Hydrol. Earth Syst. Sci. Discuss., 7, C4079–C4083, 2010
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Hydrology and Earth System Sciences Discussions

Interactive comment on "Reliability and robustness of rainfall compound distribution model based on weather pattern sub-sampling" *by* F. Garavaglia et al.

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Received and published: 13 December 2010

Detailed response to the comments of referee 1

We want to thank referee 1 for his accurate and helpful review of our manuscript. In this author comment, we list how each of the remarks provided by the referee was addressed. The comments made by the referee will be referred as RC and printed in bold; the authors' comments and answers as AC.

Concerning the detailed comments

1.1 RC : "Abstract: The reference to the SCHADEX method at the beginning of the abstract is somewhat misleading, since this method is not the core of the paper (see also below)" and "p.6760, line 2: Again, a reference to the SCHADEX method is made mentioning, that the MEWP distribution will be combined with continuous hydrologic modelling. This requires continuous rainfall series, which cannot be provided by a single MEWP distribution. This is confusing. In addition, it seems difficult to access any English paper where the SCHADEX method is explained."

AC: We will eliminate the reference to SCHADEX method from the abstract. Given that no English paper is available to explain this method, a short description will be added in the introduction.

1.2 RC : "p. 6762, Table 1: In Table 1 the MEWP distribution is related to POT sampling, but it seems that weather pattern maxima are used (there if no reference to selected thresholds)? It also seems that only data within the "Season at risk" are used? Please, make this more clear."

AC: The MEWP is based on POT sampling. The threshold is chosen equal to the 70% empirical quantile of each weather pattern sub-sample. This choice was checked on Mean Residual Life (MRL) plot. It proved to be a good compromise for the whole dataset (Garavaglia et al., 2010). In order to take into account the seasonal effect, the same seasonal sampling is used for the six probabilistic models. The comparison showed in this paper concern only the data within the "Season at risk". Our new formulation becomes:

"... the seasonal rainfall records are split into several sub-samples corresponding to each WP. For the MEWP, an exponential distribution is fitted on a POT sampling of each WP sub-sample. For the MGPWP, a GP distribution is used. The seasonal distribution is then defined as the composition, for a given season, of all WP sub-sample marginal distributions, weighted by the relative occurrence of each WP. A comprehen-

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sive discussion on the threshold selection can be found in Garavaglia et al. (2010) ..."

1.3 RC : "p. 6763, line 9: I think the quantiles are related to non-exceedance probabilities and not to frequencies."

AC : We will replace "empirical quantiles with frequency ..." by "empirical quantiles at values ...".

1.4 RC : "p. 6763, line 12: The authors use a large set of daily data. What about shorter (or longer) rainfall durations? Are in the GRADEX/ SCHADEX methods only daily rainfall data used? Can this method mitigate the problem of poor availability of long time series with a sub-daily resolution? Please discuss this issue."

AC : Two questions in fact : will the results be the same (good performance of the MEWP model) with another time step? Do we use only daily rainfall data in the GRADEX/SCHADEX methods?

For the first question we propose to add this sentence in the discussion section: "In conclusion for daily data, the MEWP distribution presents a good level of reliability and robustness with respect to the proposed criteria. These conclusions may be different with sub-daily data. It would be interesting to carry out the same kind of study based on hourly time-series even if data availability would then be an issue especially for the robustness of the results."

For the second question: SCHADEX method can be applied with shorter or longer rainfall durations (e.g. 6h, 12h, 48h). The appropriate time-step depends on the watershed. It should be close to the characteristic duration of floods produced by rainfall events (roughly, such as peak-to-volume ratio of major floods is around 1.5).

1.5 RC : "p. 6764, line 17: Statistically it is correct to exclude stations with trends. From Table 2 it seems that a large number of stations have been excluded

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because of trends. So, for practical design the question arises how to deal with that problem. It cannot simply be neglected. A brief discussion of this problem would be useful here."

AC : In fact, only 7 among 44 of the long time series have been excluded because of trends (there was a mistake in the original formulation). The new formulation becomes:

"For both datasets, the most severe test has been the criterion on the percentage of missing value. For instance, concerning the long dataset, only 44 stations over 308 (14%) were selected. Among these remaining series, the trends detection led to discard 7 more stations."

At this time we have no operational method to deal with that problem in our industrial studies. It is a concern for us and we have some ongoing development to propose solutions.

1.6 RC : p. 6770, Eq. (4): This equation is not easy to understand. May be it can be commented somewhat more. Is bootstrapping used here also to assess the confidence intervals?

AC : We will comment more in details the meaning of the equation 4 in order to provide a clearer explication (both in the text and in the caption of Fig.4). We will specify that bootstrap method is used to compute confidence intervals.

1.7 RC : Fig. 6-8: The x-axis in those figures is labeled "frequency". I think it is here referred to the "empirical non-exceedance probability" or the "cumulative frequency". Also, in the text frequency is used several times when cumulative frequency is meant.

AC : We will change "frequency" with "cumulative frequency" in the Fig.6-8. We will also do the same change in the text when cumulative frequency is meant.

1.8 RC : Fig. 6-8: I would suggest to make it more clear, that the probability distributions are estimated from criteria obtained from all stations. This may be

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mentioned in the figure captions.

AC : Reference to the dataset will be added in captions of figure 6, 7 and 8.

References

Garavaglia, F., Gailhard, J., Paquet, E., Lang, M., Garçon, R., and Bernardara, P.: Introducing a rainfall compound distribution model based on weather patterns sub-sampling. Hydrol. Earth Syst. Sci. Discuss., 7, 313-344, doi:10.5194/hessd-7-313-2010 (2010).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 6757, 2010.