^{-2}	3.0832×10^{-3}	-	2.7	2583.5	2300	0.509	1
52	Niger	Koryoumé	1963−1978	605	1.7927	-2.1028	1.9872	-9.0987×10^{-1}	2.0320×10^{-1}	-1.7638×10^{-2}	-	32.7	2656.5	2150	0.829	1
53	Niger	Tossaye	1955−1980	3364	9.3682×10^{-1}	6.1590×10^{-2}	-4.4686×10^{-2}	9.4841×10^{-3}	-	-	-	2.3	2376.5	2100	0.676	1
54	Niger	Ansongo	1952−1979	2732	9.0969×10^{-1}	6.4170×10^{-2}	-1.5309×10^{-2}	-8.4676×10^{-3}	2.9055×10^{-3}	-	-	0.2	2310.5	2050	0.524	1

Explanation: parameters B_0 to B_6, period, number N and C_{NSE0} of calibration of the relationship $K=g(Q)$ expressing the daily depletion factor K as a function of the discharge Q ($m^3 \cdot s^{-1}$), with the minimum values Q_{min} and maximum values Q_{max} of discharge used as calibration, the maximum discharge Q_{lim} limit for the use of function g and the rank R_a of classification of model 2 among the 5 models tested (equal to 1 for maximum C_{NSE0} and 5 for minimum C_{NSE0})

By noting log the decimal logarithm, the relationship $K=g(Q)$ is expressed as follows with $Q_{min} \leq Q \leq \min(Q_{max},Q_{lim})$:

$$K = g(Q) = \sum_{i=0}^{i=6} (B_i (\log Q)^i) \qquad \text{(S22)}$$

Table S4. results concerning the calibration of models 3 and 4.

						model $K = f_b(D)$					model $K = g_b(Q)$				
rank	**river**	**station**	**period**	N	Q_0	w	σ	n	C_{NSE0}	R_a	w	σ	n	C_{NSE0}	R_a
1	Bafing	Pont km17	1967-1984	200	2.9490	5.9871×10^{-5}	5.8020×10^{-2}	4.9765	0.401	1	4.0395×10^{-2}	1.3156×10^{-1}	1.6865	0.395	3
2	Samenta	Doureko	1969-1991	3393	2.3305×10	-1.5294×10^{-1}	1.1186×10^{-1}	1.4664	0.315	2	-2.4482×10^{-1}	9.6066×10^{-2}	1.4476	0.232	4
3	Kioma	Teliko	1969-1991	3274	3.7995×10	-9.8150×10^{-2}	7.9825×10^{-2}	1.9003	0.270	4	-1.8849	3.4853×10^{-1}	0.7236	0.368	2
4	Kioma	Salouma	1969-2007	2988	9.3045×10	-2.0290×10^{-1}	3.3344×10^{-2}	2.6548	0.156	4	-8.6758×10^{-1}	6.8633×10^{-2}	1.6811	0.183	3
5	Téné	Bebele	1970-2007	1082	2.8850×10^{2}	-2.3094×10^{-1}	1.8742×10^{-2}	4.0427	0.245	1	-1.7040	2.3645×10^{-2}	2.9131	0.116	4
6	Bafing	Balabori	1969-2009	1698	8.2900×10^{2}	-2.2562	3.2258×10^{-2}	2.5573	0.182	4	-4.3483	2.7128×10^{-2}	2.5583	0.212	2
7	Bafing	Boureya	1969-2010	505	1.3085×10^{3}	-2.1618×10^{-1}	5.1392×10^{-3}	10.0000	0.012	4	-2.3681	6.8574×10^{-3}	7.1017	0.093	3
8	Bafing	Daka Saidou	1952-2016	10966	1.8595×10^{3}	-2.0523	2.2643×10^{-2}	3.4650	0.296	4	-5.0958	3.3166×10^{-2}	2.5918	0.335	3
9	Bafing	Makana	1961-2016	7792	1.8580×10^{3}	-1.3557	6.2035×10^{-3}	7.4376	0.074	4	-2.1145×10	4.1882×10^{-2}	1.9489	0.523	2
10	Bafing	Soukoutali	1967-1983	2206	1.6930×10^{3}	-9.7573×10^{-1}	5.6924×10^{-3}	8.0301	0.108	4	-5.1803	1.2543×10^{-2}	4.2647	0.496	1
11	Bafing	Dibia	1956-1986	3732	2.8555×10^{3}	-7.4621×10^{-1}	4.9348×10^{-3}	10.0000	0.159	4	-2.8887	8.5921×10^{-3}	6.3268	0.389	2
12	Faleme	Moussala	1972-1992	2116	2.5970×10^{2}	-2.0094×10^{-2}	1.6709×10^{-2}	6.4585	0.116	4	-6.0381×10^{-1}	4.5699×10^{-2}	2.9622	0.195	3
13	Faleme	Fadougou	1952-2016	4751	8.7030×10^{2}	-1.2478×10^{-1}	2.7700×10^{-2}	4.2043	0.118	4	-1.6139	5.1151×10^{-2}	2.6037	0.240	3
14	Faleme	Gourbassy	1954-2016	8193	1.3920×10^{3}	-4.2018×10^{-2}	1.7970×10^{-2}	5.9884	0.143	4	-2.0639	5.8932×10^{-2}	2.6301	0.475	2
15	Faleme	Kidira	1951-2016	6094	2.4785×10^{3}	-2.4632×10^{-2}	9.5343×10^{-3}	10.0000	0.024	4	-2.6583	4.7693×10^{-2}	3.2300	0.411	2
16	Bakoye	Toukoto	1950-1992	5035	8.0270×10^{2}	-6.8012×10^{-2}	5.8878×10^{-3}	10.0000	0.007	4	-9.2971×10^{-1}	4.9066×10^{-3}	10.0000	0.227	2
17	Baoule	Siramakana	1972-1992	939	2.4865×10^{2}	-1.1543×10^{-3}	1.7597×10^{-2}	10.0000	0.081	4	-4.1534×10^{-1}	4.6393×10^{-2}	4.3308	0.200	2
18	Bakoye	Oualia	1954-2016	7927	1.2225×10^{3}	-7.6365×10^{-3}	8.9120×10^{-3}	10.0000	0.021	4	-4.5913×10^{-1}	7.0950×10^{-3}	10.0000	0.104	3
19	Bakoye	Kalé	1951-1960	736	9.5550×10^{2}	-1.1436×10^{-1}	1.7539×10^{-2}	5.2734	0.355	4	-4.2817	3.4295×10^{-2}	2.6751	0.528	3
20	Senegal	Galougo	1951-1986	7477	4.1675×10^{3}	-2.6995	1.4315×10^{-2}	4.6062	0.190	4	-2.8048	1.3906×10^{-2}	4.5445	0.396	2
21	Senegal	Gouina	1955-1986	5382	4.3280×10^{3}	-1.1576	4.8070×10^{-3}	10.0000	0.084	4	-1.6589	4.6074×10^{-3}	10.0000	0.493	2
22	Senegal	Kayes	1950-1986	5126	4.2535×10^{3}	-2.2244	8.6550×10^{-3}	6.3852	0.267	4	-6.7000	1.1827×10^{-2}	4.9400	0.319	3
23	Senegal	Bakel	1950-1986	7785	7.0425×10^{3}	-1.9061	6.5112×10^{-3}	8.1416	0.078	4	-1.7570	4.8006×10^{-3}	10.0000	0.243	2
24	Senegal	Matam	1950-1986	6410	3.9065×10^{3}	-9.4431×10^{-1}	4.1635×10^{-3}	10.0000	-0.001	5	-9.3975	5.6630×10^{-3}	6.9249	0.395	2
25	Senegal	Kaédi	1950-1986	5076	2.7525×10^{3}	-2.3076	3.7361×10^{-3}	10.0000	-0.048	5	-3.7222	3.4516×10^{-3}	10.0000	0.448	2
26	Sili	pont routier	1974-2001	1017	9.7240	-1.0746×10^{-3}	5.9475×10^{-2}	3.8421	0.280	4	-1.9228×10^{-1}	3.9894×10^{-1}	1.0956	0.414	2
27	Diarha	pont routier	1972-2003	1888	7.5245×10	-1.4965×10^{-3}	4.4098×10^{-2}	4.9561	0.390	4	-2.9871×10^{-1}	1.6105×10^{-1}	1.8589	0.511	2
28	Tiokoye	pont routier	1971-2003	1718	8.8815×10	-1.4096×10^{-3}	3.7080×10^{-2}	5.4762	0.278	4	-3.9295×10^{-1}	1.6167×10^{-1}	1.8477	0.390	2
29	Diaguery	pont routier	1974-2002	1388	6.9850×10	-1.3116×10^{-3}	2.4912×10^{-2}	7.2192	0.218	4	-4.6230×10^{-1}	9.1858×10^{-2}	2.3537	0.248	2
30	Niokolokoba	pont routier	1971-2002	893	1.0131×10^{2}	-1.1953×10^{-5}	2.3617×10^{-2}	10.0000	0.192	2	-1.2149×10^{-1}	3.9526×10^{-2}	5.5001	0.070	4
31	Koulountou	Gué du PNNK	1974-2001	744	1.8035×10^{2}	-4.7657×10^{-3}	3.7780×10^{-2}	4.7970	0.286	3	-1.2237	5.2343×10^{-2}	2.3380	0.304	2
32	Koulountou	Missira Gonasse	1970-2000	3430	2.9420×10^{2}	-2.8787×10^{-2}	7.6377×10^{-3}	8.3536	0.127	3	-4.9583×10^{-1}	1.3673×10^{-2}	5.0188	0.125	4

