Response to Anonymous Referee #1 dated **25 July 2020, attachment:**

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Referee: A section on model comparison is missed. Because authors compare 3 parameter distributions to 4 parameter, specific criteria should be adopted such as BIC and AIC.

Reply: After re-examining, we believe that the judge's suggestion was justified. The AIC and BIC criteria will allow the comparison of the studied distributions. Therefore, instead of a separate chapter, we suggest adding the following changes (marked in red).
In subsection 2.2.6:

One of the goals of this article was to propose a new GGEV distribution model in the AM and POT method. For this reason, we checked whether this distribution or the 3-parameter distributions used in these studies provided the best fit to the empirical distribution function. The Chi-squared Test (χ^2), Kolmogorov-Smirnov (K-S), and the Mean absolute relative error (MARE) tests were widely used to indicate the adequacy of the distribution functions being tested. Akaike information criterion (AIC) and Bayesian information criterion (BIC) were used to define the best fit distribution.

The χ^2 test was used to compare the selected distribution function with the empirical distribution function. The smaller the χ^2, the better the expected fit of the model to the sample being tested (Haktanir, 1991, Langat *et al., 2019).* In calculating the statistics, the R package 'stats' was used - 'chisq.test' function. with continuity correction performed.

The K-S test was used to assess the performance of individual cases as recommended in Haktanir (1991), Mamman et al. (2017), Zhang (2007). The statistic determines the distance between the estimated distribution function of the reference distribution and the empirical distribution function of the sample (Haktanir, 1991, Langat et al., 2019*).* R Package 'EnvStats' was used - gofTest function that calculates statistics and p-value.

The MARE is the index whose value is determined between the median of the observed flows and their equivalents calculated from the estimated distribution. This measure of model fit error is most applicable for engineering practice because it provides a quantitative estimate of high flows (Szulczewski and Jakubowski, 2018). Similar methods used in practice were also applied by Beskow et al. (2015), where on the one hand they used the KS, χ^2, and on the other hand they calculated the maximum, minimum and average Relative Absolute Error (RAE). Also Cassalho et al. (2018), used the RAE methods.

The AIC and BIC criteria allow to compare distributions based on estimating their likelihoods L to the same data. Both AIC and BIC require the likelihood to be maximized before it can be calculated. They are calculated as follows (Sakamoto et al., 1986):

$$AIC = 2 \cdot \ln L + 2 \cdot k \quad (6)$$

$$BIC = 2 \cdot \ln L + 2 \cdot \ln N \cdot k \quad (7)$$

where L is the value of the likelihood, N is the number of recorded measurements, and k is the number of estimated parameters.

The lower the AIC (Bezak et al., 2014, Sakamoto et al., 1986) or the BIC value, the better the fit (Sakamoto et al., 1986).

At the end of chapter 3. Results and discussion, we suggest adding:

When analyzing the AIC and BIC values in both the AM and POT methods, the lowest values were obtained for the GGEV distribution for the six analyzed profiles (Table 6). In addition, the AIC and BIC criteria showed that lower AIC and BIC values were obtained in the POT method than in the AM method, which indicates that the GGEV distribution could be used in the POT method (Table 6).However, in the studies by Bezak et al. (2014), the lowest AIC value was obtained for the LN distribution, regardless of the methods used to estimate their parameters (the lowest AIC value for LN_MM is 187.28). The highest AIC value was obtained for the GL distribution (the highest AIC value for GL _MM is 212.27). As reported by Langat et al. (2019), Tana River research in Kenya (Gariss water gauge) three-parameter distributions: 3P3 (MLE), 3LN (MLE), GEV (MLE) reached AIC and BIC values above 1000. The lowest value was obtained by the distribution 3LN (MLE) (AIC = 1081.4, BIC = 1086.0). However, the highest values were obtained for the GEV distribution (AIC = 1083.7, BIC = 1088.4). Among the three-parameter distributions analyzed in the AM method, the lowest value of AIC = 169.62 and BIC = 175.23 was obtained by the 3W (MM) distribution for the Bu sample. However, the highest value of AIC = 4168.51, BIC = 4174.13 in the AM method was obtained for the distribution 3P3 (MM); sample O (Table 6). Among the three-parameter distributions analyzed in the POT method, the lowest value of AIC = 129.05 and BIC = 134.54 was also obtained by the 3W (MM) distribution for the Bu sample. However, the highest value of AIC = 725.93, BIC = 731.95 in the POT method was obtained for the GEV distribution (MLE); MPSW sample (Table 6).

