We thank the Editor and reviewers for their feedback. We believe increasing the spinup time has significantly improved the simulations. We have addressed the comments in the following manner:

"I concur with one reviewer's concern regarding spin-up equilibrium: the multiscale scheme exhibits larger interannual variability in SMC and ZWT compared to the benchmark even after 40 years. Please provide time series showing evolution of domain-averaged SMC and ZWT over the full spin-up period for both simulations, and clarify whether this variability reflects genuine process differences or insufficient equilibration."

We have extended our simulations to a total of 150 years and included Figure 1 in the manuscript. We found this very valuable, and the reviewers were right to bring this up. We have addressed this comment and believe it enhances our simulation significantly. We also ran a simulation using the same 10 years of forcing data. The results show a state of equilibrium for the benchmark simulation, while the Multiscale simulation appears to reach a dynamic equilibrium. This is evident in Figure 1, where water table elevation (ZWT) fluctuates around the mean despite the convergence in soil moisture content (SMC) and latent heat flux (SH). We have included this figure as Figure 10 in the main manuscript. The oscillations observed in the Multiscale scheme, as well as in the baseline simulation, may indicate issues related to scale representation in both domain discretizations, which could lead to greater variability in the spatial mean of water table elevation, or numerical instability within the groundwater scheme in NoahMP, influenced by our model's lateral flows. Further analysis is needed to explore the compatibility between the numerical solution and the scale representation in HydroBlocks; however, this is beyond the scope of this study (see Section 4.3, line 748).

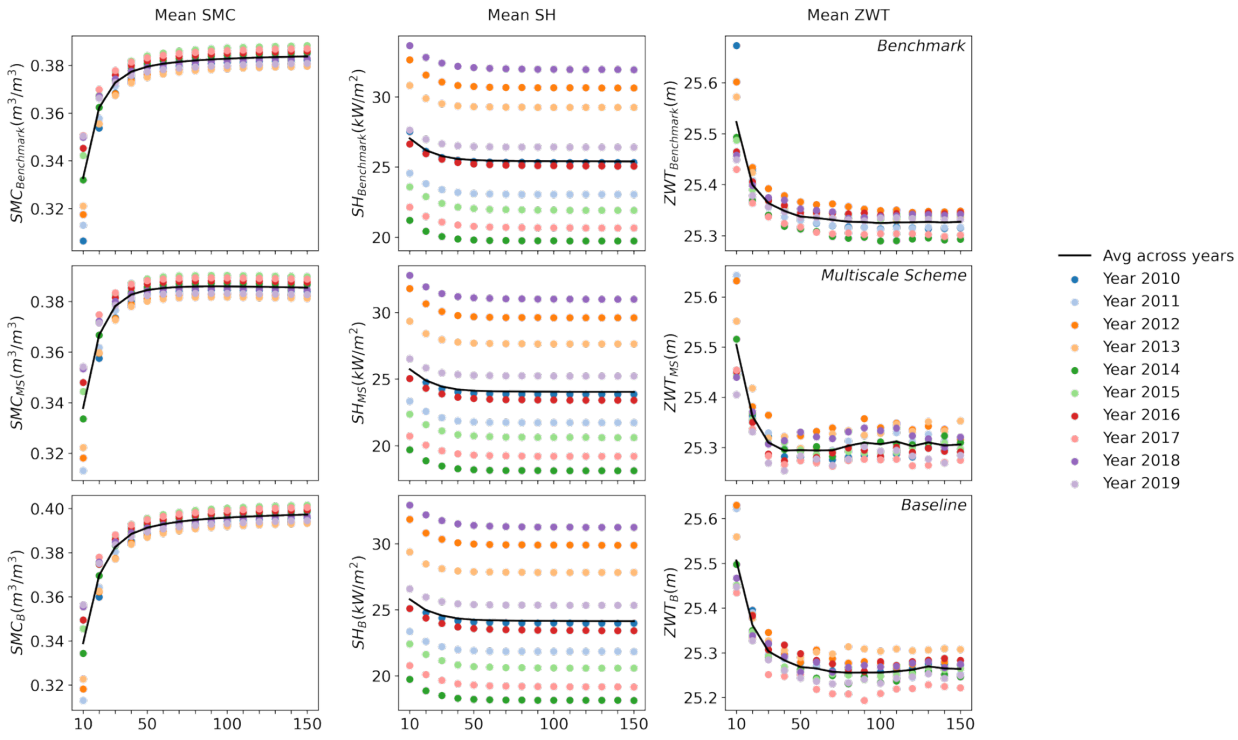

Figure 1. Comparison of estimated soil moisture content, sensible heat flux, and water table elevation throughout the spin-up period for Baseline (40,700 tiles), Multiscale Scheme (40,700 tiles), and Benchmark (1.4 million tiles).

“Another reviewer requests clearer documentation of applying Darcy's law with moisture-dependent conductivity across saturated and unsaturated zones—please expand Section 4.3 to discuss conditions under which the hydrostatic equilibrium assumption breaks down and clarify whether this approach is fundamental to the implementation or a simplifying convenience.”

We have included a new section, “4.4 Suitability of Unsaturated Lateral Flow in the Multiscale Scheme,” to clarify that our implementation is a simplification for representing unsaturated lateral flow at hyper-resolutions. However, it can accommodate the saturated-only lateral flow if necessary.