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Discussions
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Interactive comment on "Comparison of Generalized Non-Data-Driven Reservoir Routing Models for Global-Scale Hydrologic Modeling" *by* Joseph L. Gutenson et al.

Anonymous Referee #3

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The manuscript compares two generalized non-data-driven methods for reservoir routing in large-scale hydrologic models. Given the increase in large-scale hydrological models this is indeed a scientifically relevant question and of interest for developers as well as users of large-scale hydrological models. The paper evaluates two methods presented in previous papers using data from 60 reservoirs located in the US and provides overall model performances, sensitivity analysis, effect of time steps on model performance, model stability, and limitations. The paper is overall well structured, the research questions are clearly described and the language is precise. There are, however, in my view two major limitations that strongly limit the general insights of this manuscript and that require a major revision.

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Discussion paper

1.) Reservoir data used in this study:

This study uses 60 reservoirs in the US out of which 43 (71% of the used reservoirs in this study) are used for flood control and only 6 (10%) for hydropower generation and one (2%) for irrigation. Given that the majority of reservoirs worldwide are used either for hydropower production or water supply/irrigation the reservoirs selected in this manuscript are clearly NOT representative of the majority of reservoirs influencing river flow. This strongly limits the insights that this manuscript provides especially with regard to the research questions outlined in the introduction. Flood control reservoirs are arguably the reservoir type that is "easier" to simulate in a hydrological model as their operation is mostly correlated with reservoir storage levels. The electricity-demand-driven hydropower reservoirs or the water supply/irrigation reservoirs have a much stronger human intervention and depend on a variety of factors which are typically very difficult to capture in non-data-driven reservoir routing model. The authors have to ensure that there is at least an equal share of reservoirs for flood control, hydropower production and water supply/irrigation used in their analysis to be able to draw more general conclusions. An even better approach would be to make the specific analysis of model performance for different reservoir types.

2.) The authors have limited their study to the comparison of two non-data-driven methods. Given that both methods are already more than 10 years old and more and more data on reservoirs is becoming available (e.g. see http://globaldamwatch.org/ or the numerous publications to measure reservoir water level fluctuations from space) I would encourage the authors to include at least either one data driven method as a comparison or to include at least a reservoir model that allows for the possibility to include more data about the reservoir such as the Burek et al (2013) model. Otherwise this is again a strong limitation on the insights provided in this manuscript.

Minor comments:

1.) There are a number of spelling errors and english grammar errors that need to be

corrected.

2.) References Macia-Sorribes and Pulido-Velazquez 2017 is missing

3.) Page 3, lines 53-54: This is not correct. The Global Flood Awareness System GloFAS is accounting for reservoir influences in its forecasts.

4.) page 12, lines 255: Please explain better why a decrease in RMSE is observed in Fig. 2 using the Doell method while at the same time the method increases KGE and R-squared?

5.) Please explain why you did not calibrate the k coefficients for each reservoir in the Doell method. Or at least provide an analysis of the model performance calibrated versus uncalibrated k coefficient.

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