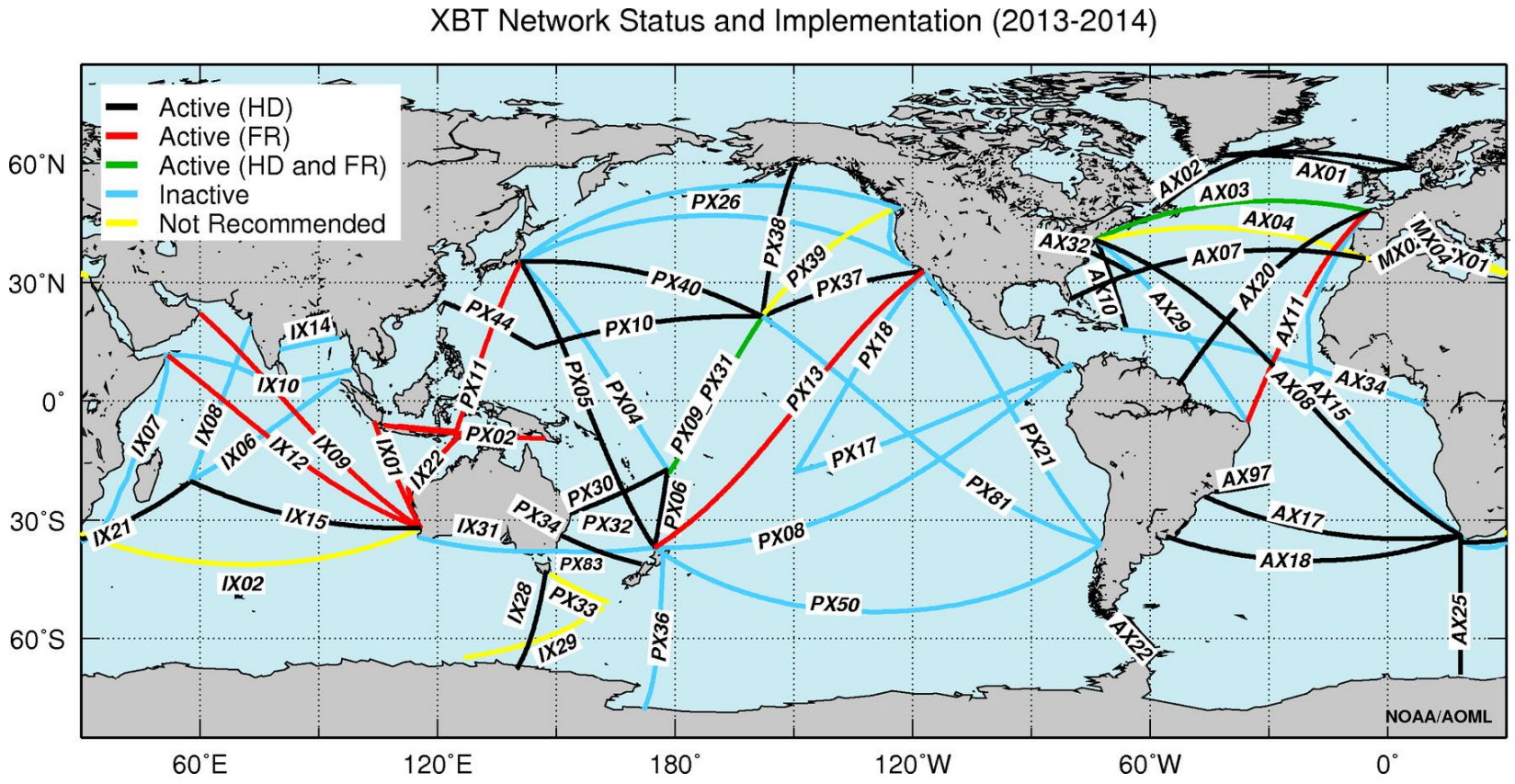
AOML and the Global XBT Network

GTSPP Meeting
Oostende, Belgium
June 17-20, 2014

XBT network
(OceanObs09, CLIVAR panels, regional/national)



Recommended XBT deployments

Low Density (0):
4 deployments per day
12 transect per year

Replaced by ARGO

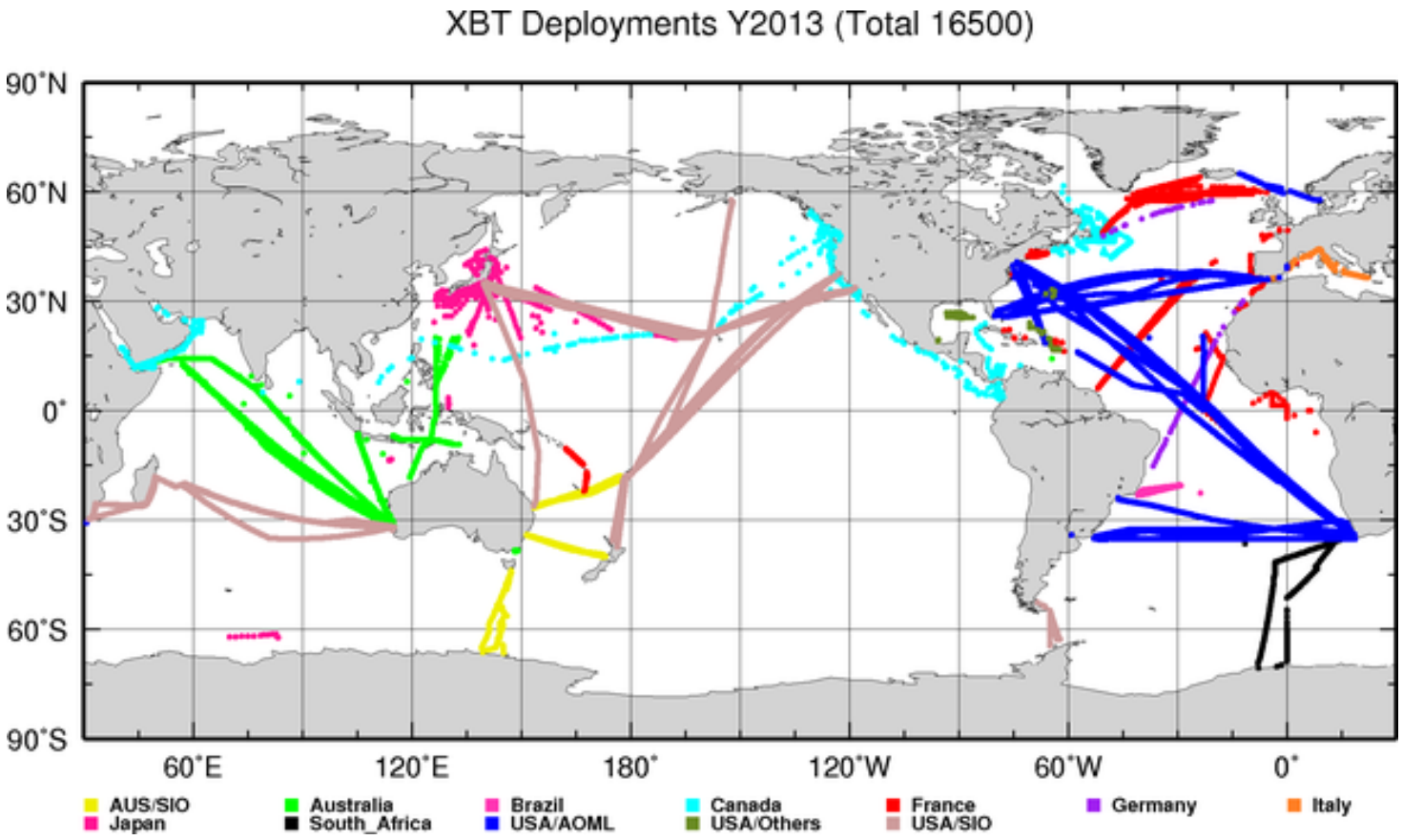
Frequently Repeated (33):
6-8 deployments per day
12-18 transect per year

