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Interactive comment on "Hydromorphological attributes for all Australian river reaches derived from Landsat dynamic inundation remote sensing" *by* Jiawei Hou et al.

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We thank the reviewer for the thoughtful comments and constructive suggestions, which will help us to improve the quality of the manuscript. Below please find our response to reviewer's comments in detail.

The data repository may have been temporarily offline when the reviewer tried to access the dataset. It should work well now using the link of http://dx.doi.org/10.25914/5c637a7449353. The dataset will also be available on the research group website (http://wald.anu.edu.au/data/) if the manuscript is accepted for publication.

Comment #1

I suspect that this study's method likely substantially overestimates river width because it assumes that all surface water measured within a given subcatchment is river water. This means that all oxbow lakes, impoundments, wetlands and other lentic waterbodies will be counted in the river width calculation. This point is briefly mentioned in the Discussion but should be acknowledged in the method section as a major assumption and limitation of the Methods and should be further discussed in the Discussion. For example, how does this assumption affect the relationship between recurrence interval and river width? Does this approach overestimate width variability with changes recurrence frequency? Would the authors be able to quantify the degree to which this approach affects their width estimates using a sample of subcatchments?

Response #1

We agree that off-channel water bodies can lead to overestimation of river width. However, the use of sub-catchment boundaries for each river reach eliminated most unrelated water bodies where possible. As for the unrelated water bodies remaining in the sub-catchment, they generally merge with channel at low recurrence frequencies (i.e. high flows) and separate at high (i.e. low flows). For analysing width dynamics, these nearby water bodies are assumed to be part of the river channel conceptually. Otherwise, we could fail to detect the maximum river width (removing nearby water bodies) or there would be abrupt changes in river width (keeping nearby water bodies at low recurrence frequencies and removing them at high recurrence frequencies). We will add further comment to the discussion section.

Comment #2

This study assumes that maximum river width corresponds to the recurrence interval of when the Landsat imagery does not show artifacts associated with cloud, shadow, or the SLC-error. This seems like an arbitrary threshold and could use more justification. Could this assumption be better justified or further discussed?

Response #2

Thank you for your comment. The number of clear observations in the overlapping scene areas could be more than twice that in most of the rest areas. The estimated river width increases much more sharply in the overlapping areas than the rest areas as recurrence changes from 0.5% (our threshold) to 0%, even for the same river reach, as a larger number of clear observations provide more chance to catch the extreme conditions. To standardise the width and analyse width dynamic of rivers across Australia as a whole, a more homogeneous condition was desirable. We will add this justification in the Method section.

Comment #3

Table 4 – readers may be interested in the variability of the parameters shown.

Response #3

Agreed. We will change this table to figure to show the variability of the parameters along different reach gradients.

Comment #4

In the methods or discussion the authors should provide an indication (preferably quantitatively) of the uncertainty of the input variables that are used in this analysis (e.g., slope, runoff, width).

Response #4

Thank you for your suggestion. The SRTM-derived 1 second (approximately 30 m) DEM has an RMS error of 3.868 m, and its uncertainties include residual stripes, broad scale stripes, steps in elevation, large offsets along the edge of the valley floor, noise due to the nature of the radar acquisition and processing, incomplete removal of vegetation offsets and urban and built infrastructure, and vegetation height over-estimated (Gallant et al., 2011). However, the majority of rivers flow on flat plains without vegeta-

tion cover and urban and built infrastructure and river gradients were only produced for the main river reaches, presumably with wider channels, which reduce the influence from uncertainties and limitations of DEM. Uncertainties from input data, parameterisation and conceptual structure in the model could affect runoff estimates, although the AWRA-L model has a strong documented pedigree in runoff estimation in comparisons with gauge data (e.g., Van Dijk and Warren, 2010, Frost et al., 2018). The raster-vector conversion anomalies to produce the Geofabric lead to overestimation of the segment length, which to some extent may counterbalance the overestimation of river width. We will add this to the discussion section.

Comment #5

Add a quick sentence about the method(s) used to define river segments and subcatchment extent in Muller et al. This is an important piece of information that likely impacts the results of this study considerably.

Response #5

Thank you for your comment. We will add a sentence about this in the Data section (see the response to comment #1 from reviewer #1).

Comment #6

P7 L18: “We excluded river widths with small upstream cumulative runoff (<104.5 m3 or 0.37 m3/s)” – please provide the reviewers with the plot over the full range of data so we can judge the appropriateness of this action.

Response #6

Agreed. The figure in fact showed the full range of data, but we will add a vertical line to show the threshold.

Comment #7

Table 6: Andreadis et al. (2013) used hydraulic geometry equations from Moody and

Troutman, (2002) - https://doi.org/10.1002/esp.403. It would be better to cite this paper in this table. Also, a recently-published study has done a similar analysis at the global scale and should at least be included in Table 6, if not elsewhere in the manuscript. https://doi.org/10.1029/2019GL082027

Response #7

Thank you for your suggestion. We will include these two valuable references.

Technical Corrections

Thank you. We will accept all the technical corrections by the reviewer.

Reference

Frost, A. J., Ramchurn, A., and Smith, A. (2018). The Australian Landscape Water Balance model (AWRA-L v6). Technical Description of the Australian Water Resources Assessment Landscape model version 6. Bureau of Meteorology Technical Report. http://www.bom.gov.au/water/landscape/assets/static/publications/AWRALv6_Model_Descri

Gallant, J.C., Dowling, T.I., Read, A.M., Wilson, N., Tickle, P., Inskeep, C. (2011). 1 second SRTM Derived Digital Elevation Models User Guide. Geoscience Australia https://d28rz98at9flks.cloudfront.net/72759/1secSRTM_Derived_DEMs_UserGuide_v1.0.4.

Van Dijk, A. I. J. M., and Warren, G. (2010). The Australian Water Resources Assessment System. Technical Report 4. Landscape Model (version 0.5) Evaluation Against Observations. CSIRO: Water for a Healthy Country National Research Flagship. http://www.clw.csiro.au/publications/waterforahealthycountry/2010/wfhc-awras-evaluation-against-observations.pdf.

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