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Hydrology and Earth System Sciences Discussions

Interactive comment on "Regional frequency analysis of heavy precipitation in the Czech Republic by improved region-of-influence method" *by* L. Gaál and J. Kyselý

L. Gaál and J. Kyselý

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We would like to thank all three reviewers for their useful comments and suggestions to improve the paper, which will be implemented in the revised manuscript.

Since the main comments of (Anonymous) Referee #3 have already been addressed in a detailed reply (Gaál and Kyselý, 2009), we confine ourselves to the comments and suggestions of the other two referees in this response.

REFEREE #1:

In his short comment, (Anonymous) Referee #1 expressed general agreement with the comments of Referee #3 as well as with the authors' reply (Gaál and Kyselý, 2009),

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and did not raise any particular question and/or suggestion that should be addressed herein.

REFEREE #2 (Paola Allamano):

QUESTION #1: "Is the choice of Lu and Stedinger test related to your Monte-Carlo simulation scheme, in which a GEV distribution is assumed as the "true" distribution? You could use instead the Hosking and Wallis test, which is also affected by this problem, but at a lower degree, assuming a more flexible 4 parameter kappa distribution."

REPLY #1: The link between choosing the GEV-based homogeneity test of Lu and Stedinger (1992) and assuming GEV distribution as "true" distribution during the Monte Carlo simulation procedure stems from the fact that the GEV distribution was identified as the most suitable for the frequency analysis of k-day precipitation totals in the Czech Republic (Kyselý and Picek, 2007). The GEV-based Lu and Stedinger test is a reasonable choice in this case. Fill and Stedinger (1995) reported that powers of the Lu and Stedinger (1992) and Hosking and Wallis (1993) homogeneity tests are nearly the same. In the area under study, Kyselý et al. (2005) showed that both homogeneity tests perform similarly in the process of delineation of homogeneous regions. Of the two tests, we preferred the one of Lu and Stedinger due to computational reasons: there are no simulations needed (cf. Fill and Stedinger, 1995, p. 96), since one may use tables for the asymptotic variance and small sample corrections provided by Lu and Stedinger (1992).

QUESTION #2: "I would also ask to the Authors to comment on the selection of the pooling methodology (modified version of Castellarin et al., 2001). [...] In my point of view, the fact of using basin characteristics, and not data statistics, to pool sites is not only done to include ungauged basins in the regions. The underlying objective of regionalization is to increase the information available locally. For example, a site could not have been interested by major events because of its limited historical record, so it is useful to use data from a "meteorologically/morphologically similar" site in which major

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events happened. The two sites, in fact, would have very different "statistics" because sample of variability, not because of heterogeneity."

REPLY #2: The pooling scheme for modeling the "true" distribution in the simulation procedure was proposed by Castellarin (2007), in a reply to our previous paper related to the ROI methodology (Gaál et al., 2007; in final form Gaál et al., 2008). Castellarin et al. (2001, p. 279, sect. 4.3) also defined the sites' similarity according to site statistics of the data samples. Further arguments for selecting the similarity measure based on site statistics (and, against a measure based on site characteristics) for the estimation of "true" distributions are as follows: i) L-moments and L-moment ratios have favourable properties: they are unbiased for short samples, and are not much sensitive to the presence of outliers (e.g. Sankarasubramanian and Srinivasan, 1999). ii) In the particular case of the ROI analysis of precipitation data in the Czech Republic, there are no "limited historical records": data samples with approximately equal record length were available over 1961-2005. There may be cases when a major event is recorded at a given site and not in its proximity; however, such cases are related to spatial variability of the rainfall producing processes. iii) Compared to a flood frequency analysis in which plenty of potentially applicable site characteristics (different geological and/or geomorphological descriptors of catchments) are available, in a precipitation frequency analysis there is a lack of site characteristics that are useful and, at the same time, can be derived in a straightforward way. If the simulation of the "true" distribution should be based on site characteristics, then it would be reasonable to choose other descriptors then those utilized in the actual "geo" and "cli" pooling schemes. In this case, however, one would face difficulties in finding a proper set of "new" site characteristics that should serve as the similarity measures in the estimation of the "true" distribution.

QUESTION #3: I agree with referee # 3 that a promising way to expand the current scope of the paper would be to analyse more (shorter) rainfall durations with the aim to ultimately develop ROI-based regional rainfall-duration-frequency models for the study area.

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REPLY #3: We repeat our reply to the comment of Referee #3 (Gaál and Kyselý, 2009): The scarcity of precipitation recordings on a sub-daily scale (low number of rain-gauge records with reliable measurements, which are, moreover, mostly not digitized and double-checked at this stage) makes the development of an ROI-based regional rainfall-duration-frequency model for the study area impossible at the moment. However, it should definitely be considered as a useful future application and extension of the methodology.

REFERENCES:

Castellarin, A., Burn, D. H. and Brath, A.: Assessing the effectiveness of hydrological similarity measures for flood frequency analysis. J. Hydrol., 241(3-4), 270-287, 2001.

Castellarin, A.: Interactive comment on "Region-of-influence approach to a frequency analysis of heavy precipitation in Slovakia" by L. Gaál et al., Hydrol. Earth Syst. Sci. Discuss., 4, S905-S910, 2007.

Fill, H. D. and Stedinger, J. R.: Homogeneity tests based upon Gumbel distribution and a critical appraisal of Dalrymple test. J. Hydrol., 166(1-2), 81-105, 1995.

Gaál, L. and Kyselý, J.: Interactive Comment on "Regional frequency analysis of heavy precipitation in the Czech Republic by improved region-of-influence method". Hydrol. Earth Syst. Sci. Discuss., 6, S78-S84, 2009.

Gaál, L., Kyselý, J. and Szolgay, J.: Region-of-influence approach to a frequency analysis of heavy precipitation in Slovakia. Hydrol. Earth Syst. Sci. Discuss. 4(4): 2361-2401, 2007.

Gaál, L., Kyselý, J. and Szolgay, J.: Region-of-influence approach to a frequency analysis of heavy precipitation in Slovakia. Hydrol. Earth Syst. Sci., 12, 825-839, 2008.

Hosking, J. R. M. and Wallis, J. R.: Some statistics useful in regional frequency analysis. Water Resour. Res., 29, 271-281, 1993.

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Kyselý, J. and Picek, J.: Regional growth curves and improved design value estimates of extreme precipitation events in the Czech Republic. Climate Res., 33, 243-255, 2007.

Kyselý, J., Picek, J. and Huth, R.: Modelling extreme precipitation events in the Czech Republic using the regional approach. In: Michaelides, S. C. (ed.): Proc. 7th Panhellenic Int. Conf. on Meteorol., Climatol. and Atmos. Physics, Vol B., University of Cyprus, Nicosia, 549-556, 2005.

Lu, L.-H. and Stedinger, J. R.: Sampling variance of normalized GEV/PWM quantile estimators and a regional homogeneity test. J. Hydrol., 138(1-2), 223-245, 1992.

Sankarasubramanian, A. and Srinivasan, K.: Investigation and comparison of sampling properties of L-moments and conventional moments. J. Hydrol., 218(1-2), 13-34, 1999.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 273, 2009.