Table 6. Goodness-of-fit information criterion

Samples	AIC, BIC	3P3 (MM)	3P3 (MLE)	3LN (MLE)	3LN (MM)	3LN (MMM)	3W (MLE)	3W (MM)	3W (MMM)	GEV (MLE)	GEV (PWM)	GGEV (MCMC)
AM												
BB	**AIC**	718.64	615.78	842.95	980.02	865.14	702.10	402.59	706.43	705.44	708.56	**359.33**
	BIC	725.30	622.44	849.61	986.68	871.80	708.75	409.25	713.09	712.10	715.22	**374.49**
Bu	**AIC**	767.27	338.30	184.63	413.95	512.36	250.80	169.62	251.46	438.52	441.13	**131.63**
	BIC	772.88	343.91	190.25	419.57	517.97	256.42	175.23	257.07	444.14	446.74	144.70
MPSW	**AIC**	660.87	550.69	871.79	897.79	863.54	655.14	416.27	658.32	1140.73	1142.65	**324.68**
	BIC	667.53	556.24	878.44	904.45	870.19	661.80	422.93	664.97	1147.39	1149.30	**339.84**
MPT	**AIC**	476.43	441.40	727.03	724.54	696.78	565.28	365.17	531.02	1008.10	1005.58	**273.36**
	BIC	482.86	447.83	733.46	730.97	703.21	571.71	371.83	537.44	1014.53	1012.01	**288.15**
O	**AIC**	4168.51	427.58	599.34	675.55	700.96	448.85	292.11	452.48	790.76	793.26	**231.55**
	BIC	4174.13	433.19	604.96	681.16	706.57	454.46	298.77	458.09	796.37	798.87	**244.62**
Wi	**AIC**	380.44	429.62	503.16	735.07	560.34	353.74	-	354.11	356.73	362.00	**353.49**
	BIC	386.06	435.23	508.77	740.68	565.95	**359.36**	-	359.73	362.34	367.62	370.72
POT, MAMRF												
BB	**AIC**	242.77	290.37	397.79	558.15	423.29	444.82	252.56	378.63	385.79	389.85	200.90
	BIC	247.98	295.59	403.00	563.36	428.50	450.03	257.77	383.84	391.01	395.06	213.16
Bu	**AIC**	241.79	228.51	197.84	208.07	310.92	185.11	129.05	186.70	191.83	195.16	100.25
	BIC	247.00	233.57	203.33	213.55	316.40	190.59	134.54	192.19	197.31	200.65	113.07
MPSW	**AIC**	344.38	420.10	480.52	650.15	497.65	542.12	306.04	439.56	725.93	447.65	232.02
	BIC	349.13	425.24	486.54	656.17	503.67	548.15	312.06	445.58	731.95	453.67	246.01
MPT	**AIC**	339.53	161.49	321.14	473.79	352.87	384.83	192.65	309.20	310.03	320.74	159.99
	BIC	344.74	166.70	326.35	479.00	358.08	390.04	197.86	314.41	315.25	325.96	172.26
O	**AIC**	430.16	430.16	428.56	556.33	459.22	405.00	239.49	356.14	363.68	365.86	187.20
	BIC	435.51	435.51	433.91	561.69	464.58	410.36	244.84	361.49	369.03	371.22	199.75
Wi	**AIC**	265.40	268.96	304.59	453.09	338.93	255.15	176.31	256.86	261.80	263.35	139.31
	BIC	270.69	274.24	309.88	458.37	344.22	260.43	181.59	262.15	267.09	268.63	151.85
POT, Hill plot												
BB	**AIC**	350.27	362.04	489.83	534.46	492.80	435.63	472.33	480.18	410.30	473.71	207.74
	BIC	355.41	367.18	494.97	539.61	497.94	440.77	477.47	485.32	415.44	478.85	220.01
Bu	**AIC**	615.77	320.96	319.39	430.20	259.95	157.45	178.87	252.97	262.34	278.72	133.58
	BIC	622.25	327.43	325.86	436.67	266.43	163.93	185.34	259.45	268.81	285.20	148.37
MPSW	**AIC**	336.75	377.41	595.26	661.57	603.67	542.12	499.00	530.15	566.49	514.97	232.77
	BIC	342.77	383.43	601.28	667.59	609.69	548.15	505.02	536.18	572.51	521.00	246.76
MPT	**AIC**	274.31	291.74	325.29	492.44	357.63	401.97	192.65	316.63	322.40	345.74	167.09
	BIC	279.66	297.09	330.65	497.79	362.98	407.32	197.86	321.98	327.75	351.09	179.64
O	**AIC**	406.21	454.74	557.06	665.61	570.45	428.06	239.49	429.67	512.03	442.63	223.46
	BIC	412.06	460.59	562.91	671.46	576.30	433.92	244.84	435.52	517.88	448.48	237.01
Wi	**AIC**	319.70	325.44	386.14	493.38	407.10	358.19	341.25	329.46	349.34	322.56	138.19
	BIC	324.99	330.73	391.43	498.66	412.38	363.47	346.54	334.75	354.62	327.85	150.73

Additionally, in Chapter 4, Conclusions, we propose to add:

4. *According to MARE* and AIC and BIC*, the GGEV distribution proved to be the best-fitted for samples with a clear anthropogenic activity such as the impact that a water reservoir has on sample's independence. This applies particularly to two methods AM and POT (MAMRF and Hill plot).*

References:

Sakamoto, Y., Ishiguro, M., and Kitagawa G. (1986). *Akaike Information Criterion Statistics*. D. Reidel Publishing Company.

Langat P.K., Kumar L., Koech R.: Identification of the most suit-able probability distribution models for maximum, minimum, and mean streamflow. Water 11:734, 2019. https ://doi.org/10.3390/w11040734

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