



A synthesis of Arctic Ocean primary production

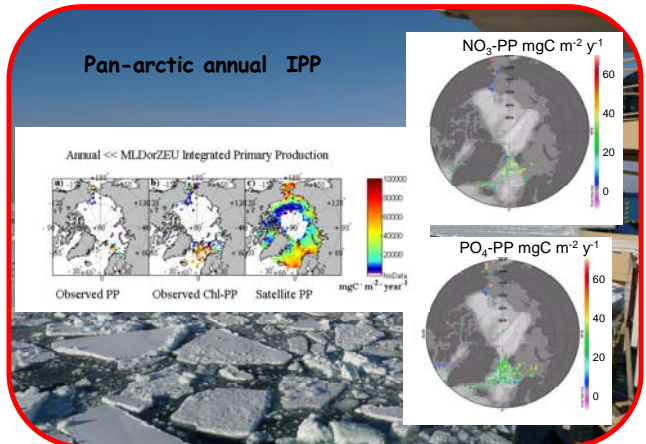
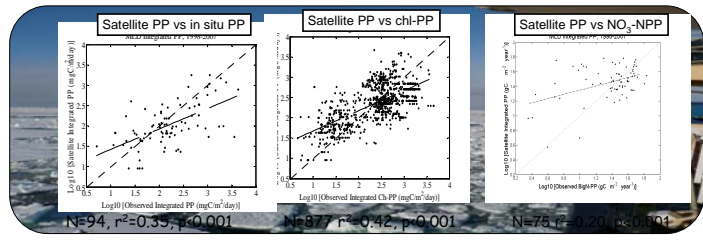
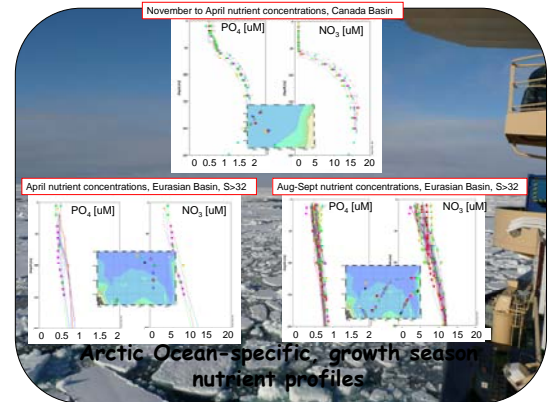
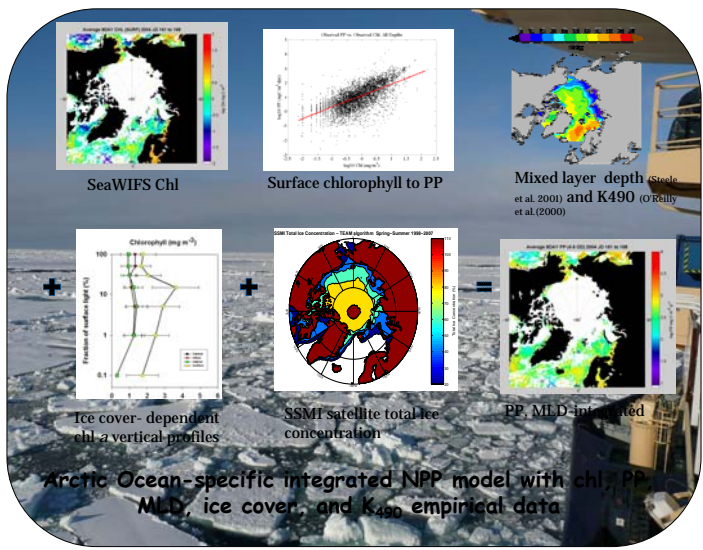
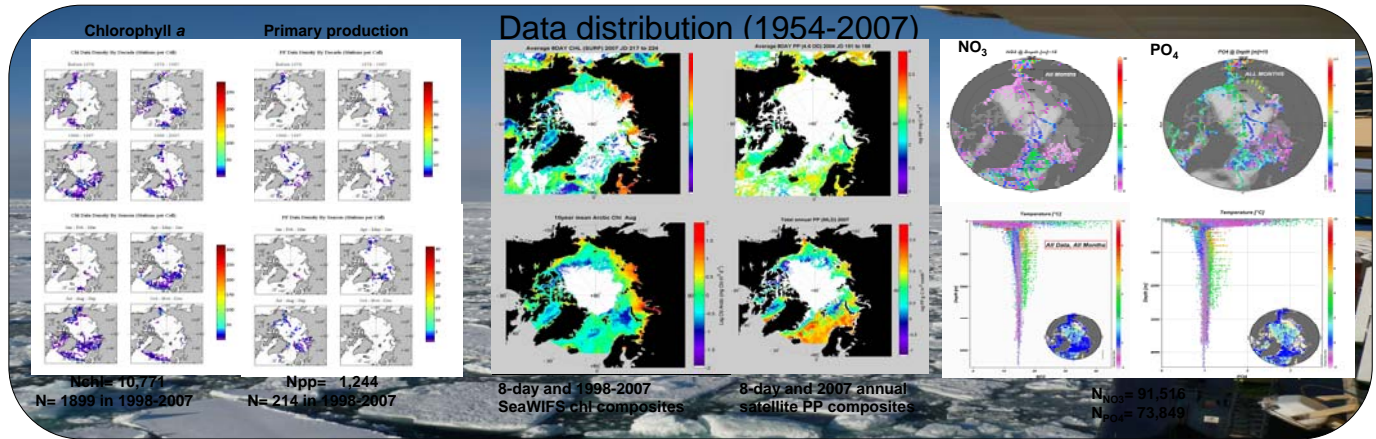


