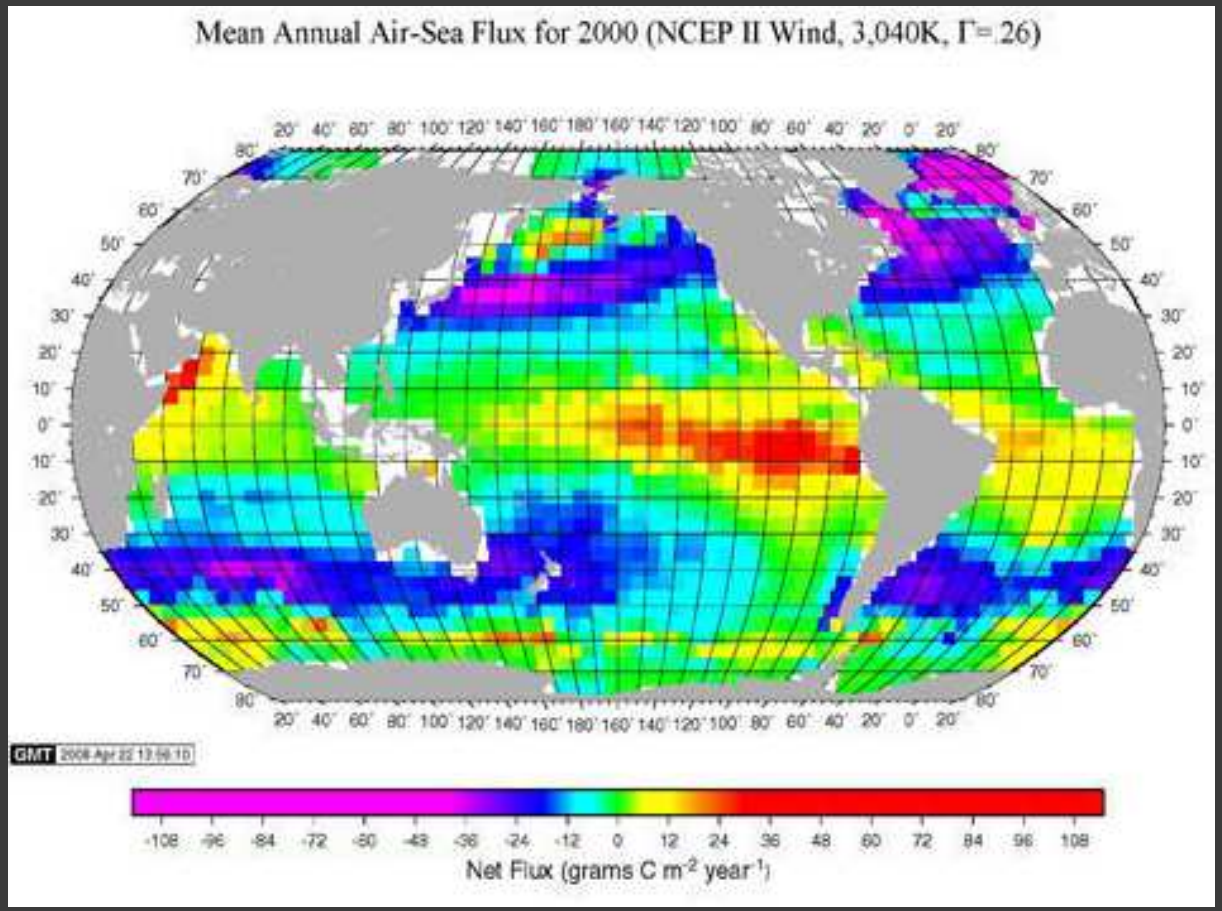
MECHANISMS CAUSING THE INTESE pCO_2 DRAW-DOWN AT THE PACIFIC SUBARCTIC-SUBTROPICAL BOUNDARY



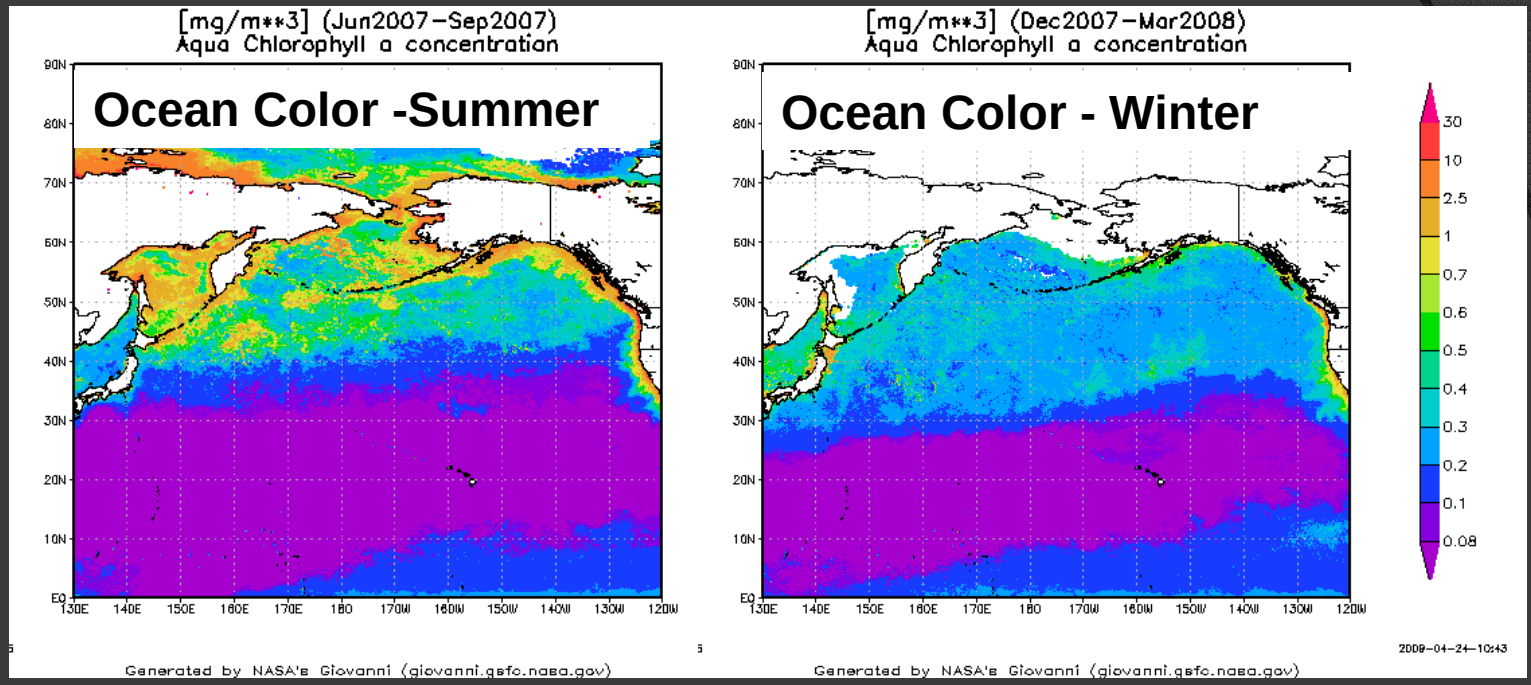
Mean Annual Air-Sea Flux for 2000

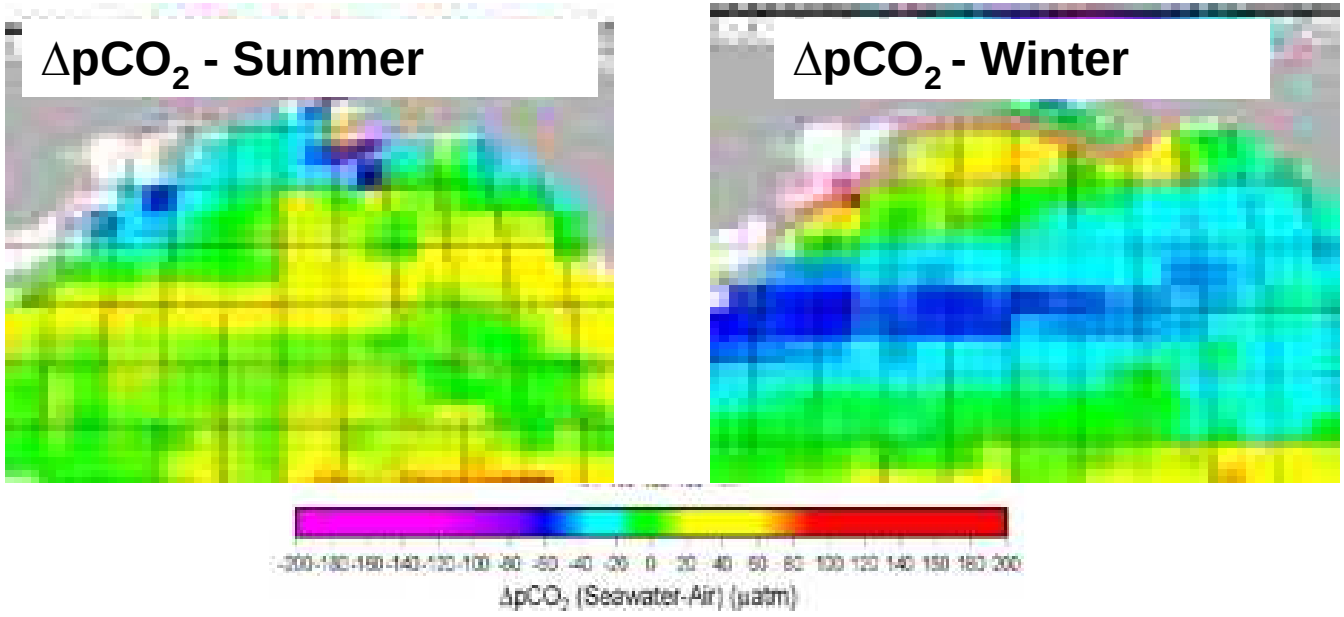
Taro Takahashi data base, www.ldeo.columbia.edu

