Workshop Overview

Objectives of workshop

Timeline

Description of the Section

Primary Objective

Solicit a collection of strong proposals, submitted to the Core Program for the February 15 deadline that cover the key parameters and other parameters identified as priorities at the workshop and by the SSC.

Role of Workshop

- provide participants with information about the aspects of the cruise track that made it compelling, and ancillary information that will strengthen each proposal.
- help PIs identify how their proposal contributes to the project as a whole, and could not achieve its objectives without the measurement of other core parameters.
- provide as many opportunities as possible for participants to identify synergies with other groups that can be used to strengthen their proposals.
- provide information and seek feedback about data management, logistics, costs and infrastructural resources provided by the management grant so that participants will be develop realistic budgets and project management schemes.
- identify at the workshop what sampling plans are logistically feasible
- get feedback from participants to help SSC set priorities

Important Considerations for choosing a section

- 1. High Impact Science, both as a part of the complete program, but also from that section alone (important to generate excitement and establish the program as a whole, both nationally and internationally.
- 2. Science product that underscore the value of multiple key parameters being measured on the same ship (see Science Plan).
- 3. Compliment International Efforts

Rationale

- Highly productive eastern boundary upwelling system
- Intense oxygen minimum zone; important in global N cycle
- OMZ expanding and shoaling over the last 40-50 y
- Largest hydrothermal plume in world’s oceans
- SE Subtropical gyre one of world’s most oligotrophic regimes

3 sub-programs within cruise

- Large lateral gradients in productivity and particle fluxes related to upwelling and inputs from continental margin
- Important oxygen minimum zone
- Most prominent hydrothermal plume in the world's oceans

Timeline

Feb. 2011	Submit Management proposal to NSF
Sept. 2011	Community meeting for scientists planning proposals to participate in the cruise.
Nov. 2011	Revised Letters of intent posted on US GEOTRACES web site
Feb. 2012	Coordinated submission of science proposals
Aug. 2012	Submission of late-breaking/last-chance proposals for ETSP science/cruise participation
Spring 2013	Cruise planning meeting for all funded PIs Management team cruise planning meeting with ship operator
Oct 2013	Cruise staged (alternate dates, Sept-Dec 2013
Fall 2014	Post cruise workshop

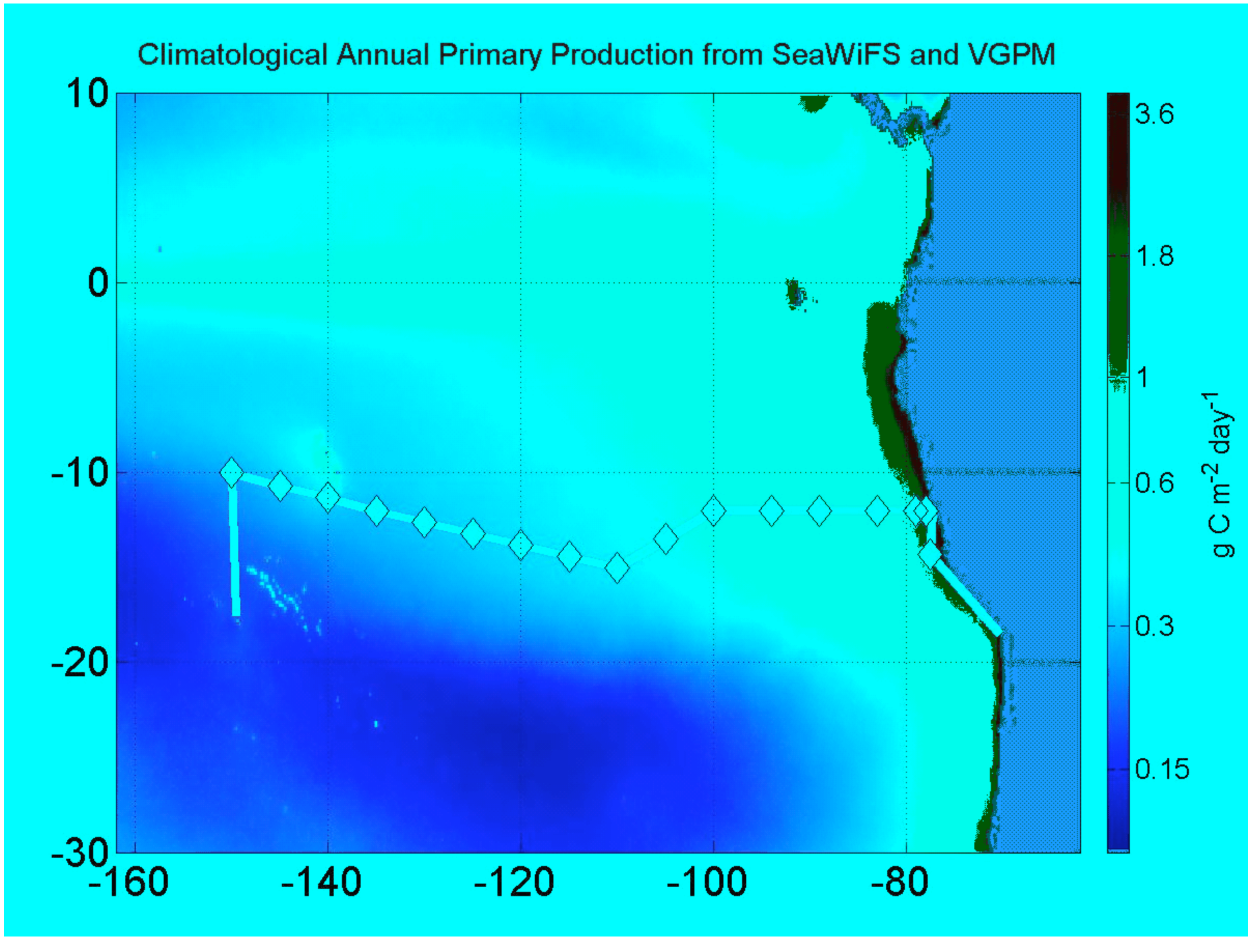


Figure 1. Cruise track & deep stations

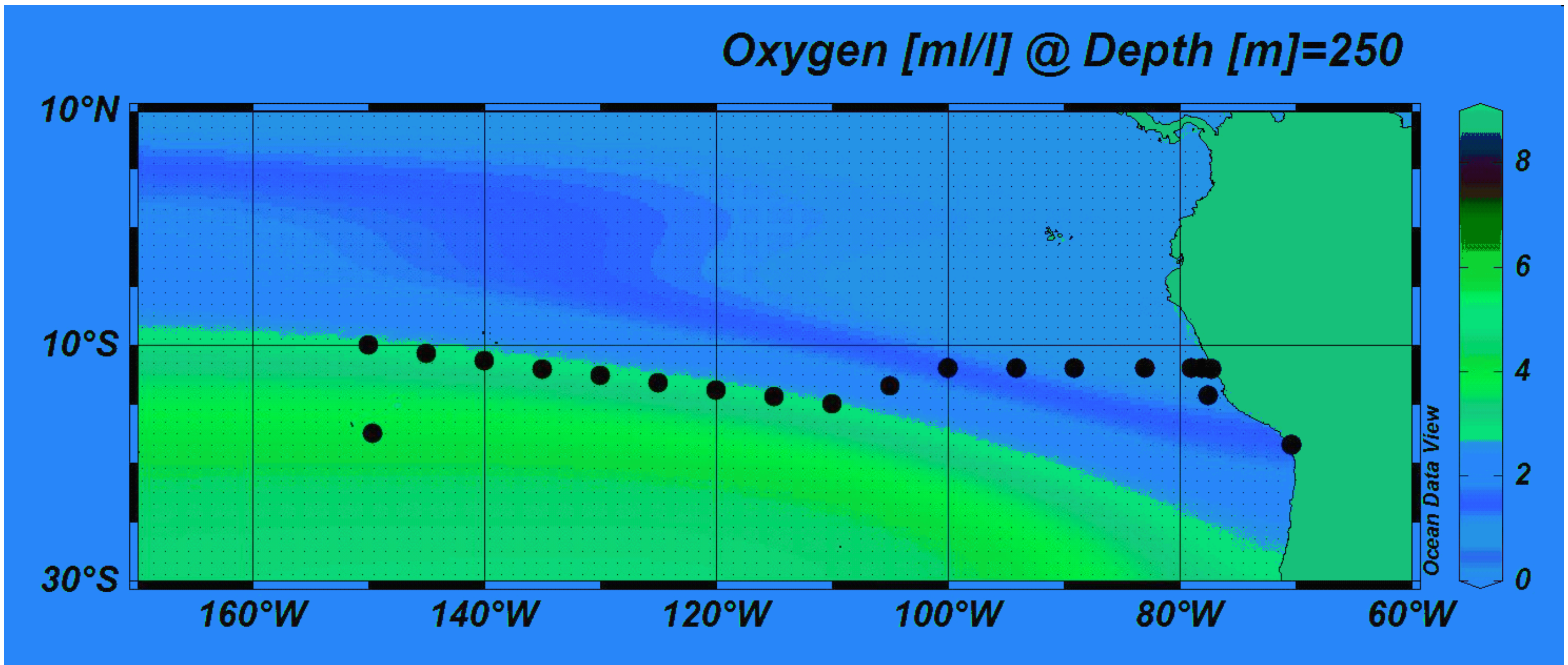
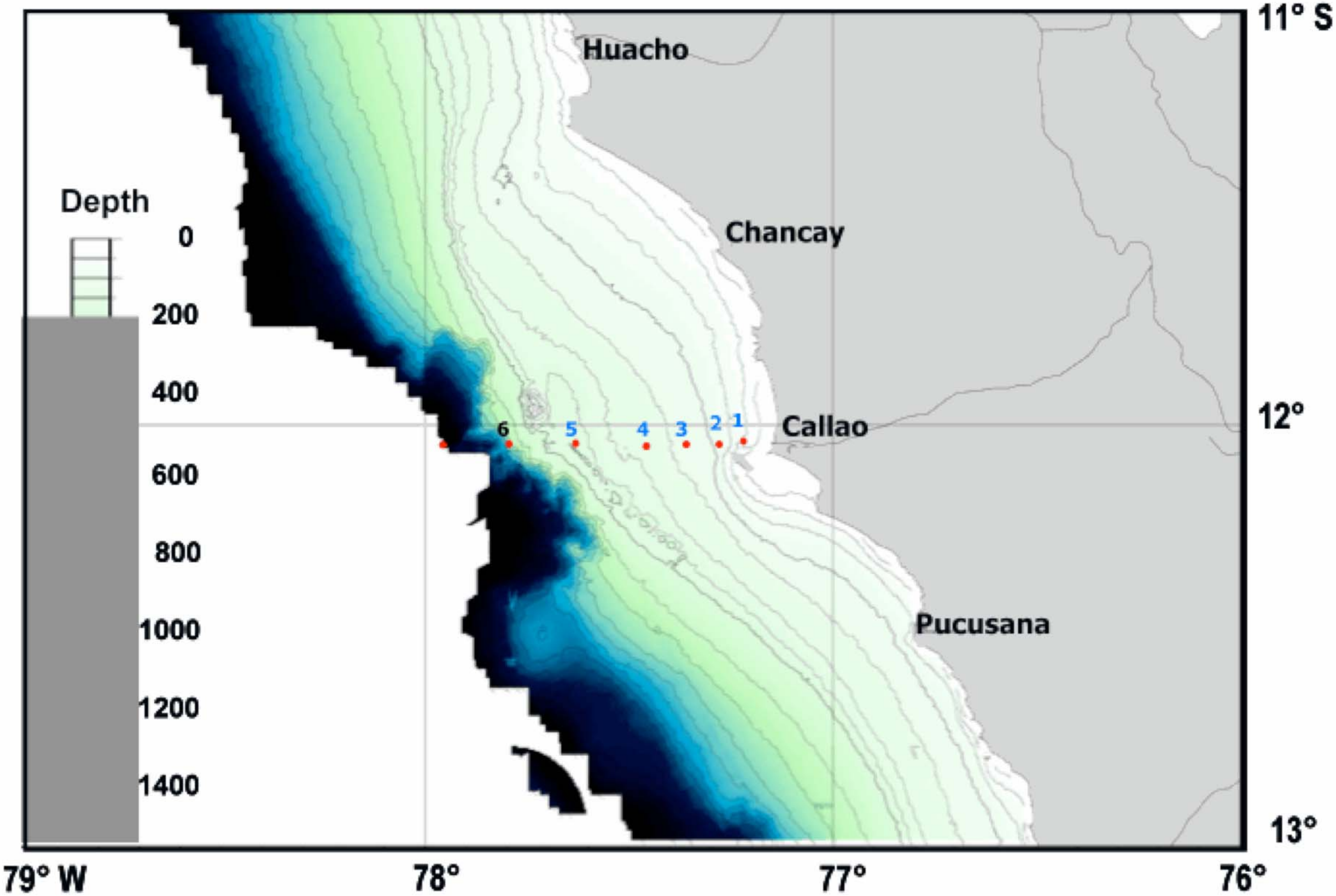


