

**Effects of topography and tidal mixing front on spring phytoplankton bloom on
Georges Bank: 2-D model experiments**

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Abstract

Two-dimensional coupled biological-physical model experiments were conducted representing a transect across southern Georges Bank. The temporal variation and sectional distribution of biological variables in a lower trophic level food web were simulated to examine the possible biological and physical factors that control the timing and magnitude of the spring bloom on Georges Bank. The model results showed that the cross-sectional gradients of biological variables are mainly induced by the topographic transition from the central bank to the deep flank area. Spring blooms occurred earlier in the shallow part of the bank than in the deep flank area, where stratification developed during later spring and early summer. Between the shallow and deep regions, a possible phytoplankton maximum concentration area (PMA) was observed in the model at the time when the phytoplankton blooms ceased in the shallow region, while the stratification had not developed in the flank area. The model experiments suggested that PMA is mainly caused by the balance between light availability and continuous nutrient supply from the nutrient-rich off-bank water through tidal mixing. Once the tidal mixing front was established, a “second” phytoplankton bloom could occur as a result of the up-front nutrient flux driven by the secondary flow. The development of spring blooms in the deep flank area is sensitive to the development of stratification, especially during the transition time between vertical mixing and stratification, which usually occurs in later April or early May.

Key words: Georges Bank, Spring bloom, Tidal mixing front, Food Web, Numerical model