

***Interactive comment on* “Simulating human impacts on global water resources using VIC-5” by Bram Droppers et al.**

Anonymous Referee #3

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General Comments:

The authors enhance the VIC model with several additional modules in an attempt to better capture anthropogenic and environmental flow requirement impacts on water use. Additional modules include those for integrated routing, sectoral water use, EFR for surface and subsurface water systems and dam operations. Overall I believe that this paper was well written and that the modules considered add appropriate value to the VIC model.

However, I believe that the methodology itself lacks in novel advancements and claims of a "first step towards integrated water-food-energy nexus modeling" (line 33) may mislead future readers. Comparisons are made only against other hydrologic models rather than considering historical datasets of observed sectoral and/or global water

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withdrawals. In addition, several Integrated Assessment Models have now begun water integration to better understand cross-sectoral impacts on water. While these often are not solved at the resolution of a model such as VIC, they may provide a useful additional comparison.

Specific Comments:

Line 33: "The improvements made here are a first step towards integrated water-food-energy nexus modeling" This conclusion should be clarified to distinguish the fact that this study may provide a first toward towards FEW modeling in hydrologic models. Integrated Assessment Models have increasingly been investigating FEW nexus interactions and should be acknowledged within the manuscript (Hejazi et al., 2014, Bijl et al., 2018, Graham et al., 2018, among several others)

Several modules are based on prior work that is now 10-15 years old (Shiklomanov 2000; Goldstein and Smith, 2002; Haddeland et al., 2006). It should be more carefully noted throughout the text the novelty of what is being added to the modeling community.

Line 328: the study is mentioned to use varying socioeconomic predictors. These could be better explained in section 2.3.2 in order to specify where GDP and GVA are obtained.

Lines 406-408: "To our knowledge no previous study has estimated the amount of global non-renewable groundwater withdrawals without using on the the models mentioned above" - see Turner et al. (2019) or Kim et al. (2016) for additional groundwater withdrawal modeling capabilities.

Line 426: "Note that VIC-WUR does not include non-renewable groundwater withdrawals, while these withdrawals would affect baseflow to a lesser degree" - I am confused, then why was there a discussion on about this in paragraph starting at line 400? Maybe consider reorganizing these thoughts.

References:

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