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Impact of sub-mesoscale physics on the biogeochemical equilibrium of idealized oceanic gyres

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Mesoscale turbulence modulates biological production in the ocean through a number of short-term small-scale mechanisms (vertical transport of nutrients, horizontal stirring, and subduction of phytoplankton), which are well identified and understood. The role of the oceanic turbulence in the long-term and large-scale equilibrium of the nutrient distribution is still an unresolved issue.

Our study aims to quantify the impact of sub-mesoscale physics on primary production budgets in the North Atlantic, focusing on both small- and long scale aspects of this impact (eddy fluxes of nutrients, change in stratification, modification of the mean currents, modification of the sub-surface distribution of nutrients).

For this purpose, a set of biophysical numerical experiments with increasing horizontal resolution (up to 2km) is compared. The model configuration is a double gyre system that represents the mid-latitude North Atlantic Ocean. Experiments are carried out for 50 years in order to reach equilibrium of sub-surface concentration of nutrients. Preliminary results show that the main impact is through the modification of the sub-surface nutrient reservoir, mainly through changes in the large-scale transport.