



Why We Need A Southern Ocean Observing System?

Oscar Schofield (oscar@marine.rutgers.edu)
Mike Meredith, Steve Rintoul and Louise Newman

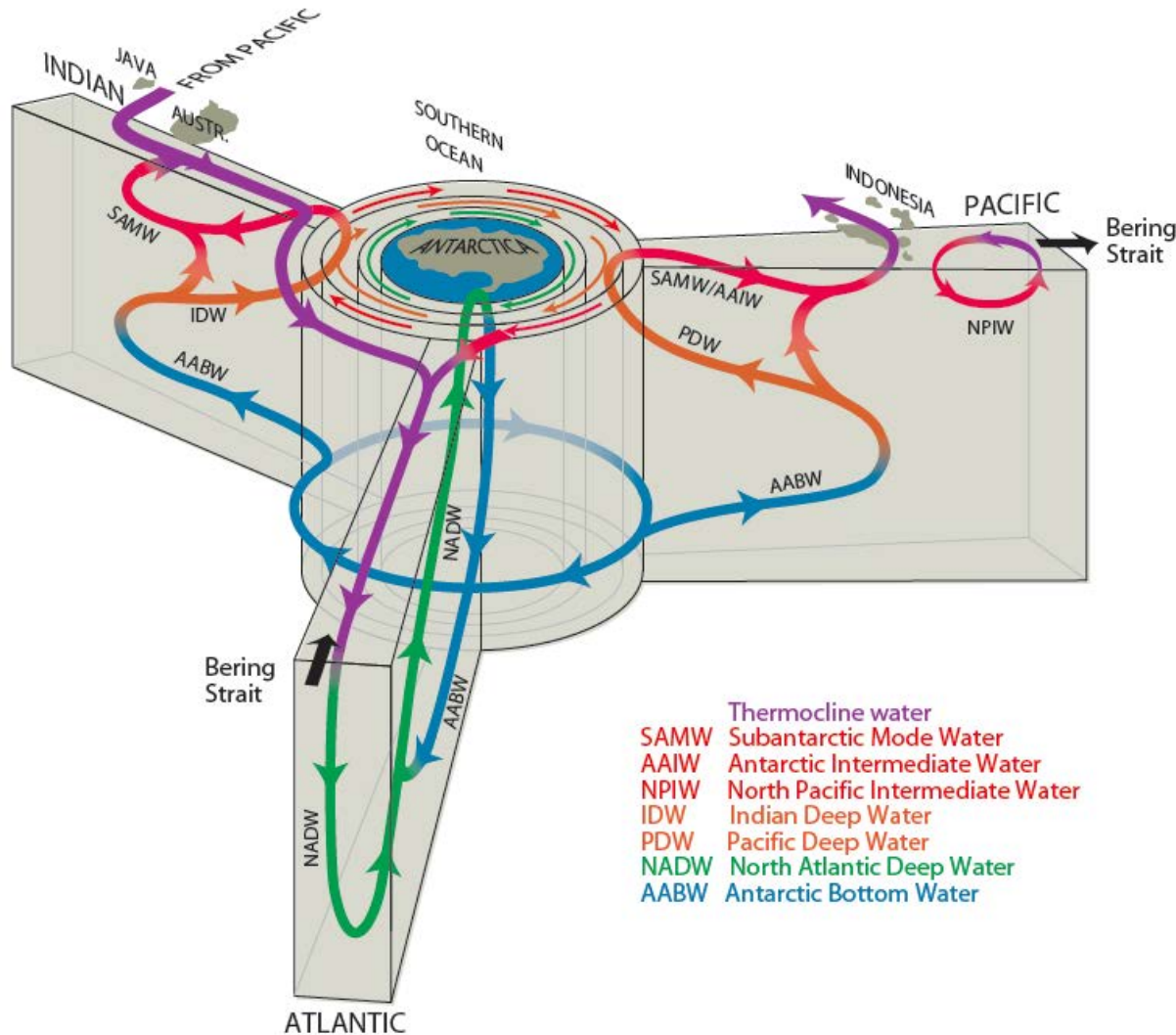




WHY SOOS?

Point 1: The Southern Ocean is disproportionately important to Earth's metabolism

The Southern Ocean is central to the circulation of the ocean

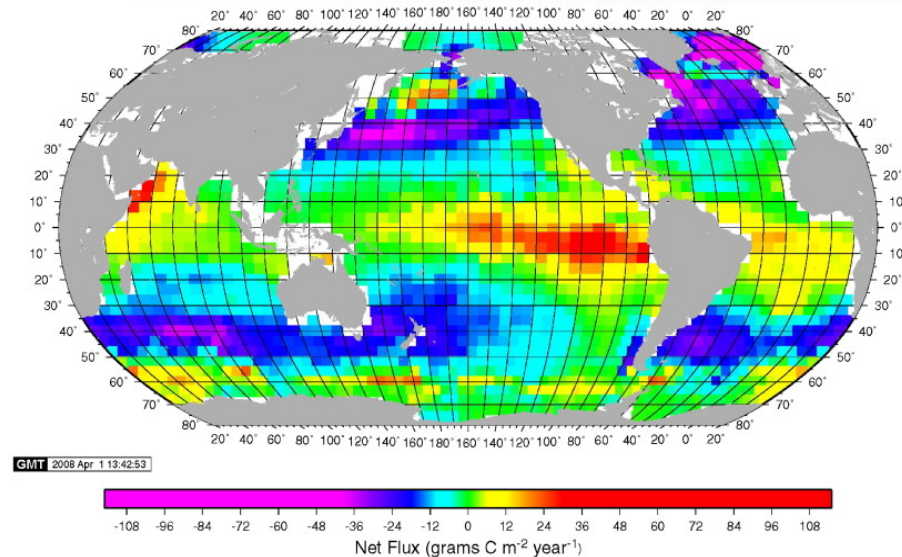


Major region of deep ocean water mass formation

Associated with the upwelling of the basin deep water masses

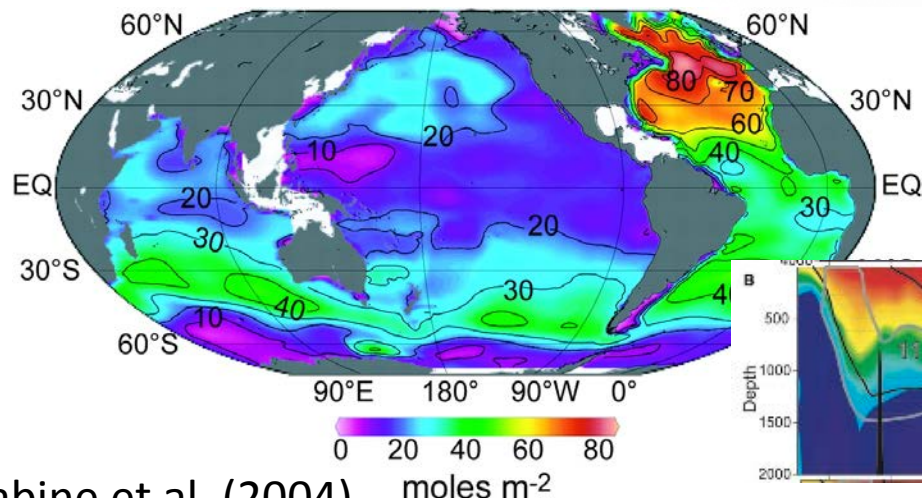
Southern Ocean: carbon uptake

Takahashi et al. (2009)

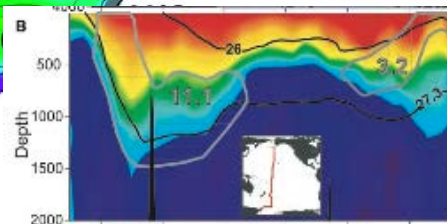


Carbon flux: Net ocean carbon uptake (blue) and outgas (red), including natural (biological, solubility pump) and anthropogenic

S.H. uptake is highest in subtropical band north of ACC.

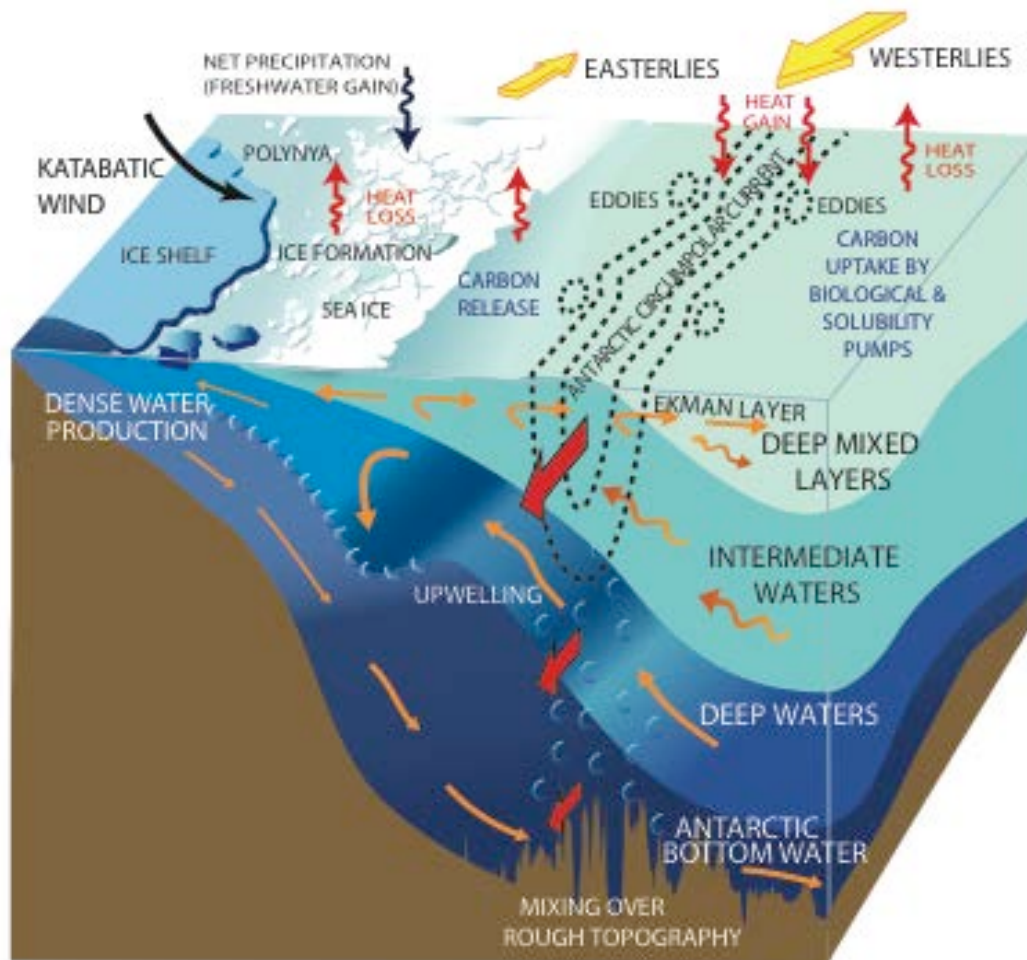


Sabine et al. (2004)



Anthropogenic ocean carbon inventory: high in band north of ACC (thick mixed layers) and low to south (upwelling)

The circumpolar circulation structures the major features



Eastward current (ACC)

