Geoscientific
Model Development
Discussions

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Interactive
comment

Interactive comment on "The Variable Infiltration Capacity Model, Version 5 (VIC-5): Infrastructure improvements for new applications and reproducibility" *by* Joseph J. Hamman et al.

Anonymous Referee #3

Received and published: 29 April 2018

General Comments:

This paper provides a comprehensive overview of the new updates and major revisions made to the Variable Infiltration Capacity (VIC) macroscale hydrology. This new version 5 of the model allows for different instances of the model driver, preserving legacy aspects of VIC and paving ways for coupling with other models, e.g., atmospheric models. A major change involves allowing the model to run in space first then in time, which was done in reverse in its legacy versions (prior to version 5). Also, the authors describe and provide some examples of several new test cases, which can be used for either unit and more scientific testing.

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[Discussion paper]

Overall it is very well written paper and provides many details on the way new model drivers and components can be run and interact in VIC. Not many papers prior to this have described the main software components of VIC, so in that of itself makes the paper more novel for the VIC and land surface model communities to reference in the future.

Specific Comments:

One area that is not addressed well in this paper is how the VIC distributed parameters (e.g., LAI or soils information) are handled and provided for the different drivers. The legacy "Classic" driver's original I/O is mentioned to still be supported, but how is that information changed (or not) for the other formats (e.g., NetCDF) to support the other space-before-time or "image-based" drivers. The VIC parameters for previous versions have been another problem for the community as they are hard to generate or customize for each user's needs. Please address how parameters can be generated (e.g., any tools) to support the "Image" type drivers and how some of the parameter tuning processes and practices (e.g., for soil parameters) can be used to optimize streamflow estimates. The handling of the parameters and preprocessing to other resolutions and grids is an important part of any model structure and release.

Minor Comments:

Page 2, lines 13-15: Part c): Previous VIC versions that have been run, prior to 5, were very slow, especially when run for large-scale simulations (e.g., NLDAS), since each gridcell was run separately through time (as referred to as "time-before-space" in the paper). Many of the other LSMs that you mention are not always run in "coupled" mode and tend to run faster than VIC in uncoupled mode. You may want to consider removing this statement or addressing the deficiency of it in relation to computation speed and how truly it was able to run faster.

Page 4, line 15: Please try to indicate what the acronym, "MT-CLIM", stands for.

Page 5, line 6: Does "RVIC" simply stand for "routing VIC"? Please include any additional information to specify this acronym.

Page 7, lines 30-32: The terminology convention of using "restarts" can be specific to certain communities, like the hydrometeorology community. It may be useful here to provide some short background on, first, what the "restart" represents and then to further specify what "exact" and "near-exact" indicate. Also, do all VIC versions, including 5, have an option to write out "instant" states and fluxes versus time-averaged?

Page 8, lines 9-13: The authors state here that the "input forcings must now have the same time step length as the model simulation" due to the removal of the MT-CLIM temporal disaggregation code, which has now become a separate preprocessing step. The reviewer wonders why temporal interpolation options have not been considered at the driver level for the forcing inputs, or why the MT-CLIM could not be rewritten to be incorporated more at the driver level. Please address in a statement or two.

Page 8, lines 25-27: Which libraries and compilers has the new VIC version been tested with? This information would be useful to the user-audience.

Page 8, lines 28-29: Are unit tests also available to be tested with the other drivers? What if changes to the drivers affect the unit tests? Please address this concern.

Page 9, lines 1-5: Why are the science-level tests only available with one driver type? Do you have science tests also set up for the other driver types?

Page 9, lines 1-15: Authors may want to mention that further descriptions of the different test figures and configuration setup are found also in Section 3.

Page 9, line 16: The "Travis CI" system is outlined for how it is used with VIC workflow and testing. Can the authors provide some additional information on the origins and source of Travis?

Page 11, lines 16-19, and Figure 3: Please either indicate here that the VIC-5 version performs at or above 0.99 rˆ2 values relative to previous VIC-4.x version(s), as you did

with the observed SNOTEL peak SWE comparison in Figure 2, or include a third time series of the VIC-4 version to show overlap with VIC-5.

Page 11, lines 24-29: Please add to this discussion how the information in Table 3 may relate to the tested parallelization performance metrics shown in Figure 5.

Figure 1: Please provide more information in the caption as to what is represented in the "Shared Driver Utilities". This part of the figure was not well addressed in the figure or accompanying documentation.

Figure 3: Mention in figure caption what the red and blue shading represent.

Table 4: Replace "they" with "that" and don't need the parentheses around "Liang et al. (1994)", just 1994.

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Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2018-36, 2018.