A proposed pilot project to study upper ocean oxygen production OCB

Float-Glider Workshop April 2009 Steve Emerson and friends

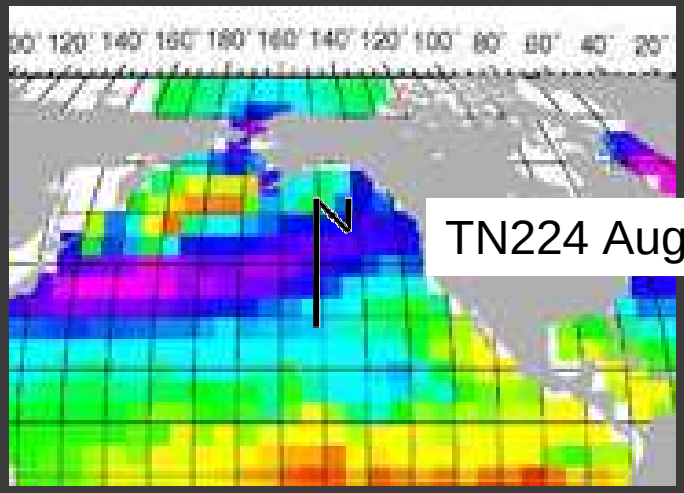
SEASONALITY IS VERY IMPORTANT



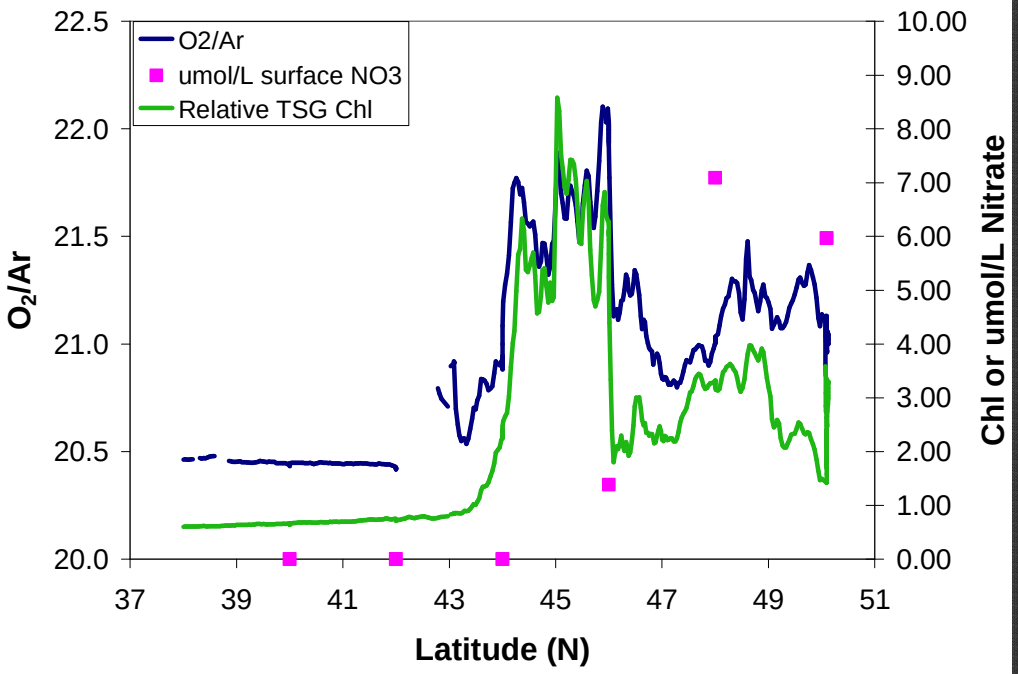


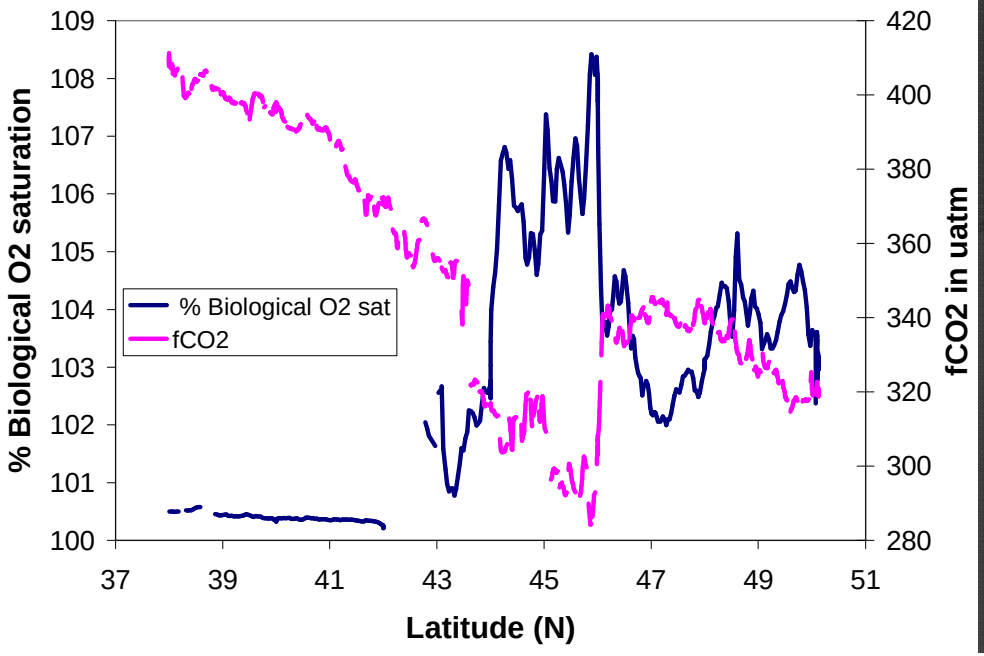
HOW IMPORTANT ARE BIOLOGICAL PROCESSES?

Lessons From The Eastern North Pacific



TN224 Aug 08

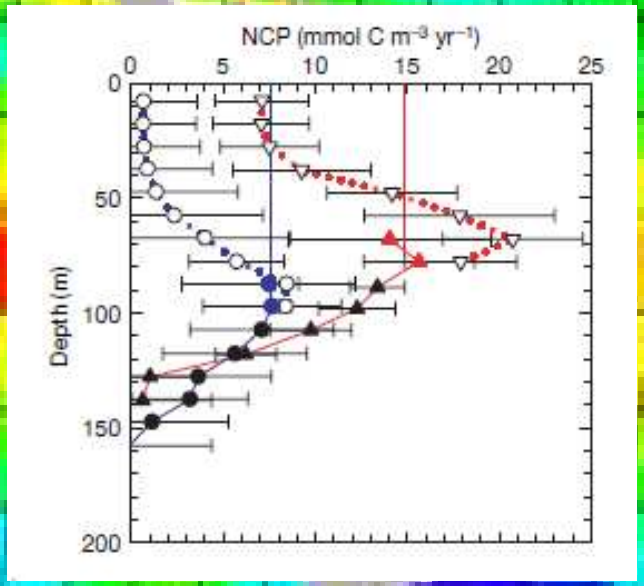




PROPOSAL: Deploy a Group of Floats at Subtropical-Subarctic Boundary in the Western North Pacific

