SOCCOM

Southern Ocean Carbon and Climate Observations and Modeling

An introduction to the Southern Ocean Carbon and Climate Observations and Modeling project

Matthew Mazloff (mmazloff@ucsd.edu)
Some slides from L. Talley and K. Johnson

SOCCOM funded by NSF for 6 years with additional support from NOAA and NASA

Directorate

Jorge Sarmiento, Princeton

Theme I Observations

Lynne Talley, SIO

Theme II Modeling

Joellen Russell, U. Arizona

Theme III Education & Outreach

Heidi Cullen, Climate Central

Ken Johnson

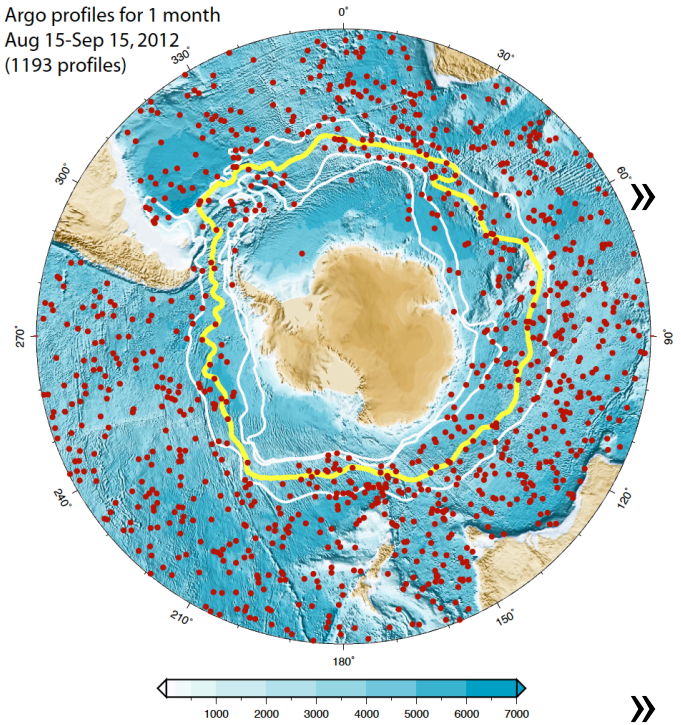
Steve Riser, U. W.

Biooptics (Emmanuel Boss, Maine, Oscar Schofield, Rutgers)

SOCCOM

23 senior researchers at 11 institutions

Southern Ocean Carbon and Climate Observations and Modeling (SOCCOM): Jorge Sarmiento lead PI



- Argo float profiling for temperature & salinity has completely transformed ocean observing over the past 10 years (left), but with significant Southern Ocean undersampling in sea ice regions
- SOCCOM (U.S.) is funded now do the same for the carbon system, ocean acidification, nitrate, oxygen, and net community production (*including sea ice regions*) by measuring biogeochemical parameters (pH, nitrate, oxygen, optics) in addition to standard Argo T/S
- Also a state estimation effort (SIO) and modeling component (GFDL/NCAR)
- 6 years; $21M; lead Princeton;

1. SOCCOM observations

(L. Talley, K. Johnson, S. Riser, E. Boss (NASA), S. Gille, A. Dickson)

Biogeochemical Argo (5 to 10 day profiling to 2000 m)

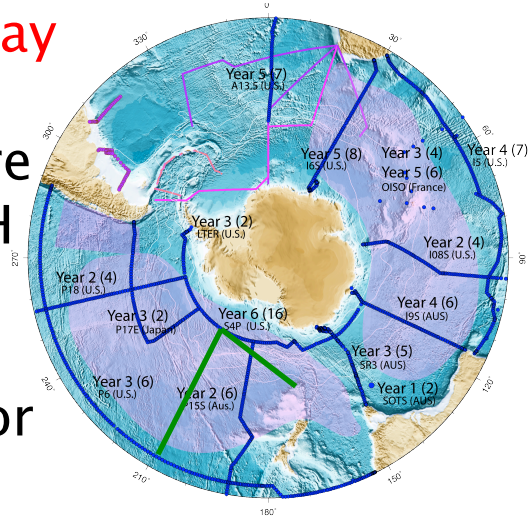
Temperature, salinity, pressure

Dissolved oxygen, Nitrate, pH

Bio-optics

pH is a newly-developed sensor

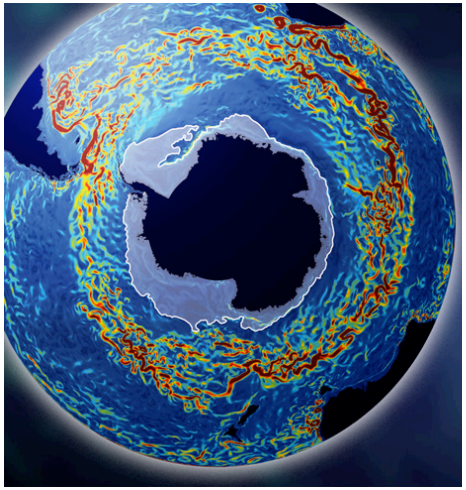
(K. Johnson; T. Martz)



