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Interactive comment on "A two parameter design storm for Mediterranean convective rainfall" *by* Rafael García-Bartual and Ignacio Andrés-Doménech

Anonymous Referee #1

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The authors identify convective storms from a 22 year record of continuous rainfall from Valencia Spain. They subsequently fit a two-parameter gamma type distribution to these storms. Through use of principal component analysis these storms are reduced to depend on a single variable which then has a return interval assigned to it. By reversing the process design storms of a given return interval can be obtained. The storms are compared to the alternating block design storm.

Major comments

I am concerned about overlap with Andrés-Doménech et al (2016). Unfortunately I cannot access the full paper (http://www.crcnetbase.com/doi/abs/10.1201/b21902-129) but the abstract states "the processed data is final used to fit the temporal pattern

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of the theoretical model for the design storm based on a Gamma function". From my reading of this manuscript it appears this is a part of the novelty claimed here.

While the above comment warrants significant concern my other comments can be addressed through a rewriting of the manuscript.

I believe the fitting of this gamma-type distribution to temporal patterns is helpful but I also believe the second part of the results, the ability to return three design storms using a single variable, has not been correctly stated. I don't find the claim "for every return period, three storms with different temporal patterns but a similar magnitude are defined" to be correct. The method proposed in this manuscript returns three storms of different duration. And given, in hydrologic analysis, it is prudent to pick storms of differing duration I don't see this as advantageous over existing methods. But, what is advantageous, is that the temporal pattern and depth have been converted to a single variable – and this hence removes the problem (at least partially) of assigning a meaningful return period to something which is composed of multiple variables. I think this just needs careful wording.

It is also worth pointing out in the conclusions that having a single temporal pattern per duration is nowadays not seen as viable for hydrologic modelling. Methods of hydrologic analysis are shifting away from single a temporal pattern for each duration (which is what has been presented here) to either using ensembles or monte-carlo type analysis of observed storm patterns. In fact, even the Huff curves present a range of probabilities for temporal patterns (and not a single curve). The method proposed here almost guarantees a curve which peaks at the start of a storm, while the IDF alternating block model guarantees a storm which peaks in the centre, both of which are constructs of the method and may not be the worst case. For an extended discussion on these Chapter 5 of Book 2 or the recent revision to the Australian Rainfall and Runoff guidelines http://arr.ga.gov.au/arr-guideline is a good resource.

My comments above may seem overly critical, but they should not detract from the

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fact that a very convenient distribution has been found for fitting convective temporal rainfall patterns and that this paper presents an advancement in ensuring the correct return period is assigned to a design storm. I just believe if the authors are to focus on the issues of temporal patterns for hydrologic design the above issues need to be discussed.

Finally, I feel like the comparison of the presented method and the alternating block design is not ideal. An additional comparison which would be more prudent would be to use something like the average variability method (see Pilgirm, 1987) or similar. This would make more sense as the average variability method is trying to construct an average temporal pattern – something which I believe this paper has performed. Again, though, I stress, the notion of a single temporal pattern for design may not be appropriate.

Please also note also that fitting curves to temporal patterns has been attempted in the past: R French & M Jones (2012) Design Rainfall Temporal Patterns in Australian Rainfall And Runoff: Durations Exceeding One Hour, Australasian Journal of Water Resources, 16:1, 21-27, http://dx.doi.org/10.7158/13241583.2012.11465401

Line by line comments

Page 1, Line 8: Can probably remove the second “of”

Page 1, Line 11: Remove “On the former work basis”

Page 1, Line 13: “High” not “Highly”

Page 1, Line 23: “The experienced their major development . . . still unresolved” This sentence is overly vague. What was the development? What was left unresolved?

Page 2, Line 6: “Widespread” – should this be “widely used”? “widely known”?

Page 2, Line 33: Again this is a very vague sentence. What are the conceptual mistakes and unrealistic assumptions? Are you addressing these here in this paper?

Page 3, Line 5: I think you can argue that the temporal pattern has just as much of an influence (see the aforementioned http://arr.ga.gov.au/arr-guideline for a discussion on this as well references on this topic). For example Ball (1994) (doi: 10.1016/0022-1694(94)90058-2).

Page 3, Line 7: Stronger consequences than what?

Page 3, Line 15 and 16: You have one thing being the most uncertain step and another thing being the most challenging task. This seems to be a contradiction and needs rewording.

Page 3, Line 17-23: This could be rewritten as one sentence: "As a design storm is composed of many variables (e.g. depth, duration, temporal pattern, antecedent conditions) assigning a single return period may not be appropriate."

Page 3, Lines 23-30: These lines just state what was performed in this manuscript. This should be rewritten to state exactly the problems this paper is addressing and how it is building on previous work.

Page 4: Could Line 8-24 be moved up and then Lines 1-7 follow. As it stands you state you use a gamma function in Line 3 and then don't actually introduce it till line 25.

Page 5: Not sure if another line can be added between equation 8 and 9 because I sort of missed this step.

Page 5, Line 24: I don't like the use of the word "easily".

Section 2.3: I understand the use of generic terms but I think you just use a delta t of 10 minutes so maybe it would make more sense to just employ that constant in this section (as you have in previous sections with eta1 of 0.05).

Page 8, Line 20: "not a" should be "no".

Section 3.1.1 – A useful reference is Dunkerley, D. (2008), Identifying individual rain events from pluviograph records: a review with analysis of data from an Australian

dryland site, Hydrol. Process., 22(26), 5024–5036, doi:10.1002/hyp.7122.

Page 9, Line 9: “Less” instead of “Lower”.

Section 3.2: I thought the relations were characterized by splitting the storms on critical duration (see Figure 2) not the ratio as stated in Line 5.

Figure 2: I don’t think the colours and symbols match.

Section 3.2: It would be nice to discuss in one line what the different alpha’s mean in practice to the temporal pattern.

Page 11, Line 5: I don’t like the use of the word “tackle” in general. I would prefer “undertaken” or something similar.

Page 11, Lines 20-27: This seems to be just repeating the introduction. It also talks about storage not being important and then states it is important. I would probably just remove this paragraph.

Page 15, Line 10: You state the alternating block method overestimates the volume. But all these temporal patterns are statistical constructs anyway – so we don’t know which is the truth.

Page 15, Line 19: “Most generally . . .” In Spain? In Europe? Around the world? This is not done Australia for example.

Page 16, Line 23: I am still undecided if this is an advantage – counting three storms for every return period. Is it more that the advantage is you have a more robust definition of the return interval in that the depth and temporal have been incorporated into one variable?

Climate change impacts and methodologies for temporal patterns are proposed in Wasko and Sharma (2015) (doi: 10.1038/ngeo2456) and Westra et al (2013) (doi: 10.1016/j.jhydrol.2012.11.033).

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