

Interactive comment on “Effects of runoff thresholds on flood frequency distributions” by A. Gioia et al.

A. Gioia et al.

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Response to Reviewer 1

RC: Section "Two component IF Model (TCIF)". The Authors should provide in this section the number of parameters associated to the proposed model. This issue is important because the Authors use an at-site estimation for some of them.

AC: We introduced in last lines of Section 3 - "Two component IF Model (TCIF)", a commented list of the model parameters specifying for all of them the physical role. Furthermore, we have reorganized the section 5 "Model application" introducing 3 sub-sections in order to clarify the overall estimation procedure and specifying which parameters were estimated by means of regional or at-site procedure.

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Interactive Discussion

Discussion Paper

RC: Note that some of the parameters of the Two component IF Model (TCIF), namely $\Lambda_L, \Lambda_H, r_L, r_H$ are estimated using flood observations at the site of interest. Two considerations come out: 1) this way of estimating the parameters reduces the applicability of this derived distribution model to river basins where you have flood observations; 2) the derived distributions are generally developed to make predictions in river basin where you do not have flood observations.

AC: We respectfully disagree with this comment according to the following considerations. We agree that derived distributions should be useful for prediction in ungauged basins but before reaching such purpose they have to be proposed, studied and tested with respect to their descriptive properties with regard to the physical meaning of their parameters. This is also the reason why we use at-site estimation of parameters unless they regard the rainfall process ($E[i_{A,\tau}], \varepsilon, \Lambda_p, k$) or they have a general geomorphological interpretation (A, τ_A, ξ, β). It is also true that, for derived distribution, testing the descriptive ability could be considered less important than verifying the model consistency. Thus main parts of the revised paper (sections 5.2.1, 5.2.2 and 5.2.3) are devoted to the physical interpretation of regional patterns of the estimated model parameters.

RC: In Figure 5 the Authors compare the distributions TCEV and TCIF to the flood observations. Some comments are necessary here. Both TCEV and TCIF show a good agreement with data. However it is important to note that the TCEV has 4 parameters ($\Lambda_1, \Lambda_2, \theta_1, \theta_2$) all of them estimated from at-site flood data, while the TCIF has N parameters ($\Lambda_L, \Lambda_H, r_L, r_H, f_{A,L}, f_{A,H}, k, 8230$); 4 of them are estimated from at-site flood data.

AC: This comment highlights that the main goal of the paper was unclear in its first version. In the revised version, we clearly state in the introduction that "A technical use of derived distributions of flood frequency is still far from operational. But, the immediate outcome of their development lies in a deeper knowledge of hydrological controls in extreme events." A comparison with TCEV, in terms of model performance,

would not have any meaning. Such comparison was shown in the first version of the paper only to show that that the TCIF distribution, as well as the TCEV, is able to reach high values of skewness. In order to remove any possible confusion, in the revised paper the TCEV curves have been eliminated from Figure 5. We still report the TCEV descriptive statistics (for comparison with TCIF corresponding values) in Table 5.

RC: Page 917, lines 11-14, the Authors write "In facts, at-site estimation techniques (Fiorentino et al., 1987b) in principle are not recommended for short length data series because of the very high estimator variability, with particular regard to parameters dependent on the second and third order moments". In the next (lines 20-23), They write "In other words, in order to obtain reliable estimates for parameters to be used within the derived model applied to observed annual flood series, we used at-site estimation of TCEV parameters performed by Maximum Likelihood Estimator." In the first sentence the Authors say that at-site estimation techniques are not recommended but in the second, the Authors use an at-site estimation technique. This could generate confusion in the Reader. Please clarify this point.

AC: In the revised paper, in order to avoid any confusion, the first sentence has been eliminated. This was done also because a regional estimate of TCEV parameters would not be useful being the paper's goal to analyze the parameters' spatial variability. This concept is now clearly reported both in the text and in the conclusions.

RC: Figures 2 and 3 are superfluous.

