The Ship Of Opportunity Program: The global XBT network

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NOAA Climate Program Office
Annual System Review Meeting
Washington, DC
October 2010

XBT Sampling modes

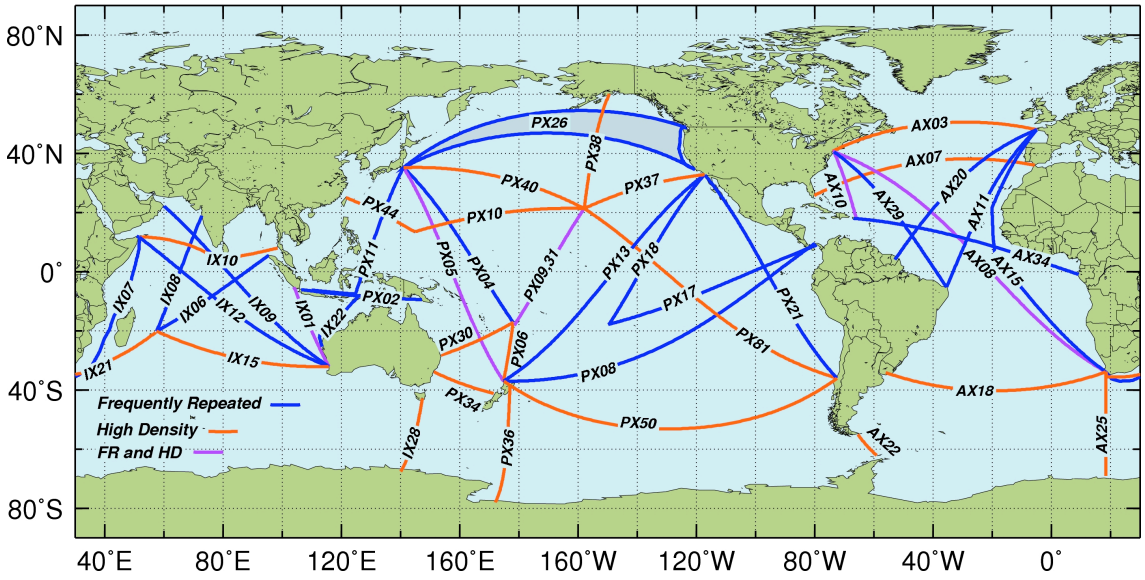
Repeat transects, 0-800m deep,

Low Density (LD) – 12 times per year/XBT obs every ~100 km
• Investigate intraseasonal to Interannual variability in the tropical oceans, and
• Investigate historical relationship between sea height and upper ocean thermal structure.

Frequently Repeated (FR) - 18 times per year/XBT obs every ~100 km

High Density (HD) – 4 times per year/XBT obs every ~25km
• Determine synergy between XBT and altimetry observations,
• Seasonal to interannual fluctuation of meridional heat advection, and
• Variability of boundary currents, fronts, eddies, rings.

XBT Network -1999



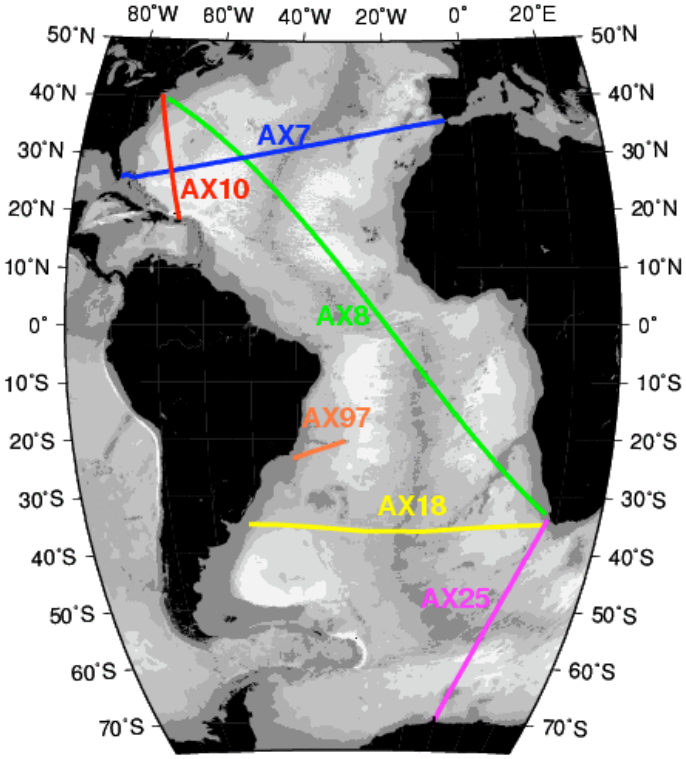
OceanObs99 Recommendations

Recommendations in OO99:

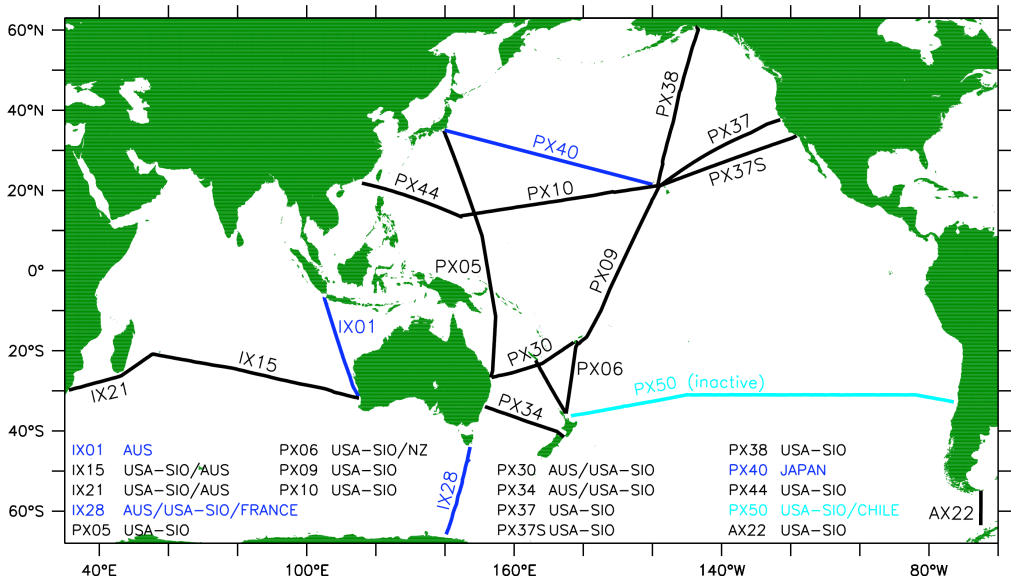
- **Begin phase reduction of LD sampling. Done.**
- **Have sufficient overlap between LD and Argo floats. No.**
- **Build network based on existing transects. Done.**
- **Develop a world ocean data base. Done by GTSPP and WOD**

