The variability and structure of the Brazil Current (Part II)

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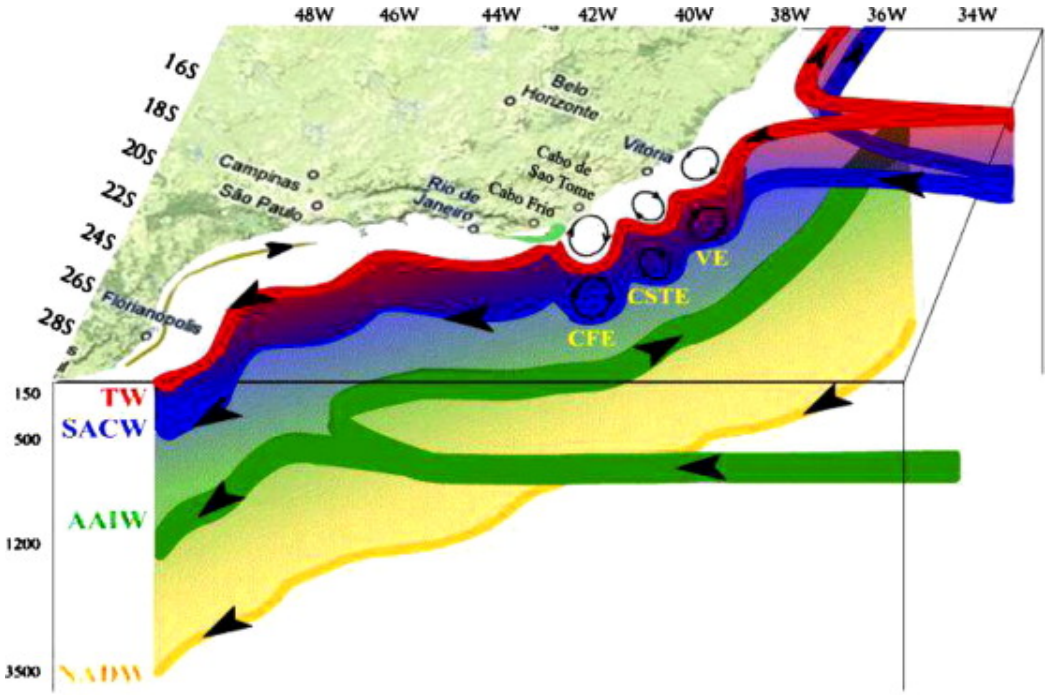
XBT Science meeting

Tokyo, Oct 2016.

