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Abstract

We evaluate several algorithms for the estimation of phytoplankton size class (PSC) and functional type (PFT) biomass from ship-based optical measurements in the Subarctic Northeast Pacific Ocean. Using underway measurements of particulate absorption and backscatter in surface waters, we derived estimates of PSC/PFT based on chlorophyll-a concentrations (Chl-a), particulate absorption spectra and the wavelength dependence of particulate backscatter. Optically-derived [Chl-a] and phytoplankton absorption measurements were validated against discrete calibration samples, while the derived PSC/PFT estimates were validated using size-fractionated Chl-a measurements and HPLC analysis of diagnostic photosynthetic pigments (DPA). Our results showflo that PSC/PFT algorithms based on [Chl-a] and particulate absorption spectra performed significantly better than the backscatter slope approach. These two more successful algorithms yielded estimates of phytoplankton size classes that agreed well with HPLC-derived DPA estimates (RMSE = 12.9%, and 16.6%, respectively) across a range of hydrographic and productivity regimes. Moreover, the [Chl-a] algorithm produced PSC estimates that agreed well with size-fractionated [Chl-a] measurements, and estimates of the biomass of specific phytoplankton groups that were consistent with values derived from HPLC. Based on these results, we suggest that simple [Chl-a] measurements should be more fully exploited to improve the classification of phytoplankton assemblages in the Northeast Pacific Ocean.