

Interactive comment on “Uncertainties on mean areal precipitation: assessment and impact on streamflow simulations” by L. Moulin et al.

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General overview

The paper was a delight to read and review. It pulls together, in a very pragmatic way, some fundamental ideas in understanding both (i) the structure of rainfall measurement errors (spatial and temporal) and (ii) their simulation using minimalist and clearly enunciated methods; William of Ockam would have been much pleased! The development of the spatial error model using Ordinary Kriging to estimate the errors at unknown positions together with their explained variance is nicely done.

The effectiveness of the technique is demonstrated in two important ways: sampling

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the distribution of the errors to show that they are close to Gaussian (Figure 4, showing that Kriging is justifiably BLUE in this context) and by cross-validation of the errors. The simulation of 100 sets of errors (reflecting observed error structures) added to the original observed raingauge readings, which are then fed into two lumped catchment models, provides evidence of the magnitude of the error propagation through a rainfall-runoff model. It was comforting to see that a choice of which of the two most appropriate models to use (taken from a larger cohort based on the conclusions of a different study), made no material difference to the results which lead to the conclusions. Altogether, this is a thorough and workmanlike piece of applied science, answering some of the currently relevant questions in hydrometeorology and its application in the “real” world.

Particular Issues

Withal that the paper is very well done, there are areas where an improvement in presentation would make it easier for the reader to more easily grasp the issues. These are detailed in this section. As this is an eponymous review, I will leave the minutiae of grammatical changes etc. to a separate commented pdf, which I will send directly to the authors.

The use of a simple AR(1) model to provide temporal structure to the measurement errors is neat; more useful is that the serial correlation coefficient (ρ) is shown to have an essentially constant serial correlation coefficient independent of site. This uniformity of ρ might be because of the stationary structure of the variogram fitted to the errors; perhaps the authors would like to comment on that issue. To address the choice of ρ , in Figure 6 a comparison is made between the error quantiles obtained on the one hand by using cross-validation and on the other by alternatively setting $\rho = 0$ and 0.6. Although, in the text (page 2082), the choice of the latter value of 0.6 is mentioned, it was not explained well enough to my mind - a value of 0.3 (based on Figure 6) seemed more appropriate. This is worrisome because the reason given in the last two sentences on the page seems to provide a questionable justification: “The selected

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constant correlation coefficient (0.6) has been adjusted to slightly underestimate the quantiles of the error distributions at all the validation sites (Table 3). The error model will have a general tendency to underestimate the rainfall estimation errors and hence their effects on RR simulations." Please justify.

The discussion of the modeled streamflow errors, (page 2087: 15+) displayed in Table 5 and Figures 8 to 10, is difficult to follow. In particular I was unable to reconcile the Table contents with the statement that (line 17+): "A large proportion of measured streamflows appears to be ... [contained in the 90%] ... confidence interval." The columns in Table 5 were difficult to reconcile with the text.

Equations (13) and (14) (page 2077) are erroneously given for standard deviations whereas they should be for variances - the power of 2 seems to be missing after each $[\sigma\text{-bar}]$. The text need not be modified.

Finally, Figure 11 is not referred to in the body of the paper.

Summary

It is good that the paper is in open access and can be quoted, because there are many valuable observations that can be immediately ingested into other current research endeavours and be properly acknowledged. Once the issues raised in the paper have been addressed to the Editor's satisfaction, I recommend publication in HESS.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 2067, 2008.

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