Preliminary Results of
Meridional Heat Transport in the South Atlantic Since 1993

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Meridional Heat Transport in the South Atlantic

What we know:

- Ekman and geostrophic components are out of phase
- Variability of both components are comparable
- Geostrophic is the dominant contribution
- Mean value = 0.51 +/- 0.15 PW
- Range = 0.3 to 0.8 PW

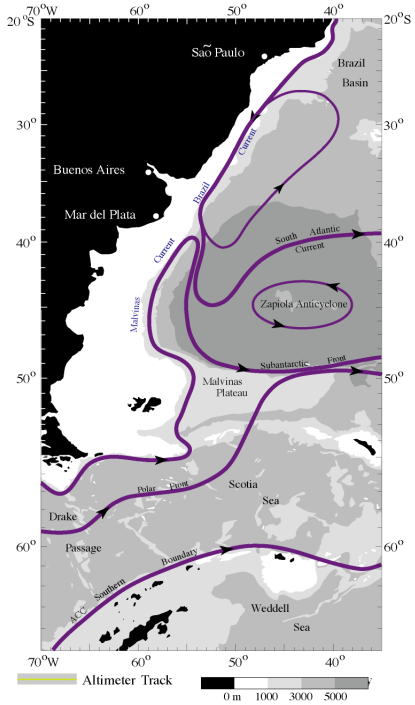
This work:

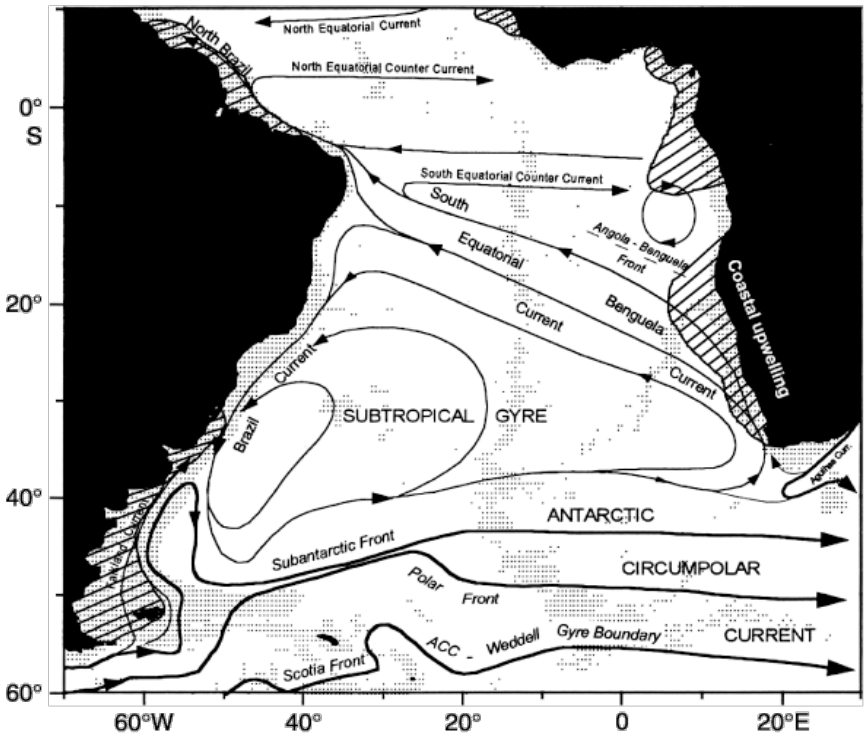
- Investigate the temporal variability of the meridional heat transport in the South Atlantic using blended XBT and altimetry observations

- Assess the contribution of the geostrophic and Ekman components to this transport since 1993