Data not widely used

High Density (28):
1 deployment every 25-50 km
(18-35 deployments per day)
4-5 transects per year

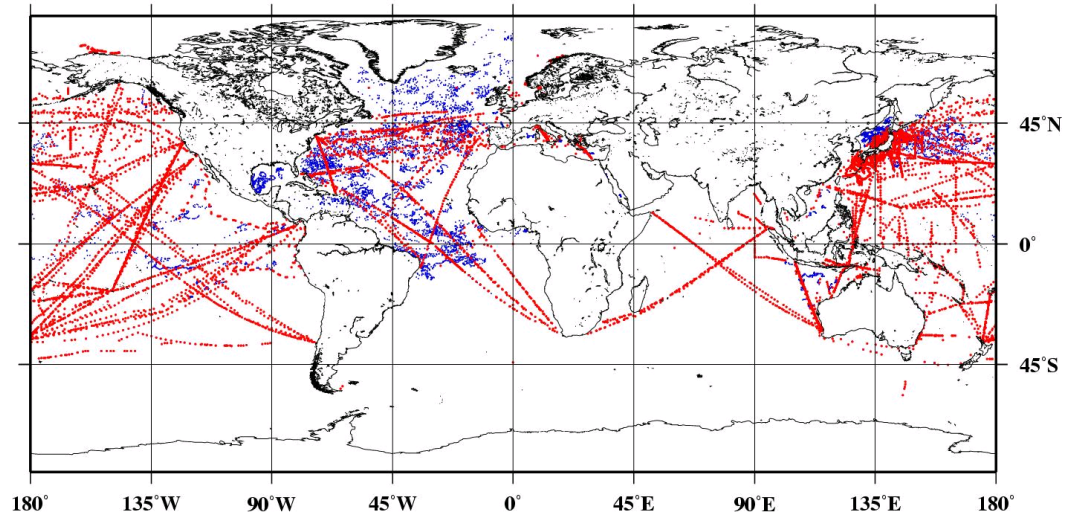
Data widely used in scientific studies

XBT deployment 2013



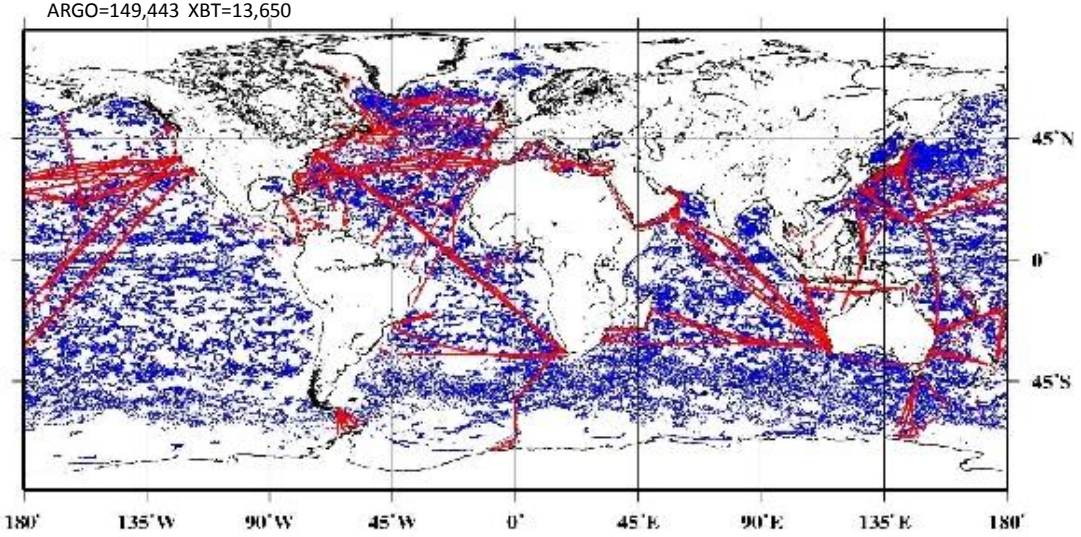
XBT and Argo floats observations
Spatial sampling

