**Hydrology and
Earth System
Sciences
Discussions**

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 #3

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General comments

The paper represents an approach to quantify the soil heterogeneity and the groundwater flows at a catchment scale by a distributed physical base numerical model. The content of this paper is of great interest and the structure of the document is clear and well written in English. I recommend the authors to undertake a moderate revision of the manuscript in order to improve its quality and take care of some minor places that are mentioned below.

The introduction gives an overview of previous and recent work in this field but doesn't really explain the necessity for the presented work. What can the results of modeling experiment contribute to the real society, not only from the scientific view?

The scenarios themselves are well explained, however, it is not explained why these scenarios have been chosen. Could you please provide a bit more background information to explain about these scenarios? Or, these scenarios are decided randomly.

The numerical model is a physically based model with a number of calibration parameters. Uniqueness and robustness of the calibration is not sufficiently demonstrated. The physical meaning of various model parameters (applied in this case study) is not well discussed in detail.

Specific comments

1. P8 Line 9, What was the 'other criteria'?

2. P9 Line16-17, it wasn't clear to me which version of gOcad and ArcGIS.

3. In section 2 'Description of the study area', why not mention land cover distribution of the catchment which will have great impact on its hydrological cycle? Some details about the horizontal spatial variability of land use and cover could be introduced.

4. The instrumentation (type and location) for the measurement of rainfall, stream flow, groundwater should be described.

5. In Section 4.1, because the study area is a major agricultural region of Canada, do people in this valley pump any groundwater for agricultural water use? How to consider the impact of human activities on groundwater recharge? Or, does this model only consider the most ideal and natural condition without any human interruption?

6. P12 Line 11-12, which hydrogeological parameters were assigned based on field work results? Which parameters are based on database? Where are the databases?

7. Results and discussion: The different stream discharge time series are only shown

in figures. It would be useful for comparison if you can quantify their distribution by, for example, the variance.

8. The model also produces overland flow, interflow, and groundwater. Why then not compare them? The title is "A modeling study of heterogeneity and surface water–groundwater interactions", how about their interaction through the modeling study?

9. P34 (Figure 6), 38 (Figure 10), and 39(Figure 11), is the date in the x-axis of data French? Can you change them to English?

10. P35 Figure 7, in the block 2, "n=0,20" should be " n=0.20".

11. P41 and 42, the numbers and labels in the x and y axis are too small to be read clearly. Can you modify them?

12. P45, in figure 15, I could not see clearly the dotted line. Which line is for which scenario? Can you improve the quality of this figure?

13. Figure 8, can you tell me the meaning of ASL?

14. How the model transfers from Potential evapotranspiration to Actual evapotranspiration? Can you briefly describe it in your article since it is very important at a catchment scale study?