**Hydrology and
Earth System
Sciences
Discussions**

Interactive comment on "Region-of-influence approach to a frequency analysis of heavy precipitation in Slovakia" *by* L. Gaál et al.

A. Castellarin (Referee)

attilio.castellarin@unibo.it

GENERAL COMMENTS

The manuscript presents a comprehensive application of the ROI approach (Burn, 1990) for frequency analysis of rainfall extremes in Slovakia. The topic addressed by the Authors is, in my opinion, relevant to the journal. Also, the study is clearly presented, and the quality of the Slovakian national dataset appears to be good. Nevertheless, I have two major comments that the Authors should address before resubmitting their manuscript to HESS.

As I detail below, my major comments concern: 1) previous literature that is particularly relevant to the study and that has not been considered, and 2) the way in which the

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

EGU

Authors designed the Monte Carlo simulation experiments. These two points affect the degree of originality of their study and the general validity of its results.

Therefore, I warmly encourage the Authors to resubmit the manuscript after a major revision that addresses all comments reported below.

SPECIFIC COMMENTS

1. ORIGINALITY OF THE STUDY

The Authors state that the main innovations of their study consist of an application of the ROI approach "for the modeling of probabilities of heavy precipitation amounts" (see e.g., lines 10-13 on p. 2632 of the abstract; lines 13-14 on p. 2366) and the use of "alternative ways of defining the between-site similarity [Ě] by means of the long-term characteristics of precipitation climate and geographical proximity of the stations." (see lines 9-12 on p. 2366).

I do not think that these concepts and ideas are original in the context of regionalization of rainfall extremes. The ROI approach belongs to a broad class of regionalization procedures called focused pooling techniques (see for instance Reed et al., 1999). The scientific literature counts several applications of these concepts to frequency analysis of rainfall extremes. Schaefer, (1990), Alila (1999), Faulkner (1999) are only a few examples of focused-pooling techniques applied to regional frequency analysis of rainfall extremes. Also, all these studies use physical characteristics (Mean Annual Precipitation, MAP; geographical proximity) to define between-site similarity.

The FORGEX method (Faulkner, 1999) adopts geographical proximity, while Schaefer (1990) and Alila (1999) use local value of MAP for identifying homogeneous pooling groups of sites. In particular, by adopting the regional models proposed by Schaefer (1990) and Alila (1999) one may estimate the statistics of rainfall extremes in ungauged sites by using only an estimate of the local value of MAP, which for instance can be retrieved from an contour-line map (see also Di Baldassarre et al., 2006).

The authors should consider all these studies in the manuscript and assess the degree of novelty of their analysis with respect to this relevant literature.

2. MONTE CARLO SIMULATION EXPERIMENT

I list here three main comments on the Monte Carlo experiments performed in the study.

2.1 The analysis shows that the pooling schemes that adopt the at-site statistics to identify homogeneous groups of sites (i.e., a1o1, a1o2 and a1o3 - see section 3.1.1) outperform all other alternatives. In my opinion, an additional regional model should be considered in order to have a fair comparison. The performance of the "a1" pooling schemes should be assessed against a traditional regionalization model in which the fixed regions are identified using the same information (i.e., at-site statistics of rainfall extremes), for instance by using cluster analysis.

2.2 More importantly, over the last decade a consensus emerged that focused-pooling techniques and, more in general, regionalization should not use at-site statistics for identifying homogeneous groups of sites. To list a few reasons, this pooling approach should be avoided because it does not consider physical characteristics or processes, it is not applicable for ungauged sites and it impacts the homogeneity-testing phase. Since homogeneity is generally tested on the basis of at-site statistics (see e.g. Hosking and Wallis 1997), with this regionalization approach one would pool the regional data and test the homogeneity of the pooling-group using the same information.

2.3 The study selects the GEV at-site quantiles as reference measures ("true" quantiles, pp. 2379, 2380). The sampling variability of these measures is rather high, and this may impact the significance of the Monte Carlo experiments.