						model $K = f_b(D)$					model $K = g_b(Q)$				
rank	**river**	**station**	**period**	***N***	Q_0	W	σ	n	C_{NSE0}	R_a	W	σ	n	C_{NSE0}	R_a
33	Gambia	Kedougou	1970-2003	5351	5.5470×10^{2}	-2.2921×10^{-2}	1.1988×10^{-2}	7.1258	0.040	4	-2.5528	7.2686×10^{-2}	2.0061	0.390	3
34	Gambia	Mako	1970-2003	4438	7.7630×10^{2}	-4.3914×10^{-2}	1.6668×10^{-2}	5.8430	0.111	4	-1.3598	4.5357×10^{-2}	2.7538	0.244	3
35	Gambia	Simenti	1970-2003	4231	1.2895×10^{3}	-4.8351×10^{-2}	1.4018×10^{-2}	6.6250	0.097	4	-1.0662	3.0502×10^{-2}	3.5541	0.251	3
36	Gambia	Wassadou amont	1970-2003	4808	1.1945×10^{3}	-6.1146×10^{-2}	9.0177×10^{-3}	8.1188	0.066	4	-1.3420	2.4233×10^{-2}	3.8098	0.261	2
37	Gambia	Wassadou aval	1974-2003	3931	1.1195×10^{3}	-4.3768×10^{-2}	1.1008×10^{-2}	7.4104	0.098	4	-4.1198×10^{-1}	1.5869×10^{-2}	5.2114	0.135	3
38	Sankarani	Selingue	1964-1980	2523	1.8260×10^{3}	-1.7337	3.7155×10^{-3}	10.0000	0.056	4	-1.4213×101	3.8869×10^{-3}	8.5788	0.060	3
39	Niger	Banankoro	1967-2006	4944	4.7150×10^{3}	-1.9520	4.1493×10^{-3}	10.0000	-0.105	5	-2.8043	4.0608×10^{-3}	10.0000	-0.103	4
40	Niger	Koulikouro	1950-1980	5359	8.9585×10^{3}	-9.7717	3.5464×10^{-3}	10.0000	-0.034	5	-2.8938×10	3.3511×10^{-3}	10.0000	0.007	3
41	Niger	Ke Macina	1953-1980	3667	5.9690×10^{3}	-2.1509	4.4873×10^{-3}	10.0000	-0.070	5	-9.6789	4.2748×10^{-3}	10.0000	-0.040	4
42	Degou	Manankoro	1982-2005	2699	6.9300×10	-1.0049×10^{-2}	6.1987×10^{-3}	10.0000	0.008	3	-8.0759×10^{-2}	5.6926×10^{-3}	10.0000	-0.007	5
43	Banifing	Kolondieba	1972-2003	1447	9.9340×10	-1.4721×10^{-2}	9.5516×10^{-3}	10.0000	-0.132	5	-3.3972×10^{-1}	8.0804×10^{-3}	10.0000	0.039	3
44	Baoulé	Madina Diassa	1971-2006	4511	4.2285×10^{2}	-4.3475×10^{-2}	5.5186×10^{-3}	10.0000	-0.058	5	-1.7608×10^{-1}	5.2273×10^{-3}	10.0000	-0.012	4
45	Baoulé	Dioila	1953-2007	8199	1.2685×10^{3}	-2.7287×10^{-1}	5.0871×10^{-3}	10.0000	-0.047	5	-3.5907	4.3224×10^{-3}	10.0000	0.430	2
46	Bani	Douna	1950-2004	10440	3.5470×10^{3}	-2.5792	3.8824×10^{-3}	10.0000	-0.055	5	-1.0878	3.9555×10^{-3}	10.0000	0.095	2
47	Bani	Beneny Kegny	1951-2003	6828	2.8020×10^{3}	-2.3033	3.7995×10^{-3}	10.0000	-0.029	5	-1.0395	3.8101×10^{-3}	10.0000	0.061	3
48	Bani	Sofara	1952-2004	9995	1.5765×10^{3}	-2.1867	3.2918×10^{-3}	10.0000	-0.044	5	-1.2638	3.2698×10^{-3}	10.0000	0.022	3
49	Niger	Mopti	1950-1980	4654	3.7845×10^{3}	-9.1493	3.0131×10^{-3}	10.0000	-0.030	5	-1.9592×10	2.8538×10^{-3}	10.0000	-0.030	4
50	Niger	Akka	1955-1980	2418	4.3105×10^{3}	-1.8423×10	2.4766×10^{-3}	10.0000	0.148	3	-8.6567	2.5802×10^{-3}	10.0000	0.097	4
51	Niger	Diré	1950-1980	5136	2.5835×10^{3}	-3.7629	3.0054×10^{-3}	10.0000	-0.009	4	-1.5374×10	2.6986×10^{-3}	10.0000	-0.108	5
52	Niger	Koryoumé	1963-1978	605	2.6565×10^{3}	-1.8584×10^{2}	1.2384×10^{-3}	10.0000	0.474	3	-3.2265×10^{2}	1.3448×10^{-3}	10.0000	0.473	4
53	Niger	Tossaye	1955-1980	3364	2.3765×10^{3}	-2.7268	3.0142×10^{-3}	10.0000	0.003	3	-1.0868×10	2.5728×10^{-3}	10.0000	-0.133	5
54	Niger	Ansongo	1952-1979	2732	2.3105×10^{3}	-4.6437	2.7286×10^{-3}	10.0000	0.066	3	-4.1431	2.5383×10^{-3}	10.0000	-0.002	5

Explanation: parameters Q_0 ($m^3 \cdot s^{-1}$), W ($m^3 \cdot s^{-1}$), σ (d^{-1}) and n of the relations $K = f_b(D)$ and $K = g_b(Q)$ imposed by the generalized Coutagne formula, expressing the daily depletion factor K as a function of the time D (day) elapsed since 15 September and as a function of the discharge Q ($m^3 \cdot s^{-1}$), with the number N of calibration and the ranking R_a of the models among the 5 tested models (equal to 1 for maximum C_{NSE0} and 5 for minimum C_{NSE0})

The relationship $K = f_b(D)$ is expressed as follows with D positive or zero:

$$K = f_b(D) = (W + (Q_0 - W)(1 + \sigma_0 + \sigma_0 D)^{-n})/(W + (Q_0 - W)(1 + \sigma_0 D)^{-n}) \quad \text{(S23)}$$

The relationship $K = g_b(Q)$ is expressed as follows with Q less than or equal to Q_0:

$$K = g_b(Q) = \frac{W + (Q_0 - W)\left(((Q_0 - W)/(Q - W))^{1/n} + \sigma_0\right)^{-n}}{Q} \quad \text{(S24)}$$

Table S5. performance of model 2 (K=g(Q)) for discharge forecasting in recession periods (value of Nash and Sutcliffe C_{NSE1} coefficient for each H horizon multiple of 5 between 5 and 120 days).

