Review of paper

'Storage water value as a signature of the climatological balance between resource and uses'

By B. Francois, B. Hingray, F. Hendrickx, and J. D. Creutin

Dear Authors, dear Editor,
I have reviewed the aforementioned work. My conclusions and comments are as follows:

1. Scope

The article is well within the scope of HESS.

2. Summary

The authors present a method to use the seasonal variability of storage water value (SWV), a byproduct of the optimization of reservoir operation with deterministic dynamic programming, as a signature to evaluate the effect of altered (e.g. from climate change) hydroclimatic forcing conditions (precipitation and temperature). They do so at the (simplified) example of a reservoir in the Upper Durance basin, whose operation is constrained by hydropower (HEP) generation and lake level maintenance (LLM) for recreational reasons. The authors present and discuss the similarities and differences of SWV signatures for HEP only, LLM only and combined HEP+LLM objective functions. All show a distinct seasonality, HEP only and LLM only differ markedly, HEP+LLM is roughly, but not entirely the sum of the two individual signatures. Further, the authors apply several altered hydroclimatic regimes to the system, representing expected climate change (absolute temperature increase, relative precipitation decrease, and combinations thereof) and discuss the resulting change in the signatures compared to the baseline scenario.

3. Evaluation

This is a nicely written, well structured, lean but comprehensive manuscript presenting an interesting and novel way to characterize the impact of hydroclimatic changes on multi-objective reservoir operation. The SWV signature can potentially be useful in many studies that deal with reservoir management and climate change.
However, there are a few **major points** where the paper falls behind its potential:

- I like the proposed signatures (figures of seasonal SWV variability). However, the signatures for the various scenarios can and are in the manuscript only compared in a visual-descriptive way. I think it would be useful to further condense the signatures to values that can be compared in an objective and quantitative way. Suitable values could be
  - the mean SWV over the period to assess the differences in mean achievable value among the scenarios.
  - to assess the shift in the seasonal pattern of SWV, one could e.g. use approaches like the Wasserstein Distance/Earth Movers Distance/Kontorovich Rubinstein distance , e.g. Moeckel, R. and B. Murray (1997): Measuring the distance between time series. Physica D 102 (3-4), 187-194, which is usually used to determine the distance between 2-d probability distributions solving an optimal transport problem. I think the paper and the proposed method would benefit from going a further step in this direction.
- In section 5, at the turn of page 9010-9011, something seems to be missing: A reference to Fig. 7 and a complete discussion of it (discussion currently starts for row 2 in the figure)

Minor points are:
8995/16: 'can be carried **out** with'

8996/8pp: This sounds very much like we know exactly how climate change will happen (which is not the case). Please formulate in a way that reflects the fact that we can only guess climate changes based on scenarios (as you do later in the text)

8997/6: Yakowitz (1982) **provides**

9002/9: you write that the lake volume is set equal to the mean annual inflow. Does this correspond to the true volume of Lake Serre-Poncon? If yes, please mention in the text, if no, please give a good reason for it (I would expect that as we are dealing with the real Durance basin, we should also deal with the real reservoir).

9002/20: In equation 9, K

9003/3: replace 'satisfied' with 'considered'

9003/7: replace 'important' with 'large'

9006/10: I assume the temperature used here is local temperature in the Durance basin that is also used for the simulations. This implies that the power produced by Serre-Poncon is consumed only locally, and likewise the fixing of the power prices. Should this not rather be on the scale of France? And if so, would your results be strongly affected?

9009/10: 'is as expected different in this case'

9009/14: 'the easier it is to'

9010/18: with 'residuals', do you mean the difference between the HEP+LLM signature and an addition of the individual HEP signature and LLM signature? Please clarify.

As I would like to see the two major points addressed, I rank the manuscript **'Major revision'**, despite its already high quality.

Yours sincerely,
Uwe Ehret