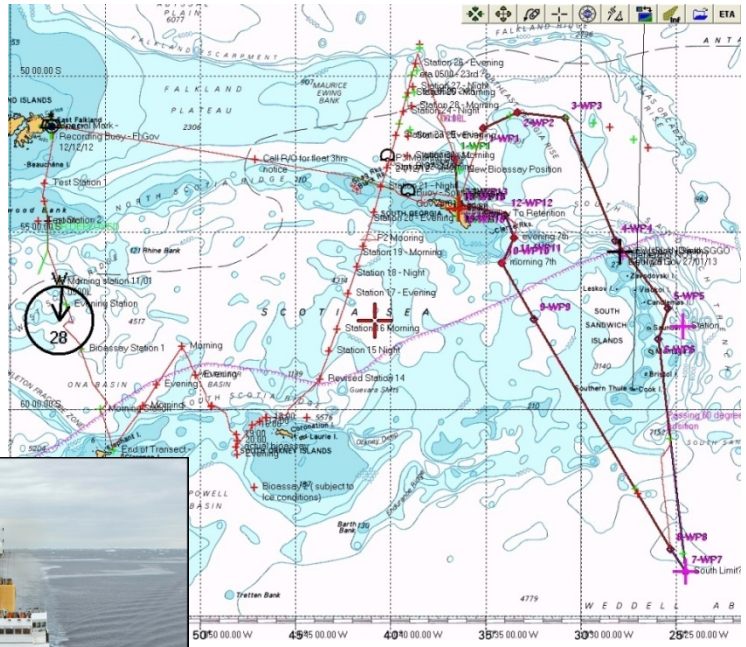
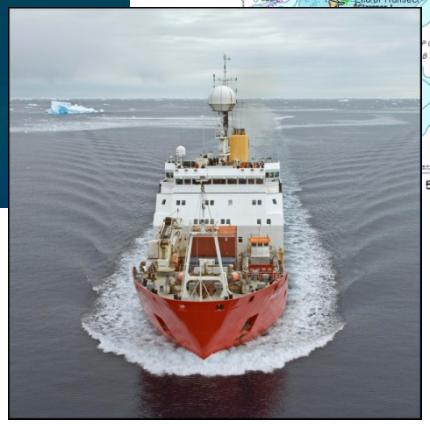
JR274 Sea Surface Ocean Acidification Consortium Cruise to the Southern Ocean

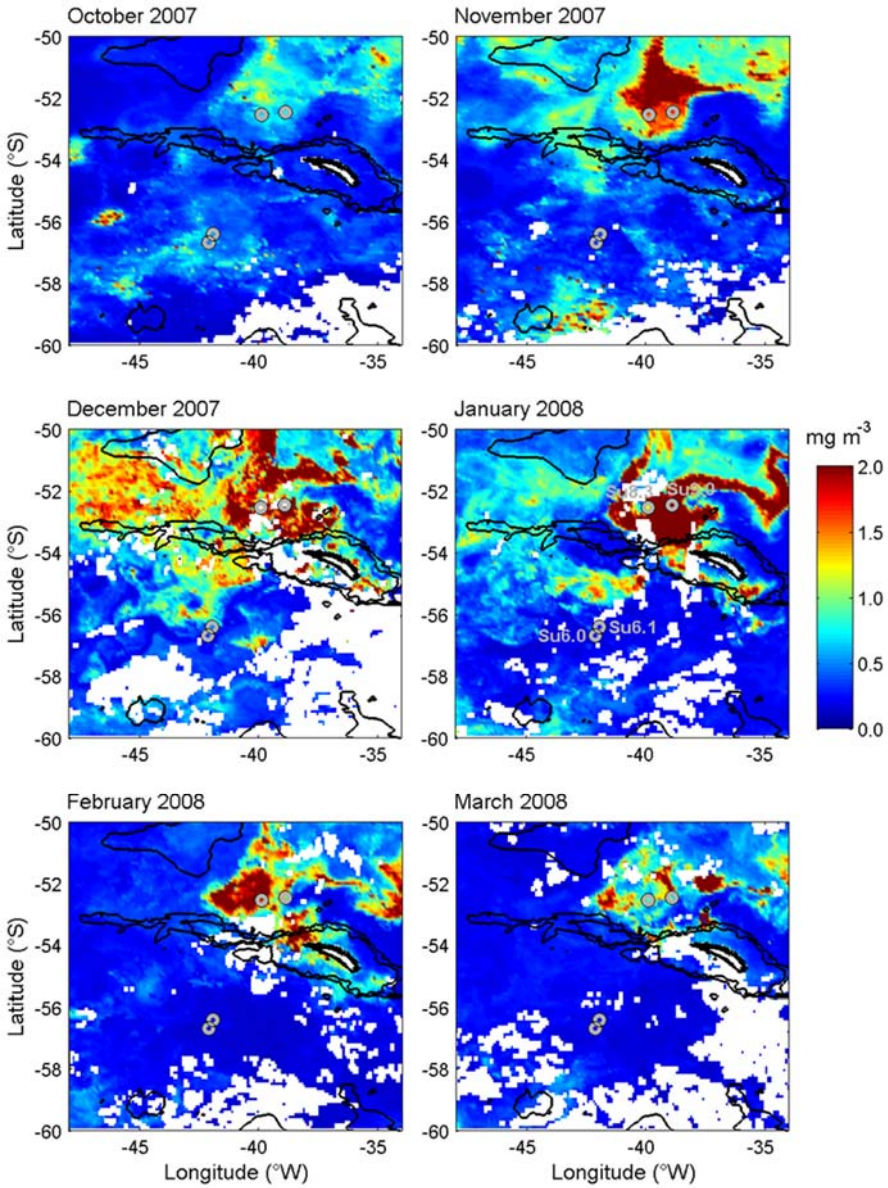
9th January to 12th February 2013





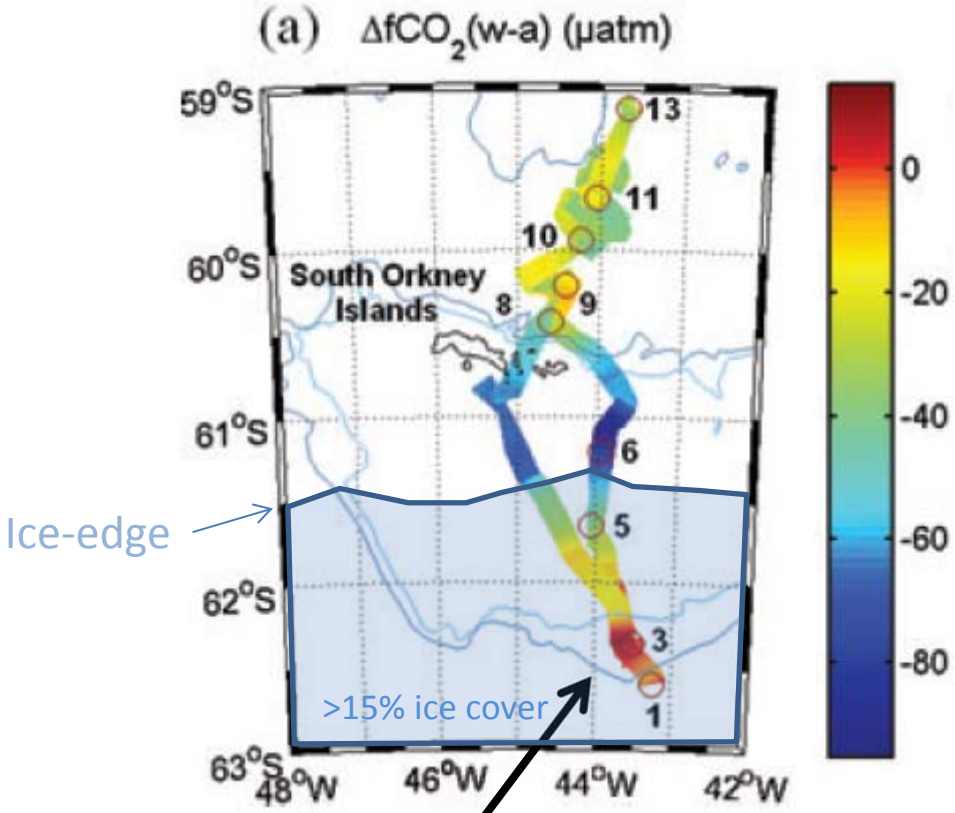
PSO: Geraint Tarling
(gant@bas.ac.uk)