	***H* (d)**		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
river	**station**	**rank**																								
Bafing	Pont km17	1	0.92	0.7	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Samenta	Doureko	2	0.94	0.89	0.84	0.79	0.74	0.72	0.75	0.81	0.78	0.74	0.73	0.71	0.68	0.63	0.59	0.55	0.48	0.36	0.15	-0.08	-0.42	-	-	-
Kioma	Teliko	3	0.97	0.97	0.97	0.96	0.94	0.92	0.91	0.89	0.87	0.86	0.84	0.82	0.78	0.72	0.59	0.3	0.1	-0.13	-0.44	-0.92	-1.57	-3.31	-	-
Kioma	Salouma	4	0.97	0.94	0.91	0.9	0.89	0.9	0.9	0.91	0.92	0.93	0.96	0.97	0.97	0.96	0.95	0.92	0.75	0.65	0.52	0.38	0.09	-0.16	-	-
Téné	Bebele	5	0.97	0.94	0.95	0.91	0.87	0.84	0.81	0.77	0.76	0.77	0.79	0.78	0.77	0.76	0.75	0.74	0.73	0.17	-	-	-	-	-	-
Bafing	Balabori	6	0.99	0.99	0.99	0.98	0.99	0.98	0.98	0.97	0.96	0.95	0.94	0.93	0.92	0.9	0.88	0.88	0.88	0.89	0.89	0.89	0.89	0.89	0.93	0.93
Bafing	Boureya	7	0.98	0.98	0.96	0.96	0.91	0.93	0.92	0.88	0.75	0.66	0.59	0.5	0.36	-	-	-	-	-	-	-	-	-	-	-
Bafing	Daka Saidou	8	0.99	0.98	0.96	0.96	0.95	0.93	0.92	0.91	0.89	0.87	0.84	0.82	0.79	0.77	0.74	0.72	0.7	0.67	0.64	0.61	0.57	0.53	0.49	0.43
Bafing	Makana	9	0.99	0.98	0.97	0.96	0.95	0.95	0.95	0.94	0.94	0.93	0.92	0.92	0.9	0.89	0.88	0.87	0.86	0.84	0.83	0.83	0.82	0.81	0.81	0.8
Bafing	Soukoutali	10	0.99	0.99	0.98	0.97	0.95	0.93	0.89	0.86	0.83	0.8	0.77	0.74	0.72	0.71	0.7	0.71	0.74	0.75	0.75	0.75	0.77	0.79	0.83	0.86
Bafing	Dibia	11	0.99	0.98	0.96	0.96	0.97	0.97	0.96	0.95	0.94	0.94	0.94	0.93	0.92	0.9	0.88	0.85	0.83	0.81	0.77	0.72	0.67	0.61	0.54	0.47
Faleme	Moussala	12	0.94	0.9	0.92	0.9	0.86	0.82	0.78	0.75	0.72	0.68	0.64	0.58	0.53	0.47	0.4	0.34	0.27	0.18	0.1	-0.01	-0.18	-0.49	-1.14	-1.96
Faleme	Fadougou	13	0.97	0.95	0.91	0.87	0.85	0.85	0.83	0.81	0.78	0.78	0.76	0.74	0.71	0.7	0.69	0.7	0.72	0.71	0.64	0.54	0.47	0.39	0.3	0.22
Faleme	Gourbassy	14	0.97	0.95	0.93	0.89	0.87	0.84	0.81	0.78	0.76	0.74	0.71	0.68	0.65	0.62	0.58	0.54	0.51	0.48	0.45	0.41	0.35	0.28	0.21	0.13
Faleme	Kidira	15	0.9	0.94	0.94	0.91	0.88	0.85	0.82	0.78	0.73	0.68	0.61	0.54	0.46	0.38	0.3	0.21	0.1	-0.03	-0.18	-0.3	-0.37	-0.42	-0.46	-0.54
Bakoye	Toukoto	16	0.98	0.95	0.9	0.81	0.74	0.7	0.66	0.62	0.56	0.5	0.44	0.39	0.35	0.32	0.25	0.18	0.11	0.04	-0.04	-0.12	-0.22	-0.33	-0.45	-0.58
Baoule	Siramakana	17	0.9	0.9	0.86	0.71	0.32	0.05	-0.3	-0.55	-0.87	-1.62	-3.26	-	-	-	-	-	-	-	-	-	-	-	-	-
Bakoye	Oualia	18	0.98	0.94	0.92	0.91	0.87	0.81	0.74	0.67	0.6	0.52	0.45	0.37	0.3	0.23	0.16	0.09	0.03	-0.04	-0.09	-0.15	-0.21	-0.27	-0.32	-0.37
Bakoye	Kalé	19	0.98	0.99	0.99	0.99	0.97	0.96	0.95	0.94	0.95	0.94	0.93	0.91	0.9	0.88	0.87	0.85	0.83	0.82	0.8	0.8	0.79	0.79	0.79	0.78
Senegal	Galougo	20	0.99	0.98	0.98	0.97	0.97	0.96	0.95	0.94	0.92	0.91	0.9	0.89	0.88	0.87	0.87	0.86	0.86	0.85	0.85	0.85	0.84	0.83	0.83	0.83
Senegal	Gouina	21	0.99	0.98	0.98	0.98	0.98	0.97	0.96	0.95	0.93	0.92	0.91	0.9	0.89	0.88	0.87	0.86	0.86	0.85	0.84	0.84	0.83	0.83	0.82	0.82
Senegal	Kayes	22	0.99	0.98	0.98	0.97	0.96	0.95	0.94	0.92	0.89	0.86	0.83	0.8	0.76	0.72	0.66	0.64	0.62	0.59	0.49	0.4	0.32	0.22	0.05	-0.14
Senegal	Bakel	23	0.98	0.97	0.95	0.93	0.92	0.92	0.91	0.91	0.91	0.9	0.88	0.86	0.85	0.84	0.82	0.8	0.78	0.76	0.74	0.72	0.7	0.68	0.66	0.64
Senegal	Matam	24	1	0.99	0.98	0.97	0.97	0.96	0.96	0.95	0.95	0.95	0.94	0.94	0.94	0.93	0.92	0.91	0.89	0.87	0.85	0.83	0.8	0.78	0.75	0.73
Senegal	Kaédi	25	1	0.99	0.97	0.95	0.93	0.91	0.89	0.87	0.85	0.85	0.88	0.91	0.92	0.91	0.89	0.87	0.85	0.83	0.82	0.79	0.77	0.73	0.7	0.67
Sili	pont routier	26	0.96	0.89	0.82	0.71	0.59	0.41	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diarha	pont routier	27	0.98	0.97	0.94	0.88	0.81	0.74	0.66	0.6	0.5	0.38	0.25	0.08	-0.14	-0.52	-1.81	-5.35	-	-	-	-	-	-	-	-
Tiokoye	pont routier	28	0.96	0.94	0.89	0.83	0.74	0.62	0.48	0.33	0.17	0	-0.16	-0.34	-0.53	-0.71	-0.96	-1.3	-1.91	-3.24	-	-	-	-	-	-

