DATA ASSIMILATION IN A MARINE ECOSYSTEM MODEL COUPLED TO A MIXED LAYER MODEL OF THE LIGURIAN SEA

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Data assimilation have been conducted in a one-dimensional, coupled physical ecosystem model of the upper ocean to characterize the observability properties of in situ observing systems. The assimilation method is based on the Singular Evolutive Extended Kalman (SEEK) filter, in which the error sub-space is decomposed into multivariate orthogonal functions of the system’s variability.

The coupled model simulates the primary production in a coastal zone of the Ligurian Sea, where oligotrophic conditions prevail. The ecosystem dynamics is represented by 12 interacting compartments expressed in nitrogen units.

The coupling with an hydrodynamic model determines the physical constraints associated to the development of a seasonal mixed layer. The stratification of the water column, according to the computation of the vertical turbulent diffusivities, is a key parameter of the evolution of the marine ecosystem.

The coupled system have been developed and validated on the basis of field data collected during the FRONTAL compains between 1984 and 1988.

Firstly, twin experiments have been performed to approach the observability properties, i.e. to study if the available data are sufficient to control the spatio-temporal evolution of the biological state variables. Experiments have been also performed where two quantities are observed simultaneously. For that, vertical temperature and salinity profiles on the one hand, and vertical nitrate and chlorophyll profiles on the other hand, have been assimilated with different spatial sampling strategies ('complete' profiles along the water column - 'pseudo-profiles' FRONTAL taking into account the spatial sampling of FRONTAL compains). These experiments allow to know if FRONTAL
data are appropriately sampled to be assimilated, or if it is necessary to take into account new strategies for futures campaigns. Secondly, applying lessons learned from twin assimilation experiments, physical and biological profiles of in situ data collected during the FRONTAL campaigns have been used to improve the model simulations.