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A Model of Plankton Dynamics Coupled with a LES of the Surface Mixed Layer

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The concentration of phytoplankton in the sea is affected by biological processes, such as growth/mortality rates, predatory zooplankton concentrations and nutrient levels. Phytoplankton concentrations are also affected by physical processes, in particular the mixing properties of the local fluid environment. On planktonic scales (10–1000 micro metres) one can assume the local turbulent flow is isotropic, with no distinction between horizontal and vertical mixing. However, agglomerations of phytoplankton into patches are observed on larger scales of up to tens of metres, whose formation will be influenced by the anisotropic advection/mixing properties, and large-eddy structures prevalent in, the surface mixed layer. This paper presents the results of the coupling of a LES model of the mixed layer, with an advection-diffusion system of equations for nitrate-phytoplankton-zooplankton concentration, incorporating parameterisations of the biological processes. The aim will be to understand how the characteristics of the mixed layer turbulence influence the observed distribution of phytoplankton.

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