The Southern Ocean Observing System

Louise Newman, Mike Meredith, Oscar Schofield

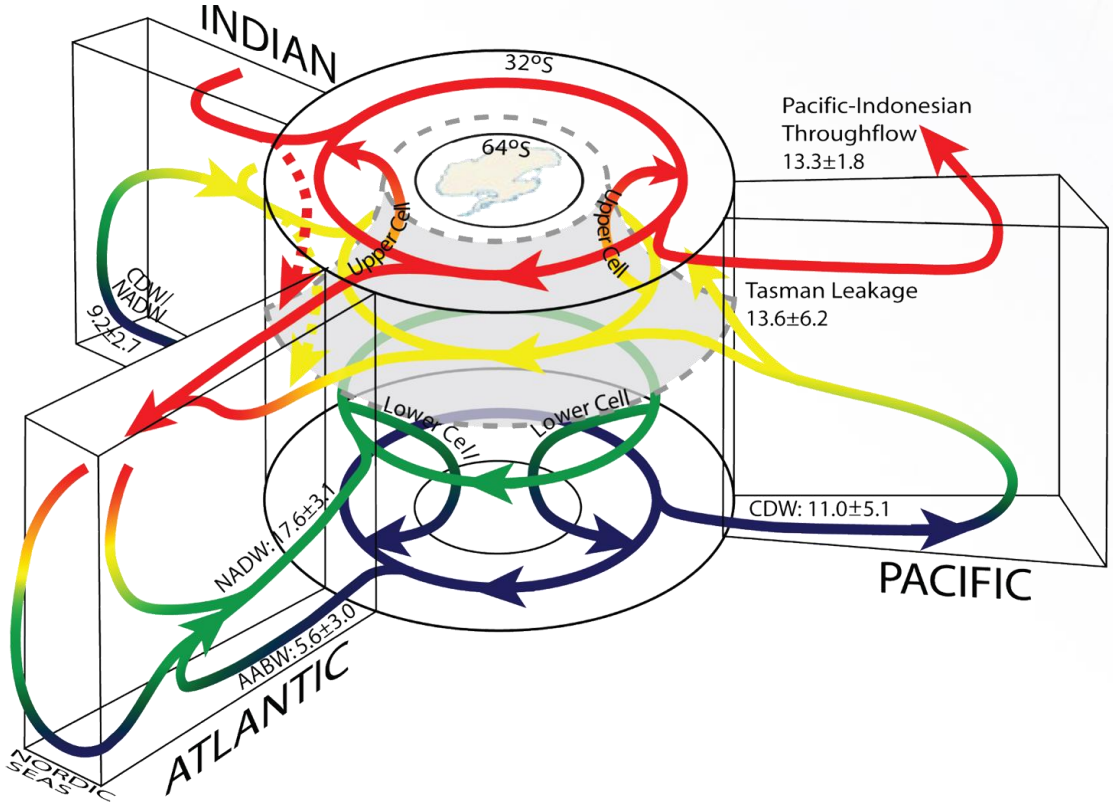
On behalf of many SOOS colleagues

SOOS
SOUTHERN OCEAN OBSERVING SYSTEM

IMAS
INSTITUTE FOR MARINE AND ANTARCTIC STUDIES

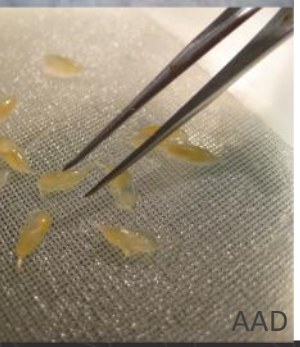
UTAS

The Southern Ocean matters – for science and society



Lumpkin and Speer 2007

- Connects all ocean basins
- Site of key water mass formation
- Drives global ocean circulation
- Significant drawdown of CO_2
- Effects global sea level
- Has unique, vulnerable ecosystems



The Southern Ocean is changing…

- Regional warming
- Decreased salinity in upper and abyssal ocean
- Basin-wide acidification
- Regional decreases in sea ice
- Shifts in ecosystems

Need to monitor and understand the changes in order to predict future changes, and mitigate impacts.

Supports the need for sustained, and internationally coordinated observations of the Southern Ocean

The Southern Ocean Observing System

- Many (mono-disciplinary) programmes in SO research, all with individual infrastructure, data routes etc. SOOS will connect across disciplines and programmes to ensure a coordinated approach to observing the SO.

- Sponsored by SCAR (Scientific Committee on Antarctic Research) and SCOR (Scientific Committee on Oceanic Research)

- *SOOS Initial Science and Implementation Strategy* – developed by SCAR/SCOR Expert Group on Oceanography and the SCAR/CLIVAR/CliC Southern Ocean Panel.

- International Project Office opened August 2011, hosted by the Institute for Marine and Antarctic Studies (University of Tasmania), with additional support from the Australian Antarctic Division.

Who would use SOOS and SOOS products?

- Research community
- Resource managers (e.g., CCAMLR)
- Policy makers (when to act? Consequences of not acting?)
- IPCC
- Local planners (sea-level rise)
- Antarctic tourism
- Shipping operators
- Weather and climate forecaster
- Educators

MISSION: To establish a *multidisciplinary* system to deliver the *sustained* observations of the Southern Ocean that are needed to address key challenges of *scientific* and *societal* relevance, including climate change, sea-level rise and the impacts of global change on marine ecosystems.

