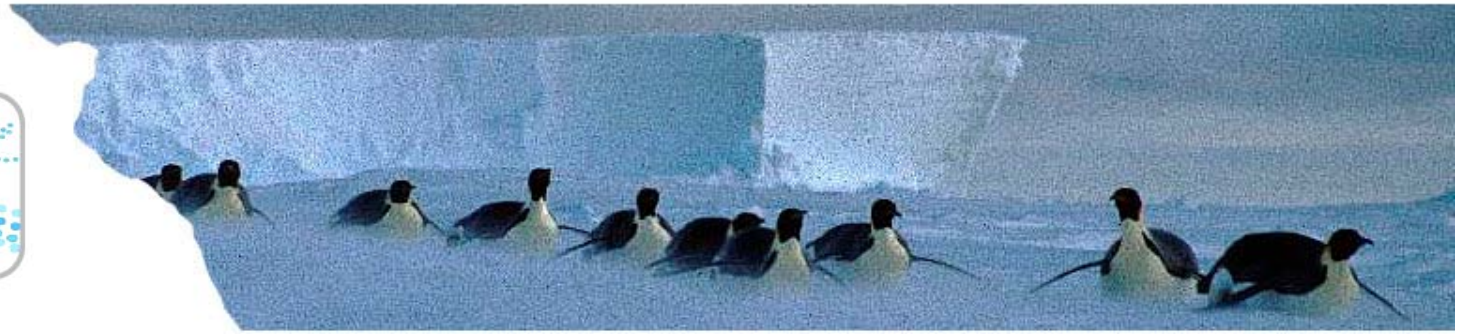
Sea Surface Consortium UKOARP



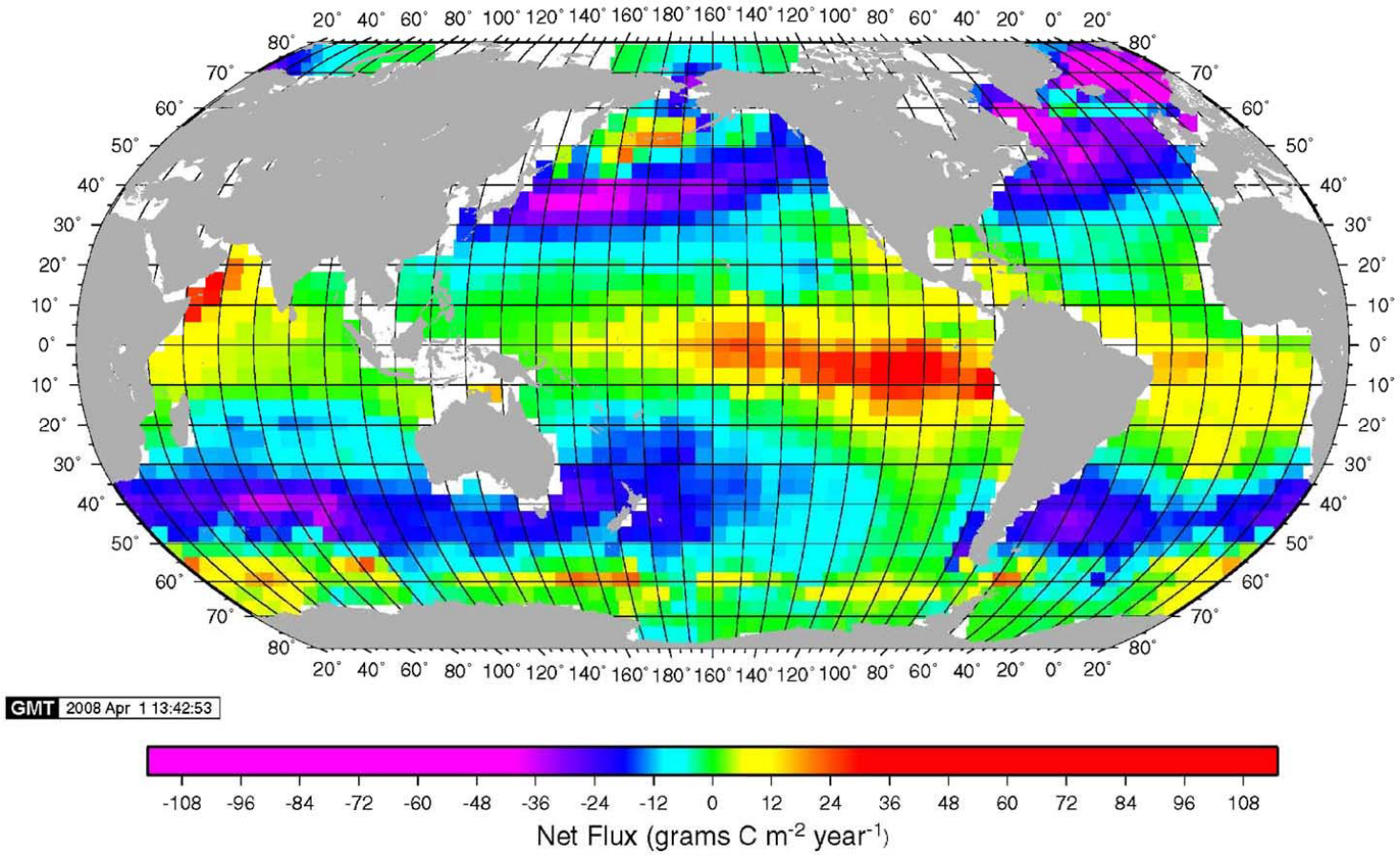
Southern Ocean Cruise

PSO: Geraint Tarling (gant@bas.ac.uk)

