

Answer to the comments by anonymous reviewer#2

We thank the reviewer for their comments on our manuscript. This is a short reply to the two major comments raised by the reviewer. We tried to address them in this brief reply to stimulate open discussion. We agree with the reviewer on their other comments and we will provide detailed answers to their individual comments after the open discussion.

The paper titled “Flexible vector-based spatial configurations in land models” uses a new spatial configuration approach with the VIC model that is based on the group response unit concept. The main goals in the paper are to first introduce a method to defining heterogeneity in VIC and then to assess the added value of multiple spatial configurations over the Bow River basin at Banff. The paper is a novel contribution and will be an excellent addition to the land surface/hydrologic modeling community. However, there are multiple issues that I describe below that should be addressed before publication.

* I don't really understand the difference between GRU and HRU in this study; from my understanding a GRU is composed of many HRUs. For example, a sub-basin (GRU) will have multiple HRUs. But based on what is being done here, these GRUs are just the classic GIS partitioning happening and thus very similar to the original definition of a HRU. Maybe I am misunderstanding something. In any case, please clarify the use of the GRU term here.

We thank the reviewer for their comment. The reviewer is correct on the original concept of GRUs and HRUs. As the reviewer correctly points out, GRUs and HRUs typically define a hierarchal spatial organization where HRUs are nested within GRUs (e.g., Clark et al., 2015). For example, in land models, a GRU could be a model grid box and HRUs could be the vegetation tiles within a model grid box; in hydrology models, a GRU could be a sub-basin and HRUs the hydrologically similar areas within a sub-basin. The forcing data could be either constant across the HRUs or distributed to each HRU (distributed forcing within GRUs is important in cases where there are strong climate gradients within GRUs, e.g., due to large elevation range). GRUs are also used to describe classifications of the landscape across the modelling domain (Kouwen et al., 1993, Pietroniro et al., 2007).

We agree with the reviewer that using the vector-based implementation there is little difference between the concept of GRU and HRU. To avoid confusion, we abandon the concept of GRU entirely and present the model as a vector-based implementation (that can benefit from the concepts of GRU and HRU).

* Line 153 - Although I am certainly a fan of “killing the grid”, it is not entirely true that “resolution loses its meaning” with the introduced approach. You still have an effective spatial resolution which is governed by the level of details that needs to exist in your polygons. Of course the advantage here is that you can have the size of those polygons vary as a function of space; however, you will still have the concept of an effective spatial resolution present. I'd suggest thinking more carefully of what moving to a polygon based approach really means and how it can be “upscaled” in more informative ways than the classic coarsening of the grid.

An excellent point raised by the reviewer. The reviewer is certainly correct that we still have the same upscaling challenges in vector-based implementations. We will discuss this issue in more detail in the revised paper.

One of the ideas behind the vector-based modeling is the flexibility of the input data. For example, for a larger basin, the forcing can be set to a higher resolution for the mountainous headwater. For our test case (limited spatial domain), this concept can be explored in detail, and our current work focuses on resampling and coarsening of the forcing grids. We will rework this section to include more discussion on the importance of “polygons” vs “grid” and the implications for large/continental scale modeling.

With kind regards,

Shervan Gharari, on behalf of the co-authors

References:

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