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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Automatic design of basin-specific drought indexes for highly regulated water systems" *by* Marta Zaniolo et al.

Anonymous Referee #1

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The study presents a new framework for determining basin drought indicators (target index) by coupling numerous models conditioned to select and weight hydrometeorological variable states (predictors) in an automated fashion. The manuscript is topically of interest and relevance to HESS readers, generally well written, and logically presented. Most comments and suggestions provided request clarification in the manuscript, although some additional (minor) analysis is perhaps warranted. Comments below.

1. Introduction: What is the motivation for selecting these 4 objectives, other than 'common' or 'convenient'? Additional justification or rationale is warranted.

2. Methods: Why is only f4 (accuracy) selected to discriminate among subsets (Fig 2, step 2)? Why this one and perhaps not others as well? Subsequently, all 4 objectives /

assessment metrics are used for presumably final selection. Does this ultimately indicate that accuracy is the most important objective? Or somehow give it more weight?

3. Results: The target variable (supply deficit) requires a more clear description earlier in the manuscript. A later statement (p17, L421) indicates that agricultural demand is used to computer the target deficient, however there could be many definitions (deficit in reservoir storage, deficit in long-term groundwater levels, deficit in meeting total demand, etc.) Why is ag demand used?

4. Results: A linear model is ultimately selected although a non-linear mode is recommended and compared. In terms of R2, there is little difference, however it may also be interesting to compare the weights given to each input/predictor. If there is a significant difference, this may not be intuitive (a statistical modeling artifact?)

5. Results: Other comparison metrics (between SI and FRIDA linear model) besides R2 may be warranted. How does the RMSE (or other) compare? Is it better to error above or below the target deficit?

6. Results: What are the FRIDA results using the exact set of 12 indicators included in the State Index? And associate weights? This may be useful for comparison (and discussion with water users.)

7. Conclusion: The authors make mention of a changing climate. What does this mean for the reliability and accuracy of the framework conditioned on historical (relatively stationary) data? Please discuss.

8. Discuss: If a subset of the 4 objectives are selected, or different objectives, how might this change the outcomes?

9. Discuss: What influence may the selection of the learning machine, MOEA algorithm, etc. have on outcomes? Are they sensitive to choices or not?

10. Discuss: Would the selected inputs/predictors change substantially is the target deficit were defined differently? It may not be overly surprising that reservoir volume

and groundwater levels are most important for a target deficit focused on agricultural irrigation demand.

11. What are the prospects for projecting out the State Index, based on the state of some features (e.g. reservoir volume) and predictions of other features (e.g. precipitation or recharge)? This is hinted at in the very end of the manuscript, but may warrant more discussion.

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