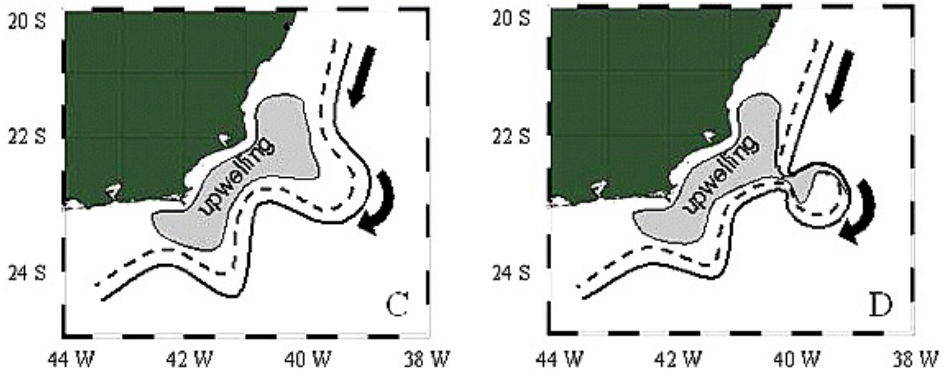
The SA western boundary system



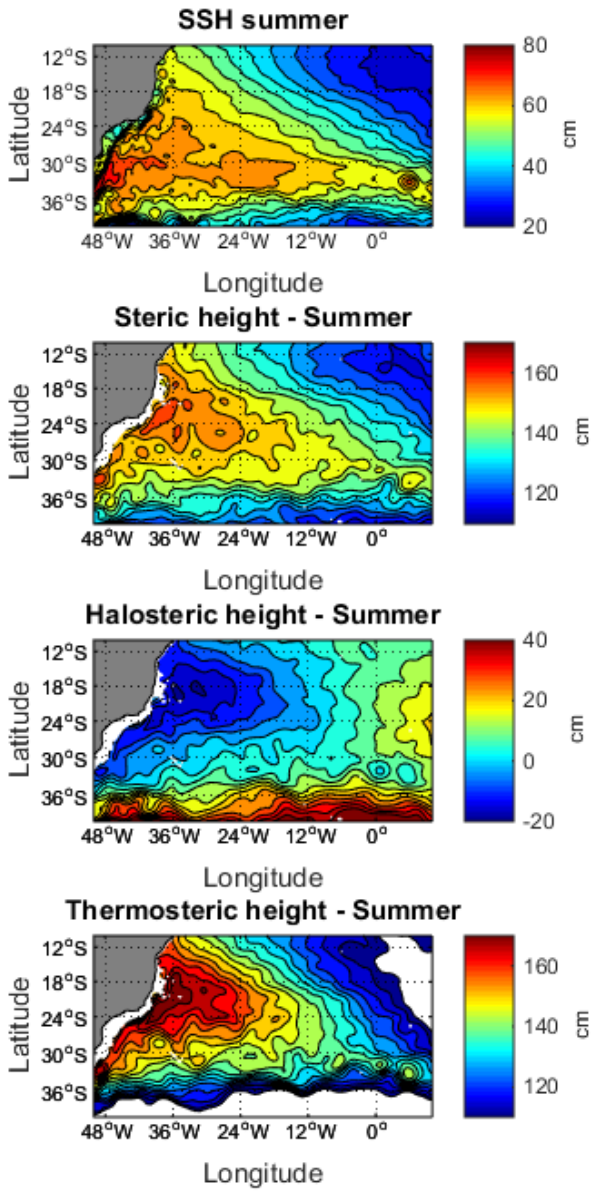
Calado et al., 2006, 2008

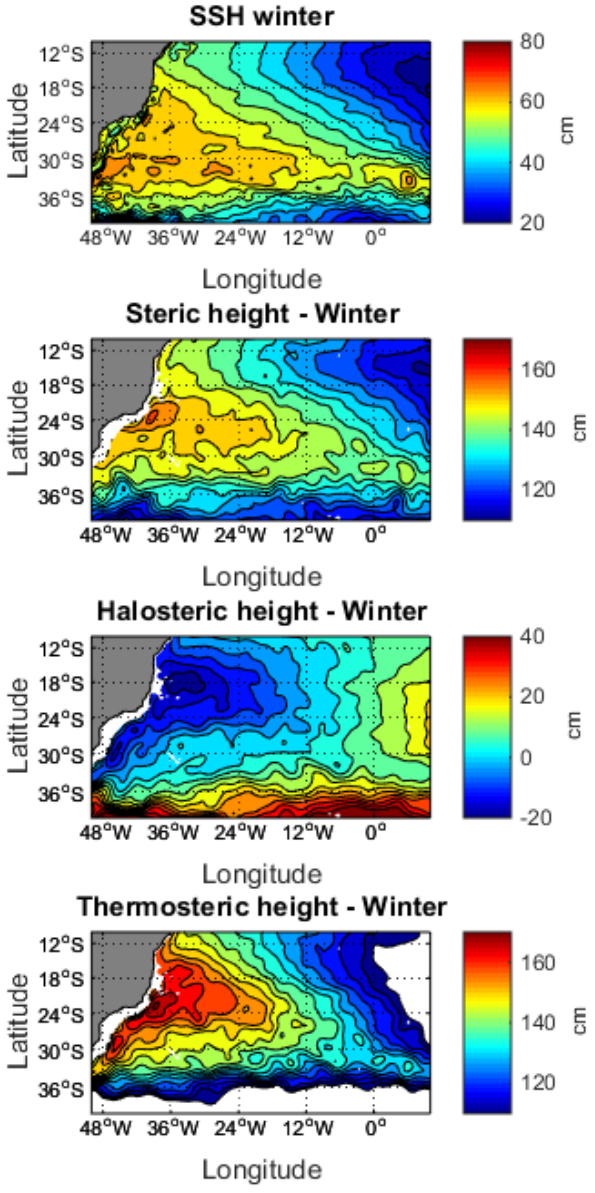
The BC system :

- Is weak relatively to the Gulf Stream
- Shows strong eddy variability
- Increases strength as it flows south.

