High-res measurements of primary production in the northern Gulf of Alaska

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Complex interplay of factors controlling primary production

Despite decades of research, we have only a rudimentary understanding of primary production dynamics in the northern Gulf of Alaska (NGA). This knowledge gap can be attributed to a lack of measurement capability in an area characterized by intense variability.

METHODS Underway and satellite-based platforms

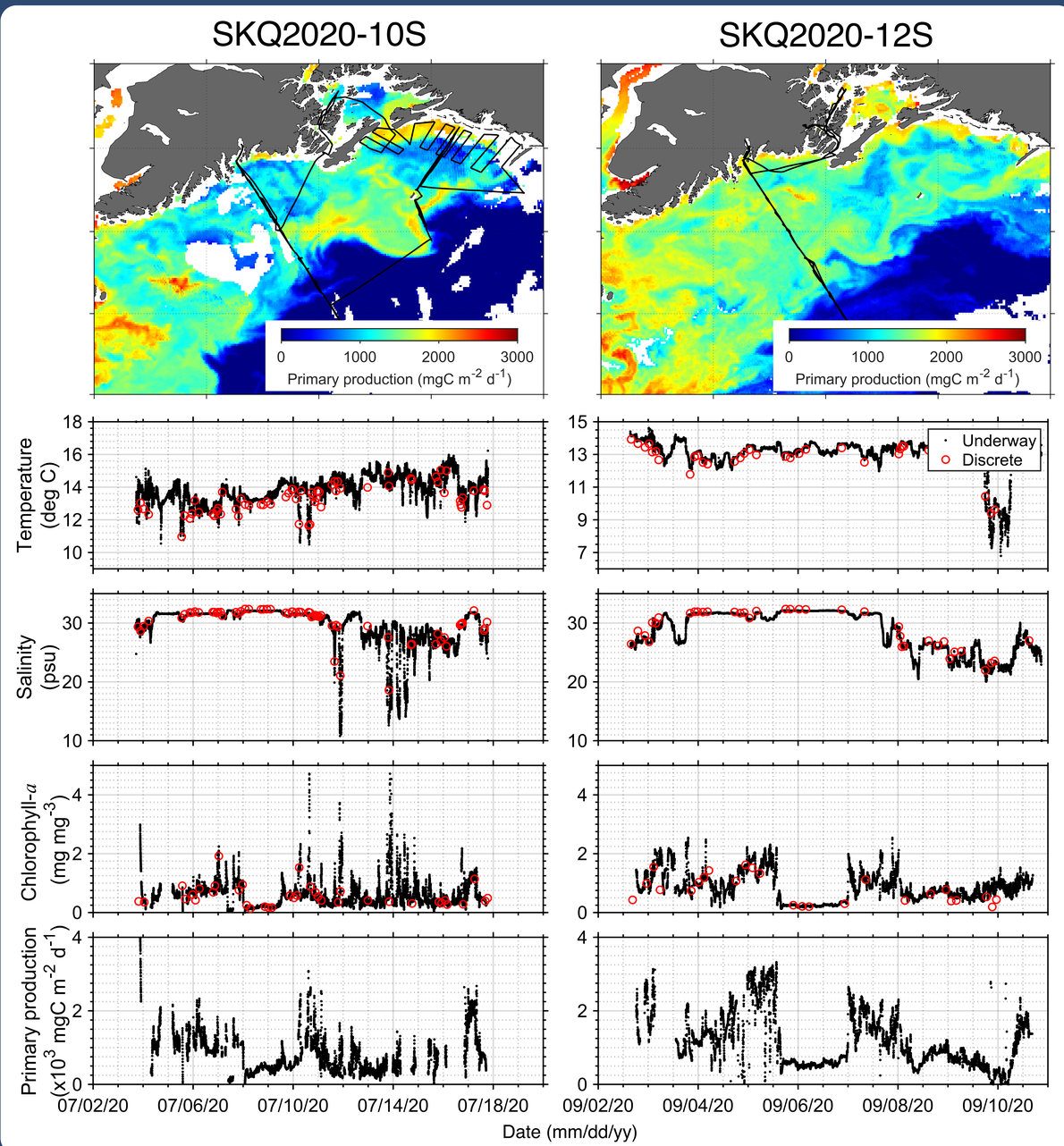
The optical underway system onboard R/V Sikuliaq enables investigations of primary production dynamics in greater resolutions both in time and space.

Satellite ocean color remote sensing can be a powerful and cost-effective tool that covers broader scales from decadal to intra-seasonal, and local to global.

RESULTS High-res monitoring of primary production

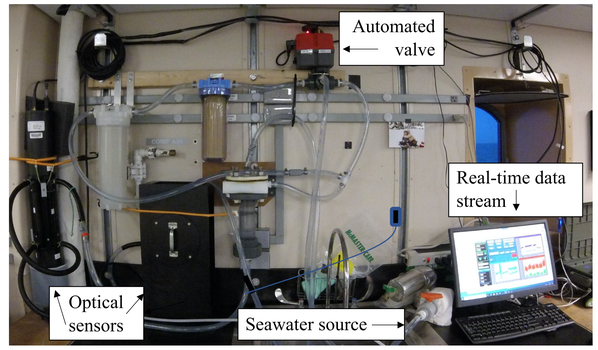
The Carbon-based Productivity Model (CbPM; Westberry et al., 2008) was used to estimate primary production. Validation results showed median difference of 23.5% and 34.5% for the underway system and satellite remote sensing, suggesting the robustness of monitoring primary production in the NGA using these platforms.

Underway and satellite observations are valuable resources for addressing complex primary production dynamics in the NGA



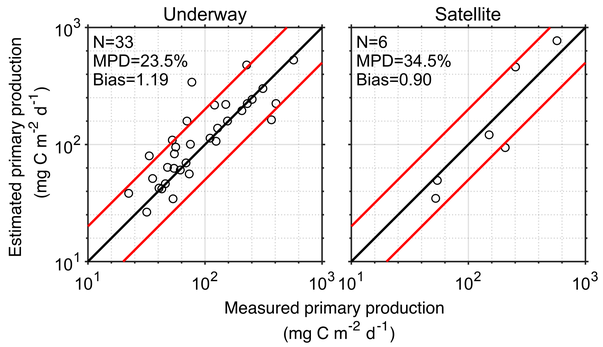
Underway system aboard R/V Sikuliaq

Optical system installed aboard the R/V Sikuliaq in July 2020. Further components, including an automated flow meter and a clean water calibration system have been added for the 2021 expeditions. Optical data (i.e., absorption and backscattering properties) acquired by the underway system is translated into biological data (i.e., phytoplankton carbon biomass, phytoplankton cellular chlorophyll concentrations, and physiological state); those are input variables to predict primary production using the CbPM.



Performance of the CbPM

Scatter plots comparing measured and estimated primary production derived from the underway system and the MODIS sensor aboard Aqua satellite using the CbPM. The phytoplankton carbon biomass more appropriately describes algal standing stocks, whereas the phytoplankton cellular chlorophyll-a concentrations are extremely plastic, responding to changes in growth irradiance, nutrient status, taxonomy, and other environmental stressors.



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