Westerly/easterly winds

Sea ice

Upwelling

Bottom water

Warm water – deep mixed layers

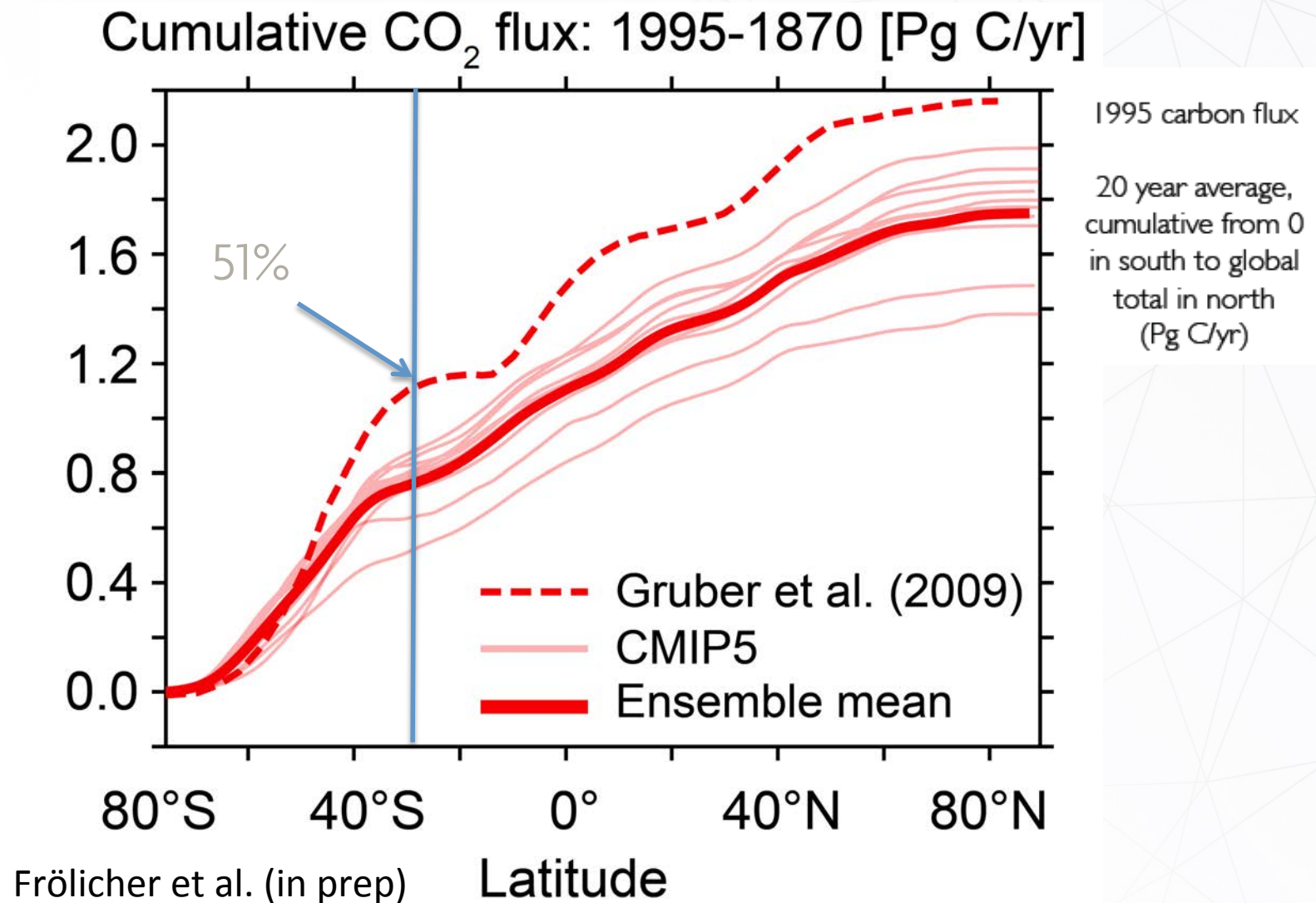
Mixing – isopycnal/diapycnal

CO₂ outgassing to south

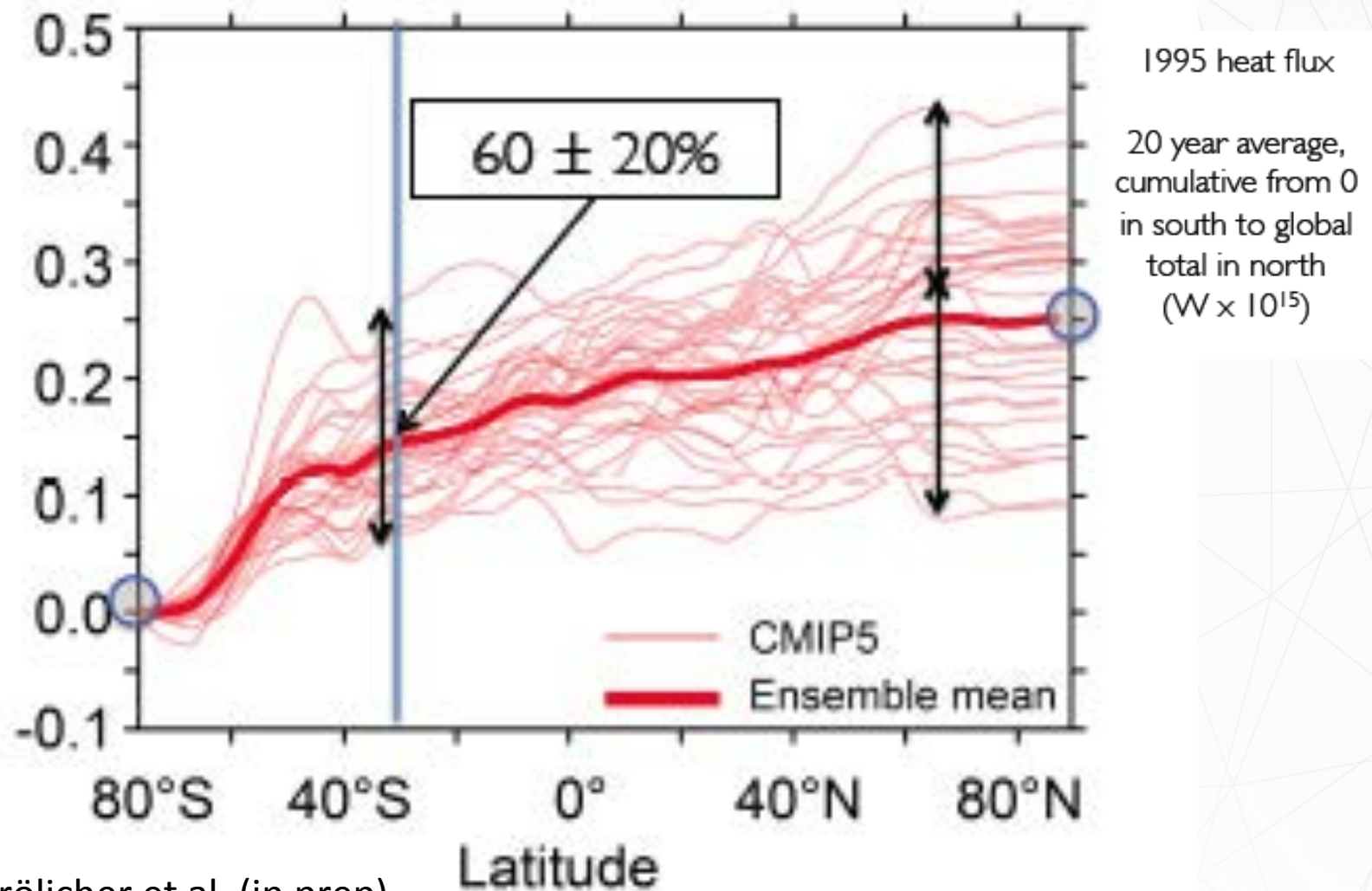
CO₂ uptake to north

Heat losses AND gains

The Southern Ocean takes up 51% of global anthropogenic carbon



The Southern Ocean represents up 60% of global heat flux



Frölicher et al. (in prep)

Why The Southern Ocean ?

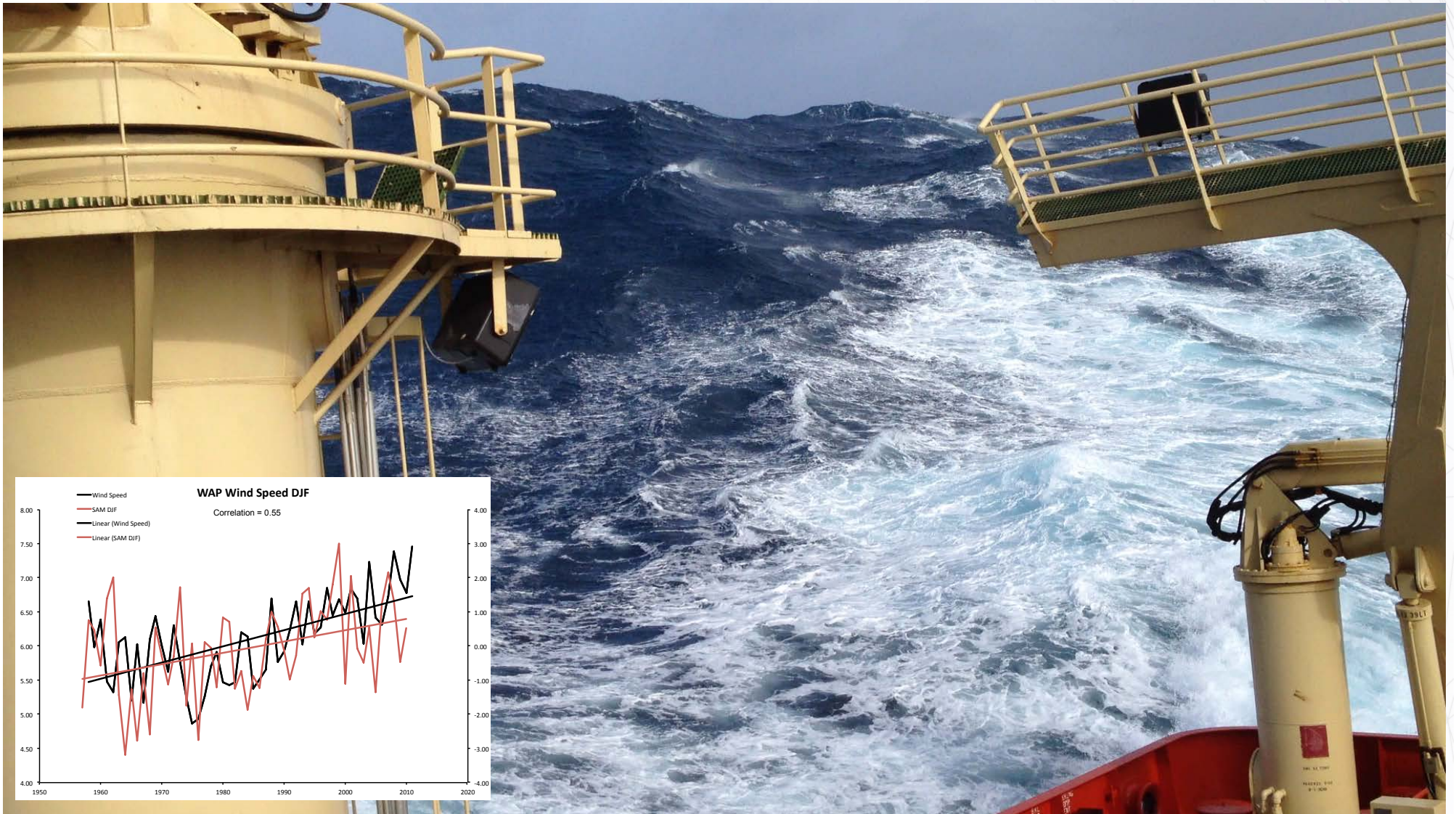
Unique Ecosystems & myriads of evolutionary innovations