Dec 2012-Feb 2013

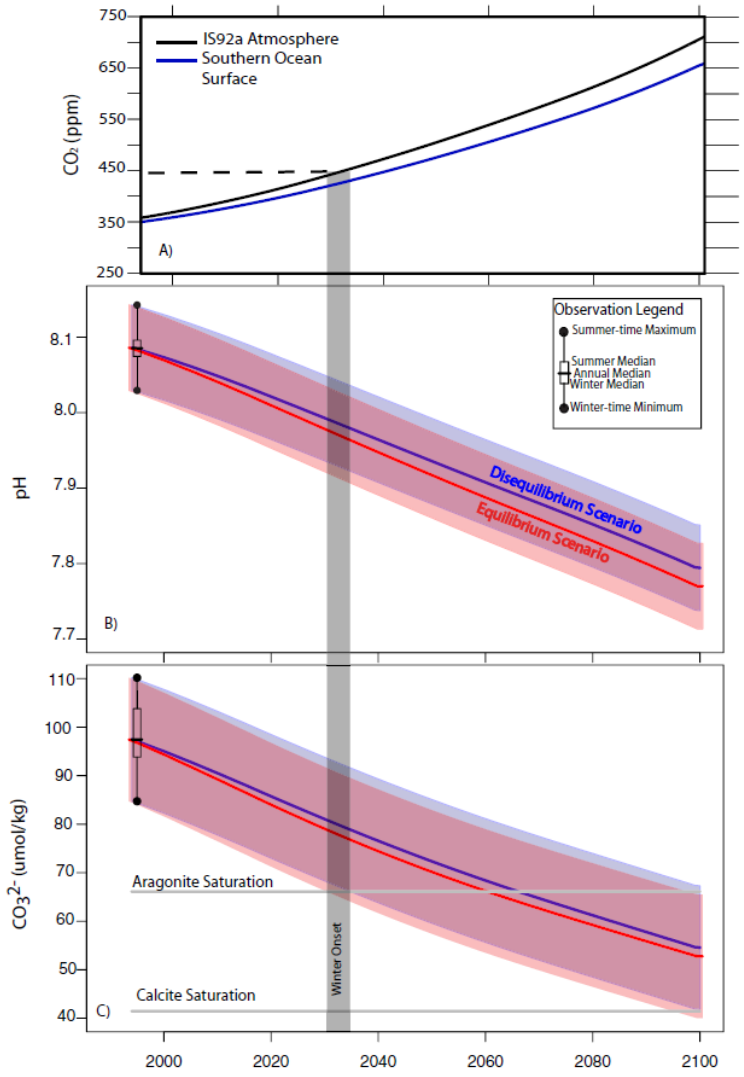
RRS *James Clark Ross*

Climatological mean annual sea–air CO_2 flux (gC m^{-2} yr^{-1})



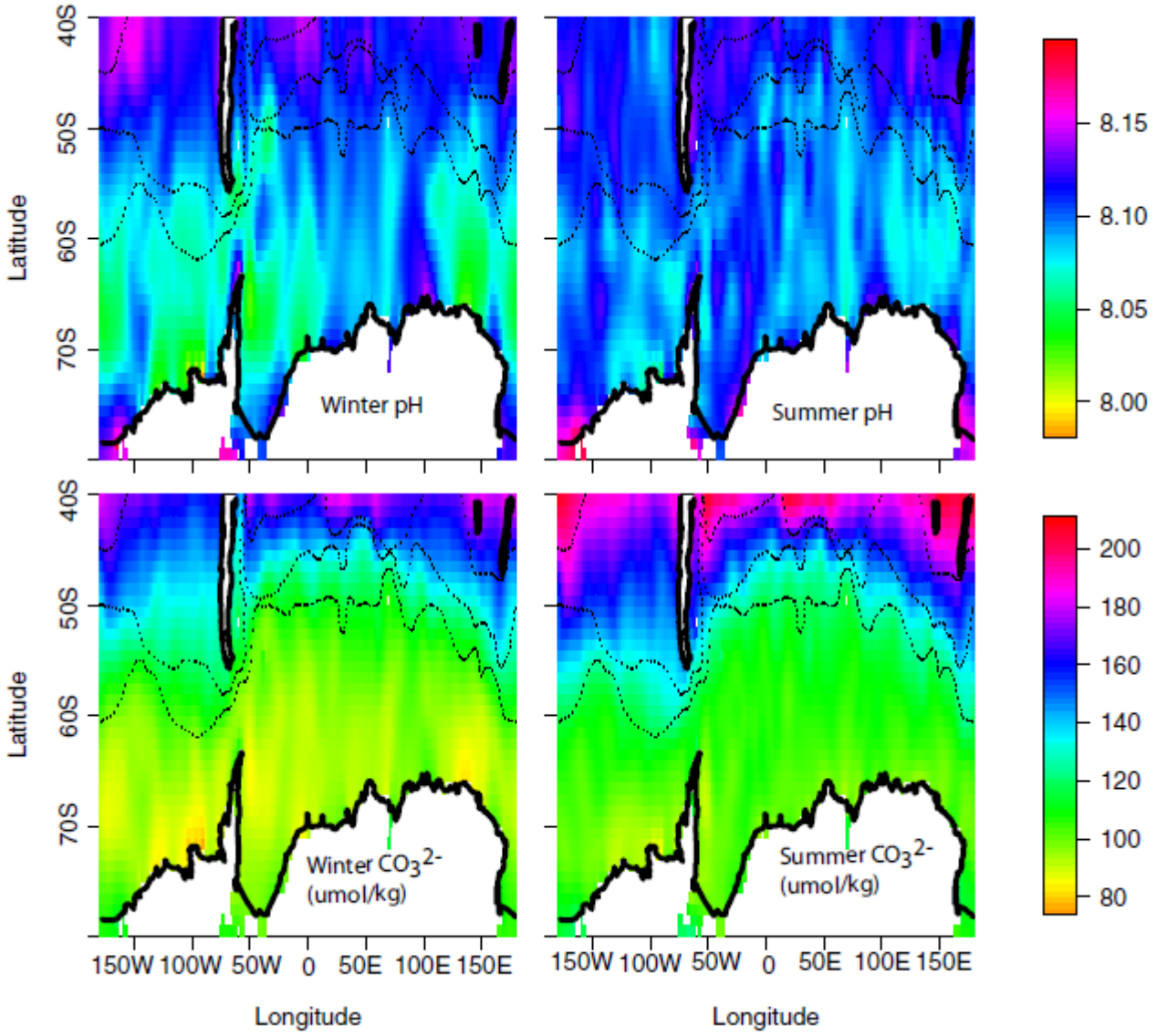
Takahashi et al. (2009)

Aragonite undersaturation in winter predicted for 2030 in Southern Ocean surface water