South Atlantic circulation

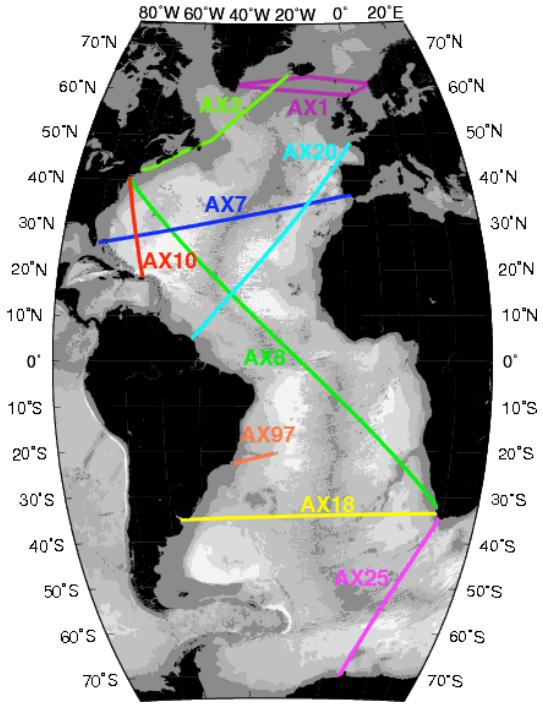
Upper ocean

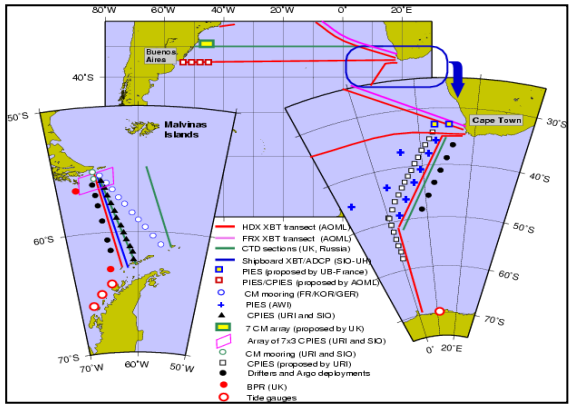


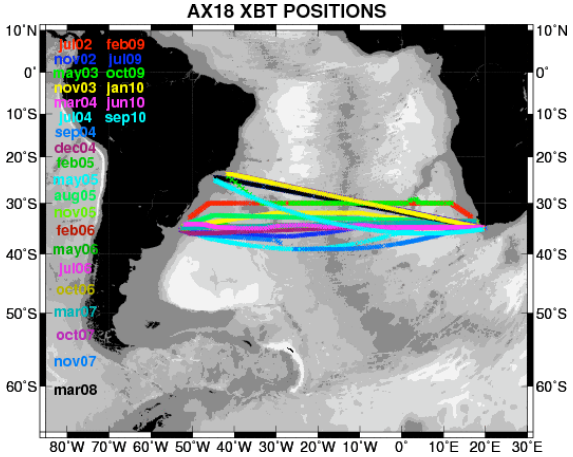


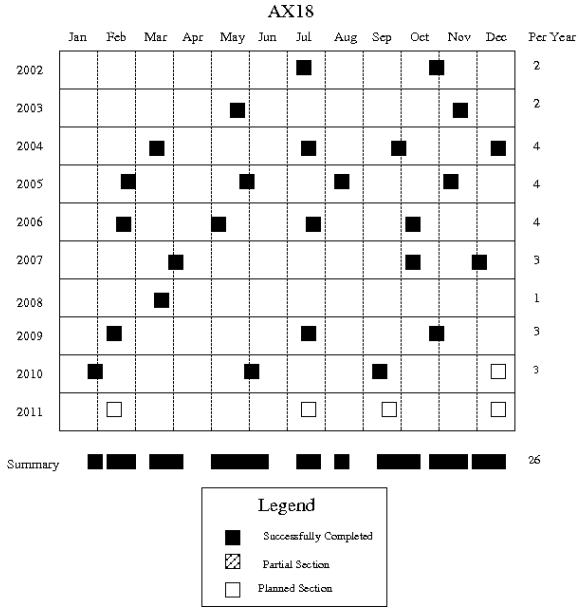
Peterson and Stramma, 1991

Atlantic Ocean HD XBT transects
AX18



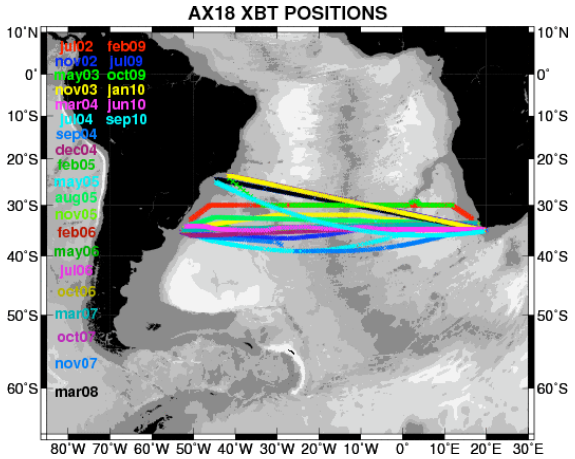


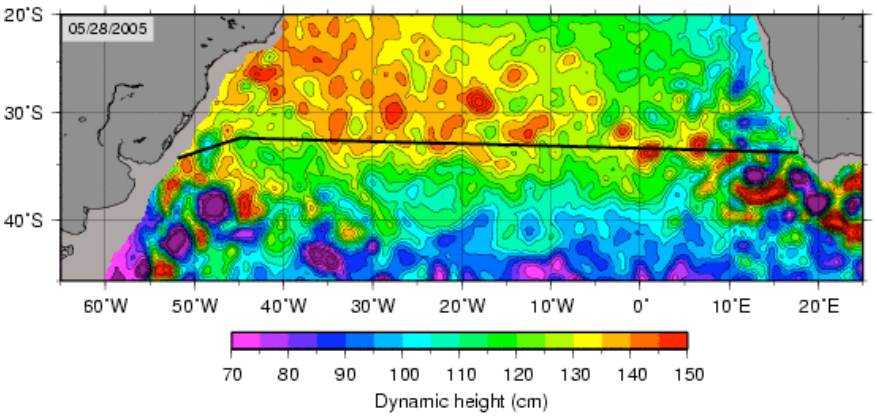


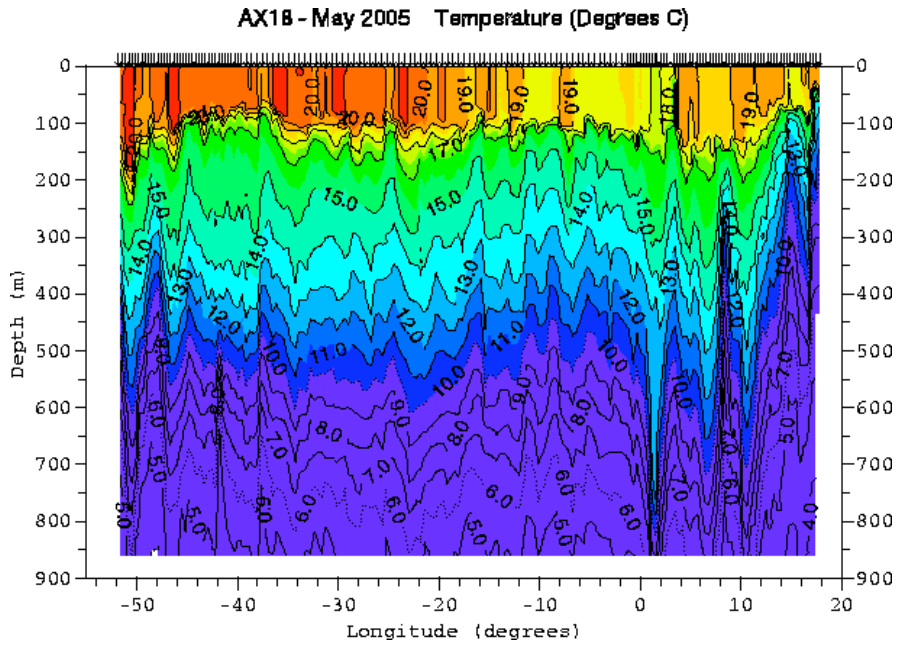


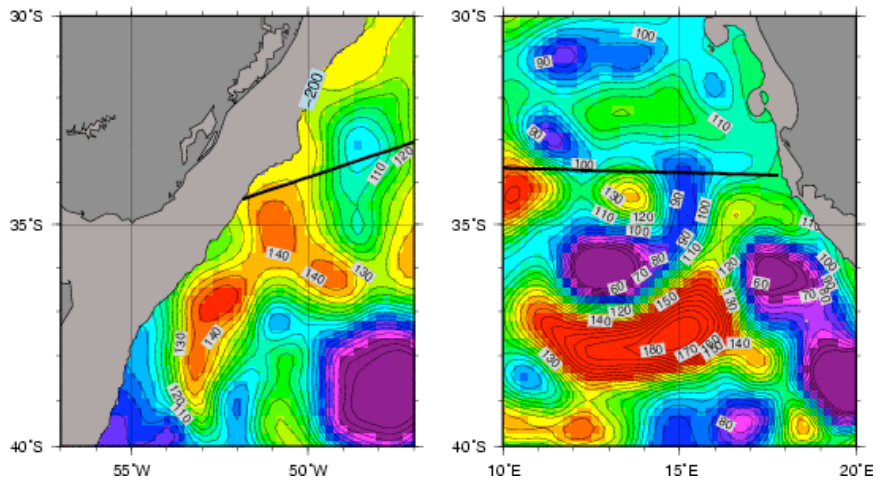
Started 2002
28 realizations
180 XBTs per realization
Oct 2007 AX17 replaced AX18