AC: Figures 2 and 3 have been removed.

Minor COMMENTS

RC: Page 904, lines 24-26, change "is based on transferability of hydrological information allowing prediction in ungauged basins" in "transfers hydrologic information from gauged to ungauged basins making predictions in the last ones". Page 905, line 1 delete "external". Page 905, line 3 change "individuate" in "identify". Page 905, the Au-

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Interactive Discussion

Discussion Paper



thors write "Such kind of analysis is required in order to test the statistical homogeneity and the spatial variability of parameters" Which kind of analyses are you referring? The sentence is not clear.

AC: These comments have been addressed in the revised version of the paper that have been significantly restructured.

RC: Page 905, the Authors write "Regionalization techniques allow the use of distributions with more than two parameters (e.g., GEV, TCEV), whose estimation procedures usually need extensive dataset, in particular for parameters dependent on the higher order moments. " This sentence could be misinterpreted by the Reader. In fact you can always use distributions like GEV or TCEV. Estimates of parameters are reliable only when long datasets are used. Please rephrase this sentence.

AC: This part of the paper was removed.

RC: Page 906, line 9, change "are implemented combining" in "combine".

AC: The entire sentence was removed.

RC: Page 906, line 28, change "in storm associated with seasonality" in "in seasonal storms".

AC: The sentence has been reworded as follows: " seasonal variability in storms".

RC: Page 907, line 10, please give a reference for "the Matalas condition of separation". Page 908, line 15, change "area" in "areal". Page 908, lines 15-16, change "as a Weibull function" in "Weibull distributed".

AC: All these changes have been made.

RC: Page 908, line 21, provide a value for the exponent ε . Page 909, line 3, provide a value for the exponent v .

AC: A value for the exponent " v " is unnecessary because in table 2 is displayed directly

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a value for the lag-time τ_A , equation 5 was eliminated and replaced by the sentence "The lag-time τ_a scales according to a power law with exponent 0.5"; a value for the exponent " ε " is now mentioned at lines 307-308 and provided in table 2 of the revised paper.

RC: Page 909, line 14, change "parameter values" in "parameters values". **AC:** This change has been made.

RC: Page 909, line 17, delete "significant".

AC: The entire phrase was reworded.

RC: Page 909, line 23, change "demonstrates" in "means". Page 910, line 6, change "indicate" in "indicates". Page 911, lines 2-3, change "flood annual maximum values of the flood peak" in "maximum annual flood peak".

AC: All these changes have been made.

RC: Page 912, line 9, insert "if" between "that" and "the saturation".

AC: The entire phrase was reworded and moved in section 5.

RC: Page 912, line 11, the Authors write "Nevertheless, apart from what is prevailing, the two mechanisms may occur in all basins". Which mechanisms are you referring? The sentence is not clear.

AC: The entire phrase was removed.

RC: Page 912, line 14, the Authors write "insisting on small portion of the basin close to the channels". This sentence is not clear. Please clarify it.

AC: This sentence has been rephrased.

RC: Page 912, line 20, change "rarer" in "rare".

AC: This change has been made.

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Interactive Discussion

Discussion Paper



RC: Page 913, line 20, change "flood annual maximum" in "maximum annual flood"; Page 916, line 10, change "annual maximum flood" in "maximum annual flood"; Page 916, line 14, change "annual maximum flood series" in "maximum annual flood series".

AC: We used in all the paper the term "annual maximum flood" that should be correct.

RC: Page 915, line 2, change the sentence "The investigated area includes a number of basins; in "The investigated area includes basins".

AC: This sentence has been reworded.

RC: Page 915, line 3, after "Puglia" add "see Fig.1".

AC: This change has been made.

RC: Page 915, lines 13-14, change the sentence "The mean annual rainfall ranges from minimum values (about 600mm) observed in Puglia and higher values (up to 1800 mm) in Basilicata and Calabria. " In "The mean annual rainfall ranges from about 600mm observed in Puglia up to 1800 mm observed in Basilicata and Calabria. ".