B. Wallis AAD

Scientific Steering Committee

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Ed Urban	SCOR Secretariat	ed.urban@scor-int.org	SCOR Ex-officio

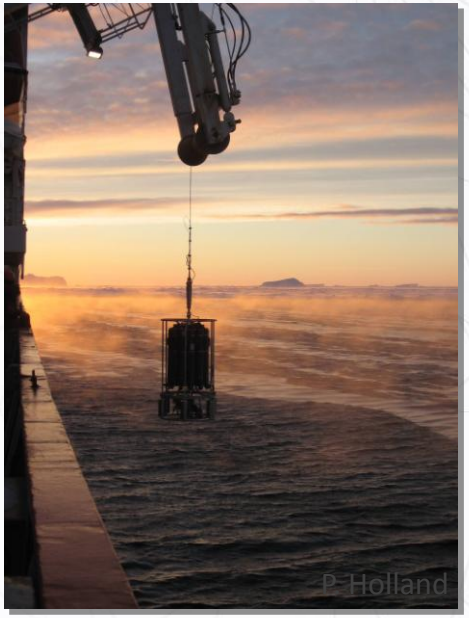
Membership:

- Expertise
- Scientific standing
- Programmatic connections
- National representation

Science Themes

Key science challenges identified as most pressing issues, both scientifically and societally - to be addressed by the SOOS:

1) Role of Southern Ocean in global freshwater and heat balance
2) Stability of Southern Ocean overturning circulation
3) Stability of Antarctic ice sheet and future contribution to sea-level rise
4) Future of Southern Ocean carbon uptake
5) Future of Antarctic sea ice
6) Impacts of global change on Antarctic ecosystems



Achieving the mission…

Many international/national programmes involved in Southern Ocean observations. SOOS will work with these to:

- Design and implement SO observing system

- Advocate and guide development of new technologies

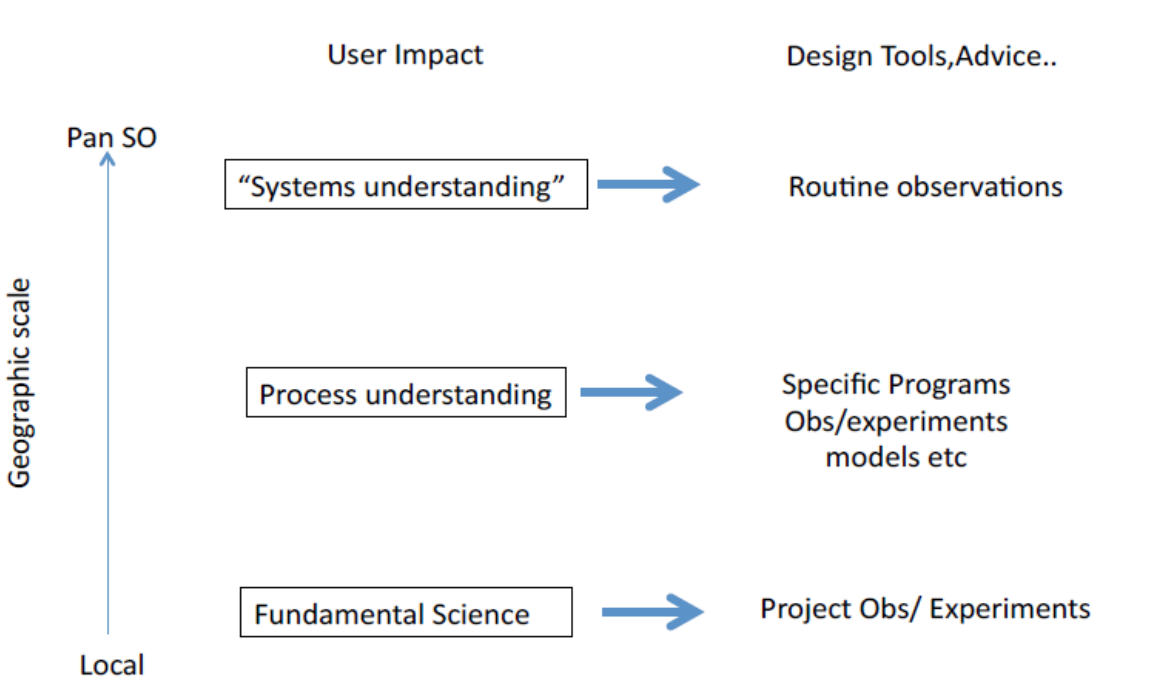
- Unify current observation efforts and leverage further resources

- Integrate / communicate – between nations, international and national projects, and across traditional disciplinary boundaries

- Facilitate and develop a data system with seamless access to essential data and data products

SO Systems Understanding: EOVs* from Routine Observations

*EOVs =Essential Ocean Variables



Design and implement a SO Observing System

End goal is a sustained, coherent, multidisciplinary observing system.

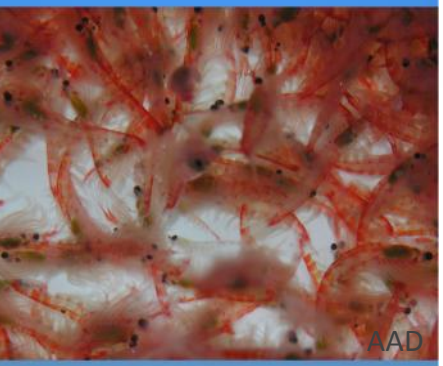
- Design optimal sampling plans for all variables
- Need quantified targets (number/frequency of required observations)

Some have already been defined, others lag behind.

