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Solving the equation for the Iberian upwelling biogeochemical dynamics: an optimization experience

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Trying to find a set of parameters to properly reproduce the biogeochemical dynamics of the region of study is a major concern in biogeochemical ocean modelling. Model parameters are constant values introduced in the equations that calculate the time and space evolution of the state variables of the biogeochemical model. A good set of parameters allows for a better representation of the biological and chemical processes in the system, and thus to model results more approximated to reality. However, it is not a straightforward task, because many parameters are not well constrained in the literature, or they may be unknown or vary considerably between different regions. Usually, the approach to find the appropriate values is running several simulations, after some sensitivity test to individual parameters, until a satisfactory result is obtained. This may be very time consuming and quite subjective. A more systematic way to find this set of parameters has arisen over the last years by using mathematical optimization techniques. The basic principle under optimization is to minimize the difference between an observed and a simulated data series by using a cost function. We have applied an optimization technique to find an appropriate set of parameters for modelling the biogeochemical dynamics of the western Iberian shelf, off the Atlantic coast of Portugal and Galicia (NW Spain), which is characterized by a conspicuous seasonal upwelling. The ocean model is a high resolution 3D regional configuration of ROMS coupled to a N2PZD2 biogeochemical model. Results using the a priori parameters and the optimized parameters are compared and discussed. The study is the result of a multidisciplinary collaborative effort between the University of Aveiro ocean modelling group (Portugal), the ETHZ (Switzerland) and the IIM-CSIC Vigo oceanography group (Spain).