Geophysical Research Abstracts
Vol. 21, EGU2019-18644, 2019
EGU General Assembly 2019

Coupled 1D physical-biogeochemical model system to simulate primary production in Lake Geneva

Shubham Krishna (1), Onur Kerimoglu (2), Fabio Lepori (3), Orlane Anneville (4), and Alfred Johny Wüest (5)

(1) École polytechnique fédérale de Lausanne(EPFL), Switzerland, (2) Helmholtz-Zentrum Geesthacht, Germany, (3) Scuola universitaria professionale della Svizzera italiana, SUPSI, Italy, (4) French National Institute for Agricultural Research, France, (5) EAWAG, Switzerland

Climate change, in combination with reduced external nutrient loading are important drivers of phytoplankton changes in lakes undergoing re-oligotrophication. Understanding and forecasting future changes in primary production in response to local and global forcing have become a major challenge for developing sustainable lake management. Primary production (PP) in lakes is driven by eco-physiological processes and physical conditions. Thus, for quantifying PP rates, coupled physical-biogeochemical models prove to be useful tools. The objective of this study is to assess how well different coupled models reproduce observed temperature and PP profiles measured at a fixed station (SHL2) in the middle of Lake Geneva. Here we coupled the 1D General Ocean Turbulence Model (GOTM) with various biogeochemical models through the framework of aquatic biogeochemical models (FABM).

We performed the first set of simulations with only GOTM for studying the sensitivity of the physical conditions to subtle changes in meteorological variables. Performance of GOTM appears to improve when the heat fluxes due to precipitation and evaporations are represented. Also, we found the model results to be extremely sensitive to SWR and wind intensity.

In the next step, GOTM is coupled with three biogeochemical models of varying biological complexity. Based on the comparisons between the performances of the biological models, we aim to gain insight into the optimal complexity of the biogeochemical models to be used. A data assimilation method is used to minimise misfits and estimate optimised parameter values and associated uncertainties for the biological parameters related to phytoplankton growth. The preliminary results show that the complex models, that resolve more physio-ecological processes than a simple NPZD model, perform better in terms of reproducing observations and in yielding lower estimates of parameter uncertainties. The next step is to cross-validate the model solutions with data from a field station in Lake Lugano (independent data, not used for optimisations). The objective behind this cross-validation exercise is to test the robustness of model solutions which is one of the metrics to assess skills of a model.