Scotia Sea contains both HNLC and iron-fertilised environments

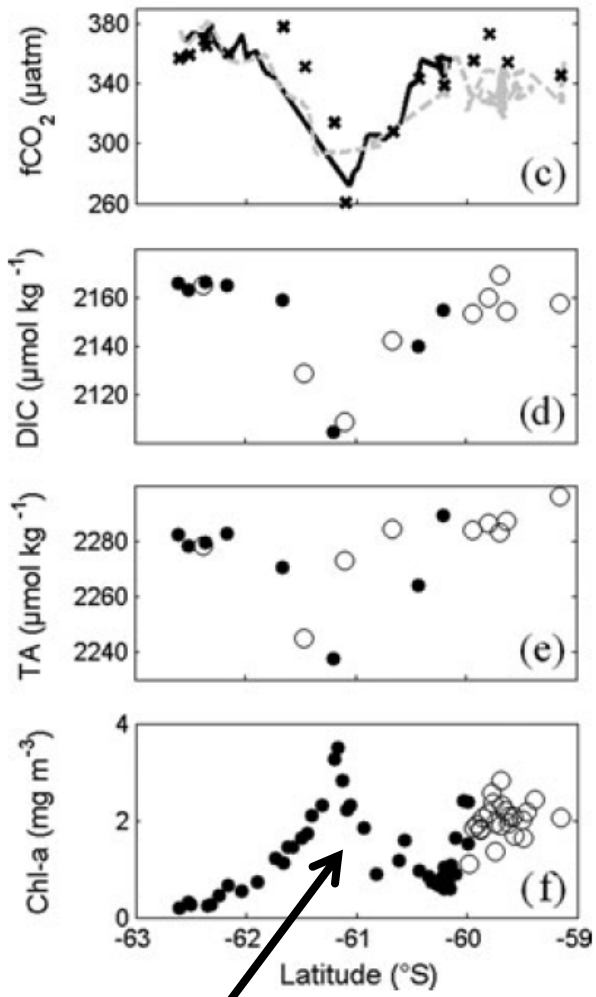


Monthly composite images of daily MODIS-Aqua chlorophyll a (mg m^{-3})

fCO_2 and DIC are strongly influenced by ice-edge effects



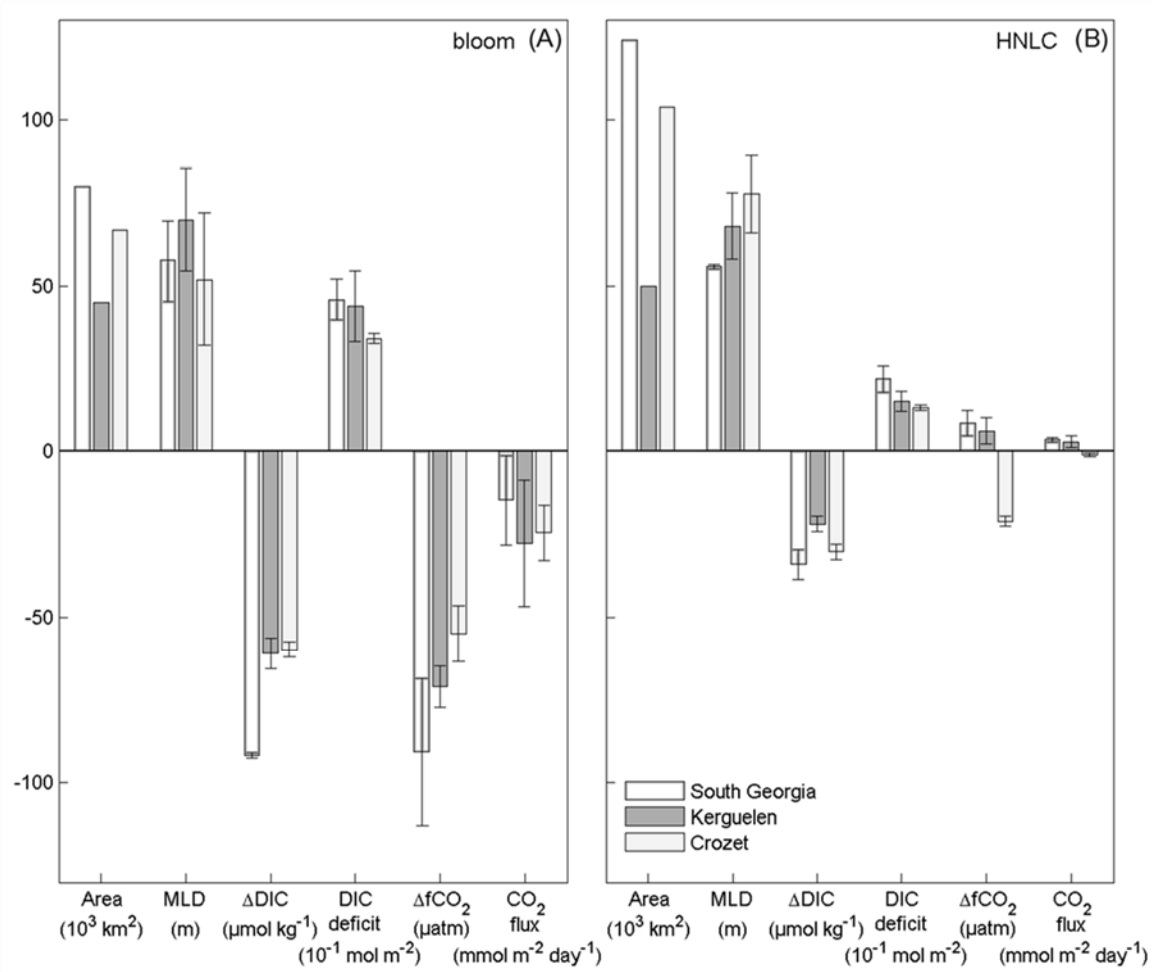
Melt of brine precipitates carbonate minerals (e.g. ikaite)
- decreases DIC and TA and increases fCO_2



