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Earth System Dynamics Discussions

Interactive comment on "Drought and Flood in the Anthropocene: Modelling Feedback Mechanisms" *by* Giuliano Di Baldassarre et al.

Anonymous Referee #2

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Drought and Flood in the Anthropocene: Modelling Feedback Mechanisms by Di Baldassarre et al.

This manuscript presents a framework for analyzing the feedback mechanisms of human activities and floods and droughts. The main focus is on reservoir operation and the corresponding feedbacks during droughts and floods. The framework is based on a so-called virtual model that can be used to understand the broad feedbacks between the two system (and not necessarily based on site specific rules of operation schemes). The notion of flood and drought memory, used here in the model, is really interesting and has not explored much in the past. Overall, I believe this is a good contribution and should be considered for publication after addressing the below

issues:

The manuscript presents an example of modelling flood and drought (Figure 5) including the actual river flows, and result from changing norms in reservoir management between operation rules aiming to better cope with flood, and operation rules aiming to better cope with drought. It would be great if the authors can plot a similar graph based on reservoir storage (i.e., observed storage, storage when the system is optimized to cope with drought, and storage when the system is optimized to cope with floods). Ideally, storage should be presented in percent of the total.

The model structure is explained well. But the parameter estimation component needs more explanation. I understand the the storage coefficient is estimated as a weighted average between a value that allows to have enough volume available during major flood events (k_f), and a different value that enables to keep enough water in the reservoir to cope with drought conditions (k_d). Please explain how k_f and k_d are estimated. There are other parameters in Equations 4 to 6. Are they assumed or estimated using a parameter estimation scheme?

The model uses a dynamically changing storage coefficient (k) to explain the changing rules for reservoir operation. Please explain the time scale of variability. Does this parameter change at monthly scale? Or seasonal?

It would be good to report the estimated parameters in Appendix or Supplementary

Materials.

Given that the model is designed to simulate long-term changes, shouldn't there be a loss term to account for direct evaporation from reservoirs? Evaporation is higher when the goal is to store water over a much longer period than when it is released faster. This may not be a big factor in overall balance. But just something to think about.

During droughts, typically, the demand is managed downstream which means the releases from reservoirs will change (i.e., a two-way feedback between demand and storage). If I understand correctly, this model does not consider this issue (?). It is worth including a brief discussion on this issue.

I suggest adding a paragraph or two on the general limitations of the model including the underlying assumptions (e.g., linearity).

There reservoir models with both constant and variable S_{max} (different S_{max} values for different months of a year). Is the S_{max} assumed to be constant or variable here?

The focus of the model is on human impact on water storage in reservoirs. I suggest making this clear in Abstract. The current version is too broad and implies a much broader human impact assessment. Also, I suggest considering adding something like

this to the title "Feedback Mechanisms in Reservoir Operation".

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