	***H* (d)**		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
river	**station**	**rank**																								
Diaguery	pont routier	29	0.96	0.88	0.8	0.75	0.66	0.58	0.43	0.24	-0.01	-0.35	-0.89	-	-	-	-	-	-	-	-	-	-	-	-	-
Niokolokoba	pont routier	30	0.83	0.51	0.34	0.28	0.06	-0.33	-1.04	-1.87	-3.01	-4.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Koulountou	Gué du PNNK	31	0.99	0.97	0.93	0.84	0.78	0.72	0.68	0.65	0.65	0.64	0.6	0.55	0.49	0.41	0.3	0.13	-0.1	-0.42	-0.9	-1.55	-2.31	-2.73	-3.05	-3.36
Koulountou	Missira Gonasse	32	0.98	0.93	0.86	0.86	0.91	0.92	0.92	0.91	0.89	0.87	0.86	0.84	0.82	0.8	0.78	0.75	0.71	0.67	0.62	0.54	0.47	0.39	0.3	0.19
Gambia	Kedougou	33	0.99	0.99	0.98	0.98	0.97	0.97	0.97	0.97	0.96	0.95	0.94	0.92	0.91	0.89	0.87	0.85	0.82	0.79	0.76	0.72	0.68	0.64	0.59	0.54
Gambia	Mako	34	0.98	0.97	0.96	0.94	0.94	0.94	0.94	0.93	0.92	0.9	0.88	0.85	0.81	0.78	0.74	0.7	0.66	0.6	0.53	0.45	0.35	0.23	0.11	0
Gambia	Simenti	35	0.97	0.96	0.96	0.94	0.94	0.96	0.96	0.95	0.94	0.93	0.93	0.93	0.93	0.92	0.92	0.92	0.91	0.89	0.86	0.8	0.72	0.62	0.51	0.33
Gambia	Wassadou amont	36	0.98	0.97	0.96	0.95	0.95	0.94	0.95	0.96	0.95	0.95	0.94	0.94	0.93	0.93	0.92	0.91	0.9	0.88	0.86	0.83	0.8	0.76	0.72	0.67
Gambia	Wassadou aval	37	0.98	0.96	0.92	0.89	0.87	0.88	0.86	0.85	0.84	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.84	0.83	0.82	0.81	0.78	0.75	0.72	0.66
Sankarani	Selingue	38	0.99	0.97	0.95	0.93	0.91	0.89	0.86	0.86	0.86	0.86	0.86	0.86	0.84	0.82	0.79	0.77	0.75	0.74	0.71	0.69	0.68	0.62	0.42	-0.23
Niger	Banankoro	39	0.99	0.99	0.98	0.97	0.95	0.94	0.92	0.9	0.9	0.91	0.93	0.94	0.94	0.94	0.9	0.76	0.71	0.7	0.69	0.69	0.67	0.66	0.66	0.64
Niger	Koulikouro	40	0.99	0.98	0.96	0.94	0.93	0.93	0.91	0.9	0.89	0.88	0.88	0.88	0.87	0.87	0.85	0.84	0.83	0.84	0.82	0.8	0.77	0.75	0.72	0.64
Niger	Ke Macina	41	0.99	0.97	0.97	0.95	0.94	0.94	0.92	0.88	0.85	0.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Degou	Manankoro	42	0.99	0.96	0.94	0.93	0.92	0.9	0.88	0.86	0.84	0.81	0.77	0.74	0.72	0.71	0.68	0.65	0.62	0.59	0.53	0.28	0.02	-0.24	-0.57	-1
Banifing	Kolondieba	43	0.97	0.88	0.76	0.64	0.52	0.41	0.28	0.07	-0.3	-0.55	-0.37	-0.27	-0.28	-0.49	-0.81	-0.98	-	-	-	-	-	-	-	-
Baoulé	Madina Diassa	44	0.99	0.97	0.93	0.89	0.84	0.79	0.77	0.74	0.75	0.78	0.82	0.88	0.91	0.9	0.91	0.9	0.89	0.87	0.85	0.81	0.76	0.69	0.65	0.6
Baoulé	Dioila	45	0.99	0.98	0.96	0.94	0.91	0.88	0.84	0.81	0.78	0.77	0.76	0.76	0.75	0.75	0.75	0.75	0.74	0.72	0.68	0.63	0.58	0.52	0.45	0.38
Bani	Douna	46	0.99	0.98	0.96	0.92	0.87	0.82	0.75	0.7	0.65	0.62	0.61	0.62	0.65	0.68	0.72	0.75	0.78	0.8	0.81	0.82	0.81	0.8	0.79	0.77
Bani	Beneny Kegny	47	0.99	0.98	0.97	0.94	0.91	0.88	0.85	0.83	0.81	0.8	0.8	0.8	0.81	0.81	0.82	0.83	0.82	0.8	0.78	0.76	0.74	0.72	0.7	0.68
Bani	Sofara	48	1	0.99	0.99	0.98	0.96	0.95	0.93	0.91	0.88	0.85	0.83	0.8	0.78	0.76	0.77	0.79	0.82	0.85	0.87	0.88	0.89	0.88	0.87	0.86
Niger	Mopti	49	1	0.99	0.99	0.98	0.97	0.96	0.94	0.93	0.9	0.88	0.85	0.84	0.83	0.84	0.85	0.85	0.85	0.83	0.83	0.82	0.8	0.77	0.74	0.7
Niger	Akka	50	1	1	0.99	0.98	0.98	0.97	0.96	0.94	0.93	0.9	0.88	0.85	0.82	0.78	0.73	0.67	0.59	0.47	0.3	0.06	-0.34	-0.78	-1.45	-2.6
Niger	Diré	51	1	1	0.99	0.99	0.99	0.98	0.98	0.97	0.96	0.96	0.95	0.94	0.93	0.92	0.91	0.9	0.88	0.87	0.86	0.85	0.84	0.85	0.86	0.88
Niger	Koryoumé	52	1	0.99	0.98	0.97	0.95	0.93	0.91	0.88	0.87	0.85	0.85	0.85	0.89	0.89	0.87	0.84	0.75	0.29	-0.07	-0.44	-1.02	-1.74	-	-
Niger	Tossaye	53	1	1	0.99	0.99	0.99	0.99	0.98	0.98	0.97	0.96	0.96	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.95	0.95	0.94	0.93
Niger	Ansongo	54	1	0.99	0.99	0.98	0.98	0.97	0.96	0.95	0.93	0.92	0.9	0.89	0.87	0.85	0.83	0.82	0.81	0.8	0.81	0.82	0.81	0.8	0.79	0.76

Warning: the results are not displayed if the number N_e of discharge forecasted at horizon H is less than 30

Table S6. performance of model 2 (K=g(Q)) for discharge forecasting in recession periods (value of relative standard error R_{rmse} = S_e/Qm for each H horizon multiple of 5 between 5 and 120 days, where Se is the standard error of the forecasted discharges and Q_m is the average of the corresponding observed flows).

