

## Mississippi Lake hydrodynamic and biogeochemical modeling project

Report #2      date: March 26<sup>th</sup> 2018

The following steps toward hydrodynamic and biogeochemical modeling of Mississippi Lake have been completed since the previous report (Dated December 5<sup>th</sup>, 2017):

- The hydrodynamic model has been set up and since there was no flow data for the creeks, different scenarios have been considered to estimate the total flow for the creeks as a percentage of the total inflow of the Mississippi River (based on Ferguson Falls flow data). The modeled and observed water level were then compared and the lowest error resulted from assigning 8% and 6% of the River inflow to the creeks in 2017 and 2016, respectively (Figure 1). Afterwards, the total estimated inflow for creeks was distributed based on the percentage of watershed area of each creek to total area of all creek's watersheds.
- The data from existing temperature loggers were then used to compare and validate the modeled data which shows a good agreement between those two (Figure 2). For the final report the errors will be measured with a numerical index to have a more extensive understanding of the accuracy of the model (e.g., RMSE,  $R^2$ ).
- The water quality model was set up and different water quality characteristics of the inflows (for both the River and the creeks) and the required boundary condition of the model has been given to the model. The preliminary (no calibration) output shows promising results (Figure 3, Figure 4, Figure 5, Figure 6; only visual examination). The next step will be calibrating the water quality model and then proceeding to setting up the appropriate scenarios.

Nader Nakhaei, Ph.D.

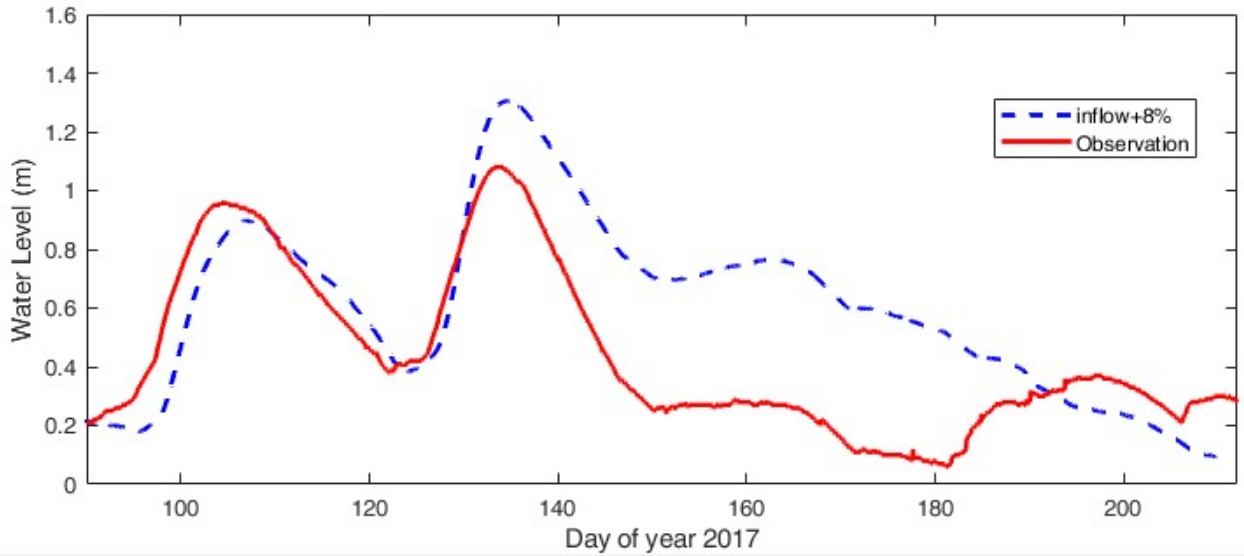


Figure 1- Comparing the observed and modeled (best scenario 8% for 2017) water level.