A possible way to address points 2.1-2.3 simultaneously would be to test the performances of the six pooling schemes a2o1- a2o3 and a3o1- a3o3 against the alternatives: "at-site", HW3r and HW1r (see section 4.2) by adopting one of the "a1" pooling

alternatives (according to the study they all perform similarly, see p. 2385, line 8) to compute the "true" quantiles, instead of the at-site quantiles. This strategy, analogous to the one used in Castellarin et al. (2001), would eliminate the necessity to include an additional regionalization model (point 2.1), would remove the alternatives "a1" from the proposed set of pooling schemes (point 2.2), and would refer to "true" quantiles which are less sensitive to sampling variability (point 2.3).

In my opinion, this modification of the study would improve the significance of the analysis, leading to results with a higher relevance to the problem of prediction in ungauged sites, which is currently a highly debated topic in hydrology.

TECHNICAL SUGGESTIONS

p. 2363, line 5 - A citation of the 5T guideline (Jakob et al., 1999) would fit nicely here.

pp. 2367 and 2368 - Are the 2-day rainfall depth maxima suitable for characterizing the frequency of convective storms? Shouldn't we refer to shorter duration (hourly, sub-hourly)?

p. 2369, line 19 - "only the Euclidian distance metric is used", I disagree, see Čunderlík and Burn (2006), also cited in the manuscript.

p. 2373, line 12 - "The spatial distribution of the mean annual precipitation (MAP) exhibits strong variability"; concerning this point, the Authors should comment on regional approach proposed by Schaefer (1990) and Alila (1999) and its possible application to the Slovakian conditions.

Section 3.4 - Is the reference to confidence intervals of estimated quantiles really useful in the context of this analysis?

p. 2386, line 21 - "The results demonstrate that the at-site approach to frequency analysis is the least suitable method for the estimation of heavy precipitation quantiles". It does not seem so for small recurrence intervals (T<10-20 years) from Tables 1-3 and Figures 3-5, but this is a consequence of the selected "true" quantiles. Also, refer to

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

point 2 of section Specific Comments in this review.

Boxplots of Figures 3-5 - Please, increase font size.

REFERENCES

Alila, Y., A hierarchical approach for the regionalization of precipitation annual maxima in Canada, J. of Geophys. Res., 104(D24), 31,645-31,655, 1999.

Burn, D. H., Evaluation of regional flood frequency analysis with a region of influence approach, Wat. Resour. Res., 26, 2257-2265, 1990.

Castellarin A., D. H. Burn and A. Brath, Assessing the effectiveness of hydrological similarity measures for flood frequency analysis, Journal of Hydrology, Volume 241, Issues 3-4, 270-285, 2001.

Čunderlík, J. M. and Burn, D. H.: Switching the pooling similarity distances: Mahalanobis for Euclidean, Water Resour. Res., 42(3), W03409, doi:10.1029/2005WR004245, 2006.

Di Baldassarre G., A. Castellarin, A. Brath, Relationships between statistics of rainfall extremes and mean annual precipitation: an application for design-storm estimation in northern central Italy, Hydrology and Earth System Sciences HESS, 10, 589-601, 2006.

Faulkner, D., Rainfall frequency estimation, In: Flood Estimation Handbook, Vol. 2, Institute of Hydrology, Wallingford, UK, 1999.

Hosking, J. R. M. and Wallis, J. R.: Regional frequency Analysis, Cambridge University Press,New York, 1997.

Jakob, D., Reed, D.W., Robson, A.J., 1999. Choosing a poolinggroup. Flood Estimation Handbook, vol. 3. Institute of Hydrology, Wallingford, UK.

Schaefer, M.G., Regional analysis of precipitation annual maxima in Washington State,

Water Resour. Res., 26(1), 191-131, 1990.

Reed, D. W., Jakob, D., Robinson, A. J., Faulkner, D. S. and Stewart, E. J. (1999) Regional frequency analysis: a new vocabulary. Hydrological Extremes: Understanding, Predicting, Mitigating, Proc. IUGG 99 Symposium, Birmingham, IAHS Publ. no. 255, 237-243.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 2361, 2007.

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

EGU