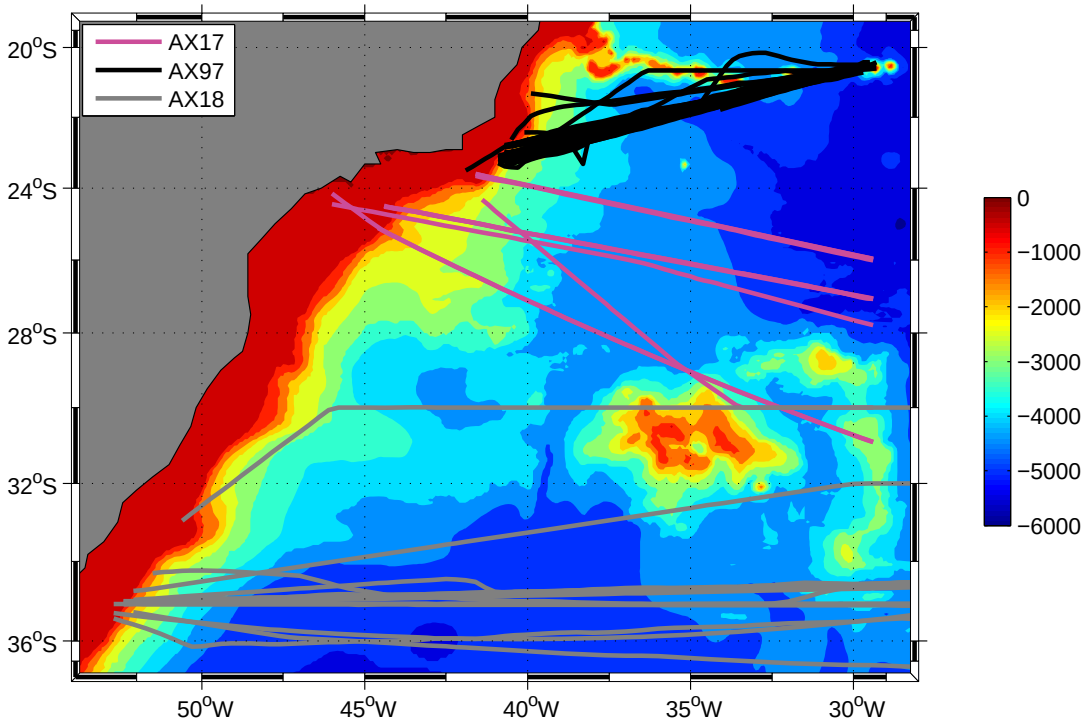


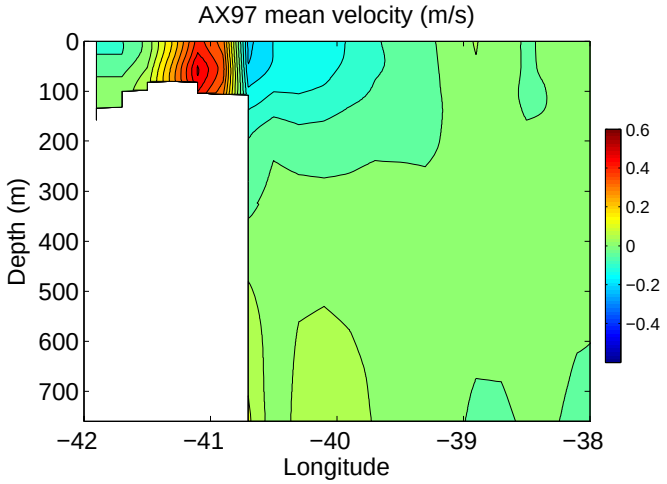
The SA western boundary system

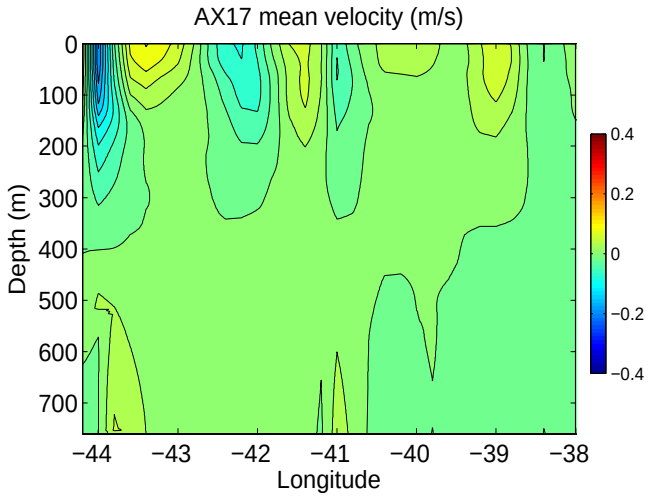