2000

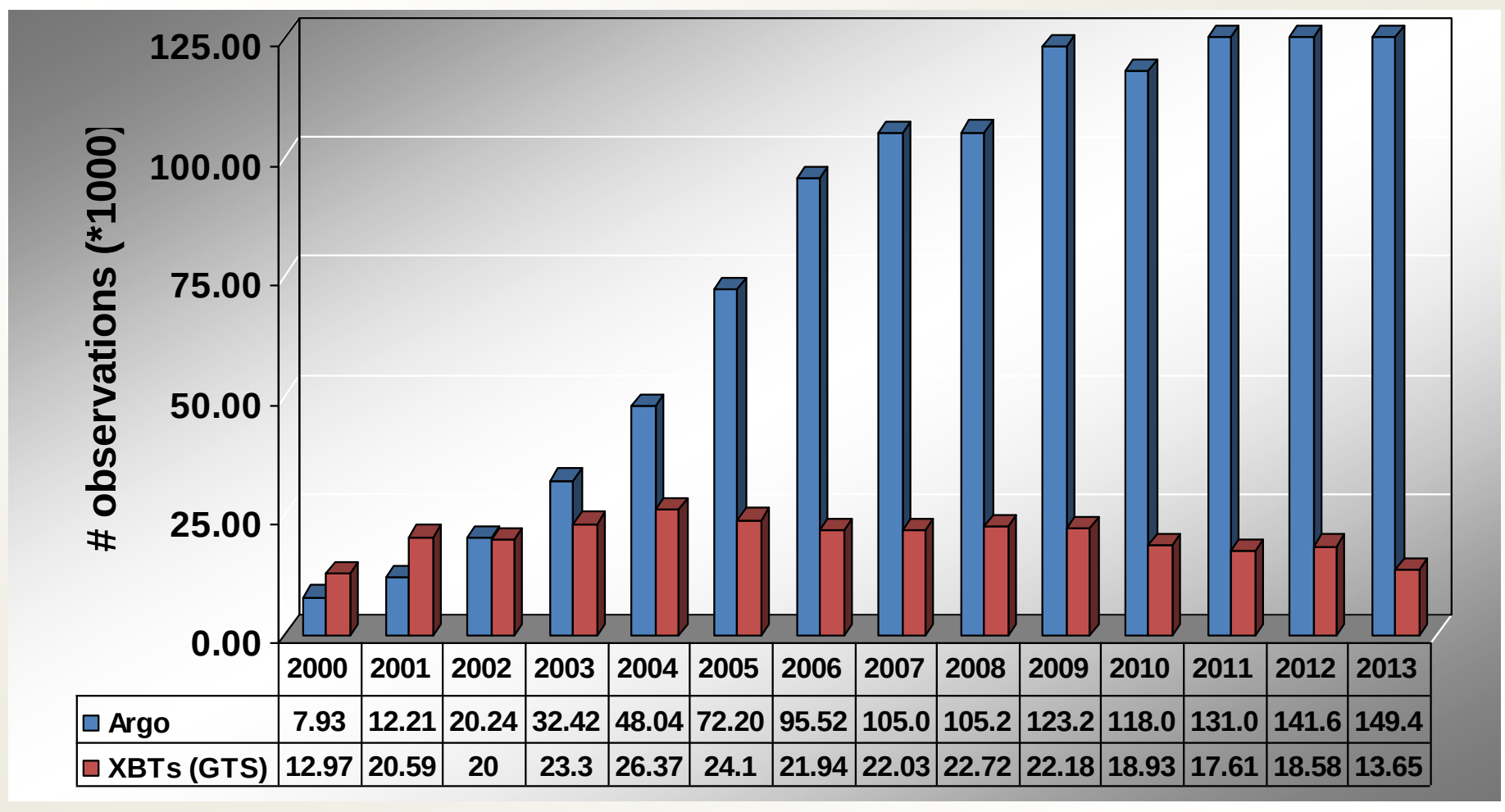


2013

ARGO=149,443 XBT=13,650

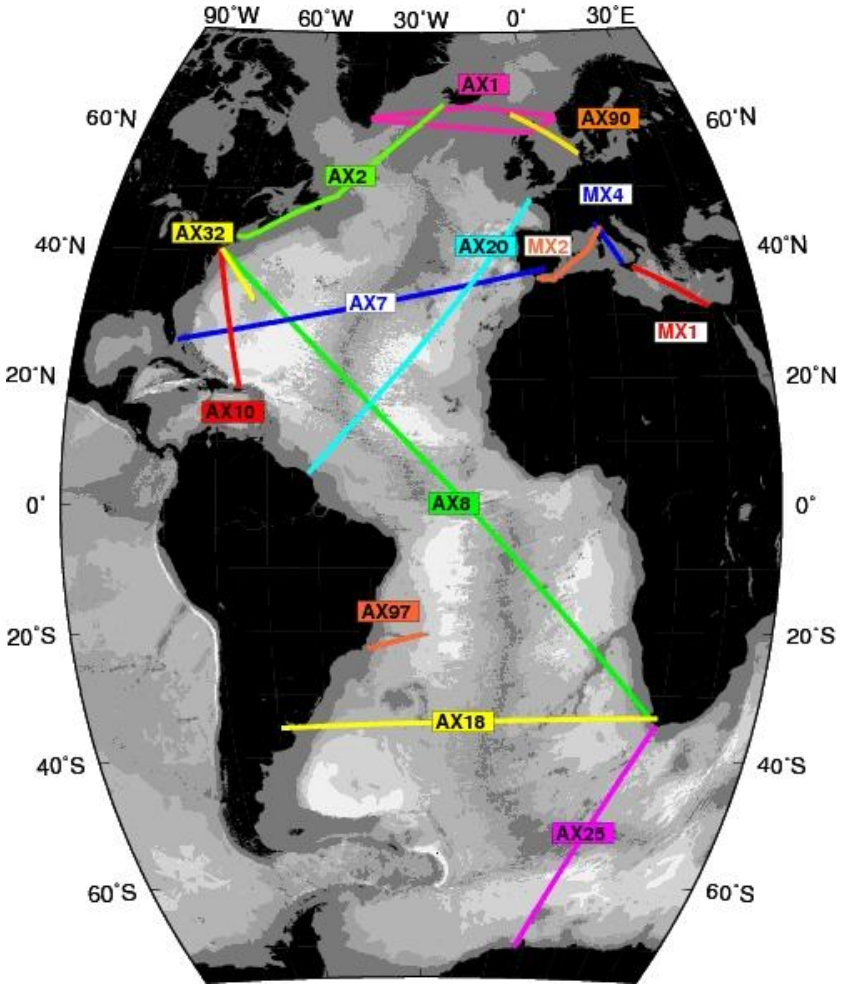


XBT and Argo floats observations
Temporal sampling



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Argo	7.93	12.21	20.24	32.42	48.04	72.20	95.52	105.0	105.2	123.2	118.0	131.0	141.6	149.4
XBTs (GTS)	12.97	20.59	20	23.3	26.37	24.1	21.94	22.03	22.72	22.18	18.93	17.61	18.58	13.65

AOML HD XBT Network
(12 transects)



