Response of phytoplankton to submesoscale dynamics in the western North Pacific Ocean

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Abstract.

A high-resolution coupled physical-biological model of the North Pacific is used to investigate the impacts of submesoscale (O(10km)) dynamics on the phytoplankton field in the Kuroshio Extension. The focus is on the seasonality of submesoscale dynamics effects on the phytoplankton bloom. Satellite ocean color imagery captures the energetic pattern of phytoplankton associated with the mesoscale and submesoscale features. The model presents the similar pattern of submesoscale variability in the phytoplankton field in early spring, but in fall, this submesoscale pattern is weak because the mesoscale variability is dominant. In winter, the energetic submesoscale variability plays a strong nitrate injection into the euphotic layer, and the distribution of phytoplankton is patchy with the finer-scale horizontal advection and the response time of growth. In fall, the small-scale variance of nitrate in the upper layer is introduced by the upwelling, and the phytoplankton is large variance with the mesoscale horizontal advection.