Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2020-461-RC1, 2020

Hydrology and Earth System Sciences
Discussions

Interactive comment on "Modeling the integrated framework of complex water resources system considering economic development, ecological protection, and food production: A practical tool for water management" *by* Yaogeng Tan et al.

Anonymous Referee #1

Received and published: 26 October 2020

General: This paper develops the complex water resources system considering three elements: economic development, ecological protection, and food safety (namely EEF nexus as authors state in the text) that is the most likely to consume water resources and applied in a case study of Guijiang River Basin. The framework is of novelty, and the authors disclosed the optimal system dynamic and coevolution & feedback results by coupling the optimal model and SD model and found that only considering economic development will result in the overload status of the entire system. Once the ecology is paid attention to, sustainable development status will be achieved. The authors also

considered the model uncertainty and sensitivity to make the model reliable. Generally, the paper is good, with an interesting topic, and has a great significance for water resources management communities, and it also well fits the scope of HESS. However, I found two main flaws in this paper that must be paid attention before it can be considered for publication.

Major concerns:

Firstly, the logic of the text should be improved. In other words, the relationship between SD and optimal model, and its combination is not clear or, difficult to understand. This is the main flaw of this text. The description of both individual models is well-explained but their relationship is unclear. The authors outlined the general framework of the EEF nexus (shown in Fig.1) but in the following section, it suddenly jumped to the optimization model before introducing the SD model, which is illogical to some extent when reading this paper and difficult to understand. What is the relationship between these two models and how to connect with each other? The framework of the EEF nexus itself is exactly the reflection of the SD model and, in my opinion, if the optimal model is interrupted within the text, the logic will be damaged. Generally, the results of SD model are not always optimal if not considering the multiple water use agents because optimal algorithms are inherently used to tackle multiple objective problems. SD model is used to simulate the real-world status of a certain system that is composed of both variable relationships and their positive/negative feedbacks but has no optimal functions. Thus, the results of some variables are not always optimal. Based on this, the optimal model should be then applied to SD to generate the optimal result, and then the dynamic results considering the external temporal changes will be proposed (Section 5). That's why we should couple two models to deal with the research problem in this paper. So far the authors did not realize this logic problem and the logic of the text is flawed for me. To overcome this problem, I suggest that section 3.2 (SD model, at least 3.2.1 and 3.2.2) should be explained before the optimal model (section 3.1) to better explain the logic of the text. In other words, replace the order of both models, and the

research framework (Fig.2) should also be adjusted to reveal the logical relationship. Otherwise, the optimal equations and SD are feeling disconnected as the editor noted before interactive discussion. Although the editor mentioned the links between equations and SD should be provided, I would still stress the above-mentioned aspects to better connect the optimal and SD model.

Secondly, the calibration and validation process of the SD model should be supplemented and I also concern about the time series. The authors stressed three different develop levels (2016-2020, 2021-2030, 2031-2040) that corresponds to the pendulum model. However, it is 2020 already and I am worrying if the calculation of 2016-2020 is of significance. Also, SD model should be calibrated and validated before using it in a real case study but I cannot find any of the relative statements. In Table 4 the authors addressed the external drivers of three different stages. There's no doubt that stage 2 and stage 3 is the output of both model, but it remains unclear what the result of stage 1 represents, which is difficult for readers to understand. Is that the simulation result or it already exists in a real case? If it is the simulation result, it should be compared with the observed (or statistic) data for more model reliability, or otherwise, all the results will not be convincing. If it is the observed data, the authors should make it clear what the relationship between the results of stage 1 and stage 2 & 3 and how the dynamic runs overtime. Please clarify this issue in the revised paper.

Other concerns:

L26: In what way does the paper "highlight the importance of water resources management"? Please explain.

L85: are usually manifested.

L113: The framework is not yet raised to theoretical altitude. It is a little bit exaggerating. The word, such as "overall", "general" may be better.

L139-147: Why single out "CAS theory" here? Please explain the usage in this text

and the relationship of subsequent sections (or add some relative statements).

L150-158: As noted before, SD and optimal model should be reconsidered. Therefore, this part should be thoroughly edited to reveal the correct logic relationship.

L656-657: Please explain why uncertainty analysis "gives a strong reference for decision-making process".

L720-721: The general brief sentence should be added to explain how the research framework "becomes a practical tool". The following two paragraphs is used to disclose the general brief sentence. Also, check if the abstract has mentioned this. The title includes "practical tool" and all the text should be surrounded this issue.

I'm looking forward the revised version of the text.

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