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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Assessment of impacts of agricultural and climate change scenarios on watershed water quantity and quality, and crop production" *by* A. D. Teshager et al.

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Q1. Provide a brief description on SWAT model calibration/validation with respect to water quantity/quality.

Answer 1. We published the entire calibration/validation of the SWAT model for water quantity and quality in a previous open access paper: http://link.springer.com/article/10.1007/s00267-015-0636-4 , DOI: 10.1007/s00267-015-0636-4 (Teshager et al. 2015). Since the calibration/validation process is quite extensive, and linked to a novel method to categorize land use and build HRUs, we referred readers to look at that publication for any information on calibration/validation of the SWAT model used in this manuscript. In this specific manuscript, however, essen-

tial information about the SWAT model and water quantity/quality calibration/validation procedures is discussed in section 3.1.

Q2. Considering the fact that the climate, land use and crop pattern will change in future, how did you deal model parameter uncertainty? Are you considering the historical model parameters for future scenarios as well?

Answer 2. We assume that the historical parameters will stay the same in our future scenarios. This is an excellent point, and the reviewer's insight on this issue is very welcome. For example, crop production technology may change in the future which may change historical crop parameters used in the model. Climate change may also have an impact in changing some of the historical crop parameters. These changes in turn will affect water quantity/quality yields. Hence, we will make sure to incorporate this comment and point out the issue in our conclusion section in the revised manuscript.

Q3. Is there a role of groundwater contribution to hydrologic modeling?

Answer 3. Yes. In SWAT hydrological modeling, groundwater is one of the hydrological components that contributes to total water quantity and quality yields. Total water yield in SWAT is the summation of surface flow, lateral flow, tile flow (if applicable, - in our area there is substantial tile flow) and groundwater flow in excess of pond abstraction and transmission loss. Total nutrient yields are therefore dependent on nutrient contributions from each of the components listed above. Detailed descriptions can be found in the SWAT input/output and theoretical documentations (http://swat.tamu.edu/documentation/). In this specific study, explicit discussion about the groundwater component is not part of the objective. As a result, groundwater contributions were not specifically discussed. In a previous study (http://link.springer.com/article/10.1007/s00267-015-0636-4), however, we have discussed the importance of groundwater flow contribution in the watershed in terms of baseflow. Hence, we encourage readers to refer the respective paper and SWAT manuals mentioned above for more information.

Q4. Please be specific what major conclusions were derived from the study?

Answer 4. We thank the reviewer for this comment. We believe that one important conclusion of our work that could be clarified in the conclusion part of the manuscript is that there are significant trade-offs in protecting water quality in intensive agricultural regions that could be exacerbated by climate change, for example, planting more switchgrass would benefit water quality but negatively impact food production. However, there is also potential for win-win situations – if biofuels from switchgrass become commercially viable, that will reduce the pressure on corn. Another conclusion we could have better outlined is that, given climate change impacts, our results suggest that substantially improving water quality will require a combination of working land practices (such as conservation tillage and cover crops) and land retirement/perennial plantings (such as planting grasses such as switchgrass). This will require substantive conservation efforts, higher than historical levels. We will expand on this issue in the conclusion part of our manuscript.

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