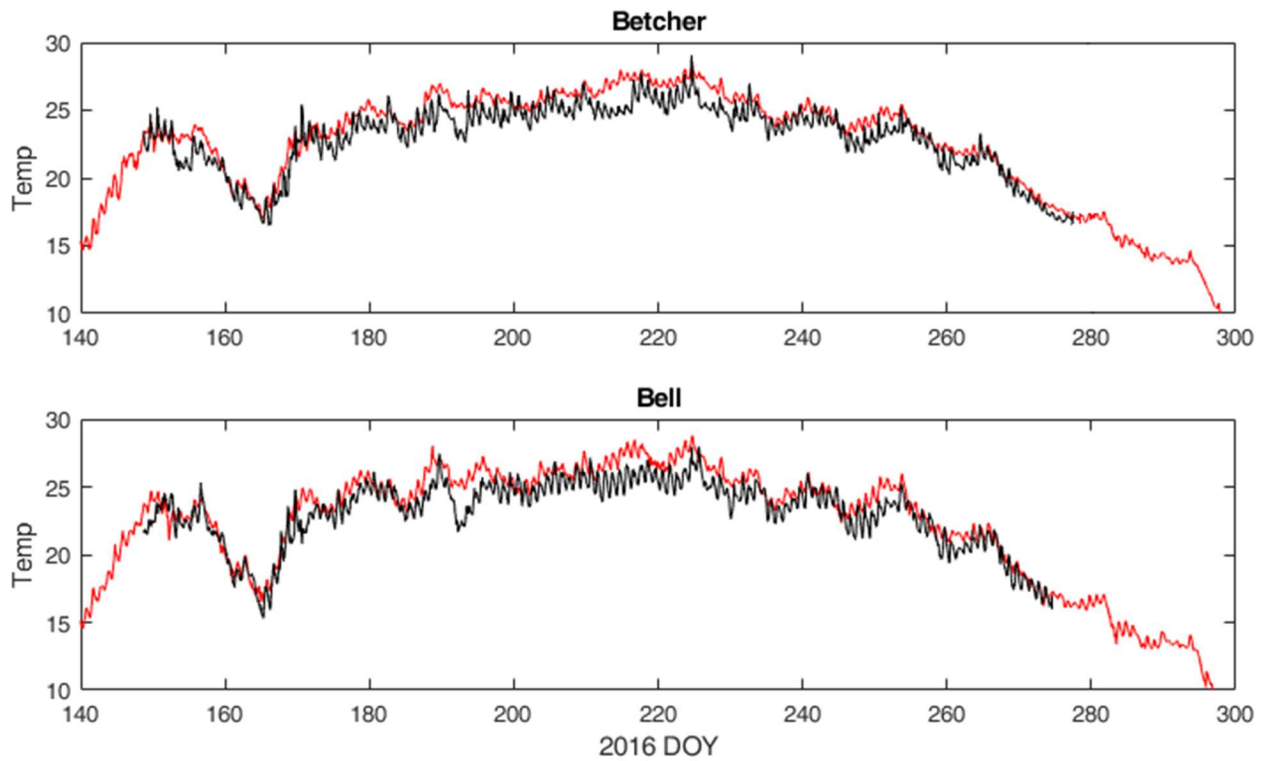


Figure 2- Modeled and observed temperature loggers (near Betcher and Bell properties in 2016).

Red is modeled and black is the observation.