	***H* (d)**		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
river	**station**	**rank**																								
Bafing	Pont km17	1	0.24	0.34	0.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Samenta	Doureko	2	0.34	0.40	0.45	0.49	0.53	0.53	0.44	0.31	0.29	0.29	0.26	0.25	0.26	0.27	0.27	0.29	0.30	0.32	0.35	0.38	0.42	-	-	-
Kioma	Teliko	3	0.15	0.13	0.13	0.13	0.16	0.18	0.20	0.21	0.22	0.23	0.24	0.25	0.25	0.25	0.24	0.25	0.28	0.32	0.36	0.42	0.47	0.53	-	-
Kioma	Salouma	4	0.27	0.34	0.39	0.40	0.39	0.37	0.36	0.35	0.32	0.28	0.21	0.17	0.17	0.18	0.20	0.23	0.24	0.28	0.31	0.34	0.38	0.43	-	-
Téné	Bebele	5	0.27	0.34	0.33	0.42	0.51	0.60	0.68	0.77	0.80	0.77	0.70	0.72	0.74	0.78	0.86	0.95	1.04	0.38	-	-	-	-	-	-
Bafing	Balabori	6	0.11	0.12	0.12	0.12	0.11	0.11	0.12	0.13	0.15	0.15	0.16	0.17	0.17	0.18	0.19	0.18	0.17	0.16	0.16	0.14	0.14	0.11	0.08	0.07
Bafing	Boureya	7	0.28	0.25	0.27	0.26	0.30	0.27	0.27	0.31	0.35	0.37	0.39	0.41	0.44	-	-	-	-	-	-	-	-	-	-	-
Bafing	Daka Saidou	8	0.16	0.21	0.24	0.21	0.20	0.21	0.22	0.24	0.25	0.27	0.29	0.31	0.32	0.34	0.35	0.36	0.38	0.39	0.40	0.41	0.43	0.45	0.47	0.49
Bafing	Makana	9	0.15	0.19	0.22	0.23	0.23	0.22	0.22	0.22	0.23	0.23	0.24	0.24	0.26	0.27	0.29	0.30	0.31	0.32	0.33	0.34	0.34	0.35	0.35	0.35
Bafing	Soukoutali	10	0.11	0.12	0.14	0.16	0.19	0.23	0.27	0.30	0.34	0.36	0.39	0.42	0.44	0.46	0.46	0.46	0.45	0.43	0.44	0.45	0.44	0.40	0.36	0.32
Bafing	Dibia	11	0.18	0.26	0.31	0.29	0.23	0.22	0.22	0.24	0.26	0.26	0.25	0.25	0.27	0.28	0.31	0.33	0.34	0.33	0.35	0.38	0.41	0.45	0.48	0.52
Faleme	Moussala	12	0.40	0.47	0.35	0.39	0.44	0.50	0.54	0.56	0.60	0.64	0.67	0.71	0.75	0.79	0.83	0.90	0.97	1.06	1.10	1.10	1.05	1.01	0.95	0.94
Faleme	Fadougou	13	0.20	0.25	0.32	0.37	0.38	0.37	0.39	0.41	0.44	0.45	0.48	0.51	0.55	0.59	0.61	0.59	0.55	0.54	0.60	0.68	0.74	0.81	0.88	0.93
Faleme	Gourbassy	14	0.30	0.36	0.37	0.41	0.43	0.46	0.51	0.54	0.57	0.58	0.59	0.61	0.65	0.68	0.72	0.75	0.77	0.79	0.80	0.82	0.85	0.90	0.95	1.00
Faleme	Kidira	15	0.67	0.42	0.36	0.41	0.45	0.48	0.50	0.53	0.57	0.61	0.65	0.68	0.72	0.76	0.81	0.85	0.90	0.95	1.00	1.06	1.14	1.22	1.31	1.37
Bakoye	Toukoto	16	0.28	0.42	0.52	0.57	0.59	0.61	0.64	0.68	0.72	0.75	0.79	0.82	0.85	0.86	0.90	0.93	0.96	0.98	0.99	0.99	1.02	1.06	1.09	1.11
Baoule	Siramakana	17	0.68	0.46	0.47	0.59	0.64	0.73	0.84	0.95	1.09	1.16	1.11	-	-	-	-	-	-	-	-	-	-	-	-	-
Bakoye	Oualia	18	0.33	0.49	0.54	0.53	0.60	0.69	0.79	0.89	0.98	1.06	1.12	1.18	1.24	1.29	1.33	1.37	1.40	1.43	1.45	1.47	1.48	1.49	1.51	1.52
Bakoye	Kalé	19	0.23	0.10	0.11	0.14	0.16	0.18	0.18	0.18	0.17	0.18	0.19	0.20	0.21	0.23	0.25	0.26	0.27	0.29	0.30	0.30	0.30	0.30	0.30	0.32
Senegal	Galougo	20	0.20	0.28	0.26	0.26	0.27	0.28	0.30	0.32	0.34	0.35	0.35	0.36	0.36	0.37	0.38	0.38	0.38	0.37	0.37	0.37	0.38	0.38	0.39	0.39
Senegal	Gouina	21	0.21	0.26	0.23	0.23	0.22	0.23	0.25	0.28	0.30	0.32	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.40	0.41	0.42	0.42	0.43	0.43	0.43
Senegal	Kayes	22	0.13	0.19	0.21	0.22	0.23	0.24	0.26	0.27	0.29	0.31	0.33	0.35	0.36	0.38	0.40	0.41	0.42	0.42	0.44	0.45	0.47	0.49	0.51	0.54
Senegal	Bakel	23	0.26	0.34	0.40	0.44	0.46	0.43	0.42	0.39	0.39	0.41	0.43	0.45	0.46	0.48	0.50	0.53	0.55	0.58	0.61	0.64	0.67	0.70	0.74	0.77
Senegal	Matam	24	0.11	0.17	0.22	0.28	0.30	0.32	0.31	0.30	0.29	0.30	0.29	0.28	0.27	0.28	0.29	0.31	0.34	0.36	0.39	0.41	0.43	0.46	0.48	0.49
Senegal	Kaédi	25	0.09	0.17	0.25	0.32	0.39	0.44	0.49	0.52	0.55	0.53	0.48	0.37	0.34	0.35	0.37	0.40	0.42	0.44	0.46	0.48	0.50	0.53	0.55	0.55
Sili	pont routier	26	0.16	0.21	0.25	0.30	0.34	0.39	0.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diarha	pont routier	27	0.21	0.20	0.25	0.32	0.37	0.41	0.44	0.47	0.49	0.52	0.54	0.56	0.56	0.56	0.55	0.58	-	-	-	-	-	-	-	-

