Hydrol. Earth Syst. Sci. Discuss., 10, C3423–C3427, 2013
www.hydrol-earth-syst-sci-discuss.net/10/C3423/2013/

Hydrology and Earth System Sciences
Discussions

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

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Received and published: 24 July 2013

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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 would also like to thank you for the very constructive feedback on this submission; it has provided us with very handy support in tackling the important issues ahead of researchers in the field.

Please find below the answers for all your queries.

A. Rana et.al.

Reviewer 1: The paper applies partition coefficient/cascade modeling to the disaggregation of daily rainfall records with the purpose of short-duration IDF curve estimation. The data are from Mumbai, India. The modeling approach is a refinement of procedures applied by the authors and others to other precipitation records worldwide. I find the paper interesting and useful, but the authors should make some editing before publication: 1. The language should be improved. This is especially a problem in Section 3.1, where several sentences are unclear. Response: The language has been improved accordingly with reference to suggestions. We have tried to make the sentences clear now.

2. Again with reference to Section 3.1, which deals with fitting the model to data and justifying specific assumptions on the parameters, it would be useful to support the modeling choices like the variation of β with scale, the assumption that P(0/1)=P(1/0), and the dependence of the beta-distribution parameter a on scale in Equation 4. Response: Beta was kept constant for different boxes and was modified to a fixed slope/intercept in accordance to what is suggested in literature. Same has now been emphasised in the text as below: "In order to use the equation α+ βm *vc a mean slope, βm, was determined for each type of box in accordance with equation 2. Thus, the slope β remains relatively constant for the different steps. However, the observed variation was modified to a fixed slope so that the intercept varied with each cascade step (Jebari et al., 2012)."

As per assumption of P(0/1)=P(1/0), it was stressed and motivated with reference in methodology section and same is coted in the text as: "Since, as found by (Güntner et al., 2001), P(0/1) and P(1/0) are generally approximately equal they can be estimated as P(0/1)=P(1/0)=(1-P(x/x))/2."

3. The tables should report all the fitted parameters. I could not find the values of the parameters c1, c2, c3 and c4 in Equations 2 and 4. Table 2 lists values of α cascade

and α model; what are these quantities? Response: Values have been updated in table 2, it should be noted that the values are same in starting and ending box, the updated table 2 is presented in attached file.

4. Figure 3 shows empirical histograms of the partition coefficient and fitted beta distributions. The fitting should be explained, as in some cases (see for example the case in the first row and next-to-last column), the fit is clearly suboptimal. Also, I do not understand the plots of the beta parameter in Figure 4: the observed values do not seem to always fit the data well and the modeled values do not follow from Equation 4. It is critical that results be explained at a level of detail that makes them interpretable and reproducible. Response: The explanation is made clear and the text is modified as below: "Fig. 3 shows fitted beta distributions (lines) to the empirical histograms (bars). The overall fit is reasonable at high cascade steps, i.e. large time scales. The fit is uncertain when the number of values is small i.e smaller cascade steps; model starts to break down at this point. The distribution parameter is close to 1 for cascade step 3 and larger (3 hours or shorter time scale). This is different from what was found in the Swedish study. This in contrast says that the rain intensity may vary during a storm even for the time scales 10-20 minutes. As seen from the Fig. 3 some improvement is achieved when using the beta distribution as compared to a uniform distribution for the lower cascade steps. For the enclosed boxes, which dominate, and the isolated boxes, the fit is good. Fig. 4 shows how the beta distribution parameter a varies with each cascade step. For starting and ending boxes, a is relatively constant and the joint mean appears to be a satisfactory approximation of the observed. Whereas, the fitted parameter is following the general trend of observations and seems to approximate the same in terms of fitting."

References: Güntner, A., Olsson, J., Calver, A., and Gannon, B.: Cascade-based disaggregation of continuous rainfall time series: the influence of climate, Hydrol. Earth Syst. Sci., 5, 145-164, 2001.

Jebari, S., Berndtsson, R., Olsson, J., and Bahri, A.: Soil erosion estimation based on

rainfall disaggregation, J. Hydrol., 436–437, 102-110, 2012.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 4709, 2013.

Table 2: Probabilities P(x/x) as function of volume class, cascade step and type of box ($\alpha_{cascade}$ is observed intercept at cascade step originally and α_{model} is linear assumption- modeled used in model)

Isolated Box (β model = 0.15, c_1 = 0.06, c_2 = -0.01, c_3 = 2.94 and c_4 = -0.20)								
Volume Class/Cascade Step	1	2	3	4	5	6	7	Mean
1	0.00	0.00	0.19	0.06	0.04	0.00	0.00	0.04
2	0.16	0.25	0.24	0.12	0.25	0.10	0.08	0.17
3	0.43	0.36	0.31	0.38	0.40	0.36	0.22	0.35
$\alpha_{cascade}$	-0.12	-0.11	-0.07	-0.13	-0.08	-0.16	-0.21	-0.12
α_{model}	-0.08	-0.10	-0.11	-0.12	-0.14	-0.15	-0.17	-0.12
Starting Box (β model = 0.22, c_1 = -0.26, c_2 = 0.01, c_3 = 4.54 and c_4 = -0.32)								
1	0.19	0.07	0.08	0.09	0.09	0.21	0.21	0.13
2	0.30	0.32	0.23	0.19	0.45	0.35	0.29	0.30
3	0.42	0.53	0.44	0.55	0.53	0.58	0.62	0.52
$\alpha_{cascade}$	-0.09	-0.09	-0.14	-0.12	-0.03	-0.01	-0.02	-0.07
α_{model}	-0.14	-0.13	-0.11	-0.10	-0.09	-0.08	-0.06	-0.10
Enclosed Box (β model = 0.29, c_1 =0.03, c_2 = 0.01, c_3 = 3.84 and c_4 = -0.26)								
1	0.45	0.35	0.28	0.25	0.26	0.47	0.59	0.38
2	0.85	0.75	0.67	0.66	0.73	0.81	0.86	0.76
3	0.97	0.93	0.91	0.94	0.91	0.89	0.95	0.93
$\alpha_{cascade}$	0.21	0.13	0.07	0.07	0.09	0.18	0.25	0.14
α_{model}	0.12	0.13	0.13	0.14	0.15	0.16	0.17	0.14
Ending Box (β model = 0.23, $c_{1\,=}$ -0.26, c_2 = 0.01, c_3 = 4.54 and c_4 = -0.32)								
1	0.15	0.00	0.07	0.09	0.05	0.03	0.07	0.07
2	0.42	0.37	0.18	0.31	0.48	0.29	0.62	0.38
3	0.52	0.56	0.47	0.44	0.60	0.41	0.64	0.52
$\alpha_{cascade}$	-0.09	-0.14	-0.21	-0.17	-0.08	-0.21	-0.01	-0.13
α_{model}	-0.14	-0.13	-0.11	-0.10	-0.09	-0.08	-0.06	-0.10

Fig. 1.