

Interactive comment on “Catchments as space-time filters – a joint spatio-temporalgeostatistical analysis of runoff and precipitation” by J. O. Skøien and G. Blöschl

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The paper presents an interesting interpretation which assimilates the rainfall-runoff transformation to a space time filter. Accordingly to this view, the catchment filters the precipitation input to produce runoff. Filtering is operated of course in time, but also in space, by interpreting the catchment area as spatial support. The filtering operated by the catchment is assumed to be governed by a space-temporal variogram model. Four different models are considered and fitted to the sample space time variograms derived by using an extensive data base referred to Austria. The paper is very accurate and interesting and in my opinion well deserves publication on HESS. I have a few remarks

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to provide. The most important one is related to my personal doubt about the physical fundamentals of the geostatistical interpolation of runoff data. There is an on going discussion in our community about this issue that I think should be mentioned in the paper.

1) First, I believe it should be acknowledged that the density of the gauging stations in the considered geographical area is indeed very high. In areas with a less dense monitoring network associated with a greater spatial variability of orography and catchment behaviours the spatial interpolation of runoff could lead to less reliable results (and less justified from a physical point of view). Spatial interpolation allows one to associate a runoff to each point in space, even over the catchment divide. Moreover, interpolation cannot represent in a feasible way the spatial variation of catchment behaviours that are very effective on the runoff formation, such as hillslope orientation, catchment slope, soil behaviours, vegetation and so forth. I am not saying that I completely distrust the spatial interpolation of runoff, but in my opinion such kind of operation should be properly justified in view of the characteristics of the study region. I believe this point should be made clear in the paper. This is especially true because in the introduction the authors state that geostatistical methods may allow one to estimate the variables of interest in ungauged locations (page 943, line 1).

2) The subdivision of catchment in classes accordingly to their area was operated by pooling in each class about 1/3 of the total number of catchments. This criteria leads to grouping in the third class catchments whose area is varying in a range from about 251 to 131.000 square kilometres. This range appears very wide. I would suggest to discuss in the paper the pooling criteria that was used.

3) Regularisation of the variogram is introduced when analysing all catchment together. Why the authors do not feel that regularisation is also needed when analysing the third class of catchments, which is extended to a catchment area range from 250 to 131.000 square kilometres? This range is almost coincident to the one that is covered by the three classes all together (from 10 to 131.000 square kilometres).

3) Among the different variogram models, a fractal approach is considered, which did not provide a good fit. The authors note that the reason for the poor fit is probably the reduced flexibility of this model with the respect to the other ones considered here. Indeed, the fractal variogram has a reduced number of parameters. However, the terminology used when commenting the results seems to imply that the poor performances are also given to the fractal nature of the approach. I had repeatedly the feeling that the authors wanted to convey a sort of disbelief towards fractal solutions in this context. I would suggest to better highlight the authors' opinion.

4) I would suggest to include the number of parameters to be optimised for each variogram model in the table 2, 3, 4 and 5 (this indication could be provided just once, in Table 2).

5) In the conclusions (page 961, line 7) the authors state that the time correlation of runoff are much more persistent than those of precipitation. This is a well known results. I believe it is due to the nature of the catchment, that essentially operates as a moving average filter of precipitation (any linear stochastic processes can be represented as a linear moving average filter of infinite order). The extension in time of the moving average filter is directly related to the concentration time of the catchment. Therefore it is fully justified that a sufficiently extended catchment provides a runoff series that is much more correlated in time than the corresponding input rainfall series. I think this is a more complete justification for this results than the one provided by the authors at page 961, lines 8 and 9.

Overall I would like to congratulate with the authors for their very good work.

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