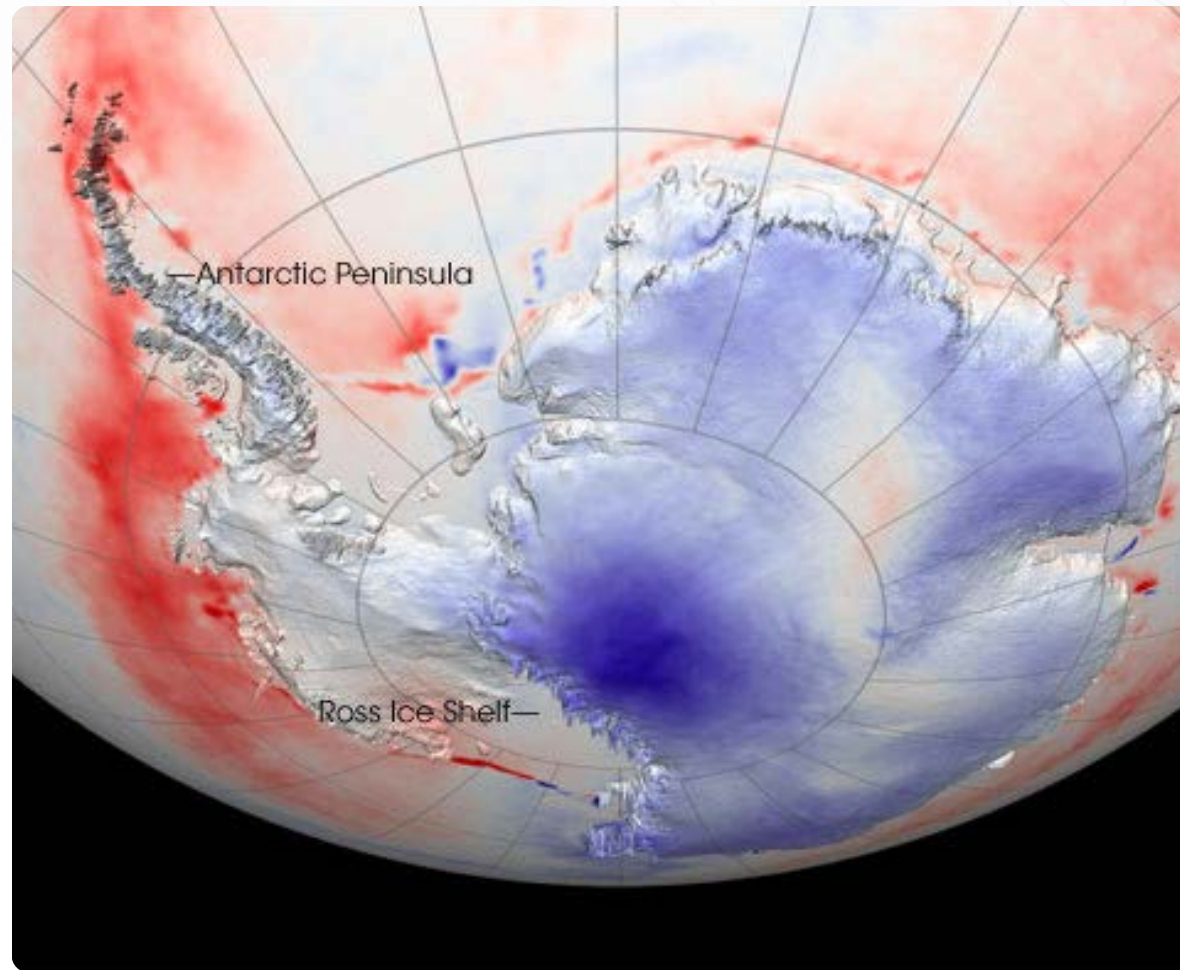


WHY SOOS?
Point 2: The Southern Ocean is changing

Southern Ocean is changing rapidly



Southern Ocean is changing

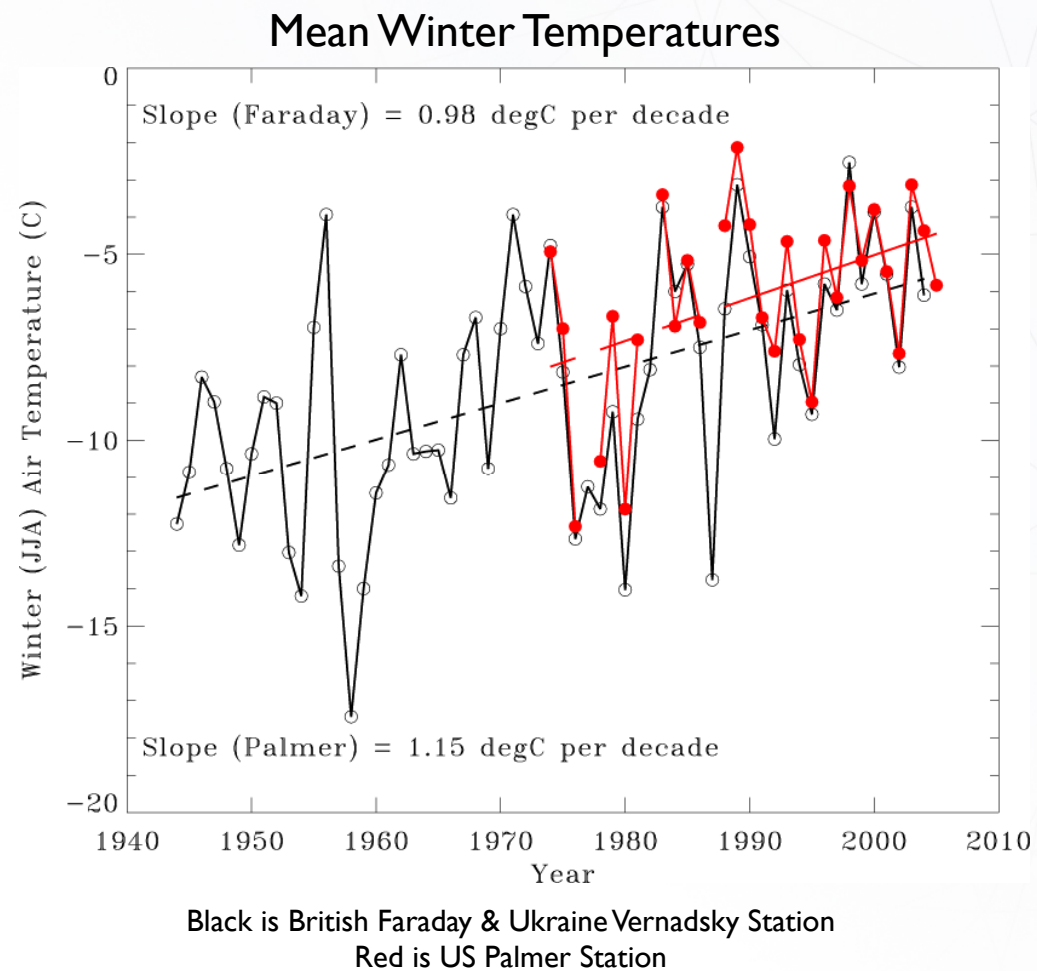


Temperature Trends (degrees C per year)