2. SOCCOM state estimation

Southern Ocean State Estimate

M.Mazloff, A. Verdy



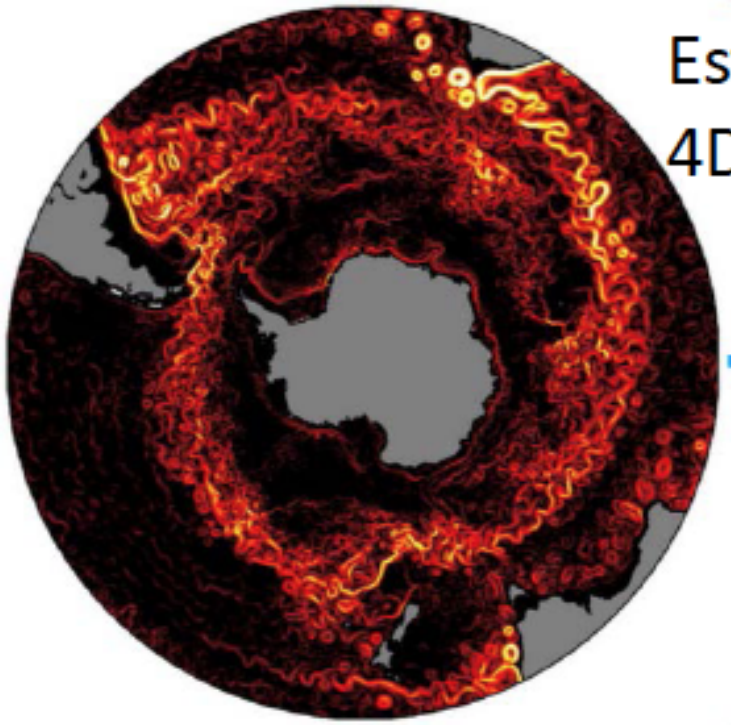
3. SOCCOM modeling

Development of SOMIP; interface with process modeling

J. Russell, J. Sarmiento, I. Kamenkovich & GFDL (Griffies, Stouffer, Dunne, Winton)

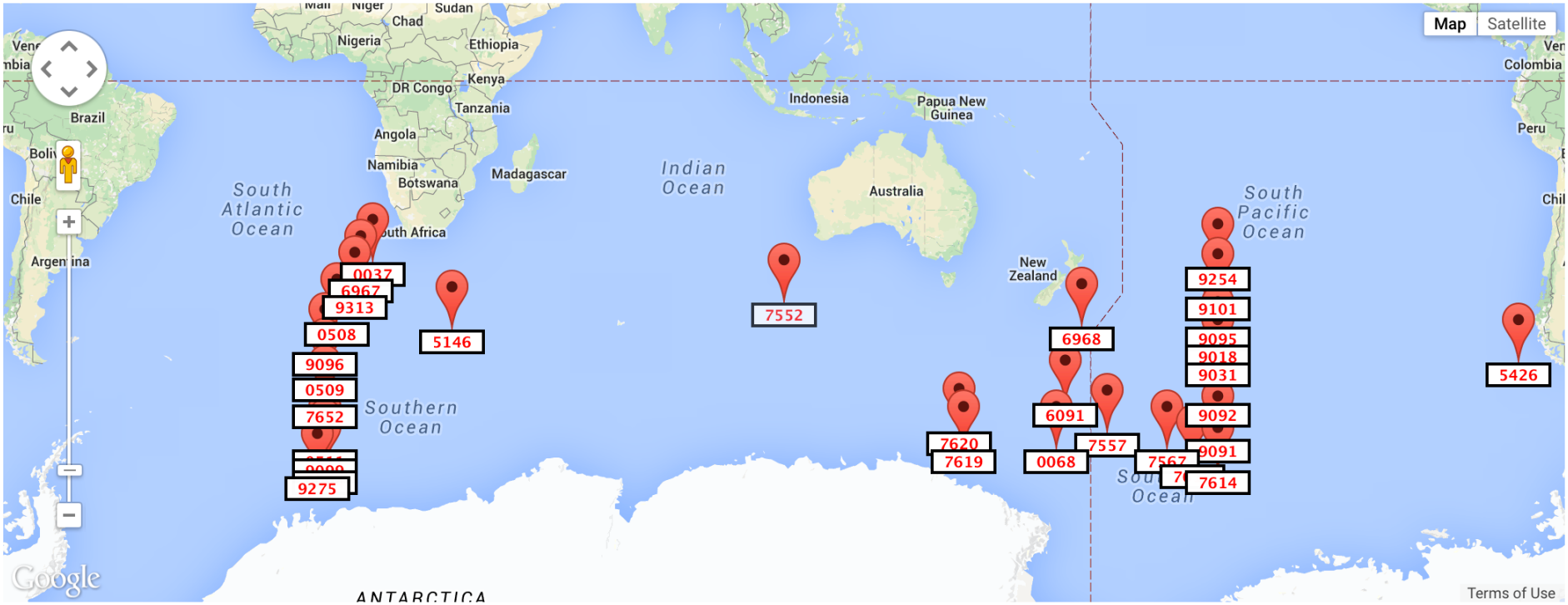
200 profiling floats over 6 years with pH, NO_3^-, O_2, biooptics with calibration tied to GO-SHIP observations

Southern Ocean State Estimate model to get 4D fluxes



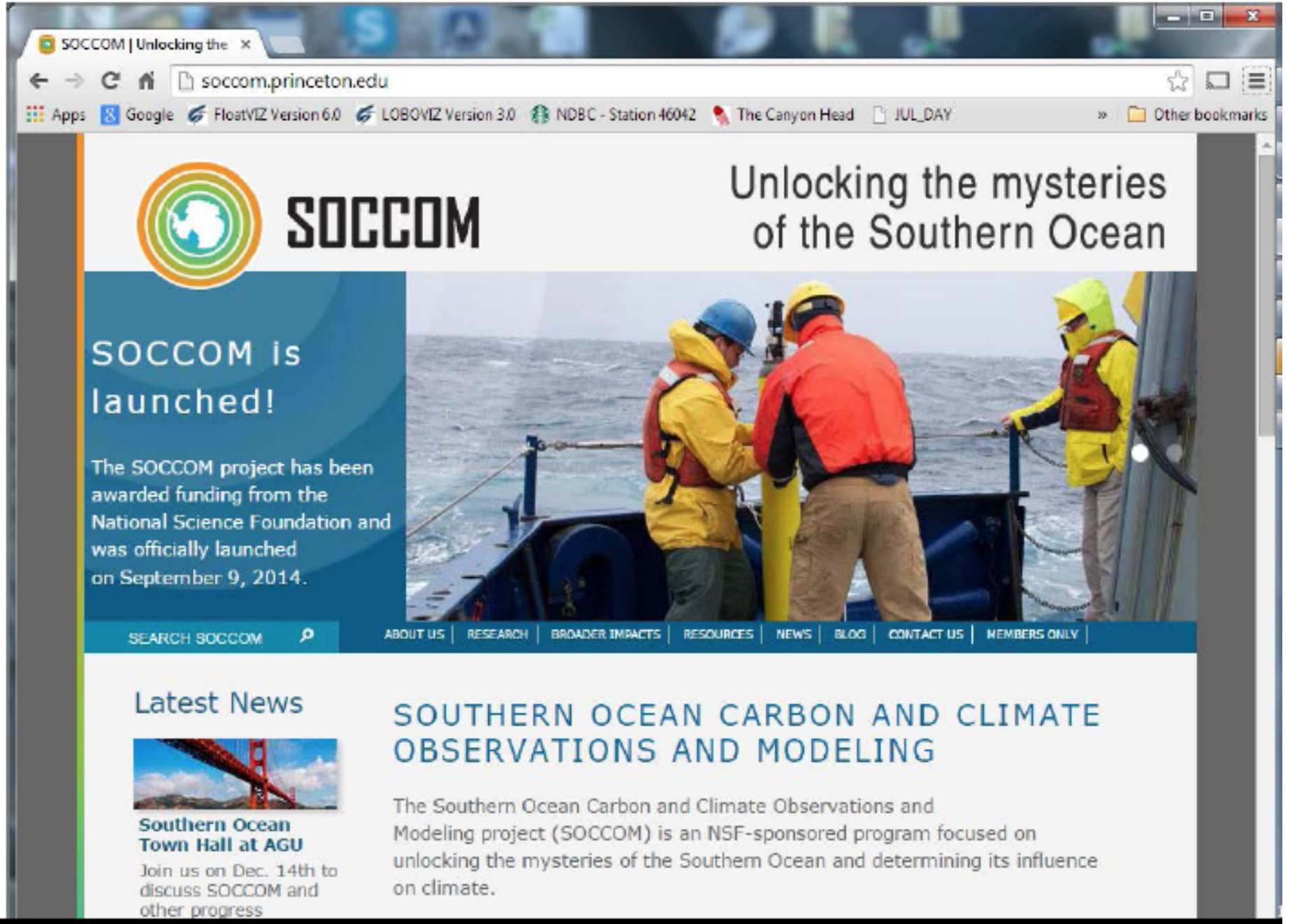
Improved coupled climate model (GFDL) predictions of Southern Ocean role in carbon and climate

Biogeochemical profiling floats in the Southern Ocean. Click a float to access data and profile plotting.



T & S Argo data posted as part of Ago.
BGC data in near real-time and posted online at SOCCOM (soccom.princeton.edu) for public use.

soccom.princeton.edu



SOCCOMViz 6.0 - Data visualization for SOCCOM, a US NSF sponsored project focused on carb and climate in the Southern Ocean

Using ISUS nitrate sensors and Deep-Sea DuraFET pH sensors in Webb Research Apex and Sea-Bird Electronics Navis profiling

What's new? Twelve new SOCCOM floats are at sea on the German Research Vessel Polarstern. These floats will be deplo the South Atlantic and across the Weddell Sea. The first float (0037) was deployed Dec. 5, 2014. Twelve floats were deplo during March/April 2014 in the Southern Ocean from R/V Revelle on the US Repeat Hydrography P16S cruise . Seven of t floats have pH sensors.

Quick Instructions | Float list and link to complete Ascii data files | Data Adjustments | Map of float tracks | Apex/ISUS descriptio page

Select Output Type and Send Request:

Plot
Text File
SEND

Raw Data or Adjusted Data:

Raw
Adjusted

Data Quality Flag:

All Data
Good and Quest.
Good Only

What dates?

All Dates available
Week Ending on End Date
Month Ending on End Date
Specify Start/End Date

Change dates: (MM/DD/YYYY)

Start Date 09/17/2007
End Date 03/12/2015

Select Float (ctrl click for more than one)

5146SoOcn.....N/
5426DrakePass.....N/
6967SoAtlantic.....N
0068RossSea .....N/C
6968SoOcn.....N/
7552SoOcn.....N/
7619SoOcn.....N/
7620SoOcn.....N/
6091SoOcn.....O/
7557SoOcn.....N/
7567SoOcn.....O/
7613SoOcn.....N/
7614SoOcn.....N/
9091SoOcn.....pH
9092SoOcn.....pH
9031SoOcn.....pH
9018SoOcn.....pH
9095SoOcn.....pH
9101SoOcn.....pH
9254SoOcn.....pH
0037SoOcn.....N/
0508SoOcn.....N/
9313SoOcn.....pH
9096SoOcn.....pH
0509SoOcn.....pH
7652SoOcn.....N/
0511SoOcn.....pH
9094SoOcn.....pH
9275SoOcn.....pH
9099SoOcn.....pH

Select One X Variable

Nitrate[µM]
Depth[m]
Date
Salinity
Temperature[°C]
DensityAnomaly
Oxygen[µM]
OxygenSat[%]
Chlorophyll[µg/l
BackScatter[/m/s
CDOM[ppb]
pHinsitu[Total]
pH25C[Total]
Lon [°E]
Lat [°N]

Select Y Variables (ctrl click >1)

Nitrate[µM]
Depth[m]
Salinity
Temperature[°C]
DensityAnomaly
Oxygen[µM]
OxygenSat[%]
Chlorophyll[µg/l
BackScatter[/m/s
CDOM[ppb]
pHinsitu[Total]
pH25C[Total]
Lon [°E]
Lat [°N]

Autoscale X & Y axis : On / Off

Enter Ranges if Autoscale is O (Min & max ranges default to 200 if Autoscale off and box is empty. Depth ranges are entere negative values on Y axis and positive values on X axis.)