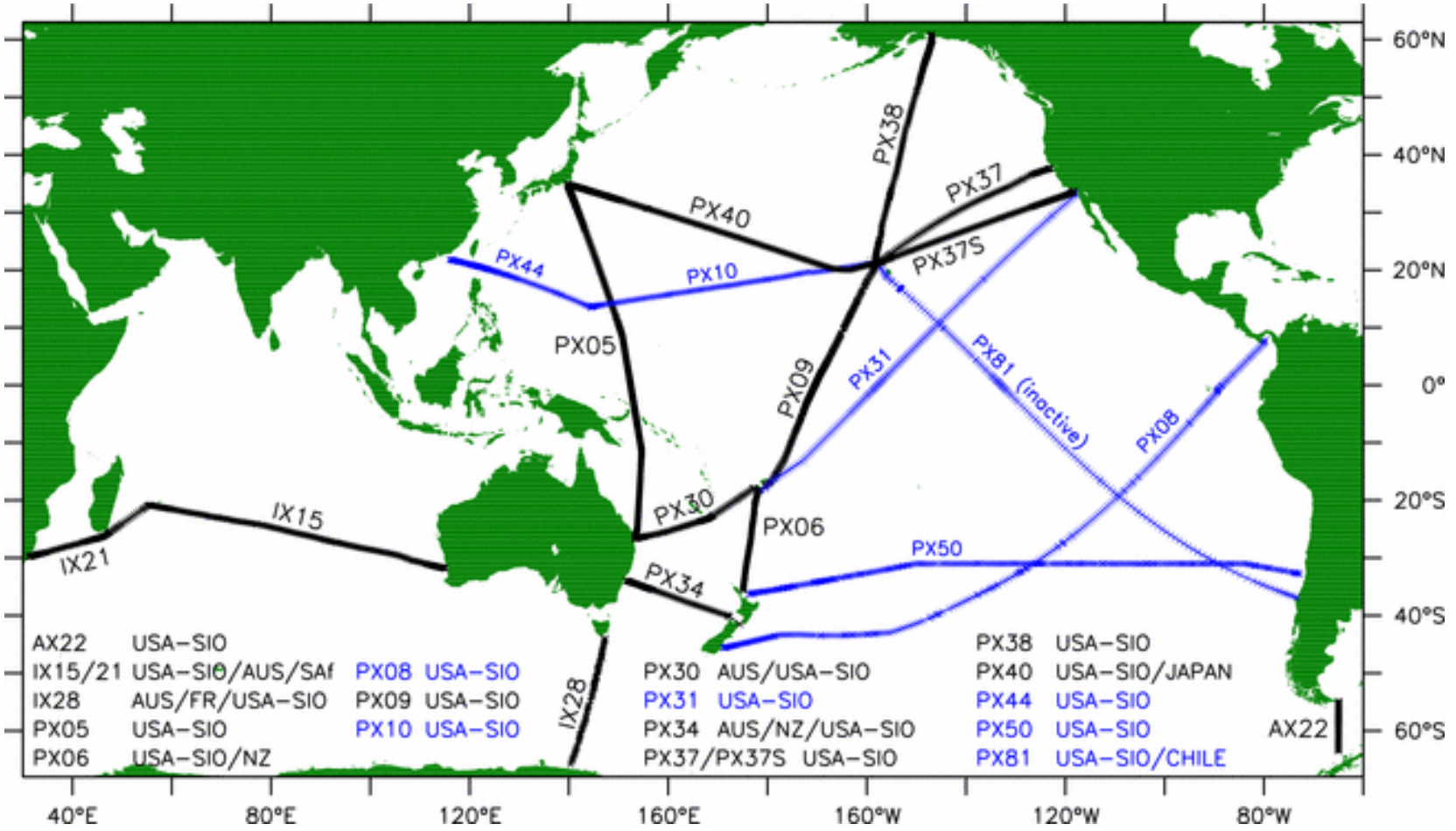
Collaboration Deployments:

- **AX01: Northern Europe to Iceland to Greenland, in collaboration with the University of Paris**
- **AX02: Boston to Iceland, in collaboration with NOAA/ Northeast Fisheries Science Center (NEFSC and University of Paris.**
- **AX07: Gibraltar to Miami (AOML only)**
- **AX08: Cape Town to New York, in collaboration with the University of Cape Town.**
- **AX10: New York to Puerto Rico. (AOML only)**
- **AX18: Cape Town to Buenos Aires, in collaboration with the University of Cape Town and Argentine Hydrographic Service.**
- **AX20: France to France Guyana, in collaboration with the University of Paris and IRD, France, and with BSH of Germany.**
- **AX25: Cape Town to Antarctica, in collaboration with the University of Cape Town.**
- **AX97: Rio de Janeiro to Isla de Trinidade, in collaboration with the Federal University of Rio Grande (Brazil) and the Brazilian Navy.**
- **MX1, MX2, and MX4 : Meridional Mediterranean Sea transects, in collaboration with ENEA/Italy.**
- **IX1,IX12,and IX28: Fremantle to Sunda Straits, Fremantle to Red Sea, and Hobart to Antarctica, in collaboration with Australia's Bureau of Meteorology and CSIRO.**

Data flow/management:

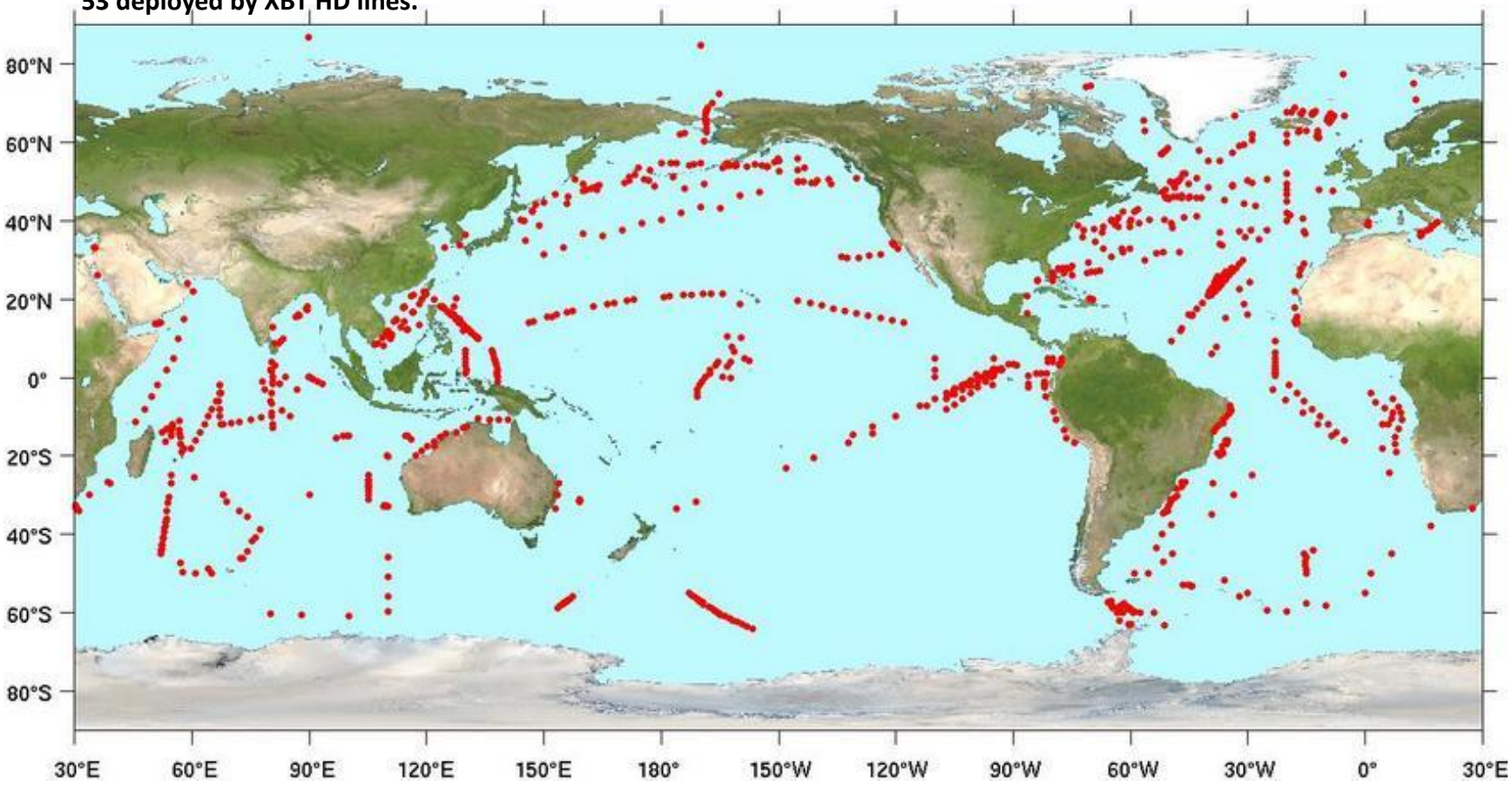
- **NWS**
- **NODC**

Scripps Institution of Oceanography (SIO)
High Density XBT Network



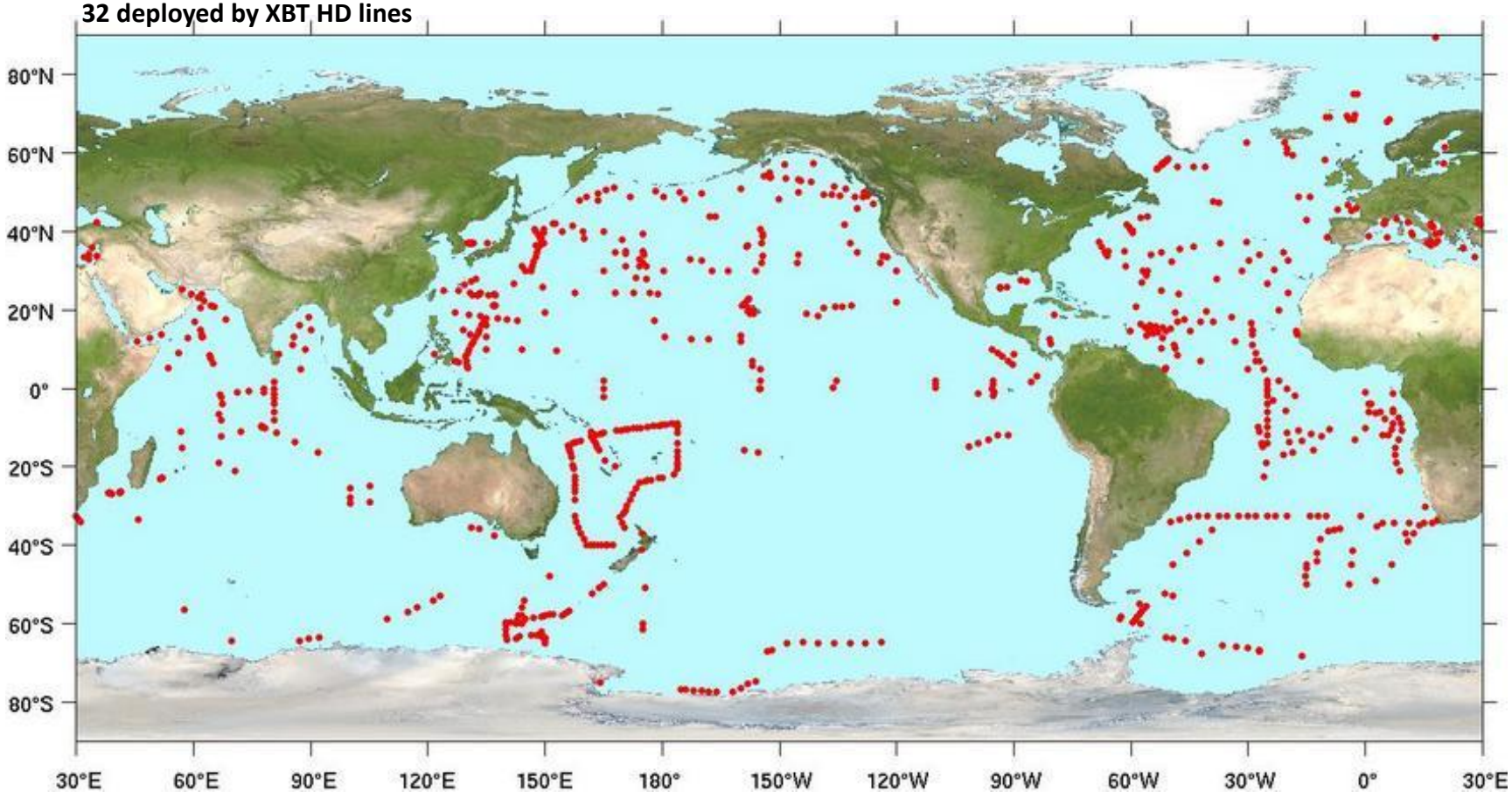
Deployment opportunity for other platforms - drifters

Year 2013
Number of Deployments: Drifter=1194
53 deployed by XBT HD lines.



Deployment opportunity for other platforms - Argo

Year 2013
Number of Deployments: argo=810
32 deployed by XBT HD lines



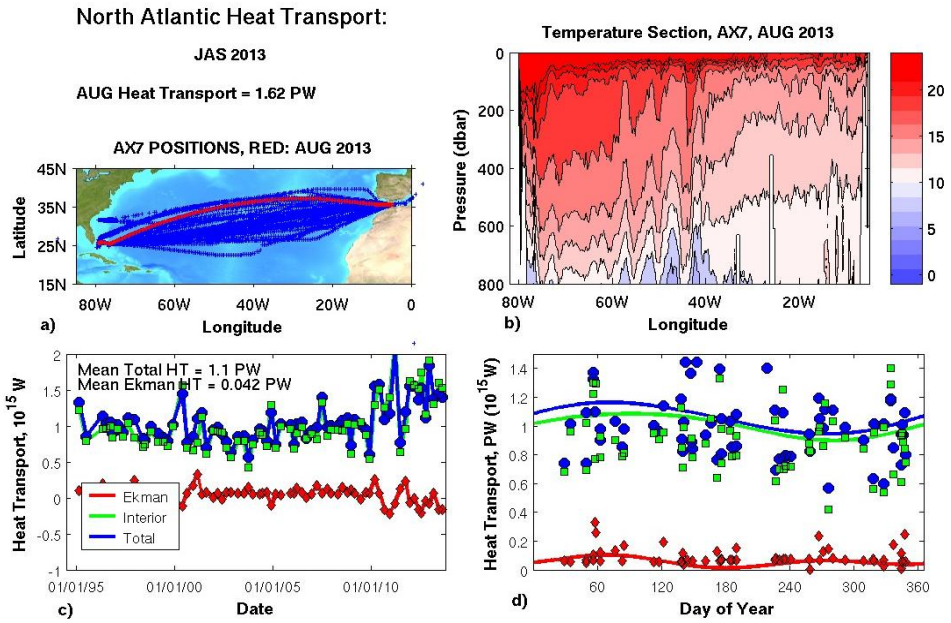
Science applications of XBTs

- **Western boundary currents**
- **Frontal regions**
- **Subsurface currents and undercurrents**
- **Meridional heat transport**
- **Upper ocean heat content**
- **Validation of numerical models**
- **Initialization of numerical models for weather and climate forecasts**