Matrai, P.¹, Hill, V.², Codispoti, L.³, Kelly, V.⁴, Light, B.⁵, Olson, E.^{1,6}
Steele, M.⁵, Suttle, S.⁴, Ermold, W.⁵, Zimmerman, R.²

¹Bigelow Laboratory for Ocean Sciences, W. Boothbay Harbor, ME, USA, matrai@bigelow.org; ²Old Dominion U., Norfolk, VA, USA; ³Horn Point Laboratory, Cambridge, MD, USA; ⁴Green Eyes, LLC Cambridge, MD, USA; ⁵U. of Washington, Seattle, WA, USA; ⁶Woods Hole Oceanographic Institution, Woods Hole, MA, USA

ABSTRACT

Recent changes in the Arctic Ocean (AO) cryosphere which include reduced ice thickness and extent and surface warming have sparked keen interest in the possible consequences for primary production (PP). However, a benchmark Pan-Arctic estimate of PP has been difficult to determine as logistical difficulties prevent field work from being carried out for much of the year. The spatial and seasonal magnitude and variability of PP in the AO is quantified with a pan-arctic approach by applying complementary methods that emphasize different spatial/temporal scales, such as ¹⁴C uptake, an empirical algorithm, and nutrient-based net community production, using the ARCSS-PP database which includes in situ data collected over the past 50 years and which have never been collectively analyzed before. This extended data set also provides validation of satellite-derived PP, an extremely valuable tool in this environment which is so difficult to sample. These estimates from satellite-based observations are also used to increase both spatial and temporal coverage. Surface, daily in situ PP averaged 70 mg C m⁻² d⁻¹ for spring for the ca. 50 year period across the AO. Annual averages of surface PP showed similar patterns in spatial and seasonal magnitude and variability to the daily PP averages. Annual integrated IPP above 65°N was estimated at 396 TgC yr⁻¹. This was considered to be the lower limit, as summertime IPP was underestimated by satellite modeling. Highest regional NCP values (~50-100 g C m⁻²) occur in the Nordic and Barents Seas. High regional net community production (NCP) (~30-50 g C m⁻²) values occur over the northern Bering Sea Shelf, in the inner and outer Chukchi Sea, and in the Canadian Archipelago, but there is considerable intra-region variability, with some of the highest productivity rates in the Arctic embedded in these regions. Moderate regional NCP (~15-25 g C m⁻²) occurs in the Inner and Outer E. Siberian + Laptev Seas and Kara Sea and over the northeastern Greenland Shelf. Low NCP (NCP < 20 g C m⁻²) occurs in the Eurasian and Canadian Basins.



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