Atlantic Ocean HD XBT transect AX18

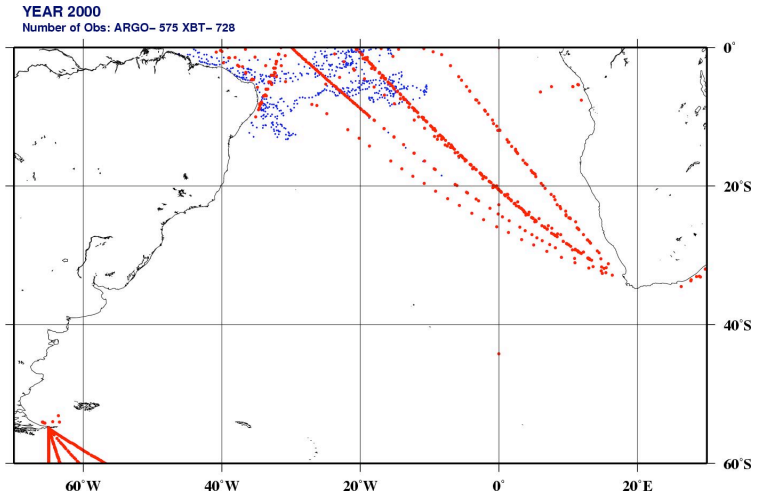


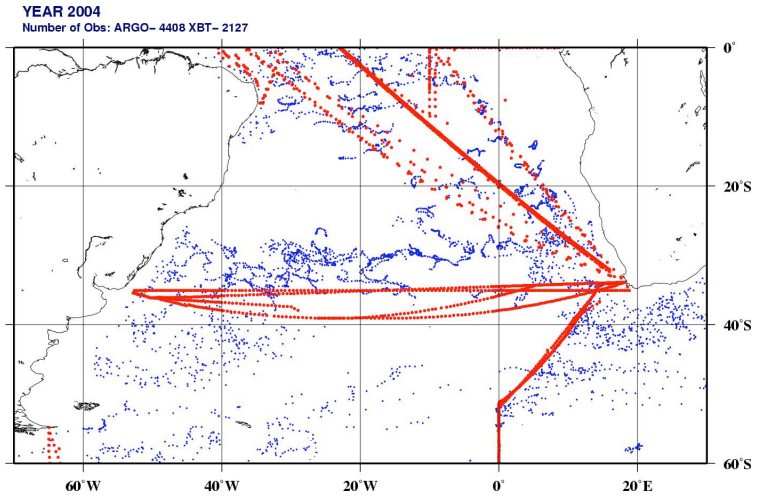


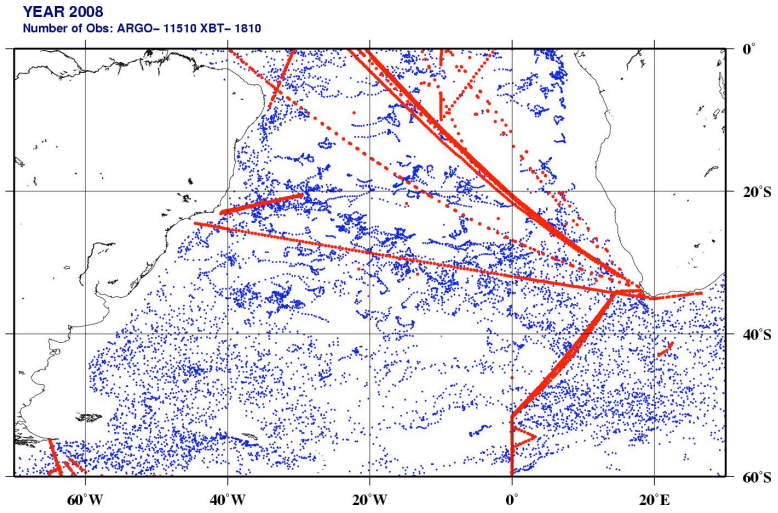


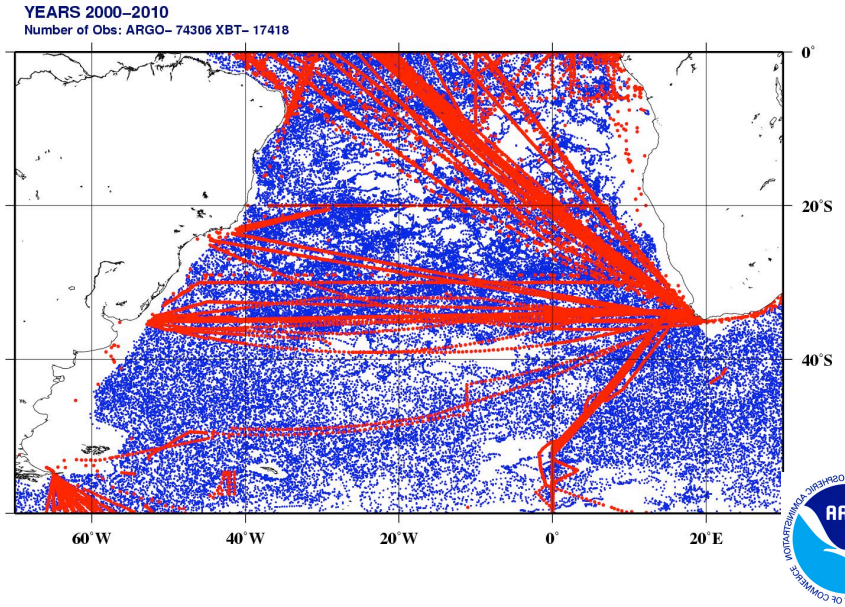


Atlantic Ocean XBT and Argo observations

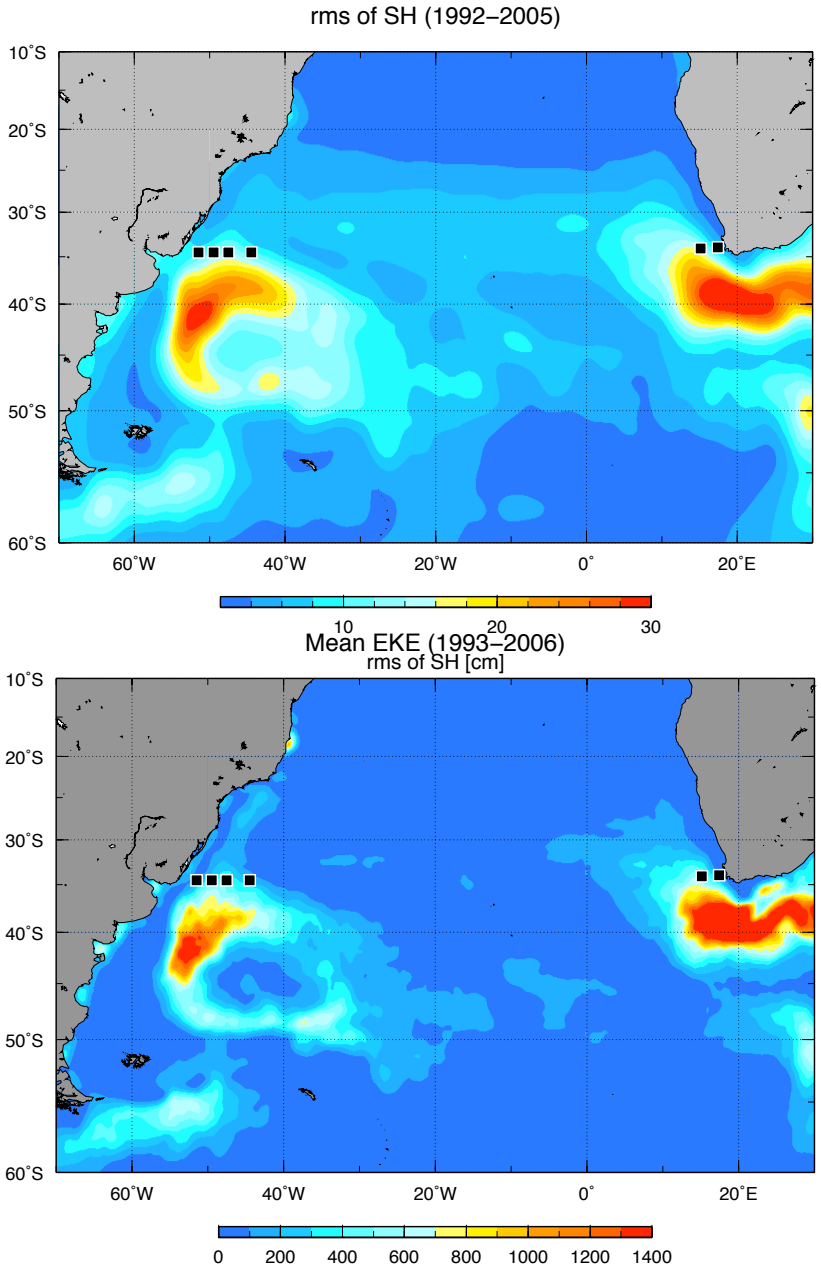






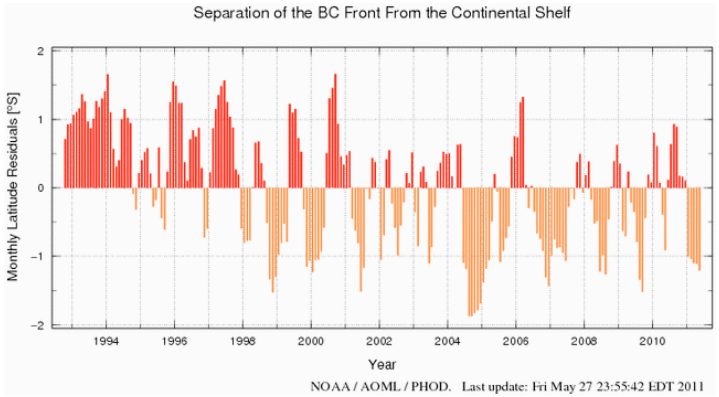


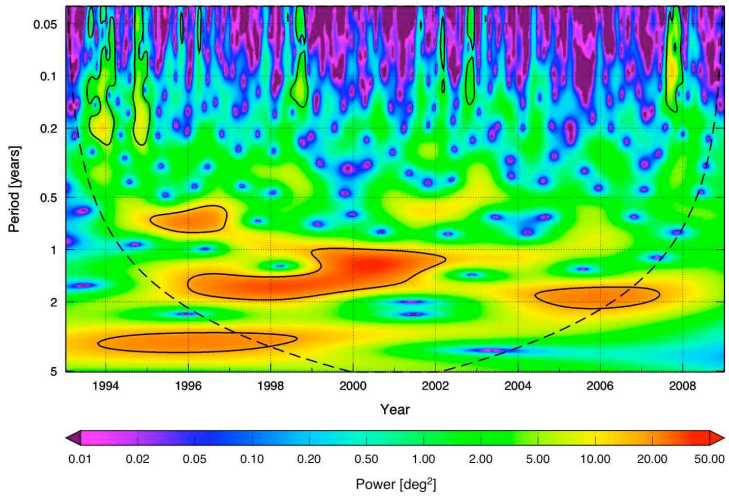
Variability Atlantic Ocean



Variability Atlantic Ocean

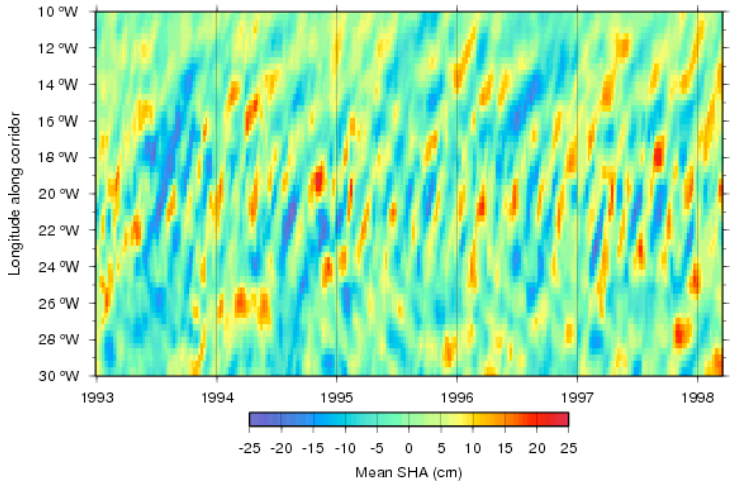
