Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2018-57-RC2, 2018

Geoscientific Model Development Discussions

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

Anonymous Referee #2

Received and published: 25 May 2018

Summary: The paper presents the implementation of the river network derived from high resolution topographic data to the river routing model in ORCHIDEE land surface model and its effects on the streamflow estimations compared to the previous coarser resolution network data. The paper discusses the optimal sub-basin sizes (called HTUs here), and also presents the simulation skills at the 12 Mediterranean basins.

Recommendation: The manuscript contains interesting analyses, but I think the paper can be improved. I would suggest the authors go through major revision.

General Comments:

1. Regarding the paper readability, the paper can be improved by making the de-

scriptions more concise throughout the paper, but especially section 3 and discussion. Section 3.3. section seems to be important, but it is a little lengthy, therefore, it is hard to follow. I would like to suggest describing each step in Figure 2a) one by one at the beginning. Also note the specific comments.

2. The paper emphasizes an importance of incorporating anthropogenic processes on river flow (irrigation, reservoir etc.) at multiple locations throughout the paper (P3-L7, P6-L5-8, P17-L20, P18-L13-15). I agree that this is one of future direction for river modeling. However, this issue is not main topic of this paper, and the paper never mentioned how high resolution gridded network-based model helps to incorporate this nontrivial processes as indicated in P3-L7. I would like to suggest at least how high resolution river network routing helps incorporate these processes

3. The paper states that the authors revised the river routing scheme. This gave me an impression that the author revised actual river routing algorithms, but the paper's contribution is to develop the method to derive river network and basin delineation and routing parameters based on high resolution DEM. Also, I understood that the routing scheme (unit-to-unit routing scheme) has not changed from the previous model. I would suggest describing title more specifically and also reword the routing scheme in the text to specify precisely what is really done in the paper (e.g., P1-L2, P1-L9. P6-L10.).

4. Improvement of streamflow estimates, in particular, volume bias, are due to the better representation of sub-basin areas than the previous model. I believe this, but to illustrate this clearly, I would suggest including total runoff depth over the sub-basin based on the new (and old) river network and compare it with observed runoff depth. This can be added in Figure 3.

5. The paper discusses some issue on computational cost on high resolution river network data (Section 4.3). For GMD paper, I think this is very appropriate. routing model is much less computationally expensive. The paper state recommended HTU

resolution improve the computational cost by a factor of 10 compared to the highest (native DEM) resolution in P11-L21. Is this factor scaled for the river basin area? I would also like to suggest stating quantified computation cost (e.g., wall-clock, or core-hours = number of processor cores x wall-clock in hours). a factor of 10 might not be significant compared to the LSM computational cost.

Specific comments

P2, L11. I am not sure why scaling causes information loss. I feel I disagree with this statement, but I guess I did not understand the statement.

P3, L6-7. This is naïve statement to me. Do you mean this by hyper-resolution LSM? Hyper-resolution LSM model does not necessarily provide better simulations (if forcing is not good). Hyper-resolution LSM may provide accurate representation of some of geophysical properties (e.g., topography), but not likely soil, geology.

P7, L8. "The area of each HTU is limited by an user-defined size". This is not crystal-clear to me. I understood the "maximum" area of each HTU is set by user to constrain the HTU areas. Correct?

P7, L27. I thought there were eight smaller HTUs and 4 inter-basins. I wonder if I misunderstood something.

P8, L7-10. Regarding combining the small HTUs, how do you determine the outlet of the combined HTUs.

P9, L13-14. I am having difficulty in understanding this sentence (how this derivation of k corresponds to unit hydrograph).

P9, L15. I am also having difficulty in this sentence and equation (LHS looks like the velocity over the HTU, and RHS looks induvial 1km pixel velocity?). Also what is D?

Last paragraph in Section 3.3. Most of sentences in this paragraph seems to be out of place (maybe fit in introduction). I would suggests removing to make this section

shorter.

P17, L22-27. Performance of streamflow simulation is based on all the model components (including forcing). These sentences weigh too much on RRS to attribute the simulation performance or uncertainty.

I would suggest combining discussions and conclusions potentially sub-section (e.g., limitation of model, future work etc.). The first paragraph in discussion sounds like reading introduction. I would suggest removing (moving to introduction) or making it very short.

P18, L9-10. This sentence should appear earlier (section 3.1?)

P18, L14-19. Issues on Nile river is already mentioned earlier, and this sentence seems to be out of place. Suggest removing this.

Table 3. Why do some rivers have two rows? For example, what is 6.83 and 5.99 for NS of Boara Pisani?

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