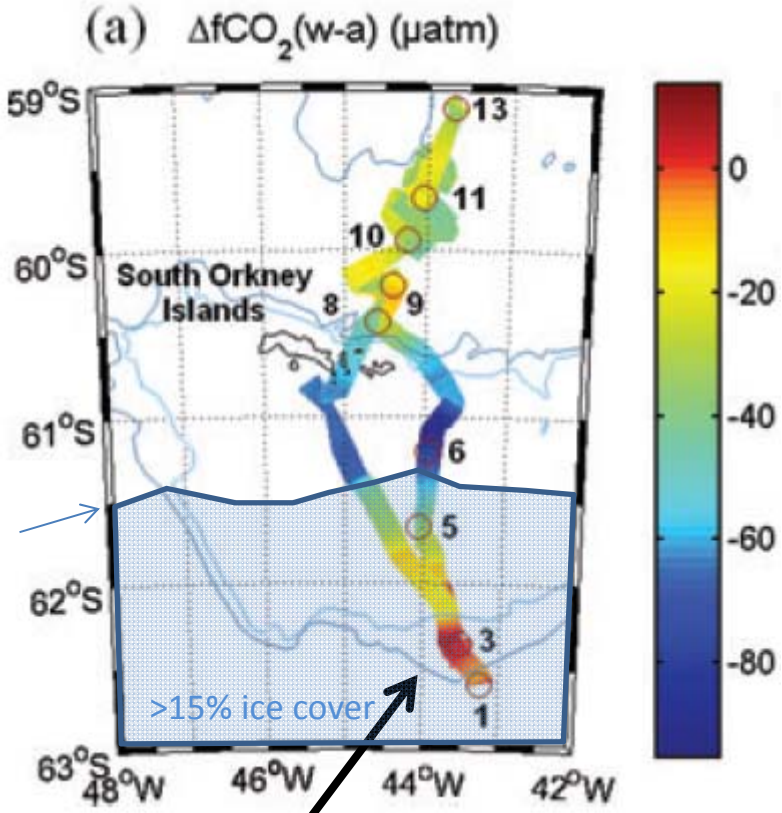
McNeil and Matear 2008

Spatial heterogeneity in pH and CO_3^{2-} concentrations

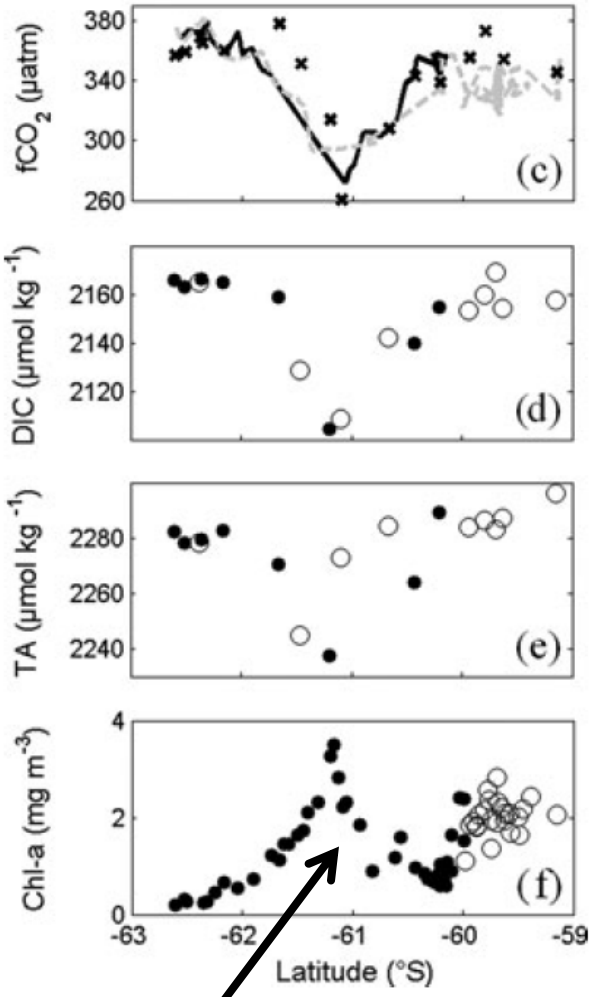


McNeil and Matear 2008

fCO_2 and DIC are strongly influenced by ice-edge effects



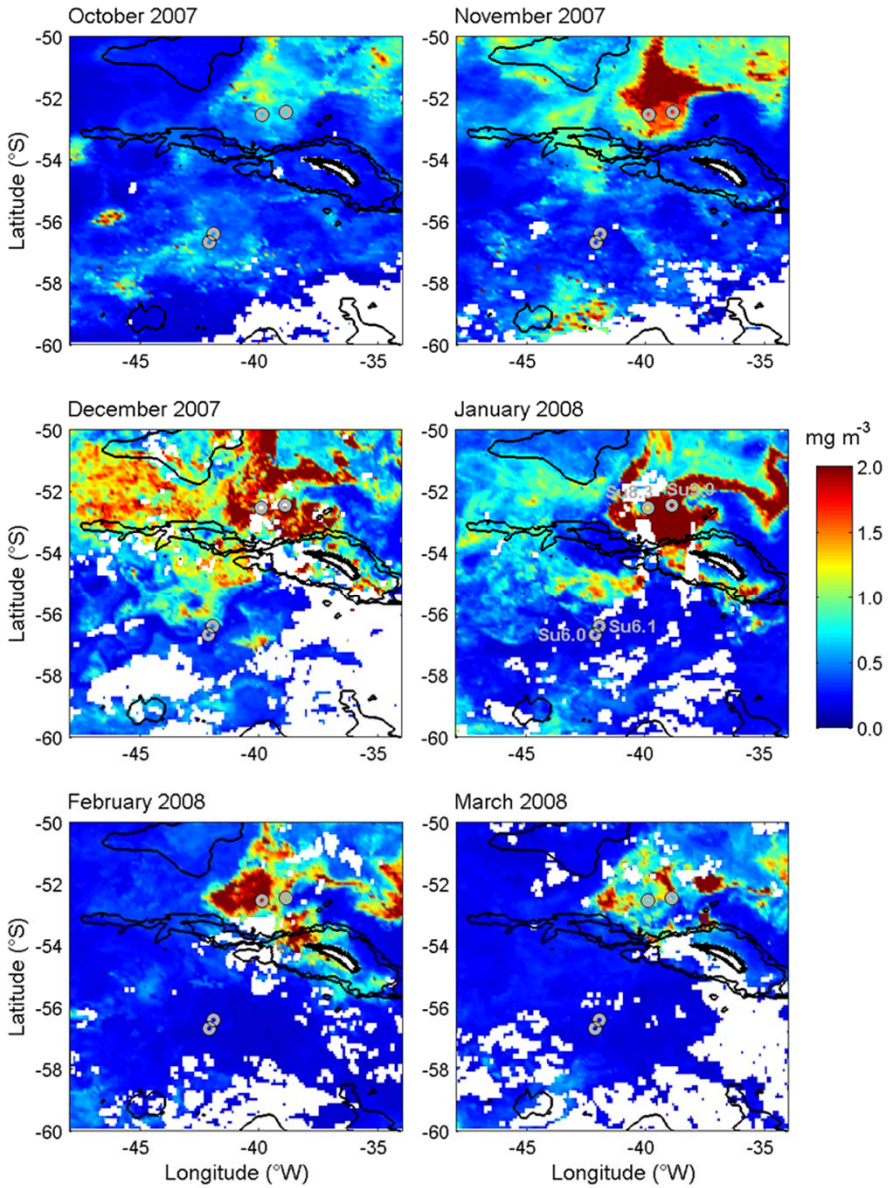
Melt of brine precipitates carbonate minerals (e.g. ikaite)
- decreases DIC and TA and increases fCO_2