SW Atlantic

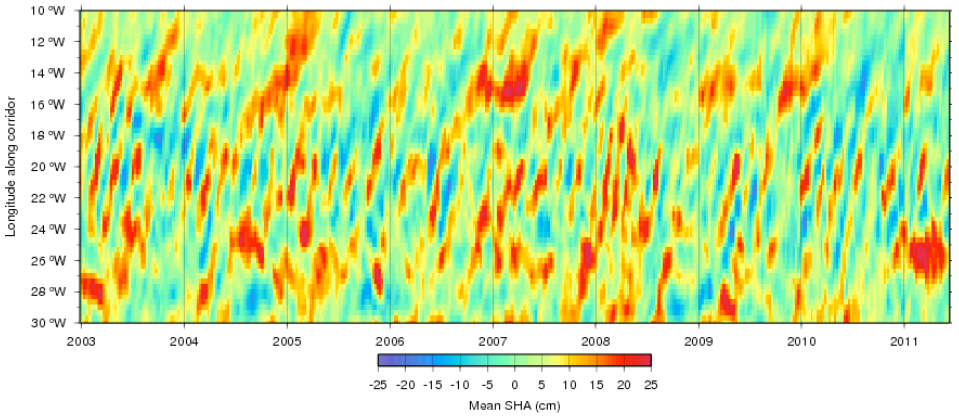




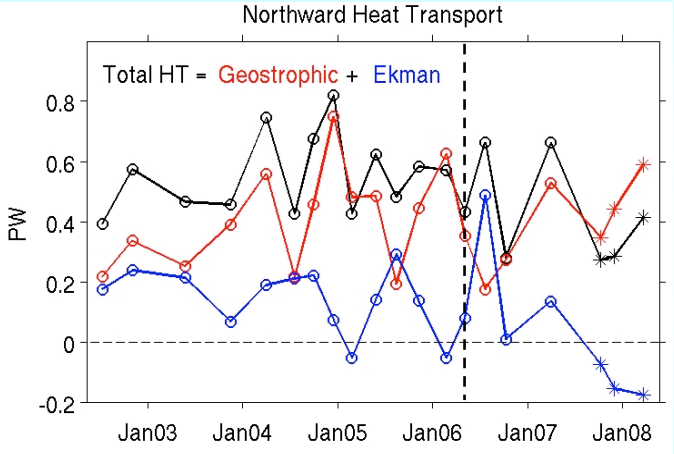
Goni et al, 2011

Agulhas Retroflection





Atlantic Ocean MHT

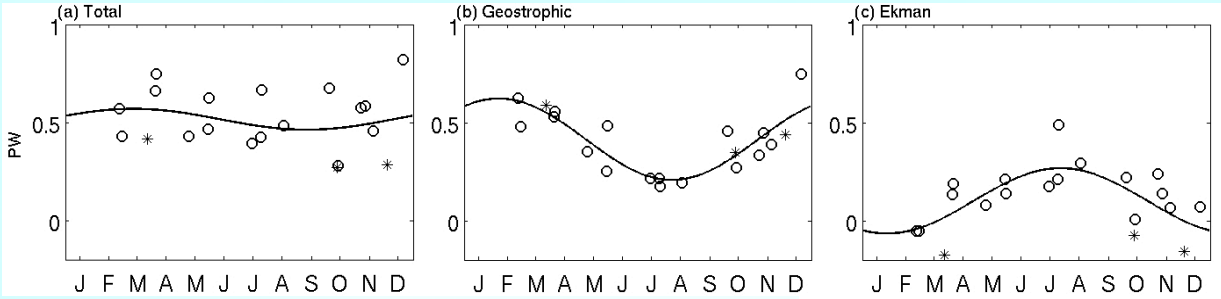


Total = 0.51 ± 0.15 PW

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

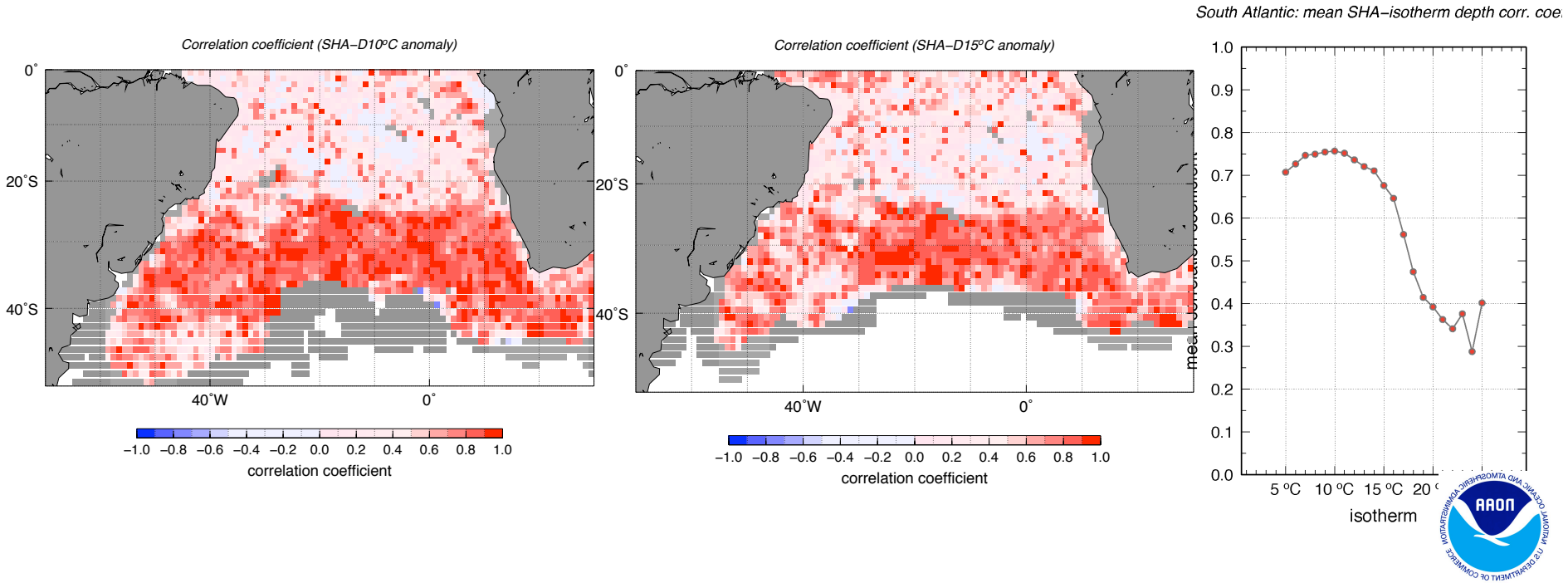


Both geostrophic and Ekman transports experience annual cycles, but they are out of phase.

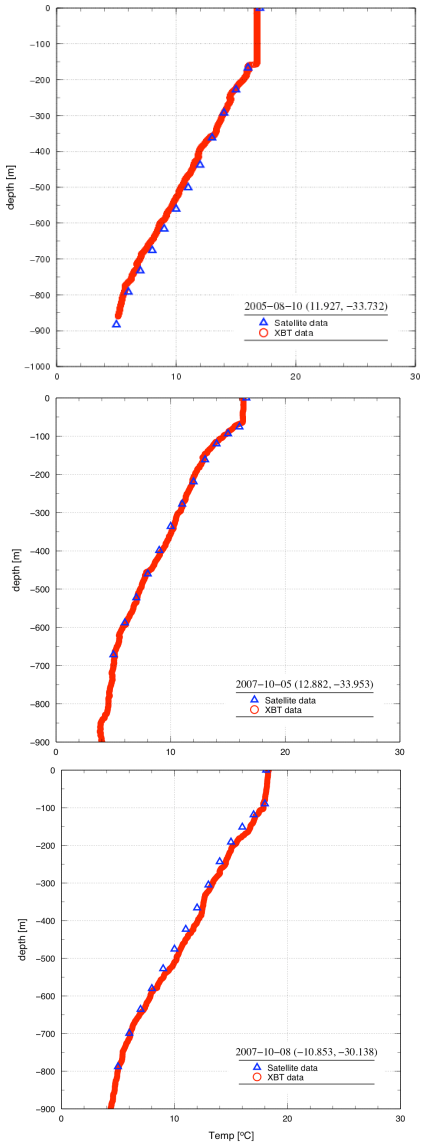
Garzoli and Baringer (2007)
