

Interactive comment on “Development and evaluation of a variably saturated flow model in the global E3SM Land Model (ELM) Version 1.0” by Gautam Bisht et al.

Anonymous Referee #1

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Bisht et al. developed and evaluated a one dimensional variably saturated flow model (VSFM) and calibrated spatially heterogeneous subsurface drainage parameters for ELM. They were able to significantly improve water table depth prediction using this model. I believe the major contribution of this work is the calibrated drainage parameters. Overall, the manuscript is not quite well organized or written. I couldn't find a motivation in the manuscript why one wants to spend extra 30% computation time using VSFM. The existing flow formulation was described, but the model was only compared against PFLOTRAN. How does it compare to the existing formulation in ELM? Would ELM perform equally well using the existing flow formulation with the new drainage parameters?

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Specific comments:

1. There is a great deal of efforts describing different models and the importance of groundwater system in the introduction, but no justification of why a new model is in need.
2. Eq. (6), missing “z” in the term after the second “=”.
3. Eq. (10), “P” in the second if should be “Pc”.
4. Eq. (14), missing dV in the last term. I didn't go through all the equations, but the authors should check for correctness/completeness of each one of them, including the appendix.
5. Make sure every variable in the equations is defined. For example, what's T in Eq.(13)?
6. Page 10, line 223: correct the conversion as -0.75 m is not equivalent to 9399.1 Pa.
7. Table 1 mentioned on page 10, line 225 is missing.
8. Figure 1 – where is the green line?
9. Figure 4 – which one is a,b,c,or d?

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