# Sequential ocean color data assimilation in a coupled physical-biogeochemical model of the North Atlantic

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This study aims to demonstrate the potential and expected benefit brought by the assimilation of remotely-sensed chlorophyll_*a* data, to realistically quantify the primary production using a large-scale, coupled physical-biogeochemical ocean model. To do so we use the NEMO ¼° circulation model in its North Atlantic configuration coupled with the biogeochemical model LOBSTER describing the nitrogen cycle through 6 state variables. We perform a year-long simulation of 1998 forced by realistic atmospheric fields derived from ECMWF reanalysis ERA-INTERIM. In a first experiment, the model is free to evolve following its own dynamics without any data constraint. Then we compare this latter simulation to several other simulations assimilating SeaWiFS ocean color data with a reduced-order Kalman filter set up with the SESAM tool. More specifically we use a SEEK filter with error modes obtained from system states extracted from the free run within a time interval, typically several months, surrounding the considered assimilation date. The state vector on which are applied the multivariate corrections contained the whole biogeochemical variables.

After fine-tuning the assimilation method, we analyze how the realism of the simulation is improved by the assimilation process. This analysis is achieved by comparing several biogeochemical state variables versus assimilation-independent *in situ* data set in the different bio-provinces of the North Atlantic basin. The results show on average positive performance of the assimilation system (e.g. in mid-latitude regions ...). However, some weaknesses are identified in coastal regions where key local processes are not considered (e.g. rivers nutrient discharges). This work describes a first approach of the problem that will be further developed in a pre-operational perspective (e.g the setup of a real-time forecasting system, or the production of multi-year hindcasts to improve currently available biogeochemical climatologies).