

Comment on hess-2021-484

Anonymous Referee #3

Referee comment on "Toward hyper-resolution global hydrological models including human activities: application to Kyushu island, Japan" by Naota Hanasaki et al., Hydrol. Earth Syst. Sci. Discuss., <https://doi.org/10.5194/hess-2021-484-RC3>, 2021

The authors present a study comparing the impact of global datasets vs. localized datasets when parameterizing hyper-resolution models for water resources applications. The paper is well written, and I appreciated the authors' efforts to obtain the best possible detailed localized data for their study site. Results show that, as expected, localized models performed better. While this is an interesting exercise, the paper would benefit from a better contextualization and insights on how we can leverage their work/their findings towards hyper-resolution modeling at the global scales, as the title suggests. Here are some major comments that should be addressed before publication:

- L 131. "it was designed for applications to any spatial domain and resolution." One of my biggest concerns when applying large-scale designed hydrologic models to hyper-resolutions is the lack of or inappropriate processes representation at the fine scales. These large-scale models were often designed under the large grid cell assumption, in which local-scale and non-linear integrations between water and land and climate were negligible. However, when moving to fine scales, processes such as lateral water flow, the interaction between the river network and the land, and surface water pumping uphill, are no longer negligible. Rather than just increasing computational grid and parameter regionalization, hyper-resolution modeling also comes with the need to further understand and represent hydrologic processes at these scales. The authors do attempt to address the need for improving human activities representation at these scales with the implicit aqueduct estimation. It would be good to have a subsection where the authors describe the H08 efforts towards also improving hydrologic processes representation at the fine scales.
- This modeling exercise demonstrated how models with localized inputs perform better than with global inputs. It would be great if the authors could provide a sensitivity analysis of the different input datasets to identify which are the most critical for improved performance. I propose a validation analysis using a leave one input out approach. In this way, besides just reporting what we know is already expected (localized models perform better), this paper has the potential to actually inform the scientific community of which of the inputs for hyper-resolution modeling we should be focusing on improving. Of course, all of them are important, but ranking them would greatly value future work in this field. Is that crop data? Precipitation? Water use and

withdraws, etc.

- L 630. "it opens the door to applications of the model to hyper-resolution global hydrology." Not really, the results actually show the opposite: that without localized data global hyper-resolution modeling of water resources is inaccurate, and that perhaps we should be focusing on localized models. If the authors can demonstrate what are the large sources of uncertainties (e.g., which are the localized input variables that drive the uncertainties), then you could say that improving a given X input at global scales can enable more accurate hyper-resolution global hydrologic modeling.
- Model calibration is an important aspect of the model validation performance, as such, the details should be moved from the supplemental material to the main text.
- Section 3.1.4, in the implicit aqueduct scheme, does the water only moves downhill? How about water pumping schemes? While they are often negligible at the coarse scale they are very much relevant at the local scale.

Moderate/Minor:

- Section 4.3, as mentioned earlier, authors should also address hydrologic uncertainties in this section.
- Figure 3. This figure could be improved for clarity. Inter-basin transfer you mean between grid cells? Does the grid cell comprise a basin? Are the rivers the blue arrows or the blue grids?
- Table 5 would benefit from a more descriptive header