X Min: X Max:
Y Min: Y Max:

Y Stack: (In a single graph, multiple Y variables or multiple stations are stacked vertically if it is On) On / Off

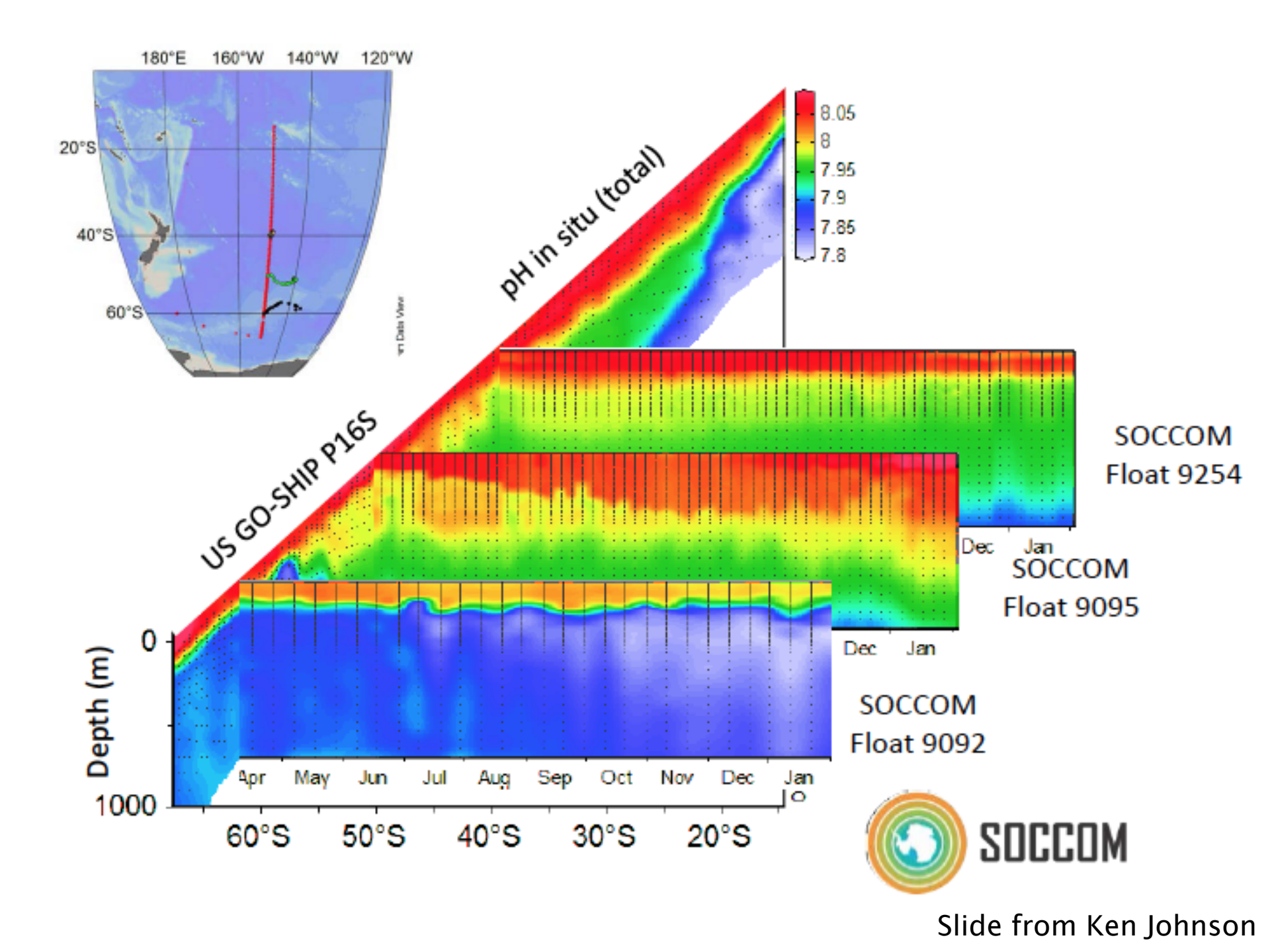
Enter Min and Max Depth range for data used in Time Series Plot (X Var = Date)

Min De 0
Max De 1050

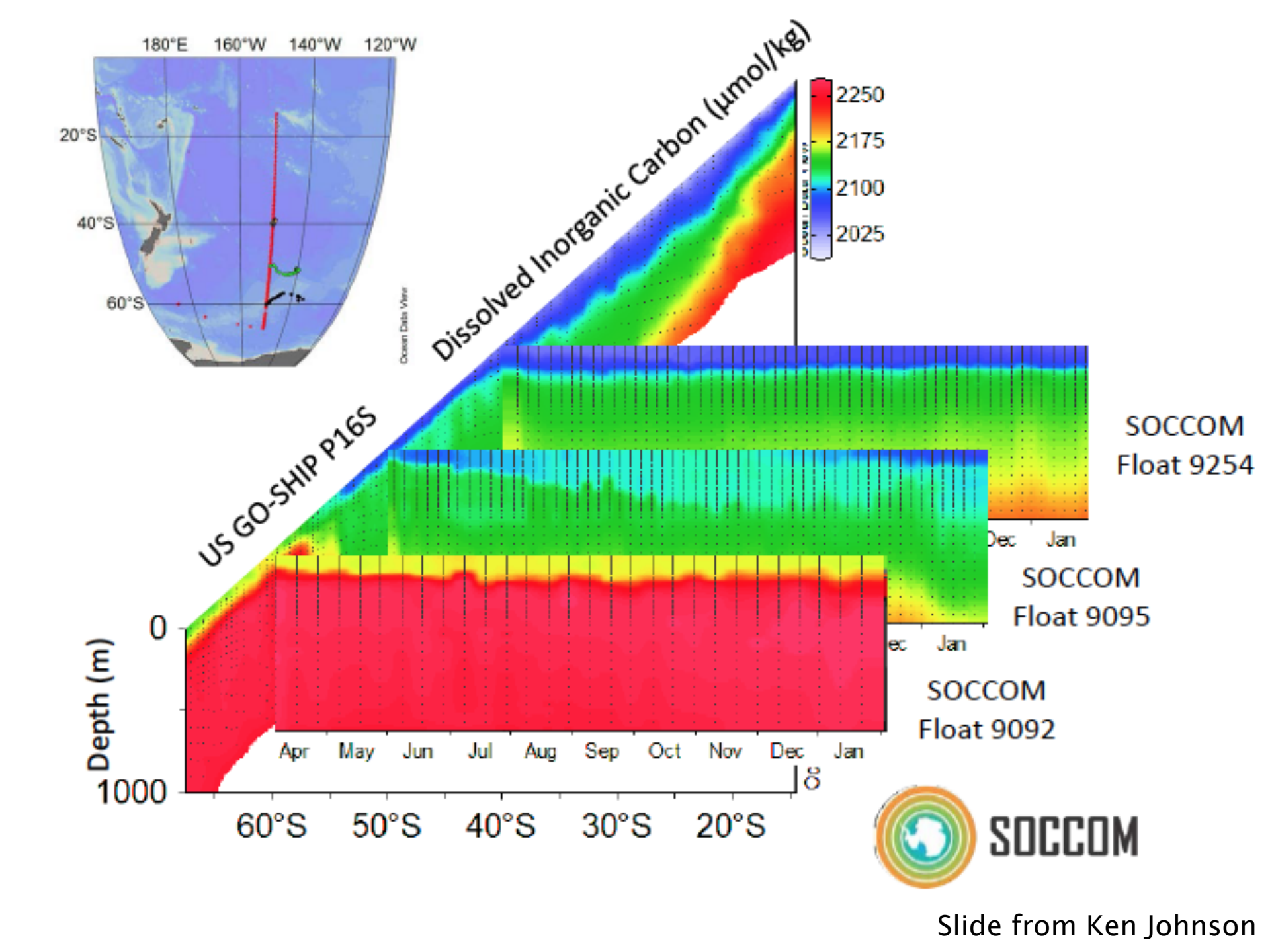
N: These floats have an ISUS or SUNA nitrate sensor.
O: These floats have an Aanderaa Optode oxygen sensor.
O6: These floats have a Sea-Bird SBE63 optical oxygen sensor.
pH: These floats have a Deep-Sea DuraFET pH sensor and pH is reported on the total proton scale.
FL: These floats have FLBB biooptical sensors for chlorophyll (470/695 nm Ex/Em) and backscatter (700 nm, 140 degrees).
FLM: These floats have a WET Labs MCOM FL, BB and CDOM optical sensor.

d: These floats have exhausted their batteries and are not operating.

