

## ***Interactive comment on “Development of IDF-curves for tropical india by random cascade modeling” by A. Rana et al.***

### **Anonymous Referee #2**

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Review of “Development of IDF-curves for tropical india by random cascade modeling” by Rana et al. for Hydrology and Earth System Sciences

In this paper, the authors are trying to develop a stochastic disaggregation model based on the random cascade modeling concept using just six months data of short-duration rainfall from Mumbai, India. The analysis presented and conclusions drawn are not sound due to huge statistical uncertainty associated with the disaggregation model parameters. The paper really lacks clarity and requires thorough revision before it can even become suitable for further review. Based on my extensive previous review experience and knowledge of the field of stochastic hydrology, I find the paper not suitable for publication in Hydrology and Earth System Sciences. The message and conclusions drawn are misleading. Below, I have provided “only” some comments/suggestions that

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can help improving the overall readability of the paper, but I still doubt the usefulness of the analyses.

Title The “i” of india should be in upper case – India.

Abstract L7: It is better to write like: “. . . rainfall data, that were disaggregated . . .” L8: It is better to write like: “. . . 2004 for developing intensity- . . .” L10: It is better to write like: “. . . assuming scale invariance and constant parameters.” It is difficult to understand what is meant by constant parameters. L10: It is better to write like: “For the Mumbai rainfall . . .” L11: Please rephrase this sentence. L12: What is the difference between modeled and disaggregated series? L13: “the” is not required after “for” and before “time” L14: What parameters were allowed to change? Please write clear statements. L17 to 18: Please rephrase. L1 to 18: Abstract needs to be written in a clear and plain language so that an average reader can understand the purpose of the research and findings of the work.

Introduction L20 to 21: These are not the consequences of extreme weather. Please rewrite this sentence. What role the extreme weather events play in pollution control? Please explain. L24: I think it is the modeling of precipitation extremes and not the evaluation. L26: Do you think development of IDF curves is part of theoretical hydrology? Reference style is not correct.

Page 4711 L1: “. . . design of drainage systems . . .” would be better. L1 to 2: Needs to be rewritten. L5: Probably you meant here “short-duration rainfall information” L6 to 8: Stochastic simulation tools are not used for extending historical data. These tools are used to simulate (some) data with statistical characteristics similar to those of the historical data. L6 to 9: This statement is not correct. Please rewrite. L8 to 12: I have no idea how the authors are trying to relate stochastic disaggregation and fitting of probability distributions. Please add additional explanation. L12 to 15: This statement is not correct. Please write clearly. If you do not understand how these models work then try to copy directly the statement(s) from the original references and quote those

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references. L16 to 19: Please rephrase. L22: It is better to write like: "... which may generally be ..."

Page 4712 L1: Probably it is "rainfall intensity" L6: "...over short periods." would be enough. L7: I suppose the quality of data is also applicable for the verification period and not only for the calibration period. L11: I think you meant statistical characteristics and not "character". L17: Probably you meant management or mitigation related issues and not hydrological processes. L19: Probably you meant fine time resolution here. "..., originally developed and evaluated in ..." would be better. L20: "... and Brazilian stations" would be better. L22 to 25: Please write your objectives in a clear and understandable manner. There are some language related issues here.

Page 4713 L3: Is there any difference between "daily accumulated rainfall data" and "daily rainfall data"? If there is none, then use only simple words. L4: If you have already introduced IMD abbreviation then you do not need to introduce it again. L10 to 12: Only six months data is used for model calibration and verification. I really doubt if such a short data can offer any useful and reliable results. There is a huge sampling uncertainty – statistical parameters estimated from longer samples have much smaller variability than those estimated from short samples. L13: Please use "... for both datasets ..." L15 to 17: This is another shortcoming of the short data used for model development. How good are the parameters estimated from a single wet season for simulating a relatively dry season? The issue of addressing the temporal variability is important and just six months data is not enough. You are dealing with stochastic disaggregation that heavily relies not only on the quality of data but also on the amount of data. L23: It would be better to use the word "stations" than "cities". L22 to 25: Please rephrase these sentences. Also explain, how the relationships based on annual and seasonal precipitation amounts would be useful in developing short-duration IDF curves? L26: This is not a correct statement.

Page 4714 L1 to 3: Please explain how this was done. L6: Some description of those principles is required. A reader of your paper should be able to have some feeling

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of those principles before referring to Olsson (1998) for additional details. L8 to 9: Wherein the constant scale-invariant parameters were used? Please describe. L11: "... two properties of the rainfall time series ... " would be better. L13: What do you mean by position in the rainfall sequence? Please explain. L17: "... into two halves of the ..." L18: "... resolution is reached, ..." L18: What do you mean by "first"? Please rephrase the sentence. L21 to 23: Please rewrite by clearly explaining the meanings of various probability notations.