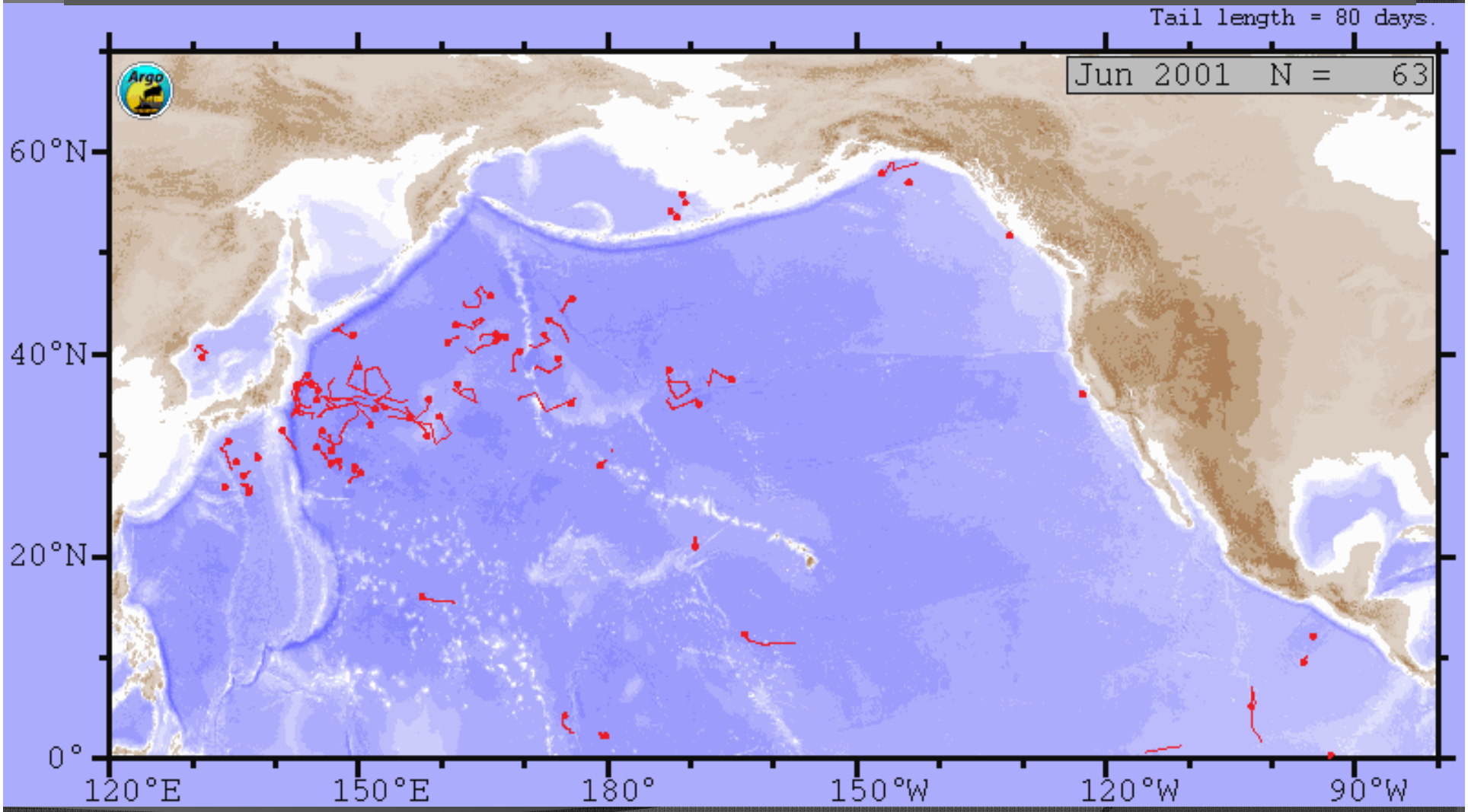
Dana Swift Holding an ARGO Float

Float End Cap Showing O_2 Sensors



Riser and Johnson, 2008 Figure 4 showing Net Biological Carbon Production determined form Argo O_2 Data

IF WE PUT ARGO FLOATS INTO THE OCEAN IN THE WESTERN PACIFIC AT THE GYRE BOUNDARY WHERE DO THEY GO ?



Freeland ARGO Site: www.pac.dfo-mpo.gc.ca/sci/osap/projects/argo/argo_e.htm

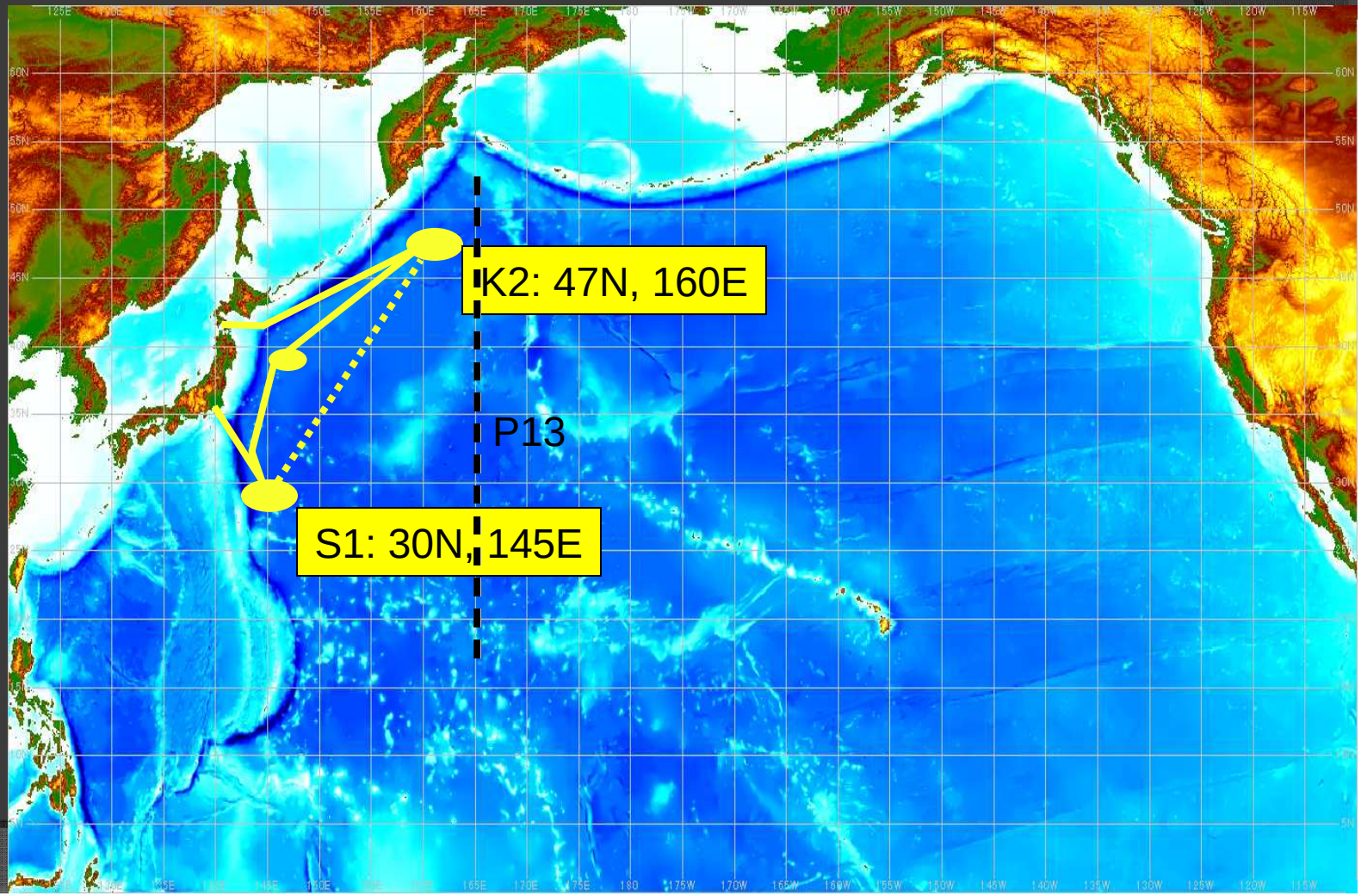
COLLABORATIONS: THE JAPANESE PACIFIC CARBON PROGRAM

Toshiro Saino (Personal communication)

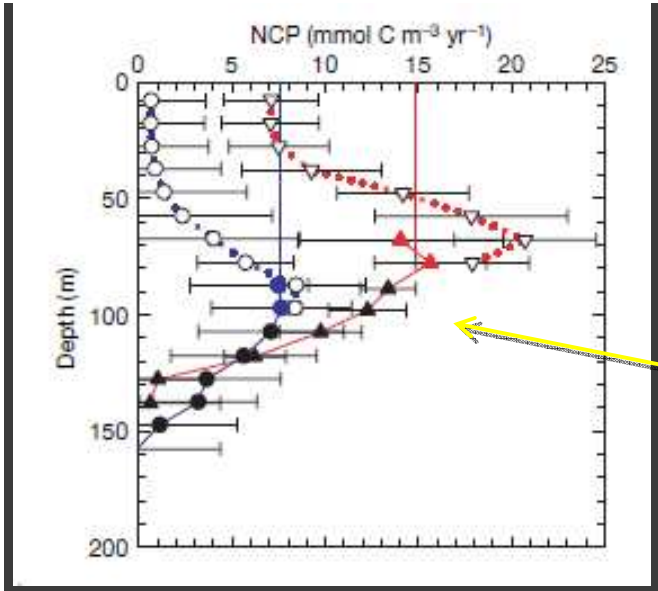
Two Time Series Stations: K2 and S1

Mirai Cruises Between them:

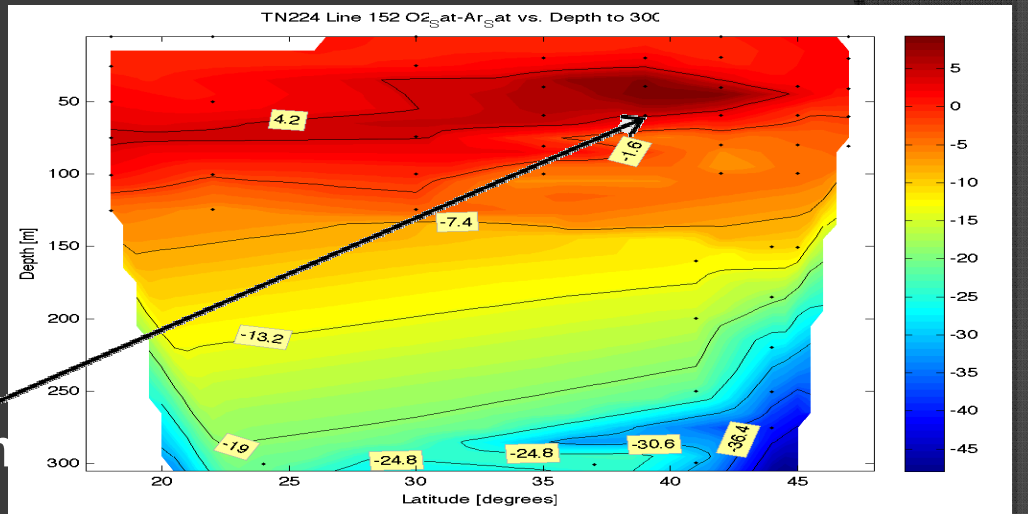
Feb, Nov 2010; Feb, Apr, July 2011



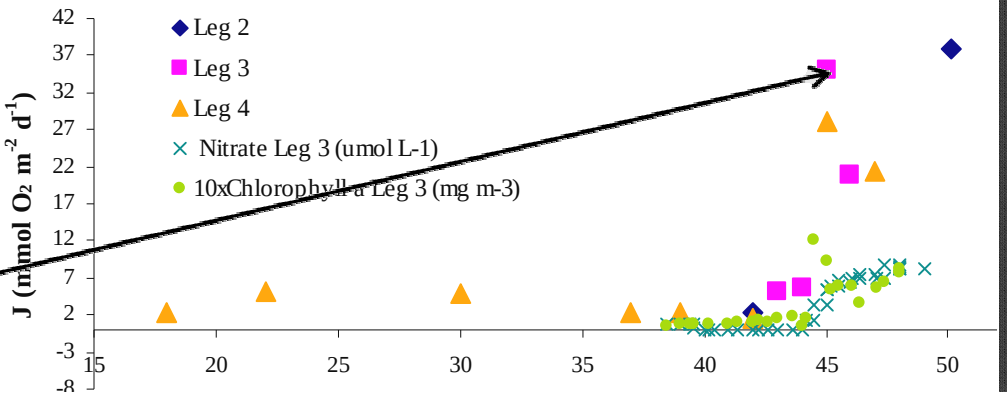
DOES THE SUBSURFACE O_2 MAXIMUM RESOLVE BIOLOGICAL PRODUCTIVITY?



Riser and Johnson (Nature 2008) derived subsurface O_2 production from ARGO float data



August/September 2008 net biological oxygen flux (J)



LESSONS FROM THE E. NORTH PACIFIC:

The subsurface ΔO_2-ΔAr Maximum

Is not at the same latitude and is much smaller than the:

Total net biological oxygen flux

SUMMARY

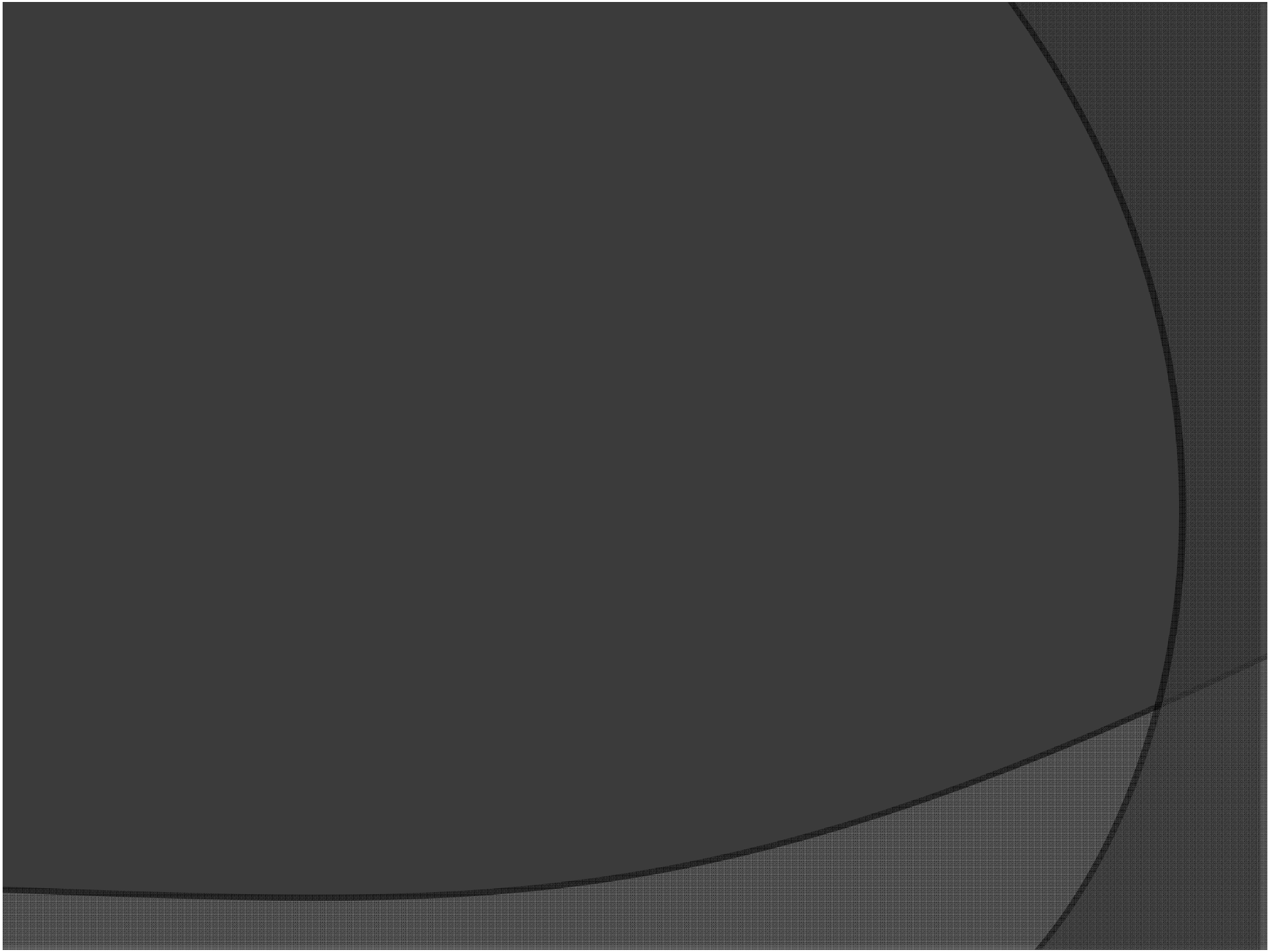
PROBLEM: - Massive pCO_2 Draw-Down at Subarctic-Subtropical Boundary of the North Pacific
Biological and Physical Mechanisms?

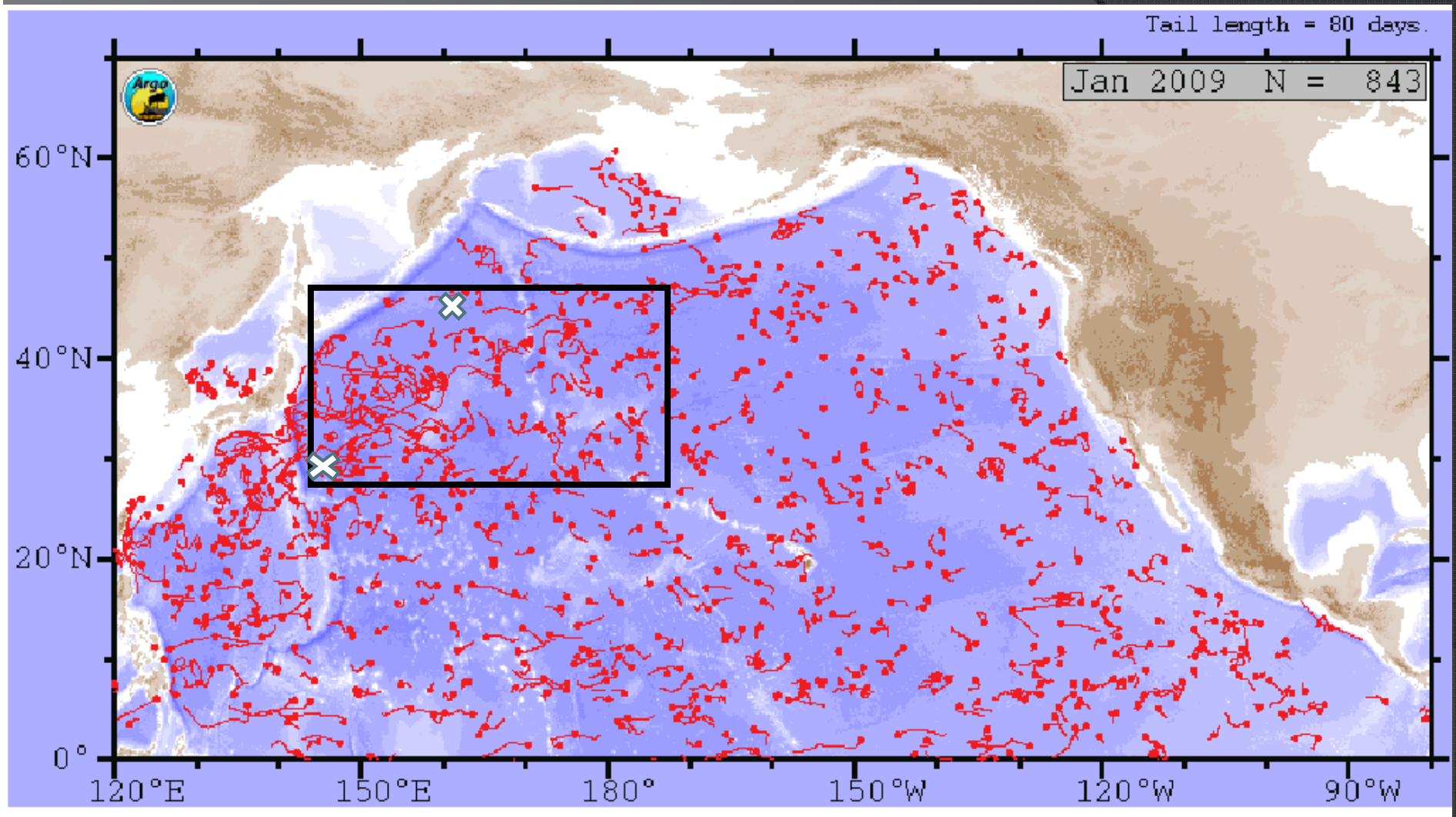
FLOATS? - Measure Net Biological O_2 Production
- Strong Seasonality Requires High Temporal Coverage