MBARI Chem Sensor Home Page | UW Float Page

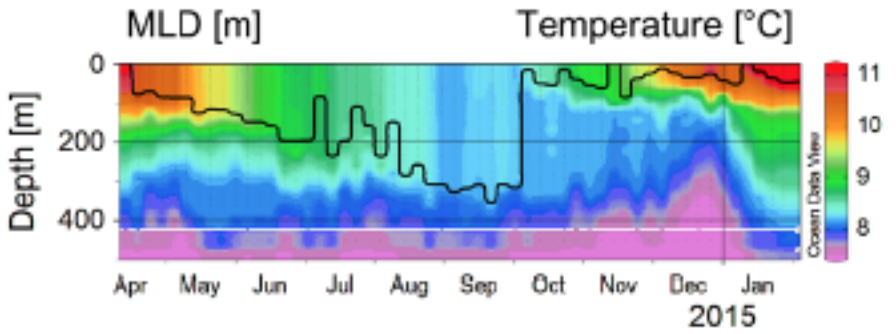


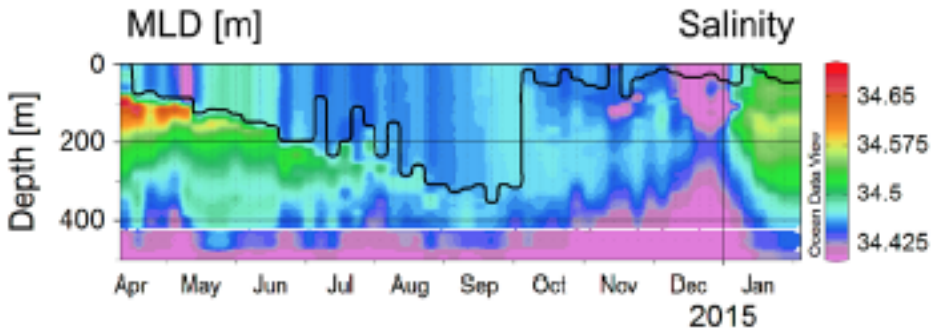
Slide from Ken Johnson

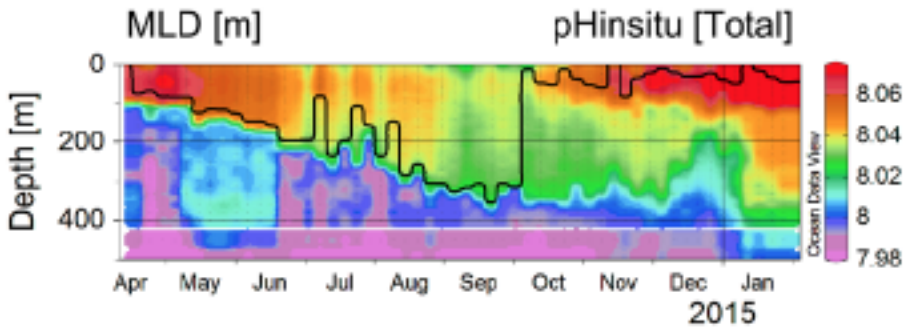


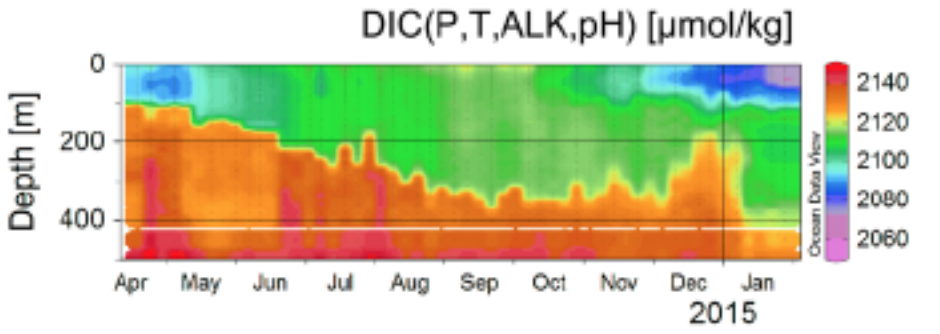
Slide from Ken Johnson

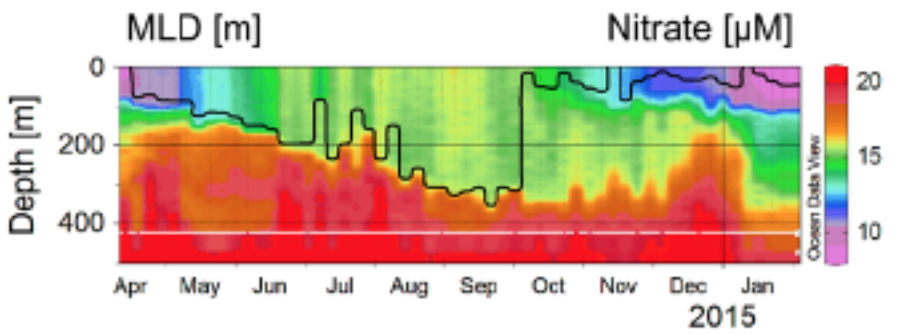
Float 9095 spring bloom carbon cycle

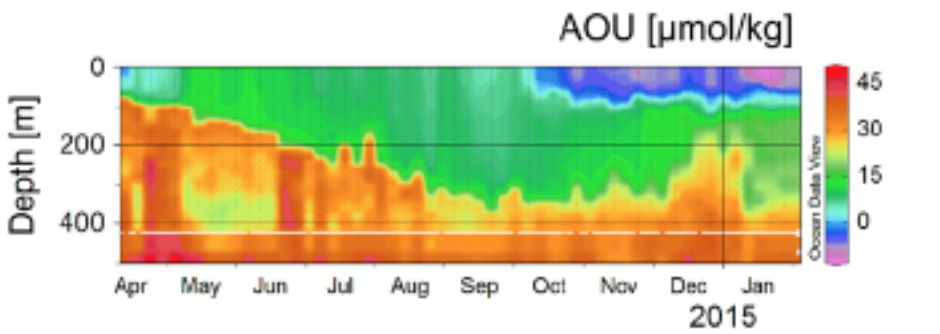


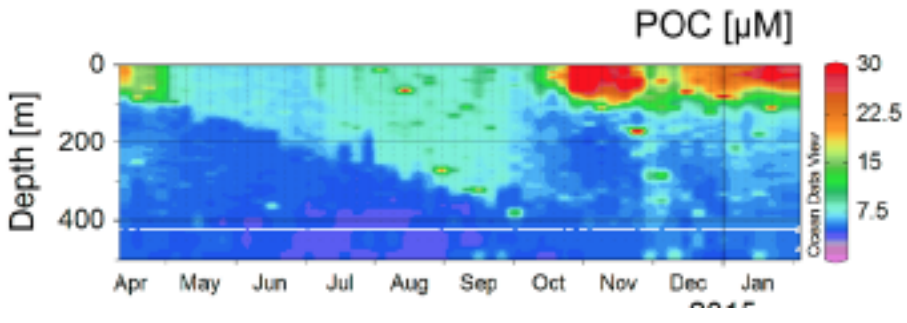


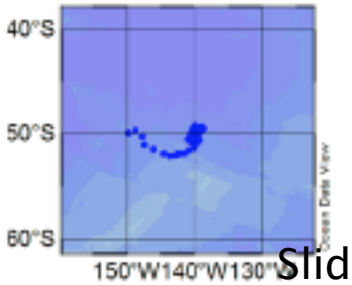












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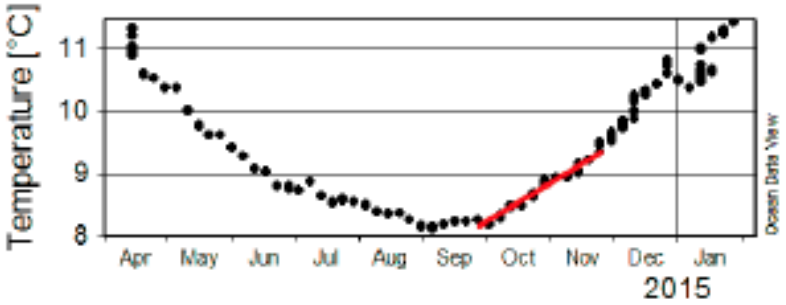
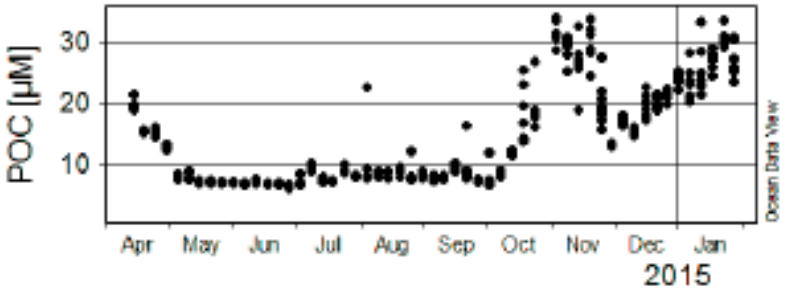
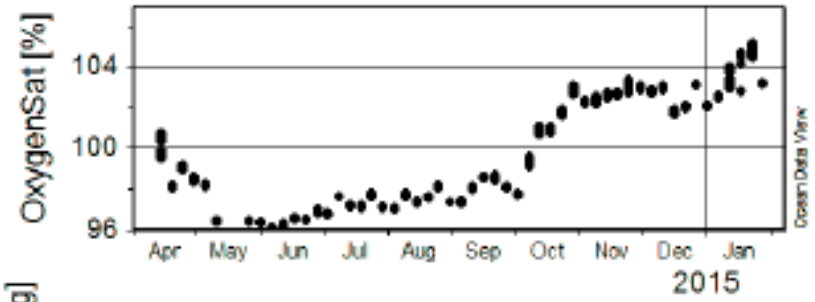
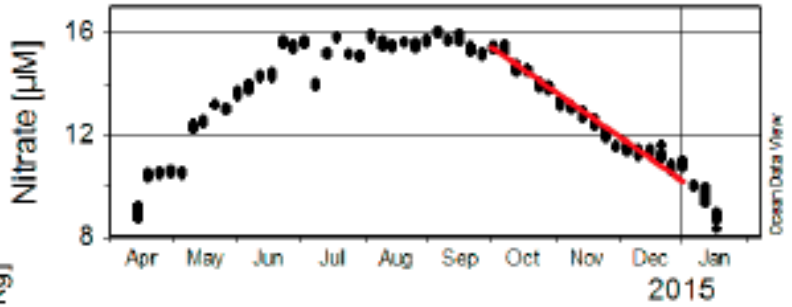
Float 9095 spring bloom carbon cycle (upper 40 m)

