Dear Editor,

We appreciate the critical yet reasonable comments by the reviewers. We wrote the original manuscript as a technical paper with the goal to document the technical aspects of modeling land surface and river transport processes using a subbasin framework (SCLM) as opposed to the commonly used grid-based framework (CLM). Therefore we did not go deeper to reveal the larger scientific advantages of SCLM, which was the topic of a separate manuscript that demonstrated significant improvements in scalability with SCLM compared to CLM. As part of response to the reviewers' comment, we have provided point-to-point responses. The reviewers' major concerns are 1) little technical innovation and 2) insufficient investigation of the scientific advantages of SCLM approach. We agree that the technical innovation is not major, though it is important to document the technical approaches to support a new configuration of a community model that is used by a large international community. We also agree that demonstrating the scientific merits of the SCLM approach is important. In response to the valuable comments from the reviewers, we plan to revise the manuscript with major improvements listed below.

1. We will significantly condense the content of our original manuscript and add more description and discussion on the indexing system approach and the soil depth issue (as suggested by Reviewer #1). We feel this part is still useful for some readers since this subbasin-based representation is not a common practice in the earth system modeling community. However, more detailed discussion such as preparation of input data will be moved to an appendix. We will also pay more attention to the quality of presentation, particularly the clarity and sharpness of figures, as suggested by the reviewers.
2. We will extend and strengthen our analysis to demonstrate more succinct benefits brought by the SCLM approach as suggested by the reviewers. We have already been able to demonstrate clear advantages of SCLM over CLM in scalability of runoff generation, which is reported in a separate manuscript under review. An important goal of the present study is to demonstrate further advantages of the subbasin framework in the coupled SCLM-MOSART for simulating streamflow. In the revised manuscript, we will examine and compare the sensitivity to the change of spatial resolutions in CLM-MOSART and SCLM-MOSART at a range of temporal scales (from hourly, daily, monthly to annual) and spatial scales (from upstream small headwater watersheds at the order of ~10^2km^2 to large basins at the order of 10^6km^2). The significance of the differences between the two approaches will be quantified as suggested by Reviewer #1, as well as analyzed to elucidate the reasons for the differences. We will also add comparison of the model simulated runoff response to the observations from the Model Parameter Estimation Experiment (MOPEX) dataset.
3. We have already completed both CLM and SCLM simulations at the other three resolutions in addition to the 1/8th degree resolution: 1/4th, ½ and 1 degree resolutions respectively over the Columbia River Basin. The original NLDAS2 forcing data used in this study were obtained at 1/8th degree resolution; therefore we don't feel there is much benefit to be gained by going with any resolution finer than the 1/8th degree resolution.
4. We will add another study region over the Midwest, which is distinctly different from the Columbia River Basin in terms of the combinations of climate conditions and landscape

properties. The above numerical simulations and analyses will be conducted similarly at the Midwest region for more insights and robust understanding of the difference between the grid- and subbasin-based representations of CLM across different climate and hydrologic regimes.

We estimate that the above revisions would require three to four months to complete. We would do our best to complete the proposed tasks and revise the manuscript as early as possible but no later than 4 months, We hope we have provided a plan that adequately addresses the reviewers' comments and a feasible timeline for improving our manuscript for significantly improved scientific contents that contribute to new insights in land surface and river transport modeling.

Again, we want to express our sincere appreciation for your time and effort and those of the reviewers. Please let us know if you have further comments or questions.

Sincerely,

Hong-Yi Li