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Simple modelling of the biological activity at the Canary Islands

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Fluid transport mechanisms between the continental shelf and the open ocean are important in several physical and biological dynamical ocean processes. They are particularly relevant to bring nutrient-rich waters from upwelling zones near the coast to marine ecosystems living in nutrient-depleted ocean areas far from the coast line.

Motivated by the vortices and filaments observed South of the Canary Islands region, we study the effects of the different transport mechanisms on a model system of plankton dynamics. We focus on the influence of Eckman pumping, and the entrainment of coastal waters by the vortices in the wake South of the Canary islands, on the biological activity in the area.

The approach is semilagrangian, building a very simplified horizontal streamfunction which contains the essentials of the large scale fluid motion in that area. As many parameters as possible are determined from observational data. A three component biological model is implemented in an advection reaction diffusion scheme. We compare the temporal and spatial averages of the long term solutions for different sets of parameters for the inflow and the vortex strength, and quantify the influence of the wake on the spatial distribution and dynamics of biological species.

For realistic parameter values, the presence of the wake and the entrainment of nutrient-rich water enhances biological activity and primary production. This may be one of the mechanisms leading to the higher biological activity in the central tropical Atlantic.