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Exploring the Monitoring Capacity of a Cabled Coastal Observatory in the Arctic as a Proxy for Seasonal Phytoplankton Dynamics: A 6-year time-series in Cambridge Bay, Nunavut, Canada

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In an effort to broaden understanding of Arctic marine environments, Oceans Networks Canada (ONC) installed fixed-point cabled sub-tidal and shore-based observatories in the fall of 2012 in Cambridge Bay, Nunavut, in the Canadian Arctic Archipelago (CAA). The sub-tidal observatory was equipped with: CTD, acoustic sea-ice profiler, camera, hydrophone, acoustic Doppler current profiler, dissolved oxygen (O_2), chlorophyll fluorescence, turbidity, PAR, pH and pCO_2 sensors. The onshore meteorological station measures standard weather parameters, including air temperature, downward irradiance, humidity, and wind speed and direction. The shore station also has an AIS receiver. Data is being recorded at between 1 and 60 Hz resolution, on the sub-tidal and shore observatory systems, all of which is freely available for download at oceannetworks.ca. The motivation for the present study was to take advantage of the unique high-resolution time-series to identify the seasonal timings of abiotic and productivity-associated events and investigate regulation of inter-annual variability. Seasonal biotic events include a shift from net respiration to production (based on O_2 measurements) and changes in the production of phytoplankton biomass that are related to solar irradiance and ice thickness. In all years, prior to sea-ice melt (late March to April), a shift from net respiration (O_2 decrease and pCO_2 build-up) to net production (O_2 increase and pCO_2 drawdown) is observed. Net production is generally reached just prior to the sea-ice break up (early July) and its seasonal duration is positively correlated to the number of ice-free days annually. We also demonstrate a light-dependent relationship in fixed-point chlorophyll fluorescence measurements in sea-surface waters of Cambridge Bay, discuss necessary data corrections and consider future instrument options.