Spatial/Variability

Average primary production in the western Antarctic Peninsula (64°S to 68°S) shows a strong onshore-offshore gradient with a 5x increase in daily production towards coastal waters. Average primary production responds linearly to sea ice retreat [higher production with later sea ice retreat in the previous spring] and negatively to summer mixed layer depth established as sea ice retreats, with higher production in shallower, and more coastal, mixed layers.

Variability in primary production relates non-uniformly with summer mixed layer depth:
- 63% of the variability is not related to mixed layer depth.
- In coastal and offshore areas primary production increases with deeper mixed layers and is associated with diatoms.
- Only 9% of the variability is related to shallow mixed layers. Spatially, this correlation in variability is observed at mid shelf and it is associated with dominance of flagellates.

Spatial/Temporal Variability

Spatial variability in primary production, expressed as anomalies, shows interannual cycles (1996, 2002 and 2006), with largest variability mismatches during periods of low production (i.e. 1999) the shelf gradient is shallow.

Time Series of anomalies can be established at each location providing this opportunity to correlate anomalies of different variables, with spatial correlation maps indicating:
- Mid shelf primary production is particularly enhanced during years of late sea ice retreat.
- Primary production anomalies relate unexpectedly to variability in mixed layer depth, with higher production in offshore and coastal waters; higher production during years of deeper mixed layer depth. Shallow waters respond as expected.
- Similarly, later sea ice retreat correlates with deeper summer mixed layers in coastal and offshore waters.

Conclusion:
- Does the variability in primary production in this region have different controls at different locations, and can these controls differ from the mean?

Introduction

Antarctic coastal phytoplankton is well known for the dominance of microplankton cells (>20 μm) supporting a short food chain; diatoms =warf=ward in contrast with oceanic Antarctic phytoplankton in high-nutrient-low-chlorophyll waters of the Antarctic Circumpolar Current which is dominated by nanoplankton (cells 2-20 μm), there is a potential for large blooms in coastal waters (25 mg chlorophyll a m-2 and 2-3 g C m-2 d-1) with important seasonal drawdown of CO2.

As the season progresses higher sun angle provides increased surface irradiance resulting in:
- Increased water column stability by melting of sea ice as days lengthen in austral spring.
- Introducing freshwater (~50%) resulting in surface waters of ~33 psu.
- Increased average light exposure at upper water column as seawater becomes ice free.
- Release of micronutrients, after accumulation of dust on ice during winter (Sedwick et al., 2000).

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