The Ship Of Opportunity Program
NOAA/AOML and SIO XBT transects

AOML



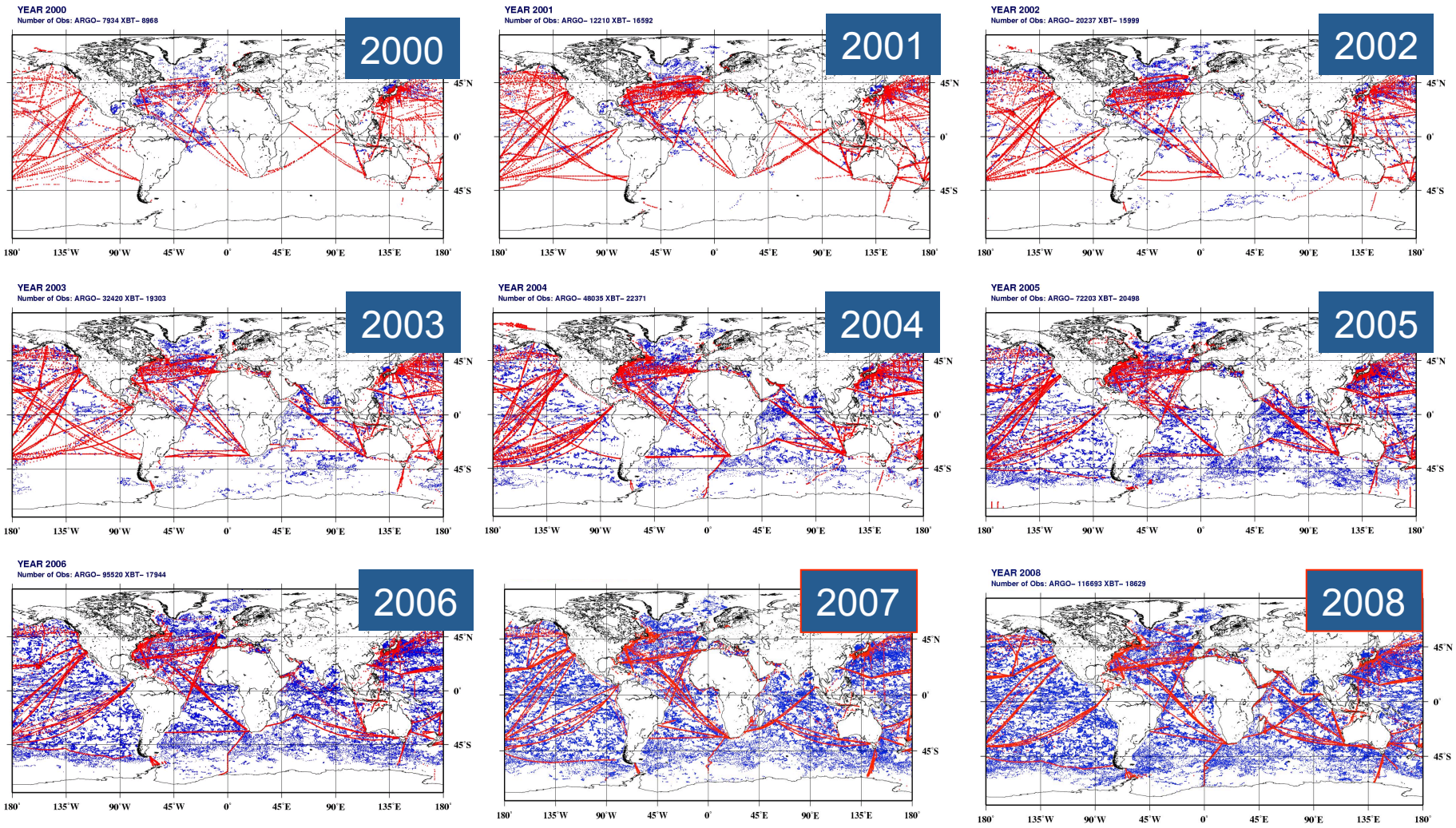
SIO



http://www-hrx.ucsd.edu/

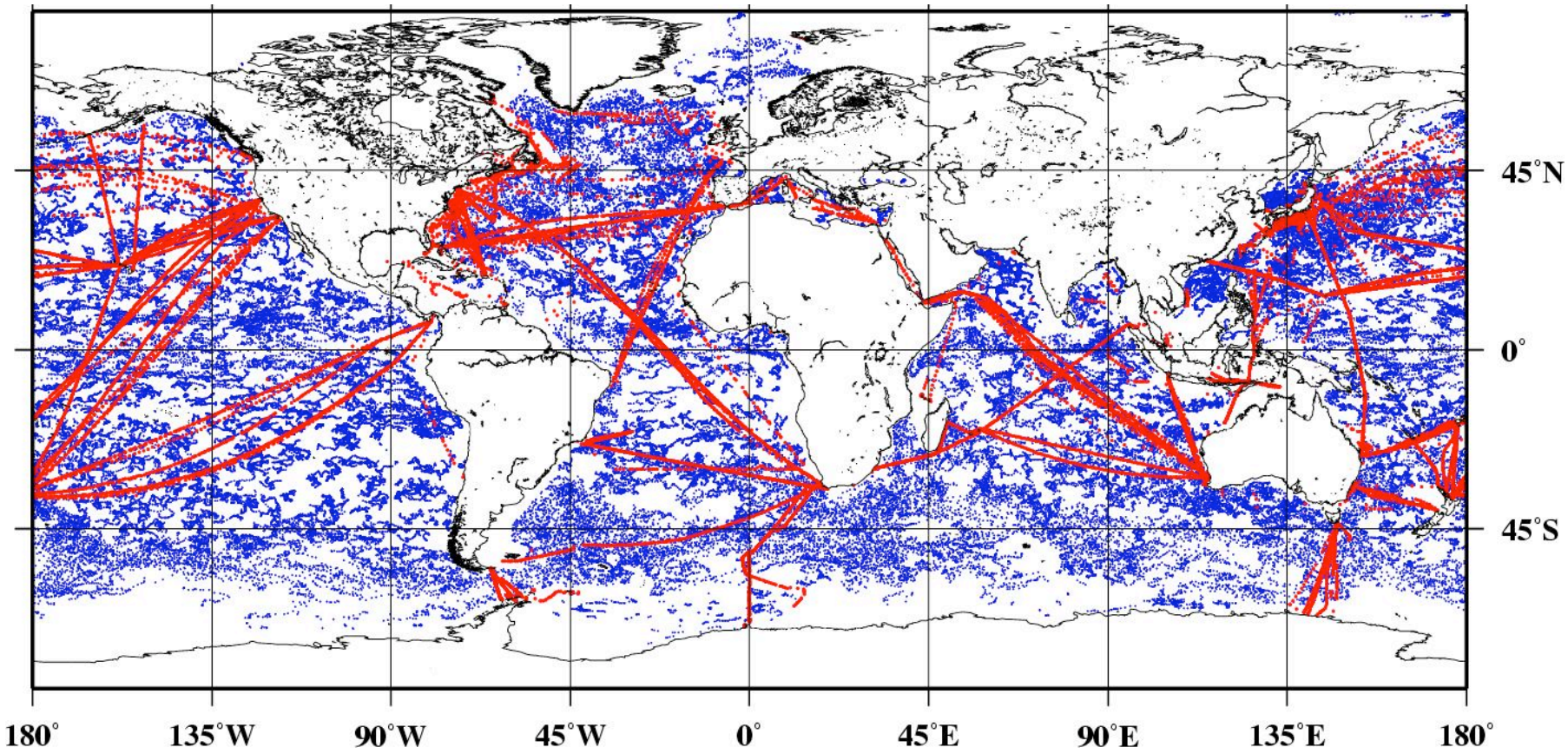
http://www.aoml.noaa.gov/phod/soop

XBT and Argo observations
2000-2008



- Determine synergy between XBT and altimetry observations,
- Seasonal to interannual fluctuation of Meridional heat advection, and
