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Hydrology and Earth System Sciences Discussions

Interactive comment on "Low-frequency variability of European runoff" *by* L. Gudmundsson et al.

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An interesting manuscript, which tries to relate the partition of long-term and short-term runoff variance to catchment and atmospheric properties. However, it has a few major technical shortcomings, which prevent me, and possibly other HESSD reviewers and readers, from believing the validity of the claimed relations.

Major shortcomings

(1) No error bars of the proportions (PHI_Q, PHI_P, PHI_T) are given. An analysed runoff series has a finite number (n = 456) of data points, which are noise influenced (e.g., measurement, uncertainty in runoff-water stage calibrations). The resulting val-

ues are therefore estimates of the true, but unkown PHI values. Without error bars, it is impossible to infer whether the relations, spatial groupings etc. are statistically significant or mere coincidence. Error bars might be calculated using classical methods (assuming Gaussianity and taking the chi-squared distribution of the variance estimator) or resampling methods (less restrictive assumptions), see, for example, Mudelsee (2010: Ch. 3).

(2) No sensitivity study is given, which would favourably lead to an assessment of how strong the PHI estimates depend on the lambda choice in the STL algorithm. If PHI estimates do not strongly depend on lambda, then the results are robust in this respect, and the validity of the conclusions is raised.

(3) Since choice of usage of the STL method itself seems somewhat ad-hoc, two other methods of PHI estimation should also be considered. Both are based on the estimated variance per frequency, that is, the estimated spectrum. The first spectrum estimation method would be nonparametric, that is, multitaper spectrum estimation. The resulting PHI values would directly follow from the areas under the spectrum for f < 1/year and f > 1/year (de-seasonalized series), error bars could be calculated from (a) bandwidth (frequency resolution) and (b) confidence intervals of estimated spectral power. On spectrum estimation, see, for example, Mudelsee (2010: Ch. 5) and references given therein. The second spectrum estimation method to be used would be parametric: fitting an ARFIMA or other long-memory stochastic process (see review by Koutsoyiannis) to the data (e.g., Beran 1994) and taking the analytically given spectrum of that fitted process. Error bars may result from uncertainties of the determined ARFIMA parameter estimates via simulations.

If those two other, spectrum-based methods would deliver a similar picture of PHI estimates, the results of the paper would be more convincing.

References:

Beran J (1994) Statistics for Long-Memory Processes. Chapman and Hall, Boca Raton, FL, 315 pp.

Mudelsee M (2010) Climate Time Series Analysis: Classical Statistical and Bootstrap Methods. Springer, 474 pp. [www.manfredmudelsee.com/book/]

Minor shortcomings (list may be not complete) and comments

(4) Title/abstract Let the word “river” appear at a more prominent position.

(5) p. 1707/l. 1/2 The online PDF hyphenates incorrectly (evap-otranspiration), which may not be the fault of the authors.

(6) Introduction The manuscript should explicitly mention the Hurst phenomenon, which it basically includes in its analysis (see review by Koutsoyiannis). Line 23/24: is it actually true that “little is known” about that?

(7) Eq. (1) Define f.

(8) p. 1710, l. 3 Give reference for daily runoff data.

(9) p. 1710, l. 14 Define acronym STL.

(10) p. 1710, l. 21/22 “. . ., thus allowing for trends in the seasonal pattern”. Fig. 2, third panel from top, seems to contradict this statement: a uniform seasonal pattern.

(11) p. 1711, l. 2 Motivate applicability of the formula (1.5 p)(1-(1.5/lambda)), why not use another formula? (It is clear that lambda_seas = 4561 » 1 and the resulting value of the expression is about 18, it is then taken closest odd integer of 19, while 17 would also work; but this is not the point here.)

(12) Sect. 3.1 The manuscript should explain STL fully, in a way that HESSD readers may replicate the findings, without the need to turn to Cleveland et al. (1990).

(13) Sect. 3.2 Motivate usage of Spearman’s correlation in favour of Pearson’s correlation. Note: Spearman (1904) instead of Spearman (1987)!

(14) p. 1711, l. 15 *von* Storch.

(15) p. 1711, l. 13/14 “. . . if the underlying manifold is nonlinear”: this manuscript has to explain this expression to HESSD readers in an accessible language.

(16) References Manuscript should not give page numbers where refs are cited.

(17) References Manuscript should not include what as appears as remnants of the literature database software of the authors (e.g., Barlow et al. 2001 has “<2105:EPDVAU>2.0.CO;2,”).

(18) References Manuscript should use consistent citing of titles (lower case of words in title except first word and names). Do not give ISBN of books. Give last access dates for URLs.

(19) References Correct citation for Spearman’s rho is (note year!): Spearman C (1904) The proof and measurement of association between two things. The American Journal of Psychology 15: 72-101.

(20) Table 1 Manuscript must explain how p-values are calculated, especially, how the reduction of the degrees of freedom owing to spatial dependences are taking into account. If spatial dependence is ignored, resulting p-values are too small and overstatements follow.

(21) Figure 2 Instead of artificially adding the series mean (which is not given numerically), the manuscript should adjust the y axes for visualisation purposes.

(22) Figure 5 The colour code is not explained.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 1705, 2011.