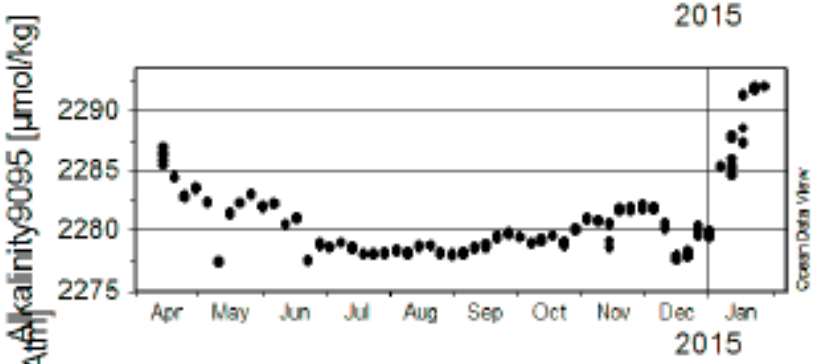




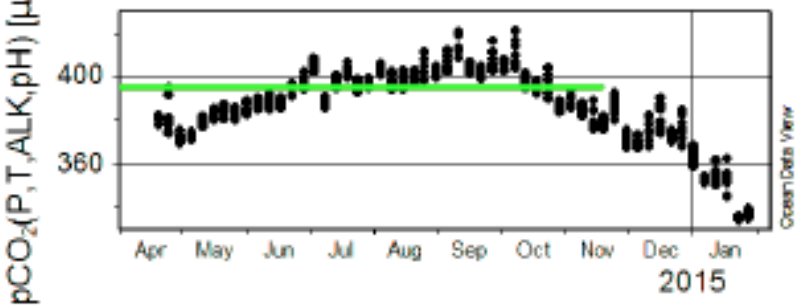


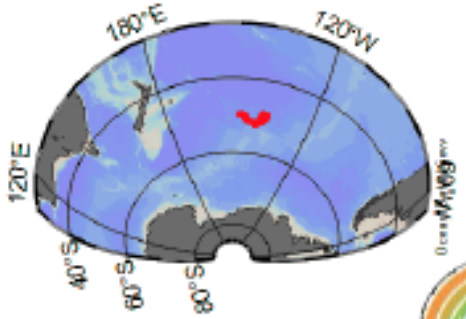


Δ = 6.9 µM



Δ = 42 µM





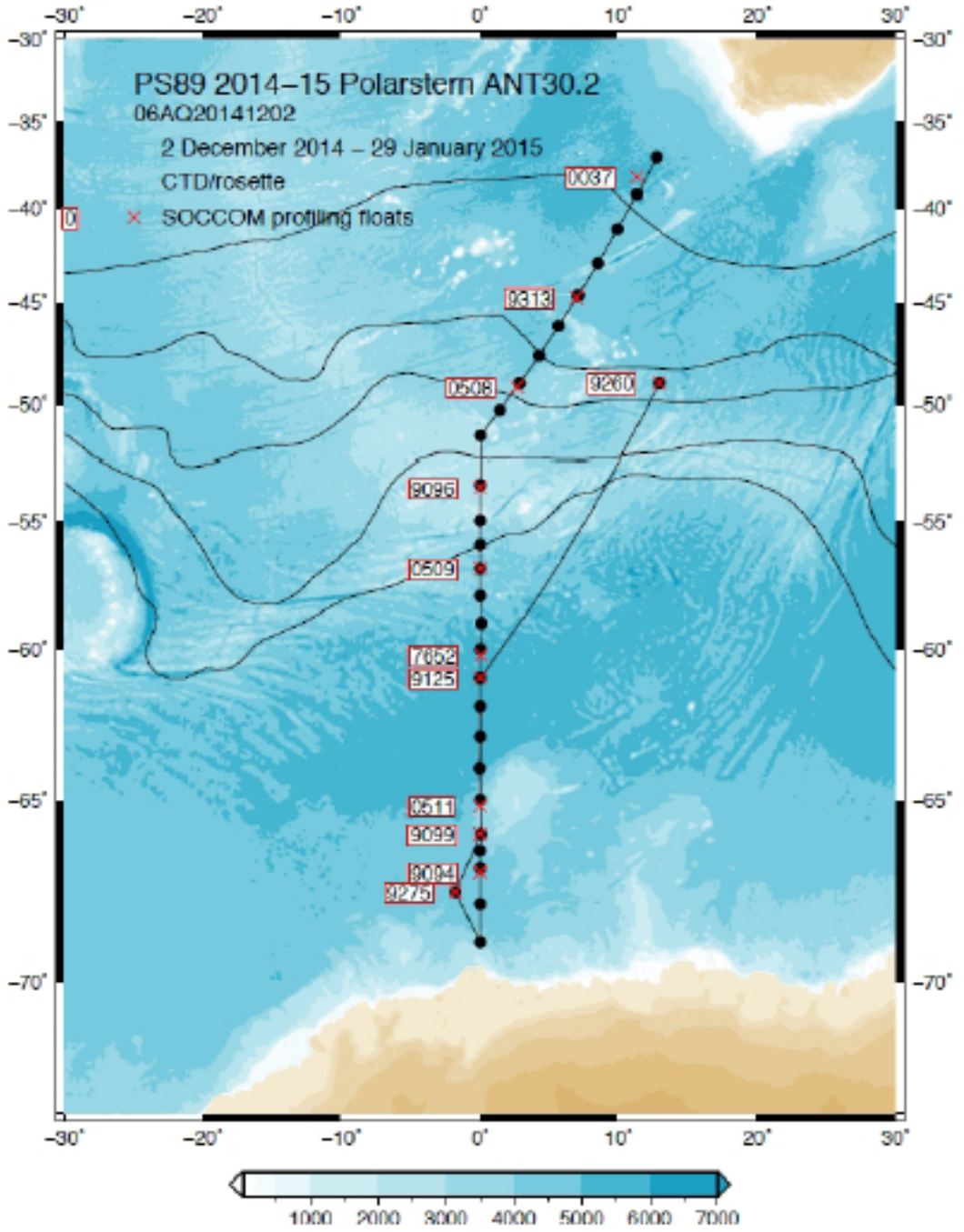
Redfield

C/N = 6.6

Float = 6.2

SOCCOM

Slide from Ken Johnson

