

Dynamic modeling of dissolved oxygen in the Aljezur coastal stream (Portugal)

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Abstract

The European Water Framework Directive requires that surface water bodies (both fresh and saline) reach a good ecological status by 2015. Dissolved oxygen is one of the indicators for the evaluation of the quality of water bodies, because it is essential for the aquatic community. Therefore, integrated tools that allow the study of the oxygen dynamics are useful to support the sustainable management of these water bodies. This study aims at extending an existing model (ECO-SELFE – Rodrigues et al., 2009) to include the oxygen cycle, and to validate it for riverine and estuarine conditions, taking advantage of the recent detailed field campaigns in the Aljezur coastal stream (southwest coast of Portugal) that included measurements of physical, chemical and biological quantities. ECO-SELFE is a coupled 3D hydrodynamic and ecological model which targets river to ocean scales. Although previous versions of ECO-SELFE include the simulation of the carbon, nitrogen, phosphorous, silica and iron cycles for several variables (zooplankton, phytoplankton, dissolved organic and inorganic matter, inorganic nutrients and dissolved inorganic carbon), the oxygen cycle was not explicitly solved by the model. To allow the simulation of this cycle, two new state variables - dissolved oxygen and chemical oxygen demand - were added in the model. The processes considered in the oxygen cycle are: the gross primary production, the respiration of the community (zooplankton, phytoplankton and bacterioplankton), the pelagic chemical reactions and the reaeration. The extended ECO-SELFE was validated in the Aljezur coastal stream using two different measurement periods (September and May). Data were measured at several stations located along the stream, from freshwater to marine conditions, which allowed the evaluation of both spatial and seasonal dynamics. Results showed the ability of ECO-SELFE to adequately represent the oxygen dynamics in both rivers and estuaries.

References

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