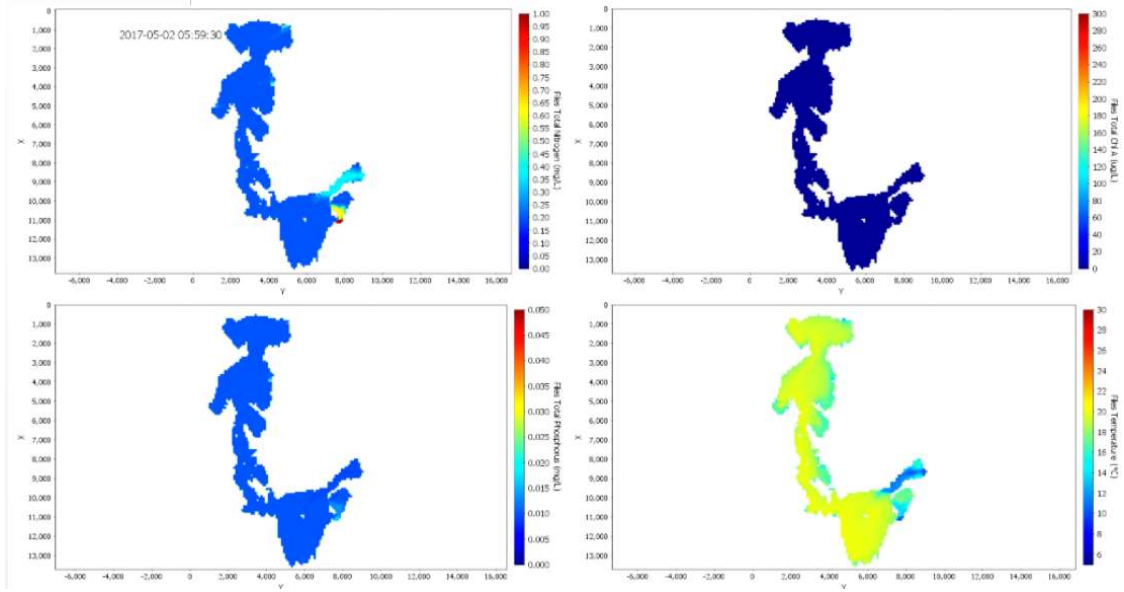


Figure 3- Mississippi Lake modeling results (water column averaged) on May 2<sup>nd</sup>, 2017. Panels: up left is Total Nitrogen, up right is Total chlorophyll a, down left is Total phosphorus and down right is the temperature.

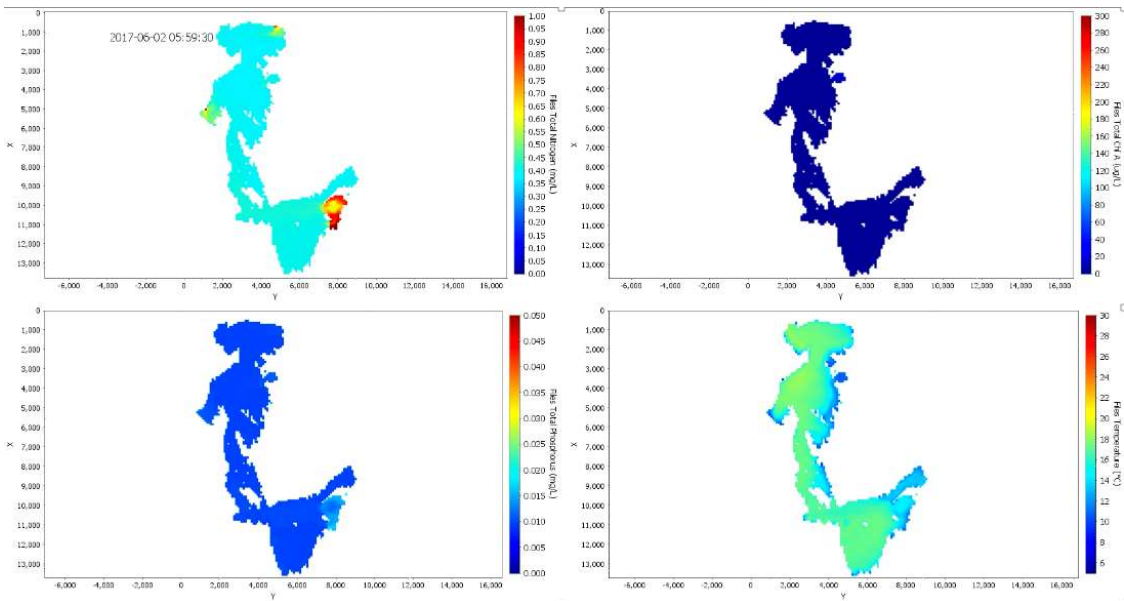


Figure 4- Mississippi Lake modeling results (water column averaged) on June 2<sup>nd</sup>, 2017. Panels: up left is Total Nitrogen, up right is Total chlorophyll a, down left is Total phosphorus and down right is the temperature.