Ice-edge blooms lead to large DIC deficits

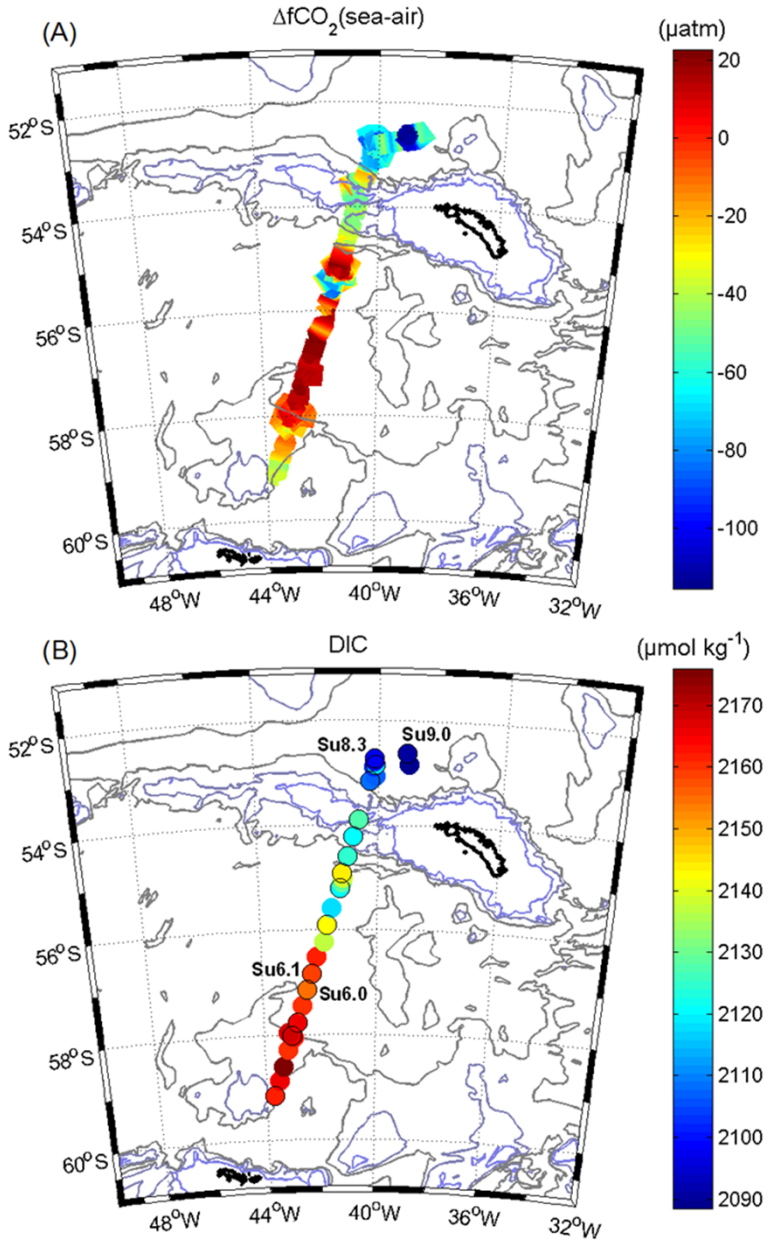
Jones et al. 2008

Scotia Sea contains both HNLC and iron-fertilised environments

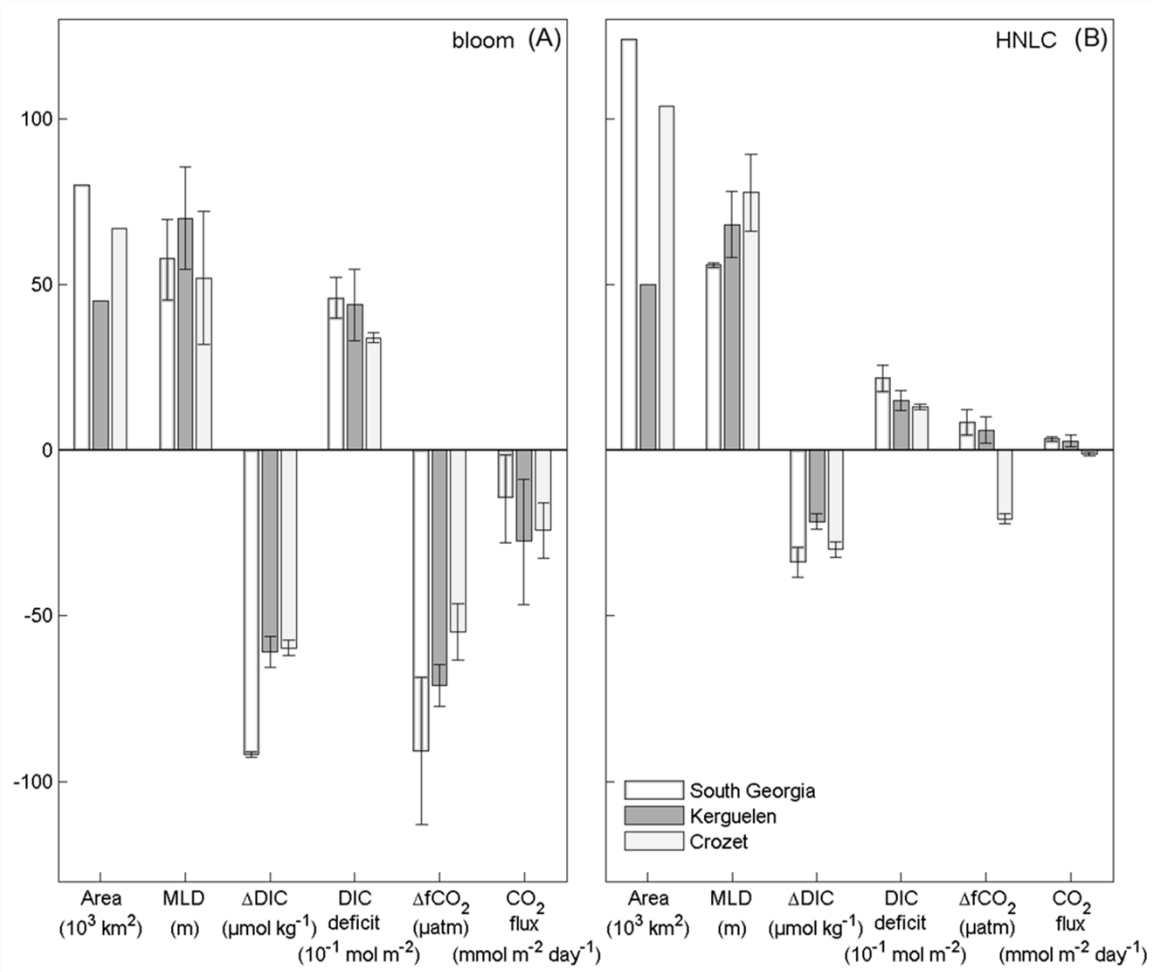


Monthly composite images of daily MODIS-Aqua chlorophyll a (mg m^{-3})

Diversity of *f*CO2 and DIC conditions in open waters of Scotia Sea

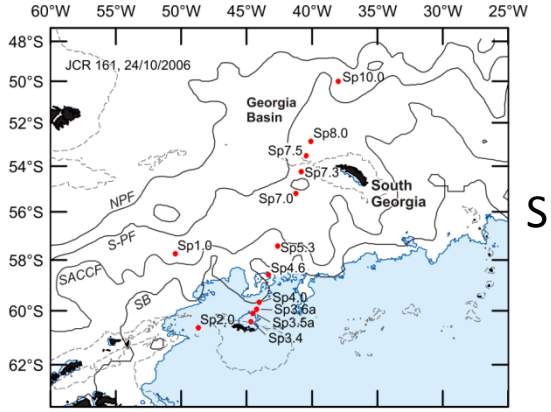


South Georgia contains the strongest observed seasonal carbon uptake in ice-free waters of the Southern Ocean