LOGISTICS: - Collaboration with Japanese Carbon Cycle Prgm
- Crosses Hydrography lines for Calibration

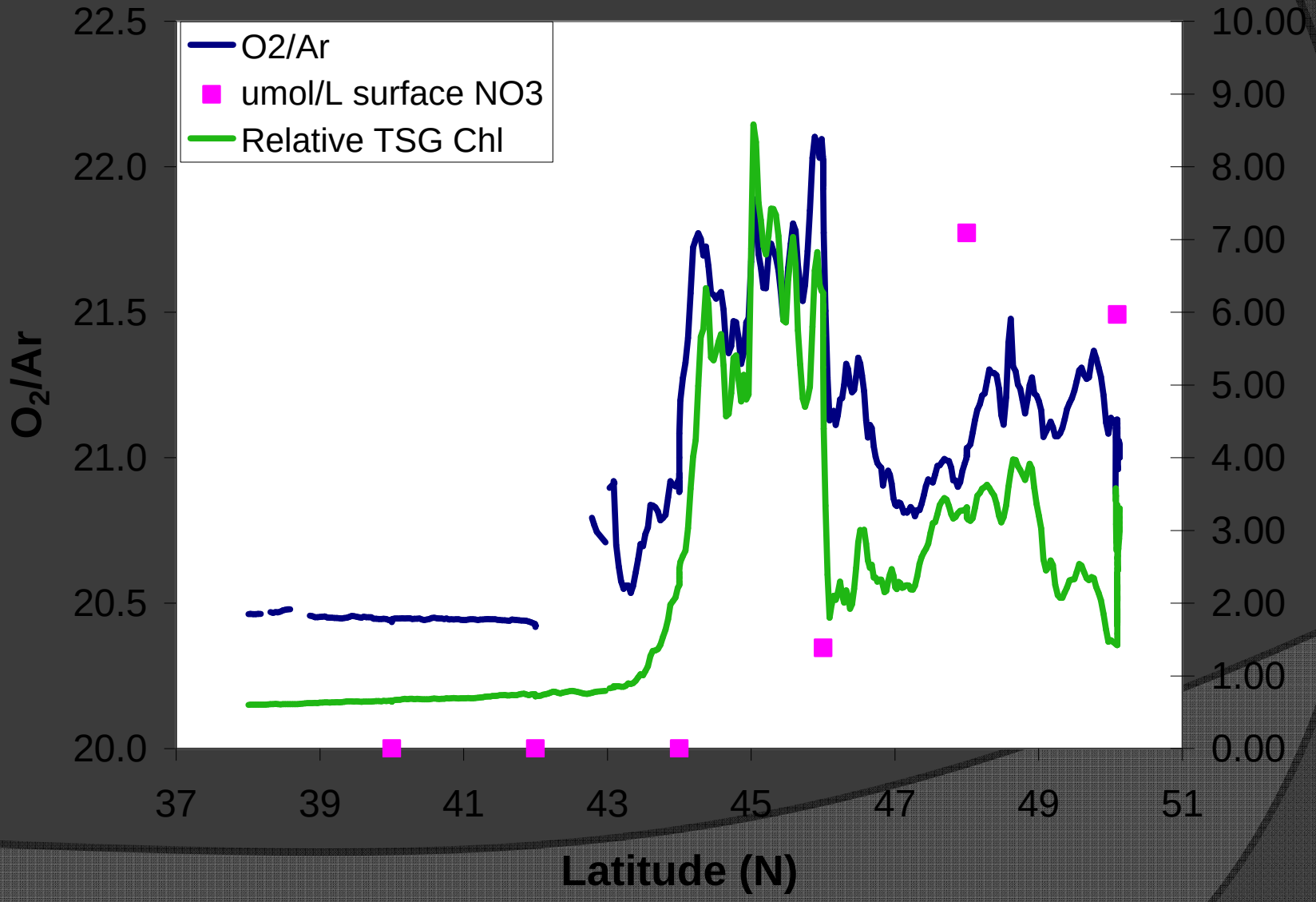
ISSUES: - Requires High Accuracy
Calibration at Surface; Calibration at Depth?

PLAN: - Deploy XX Argo Floats in W. Pacific; 35 – 45 N
Anderaa O_2 Sensor (Both?); Some NO_3 sensors

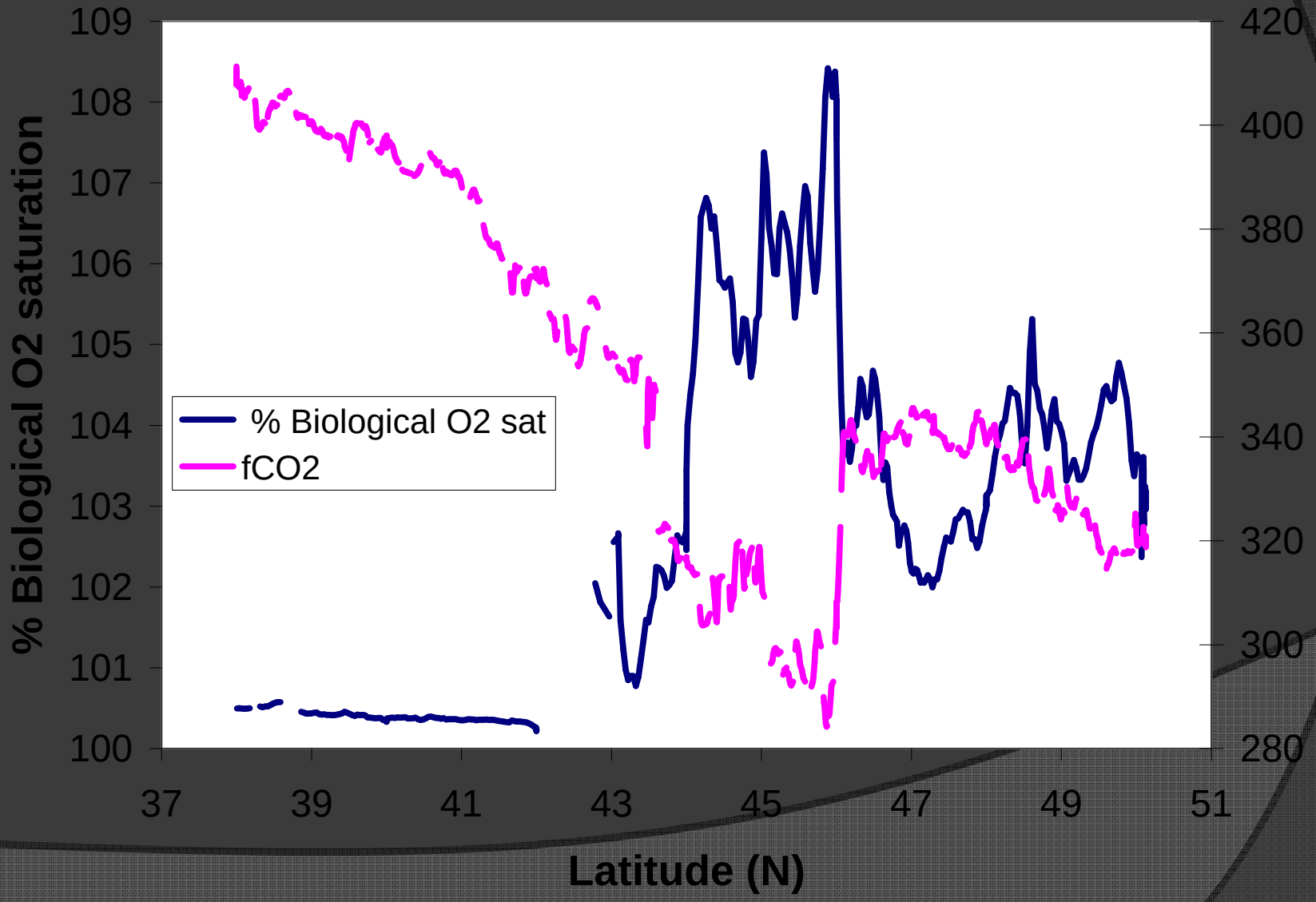



Tail length = 80 days.
Jan 2009 N = 843
60°N
40°N
20°N
0°
120°E
150°E
180°
150°W
120°W
90°W