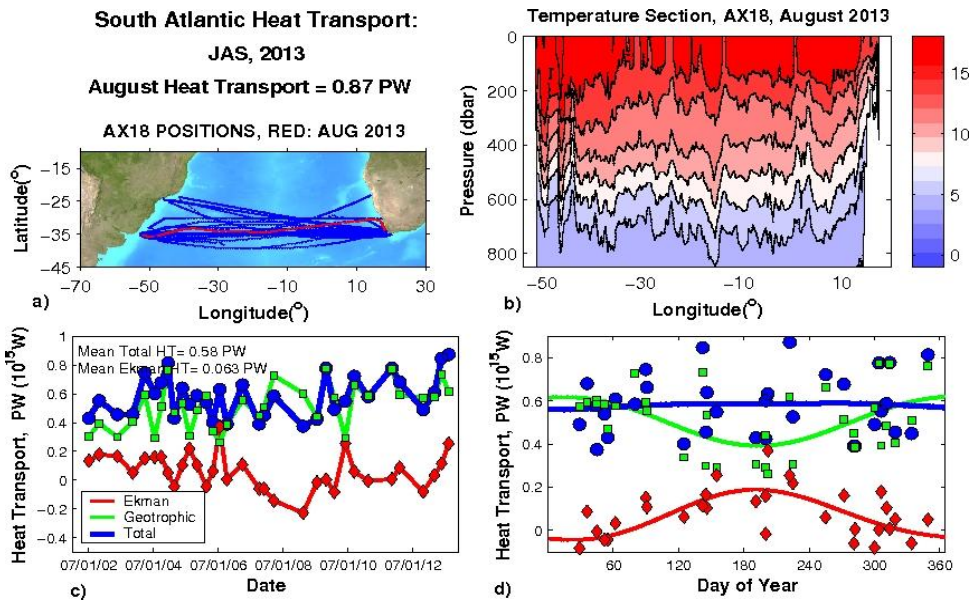
Excellent synergy with Argo floats and other observational platforms

North/South Atlantic Meridional Heat Transport

AX07

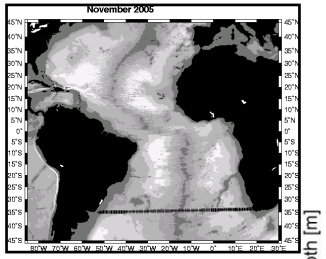


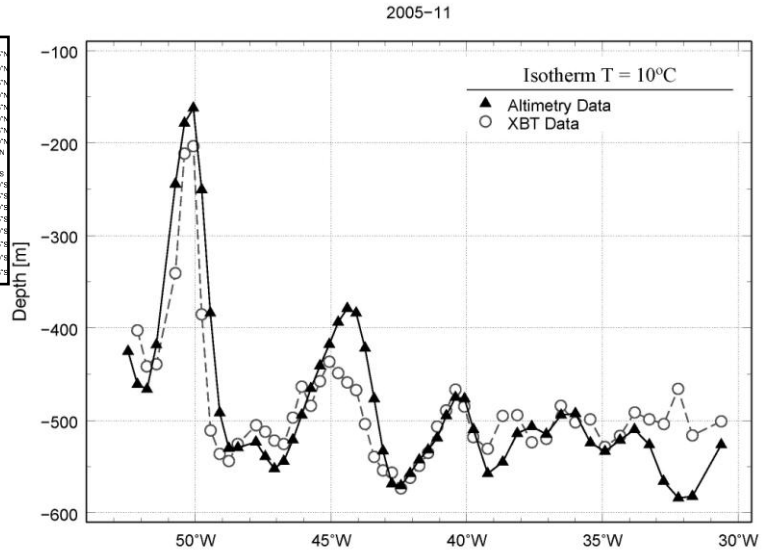
AX18

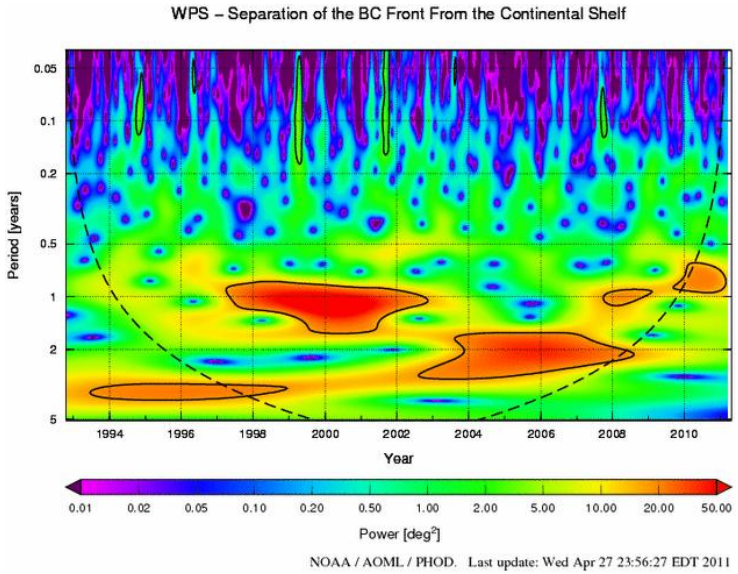


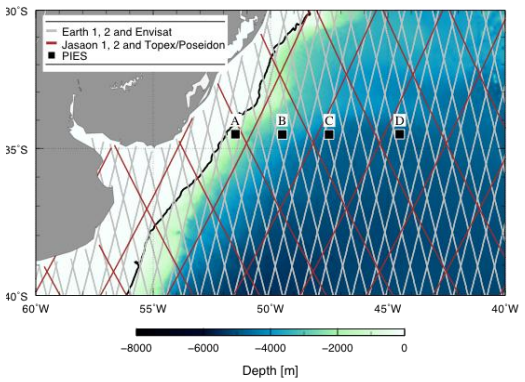
/www.aoml.noaa.gov/phod/soto/mht/ax7/report.php
/www.aoml.noaa.gov/phod/soto/mht/ax18/report.php