Baringer and Garzoli (2007)

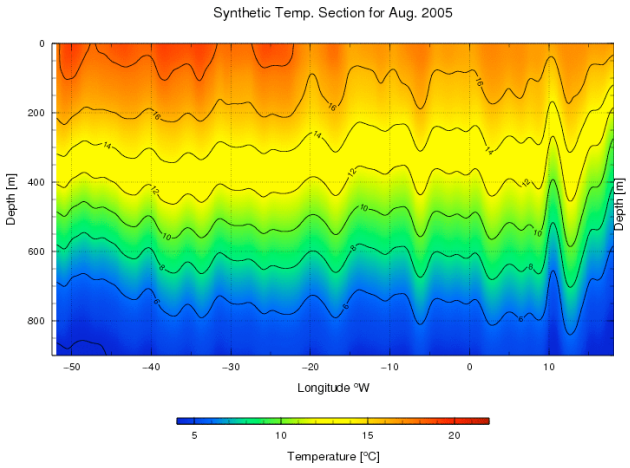
Altimetry and MHT

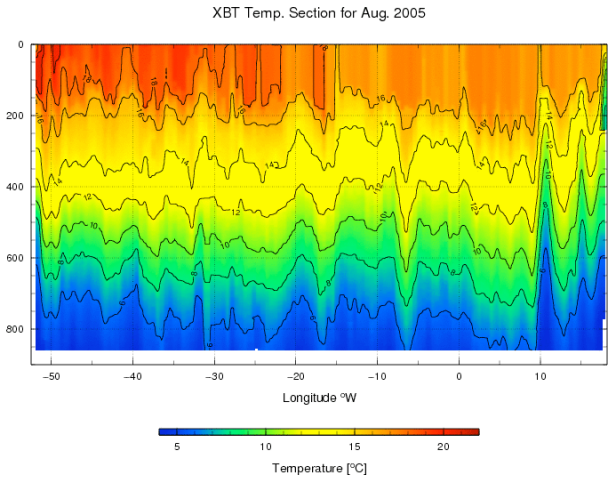
- Investigate if vertical thermal structure can be observed by altimetry
- Ekman remains the same (from monthly wind stress NCEP/NCAR reanalysis)
- Assessment of geostrophic contribution derived from altimetry and comparison with those obtained from XBTs
- Estimate MHT since 1993 (altimetry period) and evaluate changes during 1993-2002