Figure 2. Section showing OMZ



Peruvian Time Series Stations Occupied by IMARPE

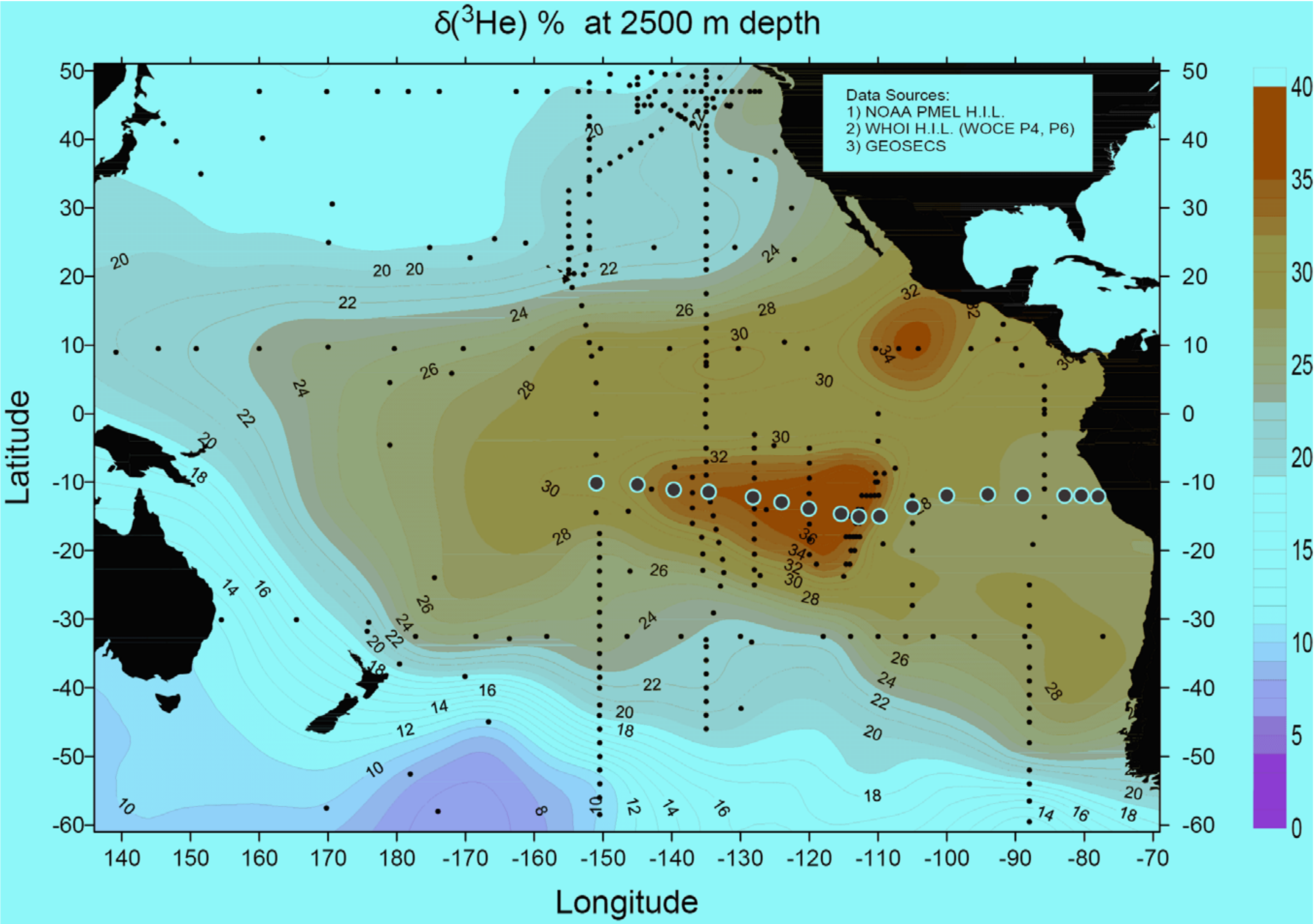
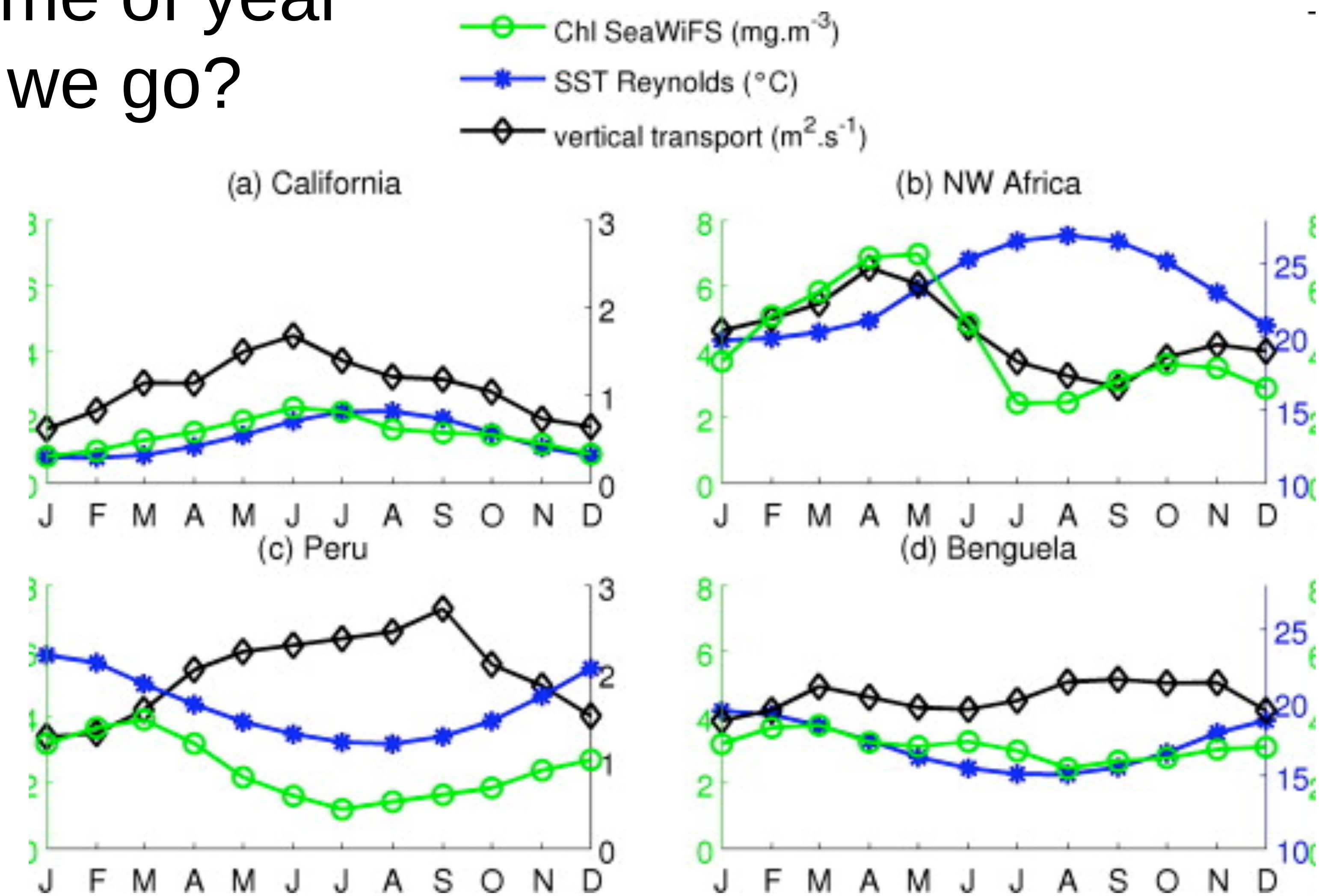


Figure 3 Cruise track showing ^{3}He plume at 2500m

What time of year should we go?



Seasonal cycles of chlorophyll concentration (black), sea surface temperature (blue) and total vertical transport (Ekman transport plus Ekman pumping) in four EBUE (10° latitude band up to 150 km offshore). ***From Chavez and Messie, 2009***.

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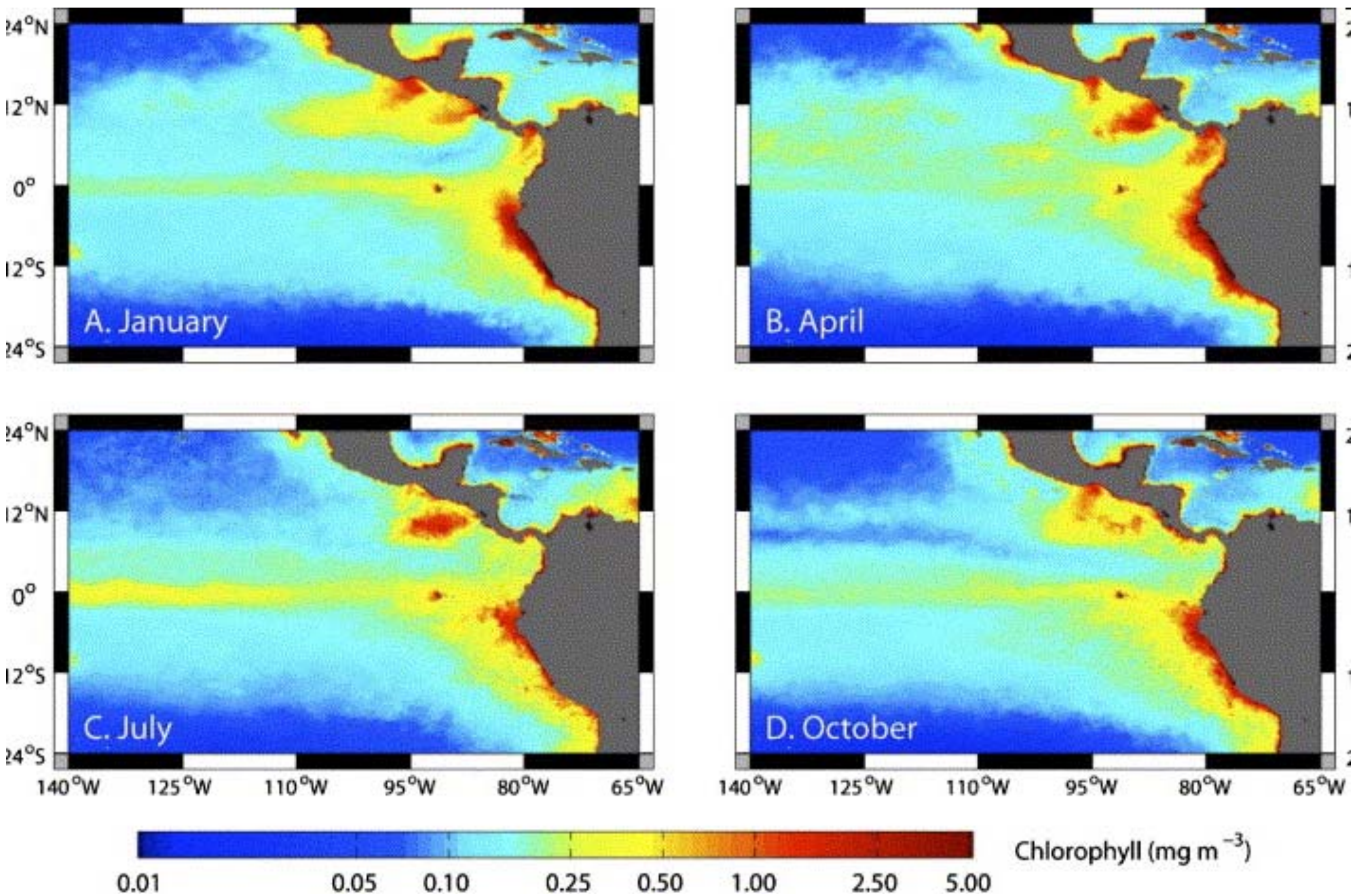
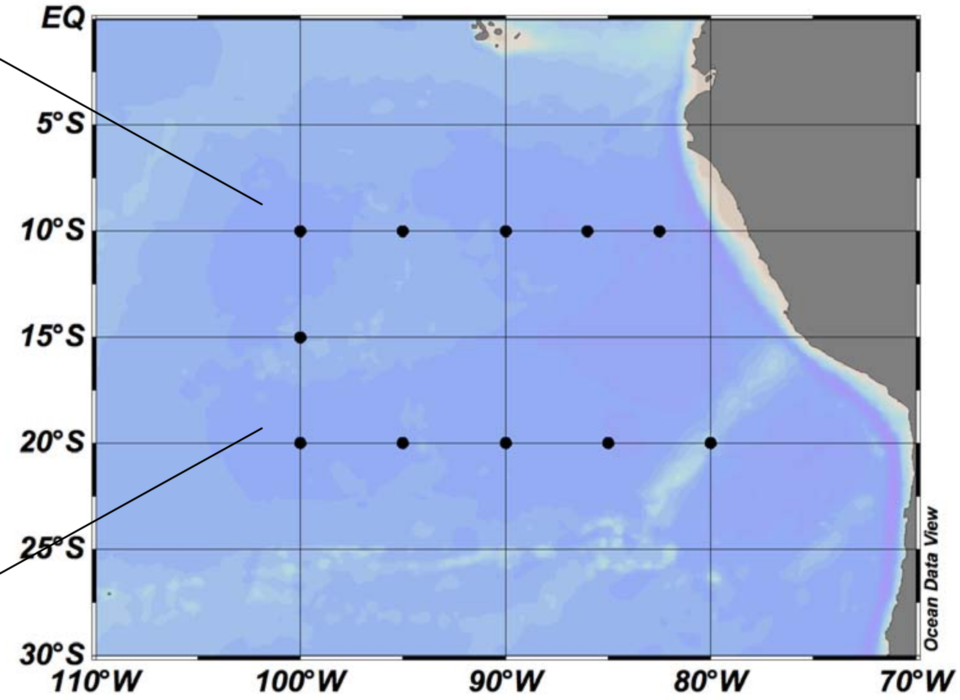