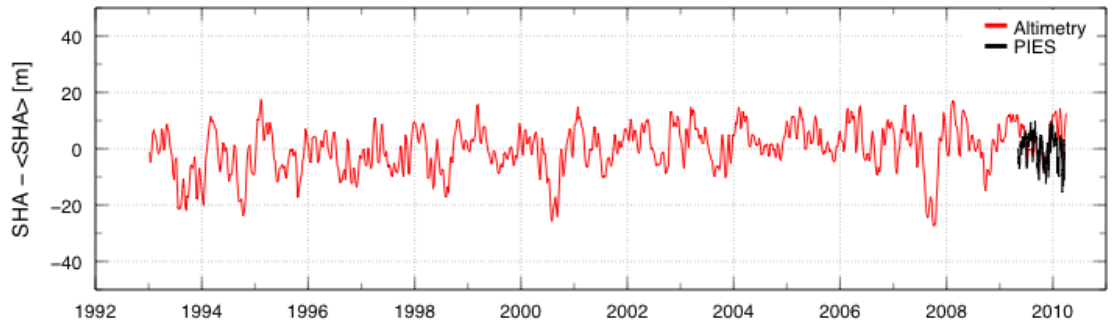
Western Boundary Currents (AX18)





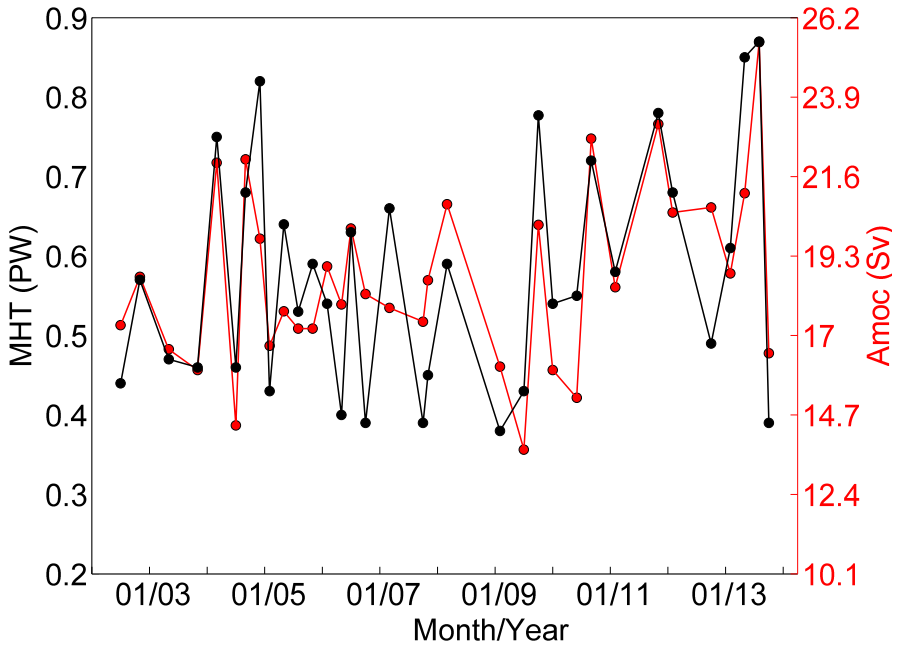


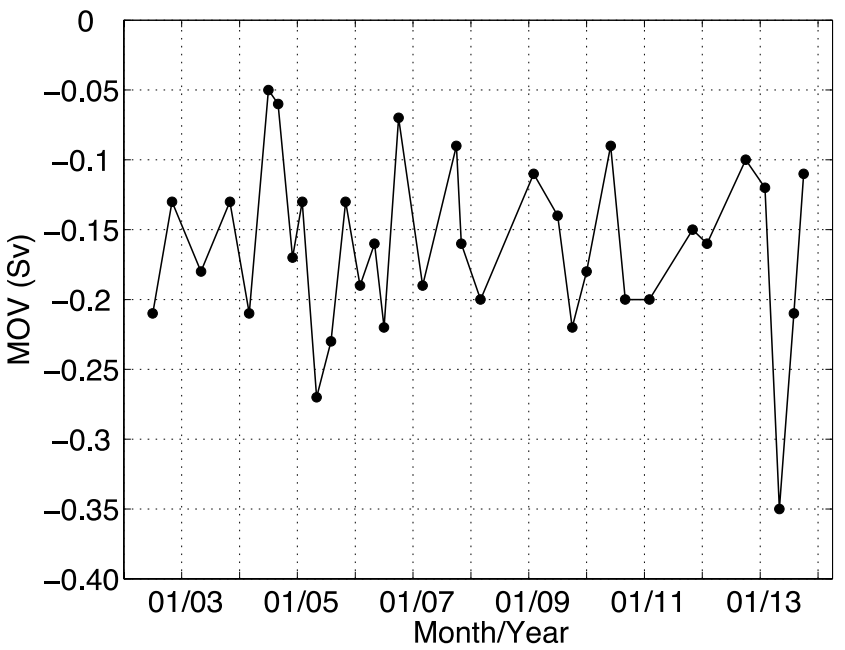




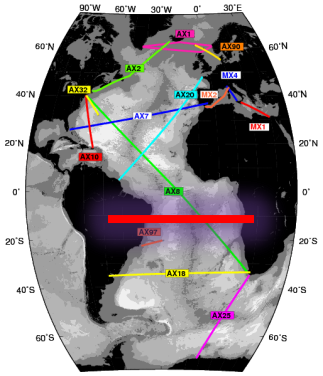
Meridional Overturning Circulation (MOC) associated fluxes and transports in the South Atlantic at 35 S (AX18)

South Atlantic XBT observations can estimate MOC, heat and fresh water fluxes





- Meridional heat transport at 35 S in the South Atlantic is 0.55 0.14 PW, with larger variability than at 26 N.
- MOC is 18.17 2.3 Sv, similar in magnitude as 26 N, but with slightly lower variability.
- Fresh Water fluxes are less than zero, implying that the MOC is bi-stable. Note that numerical models have a stable MOC with a positive slainity flux in the South Atlantic.



Frontal regions in the Antarctic Circumpolar Current (AX25)

