Reply to Review #3

Dear Colleague,

thank you very much for taking the time to review our paper and proposing some interesting comments. They have helped us greatly to improve the manuscript.

In this manuscript, the authors proposed a new tiling method to efficiently incorporate high-resolution topographic information for better hydrological simulations by atmospheric models while keeping the atmospheric grids. First, they built hydrological coherent units (HTUs) from hydrological digital elevation models. Then, by evaluating the generated river networks and sensitivity experiment results, the authors proposed a way to find appropriate truncation numbers for HTUs and time steps. Finally, they conducted offline ORCHIDEE simulations and compared the simulated discharge and river temperature with observations.

The manuscript is well-written and contains valuable information for ESM modelers. Therefore, I recommend publication after minor modifications.

Thank you for these encouraging remarks.

General comments:

1. Can you explain more about the connectivity between atmospheric grids? For example, how do you maintain consistency when an HDEM grid overlaps with multiple atmospheric grids and is split into multiple supermeshes?

Yes, this is indeed a complexity which was not discussed in the presentation of the methodology. The following sentences were added to explain the problem and the solution adopted :

"A further complexity is introduced by HDEM pixels overlapping more than one atmospheric cell. All polygons generated by the supermeshing are kept but the largest is considered to dominate and to determine the connectivity of the graph between grid cells."

2. It would be helpful to add a figure to compare the results with the previous ORCHIDEE simulations explained in Section 6. Have you observed any improvements by taking into account the detailed topography information?

The actual routing of ORCHIDEE has not changed. Only the methodology for the construction of the HTU graphs was externalized and extended so that higher resolution HDEMs can be used. It was verified that the current method applied to the Fekete et al. (2000) produces the same result as the previous version of ORCHIDEE (Results in the thesis manuscript of A. Schrapffer 2022) . Running the tests of section 6 also with the Fekete et al. (2000) HDEM makes little sense as it is at

0.5° resolution. Thus is has insufficient resolution to produce enough meaningful HTUs on the grids used by the WFDEI and E2OFD forcing.

L97: Can the atmospheric grid be divided into vegetation tiles? If so, how can vegetation tiles be related to HTUs?

Yes, this is planned future development. The vegetation would have to interact with the superficial groundwater and this can be done as we know the shape of the HTU. An example for the implementation of these ideas can be found in Picourlat et al. 2022 (see references).

L107: It may be helpful to add an explanation of how the lambda was derived.

It is a simplified version of the Manning formula for the average velocity in an open channel.

L182: Eastern -> Western? Could you include a compass symbol to indicate the direction in Figure 2?

Corrected

L185: Are any panels showing the results of the first step in Figure 2?

No, it would chose just to present the final result for two truncations. The intermediate results have not been archived.

L193: It is unclear to me which location you are referring to; it would be helpful if Figure 2a includes the names of the local rivers.

We fear that this will make the graphics too complex if all the small rivers have to be added to figure 2a).

Figure 8: four different grids -> three different grids?

Corrected.