Review comments on *"Multi-model comparison of a major flood in the groundwater-fed basin of the Somme River (France)"*

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Overview

In this manuscript, the authors compared the performance of four models for a groundwater-fed basin in France. The paper is well-organized, well-written and the topic is suitable for publication on HESS. The Somme watershed appears to be an interesting case for testing hydrologic models and land surface models, especially for those with a groundwater component. However, there are a few places in this manuscript that need to be clarified, and some grammar issue, typos, and flow of sentences to be polished. Therefore, I recommend this paper to be accepted for publication, contingent upon that the minor issues identified below be adequately addressed.

Major Comments:

1. The implementation of CLSM to the entire SOMME basin in a lumped mode looks strange to me, which might be the reason that CLSM performs worse than all the other models in this study. In other words, I don't think it is a fair comparison because CLSM was applied at a very coarse resolution (5566 km^2), while other models were applied at resolutions as fine as 1km. CLSM should be at least applied to each of the sub-basins to be fair.

2. Based on this comparison, the authors concluded that "there is no clear benefit in using a more complex surface scheme", "the use of complex land surface scheme is not a requirement to represent the hydrology of the Somme river basin". I personally feel that these are overstatements because (1) only two land surface models, which are not necessarily well-known for their capability in representing hydrologic processes, were included in this comparison; (2) one of the land surface models was applied at a super coarse resolution; (3) "hydrology" here should be "flood forecasting" or something equivalent because streamflow and groundwater dynamics are just two components in the hydrological cycle.

Therefore, I would like to see the authors add some discussions on the limitations of this comparison study in the revised manuscript to address the problems in items (1) and (2). For example, there are increasing number of studies in the literature where groundwater models have been implemented in land surface models to simulate groundwater table and recharge/discharge dynamically (Liang et al. 2003; Chen and Hu 2004; Maxwell and Miller 2005; Niu et al. 2006; Fan et al. 2007; Miguez-Macho et al. 2007; Maxwell and Kollet 2008). If these models were applied to the SOMME basin, the story could be different.

3. The terms in section 4.1.2, "soil infiltration (SI) corresponds to the flux at the bottom of the soil reservoir or root zone" and "the flux from the unsaturated zone (UF)" are confusing. Does the former refer to "percolation" and the latter refer to "recharge"? What is the difference between them in each model?

4. An explanation on piezometer measurements, meanings of piezometer heads/levels, and their relationships to water table is needed. Without such an explanation, figure 6 and section 4.3 look confusing.

5. It will be helpful to list the major calibrated parameters for each model in a table, as a reference for future work. For distributed models, ranges of parameters might serve the purpose.

6. Please combine sections 6 and 7 to one section entitled "Discussions and Conclusions".

Other specific comments are discussed as follows.

Specific comments:
1. Page 6137, line 4, "1.100 people", is this number wrong?
2. Page 6137, line 5, "(Deneux and Martin, 2001)."
3. Page 6137, line 22, "…~~even~~particularly during ~~the~~ flood~~s~~?"
4. Page 6139, lines 10-11, "The ~~both others ones~~ other two models…"
5. Page 6139, line 20, "…LSM develop~~p~~ed …"
6. Page 6141, lines 5-6, better to write the sentence as "The period used for calibration, as well as atmospheric data used for calibration, varies across the models."

7. Page 6141, line 8, what does "then only" mean?

8. Page 6142, line 7, Shouldn't it be "…on an annual basis"?

9. Page 6142, line 13, better to write as "… with ~~the~~ higher resolutions associated ~~both~~ with…"

10. Page 6142, line 18-20, "Then, the simulated surface water budget was adjusted, as well as the groundwater parameters in a steady state.". This sentence looks confusing. Parameters for both surface fluxes and groundwater simulations were adjusted, right?

11. Page 6143, lines 6-7, "retroaction", do you mean "interaction". Also, what does "surface soil moisture" mean?

12. Page 6143, lines 8-9, Please change to "Thus, the surface water budget ~~should~~ was not ~~be~~ affected by the introduction of the ~~simulated~~ aquifer." to be more confirmative.

13. Page 6143, line 9, "…in this application,"

14. Page 6143, line 11, better to write as "…~~and it was decided to use~~ hence a 1 km resolution was used."

15. Page 6143, line 21, "it was decided to set this coefficient to a low value.", please be specific, give a number!

16. Page 6144, line 3, "…the Richards equation…"

17. Page 6148, line 17, "the original baseflow from the shallow aquifer ~~being~~ accounts for only 27% of the total (not shown)."

18. Page 6148, line 20, "…~~very~~ similar. This ~~can be~~ is surprising …"

19. Page 6148, lines 26-28, "Thus, for the Somme basin ~~and on a mean annual basis~~, …the surface water budget on a mean annual basis."

20. Page 6151, line 11, "…~~and not especially on~~ not particularly for the period of the flood."

21. Page 6153, line 28, "…~~water table~~ groundwater contributes to the riverflow."

22. Page 6154, line 19, "…RMSE control point error…", what does mean, please clarify.

23. Page 6155, line 28, "…even if the CLSM…", not clear! I found the usage of "even if" in this manuscript very confusing!

24. Page 6156, line 17, "…exchanged quantities…", is this simply "fluxes"?

25. Page 6156, line 20, "…even if the simulated aquifer overflow…", not clear!

26. What does the shaded area represent in the lower panel of Figure 6?

27. Figure 8, "histogram" should be "bar plot" or something equivalent.

28. Figures 8 and 9, how to read the flooding area in them? No axes correspond to it!

References:

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Liang X, Xie Z, Huang M (2003) A new parameterization for groundwater and surface water interactions and its impact on water budgets with the VIC land surface model. J Geophys Res 108(D16), 8613, doi: 10.1029/2002JD003090

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Niu G-Y, Yang Z-L, Dickinson RE, Gulden LE, Hua S (2006) Development of a simple groundwater model for use in climate models and evaluation with Gravity Recovery and Climate Experiment data. J Geophy Res 112 (D07103), doi:10.1029/2006JD007522