	***H* (d)**		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120
river	**station**	**rank**																								
Tiokoye	pont routier	28	0.27	0.28	0.34	0.38	0.45	0.52	0.58	0.64	0.71	0.76	0.81	0.86	0.90	0.95	0.97	0.98	0.98	0.95	-	-	-	-	-	-
Diaguery	pont routier	29	0.31	0.48	0.58	0.60	0.66	0.71	0.65	0.71	0.76	0.80	0.85	-	-	-	-	-	-	-	-	-	-	-	-	-
Niokolokoba	pont routier	30	0.85	1.50	1.59	0.99	1.02	1.03	1.02	1.05	1.06	1.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Koulountou	Gué du PNNK	31	0.20	0.25	0.33	0.41	0.48	0.53	0.56	0.57	0.55	0.54	0.56	0.58	0.60	0.62	0.64	0.68	0.72	0.77	0.82	0.86	0.91	0.95	1.00	1.03
Koulountou	Missira Gonasse	32	0.25	0.45	0.57	0.52	0.38	0.34	0.34	0.35	0.38	0.40	0.41	0.43	0.44	0.46	0.47	0.48	0.49	0.50	0.51	0.52	0.53	0.54	0.54	0.55
Gambia	Kedougou	33	0.16	0.14	0.16	0.16	0.17	0.18	0.18	0.18	0.19	0.21	0.23	0.26	0.28	0.31	0.34	0.38	0.41	0.44	0.47	0.50	0.53	0.57	0.62	0.67
Gambia	Mako	34	0.21	0.23	0.25	0.28	0.27	0.25	0.23	0.23	0.25	0.27	0.30	0.32	0.35	0.38	0.41	0.44	0.47	0.50	0.53	0.57	0.61	0.65	0.70	0.76
Gambia	Simenti	35	0.30	0.33	0.33	0.35	0.32	0.24	0.23	0.24	0.27	0.28	0.29	0.28	0.28	0.27	0.26	0.26	0.28	0.30	0.34	0.40	0.47	0.53	0.58	0.64
Gambia	Wassadou amont	36	0.31	0.34	0.34	0.34	0.33	0.32	0.26	0.23	0.23	0.24	0.24	0.25	0.25	0.26	0.27	0.29	0.31	0.33	0.35	0.39	0.44	0.49	0.55	0.59
Gambia	Wassadou aval	37	0.31	0.43	0.55	0.59	0.59	0.52	0.52	0.53	0.52	0.49	0.48	0.47	0.46	0.46	0.46	0.46	0.47	0.49	0.51	0.52	0.55	0.58	0.61	0.63
Sankarani	Selingue	38	0.13	0.20	0.25	0.28	0.29	0.29	0.30	0.28	0.26	0.24	0.22	0.21	0.21	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.24	0.28	0.33
Niger	Banankoro	39	0.11	0.18	0.22	0.26	0.32	0.38	0.44	0.48	0.50	0.48	0.44	0.42	0.41	0.41	0.46	0.53	0.57	0.58	0.58	0.57	0.55	0.53	0.51	0.50
Niger	Koulikouro	40	0.11	0.18	0.23	0.26	0.28	0.28	0.28	0.29	0.28	0.27	0.27	0.26	0.26	0.26	0.27	0.27	0.27	0.26	0.27	0.28	0.28	0.27	0.28	0.30
Niger	Ke Macina	41	0.12	0.21	0.24	0.28	0.30	0.29	0.31	0.36	0.33	0.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Degou	Manankoro	42	0.19	0.33	0.41	0.43	0.45	0.48	0.49	0.50	0.52	0.55	0.56	0.56	0.55	0.53	0.52	0.51	0.51	0.49	0.47	0.44	0.46	0.50	0.54	0.59
Banifing	Kolondieba	43	0.27	0.50	0.70	0.86	1.03	1.17	1.30	1.28	1.24	1.23	1.17	1.17	1.17	1.19	1.25	1.26	-	-	-	-	-	-	-	-
Baoulé	Madina Diassa	44	0.22	0.39	0.56	0.73	0.88	0.98	1.00	1.02	0.98	0.90	0.81	0.64	0.55	0.54	0.48	0.48	0.49	0.52	0.56	0.62	0.67	0.71	0.72	0.71
Baoulé	Dioila	45	0.11	0.21	0.30	0.38	0.47	0.55	0.62	0.67	0.70	0.71	0.70	0.69	0.68	0.64	0.61	0.60	0.59	0.60	0.62	0.63	0.65	0.69	0.73	0.78
Bani	Douna	46	0.13	0.25	0.37	0.49	0.60	0.71	0.80	0.86	0.90	0.91	0.90	0.86	0.81	0.75	0.70	0.65	0.62	0.59	0.58	0.57	0.59	0.61	0.64	0.67
Bani	Beneny Kegny	47	0.12	0.21	0.31	0.39	0.47	0.54	0.58	0.61	0.63	0.64	0.63	0.62	0.61	0.59	0.57	0.56	0.58	0.61	0.65	0.69	0.73	0.78	0.83	0.88
Bani	Sofara	48	0.07	0.13	0.19	0.25	0.31	0.38	0.45	0.52	0.59	0.65	0.70	0.73	0.74	0.74	0.71	0.65	0.59	0.53	0.49	0.46	0.45	0.45	0.47	0.49
Niger	Mopti	49	0.04	0.07	0.10	0.12	0.15	0.17	0.20	0.22	0.24	0.26	0.27	0.28	0.27	0.26	0.24	0.23	0.23	0.23	0.22	0.23	0.24	0.26	0.27	0.29
Niger	Akka	50	0.03	0.05	0.07	0.09	0.11	0.13	0.15	0.18	0.20	0.23	0.26	0.30	0.33	0.37	0.41	0.46	0.52	0.59	0.68	0.78	0.89	0.98	1.05	1.11
Niger	Diré	51	0.04	0.06	0.08	0.09	0.11	0.13	0.15	0.17	0.20	0.22	0.24	0.26	0.28	0.31	0.34	0.36	0.39	0.40	0.41	0.42	0.43	0.42	0.40	0.37
Niger	Koryoumé	52	0.03	0.06	0.08	0.11	0.15	0.18	0.20	0.23	0.25	0.27	0.29	0.30	0.27	0.27	0.31	0.34	0.40	0.51	0.55	0.56	0.56	0.57	-	-
Niger	Tossaye	53	0.03	0.05	0.06	0.08	0.09	0.11	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.25	0.27	0.29	0.30	0.31	0.31	0.32	0.32	0.34	0.40	0.46
Niger	Ansongo	54	0.03	0.06	0.08	0.11	0.13	0.15	0.18	0.21	0.24	0.27	0.30	0.33	0.37	0.40	0.43	0.44	0.45	0.45	0.44	0.43	0.43	0.45	0.49	0.54

Warning: the results are not displayed if the number N_e of discharge forecasted at horizon H is less than 30

