Review of Manuscript

'Towards an ideal water-energy-food nexus model: moving beyond silos to integrated resource governance'

by W. Li et al.

Dear Editor,

I have reviewed the manuscript. My conclusions and comments are as follows:

1. Scope

The article is within the scope of HESS

2. Summary

In their manuscript, the authors introduce and describe an architecture for an integrated water-energy-food nexus model. Their architecture builds on existing models, but goes beyond them by integration and close-loop interaction of components related to the natural and anthropogenic water cycle, food and energy production and consumption. In particular, the architecture seeks to meet six objectives (O): 1) Joint modeling of resource quantity and quality, 2) modeling of return flows, thereby closing resource cycles, 3) spatio-temporal transferability, 4) integration of all (self-)interactions of the components water, energy, and food, 5) integration of economic, societal and environmental aspects, and 6) theoretical rigor and solvability. The authors start by describing the water balance model adopted from the JRB model, continue with a description of the core resource balance model components, addressing O1 - O3. Next, they describe possible water-energy-food (self-)interactions on a conceptual level, thus addressing O4. They illustrate this with an application to the BTH region in China, also on a conceptual level. In the next section, they describe how their model can be used as a basis for social welfare optimization, and how stable solutions are ensured (O5, O6).

3. Evaluation

Overall, I congratulate the authors for addressing the important and timely topic of building models that integrate natural and anthropogenic processes across the water-energy-food nexus. Such models are an indispensable prerequisite for decision-making in a world where nowadays most resource cycles are to some degree influenced by mankind. That said, I am sorry to say that there are two fundamental misses in the manuscript. **The first** is about the modeling framework itself: Any sectoral model in the water-energy-food nexus is afflicted with substantial predictive uncertainty. For hydrological predictions (as an example), this has been recognized more than a century ago (see Krzysztofowicz, 2001, and references therein), and it is still true today. If this is true for sectoral models, it is even more so for integrated models. Any ambitious model architecture in the water-energy-food nexus therefore needs to be inherently probabilistic. Such probabilistic predictions are not only an honest account of what is known (and what not), they also provide practical advantages for end users and decisionmakers (Buizza, 2008). **The second** concern is about the presentation of the architecture in the manuscript: It remains on a conceptual level throughout, describing the state variables and their interactions by interaction diagrams, closure relations and dynamical equations, but not a single proof-of-concept application is provided, nor any code or data sets for test application. To assess the realism and the competitiveness of a new model architecture, test applications with comparison against observations and benchmark models are indispensable.

These two major changes will require more time and effort than a major revision. I therefore recommend to reject the manuscript in current form, but strongly recommend a resubmission. I

hope this will not discourage the authors from their important work of developing integrated water-energy-food nexus models.

Yours sincerely,

Uwe Ehret

References

Buizza, R. (2008), The value of probabilistic prediction. Atmosph. Sci. Lett., 9: 36-42. https://doi.org/10.1002/asl.170

Krzysztofowicz, R.: The case for probabilistic forecasting in hydrology, Journal of Hydrology, 249, 2-9, https://doi.org/10.1016/S0022-1694(01)00420-6, 2001.