- Determination of stage of readiness of EOVs* and platforms

Identification of gaps in knowledge and observations

*EOVs = Essential Ocean Variables



Example of SOOS development: Southern Ocean Ecosystems

Ecosystem is a challenge due to species diversity and system complexity. Work is required to identify key components of an ecosystem that **must** be monitored, how often, and where.

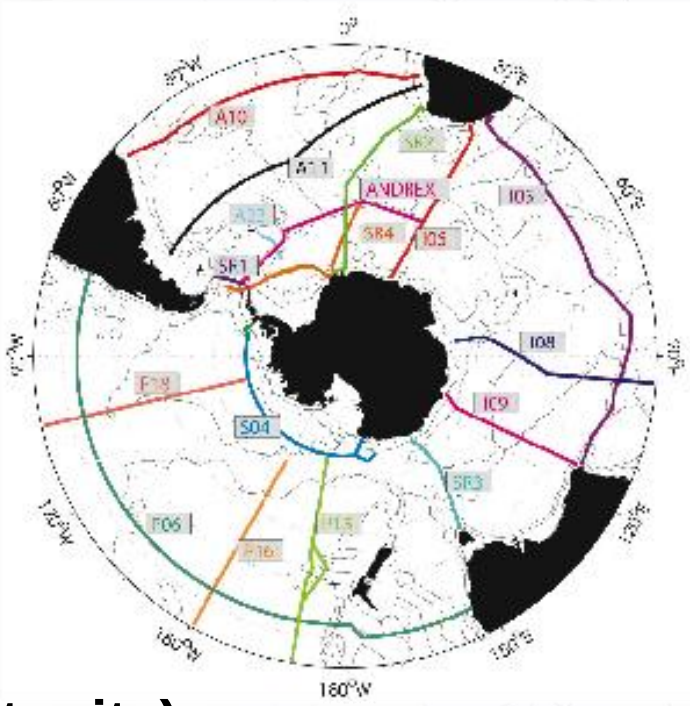
Southern Ocean Sentinel project working to address this – supported by SOOS. Sentinel will contribute to design of SOOS and is connecting physical variables with biological variables in a seamless way.

SOOS proposal for SCOR Working Group with involvement of GOOS - to identify biological parameters/variables that require monitoring on a global scale.

Unify current efforts and leverage resources: Examples

Hydrographic sections

- Addition of biological sensors
- National “ownership” of sections by countries not yet involved (Korea, China etc)
- Extension of sections through the sea ice



Extension of the SOOP (Ships Of OPportunity)

-Deployments from fishing vessels through collaboration with CCAMLR

- Deployments from tourist vessels, through collaboration with IAATO

Delivering the outputs

Key goal: develop a unified Southern Ocean data portal to enable easy access to relevant data and data products. This requires investment, but the scientific and societal return would be significantly greater.

Data Management Sub-Committee = representatives from international, national and programmatic data centres.

- Tasked with developing the data policy
- Identifying data products to provide and infrastructure required
- Advocate for data contributions

Want more information?

Contact the SOOS International Project Office:

Louise Newman (Executive Officer)
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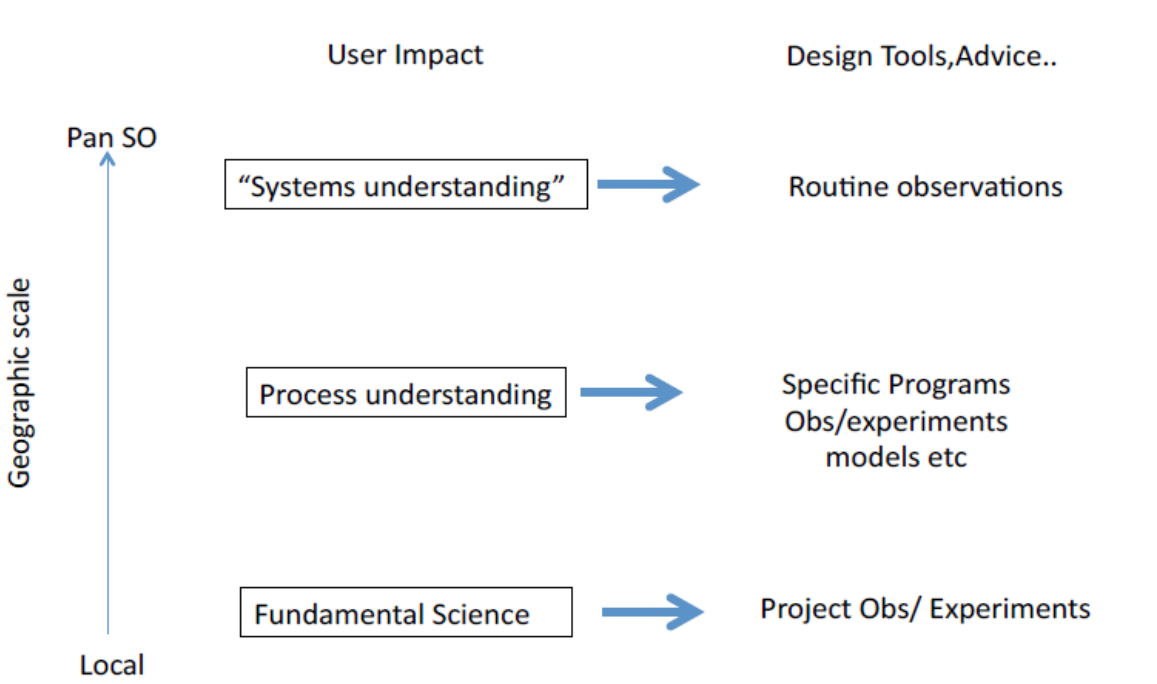
or