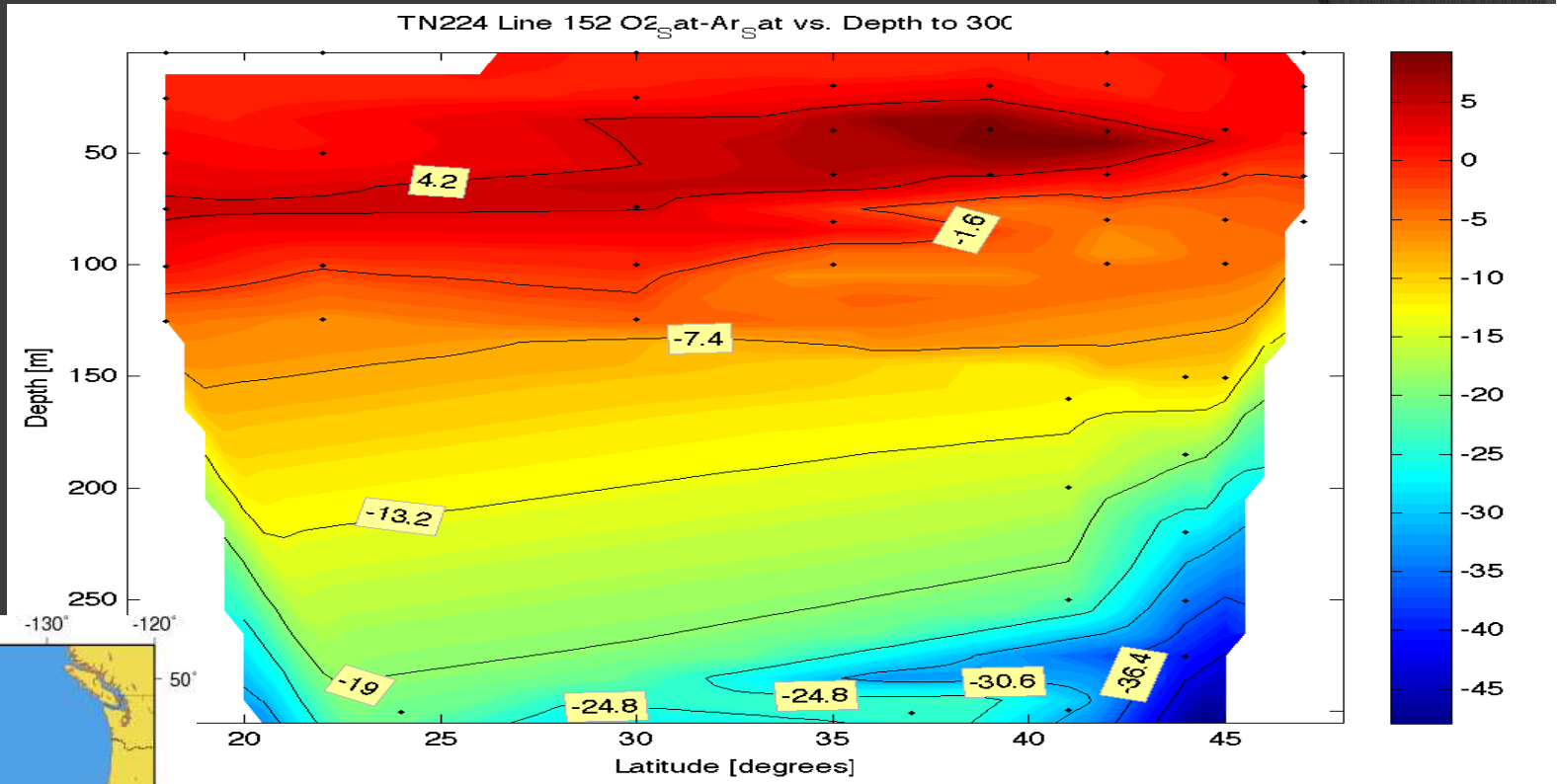
O2/Ar, chlorophyll, surface NO3
Leg 2: 145 W

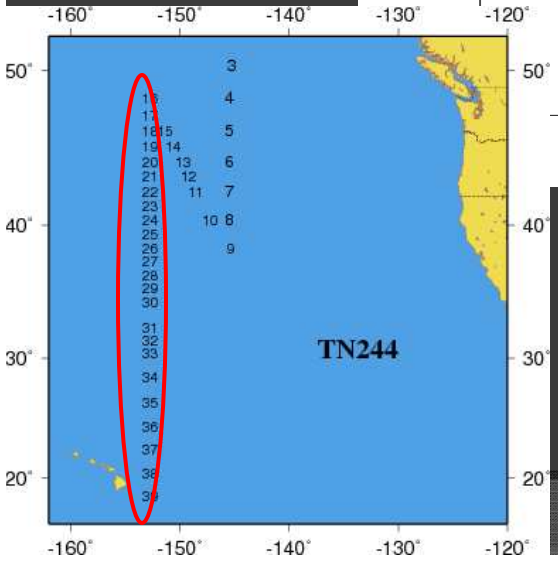


% Biol. O_2 sat. and fCO2
Leg 2: 145 W

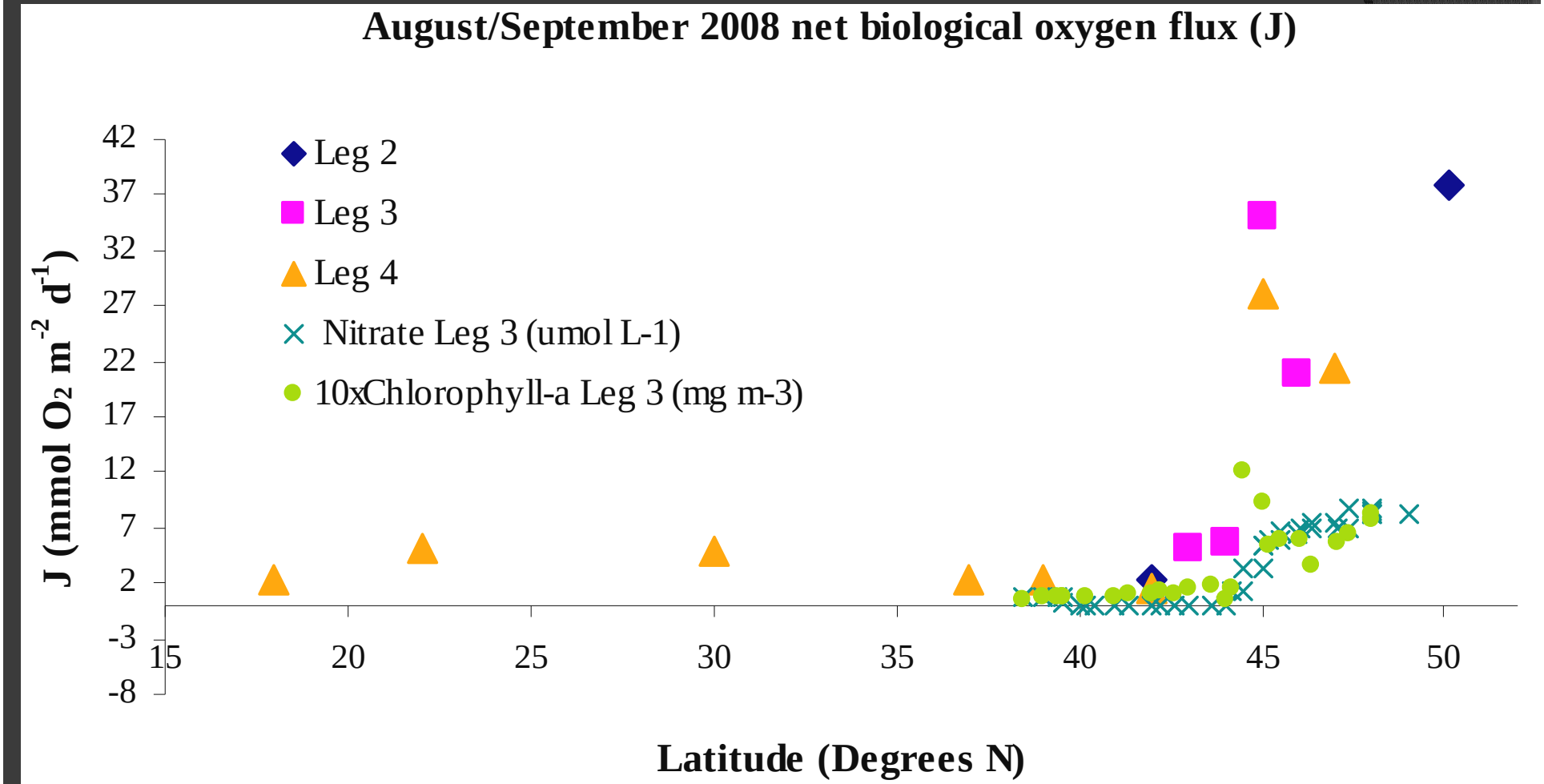


TN224 (ΔO_2 - ΔAr) (%) along 152 W





Net Biological O_2 production in the euphotic zone along 152 W (Evan Howard, calculation)

