Hydrol. Earth Syst. Sci. Discuss., 6, C2441–C2443, 2009
www.hydrol-earth-syst-sci-discuss.net/6/C2441/2009/

Hydrology and Earth System Sciences Discussions

Interactive comment on "Selection of an appropriately simple storm runoff model" *by* A. I. J. M. van Dijk

Anonymous Referee #1

Received and published: 21 October 2009

This paper addresses the interesting question of what is an appropriate model structure for predicting catchment runoff, so as to avoid parameter equifinality while still yielding accurate predictions.

One of the strengths of the paper is that data from a large number of basins (a total of 260) are used. The major weakness relates to the set of candidate model structures; as indicated by the author in the conclusions (and in section 4.7), the most complex model considered in this paper is not complex enough to accurately describe the data. This is clearly evident in Figure 4, which reveals relative average errors of 50% or more in all but one of the basins. Inclusion of the true model, or a sufficiently accurate model, in the set of candidate models is a requirement for many model selection criteria (includ-

ing the final prediction error criterion FPEC used here), and in general is a prerequisite for good model inference. See for example the book by Burnham and Anderson (Model Selection and Multi-Model Inference) for general discussion and background on this.

Therefore, the author should consider including more complex models in the analysis; complex enough so that accurate predictions are obtained and that the model is over-parameterized (with parameter correlations above 0.9, instead of a maximum of 0.4 reported here). That model would then provide a good starting point for introducing model simplifications to reduce parameter equifinality without significantly worsening predictions.

Responding to this criticism will likely require major revisions. Additional comments are listed below.

- A scatter plot of predicted vs observed event runoff for the best model would be useful to evaluate how well this model performs.

- Eq. (15): what are the advantages of using absolute errors instead of squared errors?

- Eqs. (14) and (15) are unconventional implementations of FPEC; usually epsilon is equal to the mean square error; please justify use of Eqs.(14)-(15), especially with regard to the statistical assumptions underlying FPEC.

- When applying FPEC it is crucial to adequately calibrate each candidate model, i.e. for each model one needs to find the parameter set that minimizes epsilon. On p5762, line 16, it is stated that calibration is done with a monte carlo approach using latin hypercube sampling. The author needs to provide convincing evidence that his method leads to identification of optimal parameter values: how was optimality evaluated? how many random samples were generated? What was the stopping criterion?

- section 1.1: review of runoff mechanisms needs one or more references

- section 1.2: make clear from the start that the interest of the paper is in predicting total event runoff, as opposed to a full dynamic description of rainfall-runoff processes

at hourly or daily time-scales

- Section 1.3, lines 6-8: for sure there are numerous studies that have compared alternative model formulations for predicting runoff, more literature is needed

- section 2.1: report statistics on catchment attributes (area, rainfall, etc) for the basins that were actually included in the analysis, i.e. 260 instead of the original 362 basins

- section 2.2: please describe eqs. (7) and (8) in words and explain the rationale behind these eqs.

- section 4.1: was kQF included in the number of parameters when computing FPEC?

- p5756, line 9: “return flow from the soil” is more commonly referred to as “subsurface stormflow”

- p5756, line 20: fs instead of fsoil?

- p5757, line 11: what is meant by “second term”?

- p5760, lines 13-17: specify how many events were omitted from the analysis

- p5761, line 5: bottom-up approach starts from the most complex model and simplifies it, whereas top-down goes the other way (gradually increase model complexity); so the approach adopted here would be bottom-up

- p5763, line 2: parameter correlation of 0.4 is not that high and does not necessarily indicate poor parameter identifiability

- p5763, line 24: C1 should be C2?

- p5764, line 8: C2 should be C1?

- p5768, line 3: 12 mm

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 5753, 2009.