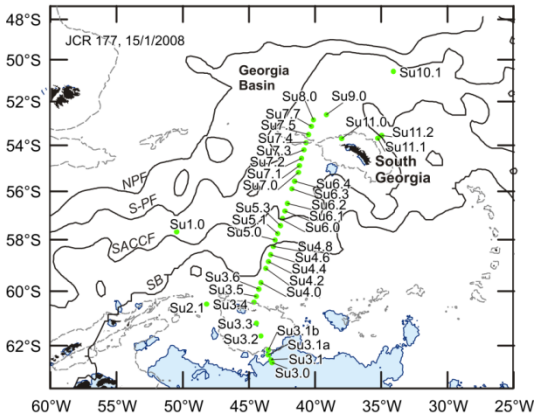


Jones et al. 2012

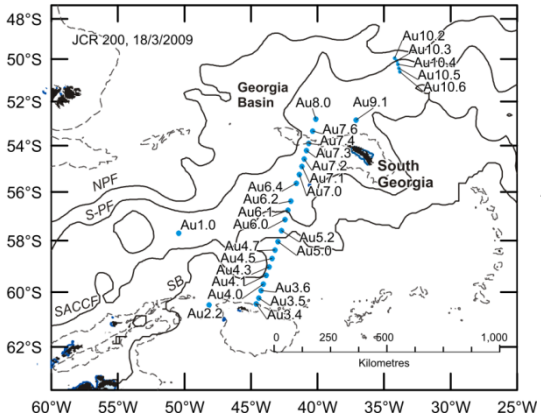
Context: seasonal open-ocean sampling programme (2007-2009)



Spring

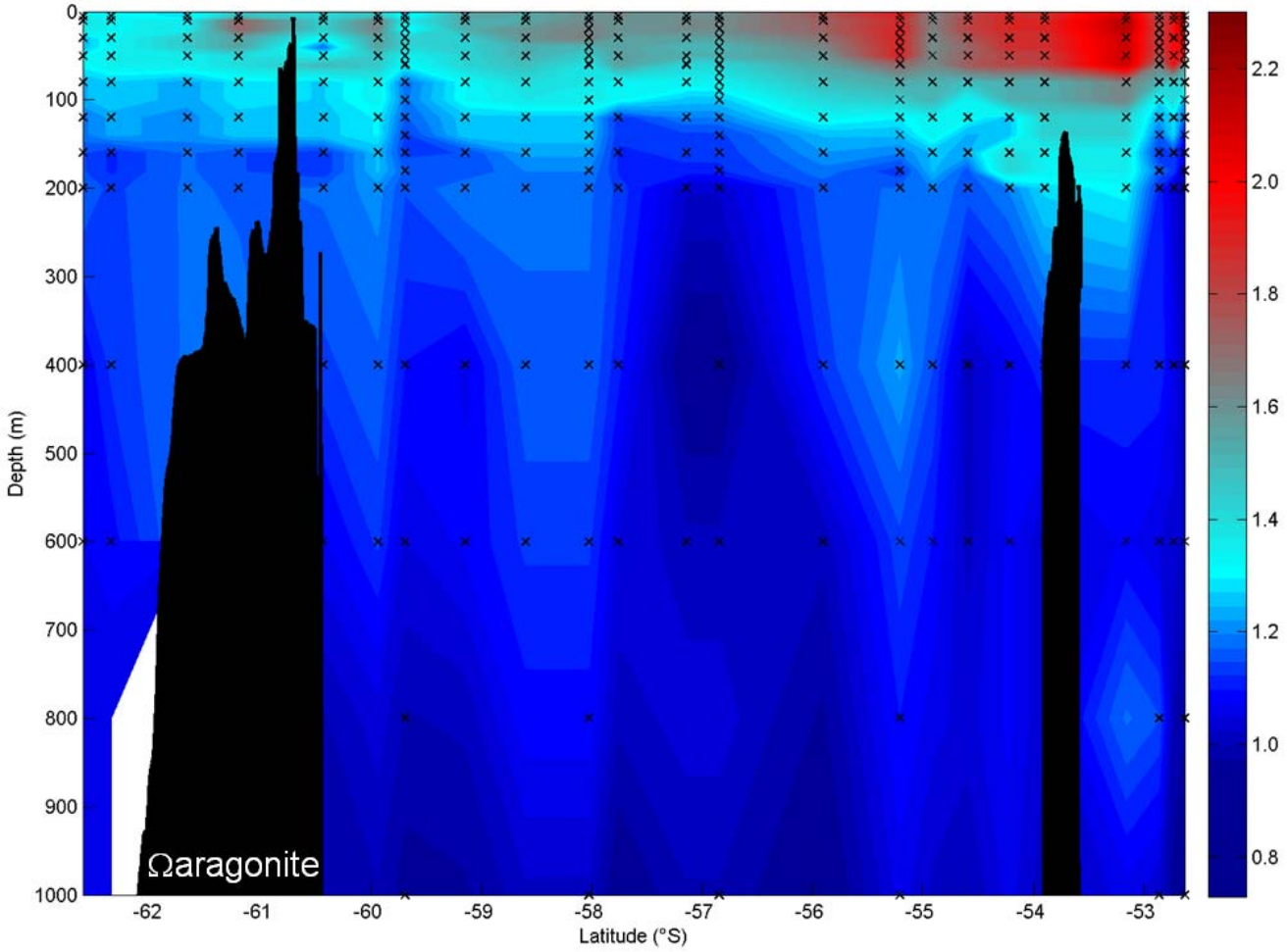


Summer



Autumn

Areas of upwelling bring aragonite undersaturated waters to within 200 m of surface



Jones 2010

Poster

Pteropods dissolve in response to anthropogenic acidification of the Southern Ocean

Nina Bednaršek*†‡, Geraint Tarling*, Dorothee Bakker†, Sophie Fielding*, Libby Jones†, Hugh Venables*, Peter Ward*, Alan Kuzirian§, Bernard Lézé†, Eugene Murphy*

