

Turbulence and the Spring Phytoplankton Bloom

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In the early spring, there is a remarkable explosion in the phytoplankton population over large areas of the global oceans, particularly in the North Atlantic. This greening event, known as the spring bloom, can easily be seen from space and can account for a significant fraction of the annual primary production. The onset of the spring bloom is traditionally explained in terms of the mixed layer depth and available light levels. Using analytical theory, we have found that the turbulent mixing rate can also be an important factor in setting the timing and strength of the bloom. To test this theory, we have used high resolution large-eddy simulations coupled with a phytoplankton model. In this talk, I will describe two situations where the turbulent mixing rate significantly affects the biological productivity: time-dependent convection, and upper ocean density fronts. The analytical theory and numerical simulations will then be used to help interpret field observations.