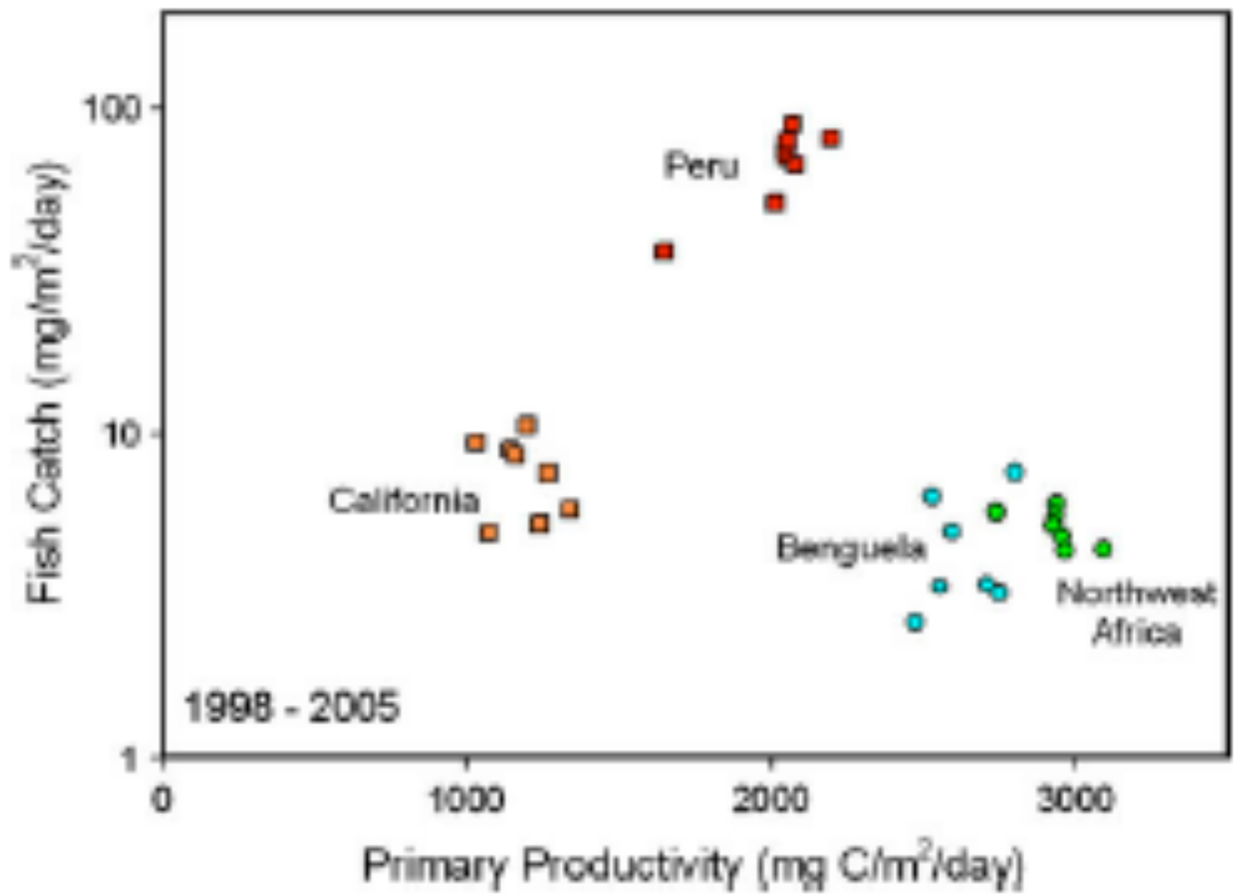
Berelson and Capone deployed sediment traps Feb 2010 through March 2011

Depth = 3700m

Their data indicate highest fluxes during time of maximum wind-stress curl (i.e. Sept/Oct) – see their data at Ocean Sciences 2012 Meeting



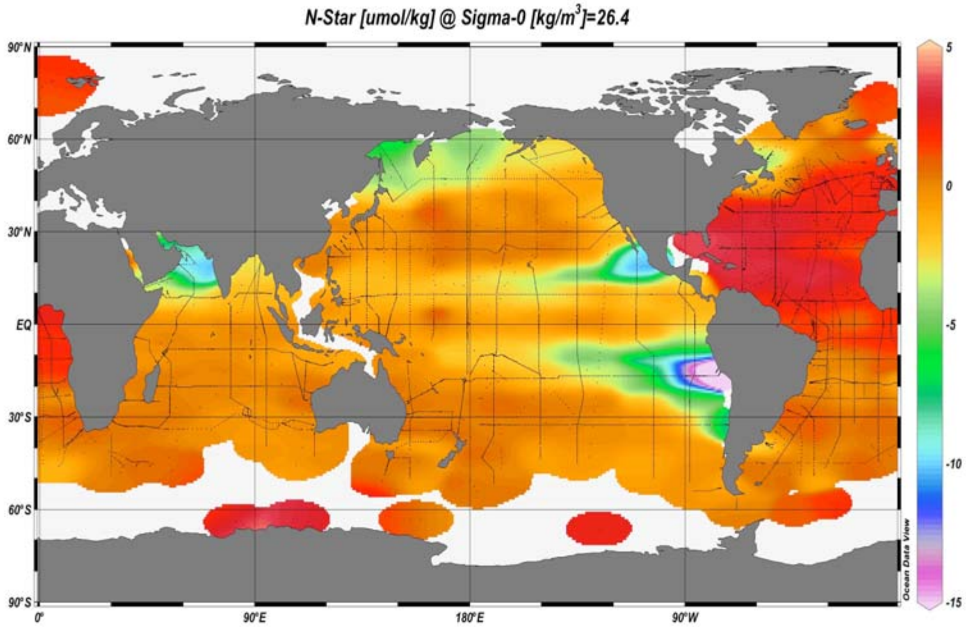
Peru Upwelling of great importance because of high productivity and high fish catch



From Chavez et al., 2009)

The nitrogen cycle along our cruise track

N* at Sigma-theta 26.4 (~250 m)

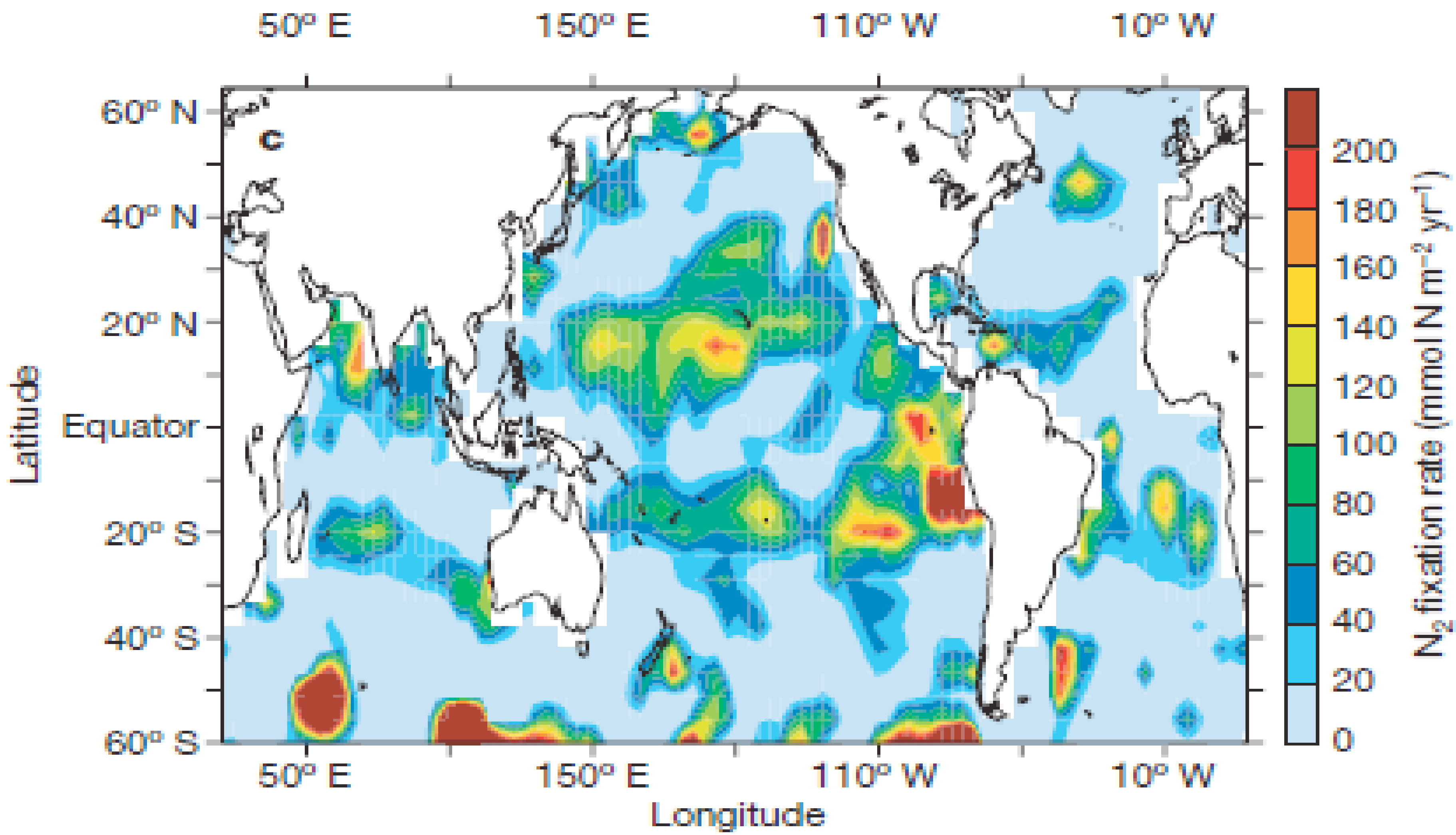


Important for:
- Global N budget
- Oceanic N_2O production

Nitrate $\delta^{15}N$ (and $\delta^{18}O$):
- Uptake and Remineralization
- Denitrification
- Anammox
- Nitrogen fixation

Figure Courtesy of Karen Casciotti

ETSP a “Hot-spot” for N fixation?

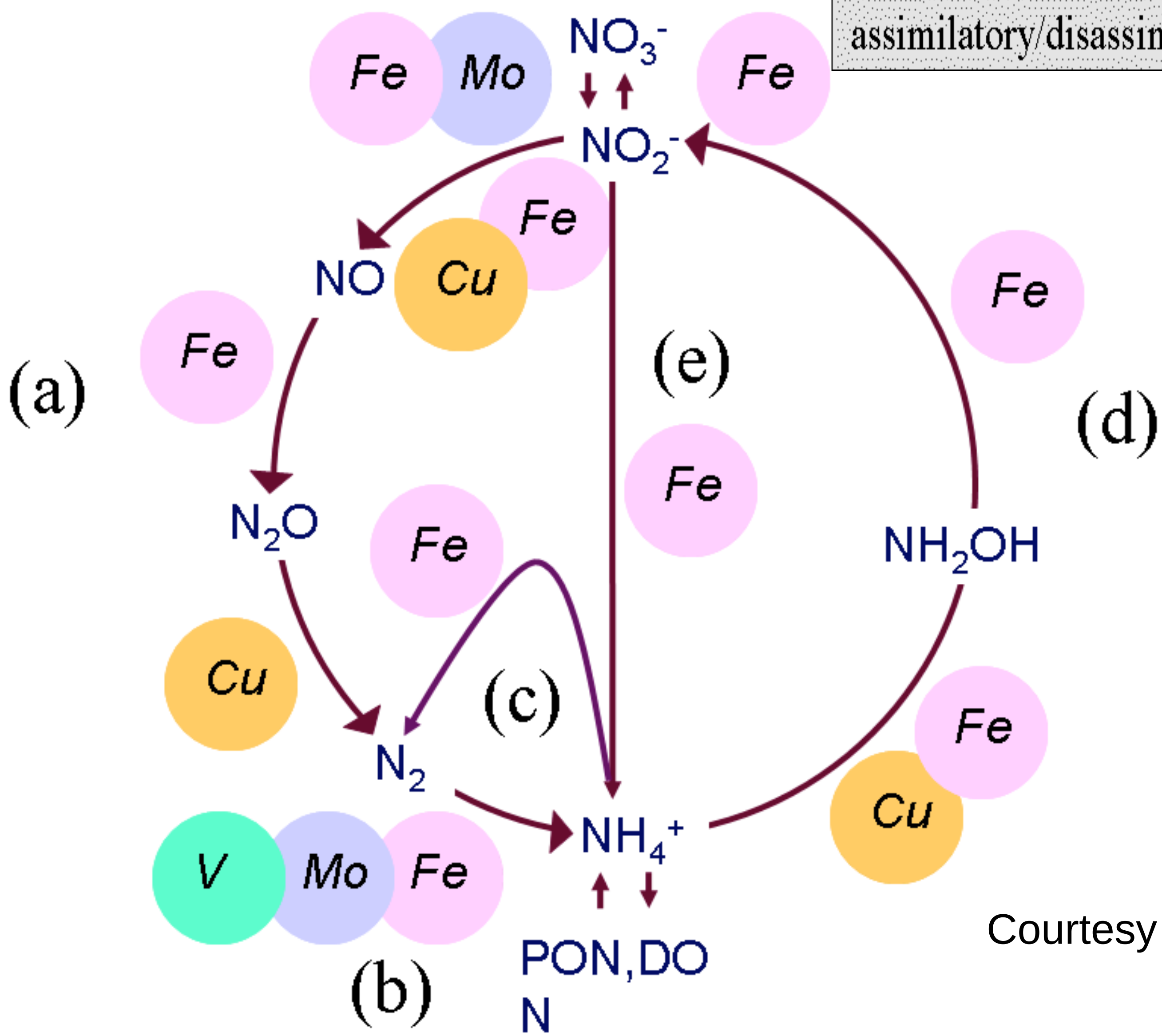


From Deutsch, (2006)

