

***Interactive comment on “A modeling study of heterogeneity and surface water-groundwater interactions in the Thomas Brook catchment, Annapolis Valley (Nova Scotia, Canada)” by M. J. Gauthier et al.***

**Anonymous Referee #2**

Received and published: 21 May 2009

In general, I really liked the paper. The question which model complexity is required to adequately model catchment hydrology is a very important one, and the amount of literature on the subject is very limited. This paper's contribution is a welcome one.

The paper is well-written, and could be accepted for publication in HESS after a minor revisions, taking care of the following issues:

Generic:

I wonder what would happen if the order of the scenarios would change i.e. first

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adding the top layers, then refining the bedrock geology. Please discuss this issue.

I also wonder how well the simplified scenarios would work if their parameters are all subjected to calibration.

and the opposite question: if no calibration is allowed at all.

Specific:

page 2752 / line 14 "to a sufficient degree" : define "sufficient".

/ line 16-17 "North Mountain basalts": is it really necessary to refer to the formation name in the abstract? just "basalt" should do, here.

page 2758 - line 9 "and other criteria" : like?

/ line 12-13 "D8 scheme ... or by ... methods" : which algorithm is actually used?

/ line 20-22 "two different ... schemes allow ..." : they allow updating. But have they been used? which one? or both?

page 2759 / line 16 "gOcad" : what kind of software is that?

page 2760 / line 9-10 "a high end laptop computer" : in 5 years time, high-end computers will have completely different specs. Please add more info on the processor speed, like as defined in flops.

/ line 15-17 : "the input fluxes are [P-Epot]" : How can P-Epot be used as input fluxes? P-Actual can, but not Epot, which is not a flux but only the maximum possible flux.

page 2764 / line 3 : "model calibration" : which calibration technique was used? which goodness-of-fit criterion was used?

/ line 5 "K and n were assigned" : a prior estimation on this scale requires some averaging procedure. Has that been done? Also. why haven't these parameters been calibrated?

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/ line 7 : "an adequate agreement" : define adequate.

/ line 9-10 : "once obtained, the parameter values ... where kept fixed for all subsequent scenarios" : is this allowed? the parameters are effective parameters, and as such coupled to the model schematisation. When this latter changes, so should the effective parameters.

/ line 20-21 : "the match was obtained after 1-2 months" : figure 6 suggests a response time of 3-4 months (recession during july-august-september)

/ line 27 : "model performance" : how is this quantified?

/ line 27 " improves slightly from scenario 1 to 8" : according to table 3, the streamflow error is smallest for scenario's 4,5,6.

page 2766 / line 16 "mismatches could be reduced" : is seems to me that the peaks in the simulated hydrographs are both too large and of the wrong shape. perhaps part of the catchments is reacting flashy (small but sharp peaks in the data) and other parts are buffering water, reacting much slower (higher baseflow).

page 2767 / line 23 : "adjusting to initial conditions" : why then is the model initialised for january with conditions that resemble summer baseflow?

/ line 29 "suggesting a much greater sensitivity to k" : this is circumstantial evidence, and should be tested directly.

page 2768 / line 26 "what is labeled as Horton ... may arise from shallow subsurface flow ... that saturate" : Sounds like Dunne OF.

Table 3 : check the use of \* \*\* marks. there are some mistakes. Also in the \*\*100.

Figures 6, 10, 11: the x-axis tick labels are in french. Why are they on the 5th day of the month?

Figure 8: the good fit is partly a result of the topographic gradient. Please provide a

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similar plot based on groundwater depth (with respect to the surface). (m, ASL) should be (m ASL)

Figure 9: "Time (days)" should be "Time (day)"

Figures 12-14: Longitude and latitude are measured in degrees, not in meters. If you want to use meters, then the labels should be "easting (m)" and "northing (m)"

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 2751, 2009.

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