Geosci. Model Dev. Discuss.,
doi:10.5194/gmd-2017-35-EC1, 2017

Geoscientific Model Development Discussions
Open Access
EGU

Interactive comment on "Coupling a three-dimensional subsurface flow and transport model with a land surface model to simulate stream-aquifer-land interactions (PFLOTRAN_CLM v1.0)" *by* Gautam Bisht et al.

J. Kala (Editor)

j.kala@murdoch.edu.au

Received and published: 3 May 2017

This manuscript is well written. It describes the evaluation and coupling of CLM4.5, a widely used LSM, to PFLOTRAN, a subsurface model. The individual codes and model coupling are well described. The simulations are evaluated under real-life conditions. The paper fits the scope of GMD very well. The paper can be accepted following the following revisions:

The most major revision required to this paper is that results with CLM4.5 alone, without coupling to PFLOTRAN, are not presented. The reader hence does not get an idea of

Printer-friendly version

Discussion paper

the added benefit of running the LSM coupled to a sophisticated subsurface model. What are the differences in the surface heat fluxes by running CLM alone versus the coupled system? If sub-surface flows have an influence on the surface energy balance, then it needs to proved that it is actually worth the effort to run the coupled system?

The abstract should mention the 3 different spatial resolutions used, especially as it is stated later that spatial resolution had a significant impact.

In the abstract, it is also stated that including lateral subsurface flow impacted (I suggest using the word influenced rather than impacted) the surface energy budget and subsurface transport. How?

At the end of the abstract, it is stated that this coupled system could be used to study land-atmosphere interactions. This is not really correct as this current modeling system does not include a dynamic atmospheric component? You ran the model with prescribed meteorology. You cannot really make this conclusion.

Line 67 – The acronym ESM does not seem to be have previously defined? Is this acronym really necessary?

The introduction gives no indication why coupling CLM and PFLOTRAN is a good and worthwhile idea. Why these two models? If CLM has been coupled to other subsurface models such as PAWS, then what makes PFLOTRAN more advantageous than PAWS? While I have no doubt coupling CLM and PFLOTRAN is a great idea, you need to explain a bit more on why this is the case. Provide a bit more background, one paragraph should do.

The paper tends to make use of many acronyms, and many of these do not seem necessary. Please only use acronyms where it is warranted. For example, the LEAF acronym is only used once, so there is no point in defining it if you don't use it again. Please carefully review all your acronyms.

In Figure 1, some of the arrows do not seem to make sense to me. CLM links directly to

PFLOTRAN Initialize, execute and finalize. Surely, CLM should only link to PLFOTRAN initialize, when then links to PFLOTRAN execute, then finalize. Also, according to your diagram, no information flows back from PFLOTRAN to CLM? Your diagram suggests that there is no two-way coupling? But the text state that soil moisture and hydraulic properties from PFLOTRAN and given back to CLM. Your flowchart does not really show this?

Use m day-1 rather than m d-1.

Figure 4 – Sorry I can hardly read any of the figure titles, please make these larger and more easily readable.

Lines 359 – 361: You state that cold month were excluded from the analysis as you end up with division by zero issues when LH becomes close to zero. That's why most people use the evaporative fraction (EF), rather than the Bowen ratio. With EF, you take the ratio of latent to the sum of sensible and latent, hence, you will not have division by zero issues. You should use EF rather than Bowen ratio.

Section 4.1 – Please use model evaluation rather than model validation. Validation implies the model is already correct to start with and you are therefore validating it. This is of course never true of any model.

Line 418: Looking at Figure 7(a) and 8, I find it hard to get an accurate idea of the differences, could you please plot the difference instead?

Figure 10 – can you please remove the textbox at the bottom (CONTOUR FROM . . . . .). Looks like an NCL plot to me. . . . I'm sure you can remove this: Âăres@cnInfoLabelOn = False

Line 447: Don't start a sentence with And.

Your use of the 2 m simulation as a surrogate truth is fine, given a lack of observations of what is being simulated. However, you cannot really say simulation x outperformed simulation y (line 482), explain why one simulation appears more realistic, but I am not

comfortable with the word “outperform”.

It would have been really interesting if you ran your model over a site for which observationally derived flux tower estimates of H and LE are available, such that you could then assess if this coupled system actually improves on CLM4.5 alone in simulating surface energy fluxes. I do understand that locations where Flux tower data are currently available (e.g., the FLUXNET network), may not necessarily be regions where the hydrology is interesting enough to warrant the use of such a model. You do however, need to acknowledge somewhere that the model needs to be evaluated against actual observations of surface fluxes.

Code availability: We had a recent discussion among GMD editors, and the point of the Code Availability section is to ensure the reproducibility. What we want is the exact code used for this paper. It is of course understandable that the code is still under development, however, we request you make the version of the code used for this paper available. If this is already on bitbucket or github, it is quite easy to make the revision/branch used for this study on ZENODO, which is the preferred repository for code as per GMD guidelines as it will generate an actual DOI for the code:

http://www.geoscientific-model-development.net/about/code_and_data_policy.html

If you do a quick search on ZENODO, you will find several codes which point to github/bitbucket repositories, but a “frozen” version of the code used can be directly obtained from ZENODO, rather than a user having to work out which branch/revision of your code was used in the paper from the github/bitbucket repo.

Interactive comment on Geosci. Model Dev. Discuss., doi:10.5194/gmd-2017-35, 2017.