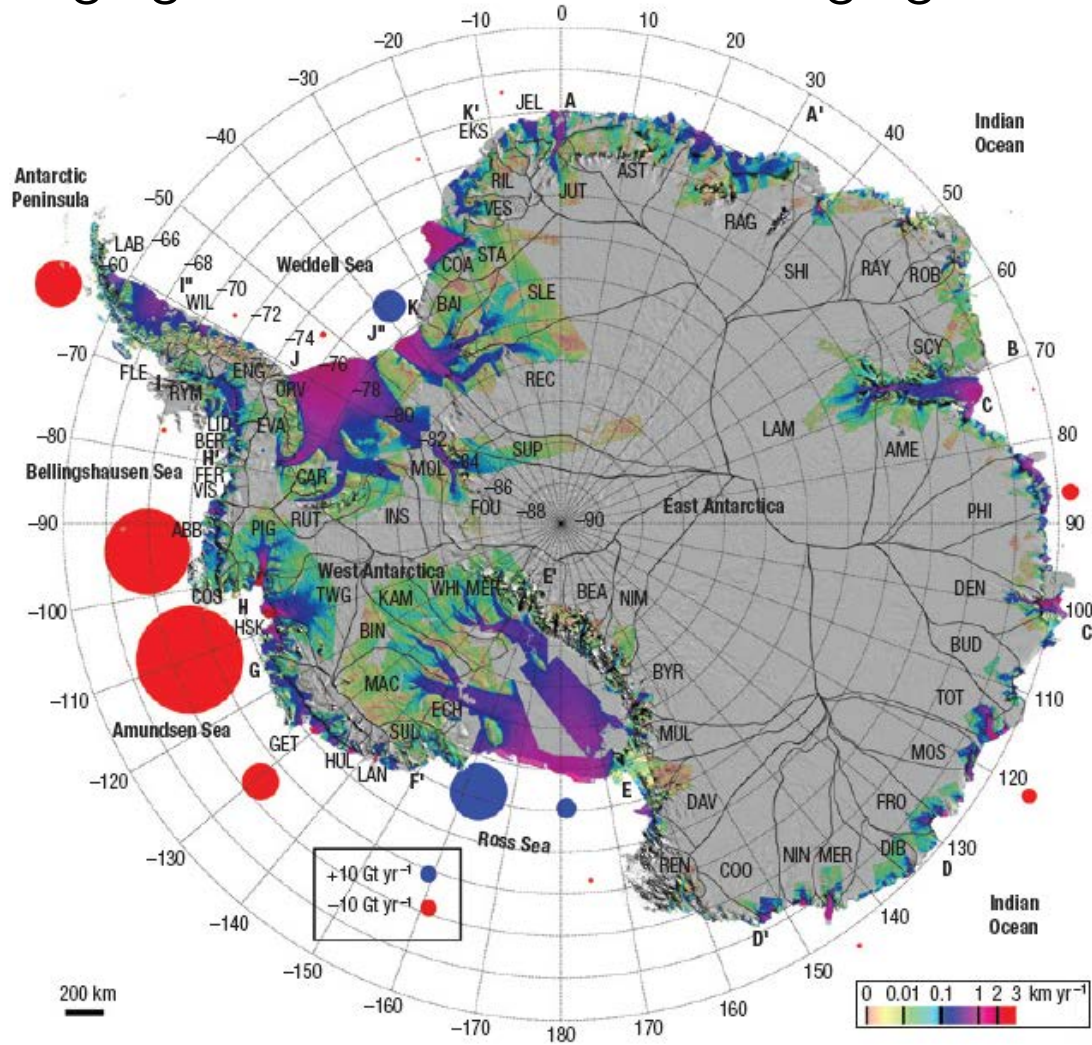


Thanks Ray Smith

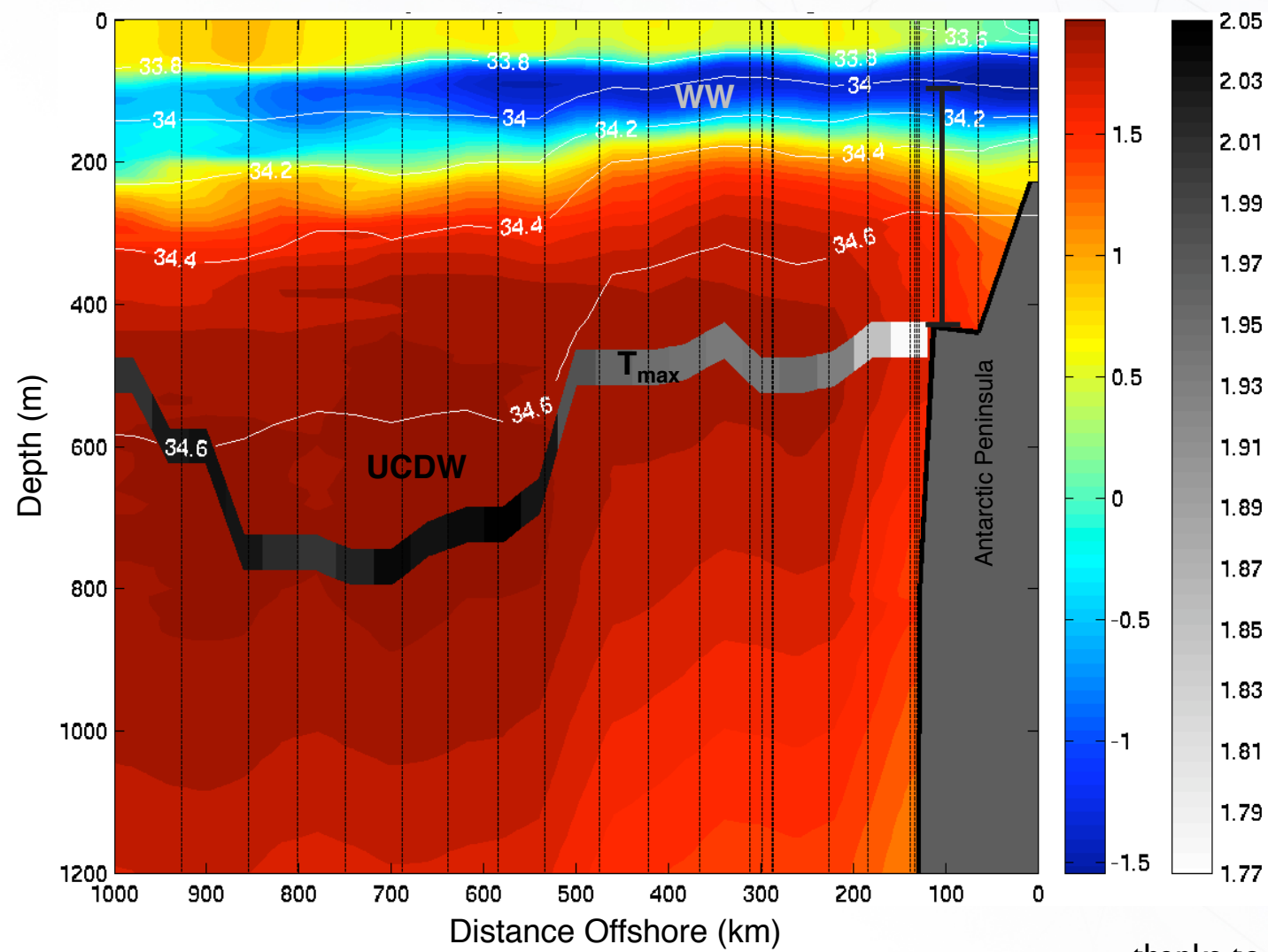
Large Changes Observed in Winters



Changing Southern Ocean is changing ice sheets



Rignot et al., 2008



thanks to Doug Martinson

Larson-B ice shelf after its collapse
Thanks to BAS & A. Clarke

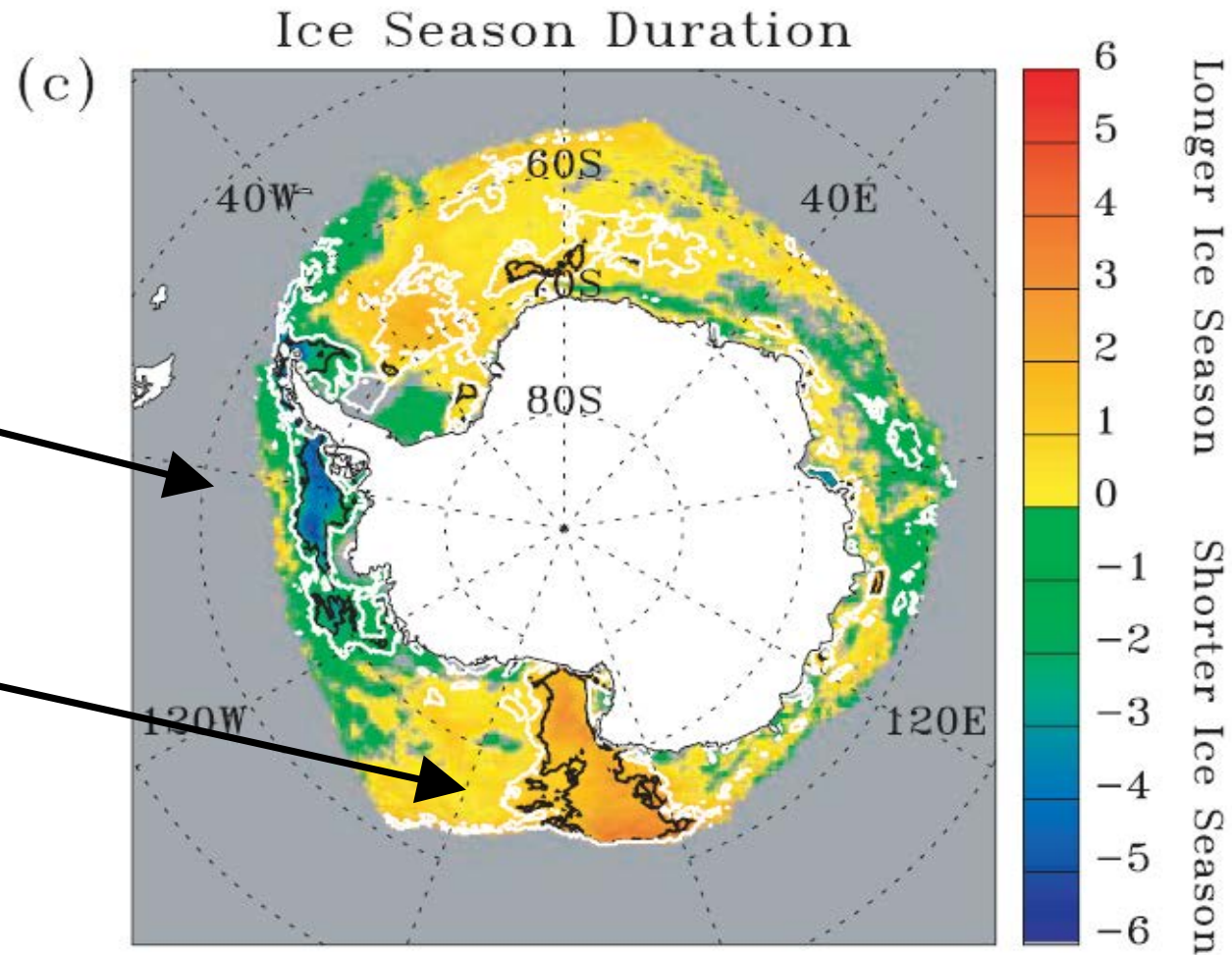


Changing Southern Ocean is changing sea ice

Changes in sea
ice duration:
1979 – 2006

-83 ± 23 days

57 ± 13 days



Stammerjohn et al. (2008)

Palmer Station in the present

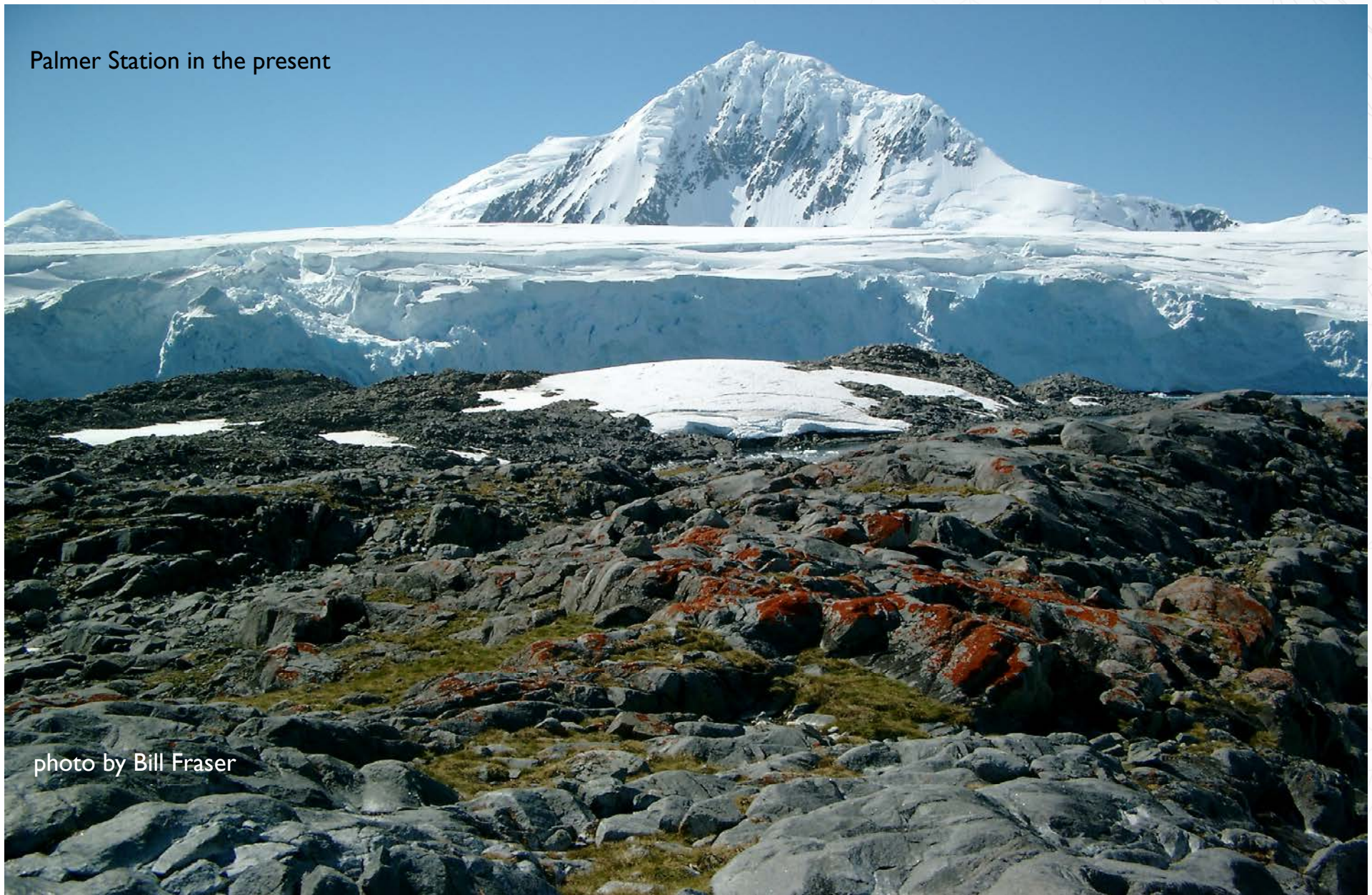
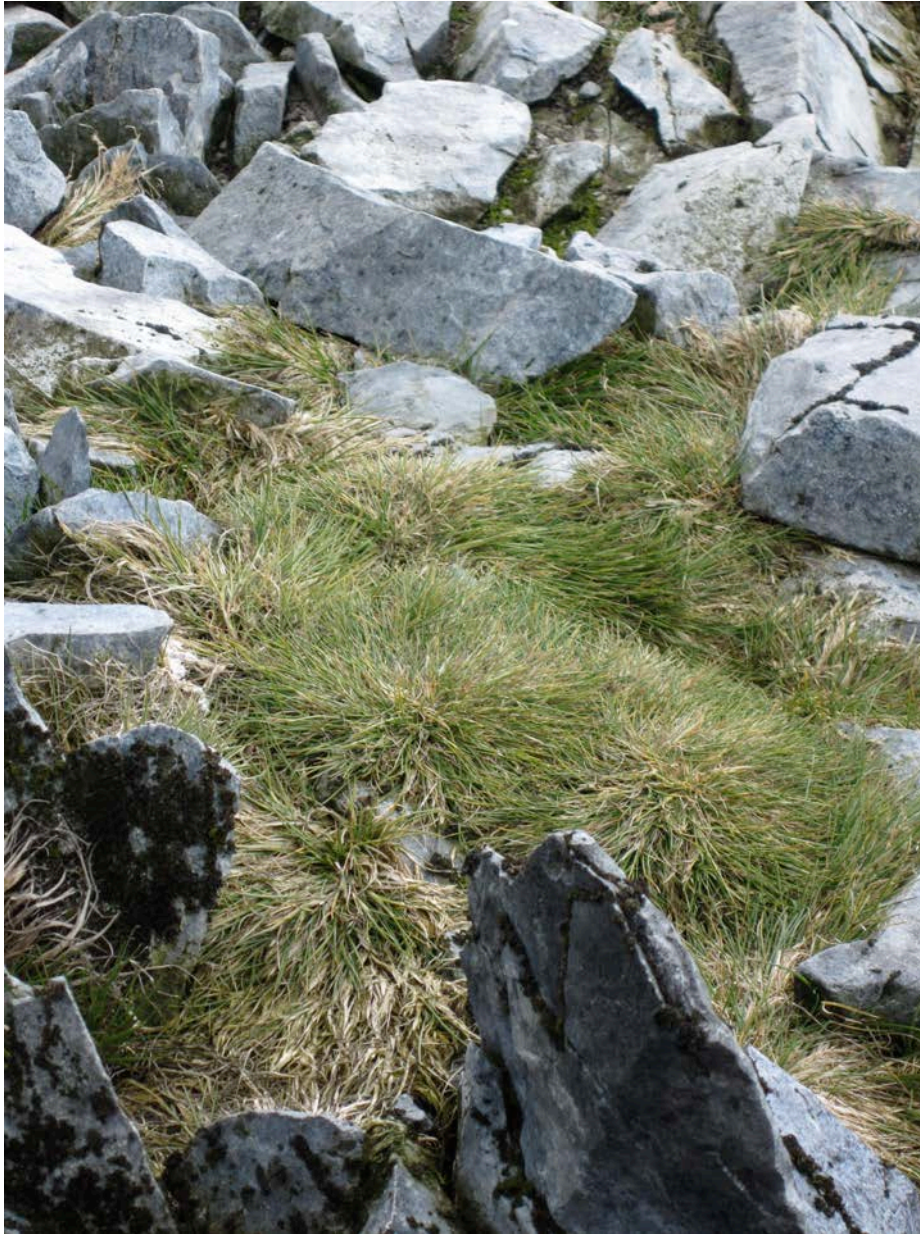
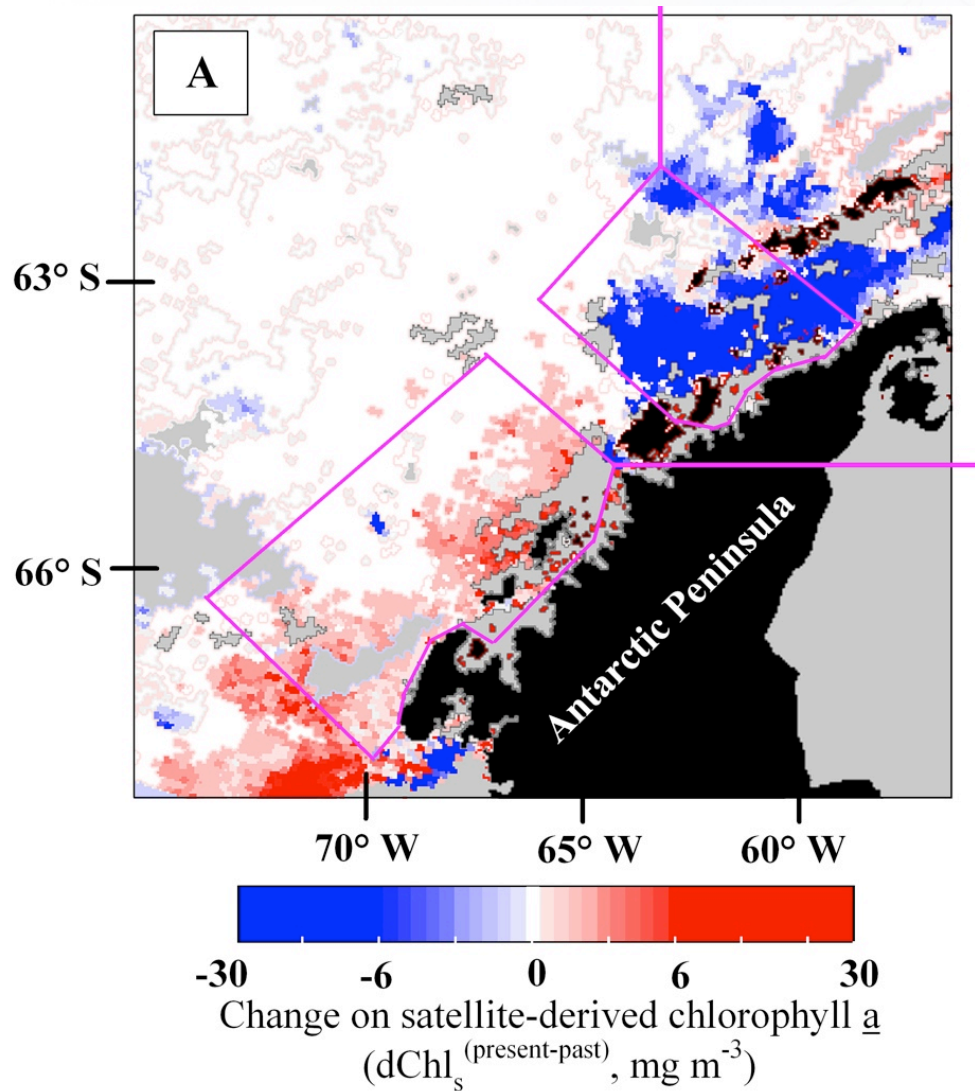


