

Interactive comment on “A global evaluation of streamflow drought characteristics” by A. K. Fleig et al.

A. Cancelliere (Referee)

acance@dica.unict.it

Received and published: 3 January 2006

The paper presents an application of the threshold level method to several daily streamflow series representative of different hydrological and climatological conditions. First, three different pooling methods to eliminate the effects of mutually dependent droughts are applied and a sensitive analysis of their parameterization is carried out. Then, a frequency analysis based on Partial Duration Series oriented to the fitting of the probability distribution of annual maximum series is presented. Although the adopted methodologies are not novel, yet the paper provides an important contribution since it presents in a clear way their application to streamflow series characterized by different hydrological regimes, thus providing good insights on the pro/cons of each methodology. The paper is in general technically sound and can be considered original in light of the broad typology of hydrological conditions analyzed. It is an interesting paper that

deserves publication in HESS journal, since it provides some qualitative and quantitative criteria to select the preferable methodology to pool mutually dependent droughts, based on the hydrological regime of the underlying streamflow series.

Comments:

The paper gives the overall impression that the selection of the threshold level and of the parameters of the pooling methodology (e.g. the time scale of the MA) can be done in an objective way, purely as a function of the hydrological features of the analyzed series. Although the hydrology certainly plays a central role on such selection, yet some words should be added about the ultimate subjectivity of the drought analysis due to the lack of an universal definition of drought. More specifically, the idea behind the threshold level method is the comparison between an hydrological series and a "demand" series. It follows that the choice of the threshold should be carried out by taking into account (either explicitly or implicitly) such demand, rather than selecting a threshold equal to a pre-fixed percentile of the flows. In other words, it should be mentioned that ultimately it is the purpose of the analysis that should drive the selection of the threshold and/or of the pooling methodology, and not just the outcome of some "blind" analysis of the data.

Similar considerations can be drawn regarding the choice of the time scale of the analysis. At page 2430, lines 9-12, it is stated that "more detailed information can be obtained from drought...on shorter time resolutions...", implying that shorter time scales (e.g. daily) should always be preferred. The choice of the time scale should be carried out on the basis of the objective of the analysis and not on the basis of data availability. Obviously, different time scales should be used if the purpose is to analyse droughts with reference to a large multi-year reservoir, or to a river for navigation.

The selection of the "optimal" parameters for the pooling procedures is carried out on the basis of a sensitive analysis of the first moments of drought characteristics to such parameters. As correctly pointed out by one of the other referees, one may wonder

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about the effects of the pooling procedure on the higher moments. For instance, a small section could be added, where a sensitivity analysis of the pooling parameters on the estimated quantiles (and/or values corresponding to a fixed return period) could be presented.

Minor comments:

Some references to alternative methods for drought frequency analysis should be added. For instance, Shiau and Shen, (2001), for estimation of return period of multiyear droughts, Bonaccorso et al., (2003), and Salas et al., (2005) for the derivation of the probability density function of drought characteristics in the univariate and multivariate cases respectively.

Other applications of pooling procedures to monthly series could be referenced, for instance, Correia et al., (1987). Also, the MA criteria has been applied by Cancelliere et al., (1995) to monthly streamflows of different hydrological regimes.

Page 2434, line 24, "With a daily time scale..." is misleading, since the occurrence of minor droughts and mutually dependent droughts is a common problem of the run method, even at much larger time scales.

Page 2442, lines 2-4 could be moved before page 2441, line 25, "Due to...".

Use of drought characteristics terminology should be consistent, as confusion may arise. For instance page 2445, line 4, "drought deficit" is mentioned, but probably "drought deficit volume" should be used. Also the term "magnitudes" is used but it is not clearly defined what it is referring to.

In Table I, please check the units of the 6th column (Station Altitude)

References

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