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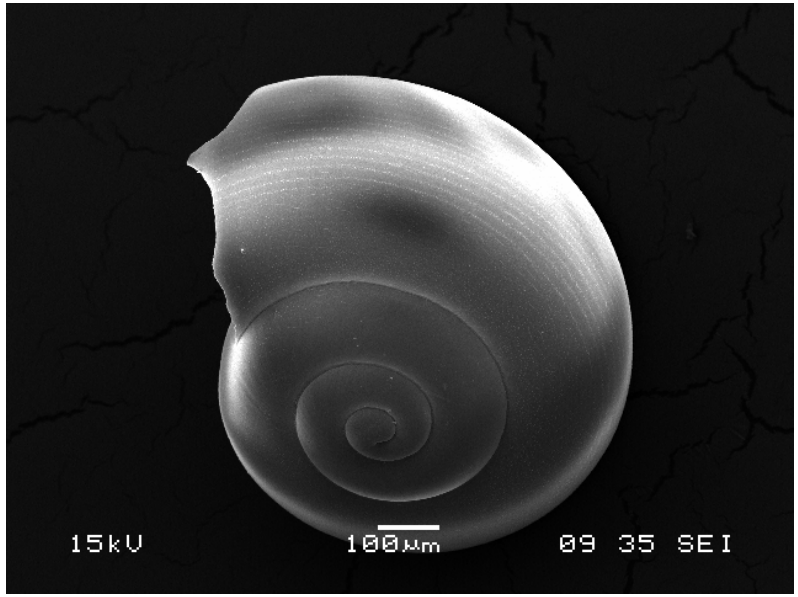
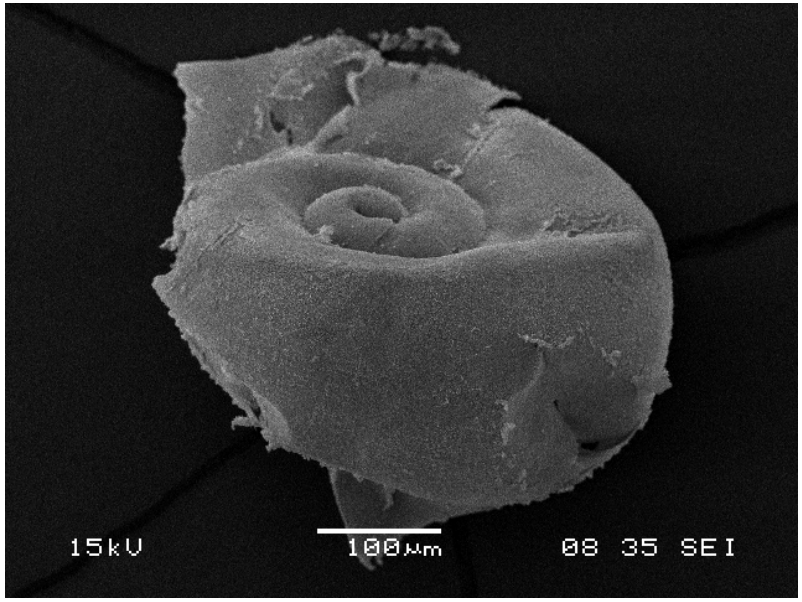
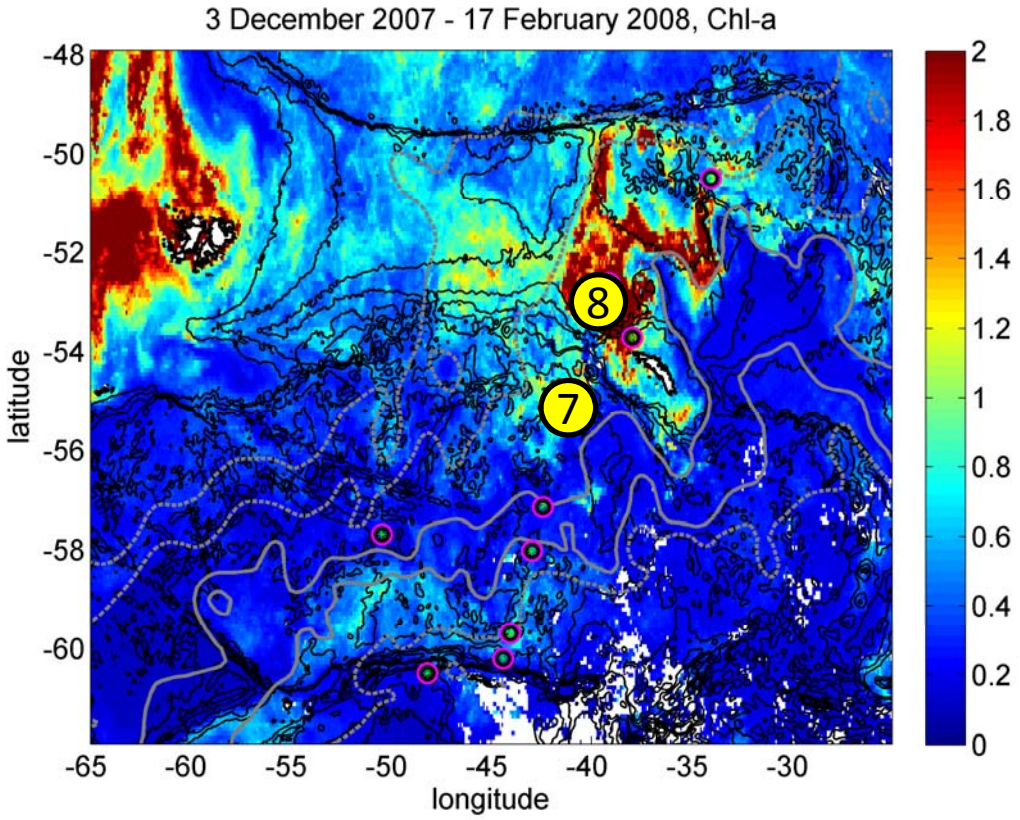
Contact: Geraint Tarling (gant@bas.ac.uk)

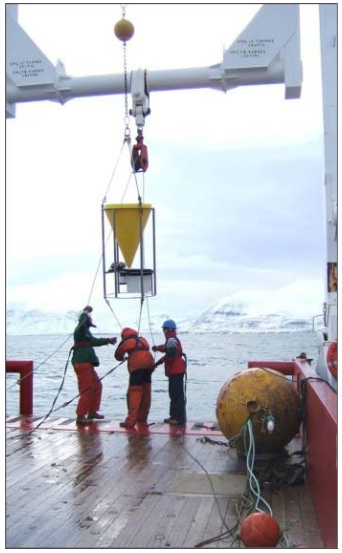


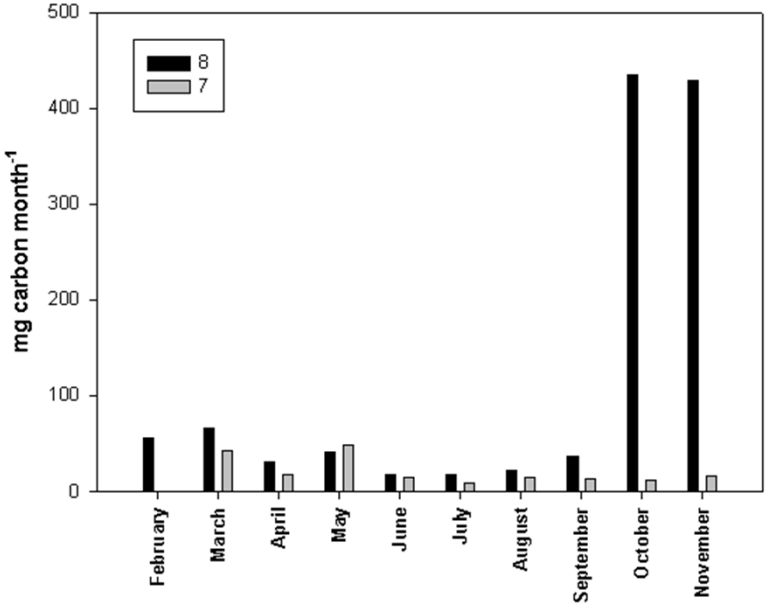


Limacina helicina antarctica visualised by SEM. *Left*: fully intact shell; *Right*: Level III dissolution resulting from 8 d exposure to $\Omega_A \approx 1$

