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Hydrology and Earth System Sciences Discussions

Interactive comment on "On the colour and spin of epistemic error (and what we might do about it)" *by* K. Beven et al.

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I enjoyed reading this paper and believe it deserves publication.

This single sentence would be enough to fulfill my reviewer duties, but I am using this opportunity to discuss issues raised in this paper.

This paper is an interesting mixture of philosophical an technical arguments. The discussion of the application of statistical methods for uncertainty assessments contains a lot of arguments which were partly extensively discussed in the literature. My personal opinion on these matters is that:

- Statistical methods and their rigorous applications in hydrology are of great advantage as they offer a large number of well developed tools to obtain answers to complex problems. However their use requires clear statements on the assumptions, specifically on those which are related to the transformation of a natural problem to a mathematical problem. Statistical methods are useless if the underlying assumptions are not valid. This makes their use dangerous and leads to statements as: *Don't trust any statistics you did not fake yourself. (Winston Churchill)*. In hydrology we often tend to forget about the necessity to make clear statements about our assumptions, and there are many applications where techniques are used without checking their appropriateness. The more we know about the natural system the more chances we have to set up an appropriate statistical uncertainty model for it.
- The shift to statistics related but statistically not completely rigorous methods has the great advantage that it focuses on the above problem of translating a natural problem to a mathematical formulation. Expert knowledge and experience can be used in a creative way to formulate statements on uncertainty. The methods become dangerous if inappropriately combined with the language of statistics statements are derived for which the mathematical assumptions are not fulfilled.

The discussion on the disinformative data is very interesting and important. Hydrological data often include gross errors not related to the hydrological system to be modeled. Filtering out these data is necessary for the identification of an appropriate model. On the other hand modelers often tended to throw out all data which contradicted their concept. Thus the suggested methodology of filtering the data before modeling is of great advantage. On the other hand some of this kind of removal of data might also lead to false models, for example in the case of systematic errors in the input. Our experience (Bárdossy and Das 2008) shows that precipitation estimation is often biased which can be compensated by model parameters. The correct treatment of these data would require an appropriate estimation of the bias (in the form of a temporally highly correlated term). Further it is very important to provide homogeneous observations as input to our models. Inhomogeneities, such as changes in observation networks might also lead to incorrect model acceptance and rejection.

Figure 4 shows that most of the hydrologically unreasonable runoff coefficients correspond to small rainfall amounts where the estimation of precipitation from measurement points is also the most uncertain. On the other hand the corresponding discharge events are also small, therefore their wrong modeling does not cause a major problem. Our experience shows that models can be well identified on a very small subset of observations which contain *unusual periods* with partly highly dynamical precipitation changes and some longer dry periods. A *positive* approach of choosing the informative data is also possible.

1. Bárdossy, A. and T. Das, Influence of Rainfall Observation Network on Model Calibration and Application *Hydrology and Earth System Science*, **12**, 77—89, 2008

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