Geoscientific
Model Development
Discussions

Interactive comment on "FABM-PCLake – linking aquatic ecology with hydrodynamics" *by* F. Hu et al.

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Review to gmd-2015-260 entitled "FABM-PCLake – linking aquatic ecology with hydro-dynamics by Fu et al

General comments

This manuscript is a concise description of the connection of PClake to FABM. This is a very powerful advancement and certainly of interest for the readership of GMD. The PClake-model is an ecological model of shallow lakes frequently used in science and management. Since shallow lakes are classically viewed as unstratified (ie mixed) systems, PClake is originally a 0D model, i.e. it models the lake as one mixed box. By connecting this model, which contained a high and reliable amount of ecological processes, to FABM it can also be applied outside the 0D context and coupled with

physical models for 1D or 3D hydrodynamics. This is a real step forward and certainly deserves publication. The MS is well written and well understandable. I have not seen major flaws or mistakes but I think that the scientific content of the paper could be improved. In its current form, the MS reads more like a newsgroup contribution and not yet like a full research paper. This would be different if 1-2 more applications would be shown. I also have a few questions about the details/consequences of the coupling and a few very minor points (see below).

I want to point out that I highly valued the excellent supplement material of this paper, which provides the experienced modeller with very helpful knowledge and facts.

Specific (major) comments

1. The paper would be improved if the abilities of the model would be shown with 1-2 more applications. This could be a simplified setting of a 3D model or a comparison of a 0D and a 1D simulation for a given system or a comparison of observed and modelled 1D dynamics in a given lake.... It would just leave a clearer impression of the abilities of the model system, particularly to those readers that have not yet heard from FABM et al

2. In the classical shallow lakes paradigm one has either a state with the dominance of pelagic primary producers (algae) or a state with the dominance of benthic primary producers (macrophytes). As soon as you move the PClake-model in a 1D-setting, every depth layer gets an own sediment surface attributed to this layer (derived from the bathymetric map). I expect that this spatial representation affects the competition between benthic and pelagic primary producers – the shallower a given 1D layer is located within the water column, the more superior becomes the benthic primary producer (because it gets more light). It is not clear to me, how exactly the benthic and pelagic compartments interact in a 1D setting – does each layer indeed have two separate ecological compartments (pelagic vs benthic?)? In the original 0D-setting everything is simple and clear because the benthic compartment is on the lake bottom

and the pelagic compartment on top of this. In the 1D setting, benthic and pelagic compartments coexist side by side within the same layer? Does that mean that the algae can never fully exclude macrophytes from the lake because the macrophytes can persist in the benthic compartments of the shallow layers (which may be a realistic condition?)??? Anyway – please explain in more detail. And keep in mind that this may become even more complex in a 3D-setting.

3. In a real lake, macrophytes grow into the pelagic compartment and can even fully occupy the pelagic compartment. Is it in the 1D setting allowed, that macrophytes can grow from there (home-)benthic layer upward into the next (pelagic) one above?

Minor comments

P2L27 has –> have

P4L16-19: I think in this setting the numerical integration of the ODE/PDEs is done by the physical model. This may be mentioned, if true

P4L29has –> have

P7L22-25: I am not sure whether I correctly understood the two final sentences about the sediment burial. Can you reformulate them?