- Variability of (boundary) currents, fronts, eddies, rings.

XBT and Argo observations
2009



Argo floats ~ 82 %
XBTs ~ 15 %

NOAA:
70+ SOOP ships ocean obs
900+ SOOP and VOS ships met bulletins

CWP OO09 Objectives

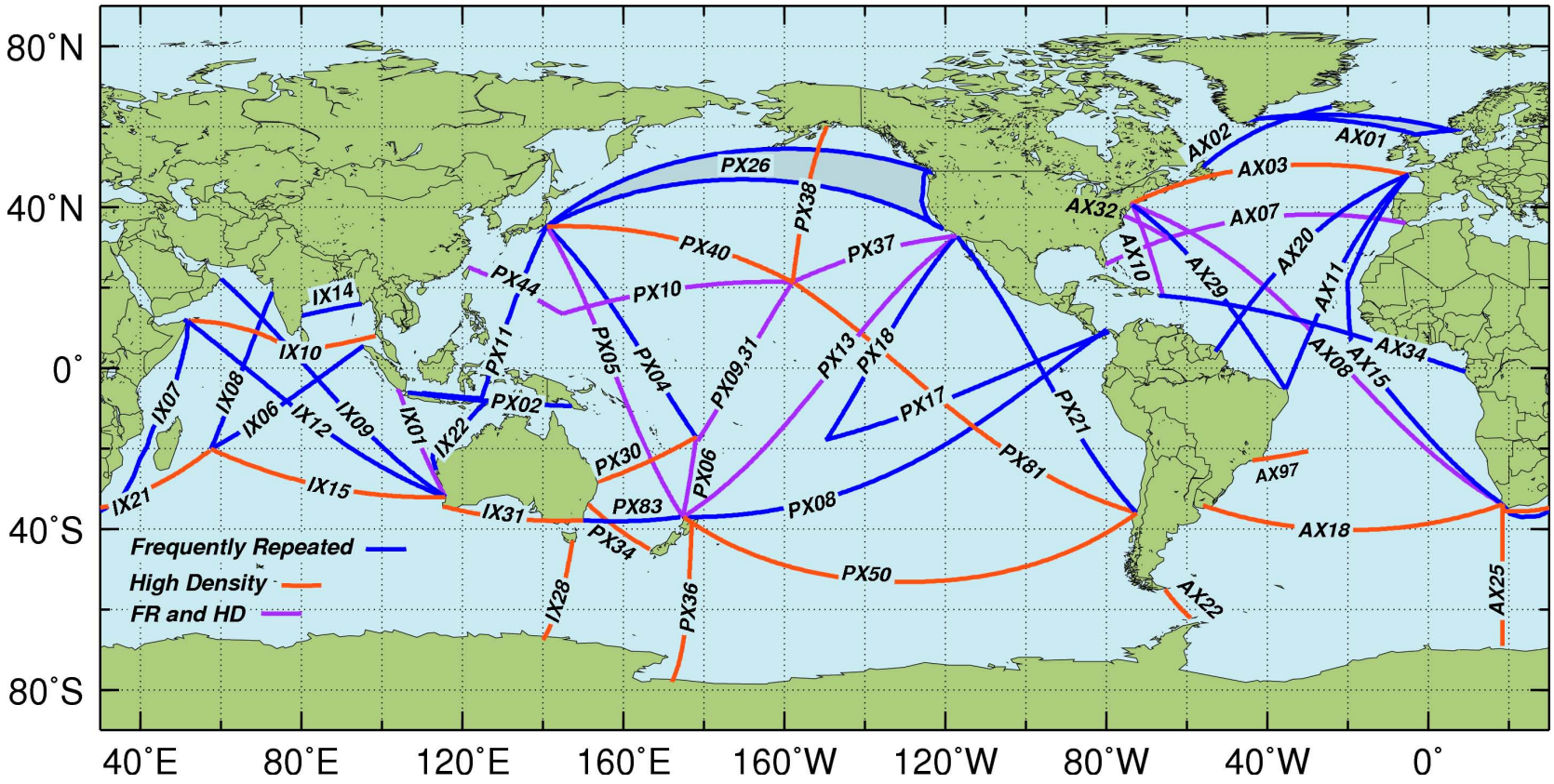
- To **assess the state of the XBT network** as recommended by the last upper ocean thermal review panel (1999),