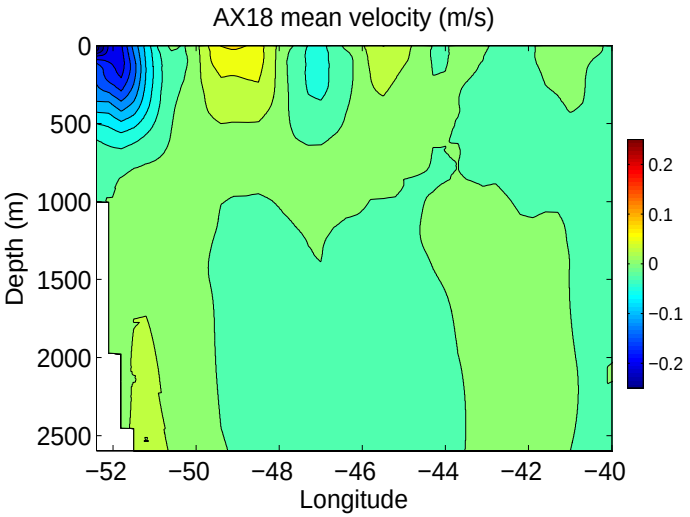


XBT transects across the BC

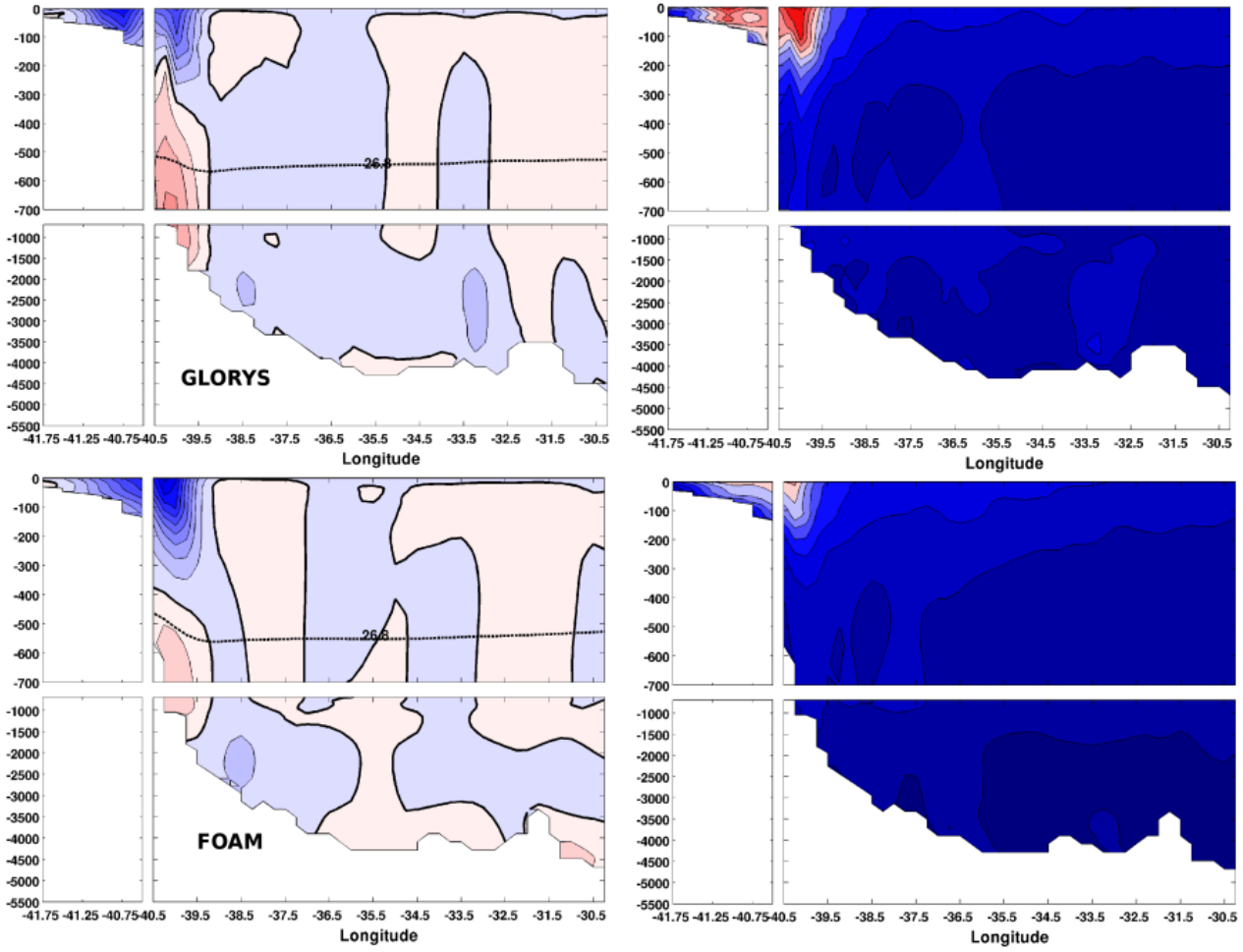








BC along 22°S