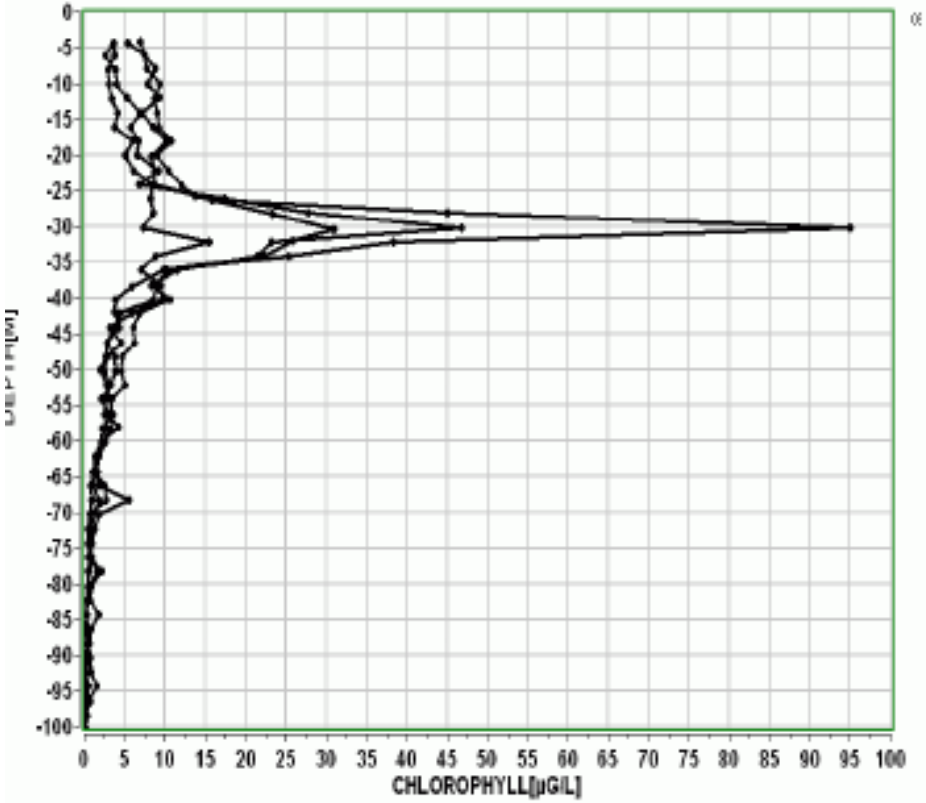


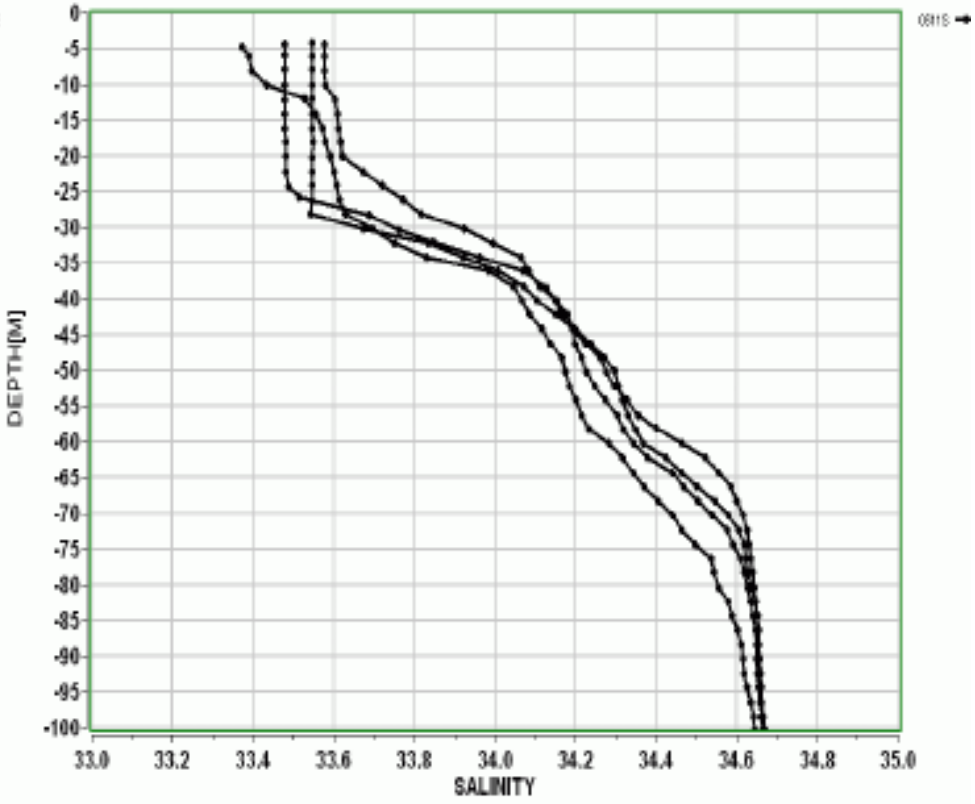
Slide from Ken Johnson

SOCCOM

SOCCOM float 0511 at 65 South

0 Chlorophyll ug/L 100 33 Salinity 35





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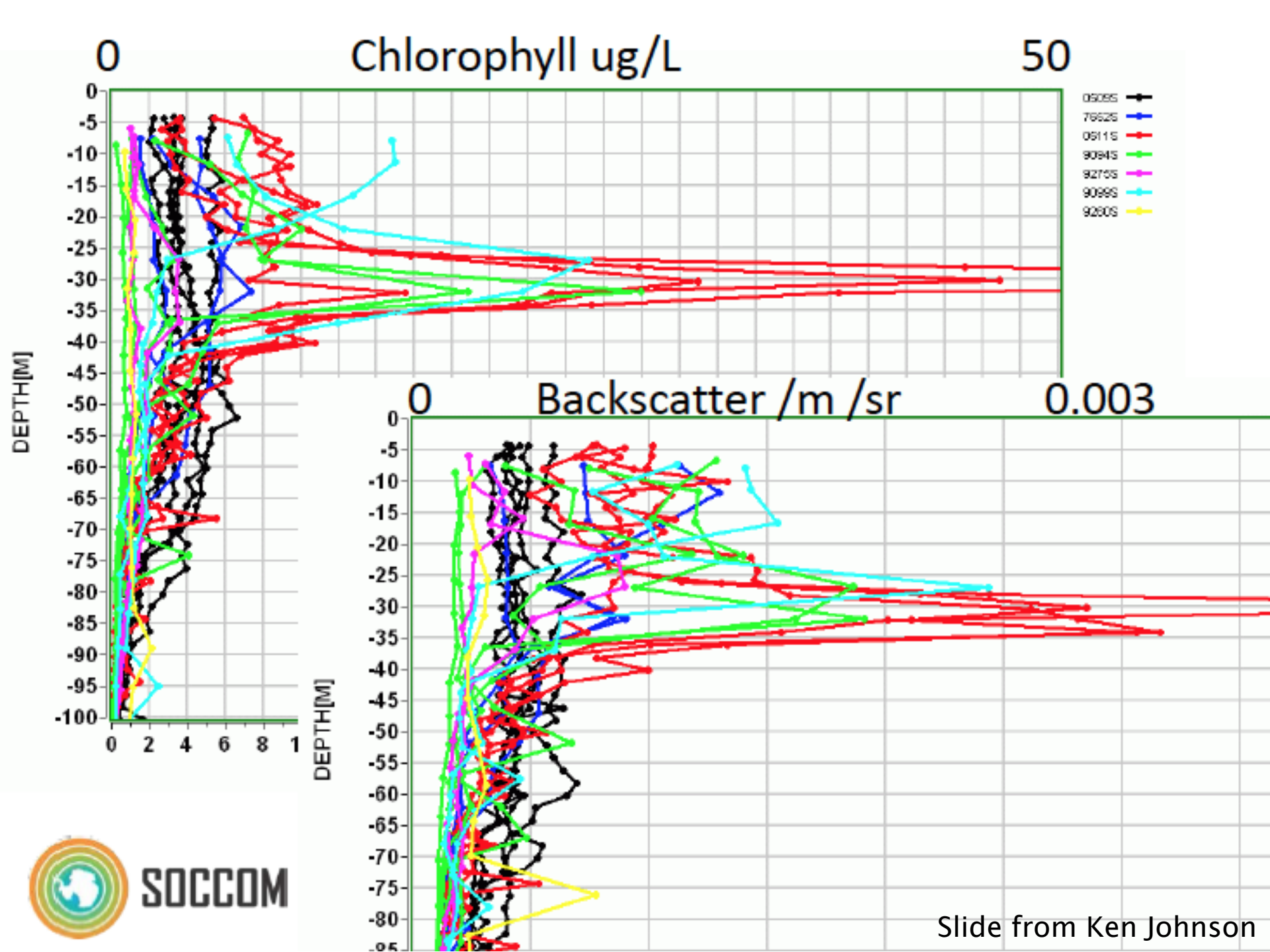
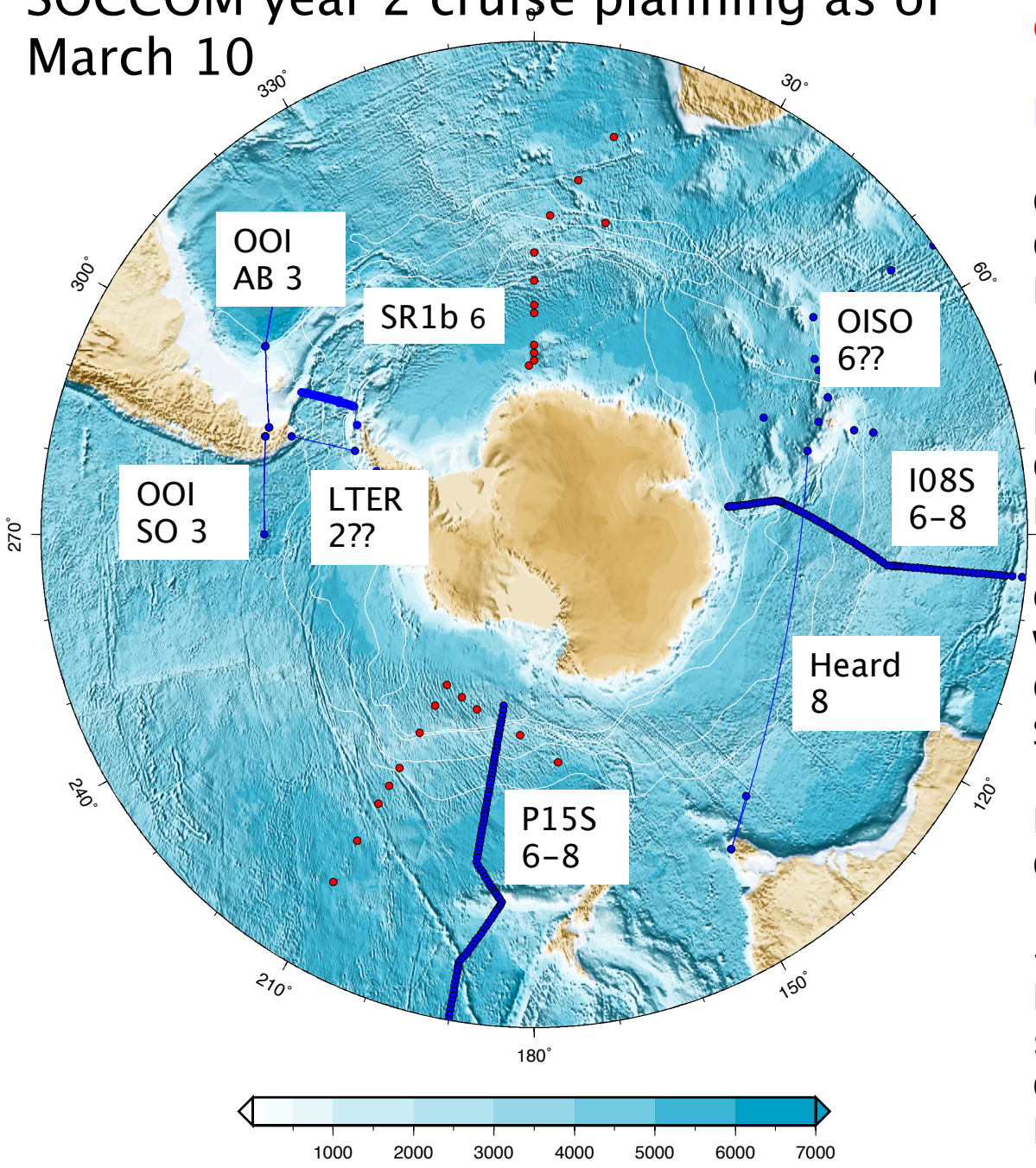