- To **evaluate if the OO99** network still holds,

- To communicate the value of XBT observations in **scientific research and in model initialization,** and

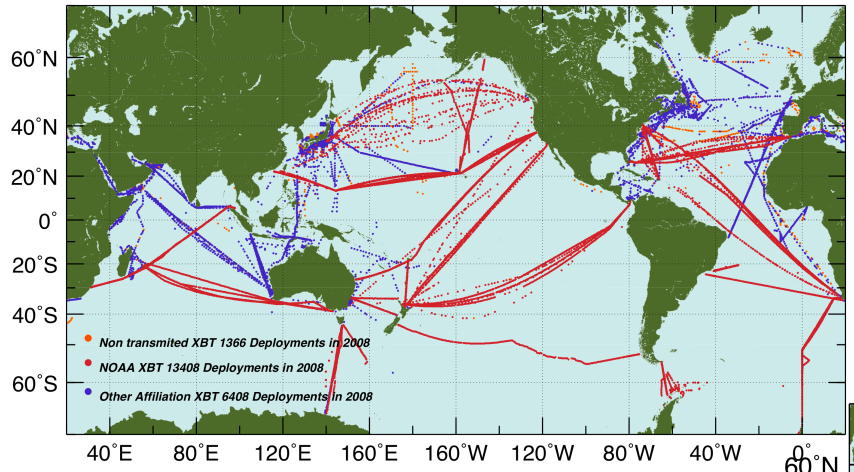
- **To make new recommendations** based on the current knowledge of the ocean, the full implementation of Argo, operational altimetry, improvement of ocean models, etc.

OceanObs09 recommendations



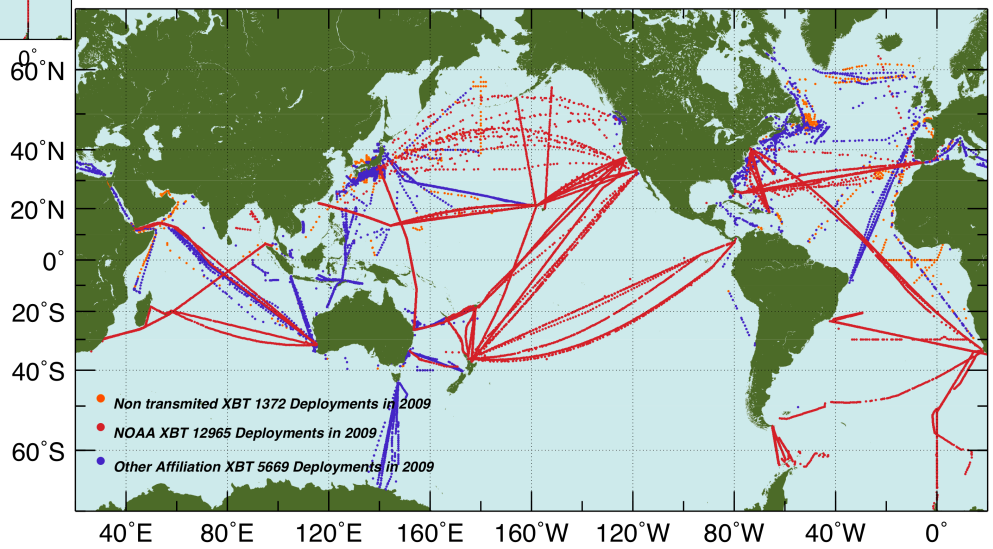
No OO99 transects dropped. Several transects added.
Only 2 recommended modes (FR, HD)
A few transects added (AX97), reinstated (AX32, Oleander Project)

XBT RT observations
2008 and 2009



2008

2009



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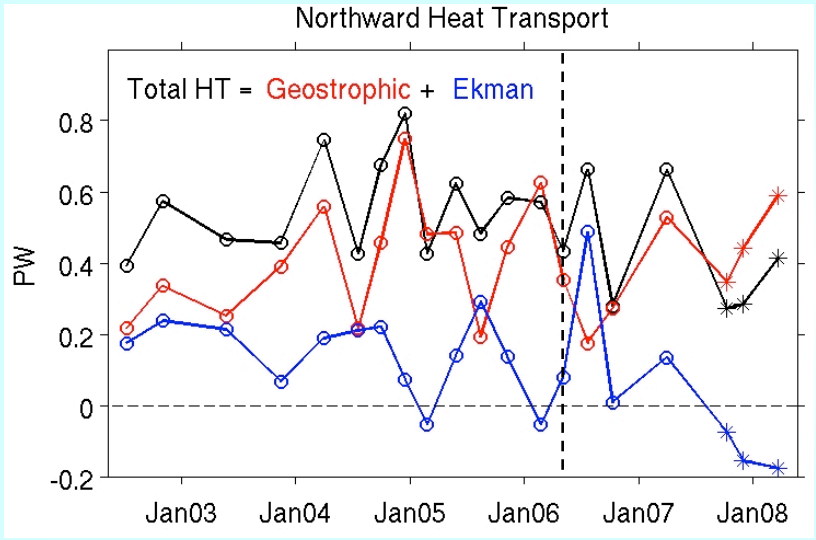
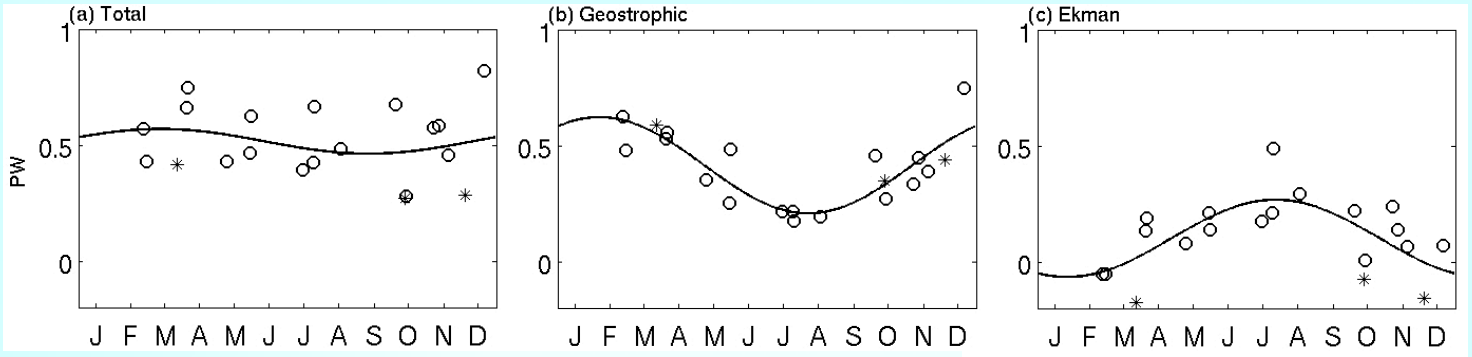
Key Results: Northward Heat Transport in SA (AX18)