Linkage Between N cycle and other key parameters in GEOTRACES

- Each step in the N cycle are catalyzed by metalloenzmes requiring metals that are key parameters in the program
- There are large gradients of these metals within the cruise track

Figure 1. Basic Features of the marine N cycle showing the metals involved (a) denitrification (b) N fixation (c) anammox (d) nitrification (e) assimilatory/disassimilatory nitrite reduction



Courtesy of Bess Ward

Expanding Oxygen-Minimum Zones in the Tropical Oceans

Lothar Stramma,[1*] Gregory C. Johnson,[2] Janet Sprintall,[3] Volker Mohrholz[4]

SCIENCE VOL 320 2 MAY 2008

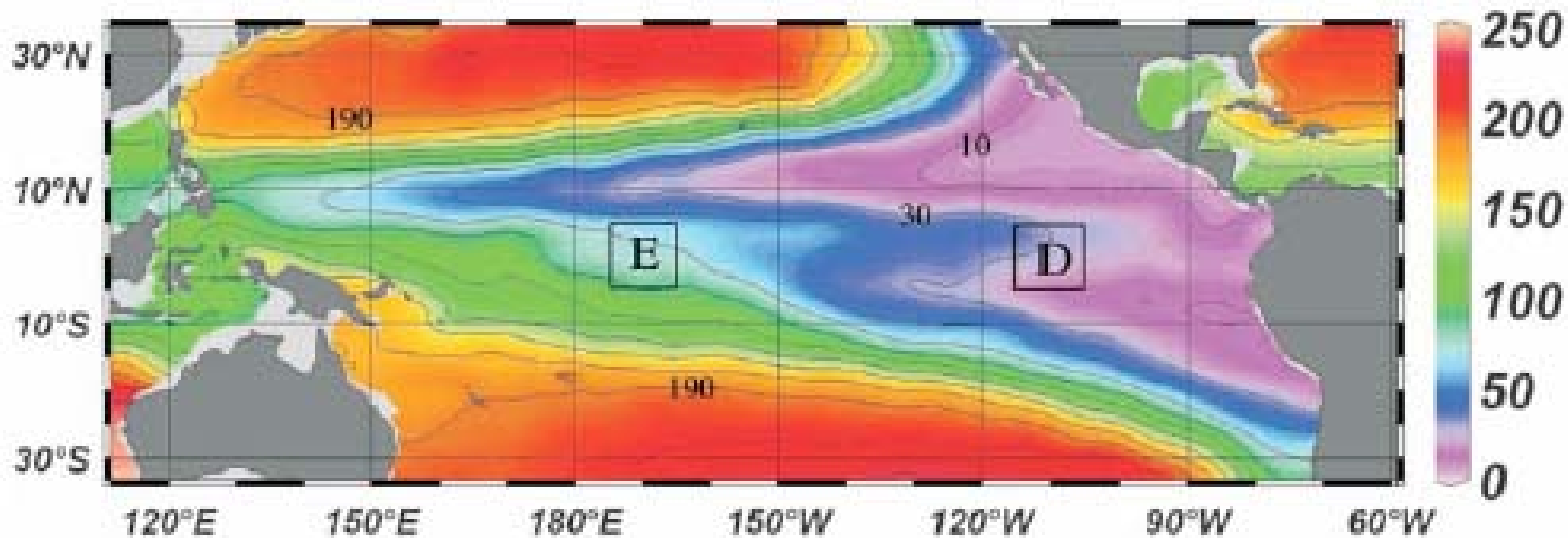
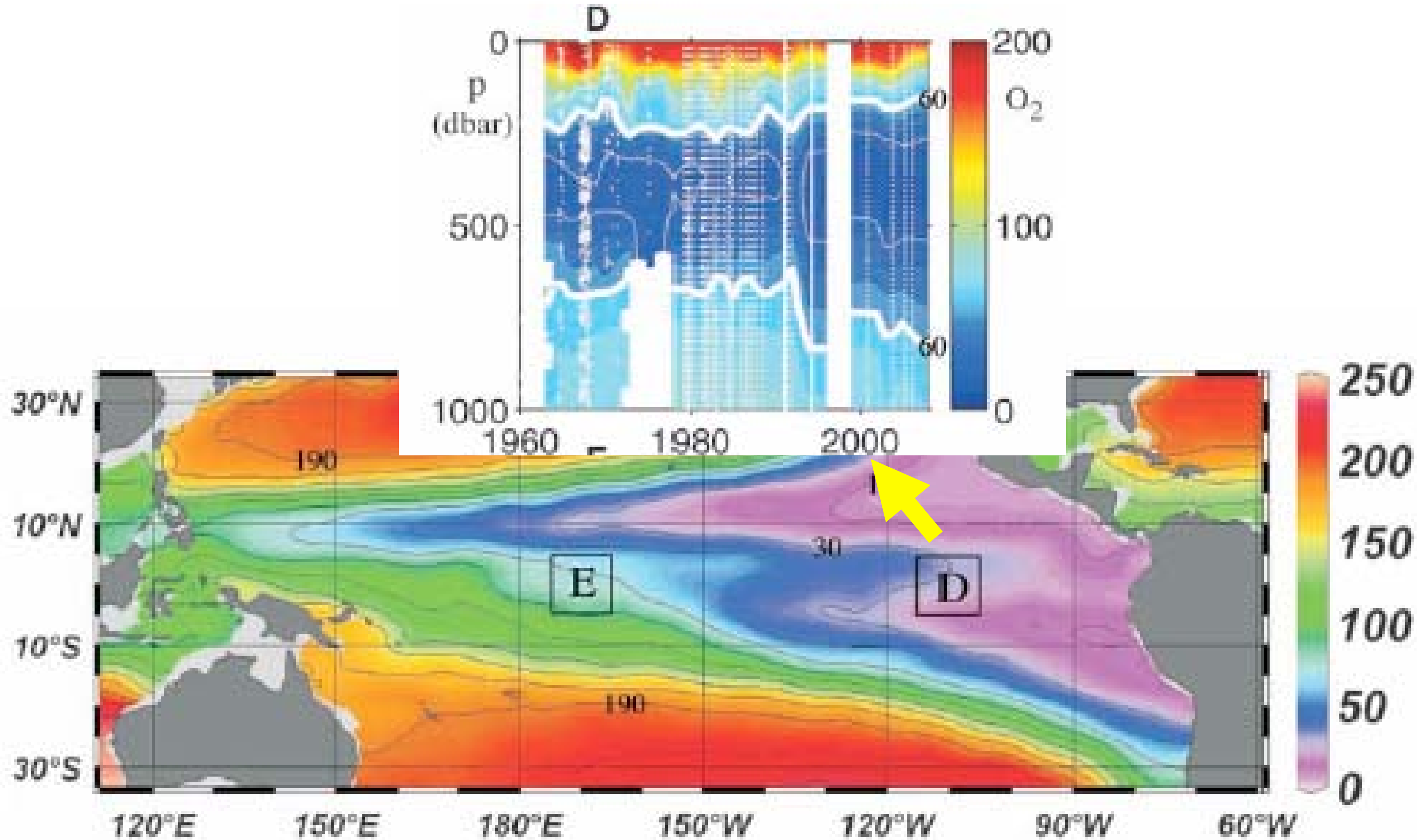


Fig. 1. Climatological mean (*18*) dissolved oxygen concentrations (μmol kg^{-1} shown in color) at 400 m depth contoured at 20-μmol-kg^{-1} intervals from 10 to 230 μmol kg^{-1} (black lines) using Ocean Data View (*19*) software. Analyzed areas (A to F, Table 1, and Fig. 2) are enclosed by black boxes.



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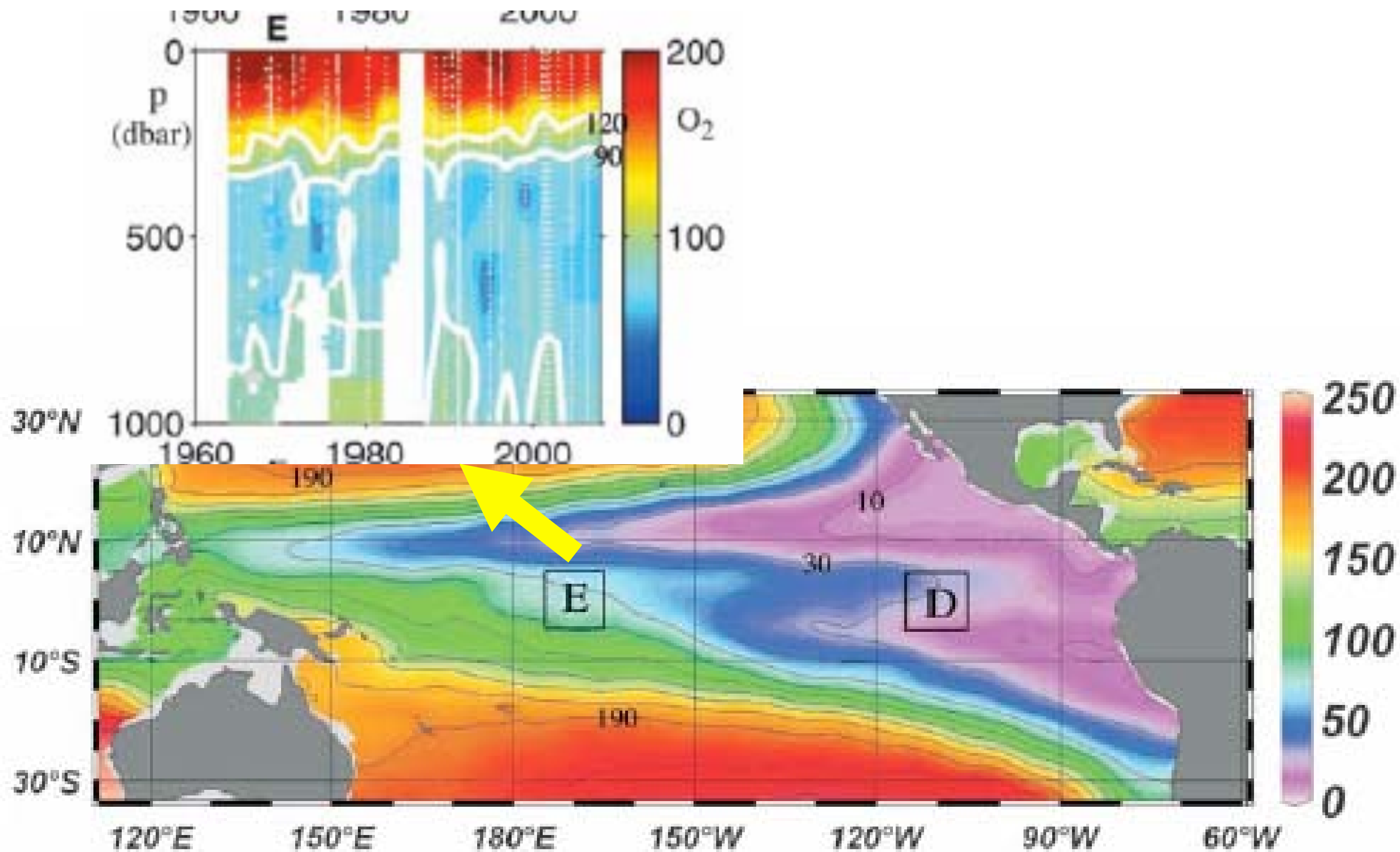