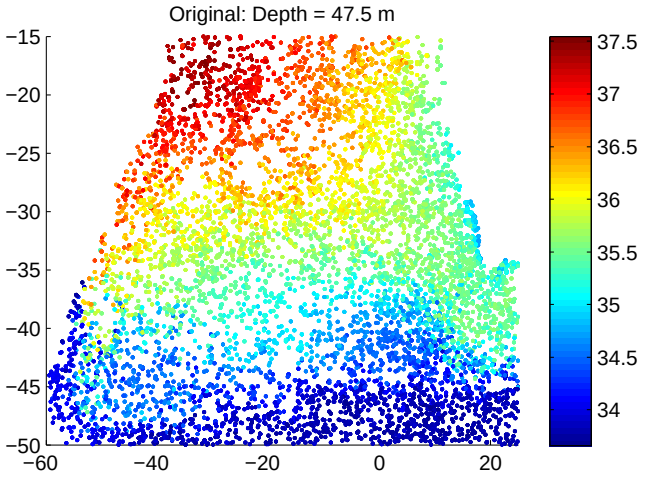


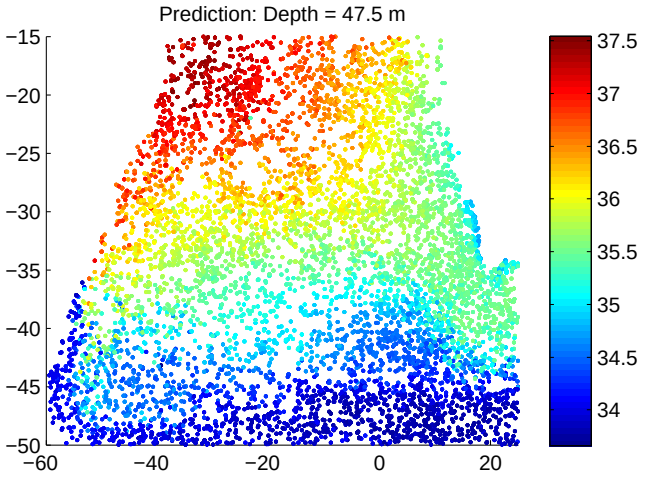
In the models, up to 30% of the BC flows along the continental shelf (Lima et al., 2016)