Check out the SOOS website at www.soos.aq

SO Systems Understanding: EOVs* from Routine Observations

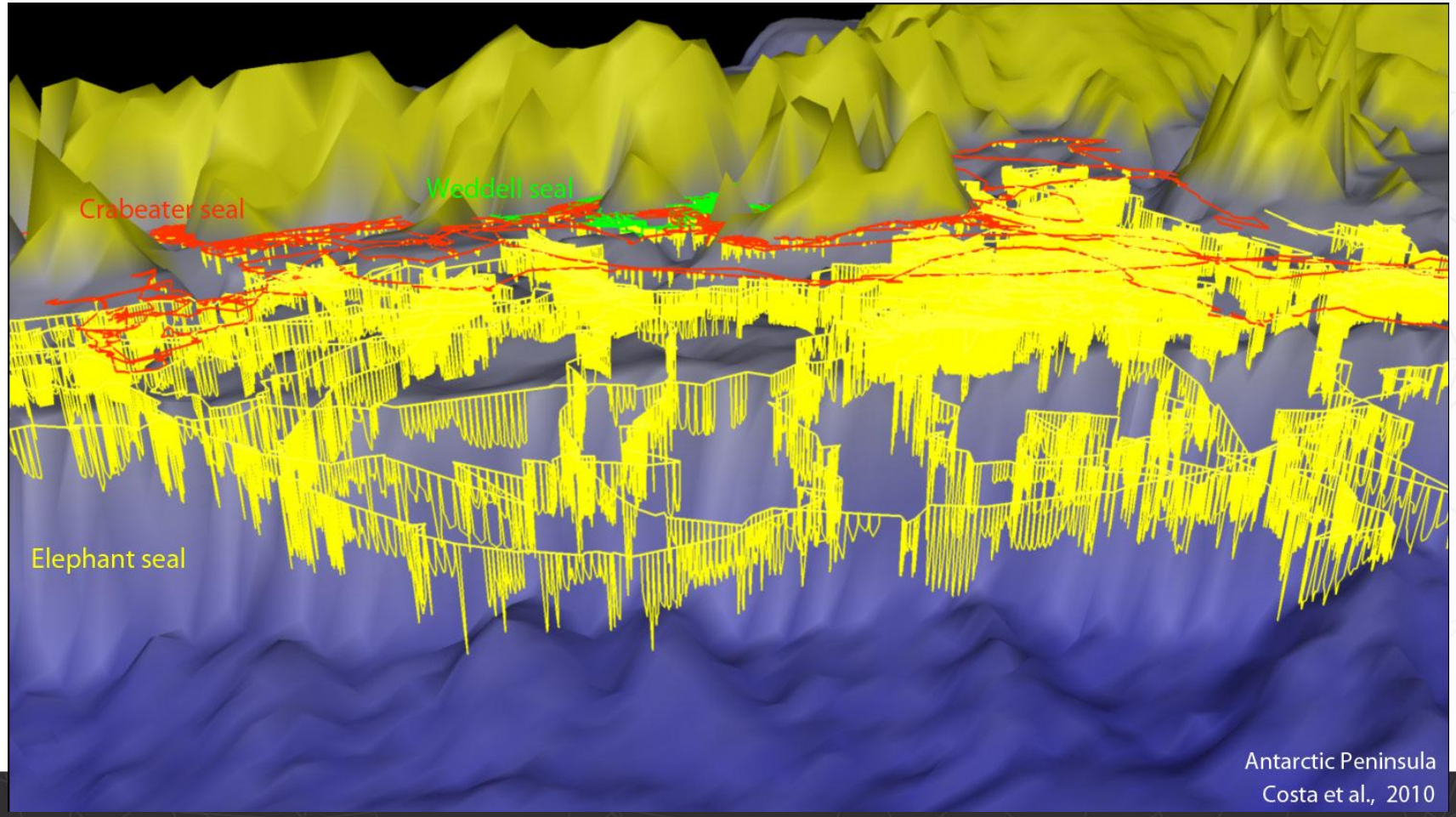
*EOVs =Essential Ocean Variables



Ecosystem Monitoring

- Ship Underway measurements: Fluorescence, FRRF, Continuous Plankton Recorder along with pCO2, pH Acoustics. (Sentinel Transects in Ross Sea)
- CEMP (CCAMLR Ecosystem Monitoring Program)- Establish node in the Ross Sea
- Ecosystem monitoring, LTER and AMLR cited as examples. Needed in Ross Sea?
- 5-year Repeat Survey of Crabeater Seals-use of airborne drones.
- Trackers/CTD on Seals, Penguins, GLS trackers on seabirds.

