

## ***Interactive comment on “Auto-calibration of a one-dimensional hydrodynamic-ecological model (DYRESM 4.0-CAEDYM 3.1) using a Monte Carlo approach: simulations of hypoxic events in a polymictic lake” by Liancong Luo et al.***

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Response (references can be found in the MS)

Thank you very much for your nice comments.

In environmental models with many parameters (e.g. DYRESM-CAEDYM), there are potentially many “sets” of parameter values that can be manipulated in concert to yield similar model performance (Stow et al., 2007), which is known as “equifinality” (Beven & Binley, 1992; Beven, 1993; Vrugt et al., 2009a, 2009b). So we use the Monte Carlo

C1

approach to produce random value between the minimum and maximum values of every parameter instead of considering on the reach of global minimum of RMSE which is normally adopted by classical method such as Gauss-Newton Method. It would be difficult to tell how many iterations are required to reach of global minimum of RMSE. So I would recommend the software users to set as many as iterations (e.g. 100,000 iterations) given that they have a robust computer. The length of running time mainly depends on the model itself (e.g. the numbers of layers, simulated variables, the min and max layer thicknesses) and the computer speed.

This automated procedure comes at the expense of “trial-and-error” that provides insights on parameter values to a user. It will be difficult to tell how the auto-calibration could save less time compare with the classical method because the auto-calibration software follows “produce random parameters - run model - compare simulations with observations – produce parameters again . . .” procedure without consideration on the reach of global minimum of RMSE. After all the iterations are finished, the parameter set with the least difference between observations and simulations will be selected as “the best parameter set” for this specific calibration.

Here is an example of auto-calibration running on my laptop for estimating length of running time:

My Laptop information: Operation system: Mac OS High Sierra V10.13.1 MacBook Pro (Retina, 15-inch, Mid 2015) Processor 2.8 GHz Intel Core i7 Memory 16 GB 1600 MHz DDR3 Startup Disk Macintosh HD Graphics AMD Radeon R9 M370X 2 GB, Intel Iris Pro 1536 MB

Model information: Crest elevation: 113.1 m Number of stg survey points: 1131 (0.1m interval) Simulation days: 122 days Time step: 3600 seconds Min/Max layer thickness: 0.5 / 2 Number of inflows/outflows: 5 inflows and 1 outflow Simulated variables: TEMPERATURE/DO/NO3/NH4/TN/PO4/TP/TCHLA

Number of iterations: 100 Start time: 11/11/2017 22:42:33 End time: 12/11/2017

C2

00:27:57 Running time of auto-calibration: 1 hour, 45 minutes and 24 seconds

If more detail information, please do not hesitate to contact me through email:  
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2017.