

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

**A. K. Fleig et al.**

Received and published: 13 February 2006

### Author Comment

We want to thank the referee Dr. Cancelliere very much for his positive response to our article and his valuable comments. Please find below our response to the comments regarding the content of the article. Technical comments will be accounted for in the revised text and are only mentioned here in case we do not agree completely.

Dr. Cancelliere: “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

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

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."

- We agree that the ultimate subjectivity of defining drought is an important aspect and it will be stressed more explicitly in the revised text. Some information about the choice of threshold level in general and for this study in particular will be added (see also: response to comment by referee #1 to page 2424, lines 13-22). This will also include a short discussion about the differences in defining drought and choosing a threshold level for at site studies and regional studies which focus on the spatial aspect of drought. Droughts are commonly defined with respect to a certain water demand or as periods drier than normal for at site studies. The definitions vary considerable according to different kinds of water usage and hydroclimatological conditions. However, for a regional study focusing on the spatial aspects of drought the definition and identification of drought events has to be consistent throughout large regions with varying hydroclimatological conditions. For these studies droughts have to be defined according to the streamflow regime. Still the definition of drought is subjective and varies between studies by different authors (see also: response to second comment by referee #1) .

Dr. Cancelliere: "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 analyze droughts with reference to a large multi-year reservoir, or to a river for

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)

navigation.”

- We agree, and information about the choice of time scale will be added (see also: response to comment by Dr. Vicente Serrano to page 2430: 1st paragraph).

Dr. Cancelliere: “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 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.”

- The suggestion to analysis the sensitivity of estimated quantiles to the chosen pooling parameters is very interesting, and we will try to implement it.

Dr. Cancelliere: “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.”

- The reference to Cancelliere et al. (1995) will be included as it deals specifically with streamflow drought.

Dr. Cancelliere: “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.”

- The text will be changed.

Full Screen / Esc

Print Version

Interactive Discussion

Discussion Paper

Dr. Cancelliere: “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.”

- The term “magnitudes” is chosen to encompass both “deficit volume” and “duration” (see page 2444 line 21-22); this sentence will be changed into: “É and the magnitude of the events, which is here expressed as deficit volume or duration.” - The term “drought deficit” on page 2445 in lines 10 and 11 will be replaced and the sentence changed into: “It is assumed that the drought deficit volumes (durations) are independent, identically distributed (iid) random variables”.

Additionally included references

Cancelliere, A., Ancarani, A. and Rossi, G.: Identification of drought periods on stream-flow series at different time scales, in: Water Resources Management under Drought or Water Shortage Conditions (ed. by Tsiourtis, N.X.), Balkema, Rotterdam, 1995.

---

Interactive comment on Hydrology and Earth System Sciences Discussions, 2, 2427, 2005.

[Full Screen / Esc](#)[Print Version](#)[Interactive Discussion](#)[Discussion Paper](#)