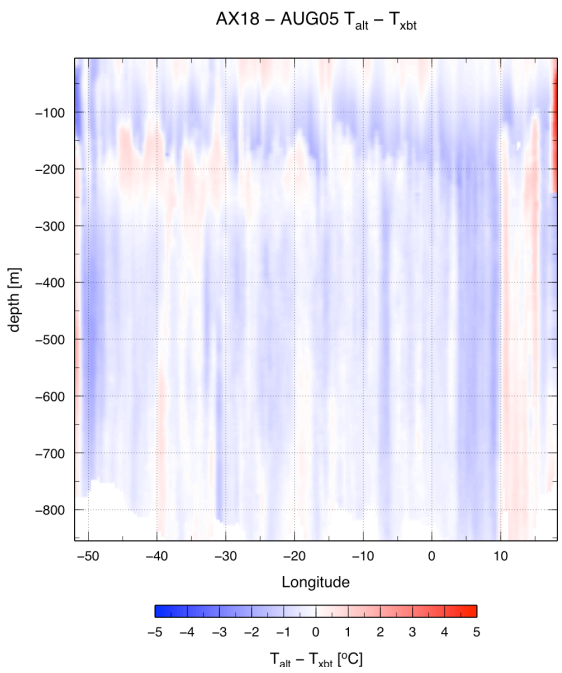


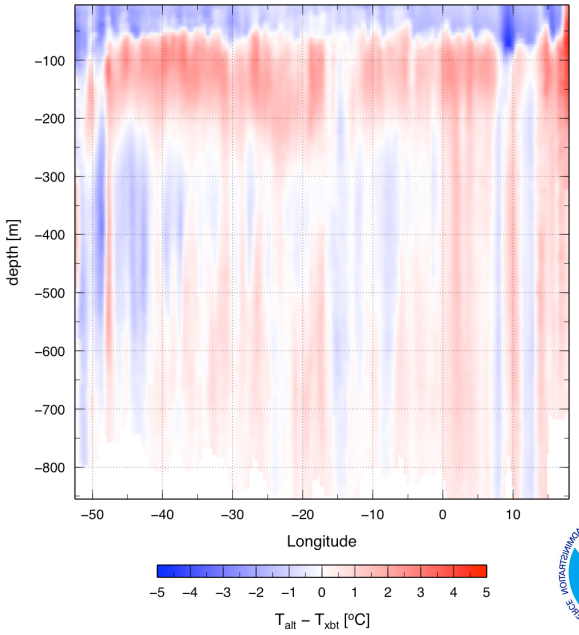
Altimetry and MHT



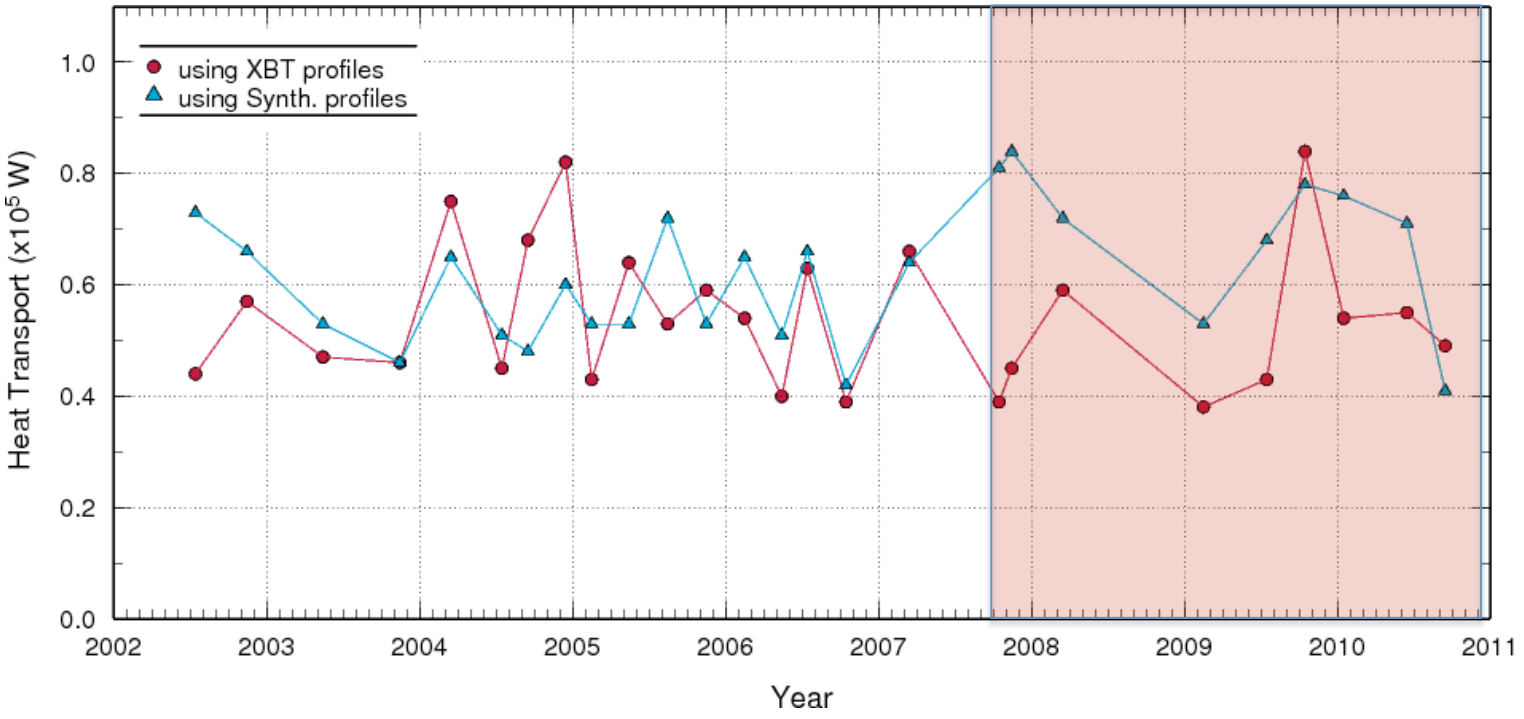




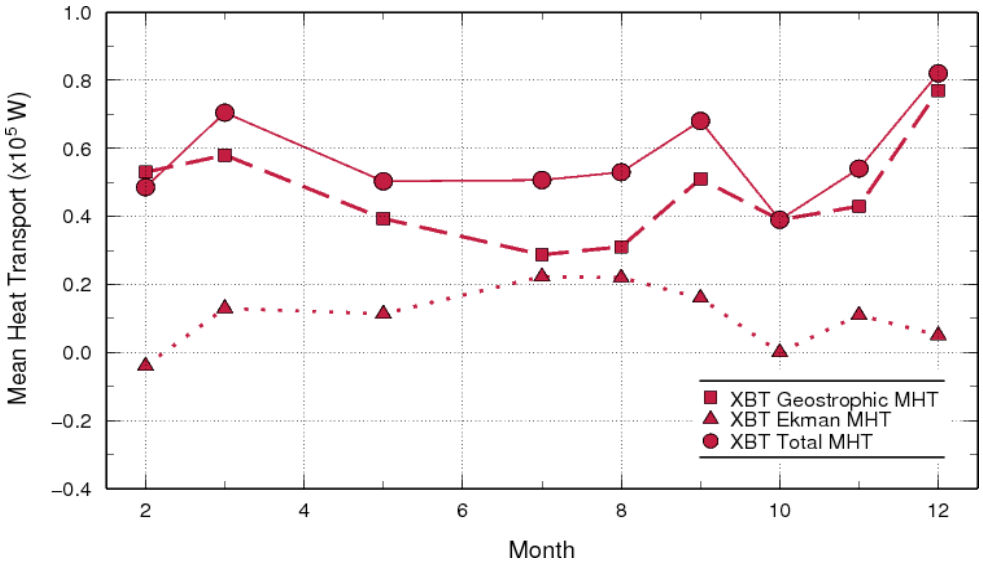




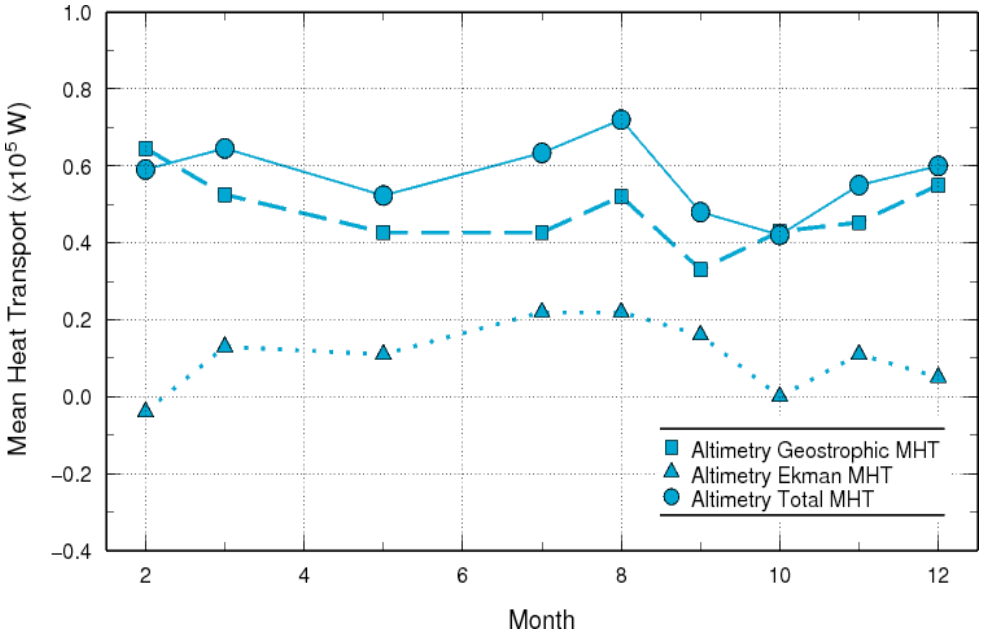
MHT from XBTs and Altimetry



MHT from XBTs and Altimetry

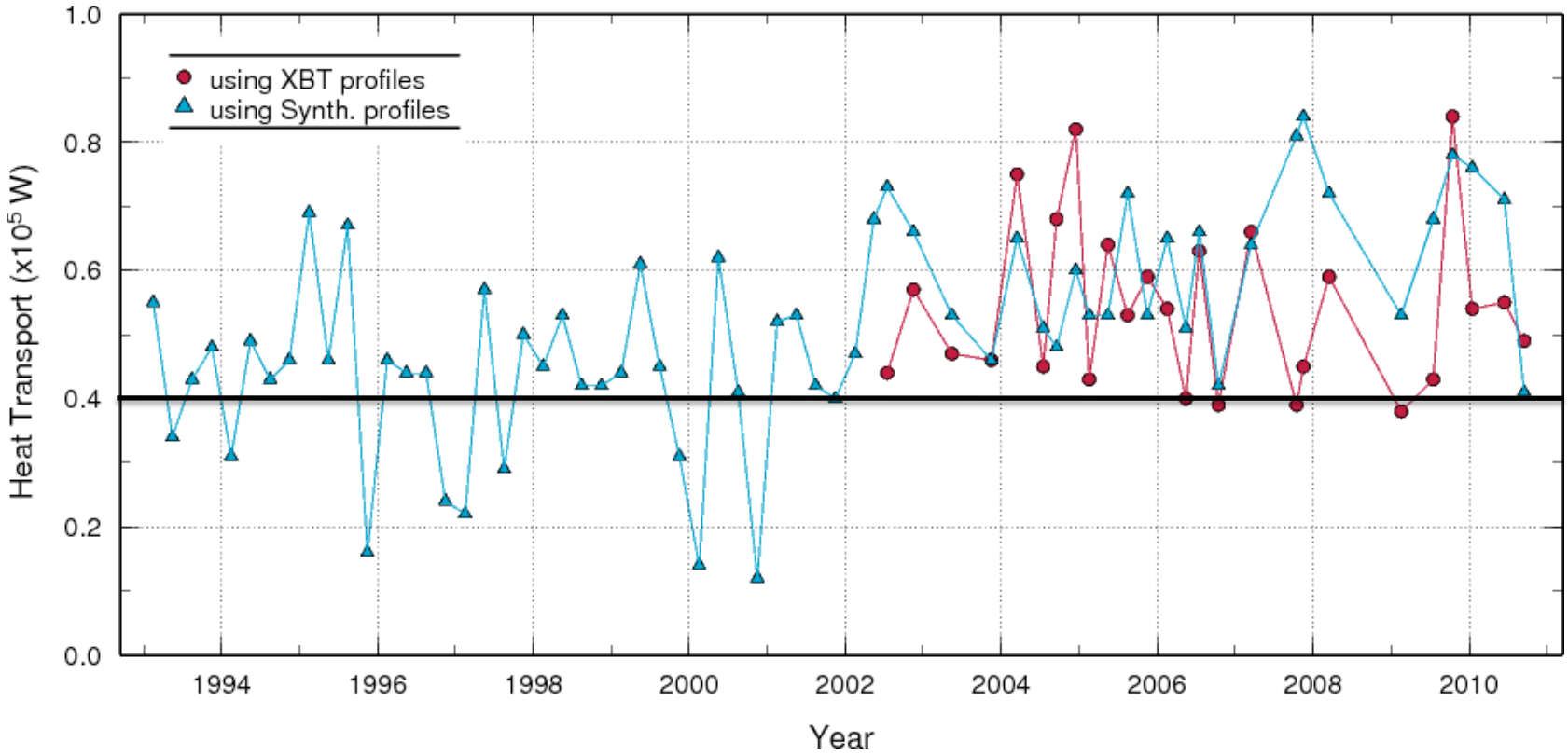


XBT 2002-2007

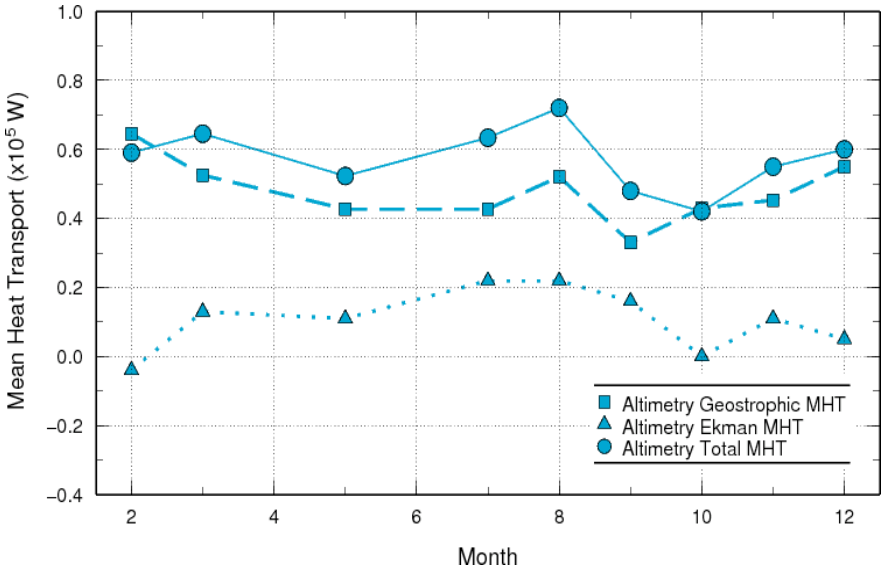


Altimetry 2002-2007

