Simulating cold-region hydrology in an intensively drained agricultural watershed in Manitoba, Canada, using the Cold Regions Hydrological Model

Marcos R.C. Cordeiro, Henry F. Wilson, Jason Vanrobaeys, John W. Pomeroy, and Xing Fang

Dear Dr. Fuqiang Tian,

Following the instructions in the editorial decision, the authors are pleased to submit the revised version of the above-mentioned manuscript. The point-by-point responses to the minor revisions suggested by the two reviewers are presented below.

The authors are looking forward to your decision on the manuscript.

Sincerely,

Marcos Cordeiro

Anonymous Referee #1

Comments:

1. Line 246: Typo, change “flwo” to “flow”.

Authors: Correction made.

2. Line 465-469: The NSE values are still negative in all the dry years. I won’t say this is an “improvement”. The authors need to provide better explanation about the poor performance of the model in dry years.

Authors: The purpose of the analysis was to provide and initial indication of the influence of preferential flow as a hydrologic control at basic level. The simulation of infiltration prior to the major melt event is not a precise description of preferential flow, since the latter process is very complex to be mathematically described and modelled. Thus, the improvement in statistical metrics should not be seen as a direct improvement of model simulations but as measure of the influence of preferential flow to stream discharge. Although NSE values were still negative, their magnitude was increased towards zero, which indicates the influence preferential flow to stream discharge generation in dry years. That said, the text was reworded for clarification. The revised text now reads: “These results indicate a potential influence of infiltration prior to the major melt event (used here as a proxy for preferential flow) on model performance in two out of six years (i.e. 2002 and 2012) when compared to the based model (**Error! Reference source not found.**). Inclusion of this process in the model structure improved predictions more than 30% of the time, although NSE values were still negative in all cases. However, processes other than infiltration could also be influencing model performance, such as an enhanced role of depressional storage.”

3. Line 623-625: With the 30% improvement, the NSE values are still negative. So I’m not sure if this mechanism is really “an important hydrological control under dry conditions”. There may be some more important mechanisms that are missing, which are causing the poor performance of the model in dry years.

Authors: As explained in answer to comment # 2 above, the improvement in statistical metrics should not be seen as a direct improvement of model simulations but as measure of the influence of preferential flow to stream discharge. Although NSE values were still negative, their magnitude was increased towards zero, which indicates the influence preferential flow to stream discharge generation in dry years. That said, the wording has been changed for clarification and another sentence added to acknowledge the potential influence of other processes such as depressional storage. The text now reads: "These results indicate a potential influence of infiltration prior to the major melt event (used here as a proxy for preferential flow) on model performance in two out of six years (i.e. 2002 and 2012) when compared to the based model (**Error! Reference source not found.**). Inclusion of this process in the model structure improved predictions more than 30% of the time, although NSE values were still negative in all cases. However, processes other than infiltration could also be influencing model performance, such as an enhanced role of depressional storage".

4. Line 767: Unfinished parts?

Authors: A standard disclaimer will be added to the final version of the manuscript.

5. The font of references needs to be changed.

Authors: Font changed to match the style in the main text of the manuscript.

Anonymous Referee #2

1. The reference: it is strange for me that the authors cited the discussion version of the HESS papers, and cited the paper in review in 2016. I strongly recommend the authors to double check the reference list and make sure it is obliged to HESS policy, including the citation format (e.g., Ln297 and 301 on Pg14).

Authors: The authors are using a citation manager (ENDNOTE) to format the citations and the respective references. The issues raised by the reviewer were a result of faulty records in the manger, which have been corrected. The references to HESS discussion papers have been updated. The paper under review has also been recently published and the reference updated (i.e. Mahmood et al. 2017). The Bibliography Output Style in ENDNOTE was downloaded directly from the Corpernicus website (Copernicus Publications style), thus abiding by HESS formatting rules. The citation format mentioned by the reviewer in lines 297 and 301 has also been corrected from default [i.e. (Author, Year)] to Author (Year).

2. There exists a lot of typos in the paper. It is hardly for me to accept it at this stage of the paper. Some examples are:
   * P4L83, process —> processes
   * P4l111, flow, tend —> flows or tends
   * P7L153, process —> processes
   * P11L245, flwo —> flow
   * P12L259, for —> to

Authors: The authors have corrected the typos mentioned above and conducted a thorough review of the manuscript to prevent these mistakes from occurring.

3. P6L126: it is strange for me to use the ecosystem term here. Why not use the term ‘watershed’ directly? or ‘watershed with different ecosystems’.

Authors: Wording changed to “watersheds”.

4. P8: stop-log dam is not a straightforward term. Please explain its meaning and the function of this kind of dam. Even it can not be called as a dam (weir can be a better word).

Authors: The paper adheres to the official terminology used for those structures, as defined in documentation from the Prairie Farm Rehabilitation Administration (PFRA), a former rural extension agency from Agriculture and Agri-food Canada responsible for constructing these structures throughout the Canadian Prairies. An example of such documentation can be found at http://www.pfra.ca/indexce2b.html?id=techinfo/smalldams.html. The dam referred to in the manuscript can be found in the link to Map - PFRA Manitoba Dams (PDF). It is listed as dam number 57 – Elie Dam. However, the terminology has been changed from "dam" to "water level control structure" to comply with the request made by the reviewer.

5. P3L68, still you miss some references, e.g., Li H., Sivapalan M., Tian F., Liu D. Water and nutrient balances in a large tile-drained agricultural catchment: a distributed modeling study. Hydrology and Earth System Science, 2010, 14: 2259-2275.

Authors: The reference suggested has been included.