Marine Mammal Tracking



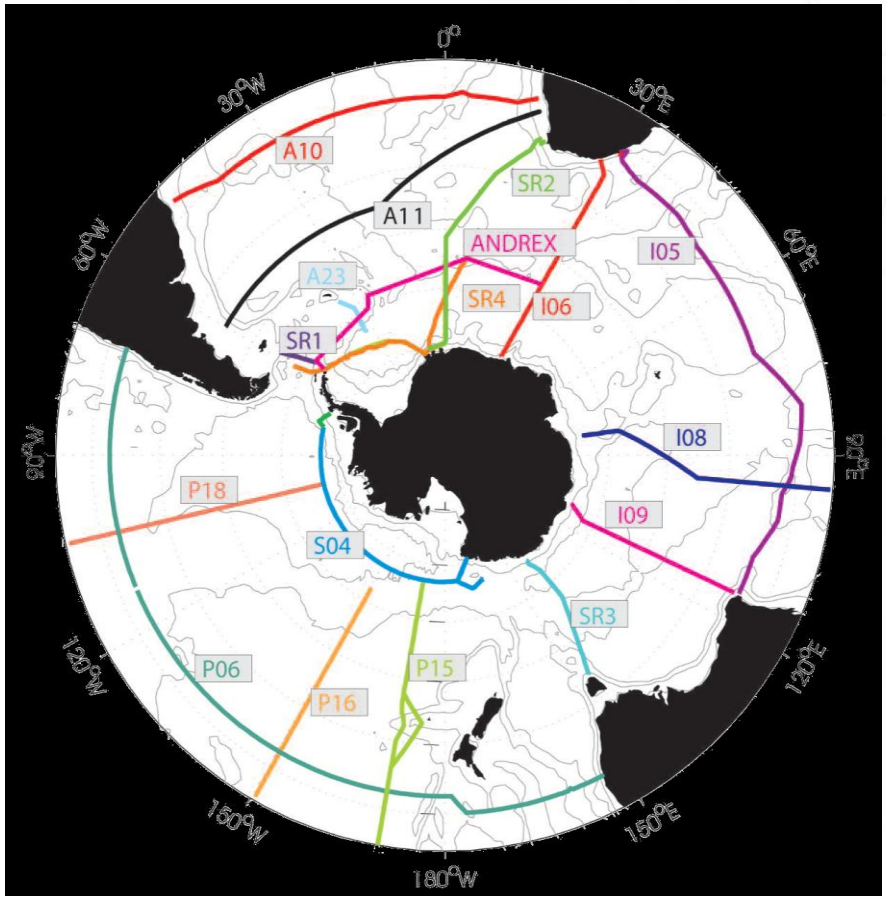
Southern Ocean Sentinel Workshop

- The IMBER program, Integrating Climate and Ecosystem Dynamics of the Southern Ocean, is holding a
- workshop on 7-11 May 2012 in Hobart with the following objectives:
- 1. Consolidation of a risk assessment of climate change impacts on Southern Ocean biota, including
- how they may be represented in food web models:
- a. taking account of existing works, to finalise a synthesis for publication in the primary
- literature on
- i. current change in Southern Ocean ecosystems
- ii. prognoses for future change based on IPCC 5 scenarios
- iii. key uncertainties for predicting change
- b. to further develop approaches to modelling Southern Ocean foodwebs and ecosystems to
- facilitate
- i. assessing current and future climate change impacts
- ii. management of Southern Ocean fisheries and the conservation of biodiversity
- iii. designing field monitoring strategies.
- 2. Consider strategies for measuring change in Southern Ocean marine ecosystems, including shipbased
- and land-based monitoring and integrated study areas, by
- a. further developing a scoping paper, and
- b. establishing a suitable implementation plan.