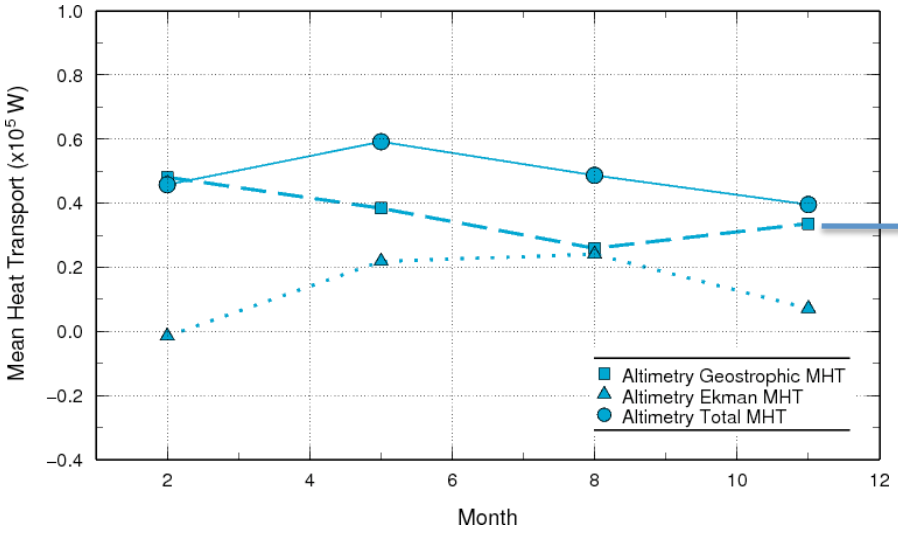
MHT from XBTs and Altimetry



MHT from Altimetry



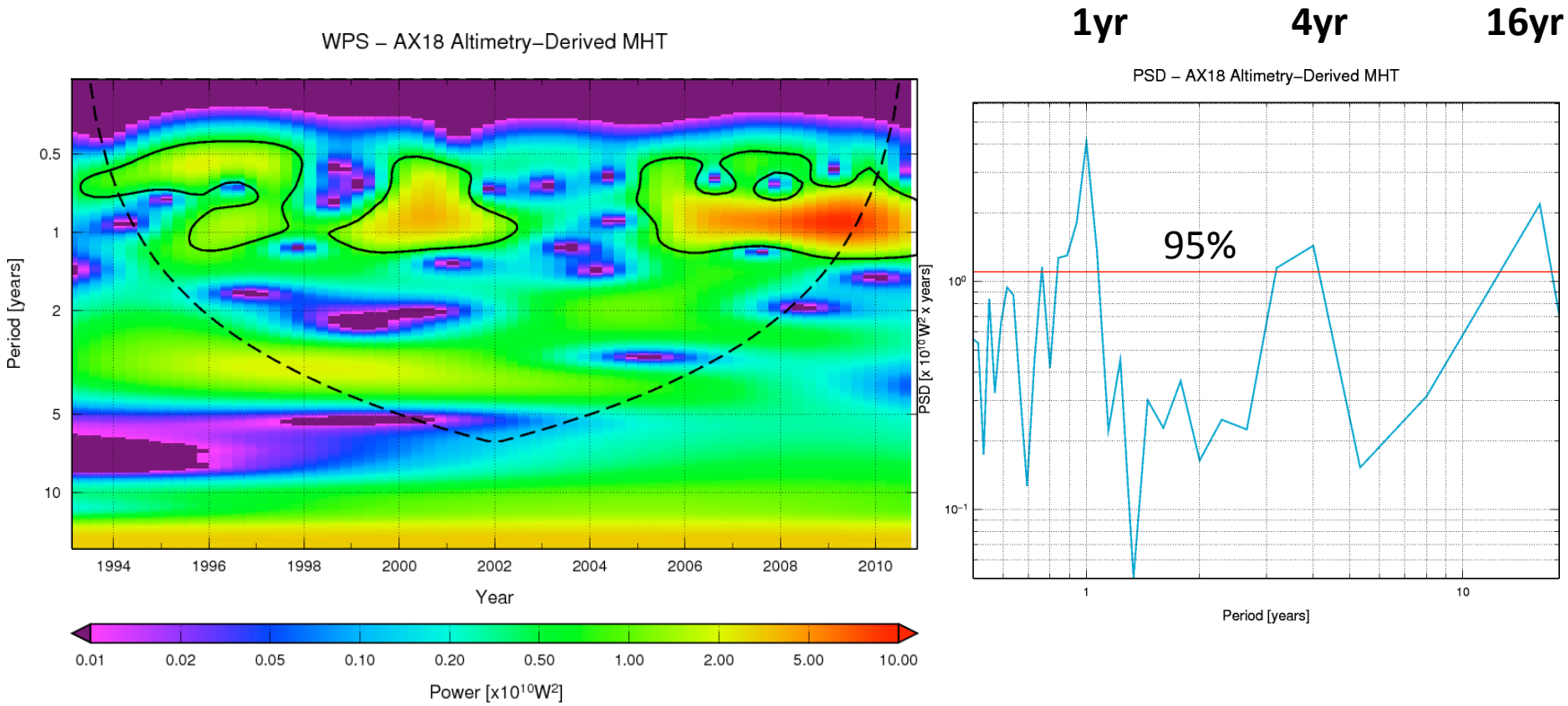
Short 2002-2007 record



Long 1993-2010 record

50 to 90% of MHT is **geostrophic** contribution

MHT from Altimetry

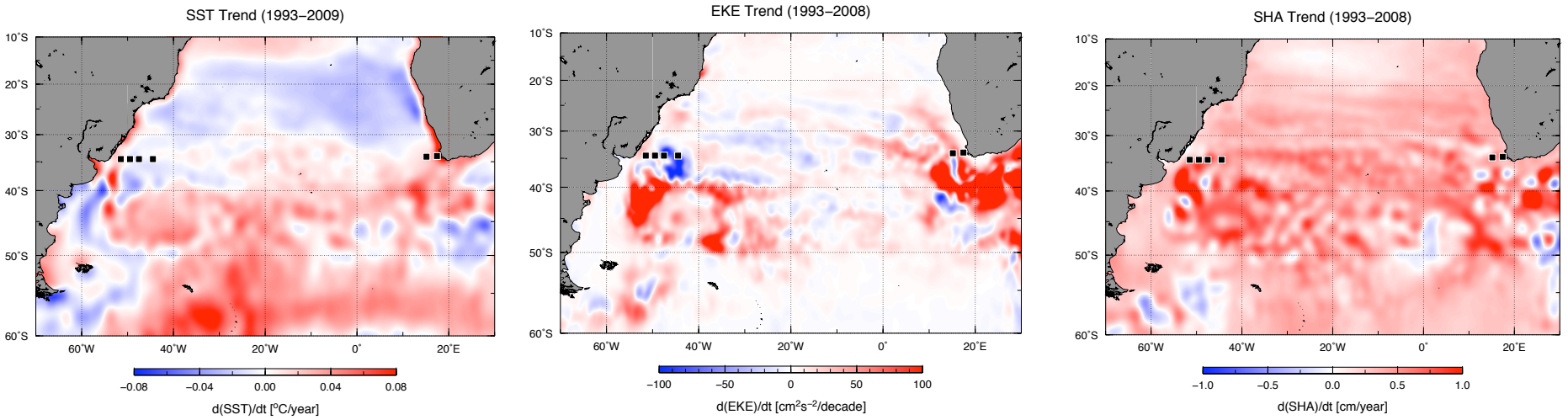


Conclusions

- Altimetry captures overall geostrophic contribution to MHT variability
- Results here confirm previous results on seasonal time scales
- Altimetry allows to extend record back to 1993
- A long period variability signal appears in the longer altimetry time series

Other Current and Immediate Future Work

- **Investigate contribution of boundaries and interior of gyre**



- **Investigate meridional changes of MHT**

- **Comparison of XBTs and altimetry results with numerical models**

- **Introduce results from other platforms: IES, PIES, CPIES, Argo, etc**