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Interactive comment on "Evaluating a landscape-scale daily water balance model to support spatially continuous representation of flow intermittency throughout stream networks" *by* Songyan Yu et al.

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The manuscript, "Evaluating a landscape-scale daily water balance model to support spatially continuous representation of flow intermittency throughout stream networks" by Yu et al. presents a study that quantifies the ability of two water balance models to simulate streamflow in two basins in Australia, with a particular focus on intermittent streamflow. The authors focus on comparing different water balance models with different timesteps and comparing a flow routing streamflow model to a simple lumped model. Perhaps the most novel component of the analysis involves the characteriza-

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tion of so-called cease-to-flow conditions by applying a gauge derived threshold to the streamflow simulations.

The manuscript is well written and of interest a variety of scientific communities including hydrologists, ecologists, and potentially biogeochemists. While there are a number of improvements that should be made to the manuscript (see below), I don't think there are any issues that warrant a major revision to this manuscript. The three most important issues that should be addressed are as follows:

1) The authors need to address the uncertainty of, and assumptions involved with, developing linear relationships at a limited number of gauges and then extrapolating these relationships across basins. For example, are the locations of the gauges a representative sample of the population of streams within the two basins, or are they biased towards large, perennial rivers segments? Another example: are the gauges used to calibrate the water-balance and streamflow models used in this study the same gauges used to estimate crease-to-flow occurrence? If so, please include how this fact may impact the results, particularly in terms of uncertainty.

2) When comparing monthly and daily models, the authors classify a month as no-flow only if every day of the month is estimated to be at zero flow. Wouldn't this approach bias the results to be more perennial? Is this why the daily model doesn't perform as well as the monthly model at the monthly timestep? Please provide some rationale on this decision for the monthly classification.

3) Finally, I suspect that Geofabric is missing some of the smallest streams (see Benstead & Leigh (2012) An expanded role for river networks, Nature Geoscience). If so, this error will control the proportion of rivers that are predicted to be intermittent, a primary finding of this study.

Specific comments:

Abstract:

L27: replace “intermittent flows” with “cease-to-flow events”

L28: add “at a monthly timestep” after “intermittency”

L29: add “, using a daily streamflow model” after “1911-2016”. The monthly model produced a different estimate.

Main text:

L92: As mentioned above, add an acknowledgement about how the location of these reference gauges is likely biased towards particular river types (e.g. large perennial rivers) and river forms (e.g. narrow, single threaded rivers located near bridges), and how this bias might influence the extrapolation of the cease-to-flow threshold to all Geofabric stream segments.

L99: Add a little more information about Geofabric. What is the spatial resolution? Does it contain all of the smallest streams in the basins? If there is a channelization threshold, it will control the proportion of rivers that are estimated to be intermittent.

L112: As mentioned above, are the gauges used to calibrate the water-balance and streamflow models used in this study the same gauges used to estimate cease-to-flow? If so, please include how this fact may impact the results, particularly in terms of uncertainty.

L114: As mentioned above, please provide more information on the types of rivers and streams that these gauges are located on. This can help the reader understand the uncertainty associated with this analysis.

L122-123: “the readily available runoff data can be more accessible for potential applications” I don’t follow this logic. Using a flow propagation model doesn’t limit accessibly and should be relatively fast using RAPID, especially at the scale of these two catchments.

L160-161: “given that we do not have access to the underlying models to directly adjust

model parameters." RAPID is open source and you can adjust these parameters.

L162: Gauges are on rivers with large upstream drainage areas. There should be an acknowledgement that there are many smaller streams that likely have higher cease-to-flow occurrence and the gauges are likely not representative of these smaller streams.

L187: "all days in a month had to have zero flow for the flows for that month to be zero". Wouldn't this approach bias the results to be more perennial? Is this why the daily model doesn't perform as well as the monthly model at the monthly timestep? Please provide some rationale on this decision.

L197-198: As mentioned above, "The temporal pattern of flow intermittency was expressed as the proportion of streams with flow intermittency > 30 days or 1 month" – is this definition of intermittent streams based off of something or is it just arbitrary?

L239: insert "fair" before "match"

L288: Please explain "time of concentration" for the uninformed reader. Would be best to introduce it earlier on in the manuscript.

L300 and L301: typo: replace "KEG" with "KGE"

L318-319: "and recently many studies have developed methods to calculate transmission losses for better flow simulations (Lange, 2005; Costa et al., 2012)." The citations provided are neither recent nor many. L329: add "temporal" before "resolution"

L337: replace "is difference" with "are differences"

Figures:

Figure 3: Providing a y-axis with units would make it easier to interpret these boxplots

Figure 5: Perhaps considering scaling some of these y-axes as log, outliers make it difficult to compare the distributions and see the distribution of data where most of the data are located.

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