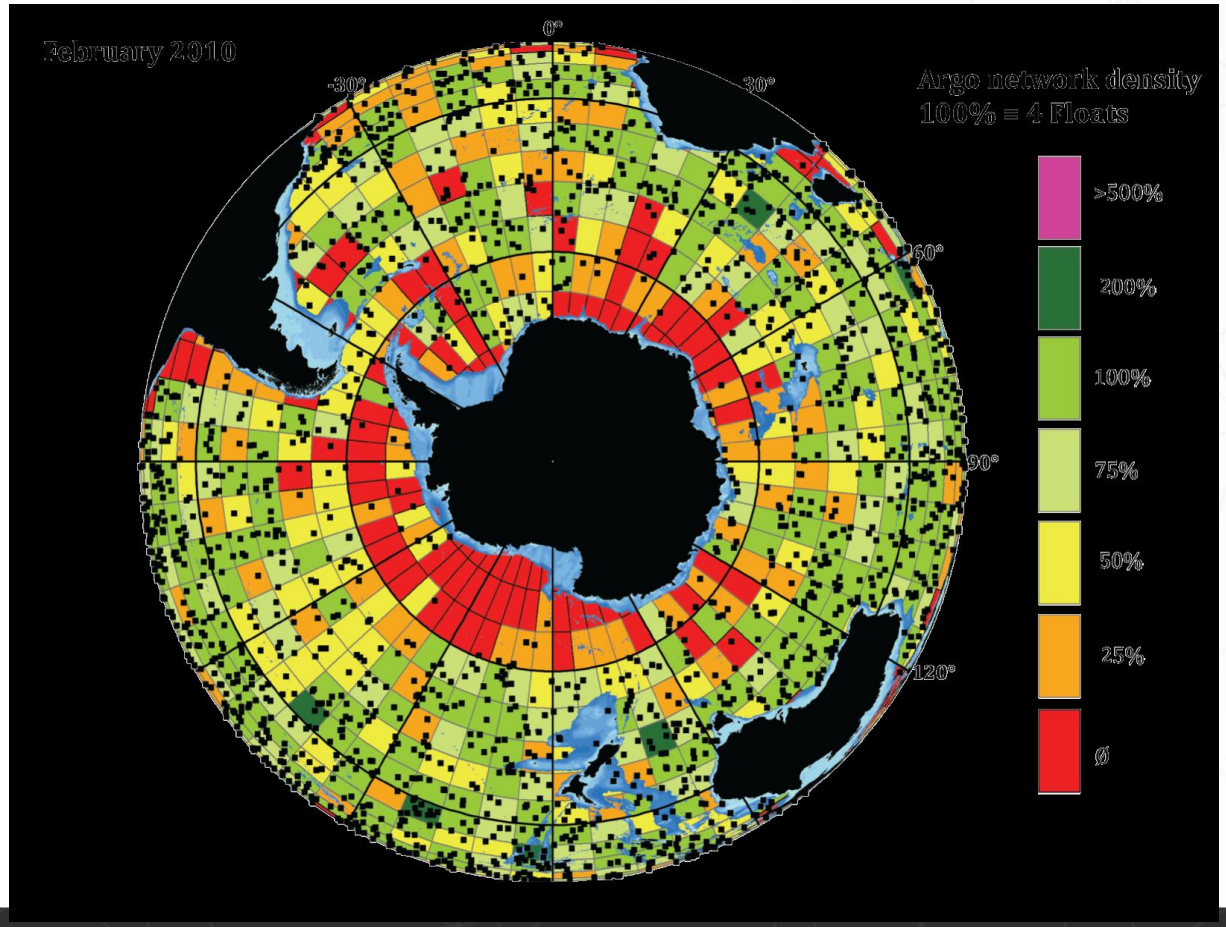
SO Heat and Freshwater Balance

- Repeat Hydrography-P15(170W), P16(150W) with extension through Ross Sea to the coast.Repeat Hydrography-SO4 (zonal section 60S with Balleny Is “Hook”
- Expanded ARGO Floats, SO to ARGO Standard of 4 Floats per 10x10 degree box, Ice-Capable