photo by Bill Fraser



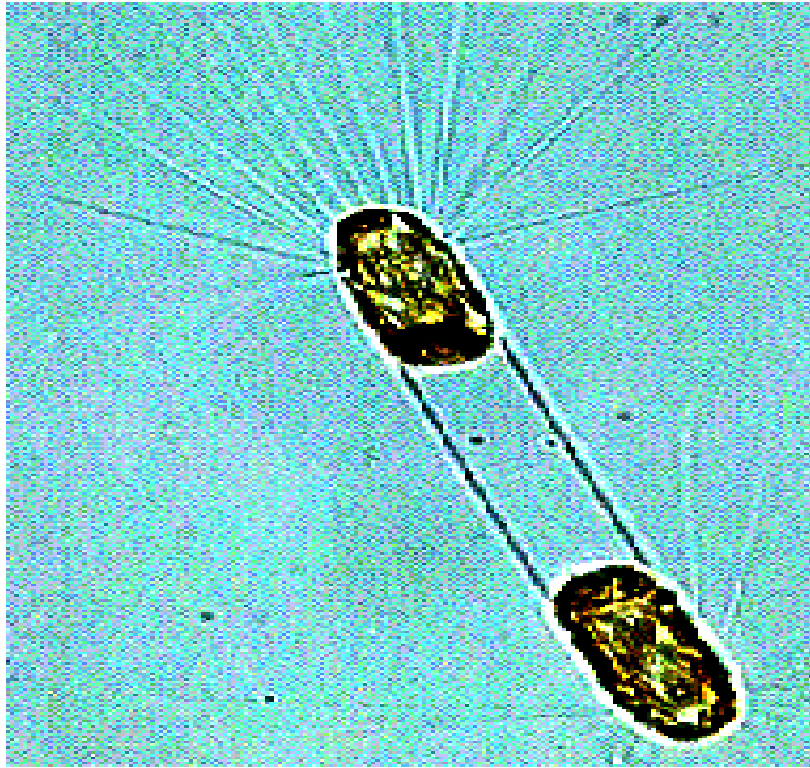
- plants in the WAP
- mushroom discovered in 2011





Montes Hugo et al. Science 2009

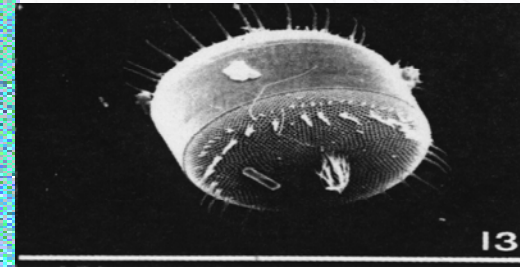
In regions where there has been trended changes there is evidence with changes in the base of the food web (the phytoplankton)



Corethron criophilum

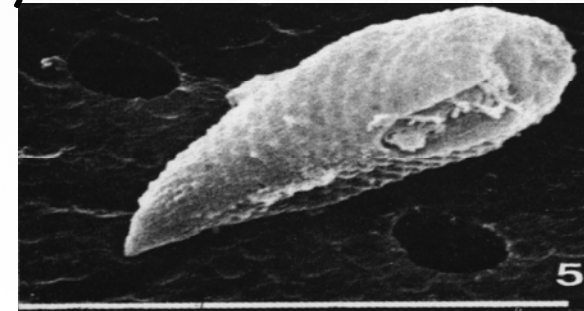
Palmer Cryptophytes --> $8 \pm 2\mu\text{m}$

SEM Micrographs from McMinn and Hodgson 1993



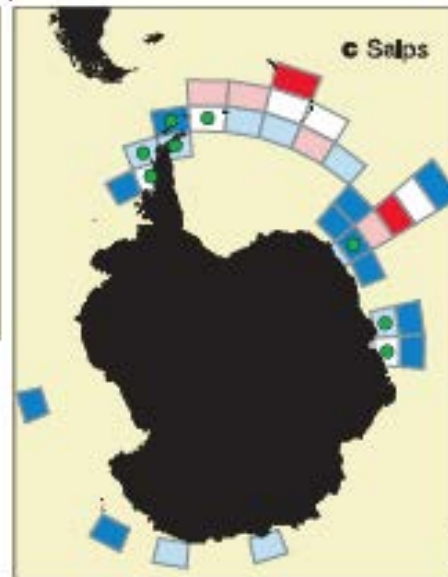
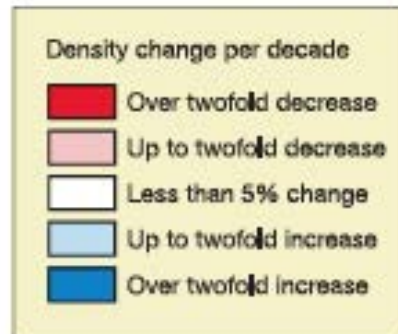
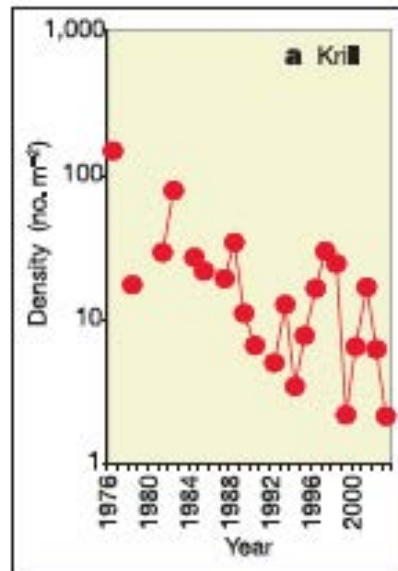
100 μm

Thalassiosira antarctica



10 μm

Cryptomonas cryophila



Atkinson et al. 2004



Changes in
phytoplankton also
seen in zooplankton.
Declines seen in krill
and the concurrent
increase in salps



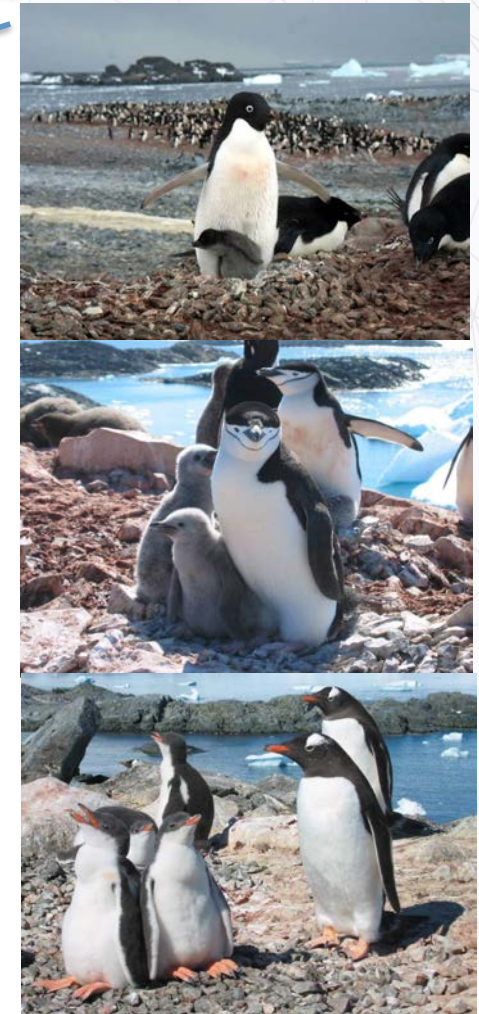
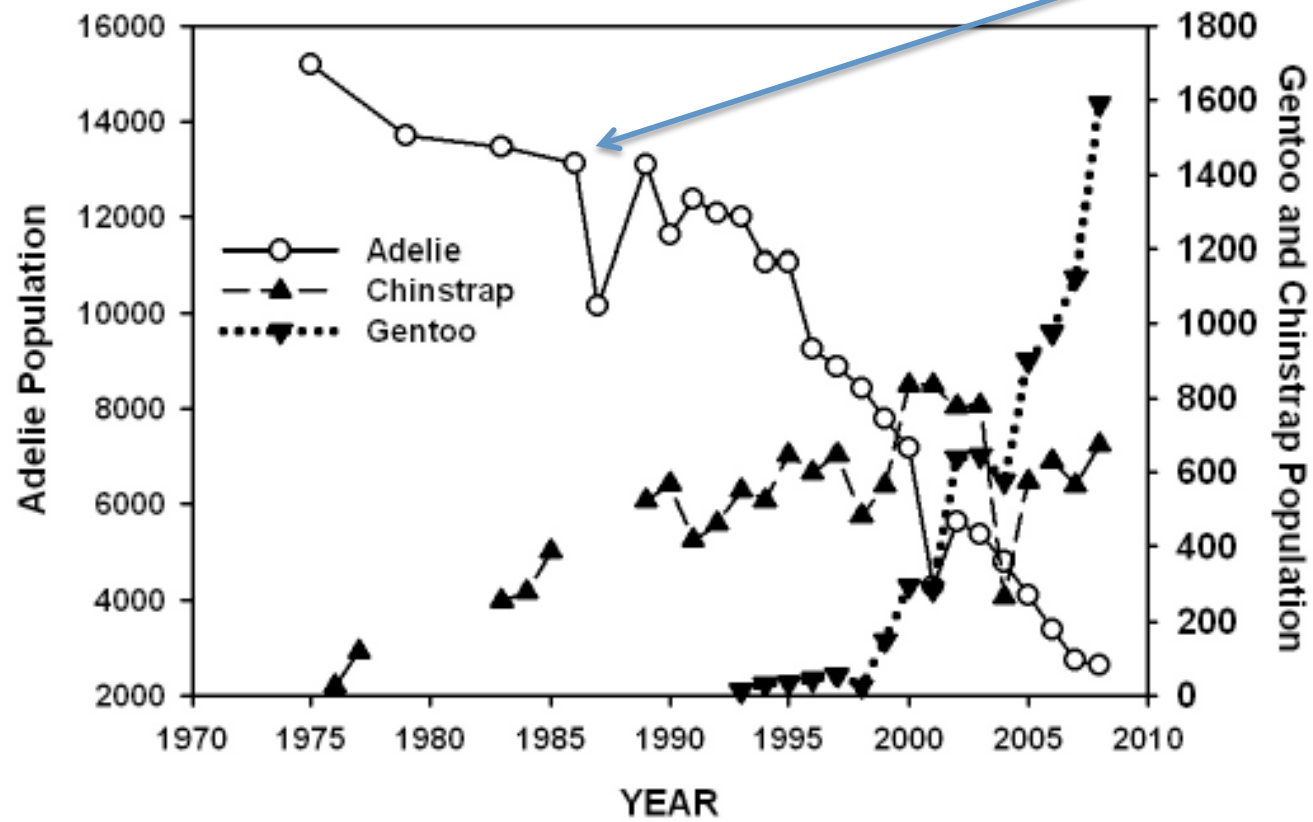