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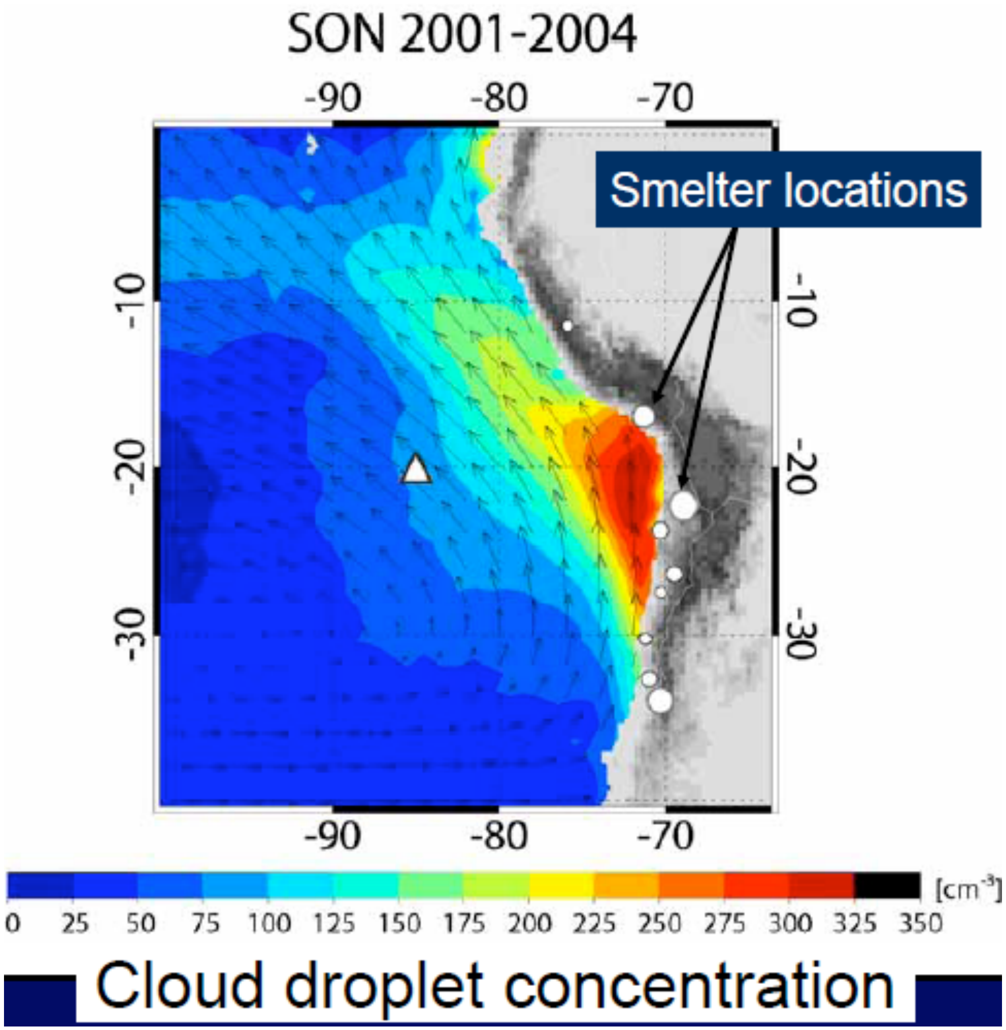
VOCALS Program



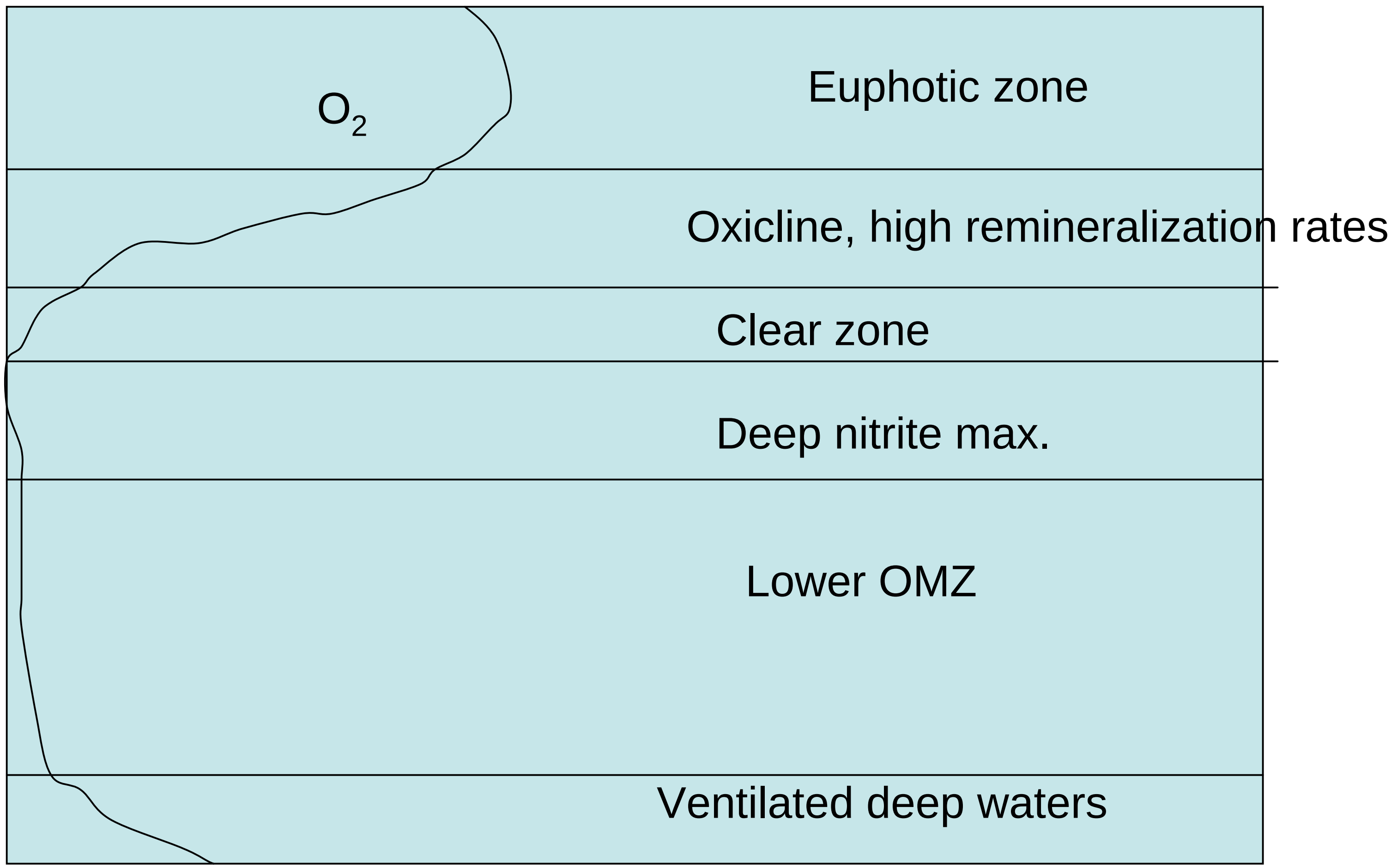
Chile is world's largest copper roducer

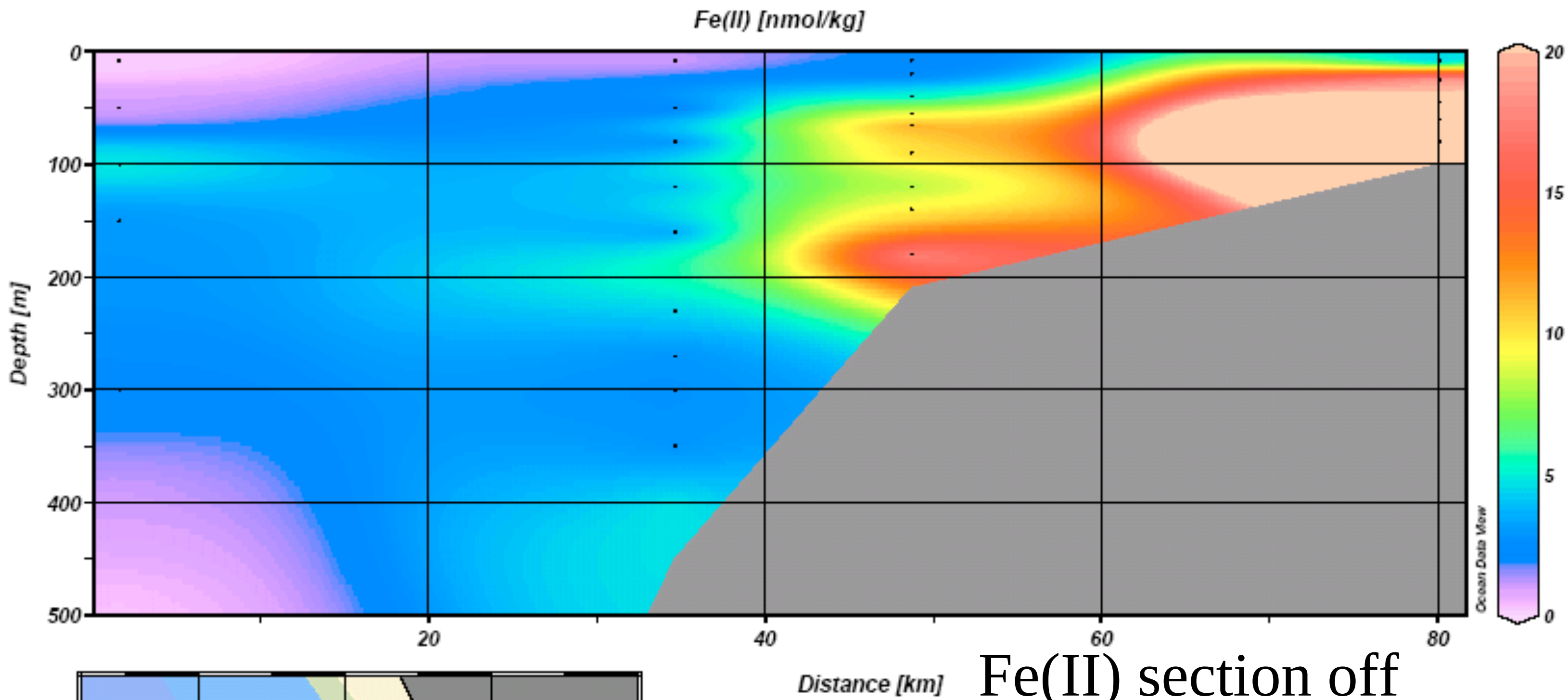
•Copper smelting SO2emissions from Chile (1.5 TgSyr-1) comparable to total SO2emissions in Germany

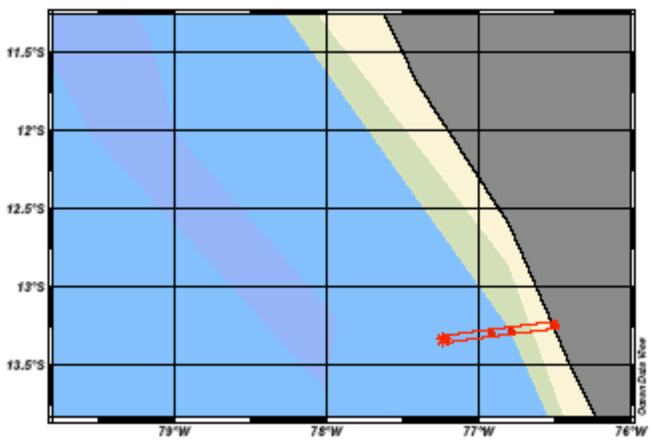
•90% of Chilean SO2 emissions from seven smelters!