Ice-edge blooms lead to large DIC deficits

Jones et al. 2008

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



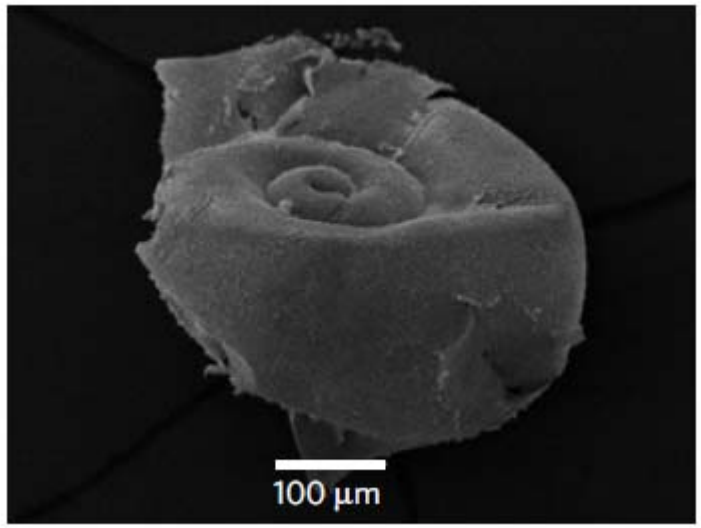
Jones et al. 2012

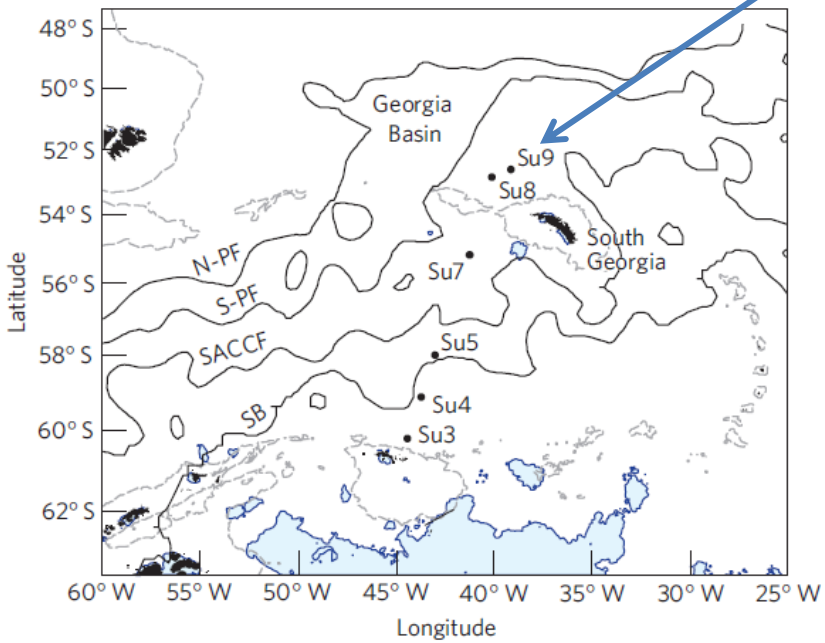
Upwelling regions

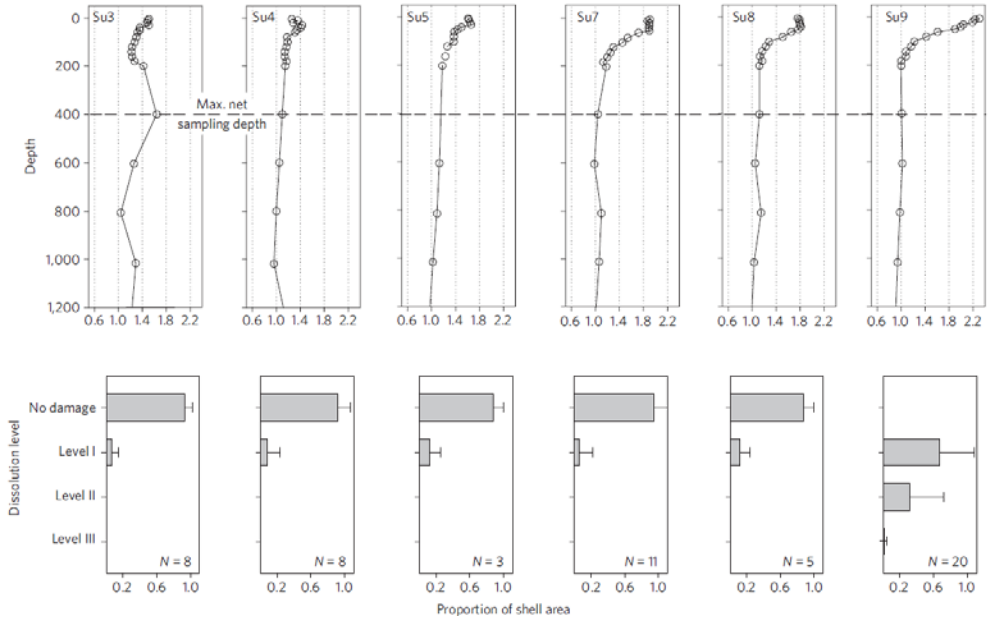
nature geoscience LETTERS
PUBLISHED ONLINE: 25 NOVEMBER 2012 | DOI: 10.1038/NGEO1635

Extensive dissolution of live pteropods in the Southern Ocean

N. Bednaršek[1,2,3], G. A. Tarling[1]*, D. C. E. Bakker[2], S. Fielding[1], E. M. Jones[4], H. J. Venables[1], P. Ward[1], A. Kuzirian[5], B. Lézé[2], R. A. Feely[6] and E. J. Murphy[1]







JR274 Cruise objectives

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

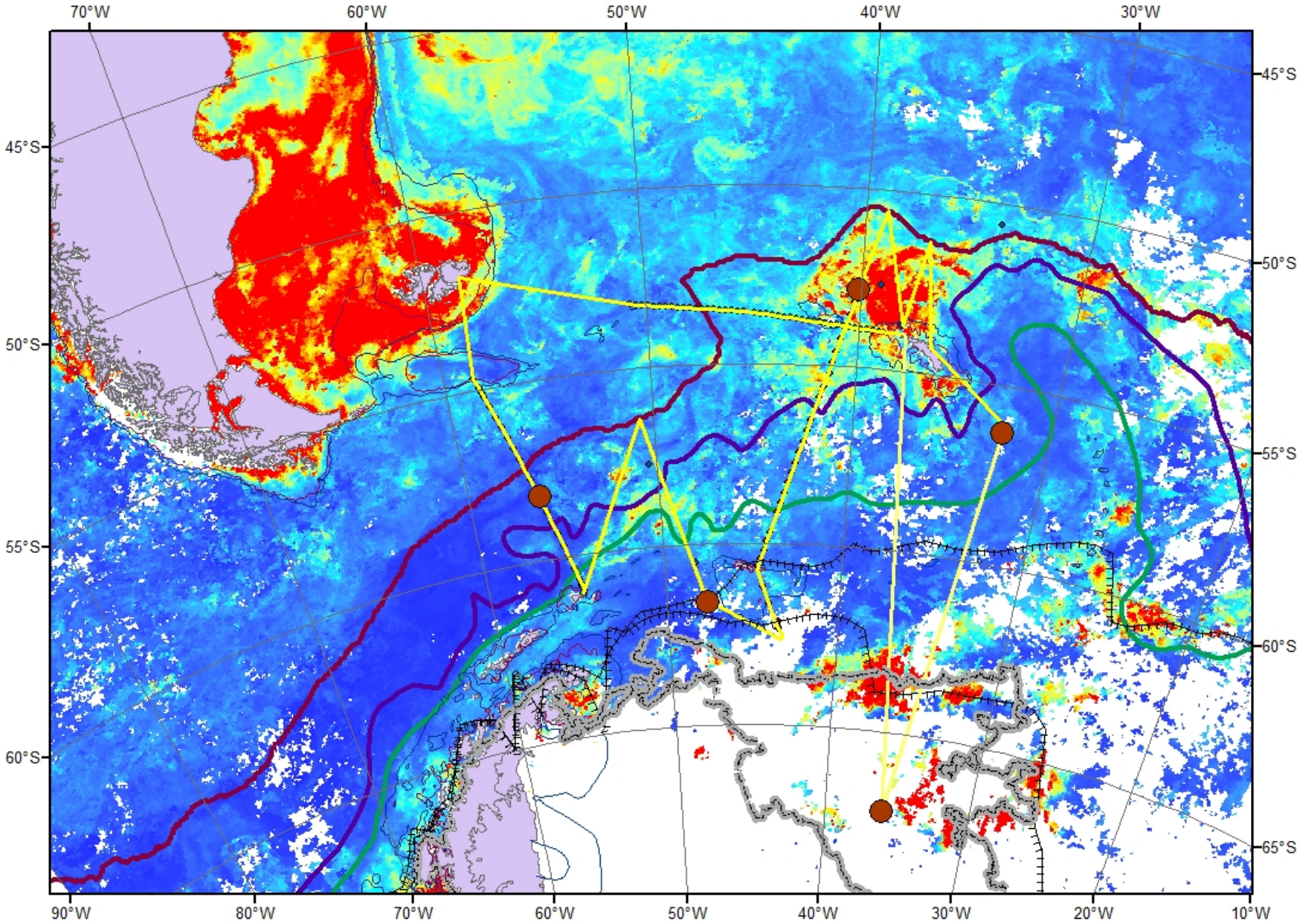
- Enter the exceptionally cold Weddell Sea where undersaturation is predicted to occur first in the Southern Ocean

- 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.

