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Sensitivity Analysis of a biogeochemical model on dissolved oxygen during low water periods

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Water quality modeling has been well developed over the past decades. However, complex biogeochemical cycles are described using a high number of parameters, leading to non uniqueness issue for the estimation of parameters sets. This study aims at performing a sensitivity analysis of one water quality model to identify the most influential parameters and better understand biogeochemical processes at work during low water periods.

The main objective is to understand the O_2 fate in a temperate river based on a case study that mimics the Seine River. The C-RIVE model is used to perform a sensitivity analysis based on Morris and Sobol methods. The results indicate that the photosynthetic parameters (η, the light extinction coefficient; P_{max}, the photosynthesis rate; α, the photosynthetic capacity) and the maintenance respiration ($maint_{phy}$) are the most influential parameters for primary producers during phytoplankton blooms. It highlights the importance of properly describing primary producers respiration processes at least with two end–members: one for maintenance and one for growth. When the river system becomes heterotrophic, the bacterial growth yield (Y_{bact}), the reaeration coefficients relating to navigation and wind (K_{navig} and K_{wind}) and the temperature affect the most dissolved oxygen concentration in water column.

In general, it can be concluded that the Morris method and Sobol' sensitivity analysis combined with the functional principal components analysis are efficient methods to apprehend the behavior of the model inputs and the model structure.