•Andes mountains prevents eastward transport

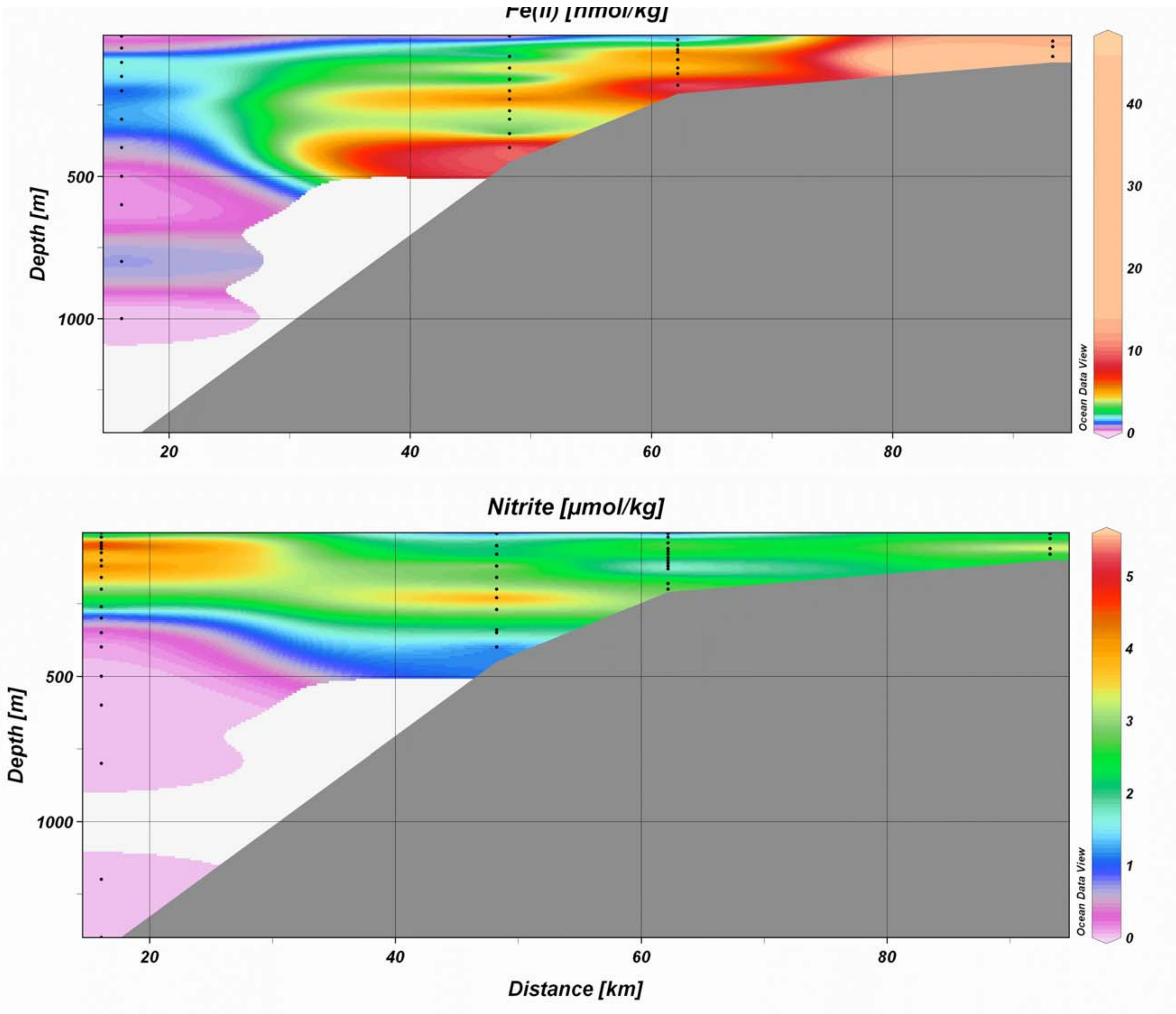
Conceptual Picture of an OMZ

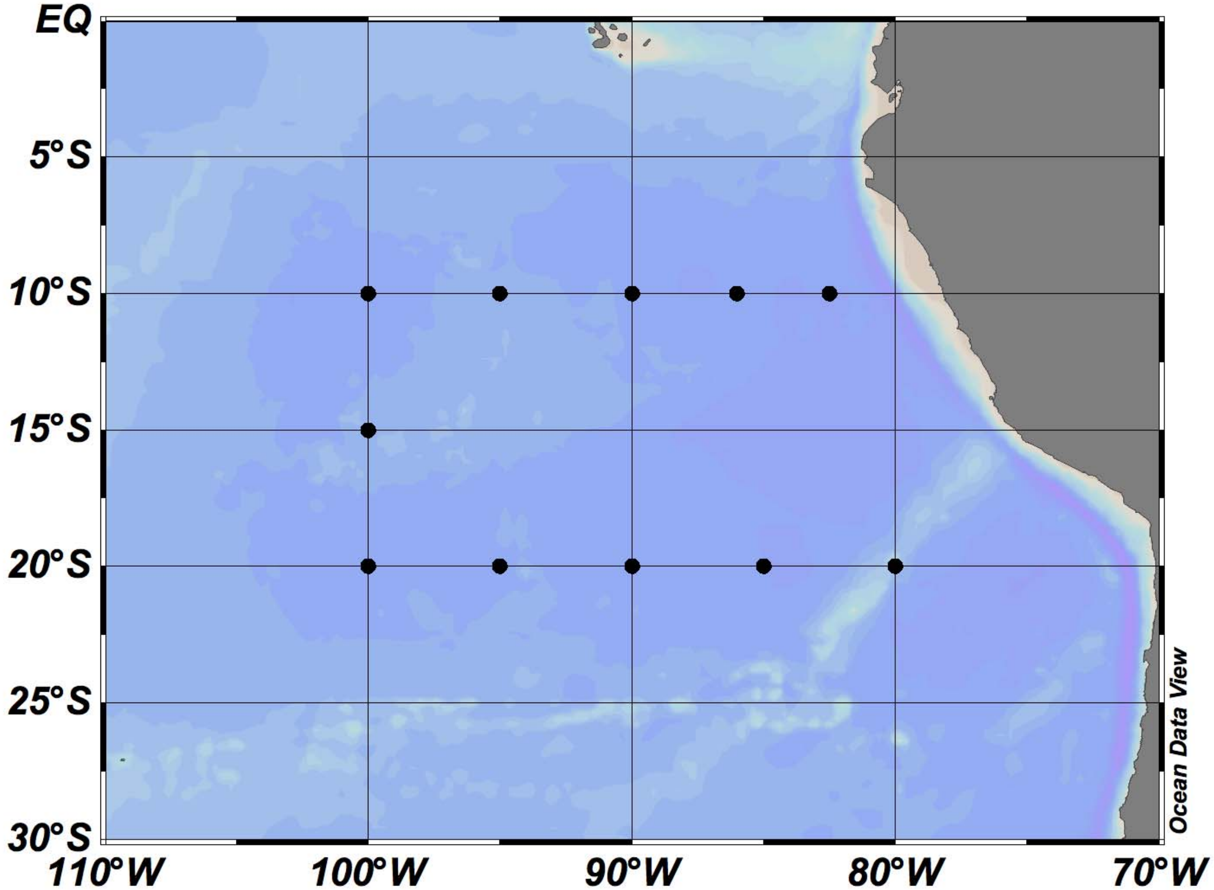




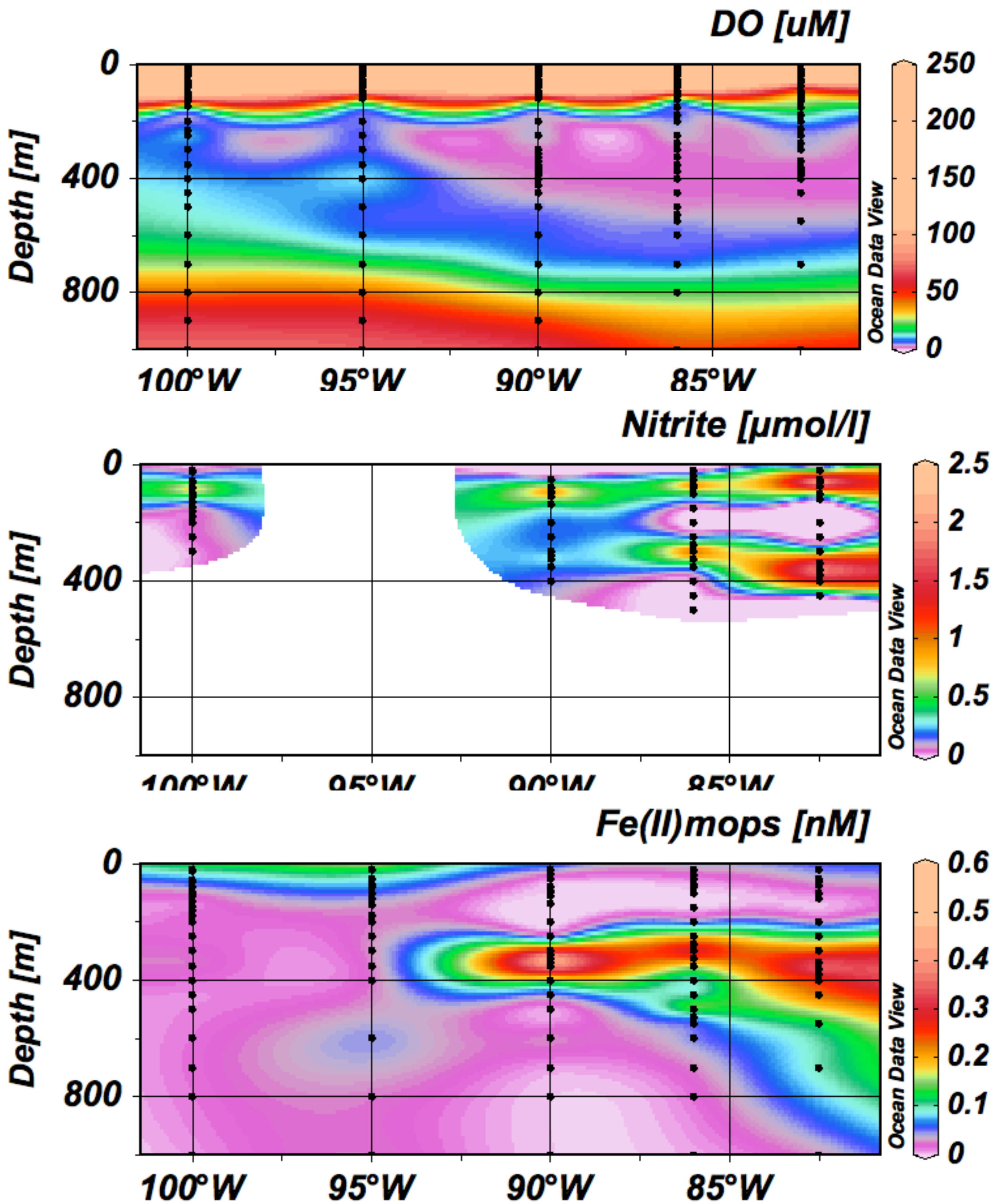


Fe(II) section off Southern Peru, Nov 2005 illustrating importance of coastal shelves in upwelling areas as a source of Fe. Note: plumes advected offshore associated with nitrite maxima.


Fe(II) [nmol/kg]
Depth [m]
500
1000
20
40
60
80
0
10
20
30
40
Ocean Data View
Nitrite [µmol/kg]
Depth [m]
500
1000
20
40
60
80
Distance [km]
0
1
2
3
4
5
Ocean Data View



Cruise to ETSP on RV Atlantis, Feb 2010, Doug Capone, Chief Scientist
Fe(II) and total dissolved Fe and Cu measured by Yoshiko Kondo



Zonal transect

10^{o} S

Cruise to ETSP on RV Atlantis, Feb 2010, Doug Capone, Chief Scientist
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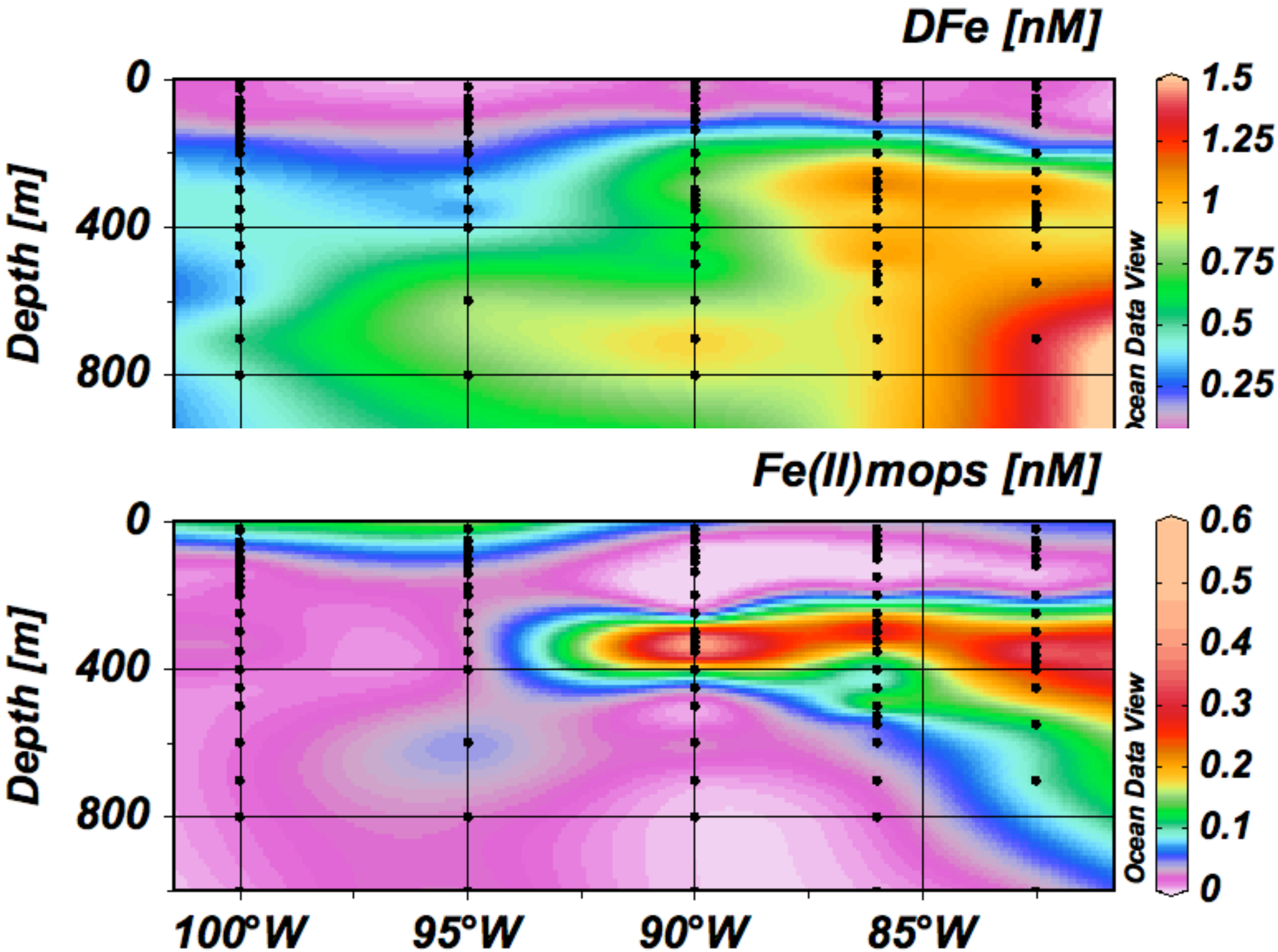
Total dissolved Fe and Fe(II) , 10ºS