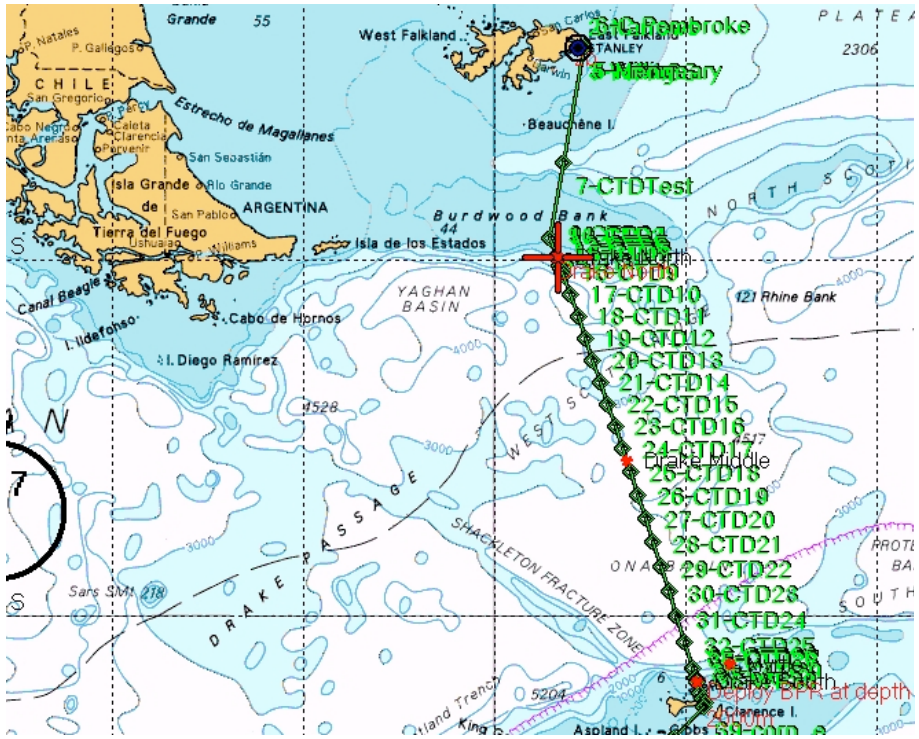
Context: Oceanographic moorings in northern Scotia Sea (2006 to present)

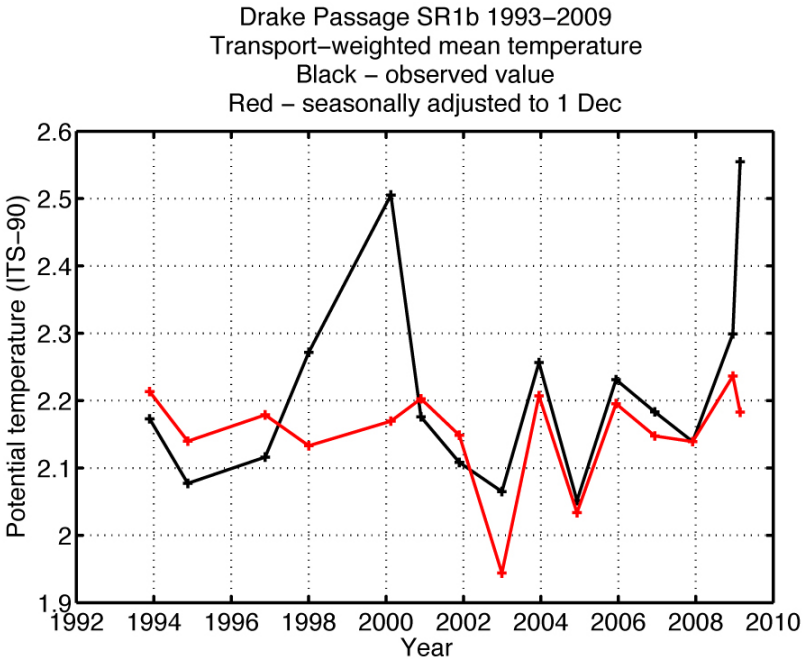




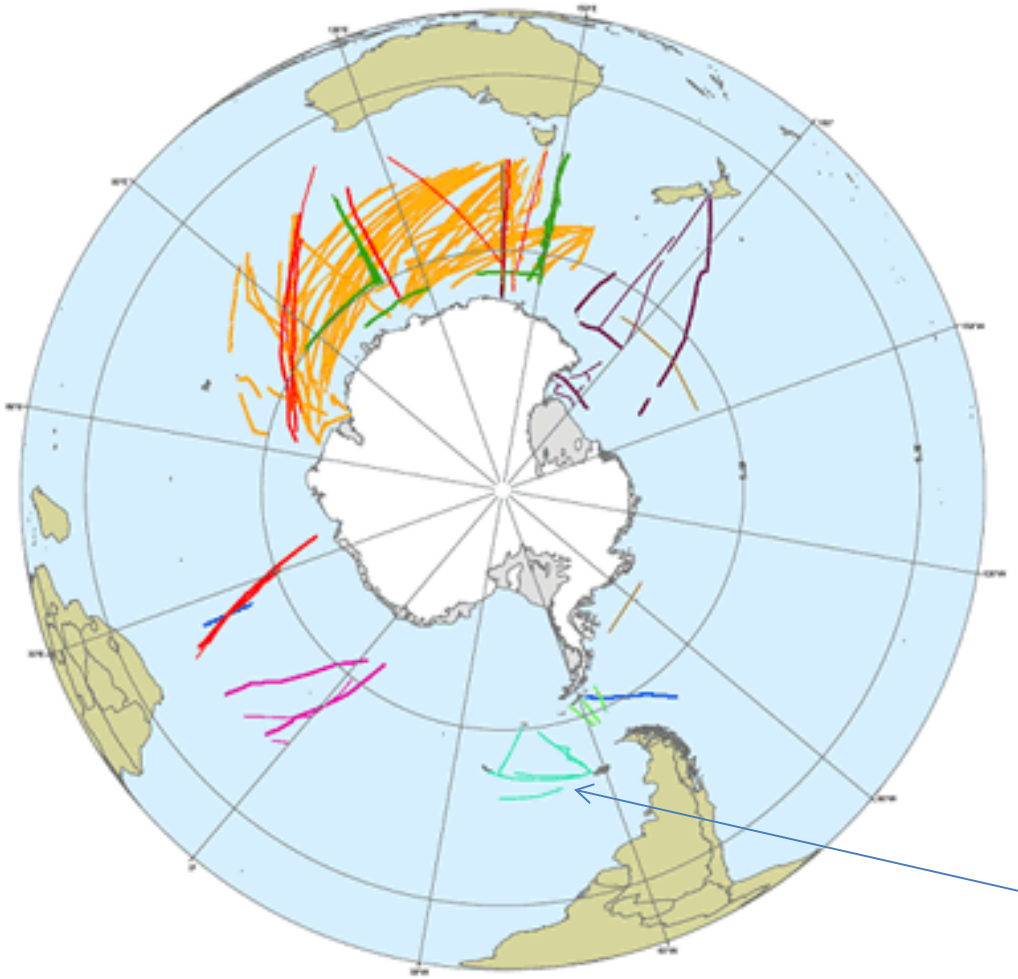


Context: Drake passage transect (1993-present)