AC: The sentence has been reworded as follows: "The mean annual rainfall ranges from around 600mm in Puglia to more than 1800 mm in Basilicata and Calabria."

RC: Page 916, line 10, change "coefficient" in "coefficients".

AC: We think that the singular is better.

RC: Page 916, line 11, delete "(Ca) in the area".

AC: This sentence has been rephrased.

RC: Page 917, line 22 change "Likelyhood" in "Likelihood".

AC: This change has been made.

RC: Page 914, line 1, Eq.(17) represents a contagious extreme value distribution. The Author should explain better than it is reported in the manuscript, how Eq.(17)

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Discussion Paper



comes from. For example, before Eq.(17) they could write "Assuming that L-type and H-type mechanisms are independent and each of them is associated with a Poisson distributed occurrence process with parameters Λ_L and Λ_H then the probability distribution of maximum annual flood is" and delete the sentence after Eq.(17);

AC: This sentence has been rephrased.

RC: Page 914, line 6, Explain where Eq.(18) comes from. I'm not sure that Eq.(18) is correct.

AC: We checked this equation and it is correct. It is well known, in fact that the sum of two independent Poisson processes give always rise to a third Poisson process with mean value equal to the sum of mean values of the first two.

RC: Page 917, lines 22-24 the sentence "Such a choice was made also to assess that differences between data series as well as their high skewness were mostly due to a physical control rather than to sample variability." is not clear. Please rephrase it.

AC: This sentence has been clarified in the revised version.

RC: Page 917, lines 27- the sentence "Furthermore, in this frame one should note that an effort is made to reduce uncertainty due to short data records, at the price of introducing uncertainty related to soil information which, in a way, is more prone to be knocked down by the advent of new technologies for earth observation. " is not clear. Please rephrase it.

AC: This sentences has been rephrased in the revised version.

RC: Page 918, line 11, I think " $\Lambda_q S \Lambda_q$ " should be changed in " $\Lambda_p S \Lambda_p$ ". Please check it.

AC: The equation was updated, $S \Lambda_q$ was written as a function of k and Λ_q .

RC: Page 918, line 13, change "annual maximum rainfall" in "maximum annual rainfall".

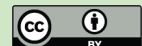
AC: The term "annual maximum rainfall" was not modified because is commonly used

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Interactive Discussion

Discussion Paper



in hydrology.

RC: Page 918, lines 15-17, the Authors write "Assuming the hypothesis of Weibull distribution of rainfall intensity and poissonian occurrence of events, the distribution of annual maxima turns out to be a Power Extreme Value (PEV) type. " Please provide a reference for it;"

AC: The reference was specified.

RC:Page 920, line 11, change "dynamic" in "dynamics".

AC: The sentence has been removed.

RC:The reference Gabriele and Iritano (1994) is not cited in the text. Page 923, lines 32-33, The reference Gioia et al. (2007) is not cited in the text. Page 932, fig.5, the last figure on the left, the label on x axis of is cut.

AC: Both references Gabriele and Iritano (1994) and Gioia et al. (2007) were removed. Figure 5 (now figure 2b) was re-edited.

References

Fiorentino, M., Gabriele, S., Rossi, F., Versace, P.: Hierarchical approach for regional flood frequency analysis, in V. P. Singh (eds), Regional flood frequency analysis, 35-49, D. Reidel, Norwell, Mass, 1987.

Gabriele, S. and Iritano, G.: Alcuni aspetti teorici ed applicativi nella regionalizzazione delle 30 piogge con il modello TCEV, GNDCI-Linea 1 U.O. 1.4, Pubblicazione N., 1089, Rende (Cs), 1994 (in Italian).

Gioia, A., Iacobellis, V., Manfreda, S., and Fiorentino, M.: Climate and soil controls on flood frequency, Proc. of WSEAS International Conferences, 223-230, 2007.

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