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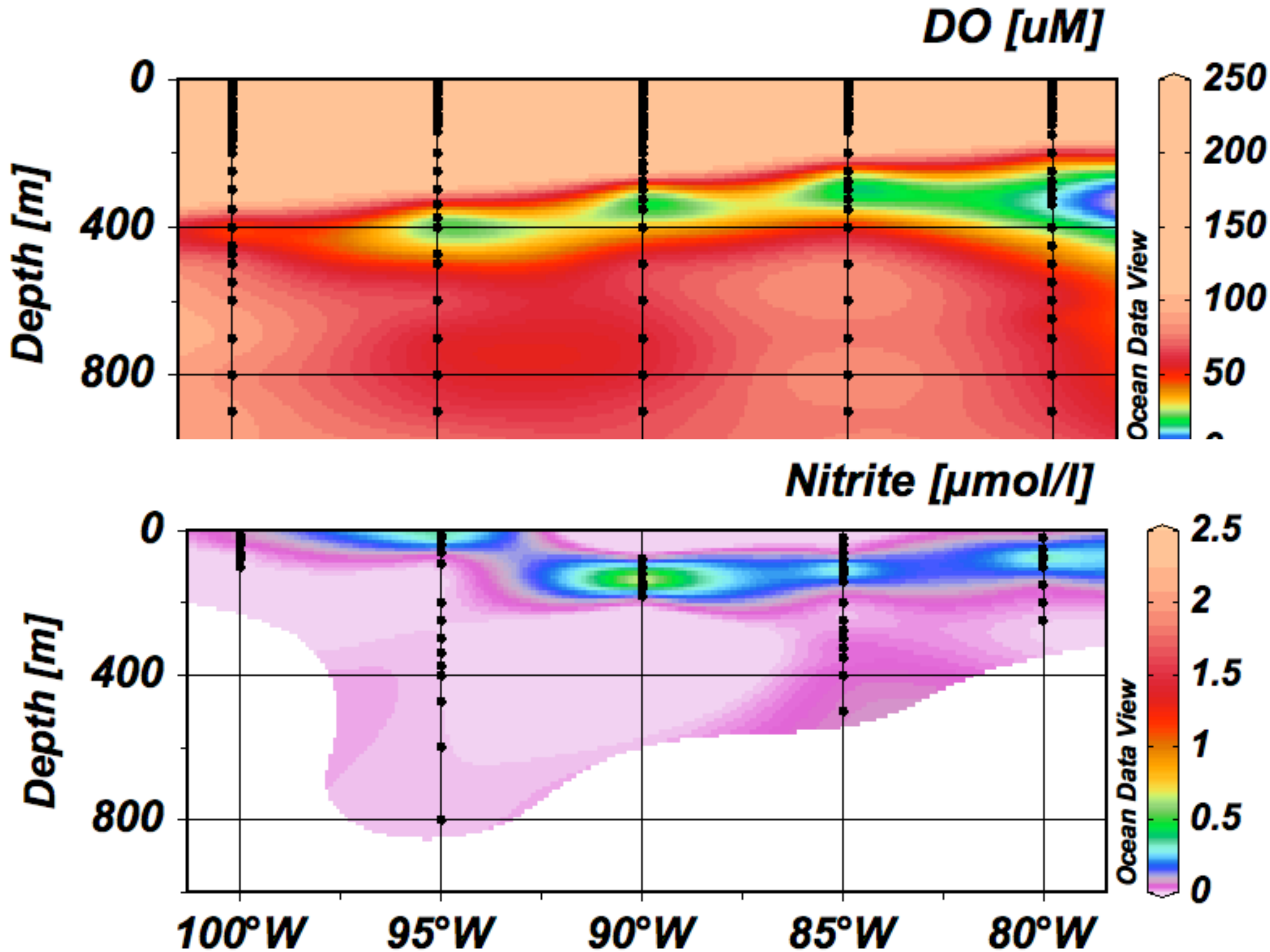
Zonal Transect 20ºS



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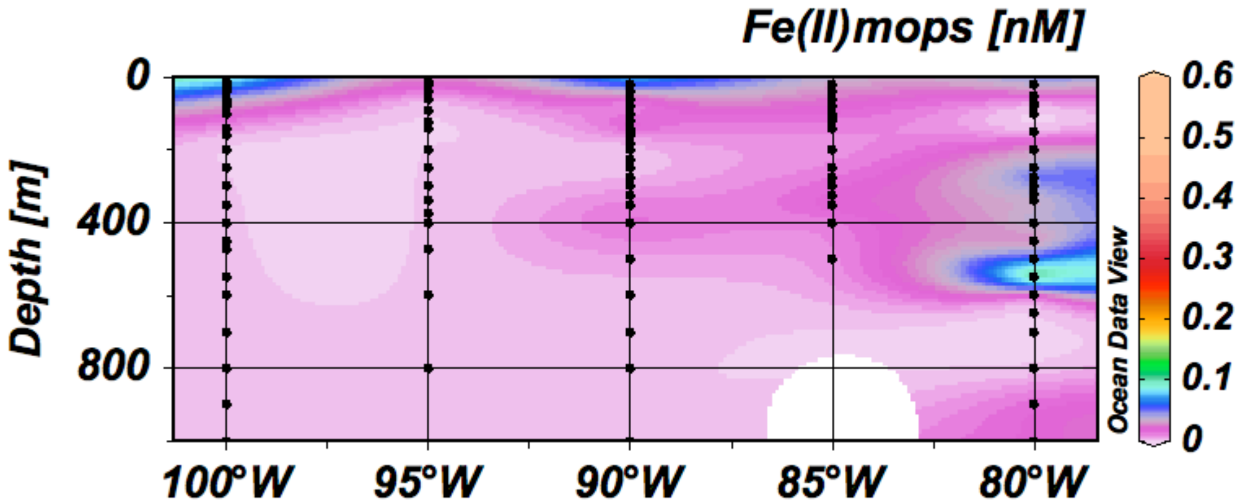

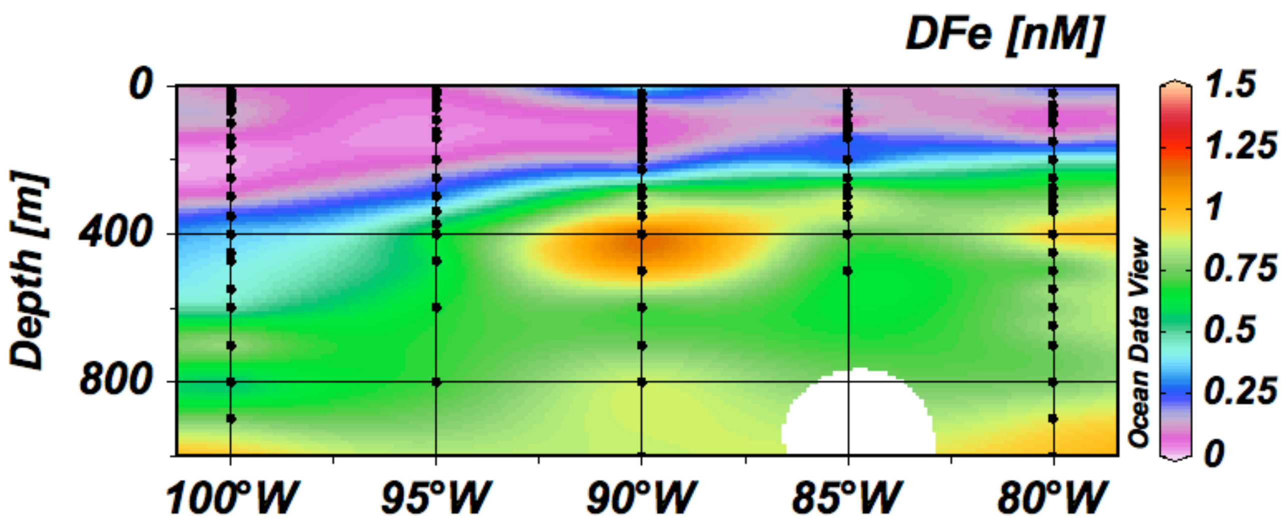

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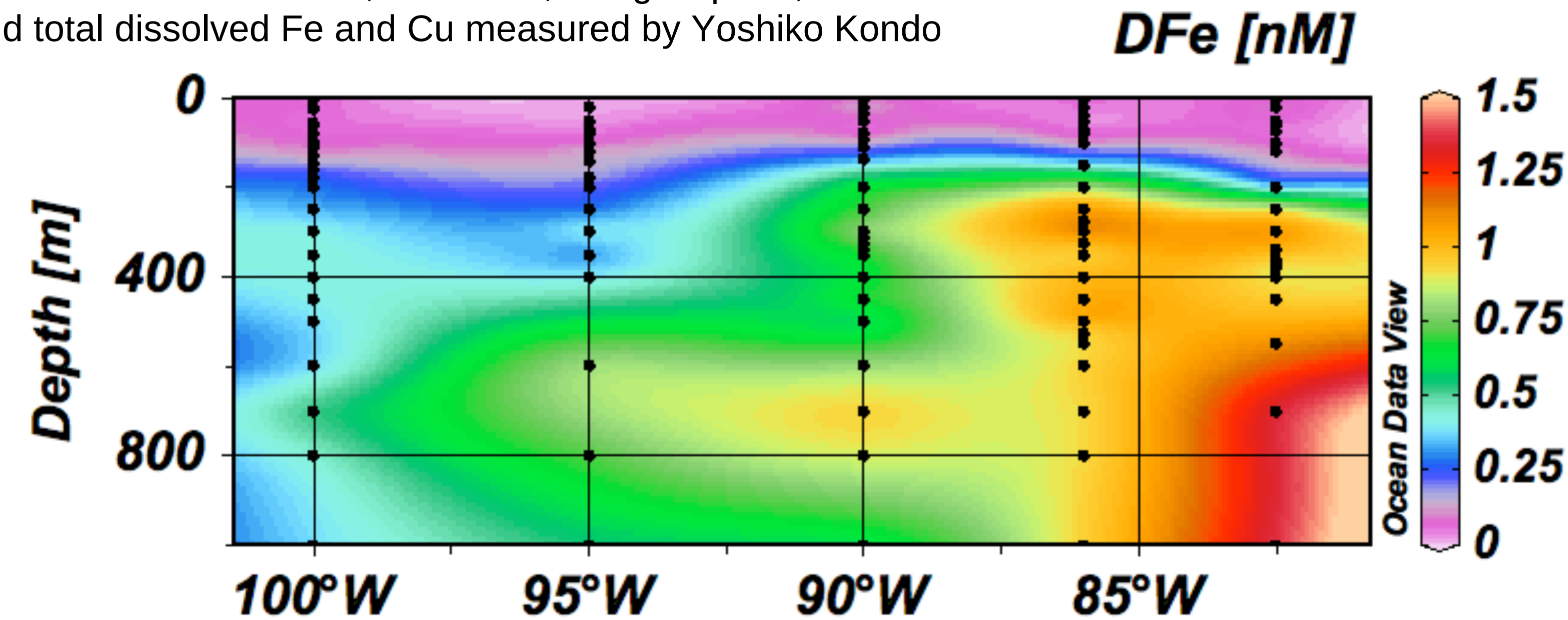
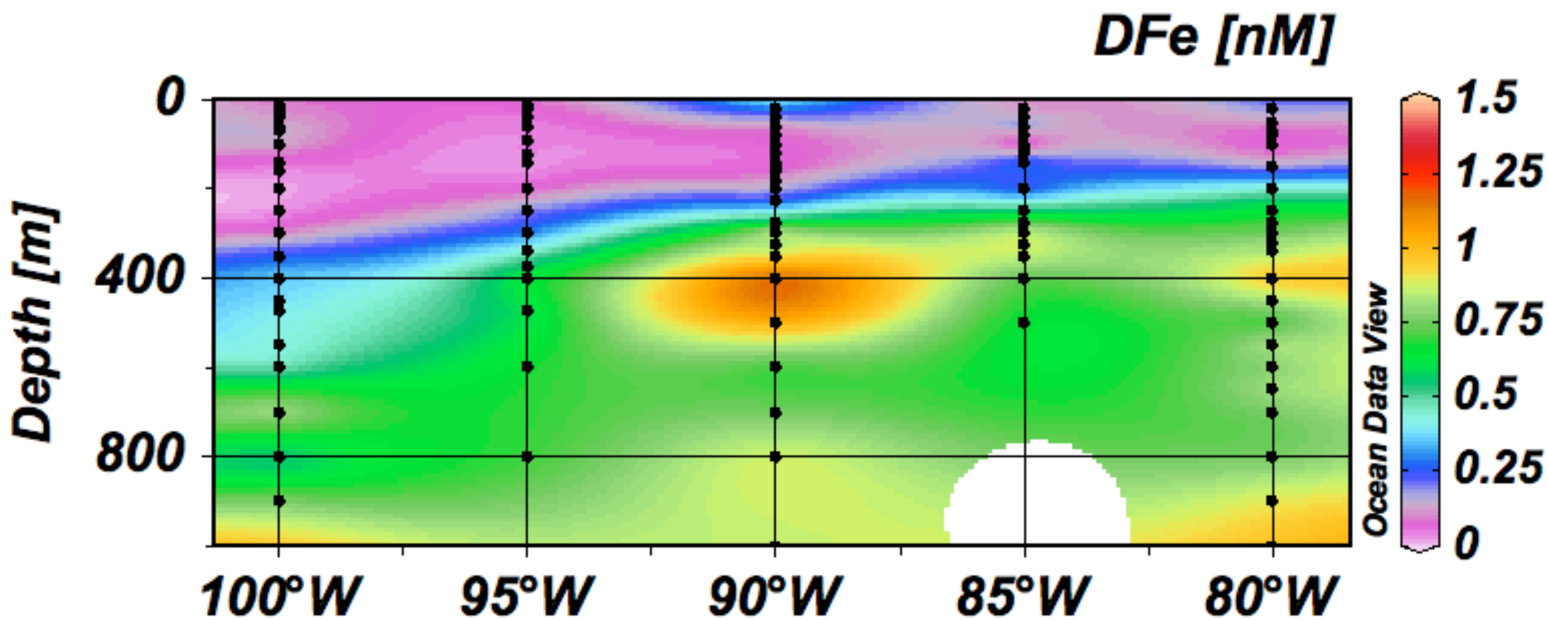
10^{o}S