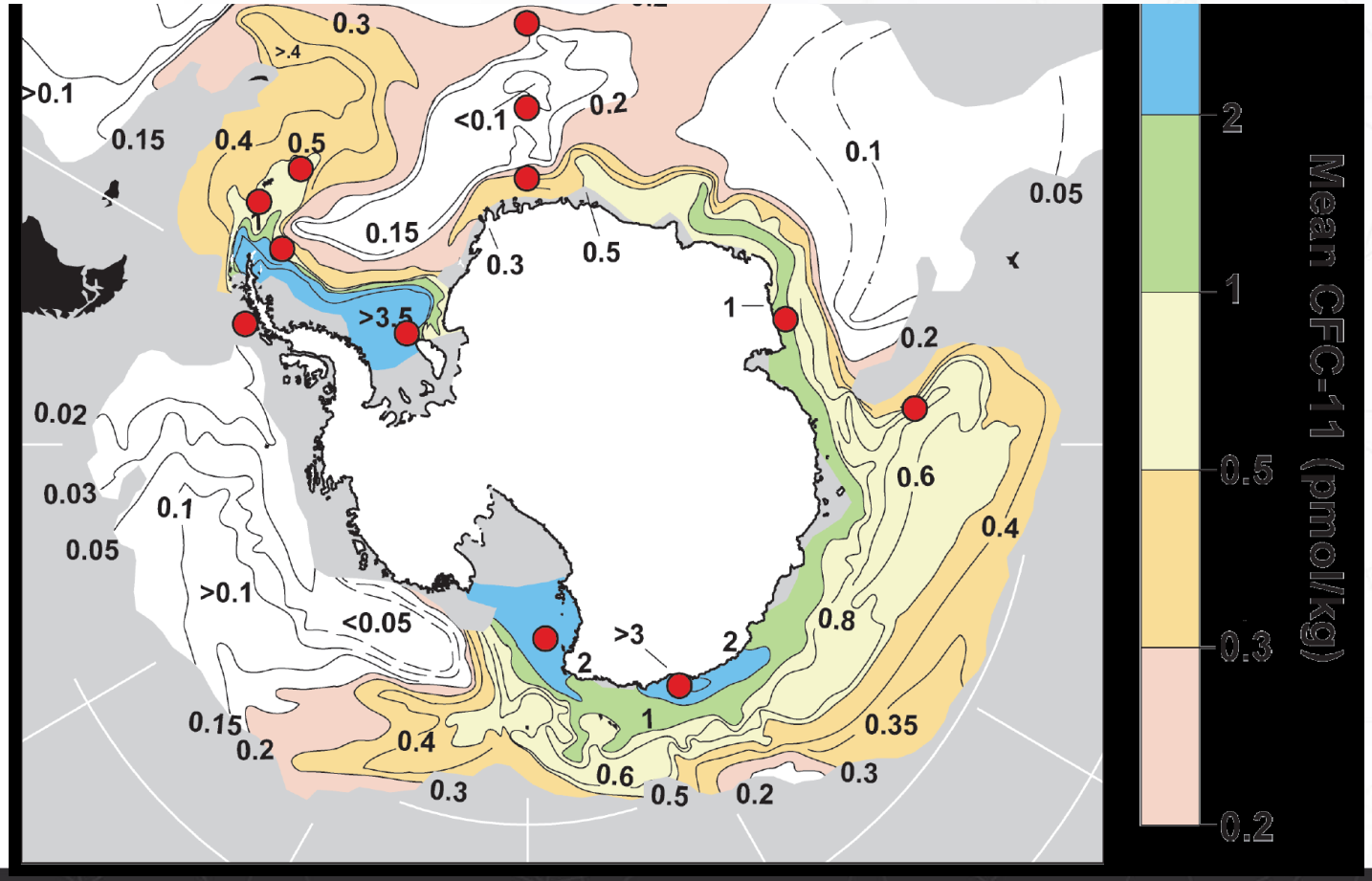
SO Heat and Freshwater Balance



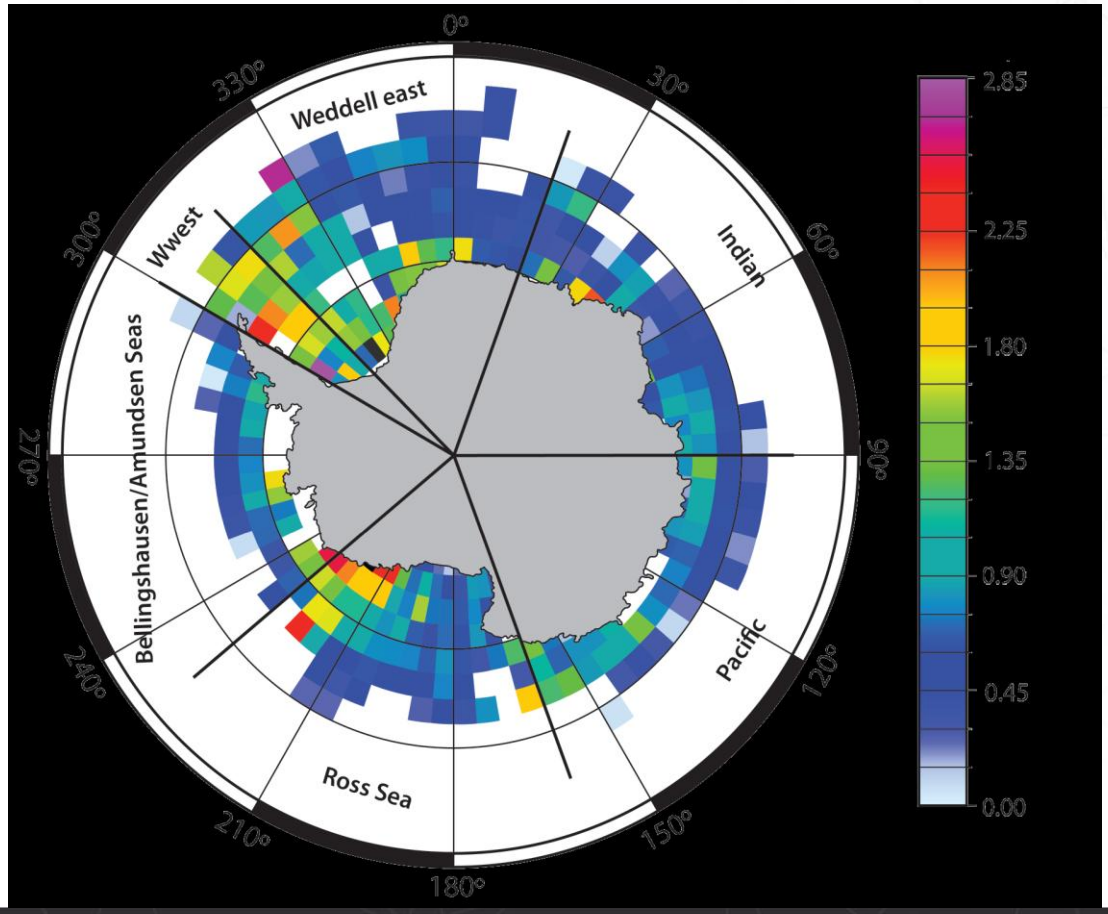
ARGO Floats-Ice Capable and Expanded Sensors



