

LAKE2K - SIMULATIONS

SIMULATION 0

Open 'L2KMaster0104R2_32bit_original.xlsm' or "L2KMaster0104R2_64bit" (Lake2K folder) depending on the Excel version you are running (how to check it: <https://jetsupport.jetreports.com/hc/en-us/articles/219403267-How-to-determine-whether-you-have-32-bit-or-64-bit-Excel>).

In sheet 'LAKE2K' set the "Directory where file saved" by selecting a folder on your pc.
RUN the model and save it as Sim_0 ('File name' cell).

In 'Output WQ' copy and export in another file excel the following time series: *Organic Nitrogen* (col. Q-R-S), *Organic Phosphorus* (col. Z-AA-AB), *Dissolved oxygen* (col. AL-AM-AN), *Phytoplankton* (col. AO-AP-AQ).
Create a chart for each time series.

SIMULATION 1 – Outflow position (from Epilimnion to Hypolimnion)

The model simulates the lake as a one-dimensional system consisting of three vertical layers. The volumes of the two deeper layers (metalimnion and hypolimnion) are held fixed whereas the epilimnion is allowed to change as a function of the balance between inflows and outflows.

In 'Outflow' change the "Outflow mode" in cell B6 → Flowout(hypo)=Flowin.

In 'Output WQ' copy and export in another file excel the following time series: *Organic Nitrogen* (col. Q-R-S), *Organic Phosphorus* (col. Z-AA-AB), *Dissolved oxygen* (col. AL-AM-AN), *Phytoplankton* (col. AO-AP-AQ)

Create a chart for each time series. What does it happen?

SIMULATION 2 – Phytoplankton

RESET ALL SETTINGS TO Sim_0 conditions before doing Sim_2.

Increase the concentration of inorganic P (by 30%) in EPI (initial conditions), in HYP (initial conditions) and in the inflow. Is the population of Phytoplankton influenced by this variation?

SIMULATION 3 – Re-aeration

Open Sim_0 and run it by changing the re-aeration method:

- O'Connor
- Banks-Herrera
- Wanninkhof

Do you notice any considerable difference in the Dissolved oxygen, under the three conditions?

SOLUTIONS

For all solutions see file "2023.10.09_Practice4_SOL.xlsx". Here below, the main effects of each step are described.

SIMULATION 1

The presence of phytoplankton is reduced along the whole year. Destratification of lake: mixing phenomena are more intense because of the lower outflow position. This reflects in decreased nutrients concentration in the upper layers, higher oxygen concentration, and lower phytoplankton levels.

SIMULATION 2

There is a (small) increment in phytoplankton presence due to higher initial P concentration.

SIMULATION 3

The third method – Wanninkhof – slightly overestimates peaks. No other big differences are found.