Hydrol. Earth Syst. Sci. Discuss., 3, S114–S118, 2006
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European Geosciences Union

Hydrology and Earth System Sciences Discussions

Interactive comment on "Mapping mean and variance of runoff in a river basin" *by* L. Gottschalk et al.

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Received and published: 31 March 2006

1. GENERAL COMMENTS

This is a landmark paper. If we are to make progress in scientific hydrology we need to deal with spatial and temporal hydrological variability in a consistent way and here the paper proposes a clever way forward. The paper is technically sound and the assumptions made in the paper are consistent with the exploratory nature of the analysis. Although all the processes are assumed to be linear this is an obvious starting point. There are numerous developments that could flow from this theory which will be interesting to see in the future.

The paper is written clearly but it is not an easy read. I have a number of minor comments that may assist in enhancing the readability of the paper.

2. DETAILED COMMENTS (P=page, L=line):

P300 L1-5 I would suggest to replace the first lines of the abstract by something like this: "The study presents an approach to represent the two first order moments of temporal runoff variability as a function of catchment area and aggregation time interval, and to map them in space. The problem is divided into two steps. First, the first order moment (the long term mean .."

P302 L4-5 " in theory .. observations allow us .. time resolution" I do not think this is the case. Today, runoff data are usually collected by data loggers in most countries of the world and these are almost instantaneous values. Also, "resolution" usually refers to sampling rate which is not what is meant here. Perhaps replace by "aggregation time interval" or something similar.

L7 and L8 "space A and time D": I would suggest to replace this by "as a function of catchment area and duration" which is quite different from space and time (coordinates) even though the units are the same.

P304 L23 "the discharge stations are shown in Appendix A": I think this should read ".. are shown in Fig. 1".

L27: Please say how long the runoff records were.

P305 L3-4: I do not understand "around zero" Suggest to leave it out.

L24: More rapidly than what?

L24: "time scales" is ambiguous - lag or interval? If interpreted as interval - as suggested by the mention in the previous line - I would have thought the opposite is the case.

P309 L23: Add "and rho is a one-dimensional correlation function to be specified."

L23: I think "h/v" should read "lambda/v"

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P310 L21-22: Maybe I have missed something but I think the two lines should read ".. is independent of time of concentration because the aggregation is linear and it is unity as it represents a normalised value (see Eq. 3)."

P311 L8-9: It is not the distances but the points that are chosen at random, i.e. according to U(O,T). The sentence should hence read ".. distances h between two points chosen at random within the two line segments that are separated by a specified distance tau. For .."

L10: "-" should be replaced by ", ".

P313, L6 "approximated by a linear reservoir": I suspect there are implicit assumptions that go with this statement. Do the authors imply here that local runoff is a random variable that is uncorrelated in space and time which is then convoluted with an exponential IUH (i.e. a linear reservoir) to produce an exponential type correlation function? Please clarify.

P314 "as a rule": See comment above, on data loggers and instantaneous measurements. Suggest to replace by "sometimes"

P315 L5: I think this should read "equals the coefficient of variation squared of the original variable X." I'm not sure what the "averaged" in this sentence refers to.

L8: Suggest to add a reference to simple scaling.

P316 L3-4: There is an intercept in both cases, so they are not proportional.

L14: I would suggest that the authors simply give the values of the parameters in line 8. Also, what parameters are used for A$<$43.5? Please give the units of all parameters.

L18: What are the units of 0.29 or is this dimensionless error variance? It would be good to be able to figure out whether this is a close fit or not.

P318 L3 "In general the agreement is acceptable": I think the agreement is very good given the exploratory nature of the analysis. The main features are indeed reproduced.

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Interactive Comment

Figs. 1, 2 and 5: It would help to use colour instead of the dashed lines to better identify the branches.

Fig. 2 shows about 30 points but there are 17 gauges in Fig. 1. Have residual catchments been plotted here? Please clarify.

Fig. 2: I would suggest to replace the caption by something like: "Estimated first moment of runoff (i.e. long term mean runoff) of the Moselle stream gauges.

Figs. 4 and 7: I would suggest to increase the font size of "a) b) c) d)" and move the letters to places where they are better linked to the respective panels.

Fig. 4 d: Is this for a duration of one day? Please add to caption.

Fig. 5: I would suggest to replace the caption by something like: "Estimated first moment of runoff (i.e. long term mean runoff): Diamonds are the local estimates from the stream gauge data, grey points are the mapped values along the streams."

Fig. 6: I would suggest to replace the caption by something like: "Temporal coefficients of variation of runoff. Plusses are the estimates from local stream gauge data; crosses are the estimates of the stochastic model for the gauged sites; grey points are the estimates of the stochastic model for the grid cells of the DEM (see App. A)."

Fig. 7 d: Is this for a duration of one day? Please add to caption.

Fig. 7: Please shorten caption - "The corresponding .. curves" is mentioned in the main text, so does not have to appear in the caption.

The English of the manuscript needs some streamlining. I have forwarded a number of suggestions directly to the authors.

3. RECOMMENDATION

This is an excellent paper. The authors should be encouraged to include the changes suggested above and streamline the English. As all the changes are minor, no re-

review is needed before publication in HESS.

Interactive comment on Hydrology and Earth System Sciences Discussions, 3, 299, 2006.