Improving estimates for BC

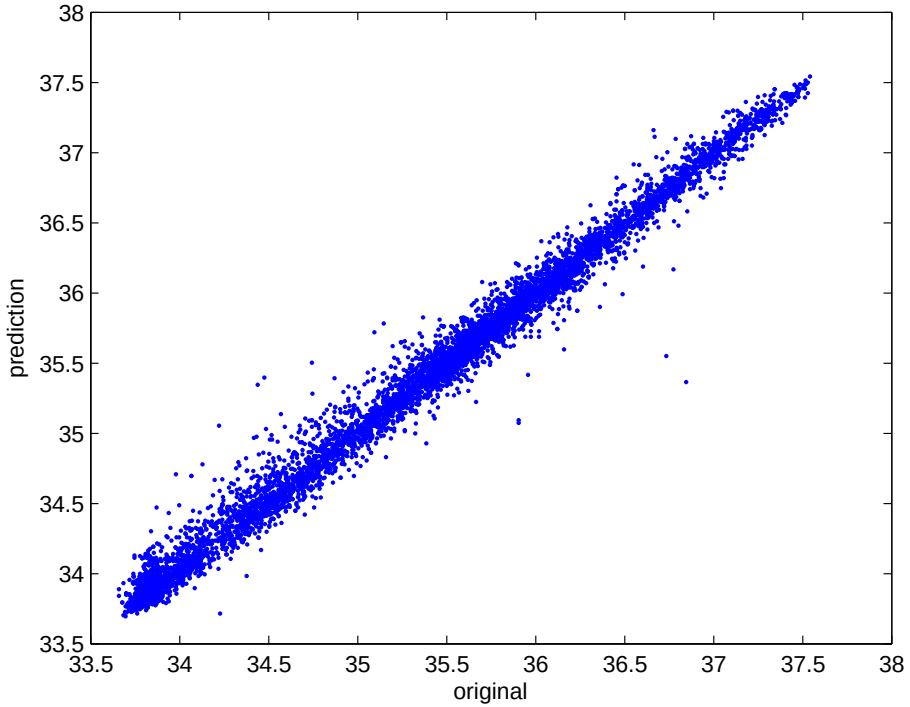
- Updated salinity estimates.
- Reference velocity: use Argo climatology (IPRC) at 500m (Goes et al., 2013)
- Extrapolation to the shelf (e.g., Montgomery, 1941; Reid and Mantyla, 1976)
- Correct altimetry SSH from the mass loading.