20^{o}S



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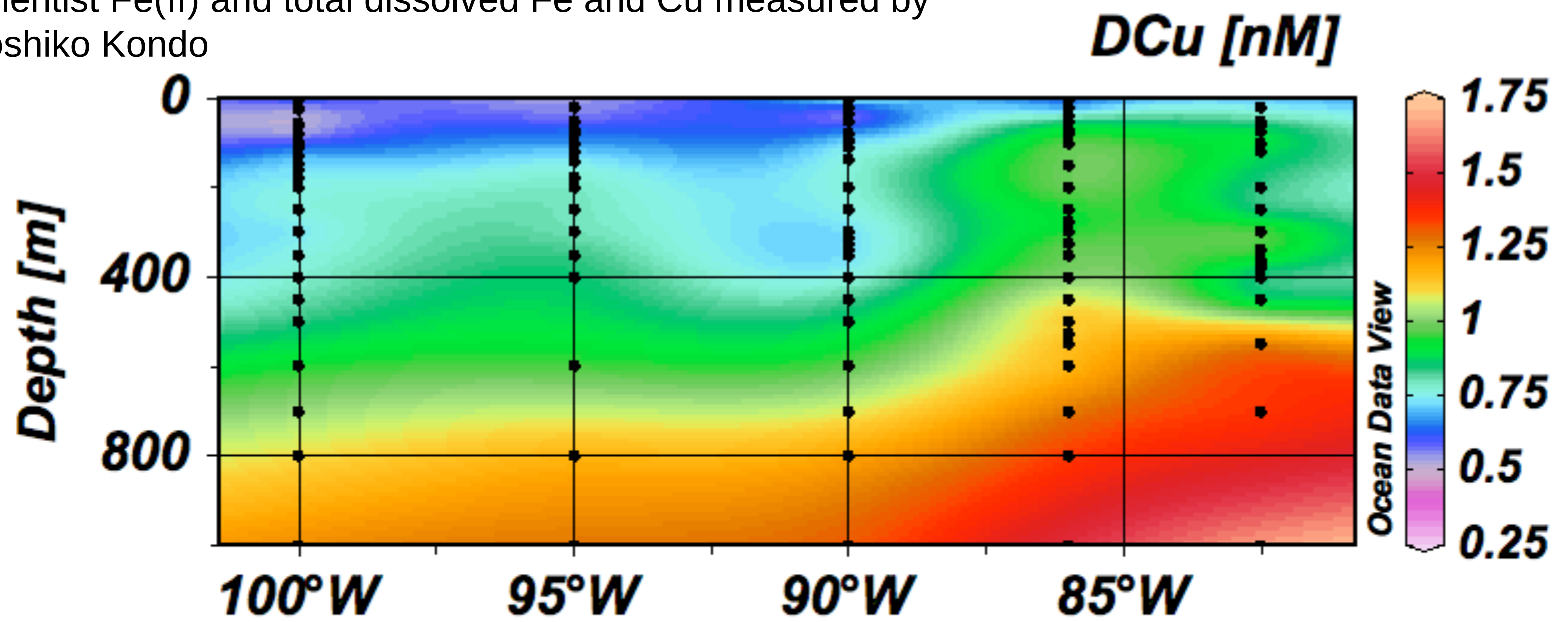

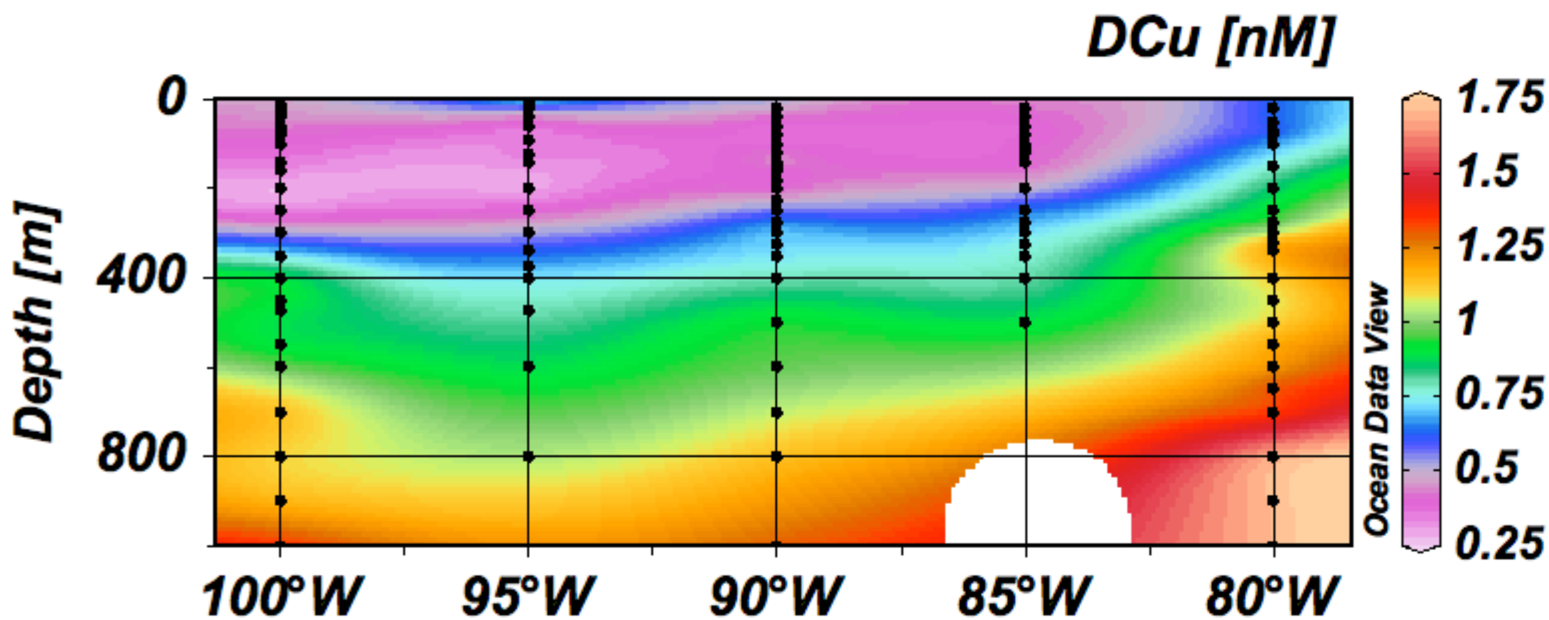

Subsurface flow is complex, with many westward flowing filaments that can transport materials from the shelf/slope offshore

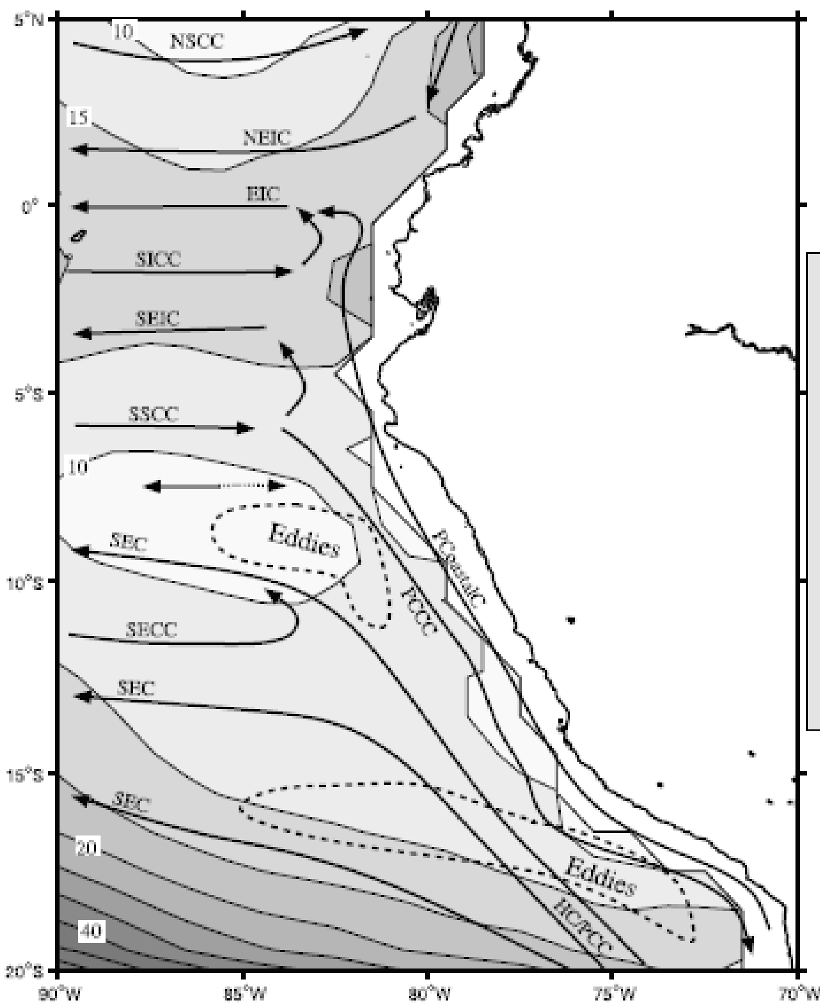

Figure 4. Schematic middepth flow field at about 400 m depth. The mean climatological dissolved oxygen distribution at 400 m from WOA05 is included. Areas of high frequency of eddy occurrence are marked by dashed lines.(From Czeschel et al., 2010)

Dissolved Oxygen

State of the Art:
Where phosphate was before MAGIC

Issues: Contamination problems surface analysis
Slow response, poor detection limits for in situ sensors

Scope of the problem revealed in Revsbech et al. 2010
Indicating O2 essentially zero at the most intense region of the OMZ.

Key feature is the difference between the green and red/blue lines in the circle
They reflect the sluggish response of the SBE43 electrode at low O2 concentrations

Optodes commercially available from Anderaa

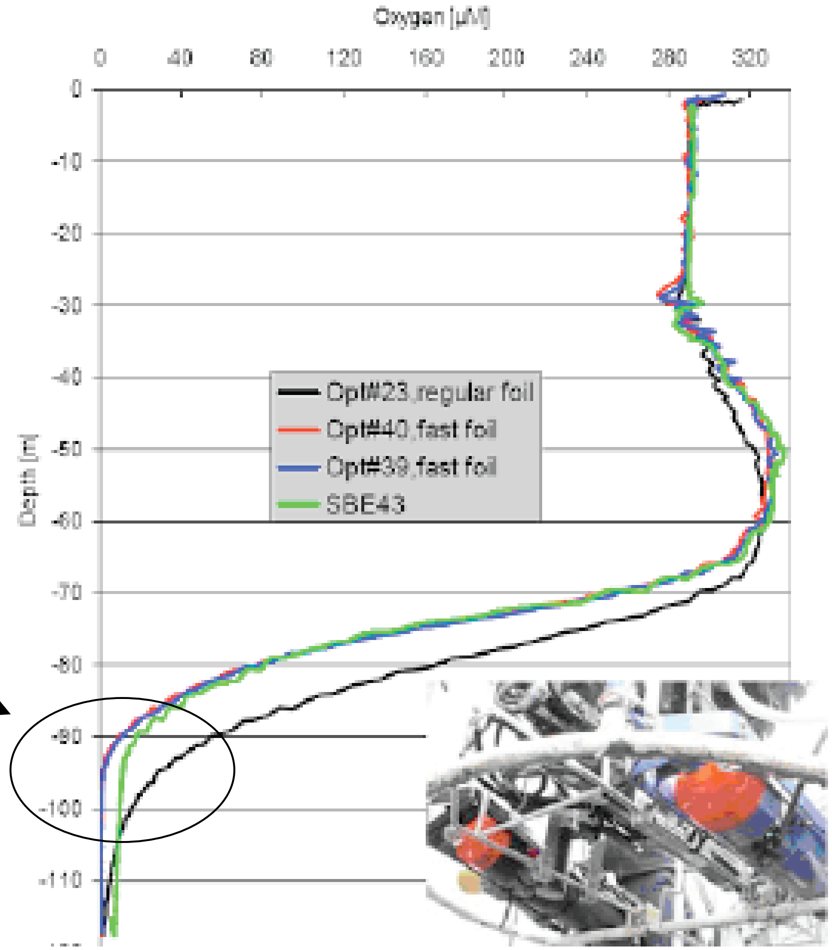

Figure 3. Oxygen profiles take with a SBE 43 O2 electrode (green) and fast foil optodes (blue and red) (Black is regular foil). Tenberg et al. 2009