Provisional cruise path

Sea Surface Consortium UKOARP



Science party

Sea Surface Consortium UKOARP

32 participants from 8 different institutes

JR274 Participants

Discipline	Participants
Bioassays	Mark Moore *(NOCS)* Sophie Richier *(NOCS)*
Primary Production	Chris Daniels *(NOCS)* Glaucia Fragoso *(NOCS)*
Nutrients and Export	Richard Sanders *(NOC)* Fred Le Moigne *(NOC)* Emma Cavan *(NOCS)*
Trace Metals	Eric Achterberg *(NOCS)* Maxi Castrillejo *(NOCS)*
Carbon chemistry	Eithne Tynan *(NOCS)* Mariana Ribas Ribas *(NOCS)* Matt Humphreys *(NOCS)* Jennifer Clarke *(NOCS)* Ting Ting Shi *(NOCS)*

Discipline	Participants
Trace gases	Frances Hopkins *(PML)* Ian Brown *(PML)* John Stephens *(PML)* Glen Tarran *(PML)*
Bacteria and microplankton	Clement Georges *(U Littoral, Calais)*
Calcifying microplankton	Jeremy Young *(UCL)* Tony Tyrrell *(NOCS)* Colin Brownlee *(MBA)*
Phytoplankton physiology	Laura Bretherton *(U Essex)*
Zooplankton	Geraint Tarling *(BAS)* Vicky Peck *(BAS)* Peter Ward *(BAS)* Natalie Ensor *(BAS)*

Support staff: Jeff Benson, Ian Murdoch, Tom Roberts (NMF)
Johnnie Edmonston, Mark Preston (BAS)

JCR Master: Jerry Burgan

JCR Back deck

JCR Science hold

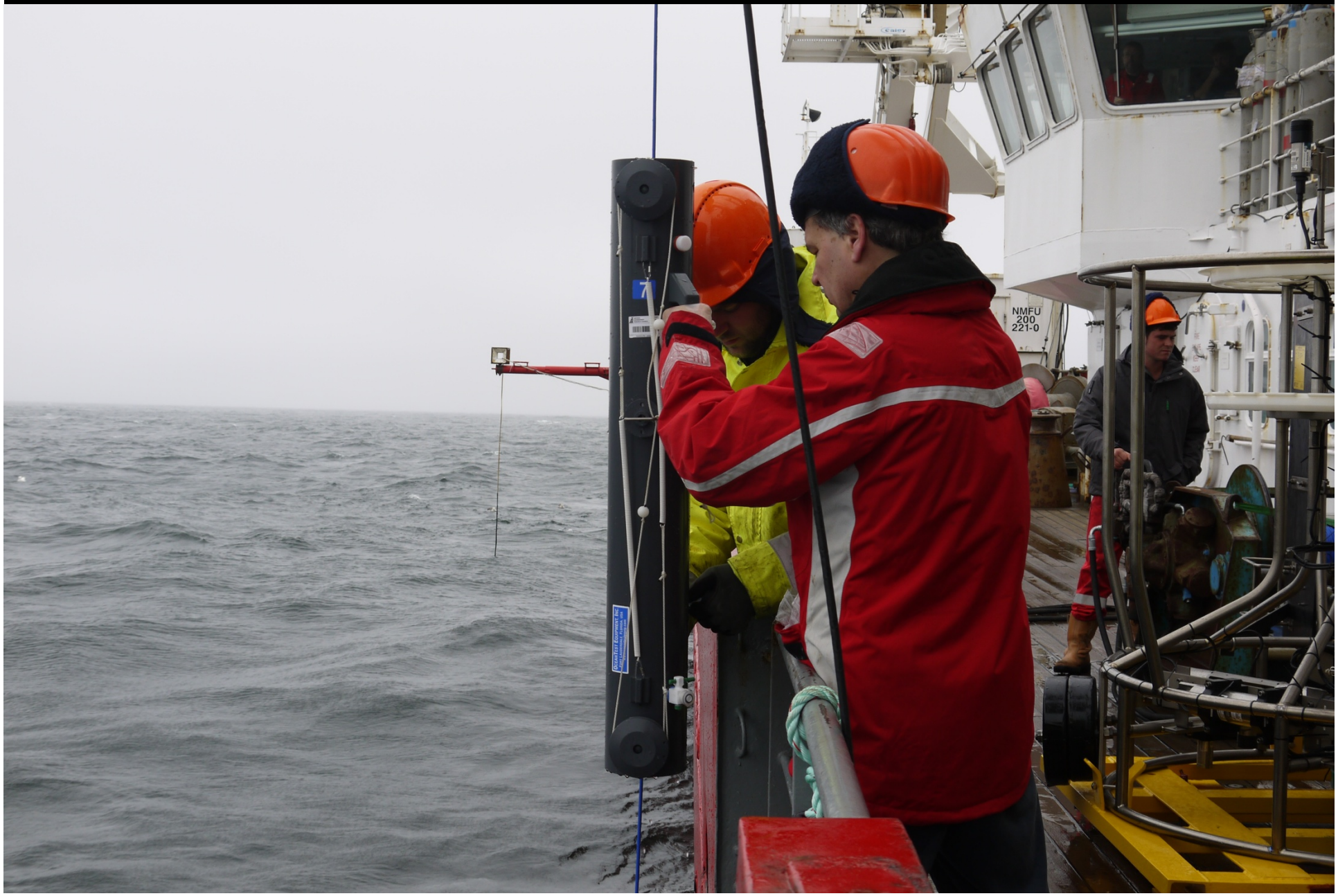
Leaving Port Stanley – 9th Jan 2013

Deployment of the Continuous Plankton Recorder

Motion compensated Bongo net

Stainless steel CTD

Go-Flos



SAPS

Snow catcher

JR274 morning stations (standard)

05:00 Retrieve CPR
05:15 Bongo nets (x3)
06:15 CTD standard
07:15 Go-Flo
08:15 SAPS (every other day) and Snow catcher
10:45 Deploy CPR

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JR274 Evening stations (standard)

(not on bioassay days)

17:00 Retrieve CPR
17:15 CTD standard
17:45 Bongo nets (x1)
18:05 Deploy CPR

Sea Surface Consortium UKOARP

JR274 Morning stations (Bioassay)

02:00 Retrieve CPR
02:15 Ti CTD x 4
07:00 Bongo nets (x3)
08:00 Standard CTD
09:00 CTD (Trace metal)
10:00 SAPS (every other day) and Snow catcher
12:30 Deploy CPR