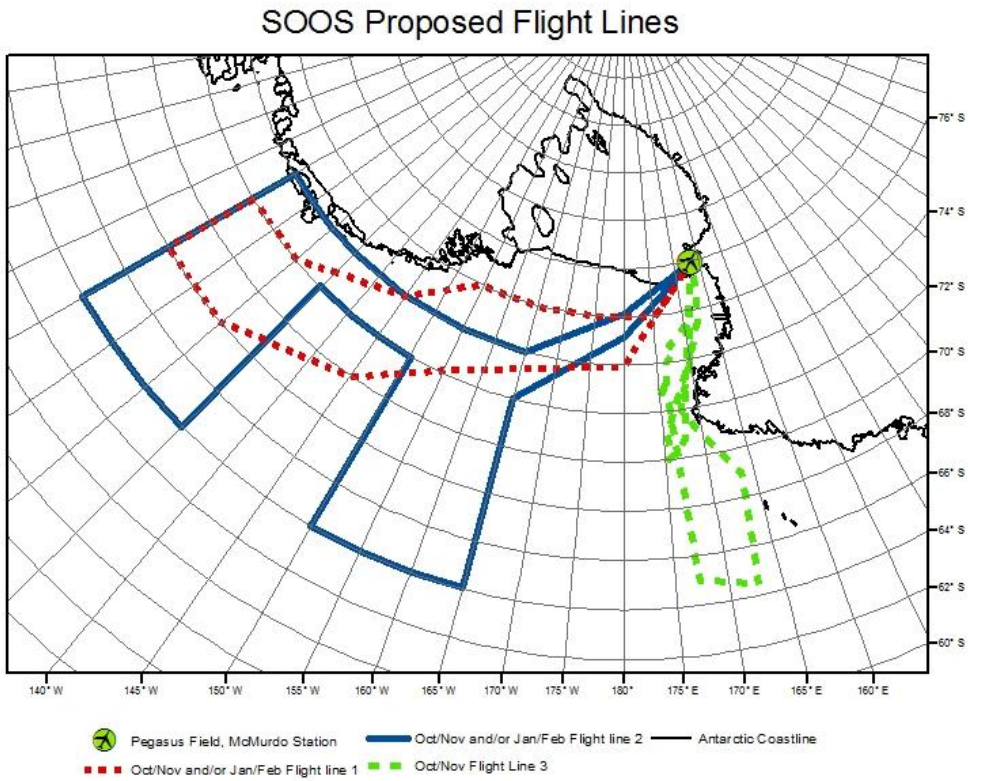
Moored Arrays-Continuous Measurements



Future of Antarctic Sea Ice
Sea Ice Thickness Fields from Ship Obs



Antarctic Sea Ice
Airborne Lidar And Photography



Digital Photos APIS 2000

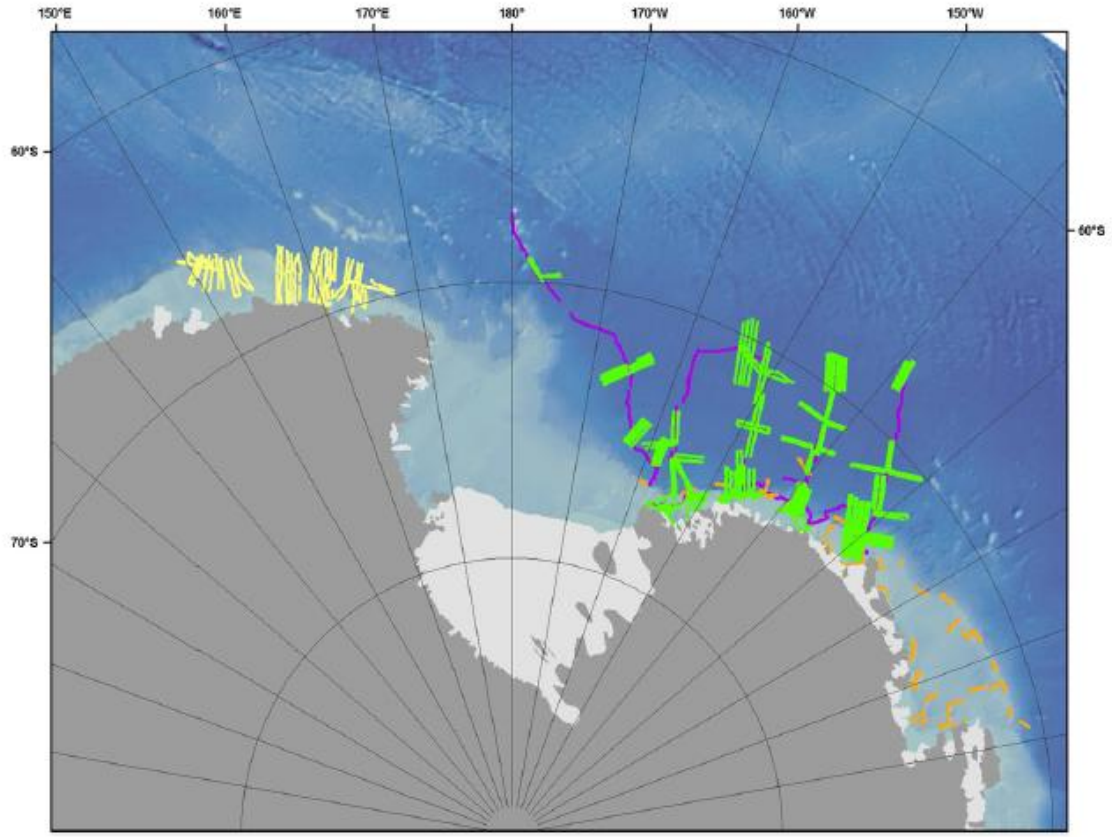


Fig. 1. Surveys for pack-ice seals the Amundsen and Ross Seas between 20 December 1999 and 24 March 2000. Aerial survey tracks are shown in green (*Palmer I*) and yellow (Polar Star III); ship survey tracks are shown in purple (*Palmer I*) and orange (*Palmer II*). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of the article.)

Antarctic Sea Ice
Airborne Lidar and Digital Photography

Gordon Research Conference on Polar Marine Science

- 9-10 March 2013, Gordon Research Seminar for Grad Students, PostDocs, Early Career Researchers (Travel Money available)
- 10-15 March 2013 GRC
- Ventura CA,
- www.grc.org, Future Meetings, Polar Marine Science
- Chair, Christine Michel, Canada,
- Vice-Chair, Paul Wassmann, Norway