Total = 0.51 ± 0.15 PW
Geos. = 0.40 ± 0.16 PW
Ekman = 0.11 ± 0.16 PW

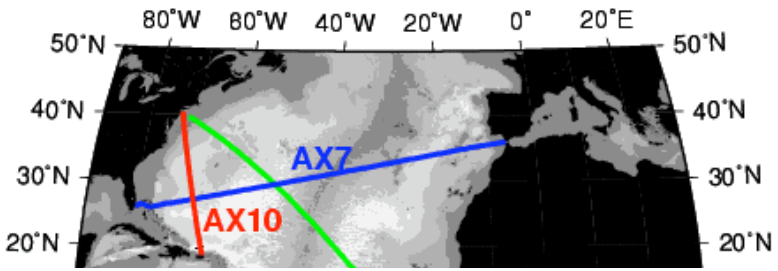
- Geostrophic transport controls the total northward heat transport.
- Geostrophic and Ekman transports experience comparable variability



Both geostrophic and Ekman transports experience annual cycles, but they are out of phase.

Garzoli and Baringer (2007)
Baringer and Garzoli (2007)

Key Results: Heat transport NA and AMO (AX07)



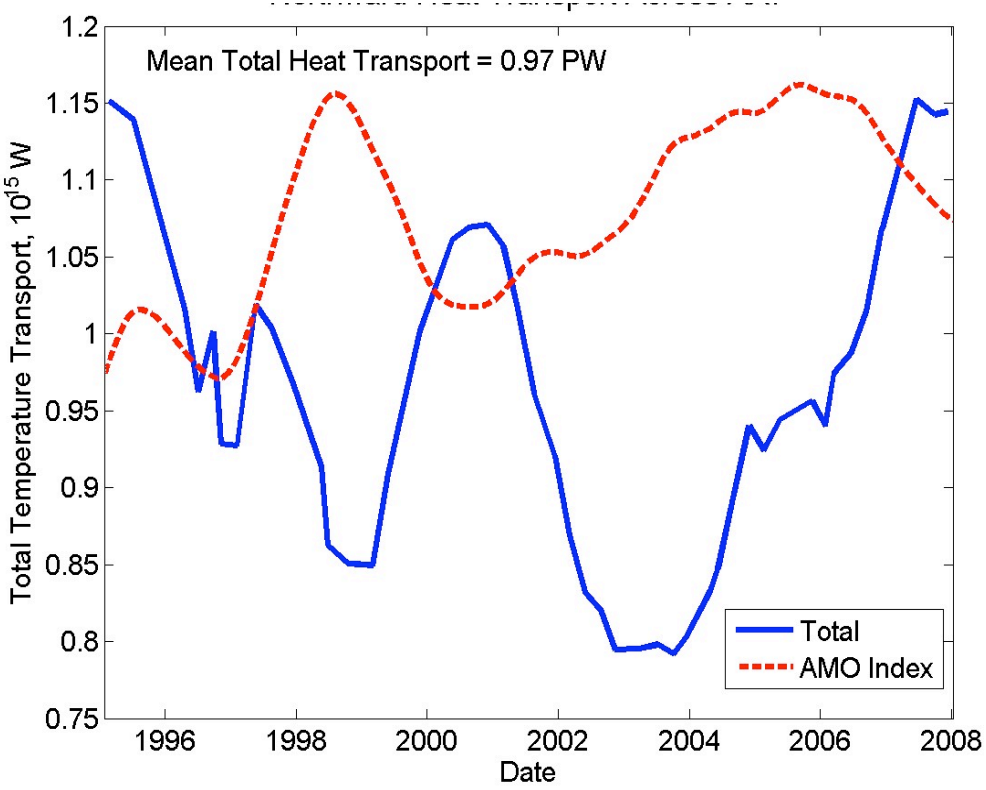


Figure by M. Baringer;
Goni et al, 2010

Key Results: Frontal regions in the ACC (AX25)

