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Interactive comment on "The Nexus Solutions Tool (NEST): An open platform for optimizing multi-scale energy-water-land system transformations" *by* Adriano Vinca et al.

Anonymous Referee #2

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This article is well written and presents a substantive body or work. I enjoyed reading the paper and can see the value in the conclusions reached and thus the motivation of the research and sharing it with the scientific community. However, having read the paper, I find I'm missing various details that would greatly enhance my confidence in the conclusions, meaning some substantive modifications should be made prior to publication.

The introduction and description of the modelling framework were very clear. The presentation of some aspects of the model is left to other papers, however given the complexity of the model and focus on linking existing models this seemed a sensible

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approach.

There is a brief presentation of hydrological model calibration and performance in section 2.3, but beyond this it is not very clear to me what the outcomes of the model are sensitive to and to what extend uncertainties is various parameters and components might impact upon the outcomes. The model is very complex and has many parameters, but what is it sensitive to in this test case. I would assume many of the components have a minor effect on the outcomes. The computation time was not clear to me, apologies if I have missed this, thus it's difficult to know what a realistic expectation for the authors is in this regard however at the very least this issue requires more discussion.

How the model was parameterised is also not very clear to me. The combination of tables 1 and 2 do not seem to represent all the data layers required by the model and they don't clearly (to me) map onto model parameters or distinct elements of the system. Perhaps this would be too long for the main text, but could it be a supplement? I'm not criticising the research as such but I don't feel I adequately understand the model data requirements from the text.

The limitations section is primarily a list of things that could be added to the model in future versions, in my opinion it's not sufficiently critical of the current model as implemented and the outputs. The text chooses to focus on several things that could be added without much evidence of how sensitive model results might be to these. There should be a discussion around the data sets needed, how well these can define model parameters and what implications these might have on the reliability of the conclusions.

Specific points: Figure 6: What simulations does this plot? Is it the mean of calibrated simulations by CWatM for the four climate models? Why not present the range and performance stats for each simulation? Section 2.3: Multiple climate models are used, but what about uncertainties in the other component? Why have an ensemble for this and then a deterministic set of parameters for the hydrological model? P24: "However,

it brings greater computational challenges associated with using classical mathematical programming methods" perhaps I missed it but what is the computational burden of the model and how does resolution affect this?

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