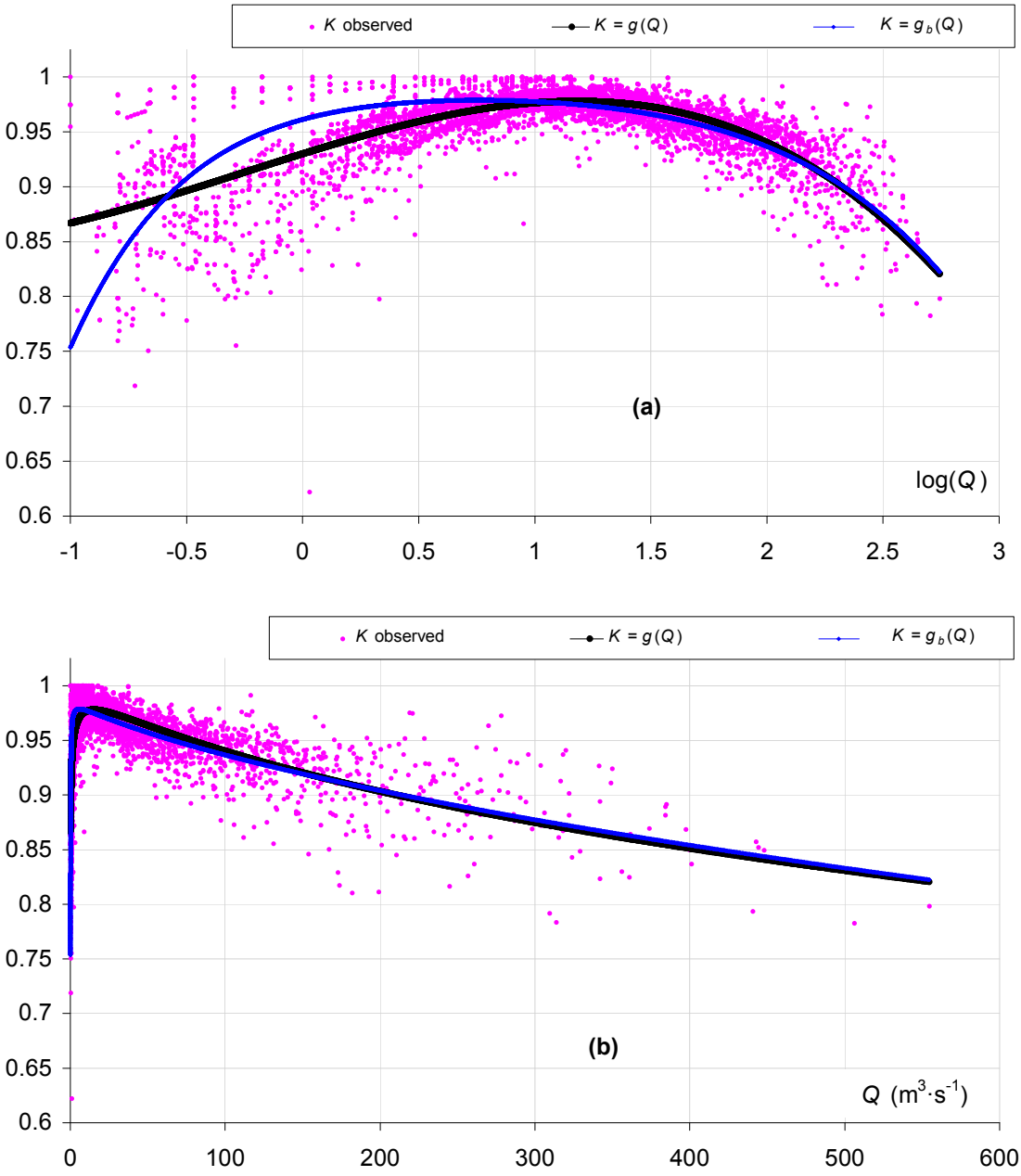

Figure S1. models 2 and 4 describing the relationship between discharge Q and K at the Kedougou station on the River Gambia (row 33; 5351 points from 15/04/1970 to 17/10/2003; C_{NSE0} = 0.576 for model $K=g(Q)$; C_{NSE0} = 0.390 for model $K=g_b(Q)$), with abscissa in logarithmic value (a) and in natural value (b)

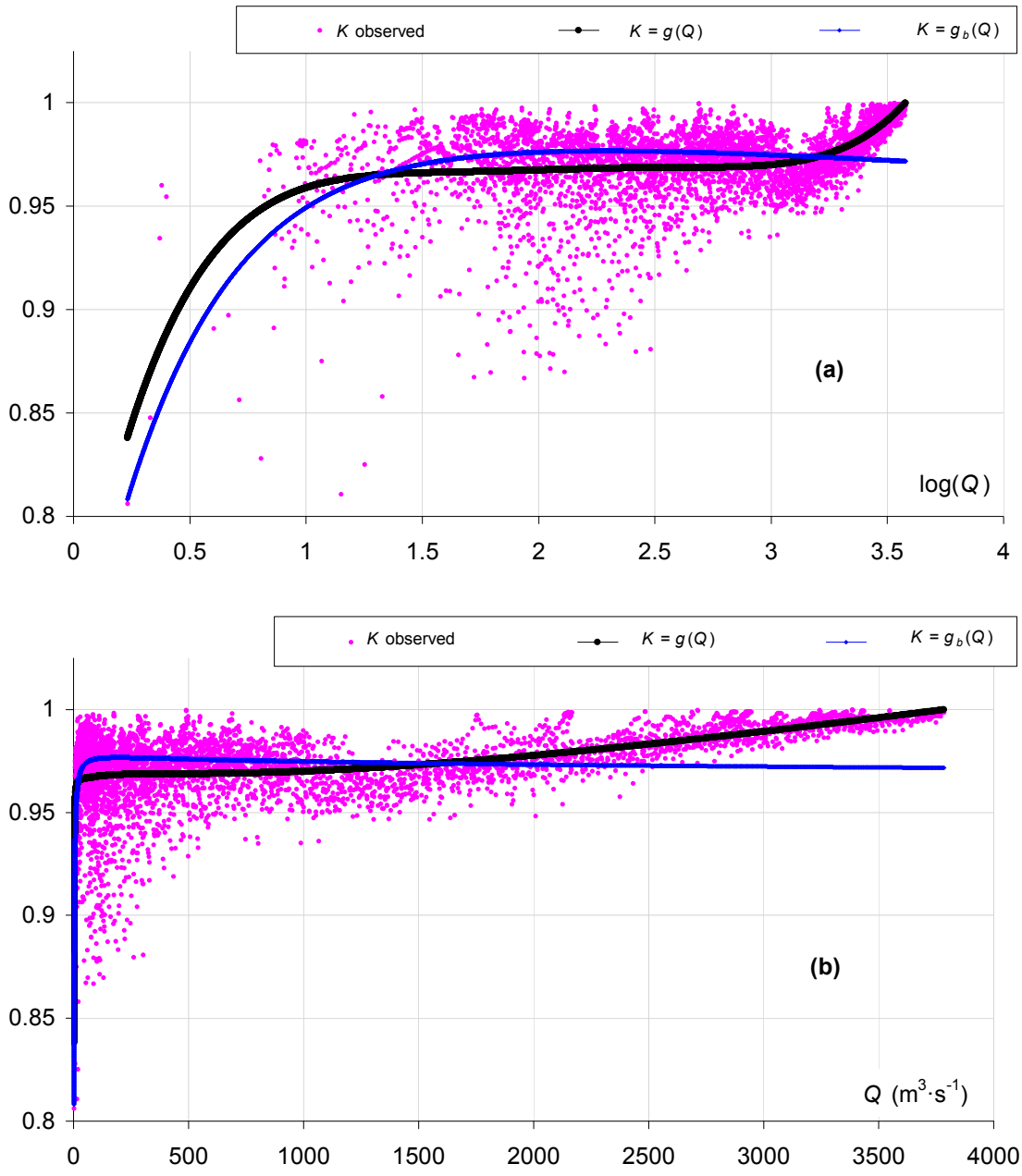

Figure S2. models 2 and 4 describing the relationship between discharge Q and K at Mopti station on the River Niger (row 49; 4654 points from 25/01/1950 to 31/12/1980; C_{NSE0} = 0.250 for model $K=g(Q)$; C_{NSE0} = -0.030 for model $K=g_b(Q)$) , with abscissa in logarithmic value (a) and in natural value (b)

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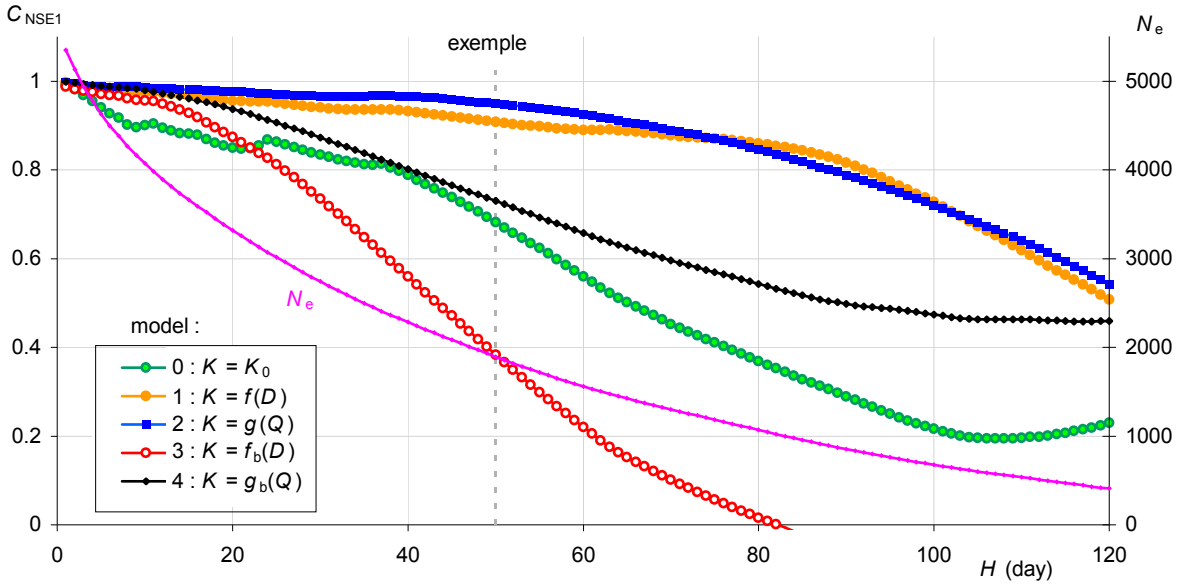

Figure S3. performance of the models in forecasting discharge during recession regimes at Kedougou, on the River Gambia, as a function of the forecast horizon *H*.

