Amundsen Sea Polynya
International Research Expedition
ASPIRE
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ASPIRE
A regularly occurring polynya just off the Dotson Ice Shelf

http://www.ldeo.columbia.edu/~sharons/animAS_bymonth.htm
• Fourth largest Antarctic polynya
• Highest peak and seasonally averaged chla concentration
• Greatest primary productivity per unit area
• Greatest interannual variability - WHY?

ASPIRE
Project Objectives:

Use inter-annual and spatial variability to elucidate climate-sensitive mechanisms directing carbon fluxes in this region.

Focus on physical (light, mixed-layer) and chemical (micro-nutrient) mechanisms controlling the duration, timing, and community structure of the phytoplankton bloom.

Determine controls on the fate of that production (zooplankton, microheterotrophy, particle flux)
Trace Metals (Rob Sherrell / Per Anderson / Silke Severmann / Kuria Ndungu)
Dissolved and particulate Fe, Mn, Zn, Cu, No, Co, Cd, V, Mo, Ca, P, Corg, Norg, Ba, Al, Sc, T, Yb, Pb, REE
TMC CTD/rosette, Towed fish, in situ pumps

Phytoplankton Abundance and Physiology (Oscar Schofield)
Physiology: Fluorescence Induction Relaxation (FIRE; Fv/Fm); 14C-bicarb incubation
Webb Slocum Glider (CTD/ Ecopucks: spectral backscatter, chla fluor, CDOM)

Zooplankton (Kajsa Tonnesson)
Abundance, grazing rates, prey preference, pellet production

Particle dynamics and sedimentation (Hugh Ducklow / Per Anderson)
Moored sediment trap, dissolved and particulate $^{234}$Th, floating sediment trap

Microbial heterotrophy (Patricia Yager / Stefan Bertilsson / Lasse Riemann)
Free- and particulate bacterial and Archaeal abundance, production, respiration, community structure,
exoenzymes, viral abundance, viral shunt, chemoautotrophy, bacterivory

Carbonate system (Melissa Chierici / Agneta Fransson / Patricia Yager)
Underway surface pCO2, DIC, ALK, pH

Physical Oceanography (Goran Bjork / Anna Wahlin / Lars Arneborg)
Water masses (especially CDW); CTD hydrography; conventional CTD/rosette

Ice-Ocean Atmosphere Interactions, data synthesis, modeling (Sharon Stammerjohn)
Large-scale ice-atmosphere variability, surface water properties, stratification, CDW
Ice-algal growth model, single-column KPP upper ocean mixing model with biogeochem
Proposed cruise track within the Amundsen Sea Polynya: Three transects and two 3-day drifting time series stations

14 days in the polynya

Sediment trap placed in area open for longest time
Examples of December sea ice conditions and ‘quickest’ routes to AS polynya

Sea Ice Image overlaid on land/bathymetry masks:
- Continental Ice is light/dark: grey (under ice image)
- Continental shelf: slightly shaded (under ice image)
- Open water: black
- Sea ice 100%: white
- Sea ice ~50%: light blue
Priorities for NBP:

1. Into the polynya as soon as possible
2. Deploy mooring and glider first
3. Two 3-day drifting experimental transects
4. Three cross-polynya transects
   (~25 nm station resolution)
5. Ice-shelf front: inputs to polynya
5. Trough sampling: inputs to polynya
6. Pine Island Polynya (depending on ice)