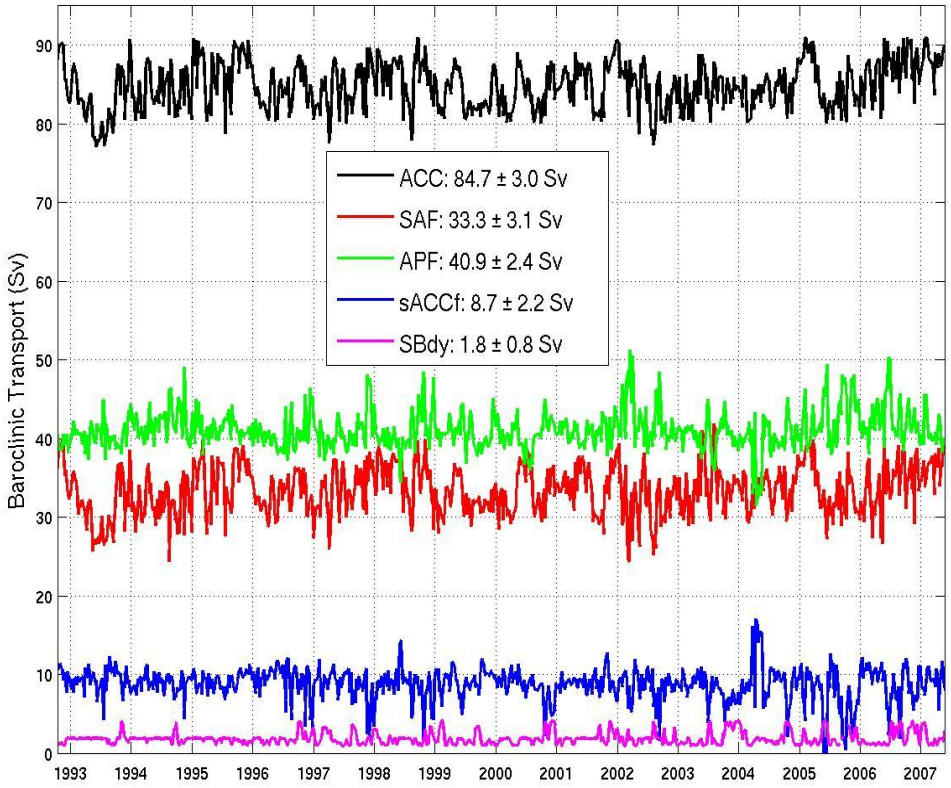
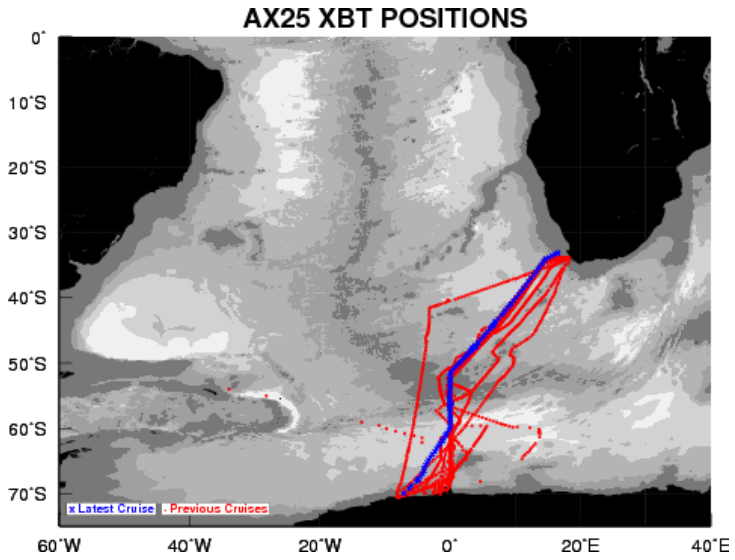


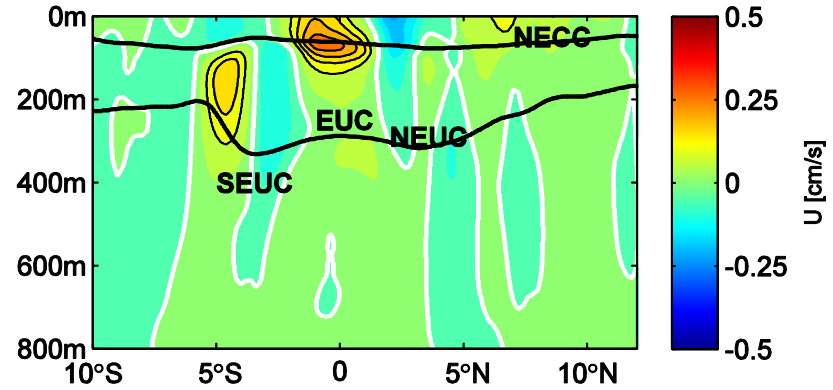
Figure by Sebastiaan Swart; Goni et al, 2010

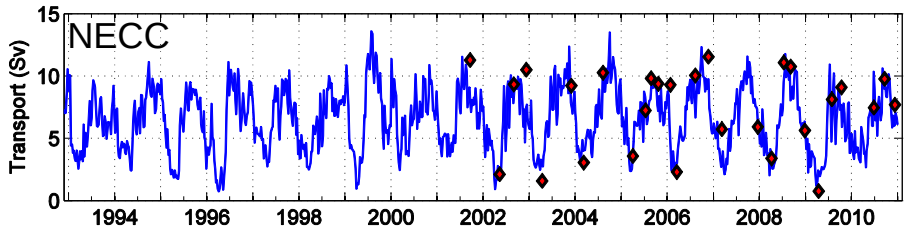
- AX25 XBT obs + satellite altimetry
- Detection of fine scale features that form the fronts,
- Subantarctic front contributes to 50% of the total transport variance of the ACC, even when its transport is less than other fronts.



AX8 XBT transect is used to study the Atlantic Equatorial Current system

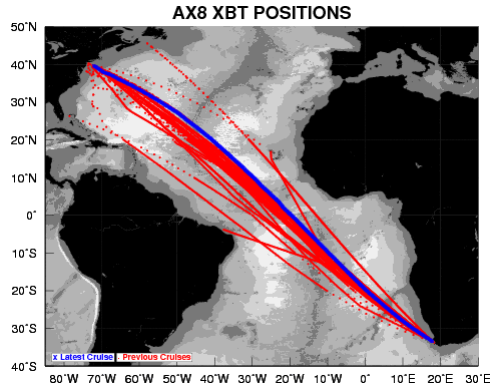
- The tropical Atlantic current system is important for the interhemispheric and west-to-east transport of heat, salt and nutrients.
- The AX8 transect has been used to monitor properties, such as velocity, transport and location, of the equatorial surface and subsurface currents.
- XBT and altimetry are used together to investigate the mechanisms of the variability of these currents, from daily to interannual timescales.





Top: *Mean zonal velocity (in m/s) across the AX8 section.*
Bottom: *Transport of the NECC (in Sv) estimated by XBT only (red dots) and using altimetry and XBT together (blue curve).*

Goni and Baringer, 2002
Goes et all. 2013



Plans for the Future - XBT

- Continue strong emphasis on research, mostly HD transects (importance of boundry currents, moc and mht including synergy with other observations)

- Continue support of XBT Science Team. (www.aoml.noaa.gov/phod/goos/xbtscience/)

- XBT improvements
  Collaborate with Sippican in XBT FRE experiments.
  Collaborate with Sippican to explore development of new climate quality XBT probe.

- Third XBT Fall Rate Workshop to be held in China in October, 2014

- Continue strong international collaboration

Recommendations

- Explore the connection between SOOP and other groups with overlap in some objectives (Scientific Committee on Oceanic Research (SCOR) and World Ocean Council).

- Continue collaboration with Global Ocean Surface Underway Data (GOSUD) and SAMOS

- Urge all institutions to transmit profiles in RT or NRT into GTS.

- Identify institutions, operators that are not currently transmitting XBT and TSG data into GTS (TC). Provide help, such as in equipment, expertise, etc.