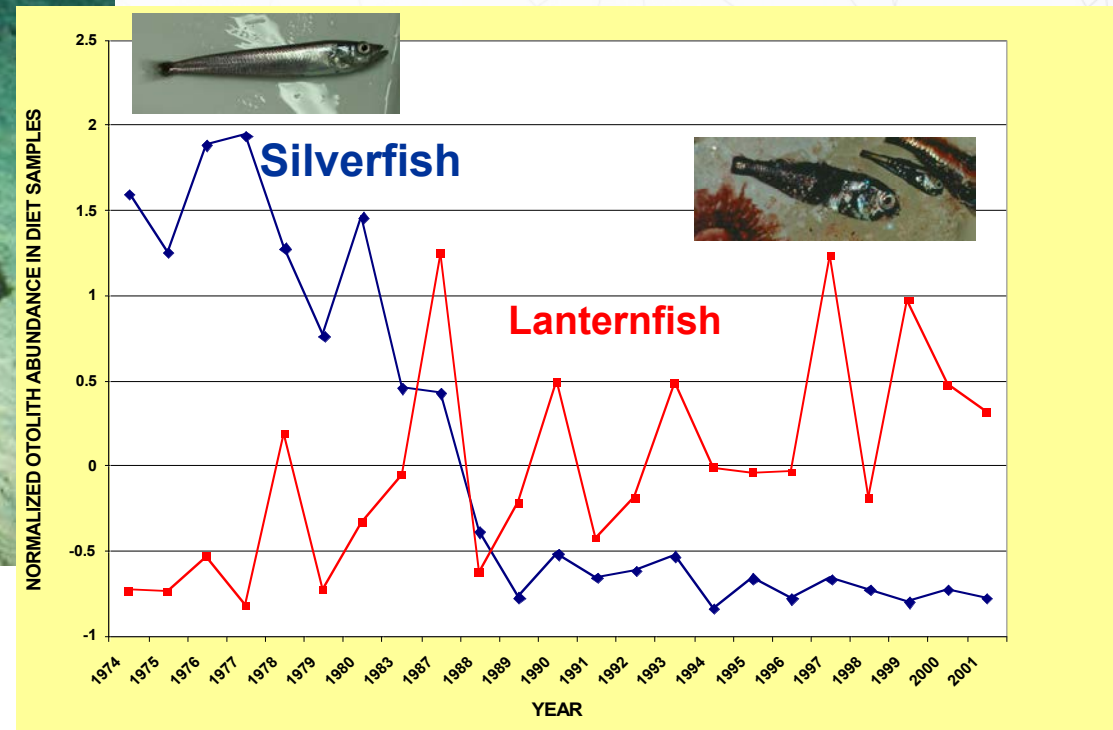
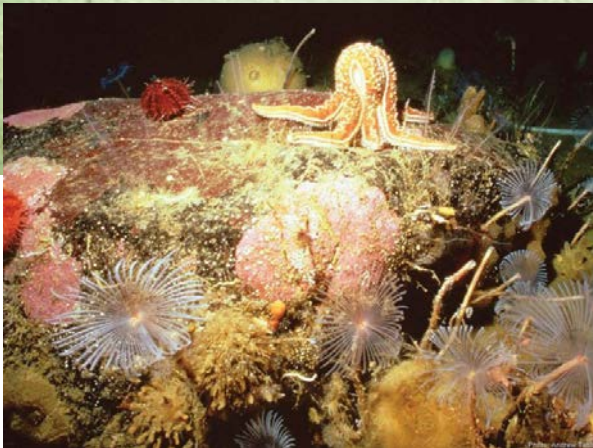
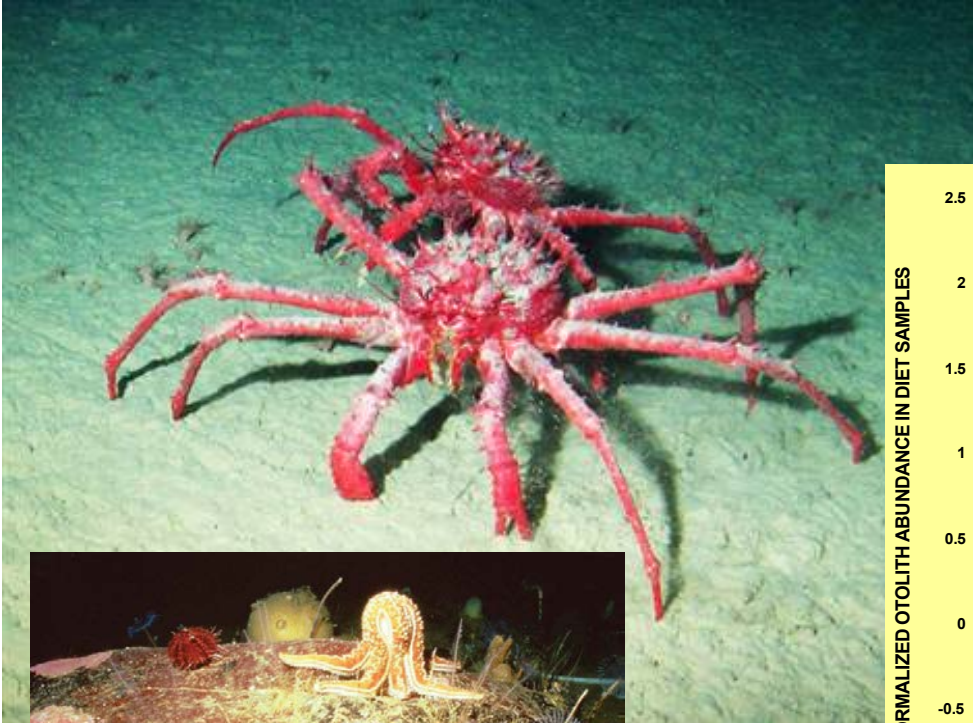
SOOS

Changes in the base of the food web felt through the food chain





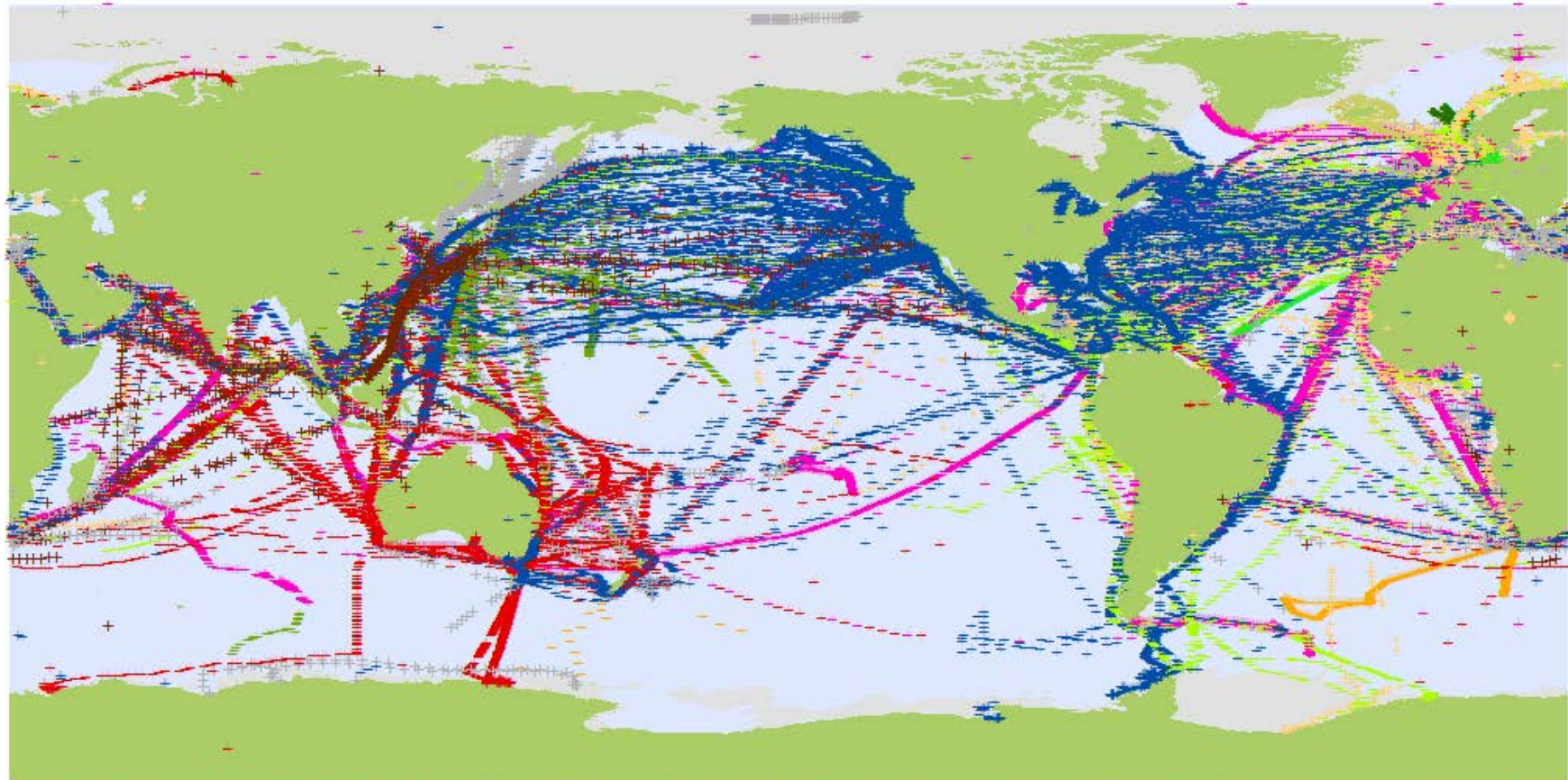
Shifts in water temperatures open up the Antarctic to invasive species



WHY SOOS?

Point 3: The distributed network of the Southern Ocean community, new technologies offers the potential for building an international SOOS

Is a SOOS feasible?



VOS (2309)
SHIP Reports (111846)

-	AMMC (Melbourne)	-	EGRR (Exeter)	-	EUMS (Darmstadt)	-	RJTD (Tokyo)
+	BIRK (Reykjavik)	+	EHDB (De Bilt)	-	KWBC (Washington DC)	+	WSSS (Singapore)
-	EDZW (Offenbach)	+	ENMI (Oslo)	-	LFPW, LFWV (Toulouse)	+	Other

January 2009

jcommops
JOINT COMMUNITY OBSERVATION PLATFORM SUPPORT AND SERVICES

SOOS

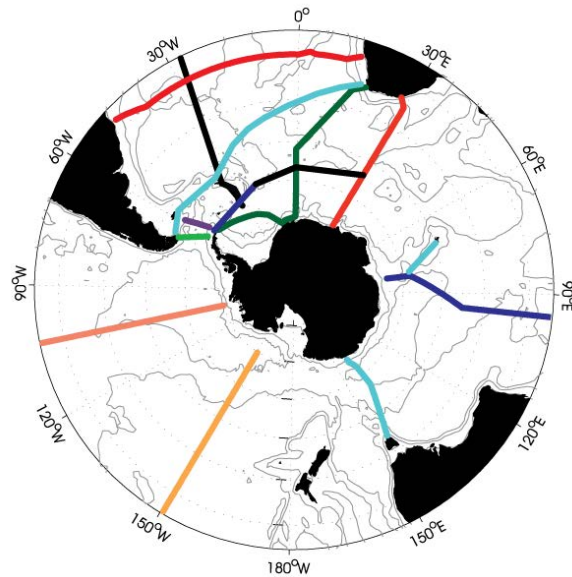
Who Needs SOOS?