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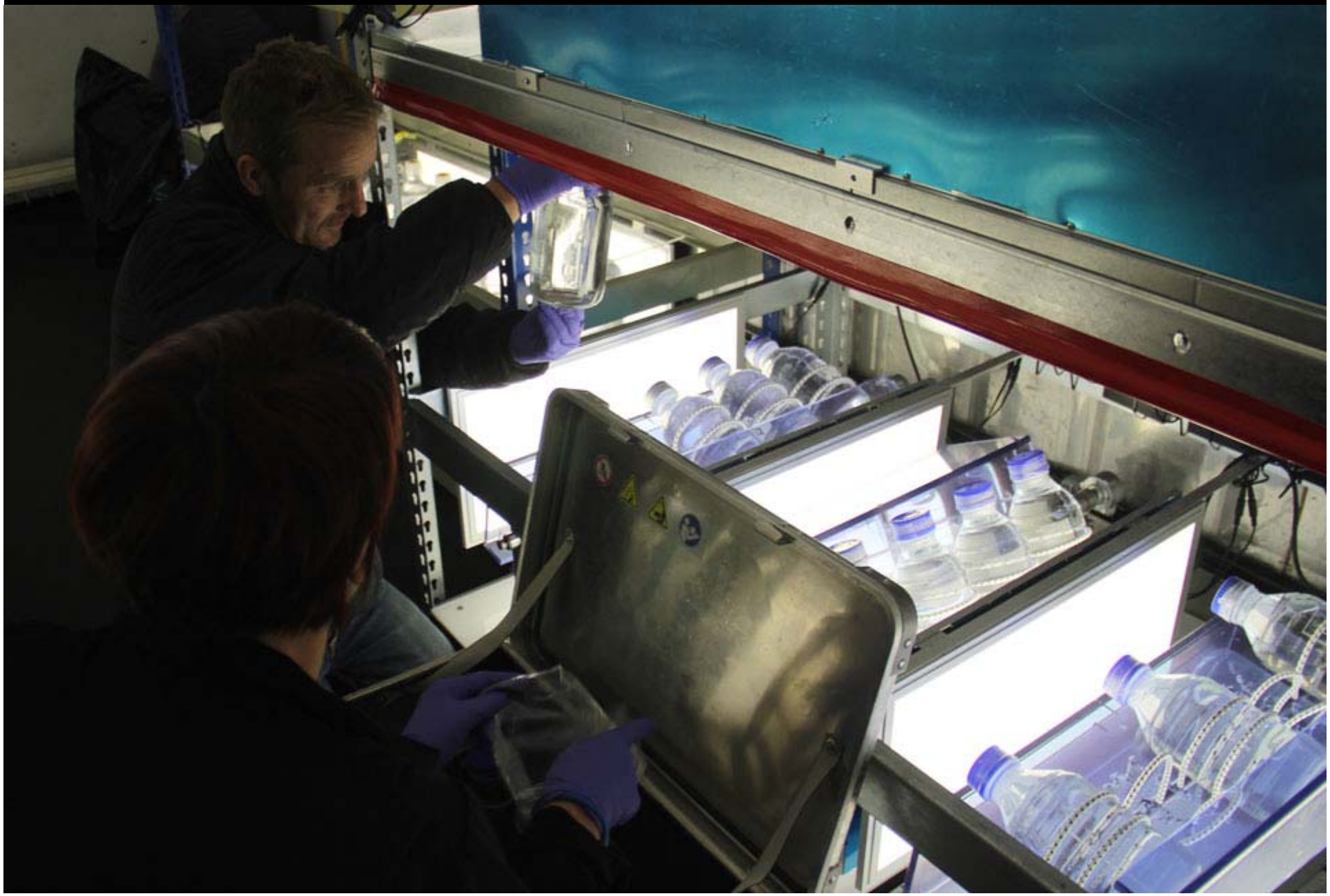
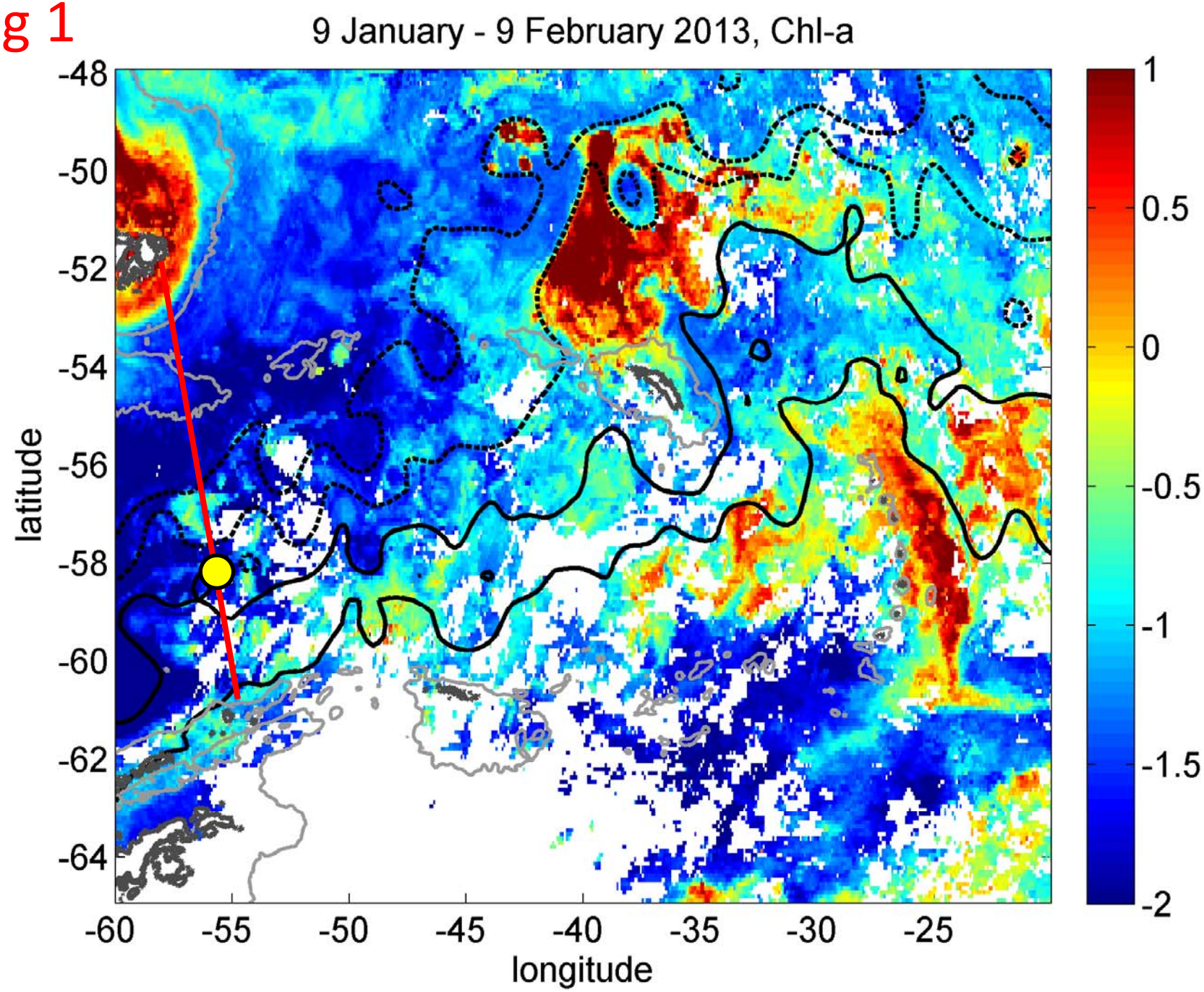
Bioassay set up

