

## ***Interactive comment on “An integrated modeling framework for coevolution and feedback loops of nexus across economy, ecology and food systems based on the sustainable development of water resources” by Yaogeng Tan et al.***

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Dear editor and authors,

This paper presents an interesting and significant contribution for coevolution process and feedback loop of water resources system considering the purpose of sustainable development by developing EEF nexus model, optimal approach, and system dynamic model. Sustainable development is always an important issue and will never outdated because it related to people's lives, and excessive social development undoubtedly

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has a bad effect on environmental protections. The subject of the paper addresses an important scientific issue for both water resources and reservoir management, and well fits the scope of HESS. Overall, this paper is well-written, has a solid theoretical basis, clear purpose, and reasonable methods. I'm interested in this topic. This short comment may not represent the overall review but I expect my below comment can help strengthen the paper and further improve its quality.

Major concerns:

The methodology section includes three main parts: outline of EEF nexus, optimal modeling approach, and system dynamic model. The methodology is of great merit and technique, but it seems to be lacking in the connection between those approaches. In other words, how to integrate the optimal model with the outline of the EEF and system dynamic model? What is the mutual relationship between those methods? Perhaps the flowchart of the overall research framework can help. In my opinion, the overall methodology refers to the theory of complex adaptive system (CAS) as you mentioned in the Introduction section (Line 87-89) because EEF nexus is substantially a complex system and, the best status of both whole system and its agents must be attained and the optimal methods are required. The three agents in this study are just each module of EEF nexus. Considering this, the adaptive process of a complex system is substantially the optimal process and each agent has their own adaptive behaviors. The optimal model presented by authors with clear objectives, constraints and solutions, which does very well. So I suggest the authors link the outline of the EEF nexus and optimal model with the theory of complex adaptive system and demonstrate it in the flowchart.

Another major concern is the presentation of the system dynamic model. How to apply in the real case study is not clear. The driving factor of system coevolution is usually either interact within the agents or the effects of external conditions on both whole systems or agents. The authors addressed the "pendulum model" to illustrate the different situations of social development, and I guess that it is the latter driving factor

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of system coevolution I stated before. It is also the driving factor of starting the adaptive adjustment process. But in the manuscript, I didn't find the relative statements, which to some extent is confused. This is the key point of the manuscript and authors should also add it in the flowchart. The introduction section should also contain such statements. The social changes drive the process of system coevolution and generate the feedback loop that is well presented in Fig.4. However, as far as I know, feedback regulations should contain cause-and-effect feedback loops that is reflected by either positive or negative. For example, increased social index causes increased water demand/supply, which further increases social index. This is a positive feedback loop. But some variables may be intensified. Negative feedback loops can eventually make the system more stable. This is the fundamental component of system dynamic model and authors should add such figure in the manuscript. Meanwhile, authors made a great contribution of feedback loop in the real case study. If the cause-and-effect feedback loop is in the manuscript, the statement about positive/negative feedback loop should be also included in the corresponding result section.

Minor concerns:

L16: What does the "scenario" refer to?

L30-31: The author stated that sustainable development is "ambiguity" but why does the author say "the new target"? It seems contradictory.

L129: by developing and controlling water...

L130: At once it is also indispensable.....: I guess "it" refers to water resources.

L165: resulting in a declining population: Please check if the statement is correct or add a reference. Row 8 Column 3 in Table2: Vegetation has something to do with crops?

L421-422: What do you mean by "reservoirs are of relatively high robustness for ecological module"?

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L461: ULRB is both heavy industrial city, not Guilin city

P18: the last row in the first column: Initial ecological streamflow because initial streamflow includes not only ecological issues but also for flood control, shipping, etc.

If the above concerns are considered, I believe that the quality of the paper will be greatly improved. I'm looking forward to the responses to my comments.

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