- Researchers
- Resource managers (eg CCAMLR)
- Policy makers
- IPCC
- Local planners (sea-level rise)
- Antarctic tourism operators
- Shipping operators
- Weather and climate forecasters
- Educators

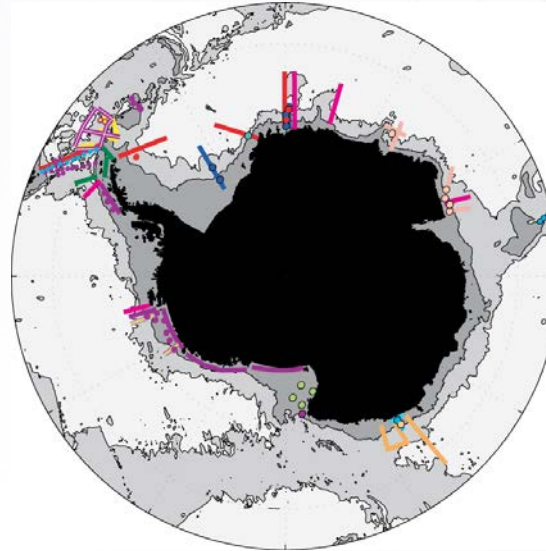


Cooperation possible as seen during IPY

CASO



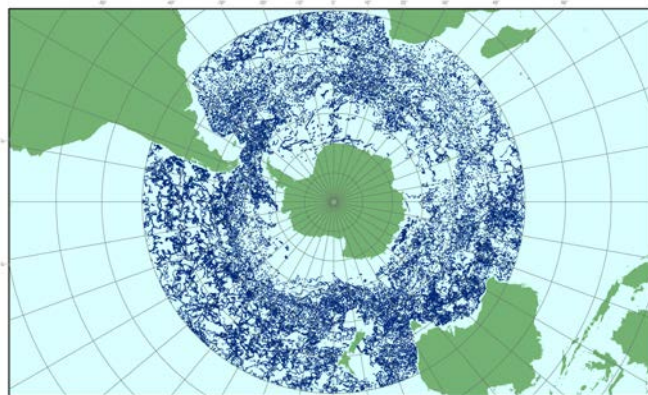
SASSI



CAML

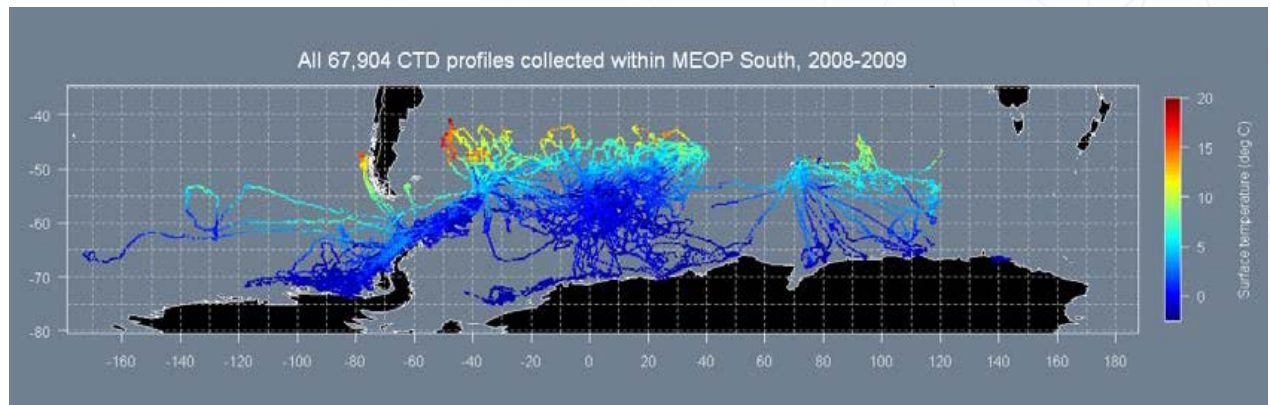


ARGO

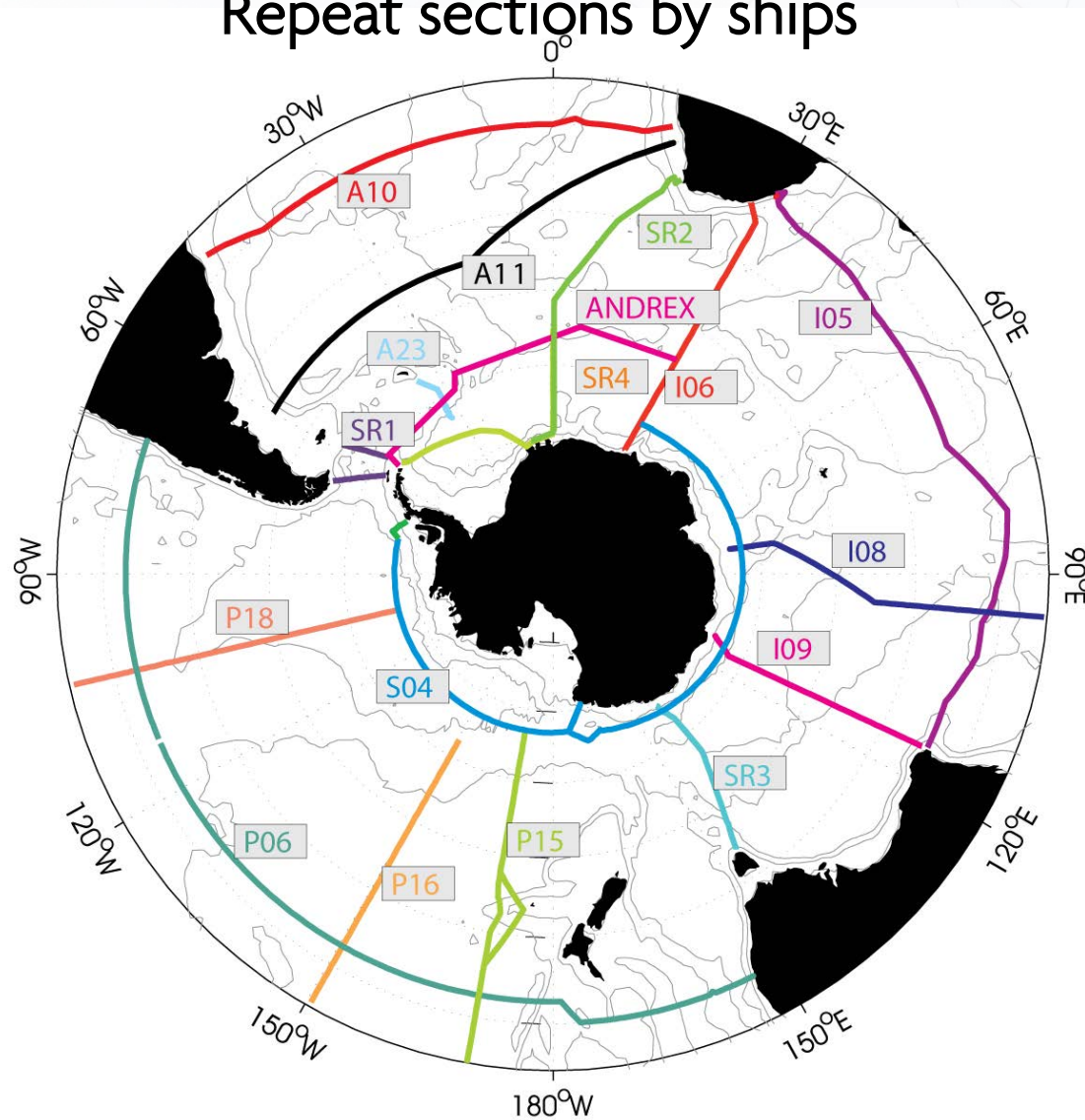


Argo 03/2007 - 03/2009
61965 profiles from 1353 distinct floats
<http://argo.jcommops.org>

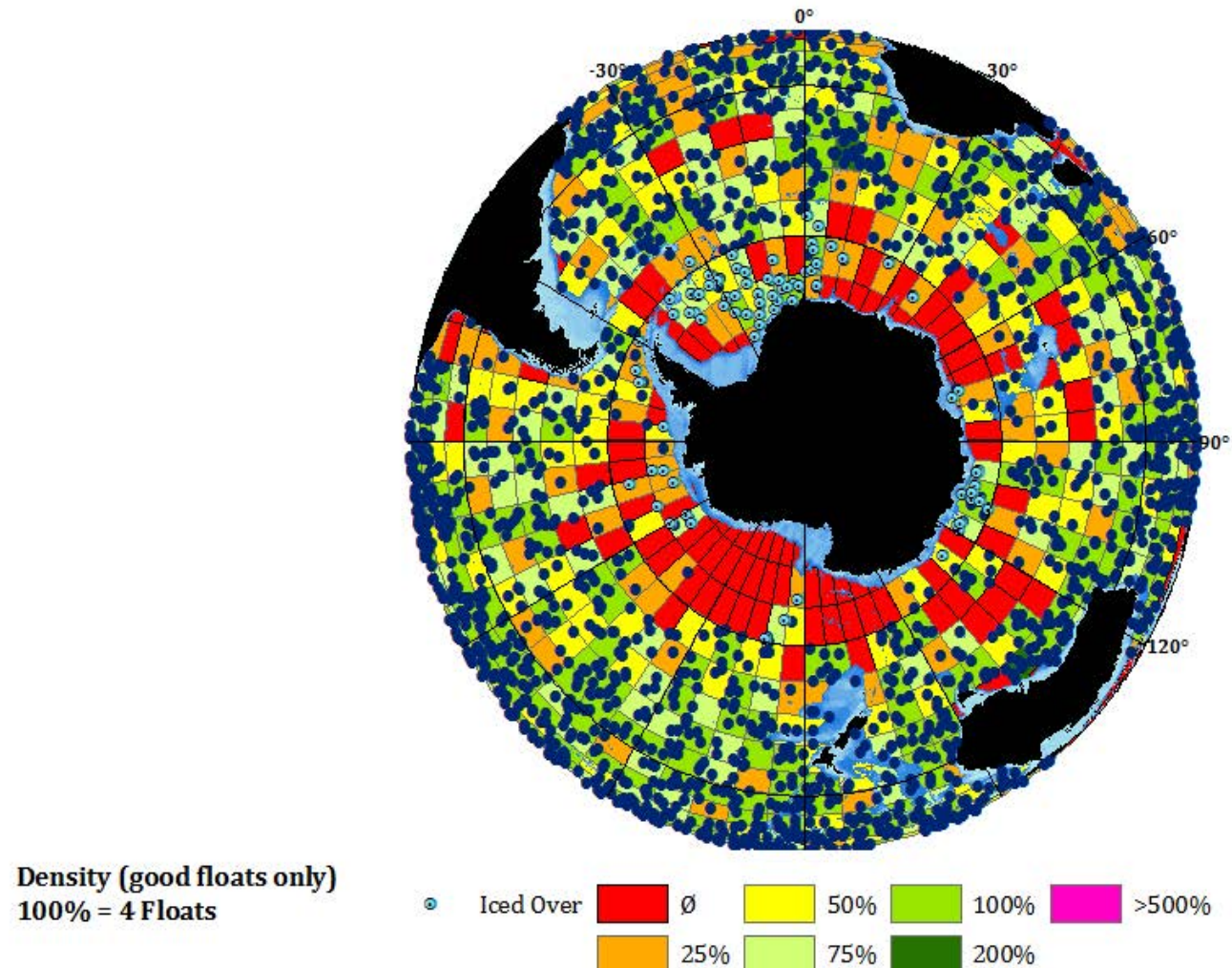
MEOP



SOOS will require traditional approaches: Repeat sections by ships



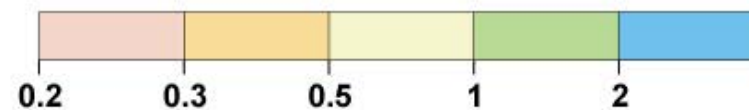
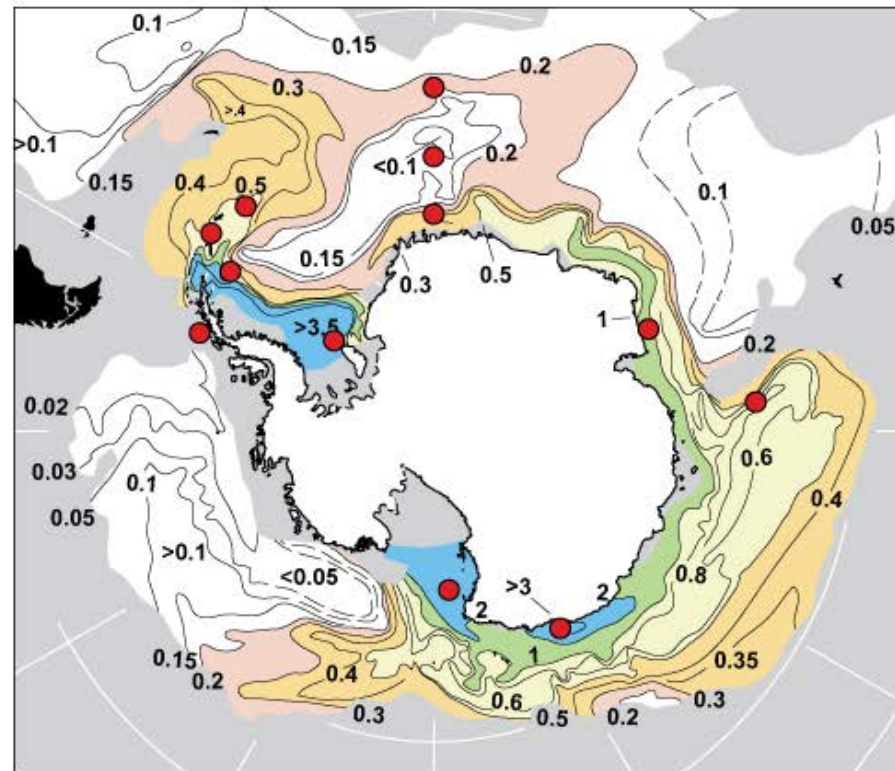
SOOS will require enhanced international observations (new network)



December 2009

jcommops
JCOMM In-situ Observing Platform Support Centre

SOOS will require moored time series



Mean CFC-11 (pmol/kg)