Bioassays

Zooplankton Bioassays



Leg 1


9 January - 9 February 2013, Chl-a
latitude
-48
-50
-52
-54
-56
-58
-60
-62
-64
longitude
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-55
-50
-45
-40
-35
-30
-25
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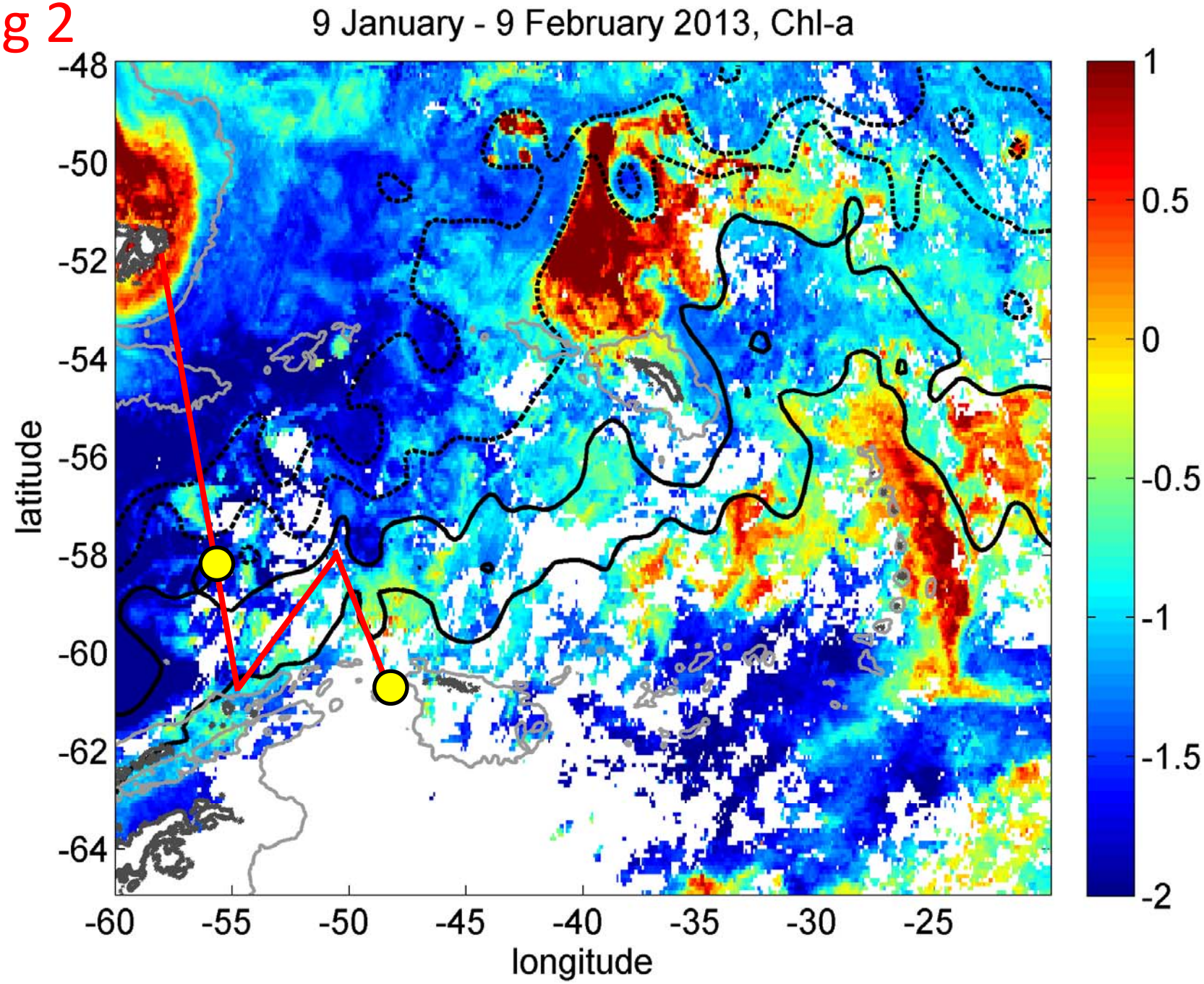
0
-0.5
-1
-1.5
-2

Elephant Island

Leg 2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-50
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-1
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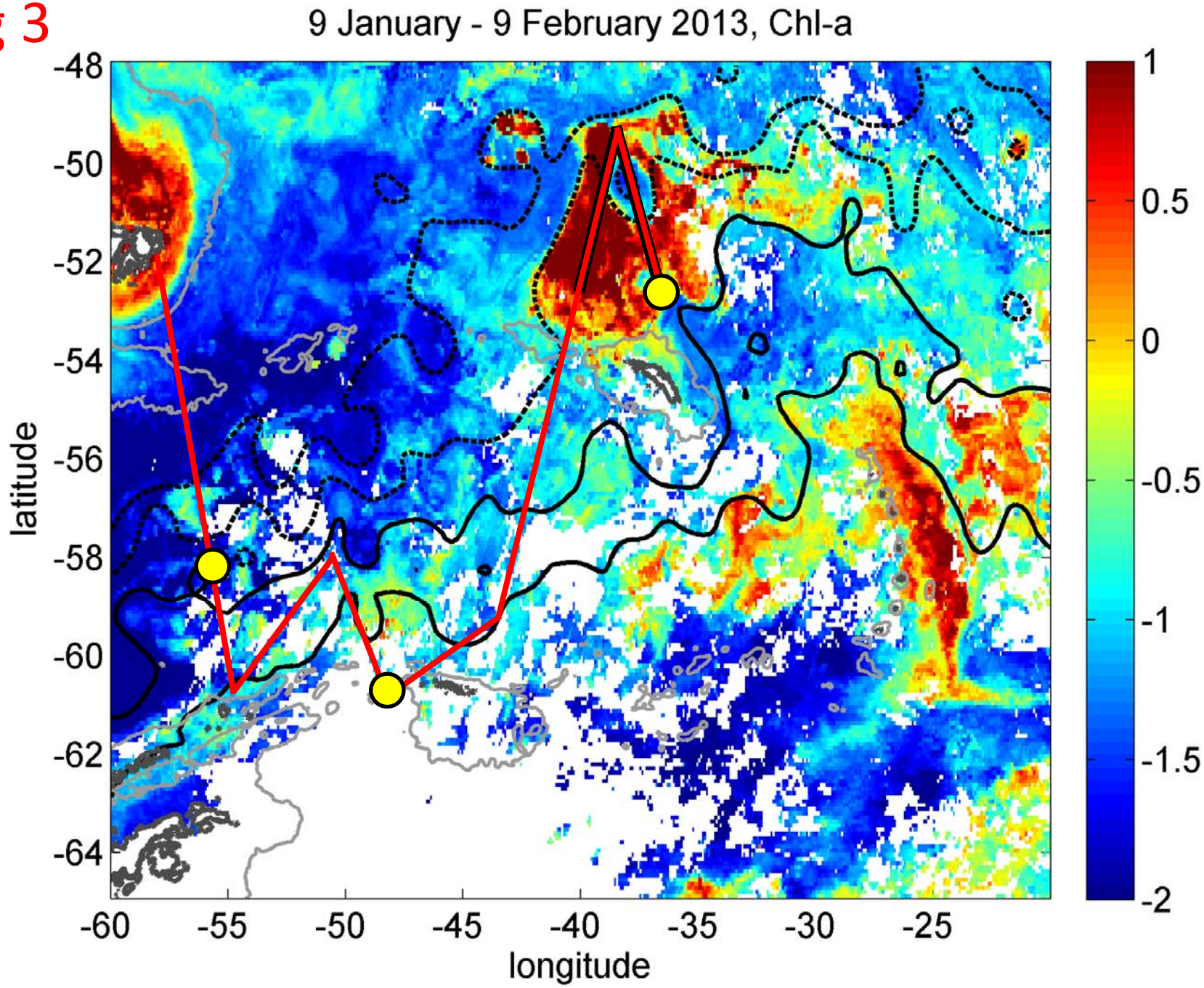
-2