SOCCOM



Slide from Ken Johnson

SOCCOM year 2 cruise planning as of March 10



Red – previous SOCCOM float deployments

Blue – Year 2 proposed

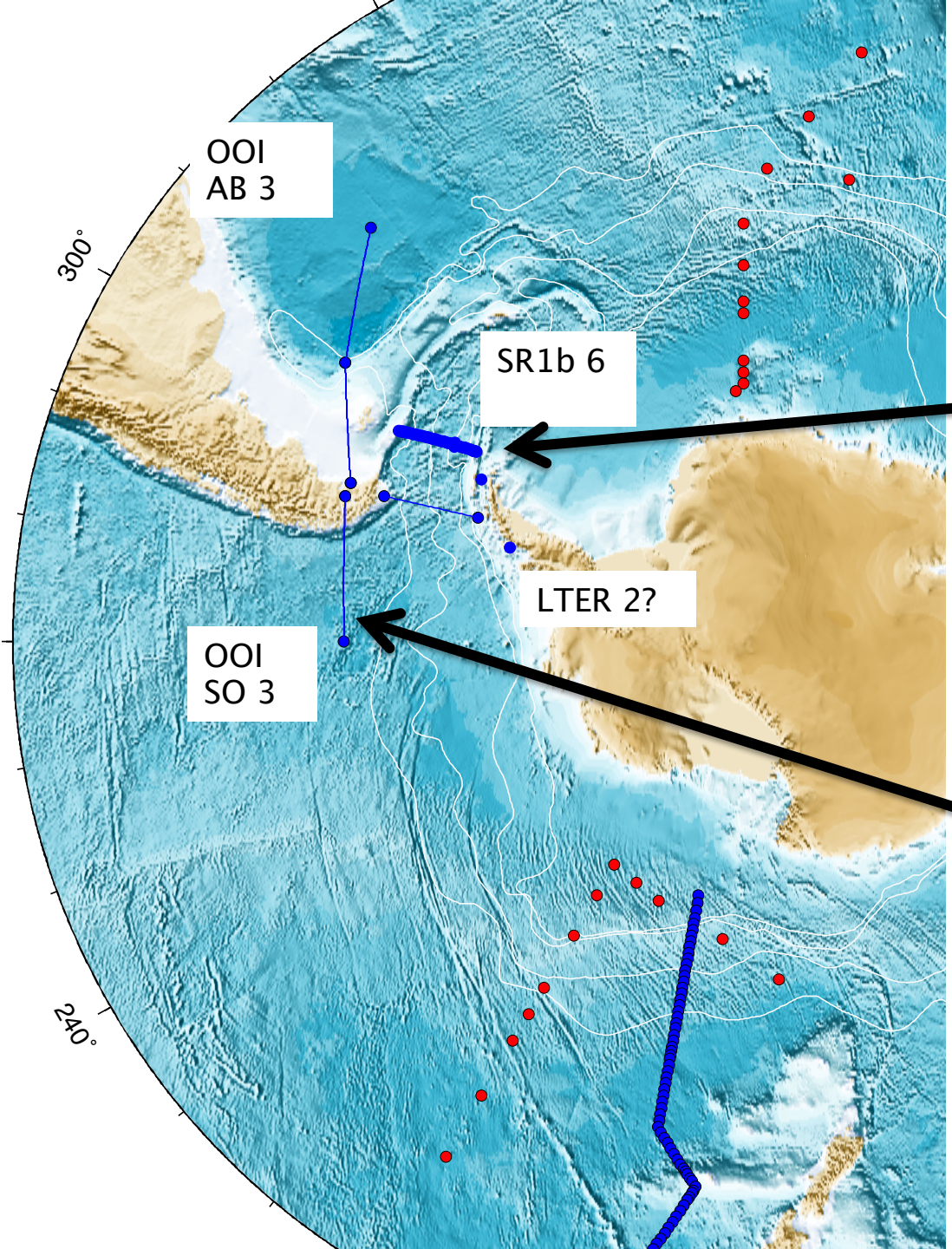
GO-SHIP I08S (U.S.; Swift; Revelle)
GO-SHIP P15S (Aust.; Sloyan; Investigator)