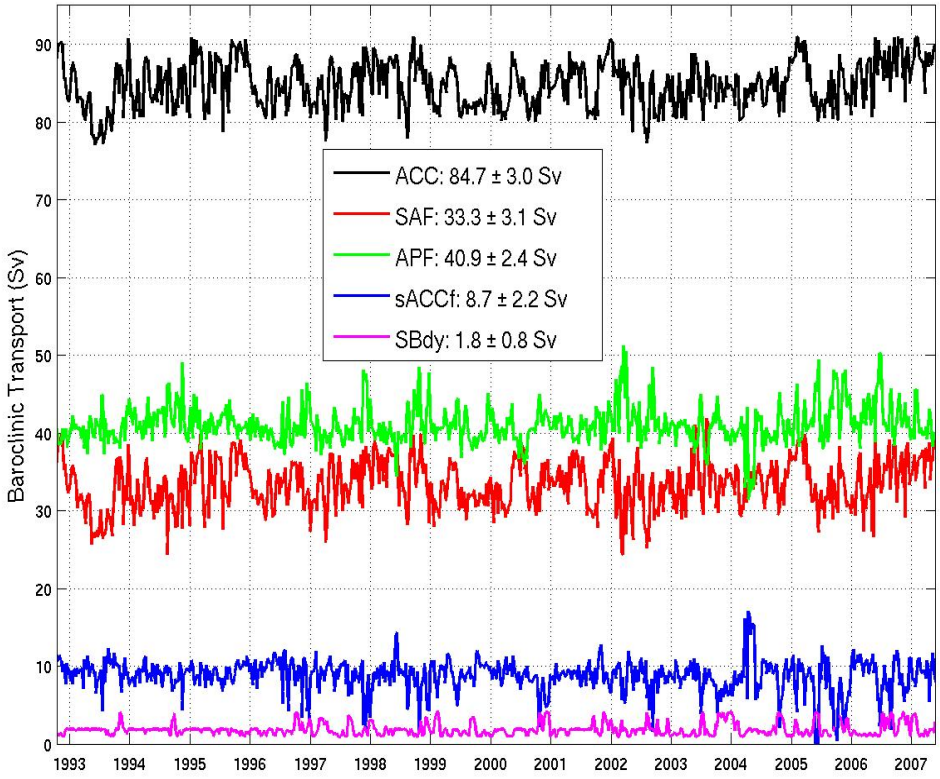
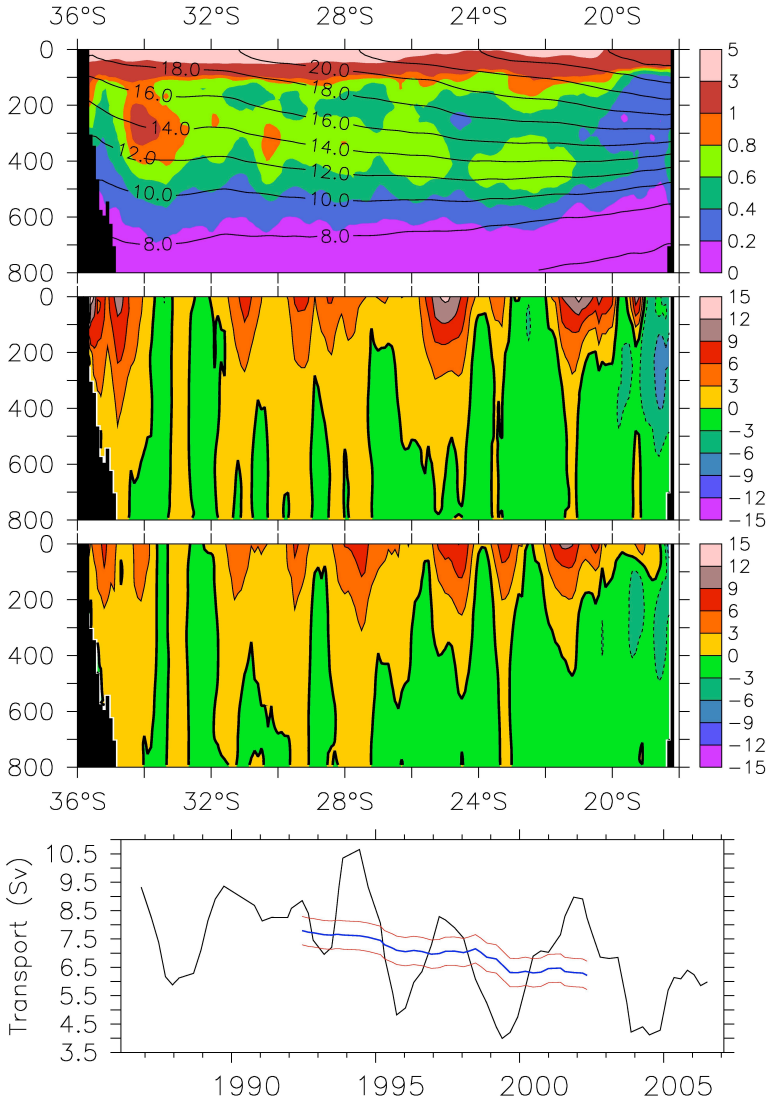
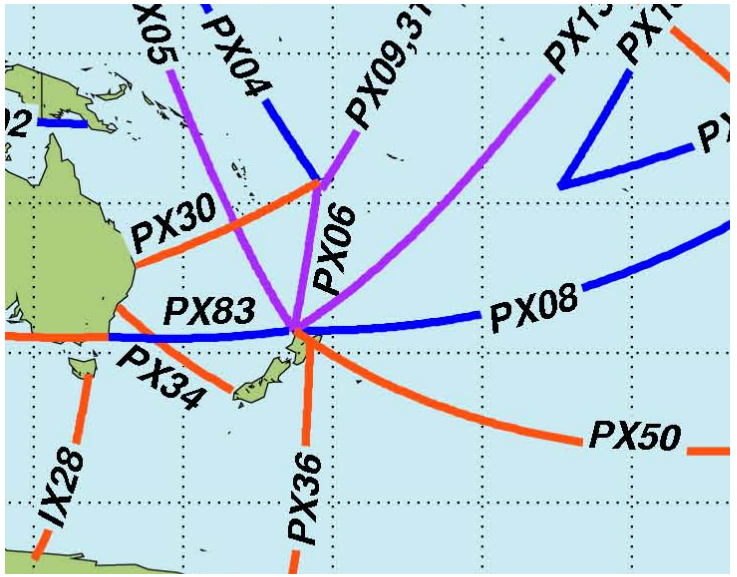


Figure by Sebastiaan Swart; Goni et al, 2010

- AX25 XBT obs + satellite altimetry,
- Detection of fine scale features that form the fronts,
- Subantarctic front contributes to 50% of the total transport variance of the ACC, even when its transport is less than other fronts.

