**Hydrology and
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Discussions

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

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Dear Reviewer

Firstly we would like to extend our appreciation towards your efforts in understanding the importance of our research. We thank the reviewer for an absolutely excellent review. The review lead us to rewrite large parts of the paper including some restructuring in that the methodology part explains the procedure in more detail and the determination of the parameters is dealt with only in the result section. The wording is improved throughout the paper following the suggestions of the reviewer. Definitions are made clear. We have been able to find some extreme hourly rainfall data, which are now included for comparison with our computed rain statistics.

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Please find below the answers for all your queries.

A. Rana et.al.

Response to comments from the reviewer:

The abstract is completely rewritten.

Also the introduction is very much rewritten with more exact wording and with unnecessary information eliminated. The objectives are clearly specified. The key objectives of this study are to (1) test and apply the cascade-type disaggregation model when there are only very limited historical short-term observations, (2) to evaluate the suitability and performance of the approach in a climate (Indian monsoon climate) where it has not been tested, and (3) determine IDF-curves for Mumbai.

The methodology section is divided into four parts: study area and data base; a clear description of the disaggregation technique, and a section on how the parameters are estimated from an aggregation process including a new figure, and finally a section how the idf-curves were determined. The problem with the short series of short-term data is discussed in the result section.

In the original paper top of page 4714 there are some sentences about theoretical probability distributions. This text is following a description on how idf-curves for a place with only daily observations can be estimated from a nearby station from which idf-curves are available. The approach are now explained in a clear way with references to Scandinavian studies.

Page 4714 original paper: the different types of rain boxes are explained using a new figure. Probability notations are strictly explained. The comments from the reviewer very much concerns the loose way of wording and the lack of clear explanation of the procedure. We believe that the procedure now is explained in a clear and strict way.

The eq(1) is given without showing any fit. This eq and the others are moved to the result section so that comparison with observations and calculations can be done.

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Eq(3), commented on by the reviewer (page 4717, L1-3) is removed. Such a relation was found for unpublished Swedish data, but do not fit at all to the Indian observations.

The wording about w-distribution has been corrected.

The only comment from the reviewer we do not agree with is page 4718, L1-9 and followed up on page 4722 L22-27. The formulations were not good so these have been changed. Concerning the content of the text: Yes, 6 months of data are very short and maybe the results are not very reliable. However, concerning wet and dry season, we are only interested of the extremes and there is only very little rainfall in the 6-month dry period, so the 6 month period is as good as a 12 month period. It might be that the reviewer means that there ought to have been a very wet monsoon period and a less wet monsoon period in the data. In that case we agree it would have been good, or many different monsoon periods would have been even better. Since we are interested in the high rain intensities we think it is relevant to show which high values that were computed and compare with some high observations. This explains why we want to keep Table 1 b, and later introduce new tables with comparisons.

Chapter 2.3 (old version – it is 2.4 in the new one). The first part of this chapter is rewritten. There were too many loose statements (reviewer L11-12,12-14,11-17. It was meant to say that idf-curves can describe the rain storm climate at a station. It is clarified that in this paper the focus is on idf-curves that can be used for urban storm water design, and thus includes only storms of short duration. However, we feel it is not fair to judge us as incompetent. IDF-curves tell about the rain climate. A storm may have a return period concerning volume and intensity with respect to duration.

Reviewer p4718 L25-26. Gumbel distribution was used because it is standard in India. The maximum likelihood method was used.

The result section: the first part was rewritten. Concerning the comments on page 4719, the effect of the short tome series is discussed later in the result section. The values of table 2 are shown and discussed before any form of relation with volume

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class is attempted. Joint mean is language problem, it is meant that the same values is used for all the four box position types.

Comment about page 4722 L22-27. See our comments above, but yes this is correct. However, we can compare with extreme hourly observation from another study in which our fourth author was involved, see new reference Zope et al..

Old paper page 4723 L1-2. The tide is not accounted for in the storm water design in Mumbai, but this is irrelevant for the paper and removed. For design 25 mm/hr is used, not considering return period. The very extreme observations are compared with those values found from the disaggregation process including the 113 mm asked for. A new Table is introduced comparing the result from this study with 1-hr storms of different return period given by Zope et al. (new reference).

A discussion of the usefulness of a study like this with only a short-period of short-term rainfall data replaces much of the text on old page 4723-. There is a new chapter " Limited period of data for parameter estimation".

Non-relevant information is removed from the conclusions section. Since the disaggregation based on parameters derived for a very wet year gives lower 1-hr rain intensities than the Zope et al values, it is possible that more intensity classes should be introduced to get better agreement.

Table 1a. The differences are discussed in the result section. Table 1b. We insist on keeping this table since it is used for comparison with the disaggregation results and 1-hour observations in the latter part of the result section. Now also the 2nd, 3rd, 4th and 5th largest values are included. Table 3. Has been changed to 1000. Fig 1. Corrected V=V1+V2=V3+V4+V5+V6 Fig 2 redrawn to show the procedure better A new fig (fig 3 in the new text) shows and explains sequence position Fig 4 (the old test) removed the log-log relation was not used Fig 5 Font size enlarged Fig 6 (old text) We are showing the results from each one of the 1000 realizations, but the fig is unnecessary and is removed. Fig 7(old)= new Fig 6 IDF-curves font size enlarged

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