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# Modelling algae growth and dissolved oxygen in the Seine River downstream the Paris urban area: contribution of high frequency measurements

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Dissolved oxygen is a key variable in the hydro-ecological functioning of river systems. The accurate representation of the different biogeochemical processes affecting algal blooms and dissolved oxygen in the water column in hydro-ecological models is crucial for the use of these models as reliable management tools. This study focuses on the water quality of the Seine River along a 225 km stretch, from Paris to the Seine estuary. The study area is highly urbanized and located downstream France's largest agricultural area, and therefore receives large amounts of nutrients. During the last decades, nutrient inputs have been significantly reduced, especially with the implementation of new sewage water treatment technologies. Even though the frequency and the intensity of observed algal blooms have decreased, blooms were observed in 2011 and 2012. These blooms are generally followed by a period of high organic matter accumulation, leading to high mineralization fluxes and potential oxygen depletion.

The hydrodynamics and the water quality of the Seine River are simulated for the 2011-2012 period with the distributed process-based hydro-ecological model ProSe (Even et al., 1998). The simulated chlorophyll a and dissolved oxygen concentrations are compared to high frequency measurements at the Bougival monitoring station (50 km downstream from Paris), which is part of the CarboSeine monitoring network. The high frequency continuous dataset allows calibrating of primary producers' physiological parameters. New growth parameters are defined for the diatom community. The blooms occur at the end of the winter period (march 2011 and march 2012) and the optimal temperature for diatom growth is calibrated at 10°C, based on an analysis of the physiological response of the diatom community.

One of the main outcomes of the modelling exercise is that the precise identification of the constituting communities of algal blooms must be achieved prior to the modelling itself. With the new growth parameters and by considering additional communities, as dinoflagellates, in the model, chlorophyll a peak values (over 60 $\mu$g/L in 2011 and over 30 in 2012) are accurately simulated. Moreover, the production rate of the communities constituting an algal bloom can be estimated by interpreting the high frequency diel dissolved oxygen curves (Escoffier et al., 2013). The modelled production rate during the 2011 bloom is of the same order of magnitude as the one estimated with this method (0.5 to 2 g/m3/day of oxygen), which validates the representation of photosynthesis in the model. Therefore the simulated oxygen response is also improved.

References:

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