Key Results: Pacific Ocean (PX06)

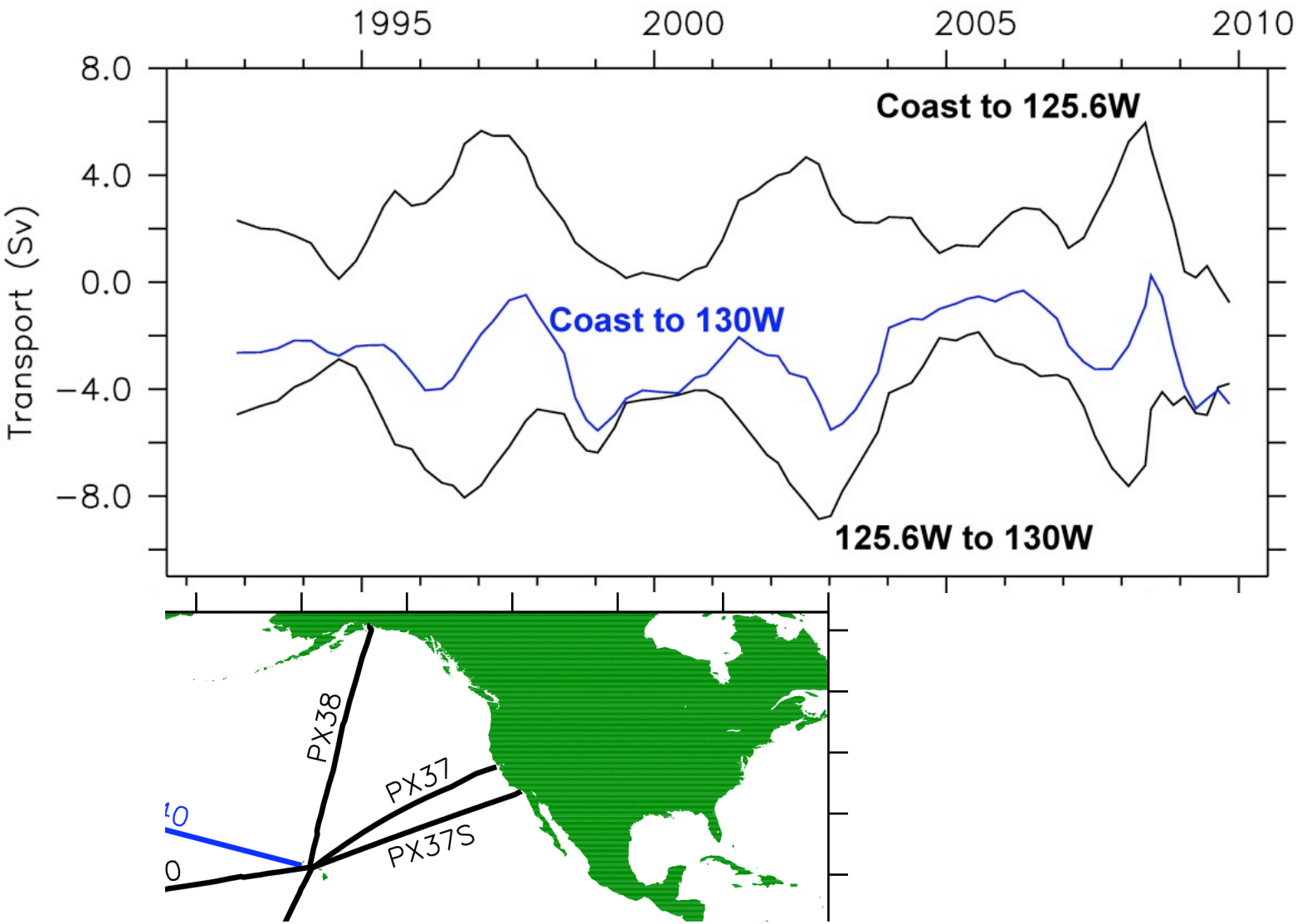




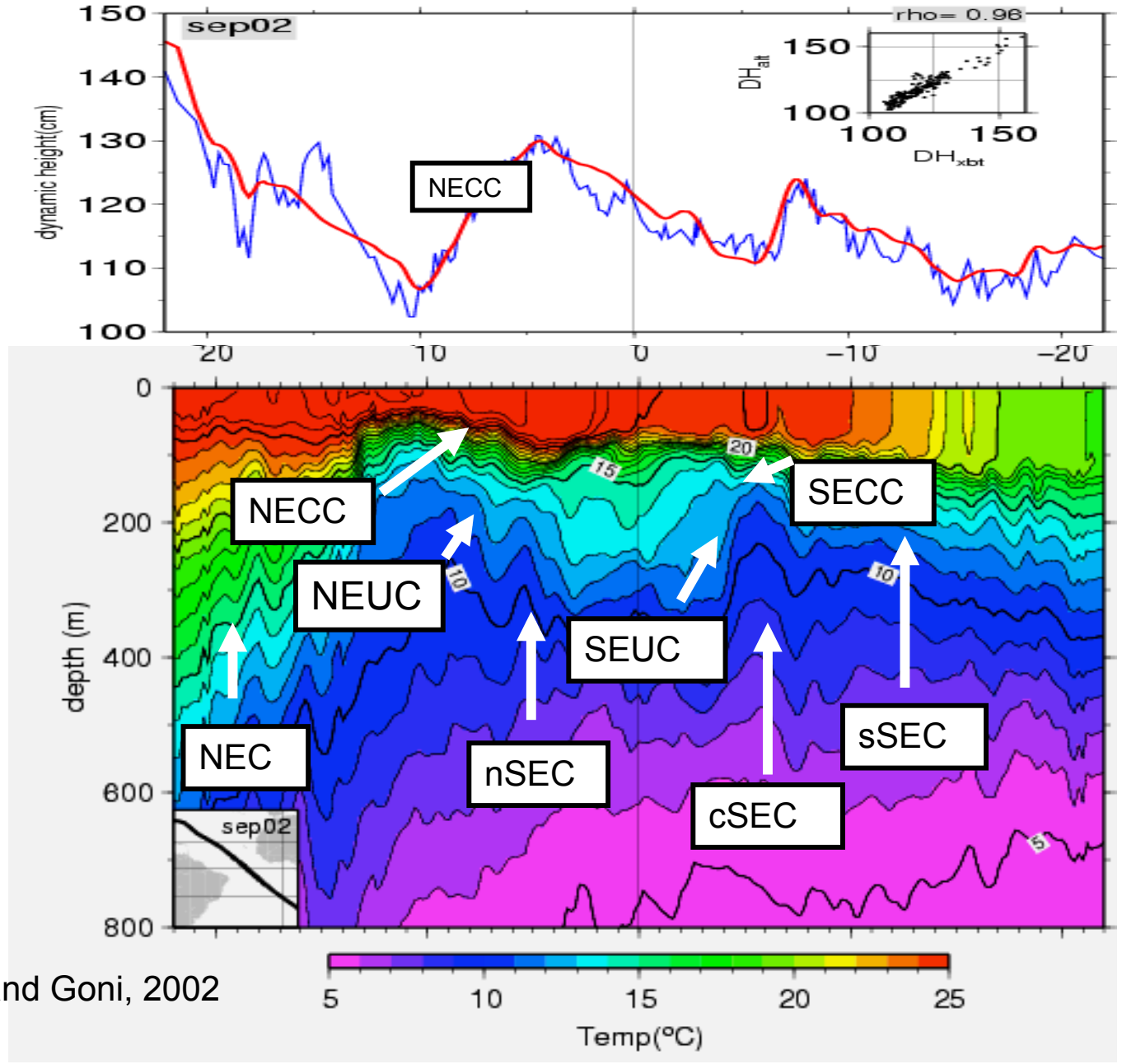
- Min temp variance at both ends,
- Eastward flow in distinct filaments
- 4 year period variability, and decadal trend in transport

