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# *Interactive comment on* "ORCHIDEE-ROUTING: A new river routing scheme using a high resolution hydrological database" *by* Trung Nguyen-Quang et al.

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The manuscript of Nguyen-Quang et al. discusses a new, high resolution routing scheme for the ORCHIDEE model. Although the concept of the routing has not been adapted compared to an earlier version of ORCHIDEE routing, the spatial resolution has been increased significantly to better represent river basin boundaries and the flow paths within the basin. The manuscript is generally well written (some textual revision needed here and there) with informative illustrative figures. Overall, I think the manuscript would be suitable for publication in GMD. There are, however, a few topics and points which I would like to see discussed in somewhat more detail.



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Discussion paper

Even though not a classical manuscript-structure was followed, I appreciated the current set-up in which Section 4 describes HTU-sensitivity (with a nice and clear conclusion in Sect. 4.3) and Section 5 the performance compared to observations.

Major

The manuscript clearly demonstrates the uncertainty introduced by forcing data. Furthermore, uncertainty introduced by human impact, and model structural uncertainty in ORCHIDEE have been discussed. Also uncertainty in the concept of the routing scheme are discussed (does not account for stream flow velocity changes, bankoverflow, etc.). As a reader, it is still unclear to me why the priority was set to improving the spatial resolution of the routing, rather than to any of these other sources of uncertainty (which are substantial). The results clearly demonstrate that the improvements from the higher resolution routing model are difficult to validate given all the other sources of uncertainty.

Continuing on this point, p.3 lines 3-5 refer to the discussion of global hyper-resolution models. This fits well in line with what has been done in this paper, but overlooks the discussion that is going on within hydrological sciences on whether focussing only on increasing the spatial resolution is the best way forward (see e.g. the comment that Beven and Cloke wrote).

In Section 3.4, three reservoir parameters have been calibrated based on the Rhone data, and subsequently these parameters have simply been applied to all basins. That does make me wonder how sensitive the routing model is to these parameters, and how different the parameters are when calibrated on another basin. I think this is too important to simply step over like is done now.

Many results are presented at the monthly time scale. First thing I wondered is the added value of the high resolution routing for the monthly timescale, because in principle all that routing does is delaying the water over time, but given the size of the basins, this effect is expected to be limited on the monthly time scale. So, then the added value

of the improved routing is basically only in better delineation of the basins compared to the coarse resolution scheme, for which a complex DEM and flow direction scheme is not necessary. Could you respond to that?

The analysis on the daily time scale (e.g. Sect 5.3) to discuss model performance seems therefore more relevant, but only shows results in terms of a flow duration curve, and from a flow duration curve it is hard to retrieve timing-information. Is it not possible to include hydrograph-information to demonstrate the simulations versus observations directly?

The current conclusion (sect 7) consists of one paragraph with the results, while the second paragraph is basically only recommendations. I think it would improve the strength of the paper to not end with mentioning everything that is missing still, but describe what has been added with this rrs. Furthermore, the results of section 4 and 5 could be touched upon in the conclusion.

Minor

General; there is a tendency throughout the manuscript to describe the figure legend in the main text (see e.g. p.8 l.15). This is not necessary and makes the manuscript less nice to read. Describe the legend in the figure caption and the conclusions from the figure in the main text.

As not being very familiar with the models discussed in the Introduction, I don't see the logic between the section starting on p.2 l.7 and the section on p.2 l.20. The first section says: ".. redistribution in turn can feed other processes in the LSM (floodplain evaporation, irrigation)." Then it continues to describe how post-processing routing schemes neglects feedback interactions between river discharge and soil hydrology. In the second section, the ORCHIDEE routing is described, but as far as I could find in the manuscript, this routing also does not account for floodplain evaporation, irrigation, or river discharge / soil hydrology interaction. Therefore this is confusing to the reader.

Figure 1: the red colour appears in the legend, but is also used to indicate the regions of this study. It is unclear if the red colour then still refers to the legend colour too.

p.6 l.7: it is unclear how this scheme allows for irrigation withdrawal and flood plains. Perhaps elaborate on that. Furthermore, it is correct that irrigation is not accounted for in this study, right? If the routing allows for that, why was it excluded in a application in a region where irrigation is expect to play an important role?

p.14 l. 28 I am not familiar with the power spectrums discussed here. Perhaps some more information on this methodology can be provided, and what the implications of the results are.

p.17 l. 15 I don't see how the results support this (strong) statement.

References

Beven, K. and Cloke, H.: Comment on "Hyperresolution global land surface modeling: Meeting a grand challenge for monitoring Earth's terrestrial water" by Eric F. Wood et al., Water Resour. Res., 48, W01801, doi:10.1029/2011WR010982, 2012.

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