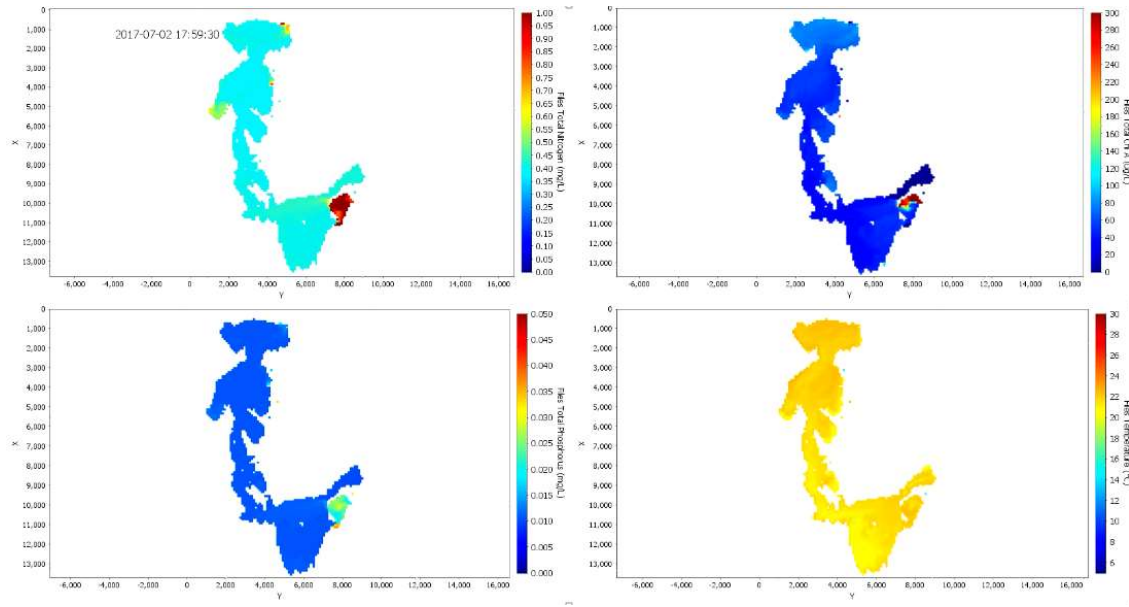


Figure 5- Mississippi Lake modeling results (water column averaged) on July 2<sup>nd</sup>, 2017. Panels: up left is Total Nitrogen, up right is Total chlorophyll a, down left is Total phosphorus and down right is the temperature.

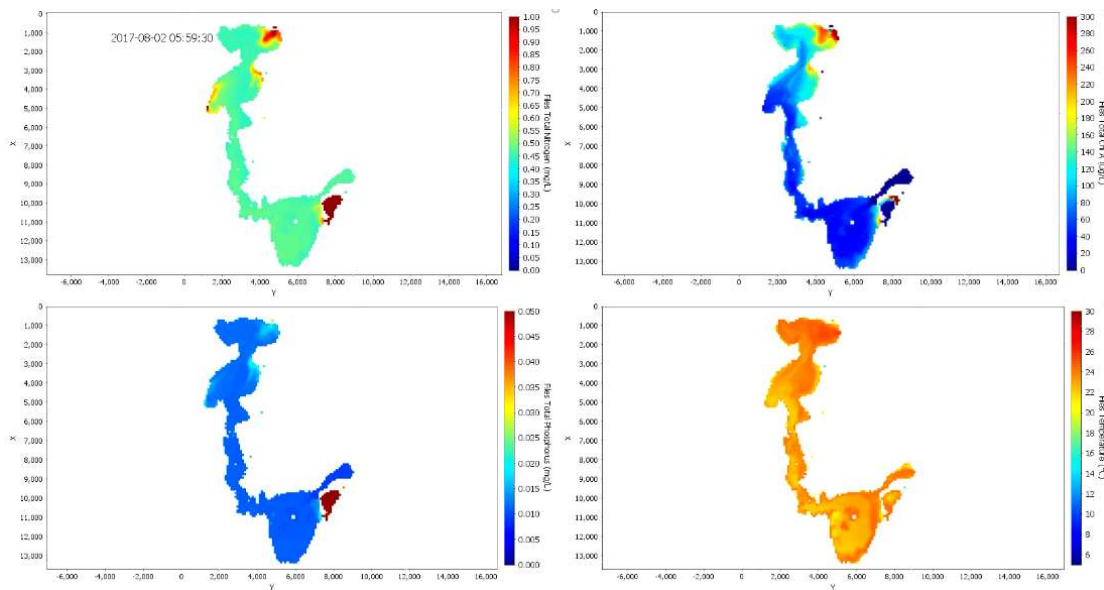


Figure 6- Mississippi Lake modeling results (water column averaged) on August 2<sup>nd</sup>, 2017. Panels: up left is Total Nitrogen, up right is Total chlorophyll a, down left is Total phosphorus and down right is the temperature.