Geoscientific

Model Development

Discussions

**[GMDD]**

Interactive

comment

# *Interactive comment on* "BioRT-Flux-PIHM v1.0: a watershed biogeochemical reactive transport model" *by* Wei Zhi et al.

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It is very useful to have new models so that one can compare different approaches, especially when the models have open source code like this one.

However, with very many existing catchment-scale biogeochemical water quality models, it should be more clearly stated what this model provides that others don't, and how it can shed light on catchment processes that were previously not well understood. Or alternatively how this new software makes the job of the model user easier. For instance, the process descriptions for Phosphorous, DOC and Nitrogen don't look too dissimilar to existing models.

My impression is that this model is toward the complex end of the spectrum when it comes to parametric complexity. I miss an explicit analysis of this. For instance, how many parameters have to be calibrated and can not be sufficiently constrained by

(easily obtainable) measurement or literature values?

Knowledge of this is of vital importance to a user. For instance, if one wants to do a very thorough investigation of the processes in a single catchment one maybe has some time to spend to do a very detailed model setup. However, in some applications one needs to model all the inputs from land into a whole coastline or a large set of lakes. In such an application one often relies on autocalibration and upscaling, and in such applications high parametric complexity can be detrimental. On a similar note, data availability of data that can be used as model drivers can vary between locations. Does this model accomodate for locations with low data availability?

If the stated goal of the model is to be a research model targeted at understanding catchment processes, rather than a model that can also be used as an input source for oceanic models or to be used by government officials to inform policy decisions on a large scale, then this is maybe not as big of a concern. But that could be made more explicit.

Can you argue why the model complexity is justified? Some studies show that simple models can give as good predictions as complex ones while taking much less time and data to deploy. I can see that you have a plot of sensitivity to turning off various nitrate processes, but what about sensitivity to simpler or more complex descriptions of these processes? What is the sensitivity of model results to perturbations in the parameters?

Similarly, what is the sensitivity to subdividing the land into many cells? Is having 100 cells warranted, or can you get just as good predictions just using a couple of cells describing the different land use types? (I understand the argument about identifying hot spots, but it could also be interesting to see if the subdivision has impact on the stream concentration predictions).

What is the calibration process like for the user? Are any autocalibration tools set up for the model?

Interactive comment on Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2020-157, 2020.