Page 4715 L2: This statement does not make any sense. I understand what you are trying to do but please explain clearly. L4: You need to determine the weights and not the distribution of something. Please correct. L5 to 7: Same problem of ambiguity. Please explain the procedure in simple words in a clear manner. L11 to 16: This explanation can benefit by a schematic diagram. Please include a schematic diagram for each case discussed. L18: Probably, it would be better to state like: "... both halves of the interval will contain non-zero volume ..." L21 to 23: Please rephrase. L26: The validity of this relationship is required to be established. Please include a diagram showing how good is this approximation?

Page 4716 L5 to 12: First you need to prove that  $P(x/x)$  is independent of the time scale and then to prove that  $\alpha$  is time-scale dependent. This can easily be shown using the observed data. L14: How these parameters were estimated? L15 to 16: It is not correct. You should state that "a uniform distribution was assumed for weights". L20 to 22: Please rephrase.

Page 4717 L1: "Based on our evaluation ..." Please include references for the literature. L5 to 8: Please rephrase.

Page 4718 L1 to 9: As mentioned above, no inter-annual variation in the precipitation statistics is considered, which is important to develop a useful model. The six month data cannot provide that variation. If the model is stochastic, then the original parameters (used in simulations) are preserved when their means from a large number of

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simulations are derived. In other words, the parameters obtained from the six months data are required to be preserved by the model, otherwise the model is useless. I have no idea why the authors decided to use mean values from the simulated data and not the original values from the observed data. L11 to 12: This statement clearly proves incompetency. It is difficult to state that a rain storm is associated with a single “intensity” unless the storm is of 1-minute, 1-hour or 1-day duration. The terms like average intensity and maximum intensity are more relevant for rain storms in general. Here, the authors are also talking about frequency or return period. In general, a rain storm is not associated with a return period. These are the various characteristics of a rain storm that could be interpreted in terms of return periods. L12 to 14: It is not necessary that IDF curves can only be developed for shorter duration rainfall. L11 to 17: These appear to me very loose statements and therefore are not sound from a scientific viewpoint. Please rephrase. L25 to 26: I am not sure what the authors are trying to state here. How the choice of the Gumble distribution was made? Please explain.

Page 4719 L9 to 10: This statement and conclusion appears to me not correct. Please demonstrate how the beta slope remains constant with respect to different steps. L15 to 16: Here, you came across with the issues related to short samples. This was pointed out earlier. Page 4720 L1: It is hard to make such a statement due to a short record used in the study. L6: What do you mean by the joint mean?

Pages 4720 to 4723 Sections 3.2 and 3.3: These parts of the paper are written relatively in a better manner than the previous sections as there are less ambiguities and language related issues. The utility of the analyses are really questionable, since there are no other means of verifying the model except the six months data used for development.

Page 4722 L22 to 27: There is no way to verify these intensity values because the underlying model used for disaggregation is based on just one wet season and it does not consider the characteristics of short duration rainfall of average and dry seasons. It is possible, that high intensity values could be an artifact of the underlying disaggrega-

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[Interactive Discussion](#)

[Discussion Paper](#)



tion model, developed from a single wet season. The best strategy should have been to calibrate the model on a wet season and verify it on a dry season and vice versa. This would have unfolded the inherent weakness or usefulness of the disaggregation strategy.

Page 4723 L1 to 2: What is the return period of current design standard? What do you mean by low tide here? L8: How this value (113 mm) is comparable with the ones obtained through disaggregation? Please explain. L8 to 10: It is not possible to make this conclusion since the deficiencies associated with the model development procedure. L12 to 27: Please note that it is not possible to derive such conclusions unless the results have been derived using robust model development procedures. Also, it is difficult to promote that a model developed from just six months of rainfall data would prevail over that developed from a larger set of data. There is a huge statistical uncertainty associated with the parameters of the disaggregation model. How is it possible to promote such a model? In other words, you are trying to say that there is no point in using larger sets of data and just six months data is enough to derive IDF curves to be used for infrastructure design purposes.

Page 4724 and 4725 - Conclusions Please improve the language of this part and present only useful and relevant conclusions and try to avoid unnecessary discussion which is not related to the subject matter of the paper.

Table 1a There are considerable differences between the statistics of both periods and these were not reflected in the parameters of the disaggregation model.

Table 1b This information is not useful and can be eliminated.

Table 3 In the text, you mentioned 1000 realizations and here it is 100. Which one is correct?

Fig. 1 Do you think the volume equation is correct? V1 is already divided into V3 and V4, but V1 is also present in the volume equation.

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Fig. 3 Please describe what do you mean by  $x/x$ ?  $P$  is used to denote probability. In this figure, you are also using it to denote position type. Please use separate notations.

Fig. 4 What does the top title of each panel represent? Please explain in the caption. Do you think there are multiple modeled relations? If so, please explain.

Fig. 5 It is difficult to read this figure. Please increase the font size and increase the size of the figure.

Fig. 6 What are you trying to show here?

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