Hydrol. Earth Syst. Sci. Discuss., 8, C5740–C5743, 2012
www.hydrol-earth-syst-sci-discuss.net/8/C5740/2012/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Bayesian uncertainty assessment of flood predictions in ungauged urban basins for conceptual rainfall-runoff models" *by* A. E. Sikorska et al.

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Received and published: 17 January 2012

This paper presents a method for flow prediction and uncertainty assessment suitable for small/poorly-gauged basins, using Bayesian methods including explicit representation of input rainfall errors. Flow measurement and structure errors are represented jointly by an autoregressive error model using a Box-Cox transformation. In general I found the paper to be very well organised and well explained. Although similar methods may have previously been applied, this paper is a worthwhile addition to the literature since it demonstrates clearly how to apply the most recent techniques to a typical urban

catchment with poor gauging record. The method devised by the authors for deriving prior distributions on the model parameters using multiple regionalisation algorithms is particularly useful.

There are some points which should however be addressed prior to publication:

1. The authors do not separate model structural errors and flow measurement errors, and comment in several places that flow measurement errors are small, and therefore this source is dominantly caused by structural error. Although I agree that it is not necessary to separate all error sources where there is insufficient information to do so, this should be clearly stated and flow measurement error should not be ignored. Recent papers such as McMillan et al (2010), Thyer et al (2009) and Westerberg et al (2011) have all demonstrated that flow measurement errors can be large and have a significant impact on parameter inference.

2. The authors draw strong conclusions about the dominance of input uncertainty. However the increased posterior standard deviation of rainfall multipliers compared to the prior might be partly due to the high degree of freedom allowed when all 14 rainfall multipliers are inferred from limited available data. In effect, some of the output uncertainty might be implicitly included in the input uncertainty. Recent papers by Renard et al (2010, 2011) explore very similar questions and conclude that weak priors on rainfall multipliers can lead to overestimation of the posterior standard deviation. The authors should reference these papers and comment on how the findings relate to their work.

Minor Comments:

1. The abstract states that predicted flows were 'up to 7 times higher' than observations, but then 'this was reduced by 150%' by Bayesian updating. The language is unclear - please say how many times higher were the flows after updating.

2. May be better to refer to the catchment as 'poorly gauged' rather than 'ungauged'

HESSD

8, C5740–C5743, 2012

given that gauges were available for the catchment.

3. Figure 1 was hard to understand and did not add to the discussion, it could be deleted.

4. The priors for the parameters were fitted using lognormal distributions (Page 11086 Line 14). Please comment on why the lognormal was chosen and whether it can be satisfactorily fitted with only 5 data points.

5. The CN parameter was given a prior with standard deviation 10% of the mean. That seems rather small for a fitted parameter - please comment.

6. Please update the McMillan et al (2010) reference - citation below.

References:

Renard, B., D. Kavetski, G. Kuczera, M. Thyer, and S. W. Franks (2010), Understanding predictive uncertainty in hydrologic modeling: The challenge of identifying input and structural errors, Water Resour. Res., 46, W05521, doi:10.1029/2009WR008328.

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HESSD

8, C5740–C5743, 2012

18TH WORLD IMACS CONGRESS AND MODSIM09 INTERNATIONAL CONGRESS ON MODELLING AND SIMULATION: INTERFACING MODELLING AND SIMULATION WITH MATHEMATICAL AND COMPUTATIONAL SCIENCES Pages: 3414-3420 Published: 2009

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 11075, 2011.