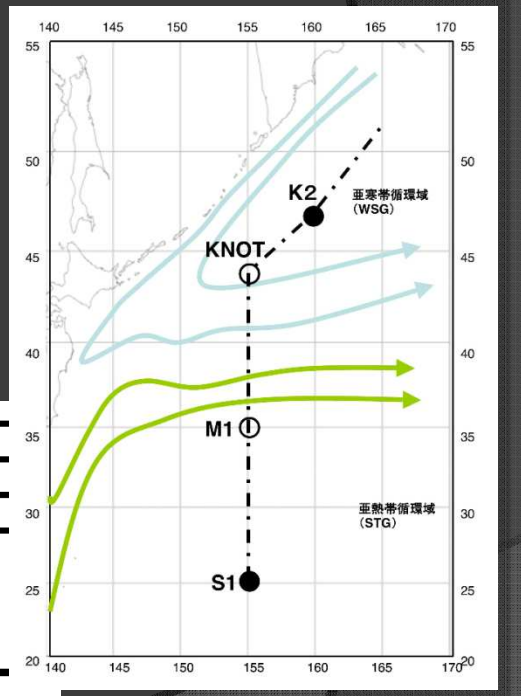


Proposal for Mirai Cruises

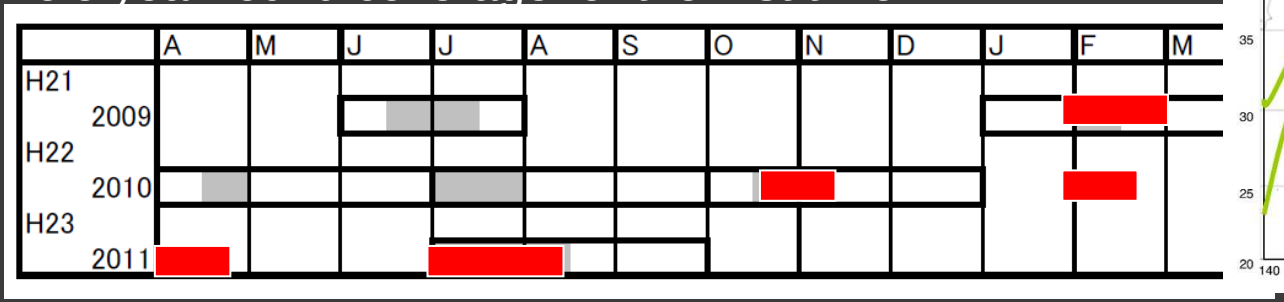
Time series cruises to study seasonal variability of end-to-end food web Dynamics and biogeochemical cycles

Multidisciplinary Cruise
IORGC, MIO,XBR□FRCGC + outside JAMSTEC

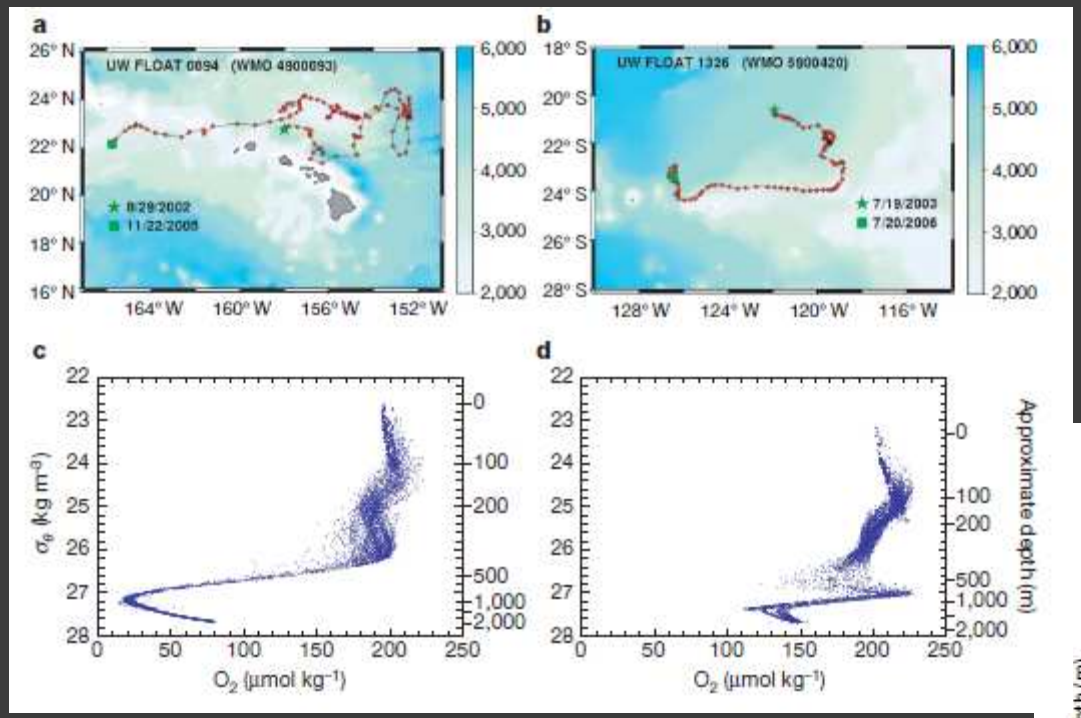
Comparison of North and South stations
Different response to the same external forcing

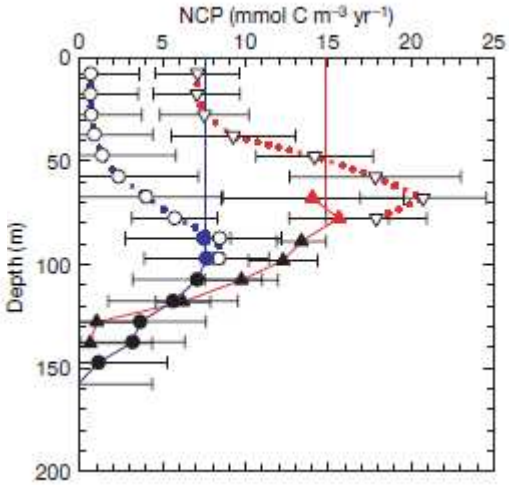


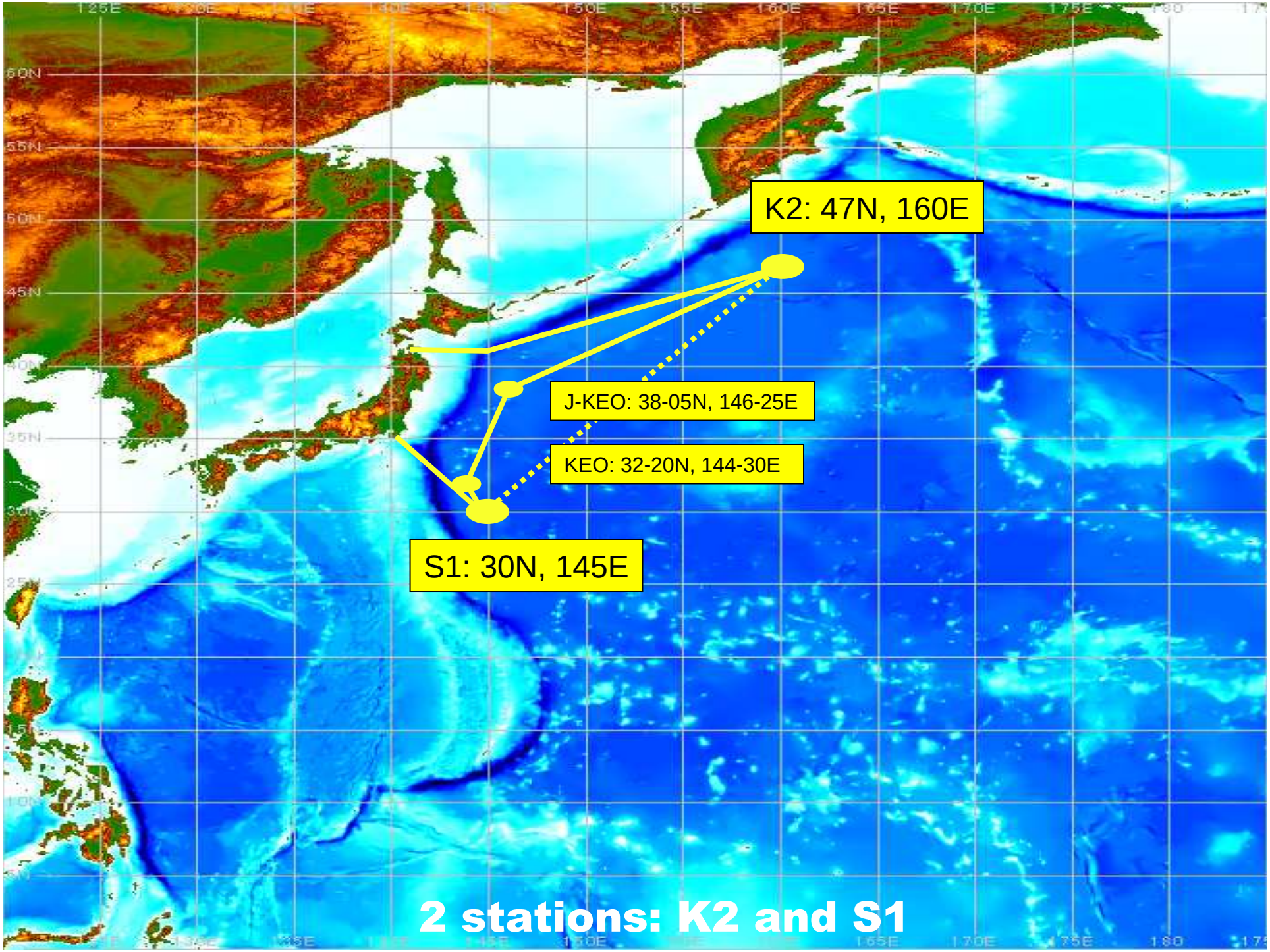
Whole year round coverage for the first time