Inhabited ice floes

View from the bridge

Leg 3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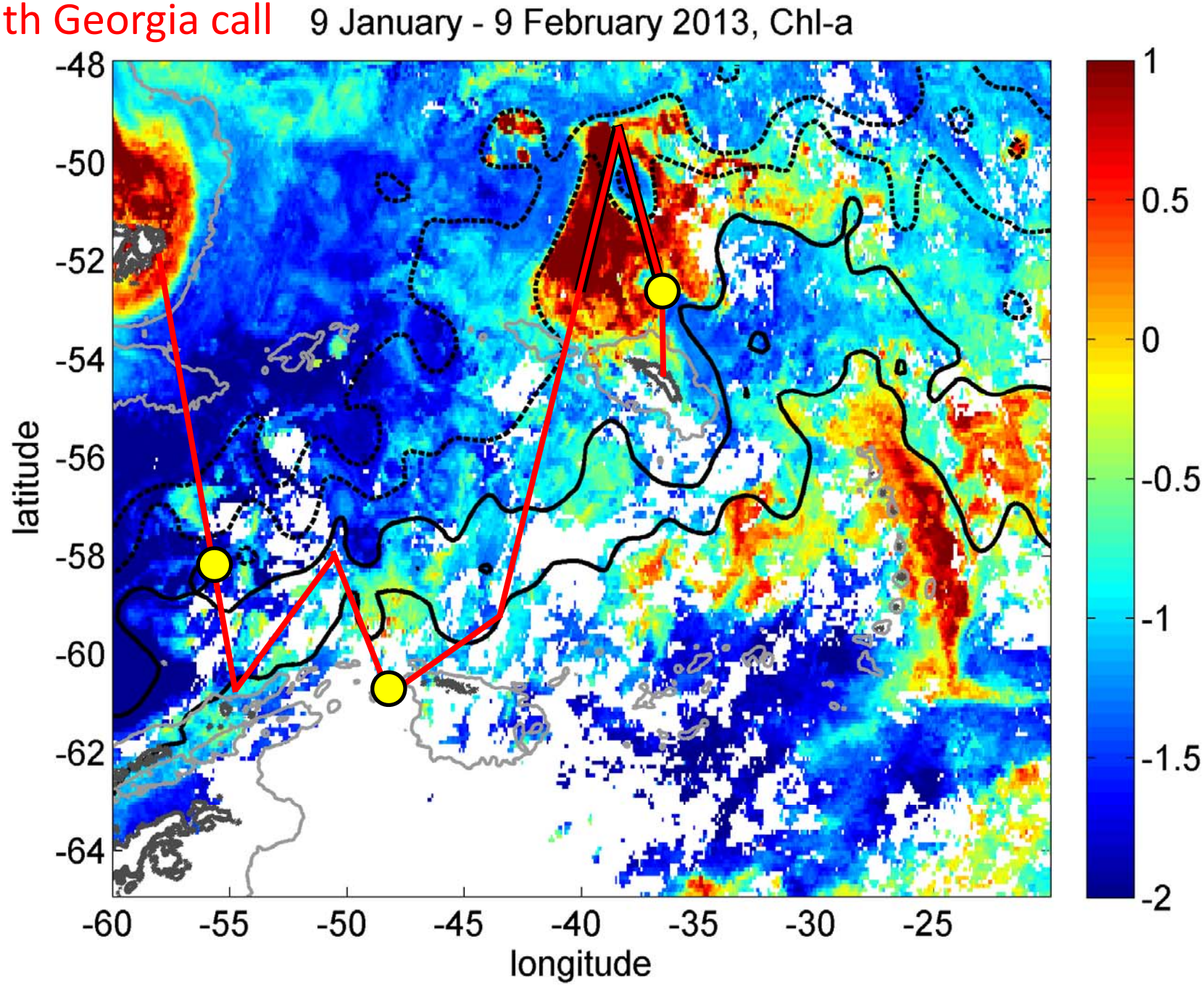
Phytoplankton bloom

