

Interactive comment on “Simulating Coupled Surface-Subsurface Flows with ParFlow v3.5.0: Capabilities, applications, and ongoing development of an open-source, massively parallel, integrated hydrologic model” by Benjamin N. O. Kuffour et al.

Anonymous Referee #1

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Authors have summarized major advances in development of an integrated hydrologic – atmospheric model (ParFlow.*) for simulating terrestrial hydrologic processes. The paper is a nice summary of authors' effort in the past 3 decades on ParFlow development, and its coupling with land surface, atmospheric and reactive transport models. As authors state, the information presented here has been previously published as part of software manuals and papers published by the developers. Therefore, this manuscript provides a valuable resource for the users to learn about the model func-

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tionality.

However, it would be more useful if authors consider adding the following information:

1. The paper falls short in describing capabilities of ParFlow in comparison to other integrated hydrologic models such as CATHY, HydroGeosphere, etc. This will help users with model selection for a particular application.

2. It would be very useful if authors could describe future model development. What is next?

3. Despite improved parallel efficiency for large scale application, model application for large domains is computationally intensive. Can authors provide further guidelines for model set-up (table of inputs), initialization and calibration? Are there any efforts underway to improve computational time?

4. While authors summarized various application of the model in Table 2, it would be great if they can present a simple case study that compares computational time as different components are added from land surface to the atmosphere, and show how simulated outputs have been improved compared to observations.

Minor Comments:

Lines 82-85- The differences between the integrated approach and indirect approach is not clear. Please explain.

Line 94 – Kollet et al. (2010) does not seem to be a suitable reference here as the focus of the paper is on parallel efficiency. Please refer to Kollet and Maxwell (2008), Water Resources Research instead.

Line 139 – Is the variable vertical discretization only possible with the terrain following grid option in ParFlow?

Line 155 – Remove “of” from “relative of saturation”

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Line 171- According to equation 4, units of Darcy flux should be LT⁻¹.

Section 2.3. Add information regarding flow routing approach. For example, does the new version support D8 flow direction?

Line 194 – Move “slope” before the “(gravity forcing term)”

Line 254 – Add “relative” to Si

Line 742- To main consistency, write units.

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2019-190>, 2019.