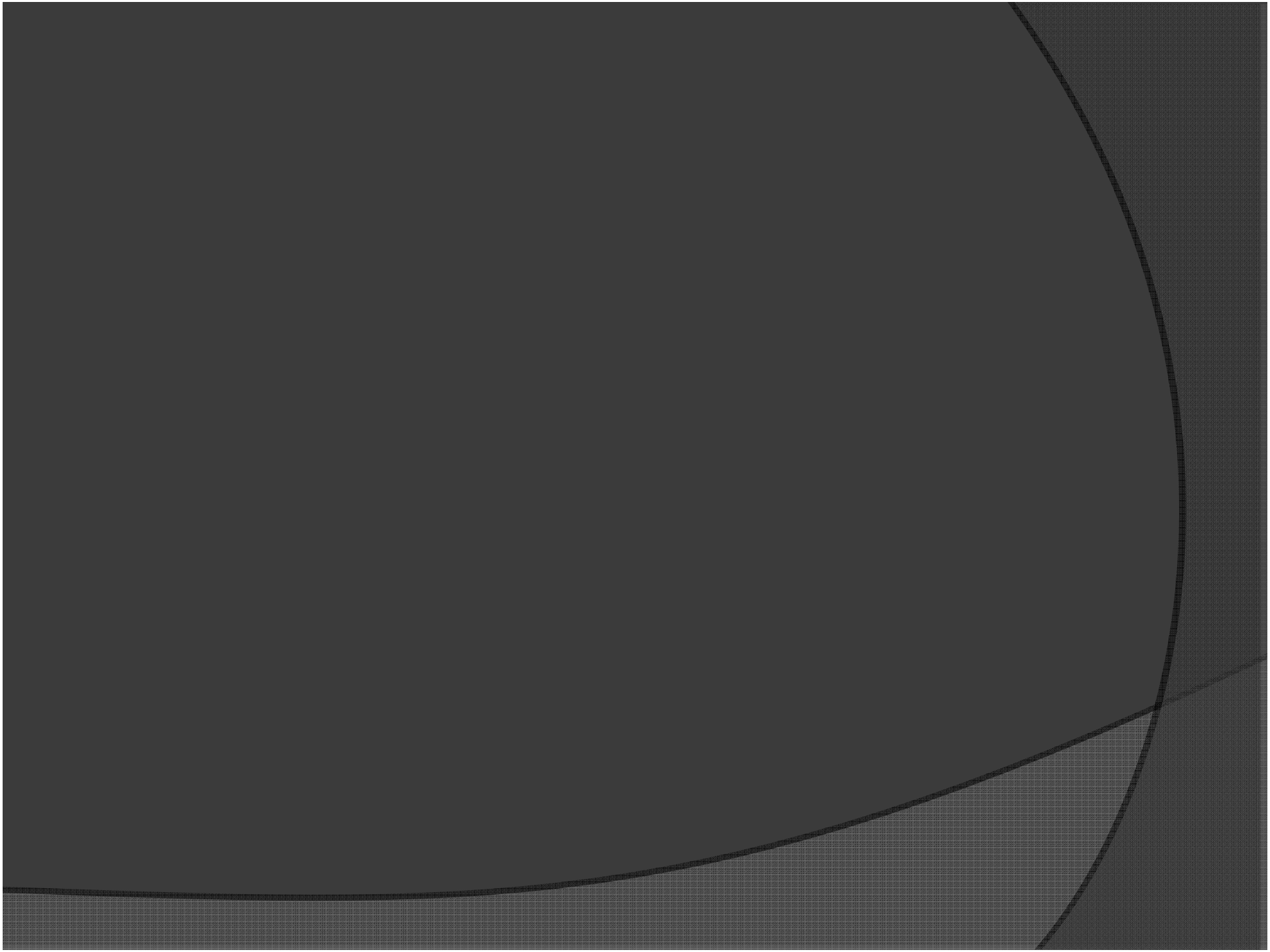


Collaboration with satellites obs. group as well as 4DDA res. group


a
UW FLOAT 0894 (WMO 4900893)
8/29/2002
11/22/2005
26° N
24° N
22° N
20° N
18° N
16° N
164° W
160° W
156° W
152° W
6,000
5,000
4,000
3,000
2,000
b
UW FLOAT 1326 (WMO 5900420)
7/19/2003
7/20/2006
18° S
20° S
22° S
24° S
26° S
28° S
128° W
124° W
120° W
116° W
c
d
σ_θ (kg m^{-3})
O_2 (µmol kg^{-1})
Approximate depth (m)
0
100
200
500
1,000
2,000

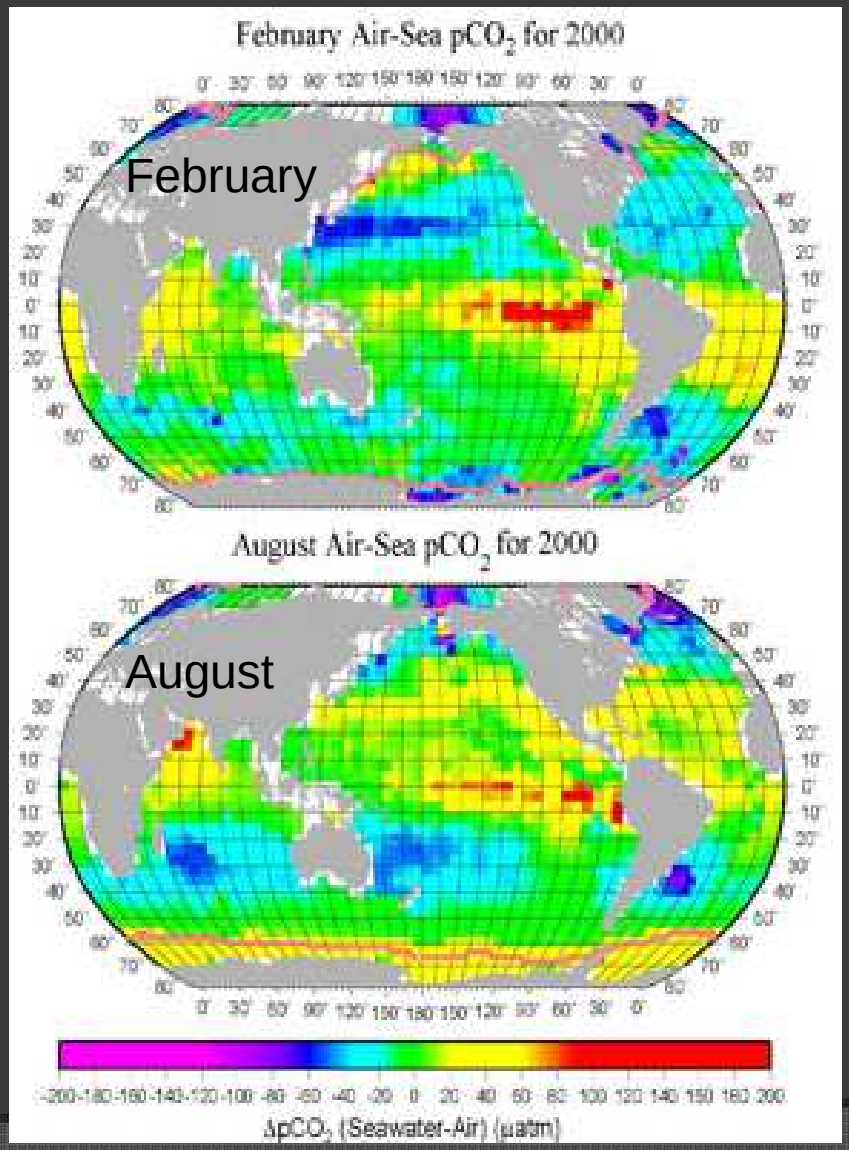

NCP (mmol C m^{-3} yr^{-1})
0
5
10
15
20
25
Depth (m)
50
100
150
200


K2: 47N, 160E
J-KEO: 38-05N, 146-25E
KEO: 32-20N, 144-30E
S1: 30N, 145E
2 stations: K2 and S1



Seasonality is Very Important

ΔpCO2



Cruise Track for TN224 Student Cruise August/September 2008