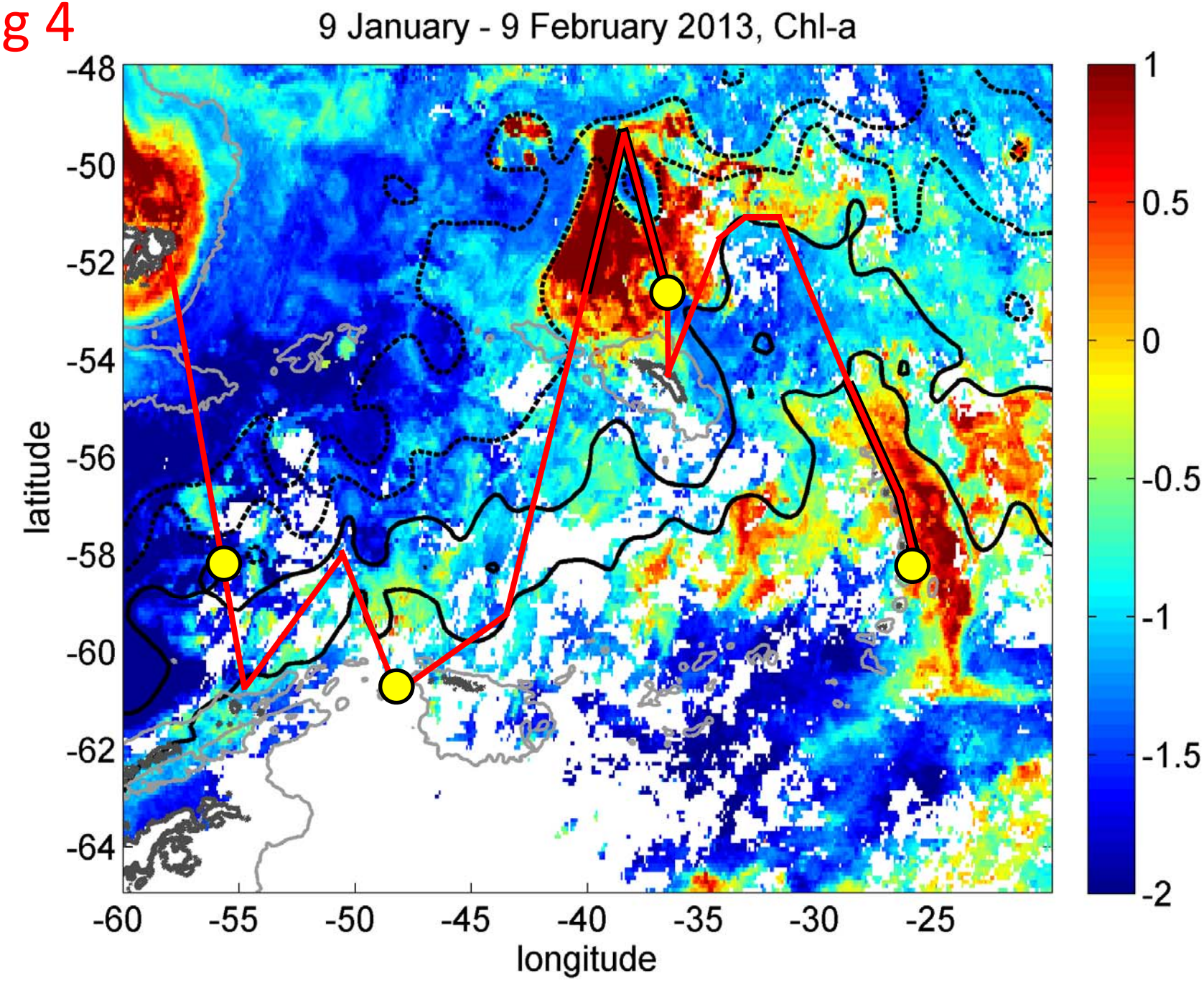
South Georgia call



Arriving at King Edward Point

Some R&R

Leg 4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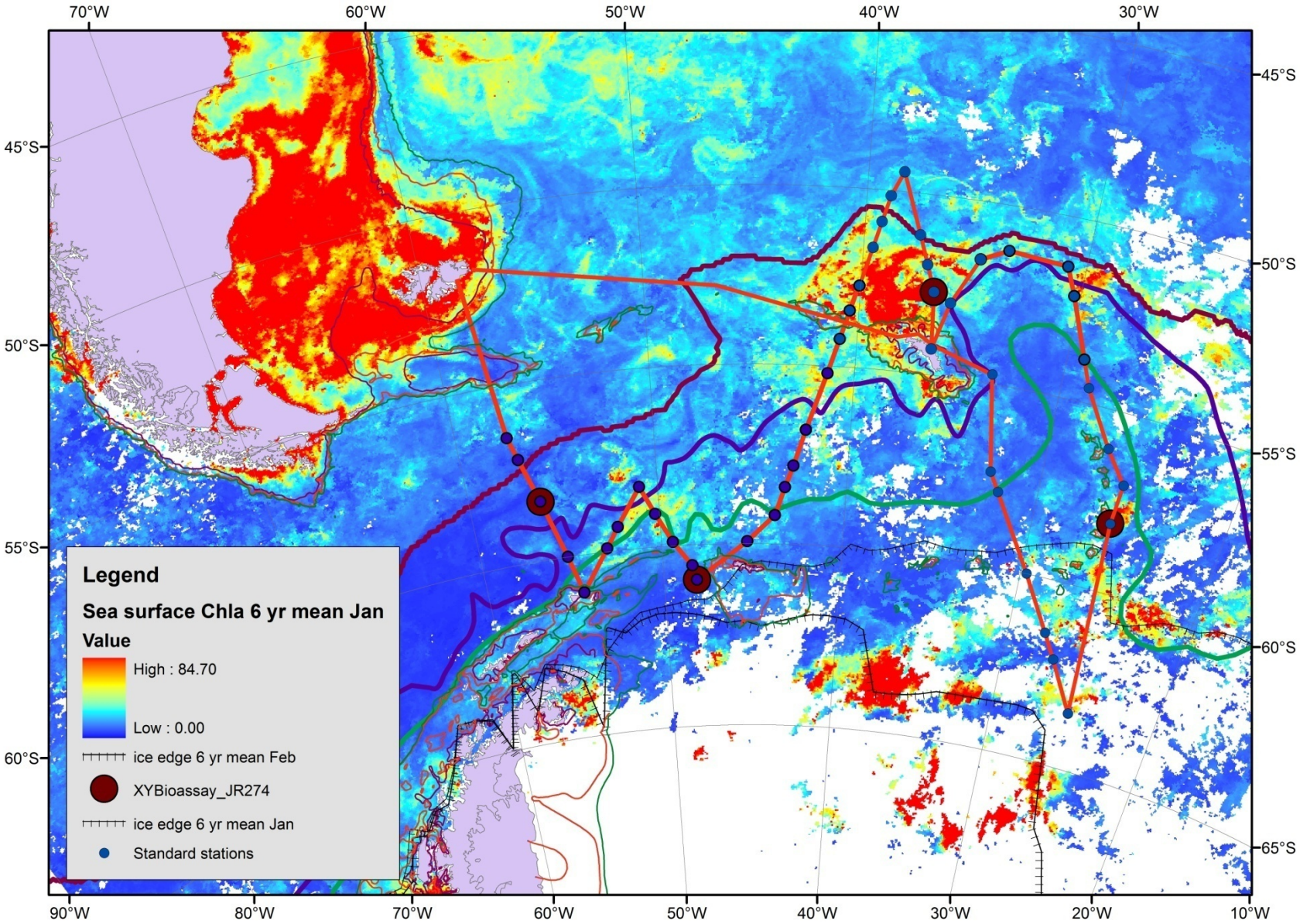
South Sandwich Islands

Implemented JR274 Cruise Path



Implemented cruise itinerary

09/01/2013	Depart Stanley
10/01/2013	Travel south + tests
11/01/2013	Travel south + tests
12/01/2013	Bad Weather day
13/01/2013	Bioassay 1
14/01/2013	Bioassay 1
15/01/2013	Bioassay 1
16/01/2013	Bioassay 1
17/01/2013	Washup/turnaround
18/01/2013	Bioassay 2
19/01/2013	Bioassay 2
20/01/2013	Bioassay 2
21/01/2013	Bioassay 2
22/01/2013	Bioassay 2
23/01/2013	Bioassay 2
24/01/2013	Washup/turnaround
25/01/2013	Bioassay 3
26/01/2013	Bioassay 3 + KEP (Doctor PAX exchange)
27/01/2013	Bioassay 3 + KEP (leave early AM)

28/01/2013	Bioassay 3
29/01/2013	Bioassay 3
30/01/2013	Bioassay 3
31/01/2013	Washup/turnaround
01/02/2013	Bioassay 4
02/02/2013	Bioassay 4
03/02/2013	Bioassay 4
04/02/2013	Bioassay 4
05/02/2013	Bioassay 4
06/02/2013	Bioassay 4
07/02/2013	Bioassay 5
08/02/2013	Take down and KEP PAX uplift
09/02/2013	Bird Island PAX uplift
10/02/2013	Passage
11/02/2013	Passage
12/02/2013	Arrive Stanley
13/02/2013	DEMOB
14/02/2013	DEMOB
15/02/2013	Depart ship - 5AM

Sea Surface Consortium UKOARP

Deployment statistics

Go Flo	25 deployments
Bongo nets	91 deployments
CTD	78 deployments in total SS CTD 47 deployments Ti CTD 31 deployments – 8 to 1400 m, 5 to full depth, 16 for bioassay setup, 2 for cleaning
Snow catcher	48 deployments
SAPS	14 deployments
CPR	42 deployments

Sea Surface Consortium UKOARP

Summary of water column characteristics at Bioassay stations

	Bioassay 1	Bioassay 2	Bioassay 3	Bioassay 4
Location	Mid Drake's Passage	Ice-edge South Orkneys	N of South Georgia	South Sandwich Islands
Mixed layer depth	50 m	60 m	70 m	35 m
Mean mixed layer temperature	1.9°C	-1.5°C	2.3°C	0.4°C
Peak Chl-a	0.7 ug l^{-1}	0.4 ug l^{-1}	0.3 ug l^{-1}	2.1 ug l^{-1}

Bioassays

Bioassay	Location	Total Duration	Treatments
1 13/1/13	58.37°S 56.25°W (Mid Drake's Passage)	4 days	1)Iron + 750 ppm 2) Iron + ambient 3) No iron + ambient 4) No iron + 750 ppm + deep casts
2 18/1/13	60.97°S 48.13°W (Ice-edge SW of South Orkneys)	6 days	1)Iron + 750 ppm 2) Iron + ambient 3) No iron + ambient 4) No iron + 750 ppm + deep casts
3 25/1/13	52.69°S 36.63°W (North of South Georgia)	6 days	1)Ambient 2) 750 ppm 3) 1000 ppm 4) 2000 ppm + deep casts + additional iron controls
4 1/2/13	58.08°S 25.93°W (East of S. Sandwich Islands)	7 days	1)Ambient 2) 750 ppm 3) 1000 ppm 4) 2000 ppm + deep casts + additional iron controls

JR274 Cruise report

JR274 Sea Surface Ocean Acidification Consortium
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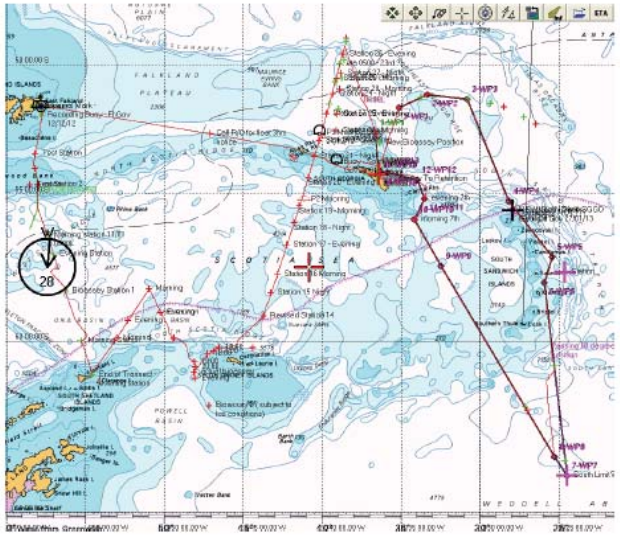

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https://www.bodc.ac.uk/data/information_and_inventories/cruise_inventory/report/11606/

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