

Geosci. Model Dev. Discuss., referee comment RC2  
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## Comment on gmd-2021-170

Anonymous Referee #2

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Referee comment on "Evaluating the Atibaia River Hydrology using JULES6.1" by Hsi-Kai Chou et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-170-RC2>, 2021

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### Review of "Evaluating the Atibaia River Hydrology using JULES6.1" by Chou et al.

The authors describe the results of using the JULES land surface model to model streamflow in a catchment of ~2000km<sup>2</sup> in Brazil. Two alternative representations of runoff generation are compared, and the sensitivity to runoff parameters is investigated. The TOPMODEL-based representation is considered to be better and those results are presented in more detail. The authors consider that the model does a reasonable job in this catchment, and suggest that the main deficiency is the relatively sparse raingauge network in the area.

The topic that is addressed - can we use "phycis-based" land surface models to make useful simulations/predictions, particularly in relatively data-sparse areas? - is of wide interest. However, I feel that certain aspects of the approach and analysis need to be explained better - see more detailed comments below - and the presentation improved to help the reader. I also feel that one of the main conclusions is stated too confidently; the abstract says "Our results show that the coarse resolution of rainfall data is the main reason to reduce model performance". While I agree that the rainfall data are likely a major limitation, I don't think anything has been proved quite so conclusively and the language should be revised accordingly.

Overall I suggest that the presentation needs to be improved before this manuscript could be published further - but this manuscript represents a good start. (Whether these constitute minor or major revisions is a moot point.)

### Comments

Another highly relevant paper (because it looks at runoff production and riverflow in JULES, and the sensitivity of various runoff parameterisations) is Martínez-de la Torre et al., 2019, Using observed river flow data to improve the hydrological functioning of the JULES land surface model (vn4.3) used for regional coupled modelling in Great Britain (UKC2), *Geosci. Model Dev.*, 12, 765–784, <https://doi.org/10.5194/gmd-12-765-2019>.

L31 and following: The phrasing and punctuation make some aspects slightly difficult to follow. Also the final sentence - there are already models, and the perceived need is for one in the public domain (which isn't quite what is said).

L32: The Sacramento model (SAC-SMA?) will almost certainly have papers that can be cited - assuming this is the same model.

L34: The discussion of Bayesian and MCMC models is confusing, as neither is used here. Clarify that these are possibilities, not currently used for this catchment.

L74-77: Much of this is about the region, not the model. Move to Sec2.2? Also you talk about sub-catchments before you have introduced us to the whole area (in Sec2.2). I would be tempted to move all the geographical information to before the model is introduced.

L74: Somewhere (probably near here) you should clarify that you run the model representing each sub-catchment (Fig.1) as a single model gridbox.

L76: How many data are missing? It would be good to know something about this aspect of data quality. Do you need to swap entire years, or can you just patch data where they are missing (e.g. days or months)?

L83-86: This is about your methodology, not JULES. I suggest this might be better in Sec2.3 (which could be renamed).

L86: The TOPMODEL parameterisation in JULES also includes an exponential decline with depth of the saturated hydraulic conductivity, with parameter  $f$  (see Gedney and Cox (2003) or Clark and Gedney (2008)). Results are potentially sensitive to that parameter (I expect), so why did you not include that parameter in your sensitivity analysis?

L99: Time series - for how many locations? (Fig.1. tells us.)

L105: Note that higher resolution reanalysis-type datasets are available (e.g. ERA5-based data available via the Copernicus service) - not that that alone guarantees improved accuracy.

L130: This section only makes much sense if the reader is already familiar with the PDM and TOPMODEL parameterisations in JULES. In general these parameterisations should be introduced in more detail - e.g. assumptions, how they work, how they differ. The functional forms used should be presented in your manuscript, to save readers having to search through other papers, and so that they can understand how the parameters you vary are used in the model.

The model configuration (parameter values) and the modelling approach should be described in more detail. Suggestions and questions follow:

How did you go from the MODIS land cover map to fractions of the model surface types?

To what extent is the catchment hydrology modified by human behaviour? If modification is important, is this represented in the model?

What topographic index data were used for TOPMODEL?

How was the model initialised, and was there any "spin up" period?

How were all the other parameters and switches set - e.g. did you start from an existing configuration? A keen reader can find all the settings in the Zenodo bundle, but that still doesn't explain where they came from.

Were the optimal parameter settings determined using "expert judgement"? e.g. You present various statistics of the flow, and describe some of the model sensitivity, but how did you come to your final decision? It does not appear to have been through anything such as a weighted-average of the statistics. For some metrics PDM was better than TOPMODEL.

Was the sensitivity analysis performed "one at a time"? What about any possible interaction

between parameters? This possibility should at least be mentioned.

You present results only for the flow gauging station that is furthest downstream (I think). Fig.1 suggests that you have two or three other gauging stations that are close to catchment outlets - could you also look at model performance at those points? Those could potentially also tell you if the model behaves better in some parts of the catchment (e.g. headwaters) than elsewhere.

Clarify your final parameter settings - i.e. the values that were used for the main runs.

General comment on the language - while the manuscript is understandable and written in fairly good English, there are quite a few bits where the language could be improved to make the meaning clearer. If it is possible to get someone (e.g. a native speaker) to spend a bit of time on this, I think you could make improvements without having to spend a lot of effort.

A few specific examples (just a few phrases that I noted; the more important changes would be about the phrasing of certain sentences):

L50 "JULES's model"

L54 "detailily described"

L70 "physics and chemical properties"

L140: "we found a merely change"

More minor comments

Citations appear in various formats - tidy up.

L202: The reference for Brooks and Corey (1964) looks to have been mangled.

L77: DAEE is (currently) only explained later.

Fig.3: Add units of flow.

Fig.5: Clarify that this is using TOPMODEL.