Effect of large marine diatoms growing at low light on episodic new production

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ABSTRACT: Mesoscale eddies have been shown to be a common feature of open ocean regions such as the Sargasso Sea. By lifting nutrients up to the lower portions of the euphotic zone, these eddies can cause episodic phytoplankton blooms that can lead to substantial new production. In the Sargasso Sea, it has been estimated that such blooms can account for 35%-50% of annual new production. In the present study, it was shown that a common large diatom *Stephanopyxis palmeriana* is capable of growing in a low-light environment typical of the bottom 50 m of the euphotic zone at rates sufficiently high to sustain the contemporary estimates of new production that have been attributed to mesoscale eddies. The diatom was grown in laboratory batch experiments at irradiance levels from 11 to 79 μmol photons m^{-2} s^{-1}, equivalent to irradiance levels occurring in the Sargasso Sea during the summer at depths from ~100 m (the 1% light level) up to 50 m. Resulting growth rates were compared with growth rates from the literature for similar large diatoms, and a simple model of new production was developed to show the dependency of new production on specific growth rate. Included in the model were other important parameters such as the depth of nutrient incursion resulting from lifting of the thermocline when an eddy passes, the duration of the bloom, and the size of the prebloom diatom population. Using realistic ranges for these parameters, it was evident from the model that there is no physiological constraint on these large diatoms from growing fast enough at very low light levels to meet the new production estimates resulting from eddies.