Context: Continuous plankton recorder



BAS/FI Fisheries transect:
2005 to present

Continuous plankton recorder tows conducted between 1991 and 2008

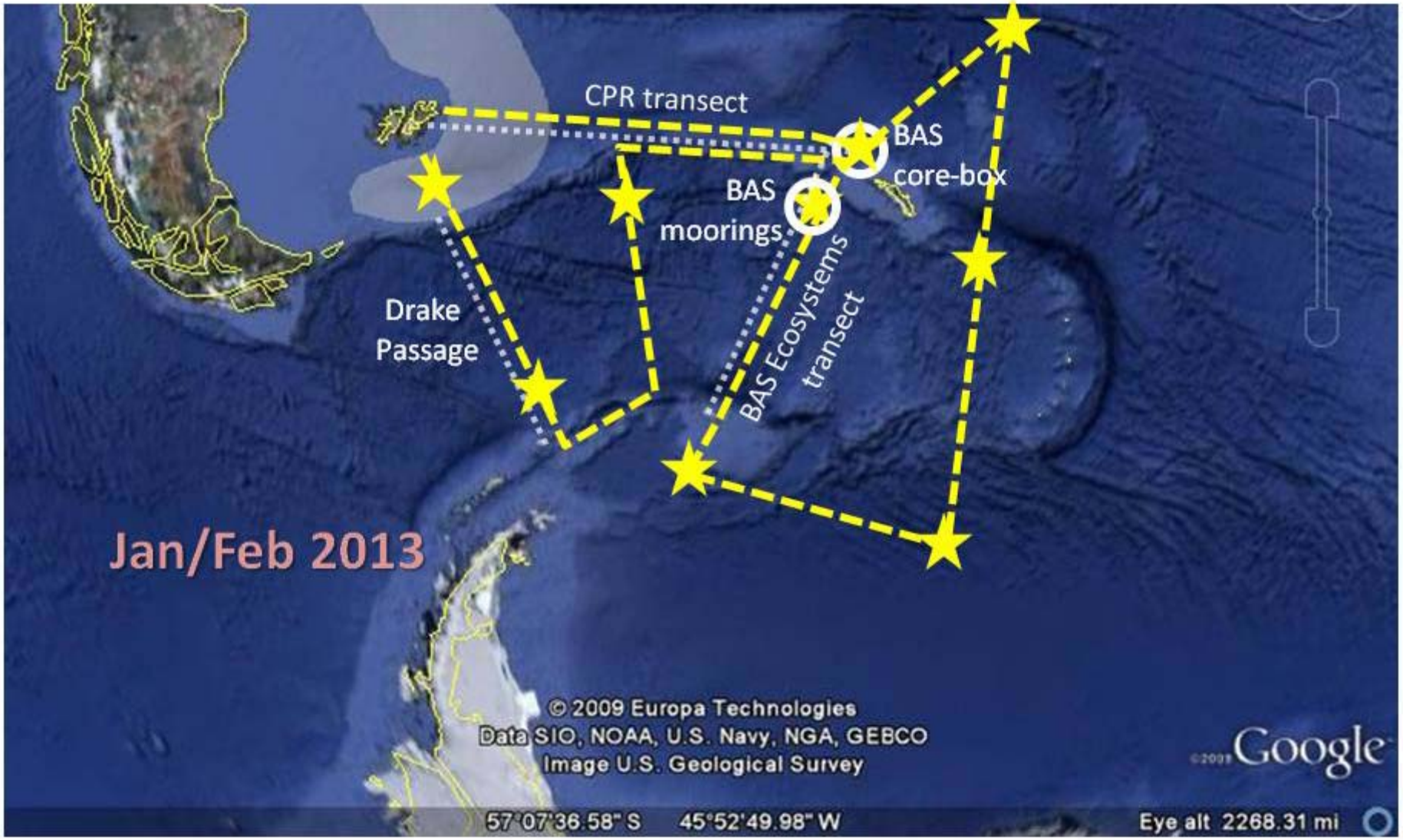
JR274 Cruise objectives

• To cover the regularly sampled Drake Passage (recent cruise found surface Ωaragonite from 1.25 to >2)

• Strong gradients in ΩCaCO3 will be covered along multiple N-S transects at different longitudes, in ice edge regions and on moving into high productivity (raising pH and ΩCaCO3 but not SST) waters NW of S Georgia.

• Previous BAS transects will be traversed, allowing repeat observations (incl. carbonate system) particularly upwelling regions where surface Ωaragonite ~ 1.

JR274 Cruise plan (35 days at sea)



JR274 Sampling strategy

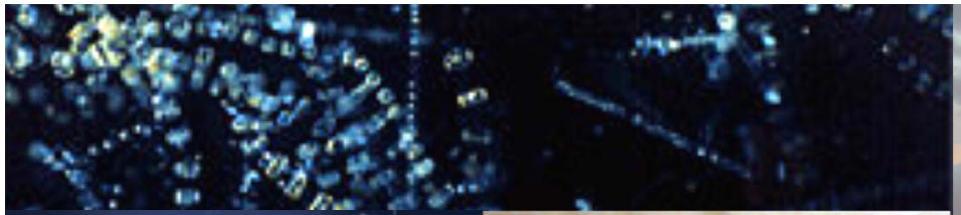
- ~30 sampling stations

- Water sampling mainly to ca. 300 m with occasional full depth CTDs. Zooplankton and microplankton collected between 0 and 200 m.

- Additional casts using the Ti rosette with trace metal clean OTE bottles for dissolved iron measurements.

- Underway sample collection for a suite of biogeochemical variables will be undertaken using a trace metal clean sampling system. CPR used for zooplankton

- Perturbation bioassay experiments performed at 8 contrasting locations



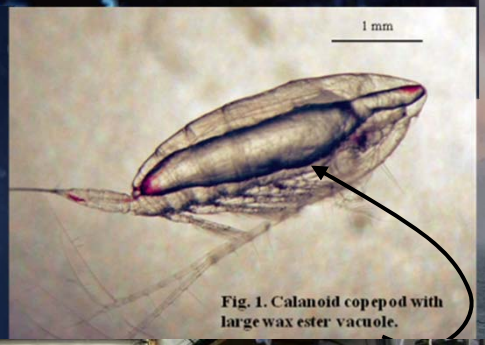
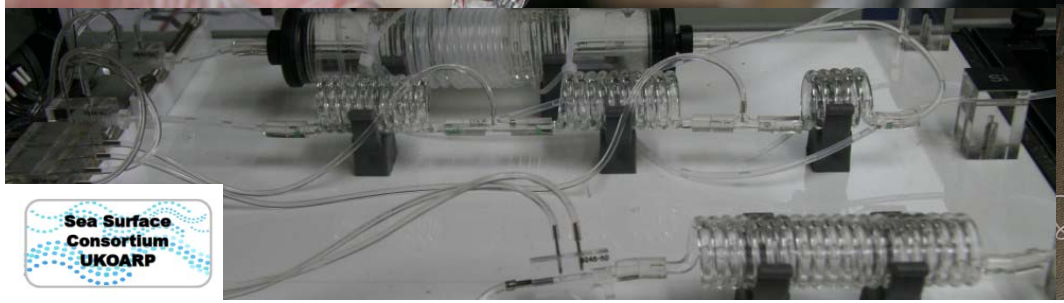


Fig. 1. Calanoid copepod with large wax ester vacuole.



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