Figure by Dean Roemmich;
Goni et al, 2010

Key Results: The California Current and Undercurrent (PX37)



Key results: zonal currents in the TA



Baringer and Goni, 2002

XBT Biases

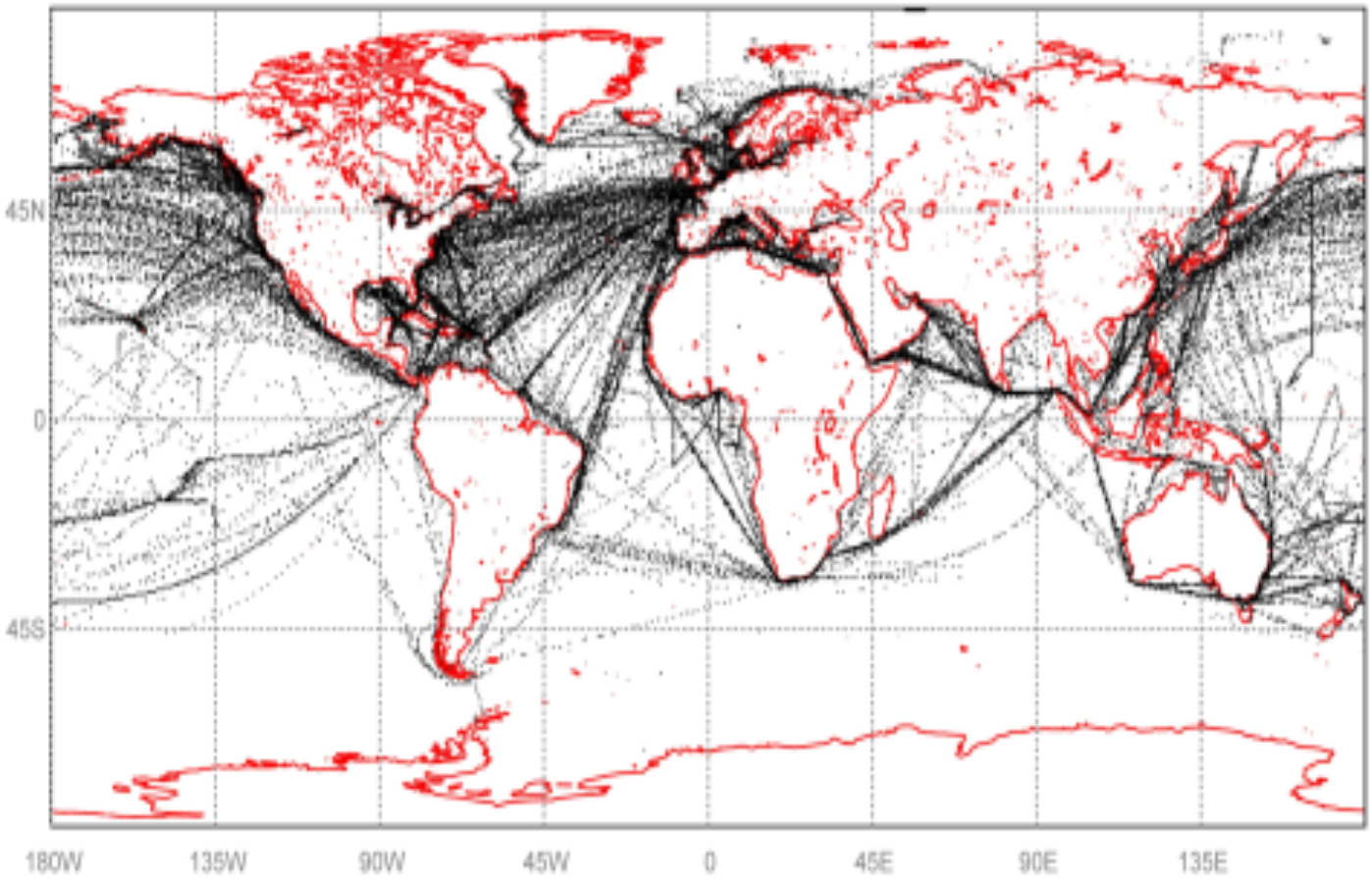
$z(t) = a * t - b * t^2$

2 XBT workshops:

- Time dependence FRE coefficients
- Experiments to determine value of coefficients

Please visit poster

SEAS and Marine Meteorological Observations



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Future of XBTs

- Strong collaboration with shipping companies
- Strong support of High Density XBT transects
- Pressure sensors, switches
- First XBT science workshop (Hobart, April 2011)