Example: the forecasting of N_e = 1894 values of discharge at horizon H = 50 days gives a C_{NSE1} equal to 0.682, 0.907, 0.949, 0.384 et 0.730 with models 0, 1, 2, 3 and 4 respectively

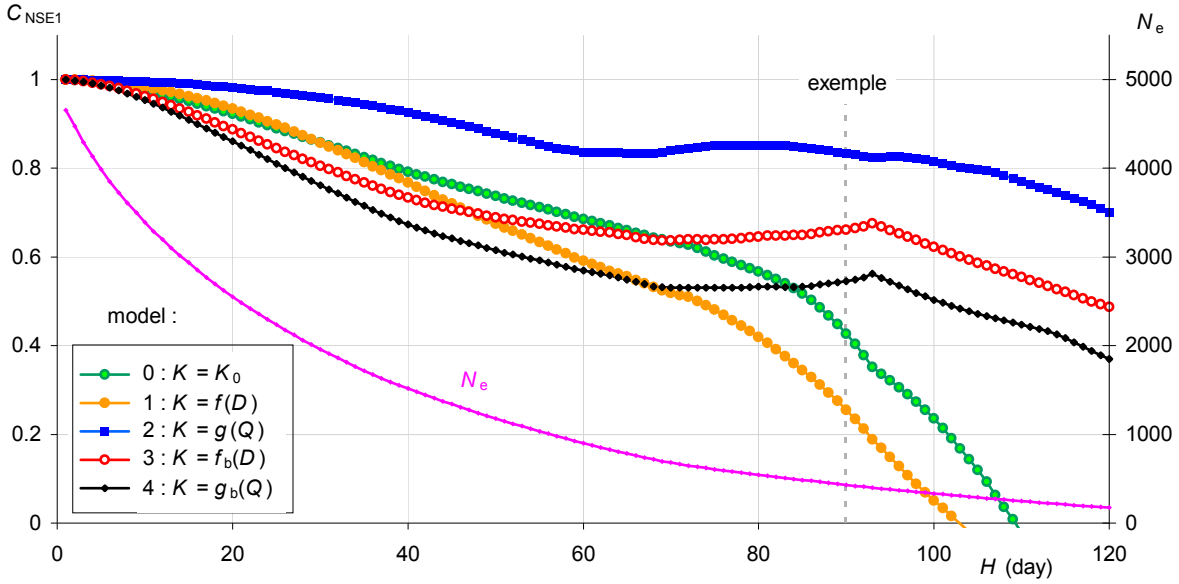

Figure S4. performance of the models in forecasting discharge during recession regimes at Mopti, on the River Niger, as a function of the forecast horizon H.

Example: the forecasting of N_e = 431 values of discharge at horizon H = 50 days gives a C_{NSE1} equal to 0.427, 0.255, 0.834, 0.662 et 0.546 with models 0, 1, 2, 3 and 4 respectively

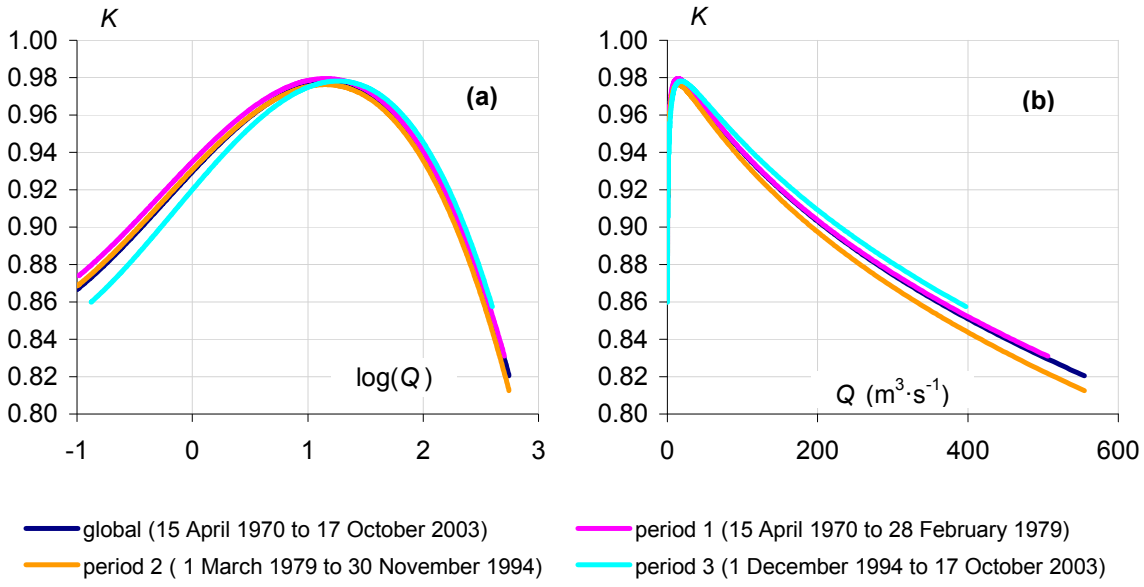

Figure S5. model 2 representing the daily depletion factor *K* as a function of discharge *Q*, calibrated on successive periods 1 to 3 and on the global period for Gambia at Kédougou (station 33), with abscissa in logarithmic value (a) and in natural value (b).

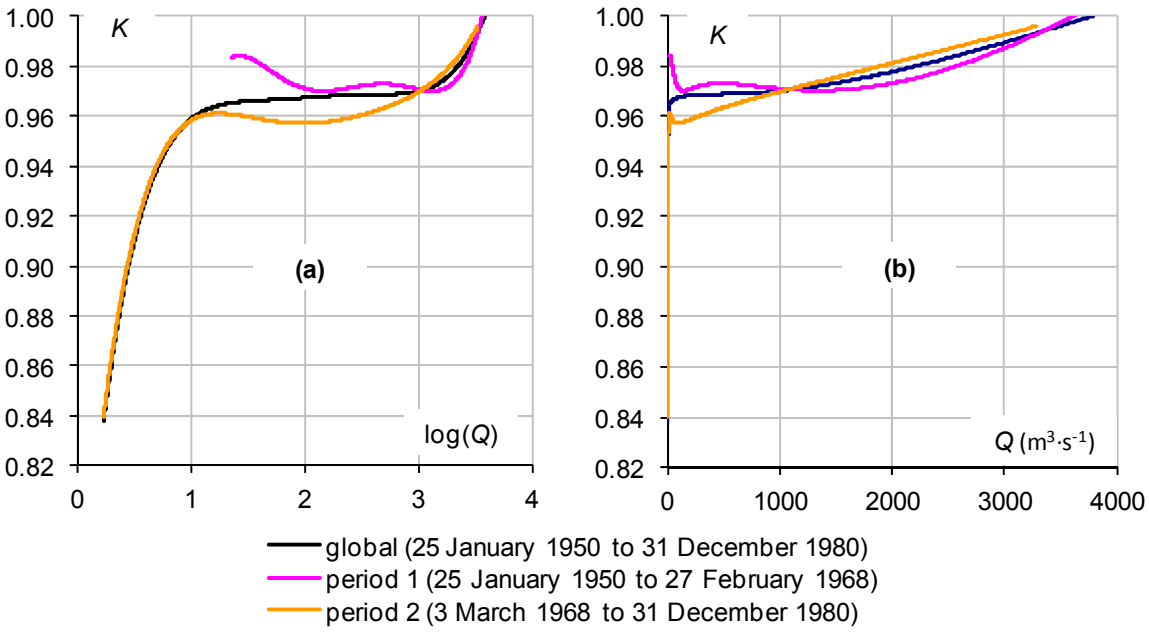

Figure S6. model 2 representing the daily depletion factor *K* as a function of discharge *Q*, calibrated on successive periods 1 and 2 and on the global period for Niger at Mopti (station 49) , with abscissa in logarithmic value (a) and in natural value (b).