CSIRO eddy (Aust.; Strutton; Investigator)
CSIRO Heard Island (Aust.; Chase, Bowie; Investigator)

OOI Southern Ocean (U.S.; R. Weller; Palmer)
OOI Argentine Basin (U.S.; U. Send; Palmer)

NOC SR1b (UK; Firing; James Clark Ross

------ OTHER??----
LTER (US; Ducklow; Gould) – space issue on Gould
OISO (France; Claustre; Marion Dufresne) – no response

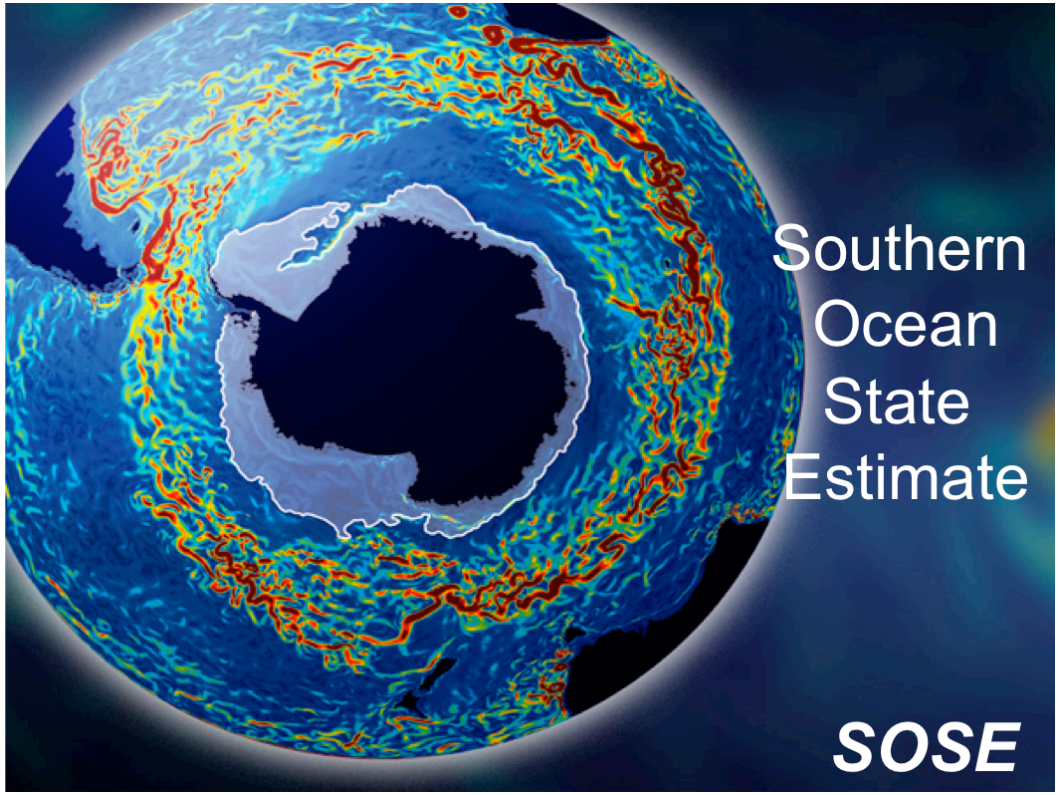


Most relevant to ORCAS collaboration:

NOC SR1b (UK; Firing; James Clark Ross)
17–29 Dec.
6 SOCCOM floats likely to be deployed

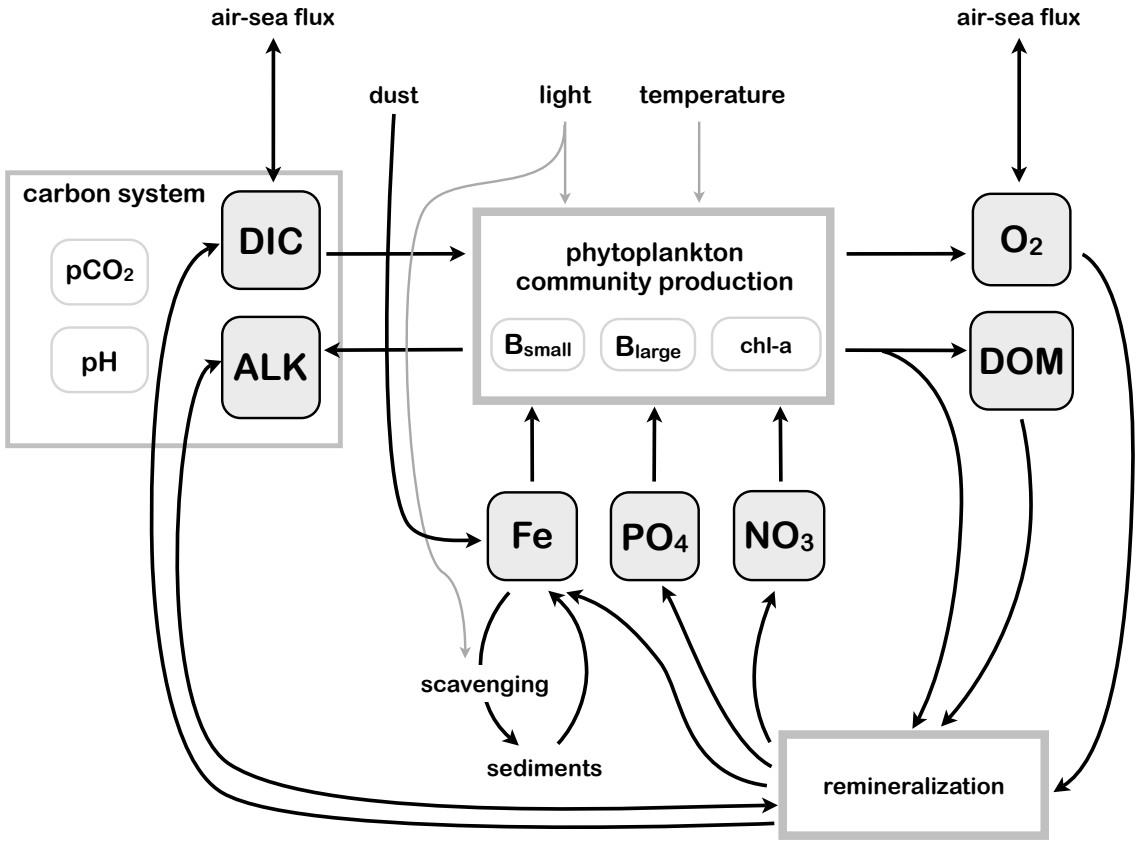
OOI Southern Ocean (U.S.; R. Weller; Palmer)
9 Dec. – 4 Jan.
3 SOCCOM floats likely to be deployed.

The Southern Ocean State Estimate (SOSE) physical model



- 78° S to the equator
- 1/12° with 104 levels
- 1/3° and 1/6° with 52
- Atmospheric boundary layer scheme (ERA-Interim first guess atmos. State)
- full sea-ice model
- KPP parameterization
- 2005 to ~2 years from present
- sose.ucsd.edu

Biogeochemical model



Using BLING Version 2, so DOM is now DOP, DON

SOMIP (Southern Ocean Model Intercomparison Project)

- With OMDP
- Goal is improvement in carbon modeling and understanding of response to wind, in coupled climate models
- Develop wind perturbation, freshwater forcing protocols for SOMIP
- Metrics developed starting with US CLIVAR SOWG leadership (J. Russell and I. Kamenkovich, chairs)

SOCCOM

Southern Ocean Model Intercomparison Project

- Wind forcing
  - SAM changes in winds: contraction, strengthening
  - katabatics
- Hosing/freshwater perturbation experiments
  - Steric sea level changes; watermass changes
  - Experimental design questions: just at surface or inject freshwater at depth?
- Both? Other? Depends on mutual interests and critical mass of models participating.