Response to Anonymous Referee #2

Overall the paper follows sound and well known techniques to estimate, regionalize, and calibrate channel geometric and friction parameters in applications used in continental scale water modeling. Due to the large spatial scales of the National Water Model, several simplifying assumptions are understandibly employed to come up with regionalized estimates of the most important parameters as determined by a sensitivity analysis. These assumptions are well characterized and the limitations of them are properly described in the assumptions. Although the overall skill improvement of the aggregated response in time and space is minor, several knowledge contributions are made in the process. An assessment of the spatial variance of the methods is properly documented and some of the major contributing factors to skill performance outside of the scope of the paper are discussed.

One of the principle questions that is a bit unclear to me is if the Land Surface Model wasn't ran in the 8 year simulation then how were the inflows and subsurface fluxes determined? Since stream flows are highly dependent on magnitude to determine their optimal, respective parameter settings, it's important to have more clarity as to where these data points were obtained. Otherwise, the limitations of the study are clearly outlined especially including the coarseness of the regionalization, lack of additional predictors in the regression, lack of spatial relationships, and lack of consideration for compound friction values. A fair survey is conducted of more robust techniques that can be employed in the future to possibly obtain better results. An assessment of the spatial variance of the performance of the methods is properly documented and some of the major contributing factors to skill performance outside of the scope of the paper are discussed. The study's conclusions are fair given the methodologies employed and the results obtained. Overall, the motivation for more work into calibrating continental scale hydrologic models is well argued for.

We thank the reviewer for their acknowledgement of this paper's contributions despite the outlined limitations and assumptions. The reviewer is correct that inflows and subsurface fluxes were obtained from the outputs of the Land Surface Model (LSM). These fluxes were generated from a prior full model simulation over this time period using the operational settings and were used as inputs for the channel routing module simulations used in our experiment. LSM simulation settings reflect a partial calibration performed by the National Water Model team, but any further LSM simulation was beyond the scope of this analysis.

Specific technical corrections hover around the ambiguous use of variable symbols including but limited to m, b, i, S, and w. The authors should strive to use unique notations for each variable across equations to avoid unnecessary ambiguities. More clarity can be provided when discussing the different samples of stream gages used. Please see the attached file for more technical comments.

We recognize the confusion that may arise from repeated variable names and make several alterations to the formulas and variables to correct this and limit any confusion:

Original, Line 207: "$d = m \times w + b$"

Revised: "$d = \boldsymbol{\beta_1} \times w + \boldsymbol{\beta_0}$"

Original, Line 214: "$\log (n_i) = m \times \log (S_i) + b$"

Revised: "$\log (n_j) = \boldsymbol{\beta_1} \times \log (S_j) + \boldsymbol{\beta_0}$"

Please also note the supplement to this comment: https://hess.copernicus.org/preprints/hess-2021-552/hess-2021-552-RC2-supplement.pdf

The contents of this supplement PDF appear to be the original manuscript only.