SOOS will require ice data

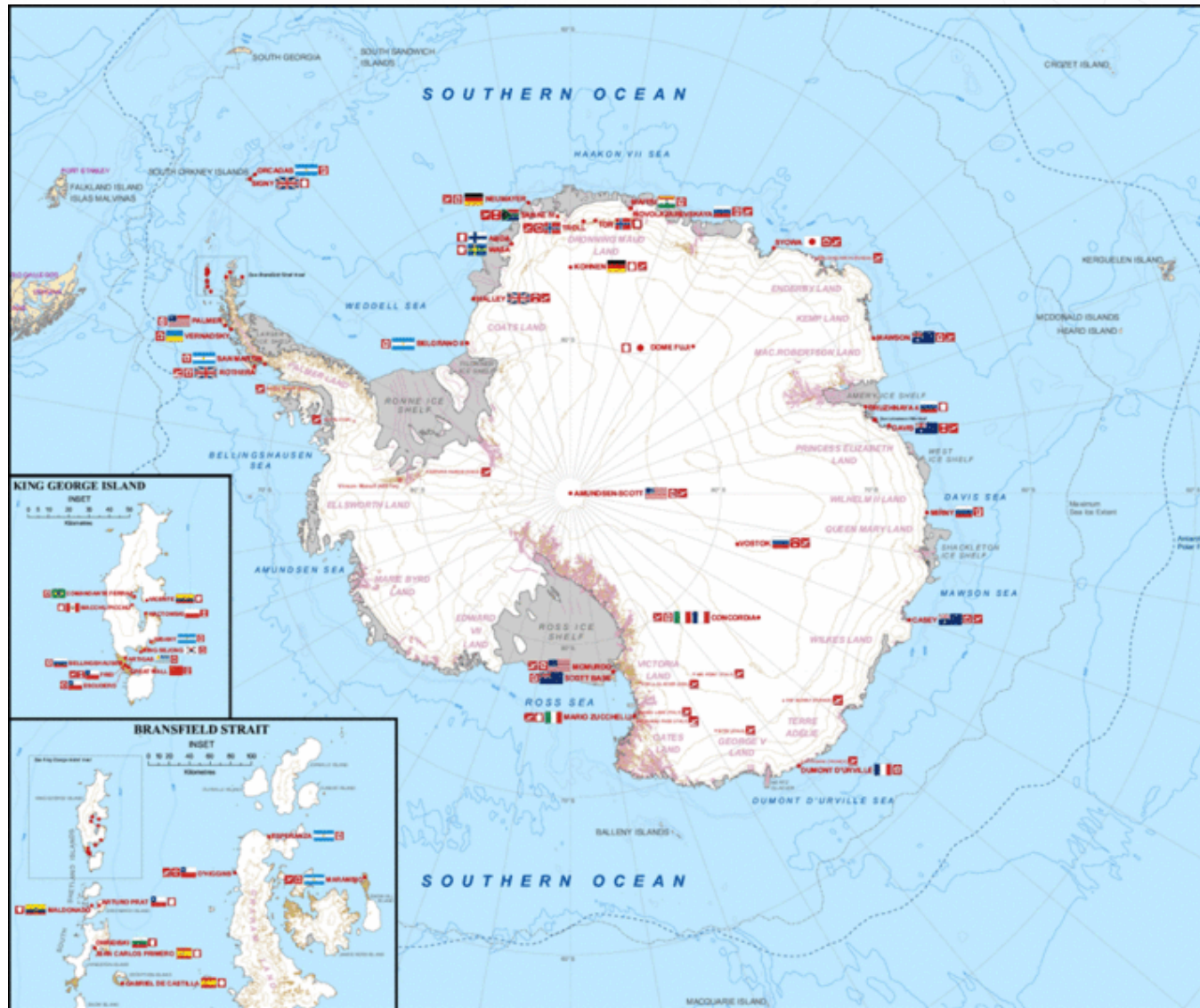


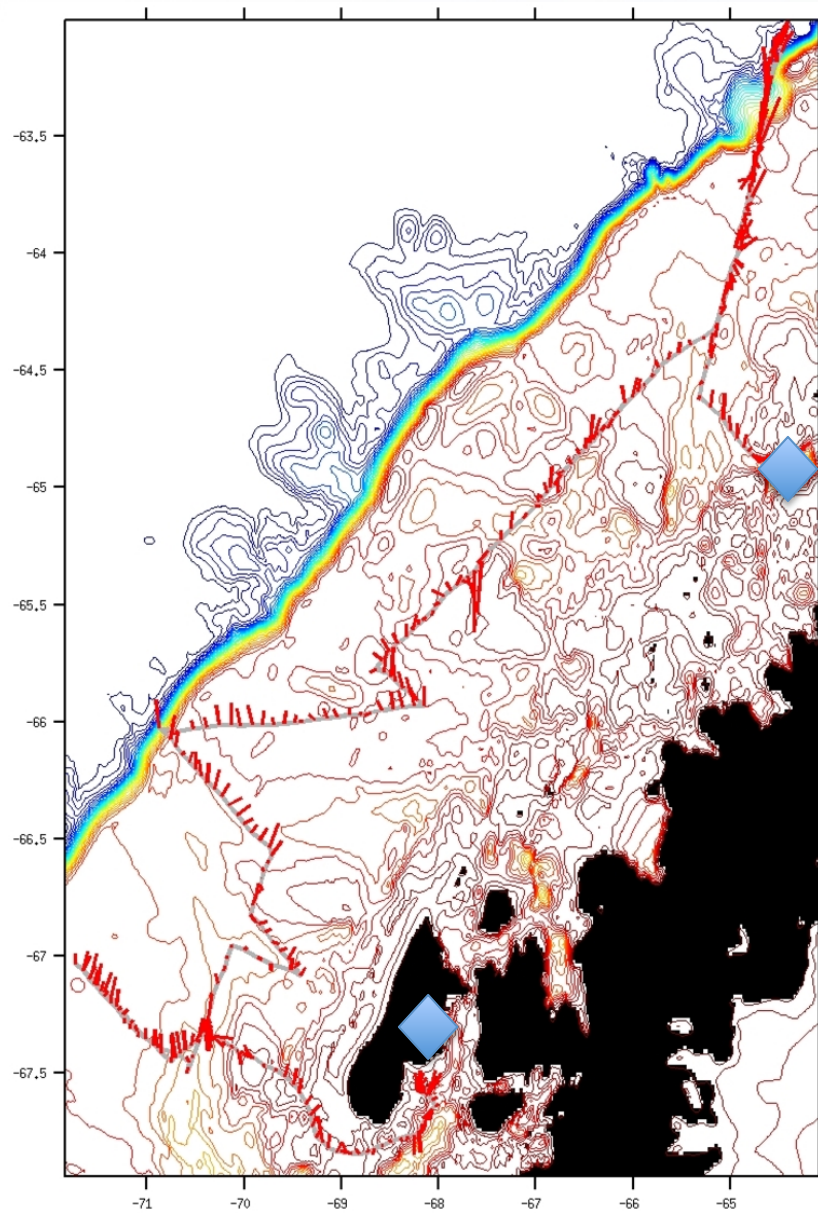
National Marine
Environmental Forecasting
Center




Marcel Nicolaus, AWI

SOOS will require enhanced utilization of field stations





SOOS will require data systems and data portals

SOUTHERN OCEAN OBSERVING SYSTEM PORTAL

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Map Layers | Add WMS Servers

- Theme 1 - Heat and Freshwater
- Theme 2 - Circulation
- Theme 3 - Ice-Sheets and Sea Level
- Theme 4 - Carbon
- Theme 5 - Sea Ice
- Theme 6 - Ecosystems

Welcome to the SOOS Data Network

This Portal is the primary access point for search, discovery, mapping and down that has been determined to be of significance to the [Southern Ocean Observing System \(SOOS\)](#). As existing data of relevance are detected by SOOS participants they discoverable via this Portal. All new data generated directly as a result of SOOS-r will be published via this site.

This SOOS Portal is a data aggregating service and as such many of the datasets via this interface may also be available from dedicated web sites operated by SO communities and existing, 'theme-specific' data networks. The 'points of tr data are listed in the metadata for each discovered dataset.


The portal provides two ways of discovering data:

Either through our [map](#) interface or by searching our [metadata catalogue](#).

Want to contribute data to the SOOS Data Portal?

Please see how to [contribute data](#) to the SOOS Portal

The sea-ice around Antarctica is dynamic and ever-changing, to view the latest s Antarctic sea-ice go to the Centre for Australian Weather and Climate Research (C concentration and extents page).



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The SOOS Portal is hosted by IMOS on behalf of the Southern Ocean Observing System (SOOS).

SOOS Portal v2.42.0, build date: 12/06/2013 16:20

SOOS Data Network Links


[Australian Ocean Data Network](#)
[National Collaborative Research Infrastructure Strategy \(NCRIS\)](#)

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7 places left for the 2013 Antarctic Ice Rises workshop.

Registration

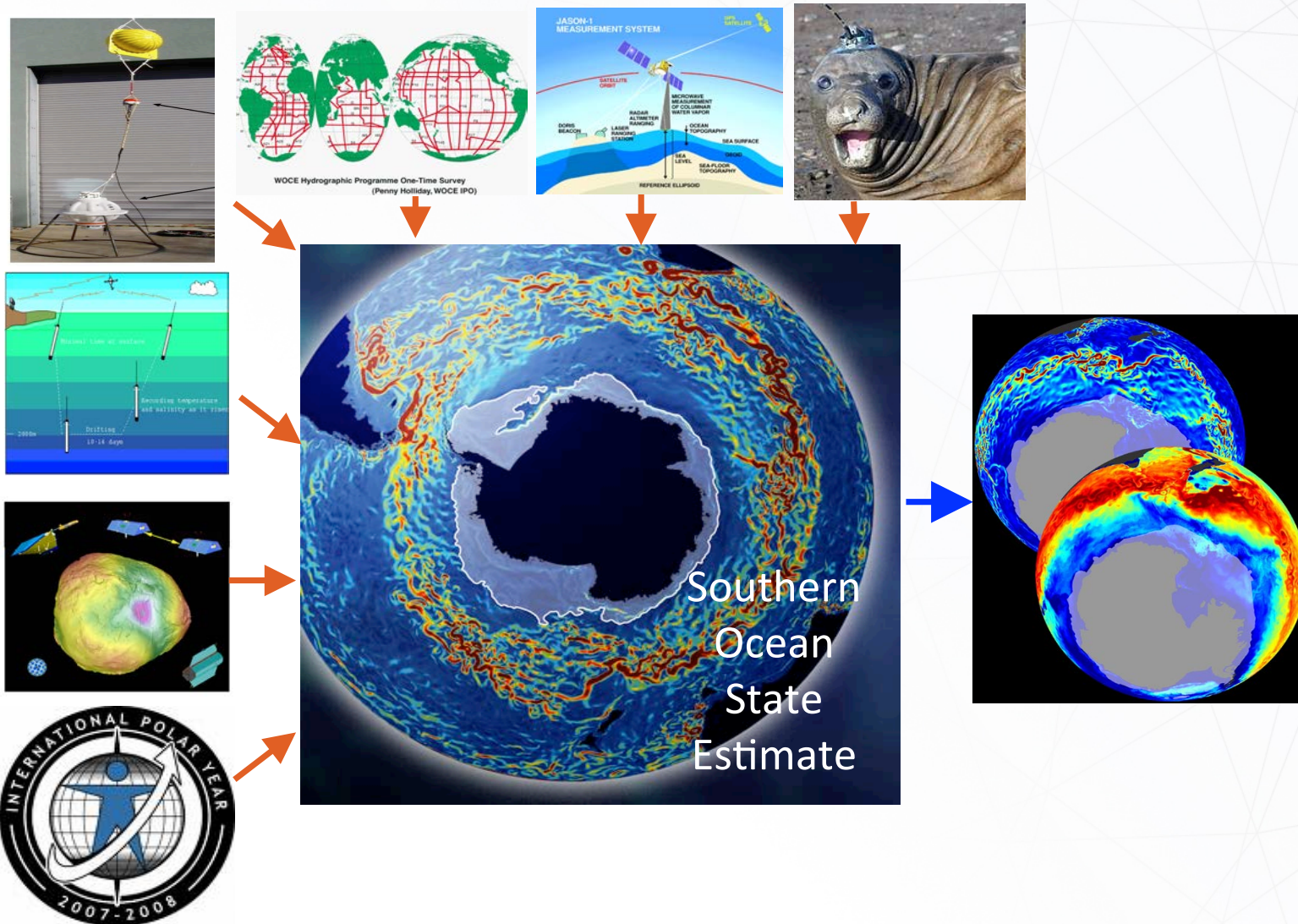
www.climate-cryosphere.org
CIC aims to improve understanding of the cryosphere and its interactions with the global climate system, and to enhance the ability to use parts of the cryosphere for detection of climate change.

Monday at 11:09pm

414 people like Southern Ocean Observing System (SOOS).



SOOS will require advanced assimilative models



Where are we? SOOS is just beginning, so open for all as
the journey is just beginning

