

# ***Interactive comment on “A stochastic event-based approach for flood estimation in catchments with mixed rainfall/snowmelt flood regimes” by Valeriya Filipova et al.***

## **Anonymous Referee #2**

Received and published: 12 July 2018

article This paper propose a stochastic event-based method for design flood estimation in Norway. The presented approach is described and the results are compared to a flood frequency analysis and a commonly applied design storm approach based on a single design storm. The methods are applied in 20 small to meso-scale catchments across Norway to estimate the 100 and 1000 year return period event. Furthermore, a sensitivity analysis of the model parameters, initial conditions and precipitation input was performed to determine their importance to the resulting flood frequency curve. The results show large differences between the applied methods while the sensitivity analysis shows the importance of the investigated aspects, which helps to explain the large differences.

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The study addresses an important topic, which is relevant also for practical applications, as rather subjective user assumptions are overcome by the stochastic approach. The manuscript fits well into the scope of the journal. A good review on the subject is given at the beginning, however, the proposed stochastic event-based method itself should be explained in a more structured way and the writing could be improved, especially in the second part of the manuscript. Furthermore the presentation and description of the results could be enhanced, as they are sometimes not clear for the reader. There is room for improvement at certain points:

### General Comments:

As I understood, the main purpose of the work is to propose a methodology to overcome the limitations of more commonly applied event based modelling for flood frequency estimations by a stochastic modelling of preconditions, including SWE, and meteorological input. The individual modelling of the different aspects are described in the manuscript, however, it is hard to follow how the different parts are connected. A preceding sub-section with a less detailed step by step explanation of methodology, maybe including a schematic illustration (inputs/ models/ methods / output), could help to better explain the methodology.

For the validation of the disaggregation procedure the disaggregated data were compared against hourly station data. Is this correct? I would be interesting to see how well the disaggregation procedure was performing (For example showing a obs-sim, QQ-plot). It is stated that it works better than equal divisions which is not surprising. What is the advantage of the further equal division to 1h if it is stated that 3-hours are already enough? Further, it is not obvious why the gridded seNorge.no Data are matched to the HIRLAM data if they are in the needed temporal resolution already?

A 1000 years event is extrapolated from daily observation series (length not further

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specified). Furthermore the results are then multiplied by empirical factors, to match sub-daily peak flows. I am not aware of the engineering practice in Norway, however, I am not sure about the meaning of the results by this extreme extrapolation and at least this should be critically discussed.

The sensitivity analysis is interesting, however, also confusing including Figure 7 and Table 3. It is not obvious on what basis the percentage difference is calculated. This is also not clear in the follow up comparison of the methods. What exactly is the calibrated model? Also the section misses an explanation of the shaded area which is prominently displayed in Figure 7. Furthermore, the different precipitations settings tested are not well explained. A table, summarizing the different tested aspects, would help to guide the reader.

The Figures and especially the captions should be improved, as they are often not self-explanatory. This includes also missing units, labels and abbreviations.

Maybe consider a professional language proof reading.

### **Specific Comments:**

The abbreviation PQRUT, used from beginning (abstract), is not introduced on page 4 or rather page 8. Please declare the meaning of PQRUT first time mentioned.

The characterizations of catchments and chosen abbreviations are introduced on P4 and repeated later (P5, I5) without brackets (e.g. “sparse vegetation over tree line (B)” and “sparse vegetation over tree line B”). Either use brackets throughout the manuscript or only use the abbreviation. Additionally by choosing more self-explanatory abbreviations or using full words (eg. forest; marsh), would be easier to understand, especially in Table 1.

P.5 I.15: The last sentence does not contain important informations and could be omit-

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ted

P.6 I.1: The addition “,which can be used for modelling in ungagged basins.” could be omitted, as it seems not connected to the procedure.

P.6 I.2: A citation should be added to the DDD model or the corresponding R-package.

P.6 I.11: In my opinion, the meaning of the “critical duration” rather reflects the link between the duration and intensity of precipitation “events” of a certain probability, than to ensure the modelling of the complete flood hydrograph.

P.6 I.32: “individual risk seasons could have been defined”. One wonders why it was not done? If not so important for the result, please consider to omit this half sentence.

P.8 I.12-17: Please check grammar and style of the section.

P.8 I.28: Was there a specific reason for using the “Gringorten plotting” position?

P.12 I.3: A more detailed explanation what exactly is analyzed here is missing.

P.12 I.25: Maybe the catchment steepness should be introduced in the section “study area”.

P.13 I.25: Why is it peak to volume? I thought it is daily mean to daily max discharge?

Table 1: Missing units. Furthermore, the variables could be sorted and clustered more logically (e.g. temperature and precipitation; Q and AMAX).

Table 3: Why are 100 values sampled? Does T mean the threshold Parameter  $Trt$  ?

Figure 2: Labels and units are missing

Figure 3: Labels and units are missing

Figure 7: is confusing because of the large number of different colored lines. Maybe two plots can help to distinguish between the different aspects as for example the precipitation input and other aspects. The legend is confusing as well. GDP was fitted

to what? Y-Axes should start at 0, x-axes missing a label and to be consistent with the rest of the work it should not exceed 1000.

Figure 8: It is impossible to distinguish between 20 colors. Do the colors have any meaning? If they should be recognizable, numbering would be a better option. The numbers could then also be used in Figure 10, so the link between the performance of the model and the results are given.

Figure 9: What exactly is shown in the plots. Please add a more detailed explanation.

Figure 10: The scale “percentage difference” should be unambiguous. The base of the “difference” should be clarified.

### Technical Notes:

“Figure” and “Table” should start with capitals

Please use the degree symbol e.g. 4° C (P.5 l.10, P.8 l.23 +26,...)

Please use [mm year<sup>-1</sup>] instead of [mm / year]

P.3 l.22: grammar “, as is often used”

P.5 l.3: Subscript i in  $a_i$  and  $A_i$  ( $a_i$  and  $A_i$ )

P.7 l.6: Missing link to “section”

P.7 l.20: Typo: “multivariat” instead of “multivariat”

P.7 l.23: Whitespace, “values,p,”

P.9 l.1: Whitespace, “where,P”

P.9 l.34: Whitespace, “(29

P.11 l.3: Whitespace, “GL(Generalised... ”

P.11 I.10: Typo, “mm//°C”

Check citation “Beven, Keith, . . . 2014”

Check citation “Chow, . . . 1988”

Check citation “Fleig, . . . 2013”

**NHESSD**

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