

Interactive comment on “VIC-CropSyst: A regional-scale modeling platform to simulate the nexus of climate, hydrology, cropping systems, and human decisions” by Keyvan Malek et al.

Anonymous Referee #2

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In this paper the authors present a regional version of a coupled model system, the VIC hydrological model and the CropSyst crop model. The objective of the coupled system is a.o. to evaluate the potential impact of adaptation measures taken by farmers on basin scale hydrology.

General comments

- The authors could elaborate a little more on the potential applications of this coupled model system, as they make not clear what is the added value of the coupled system versus the individual models. - The authors claim that the coupled model system can be used to evaluate the impact of certain agriculture related adaptation measures over the region or river basin, but I was surprised to see that this impact is only modelled

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in one way. The way I understand the model from this manuscript, is that irrigation water is assumed to be always available, but the source of this irrigation water is not discussed. Unless water is always extracted from deep confined groundwater layers, there should be an effect of water withdrawals for irrigation on streamflow and water availability downstream. Since VIC explicitly calculates streamflow, I think it is a missed opportunity not to include this interaction, especially since irrigation withdrawals have been implemented before eg. by Haddeland et al. To my understanding there is no consideration of water shortage for irrigation. - I miss the broader embedding of this research in the existing body of knowledge. This model is certainly not the first to combine a hydrology and crop model (eg. LPJmL), but the authors seem to mainly relate to their own research in the introduction. - For sake of reproducibility, the authors should include more background of the models and equations used.

Specific comments

- The abstract would benefit from a little more text on potential application of this model, and more specific on how it can be used to inform 'policy and best management practices to promote sustainable agriculture'. What can the model do, that cannot be done without a model? - Pg 2, r 6.. there are unanswered questions.... what are the unanswered questions and how are you going to address them? - Pg2. r 6. The consequences of what kind of decisions are not understood? Can you give an example of a situation where that happened and where the use of this model could have helped? - P2.r7. What are the knowledge gaps? - P3. R 7. What kind of human decisions? - P3 r 22. Can you give examples of the management decisions farmers can make? - P4 r1. What is meant by 'large scale results'? - P5. I am surprised to see that you are not referring to other models that are also capable of relating hydrology to crop production. - P5. Could you explain a little better why the (vertical) soil water balance of VIC is better than the one that was originally included in CropSyst? Since you are not using the lateral flow generated in VIC, the advantage of this coupling is not completely clear (to me). - P6. L14. It would be good to have a little more information on the crop model,

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since the information given here is very limited. E.g. which crops are included, how are sowing and harvest dates determined, is there any management included, how is yield calculated. - P8. L6. As long as the paper describing the irrigation module in more detail is unpublished, it is difficult to judge the model, so a little more detail regarding algorithms is required here. - P8. It is very impressive that the model is able to simulate over 40 different irrigation systems, but it would be good to briefly describe how differences between those systems are implemented in the model and which assumptions are made. - P8 l22. Which crops are included? - P8 l29. For readability, it would be good to write out the meaning of Esi in this sentence and put Esi between brackets. - P9 l8. What is the equation, I think it would be good to add it here. - Idem for the equations in line 12 and line 14 (referring to an equation in an article in preparation is not ideal). - P10 l5. The simulated variables that are compared, could results been shown for all the mentioned variables? - P10 l18. The soil files were modified using available information, could this be explained? - P11, l 19. Are those climate data the same as the climate data mentioned on p 10 (DAYMET)? This is somewhat confusing. - P 11 line 25. I understood from table 2 and different figures that simulations were made for corn only, how was the crop distribution information used? - P12 section 3.3.1 Is water shortage for irrigation not considered at all? Could that be an issue in this region? - P12 section 3.1.2. Could the overestimation of etp also have to do with water shortage, the used crop parameterization? - P12 3.1.3 could you describe a little better how yields are calculated and also reflect on why the variability for irrigated yields is not captured. - P13 3.1.4 It would be interesting to see some reflection on the meaning of errors. - P14 I think it is good to emphasize here that the model can be used to evaluate the cumulative effects of large scale implementation of selected adaptation strategies over a basin or watershed.

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