Updated salinity

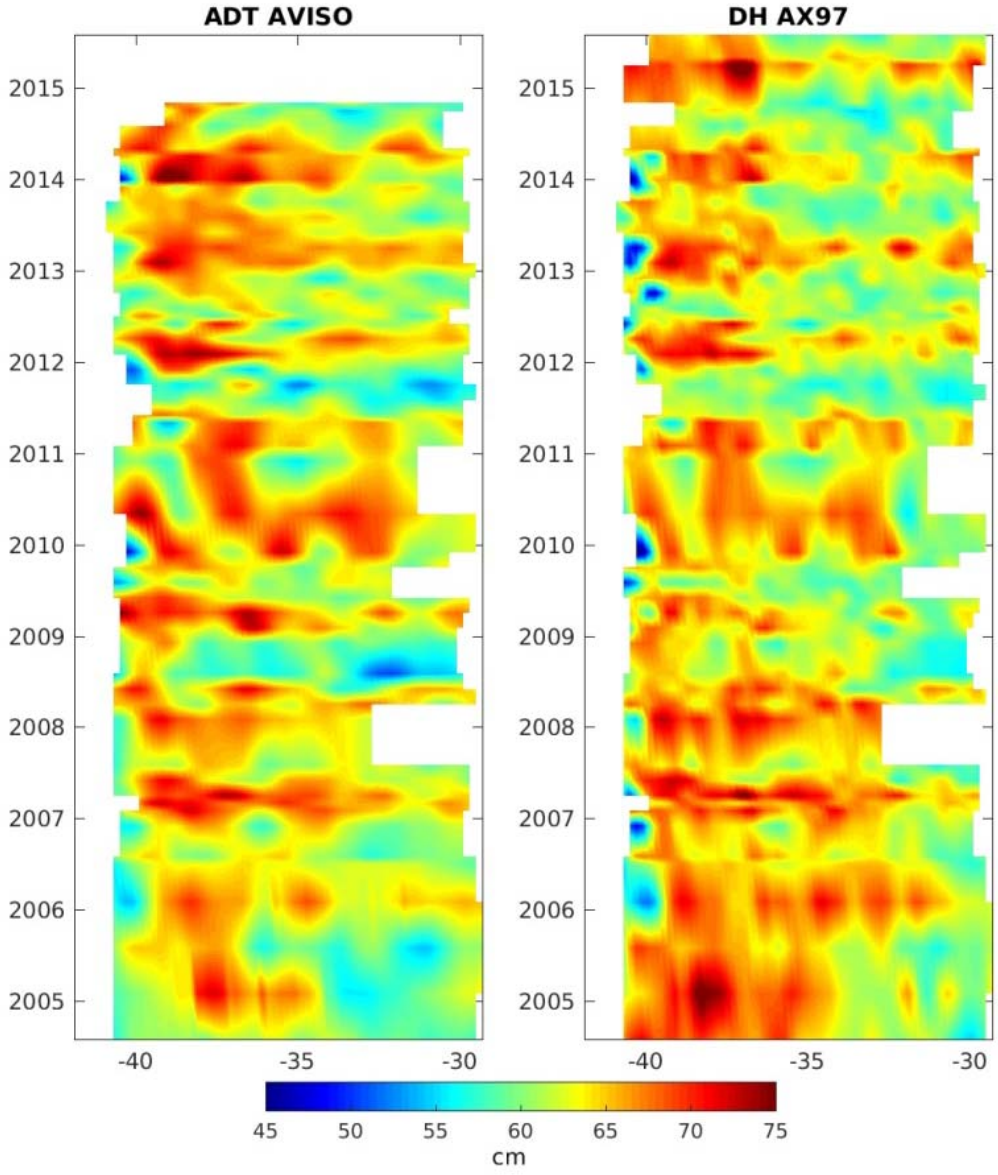




TS lookup tables are created for the South Atlantic using a multiple linear regression.

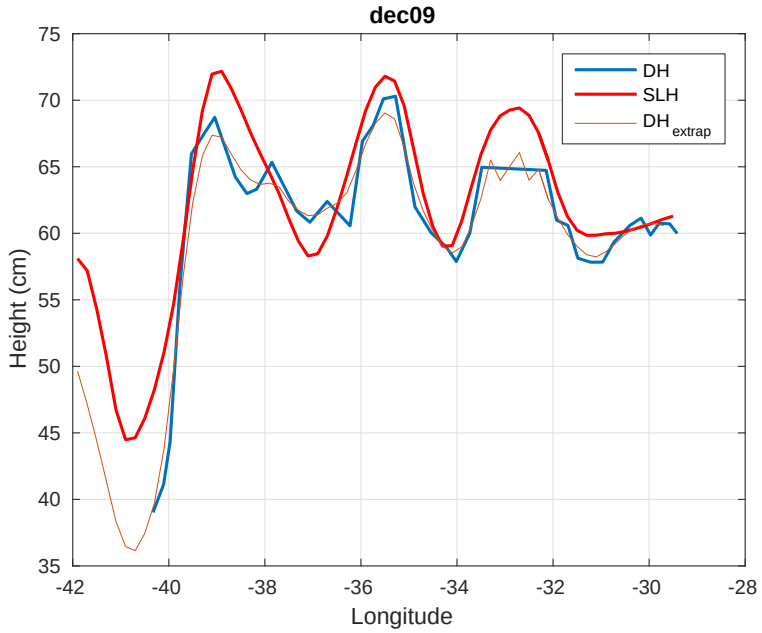


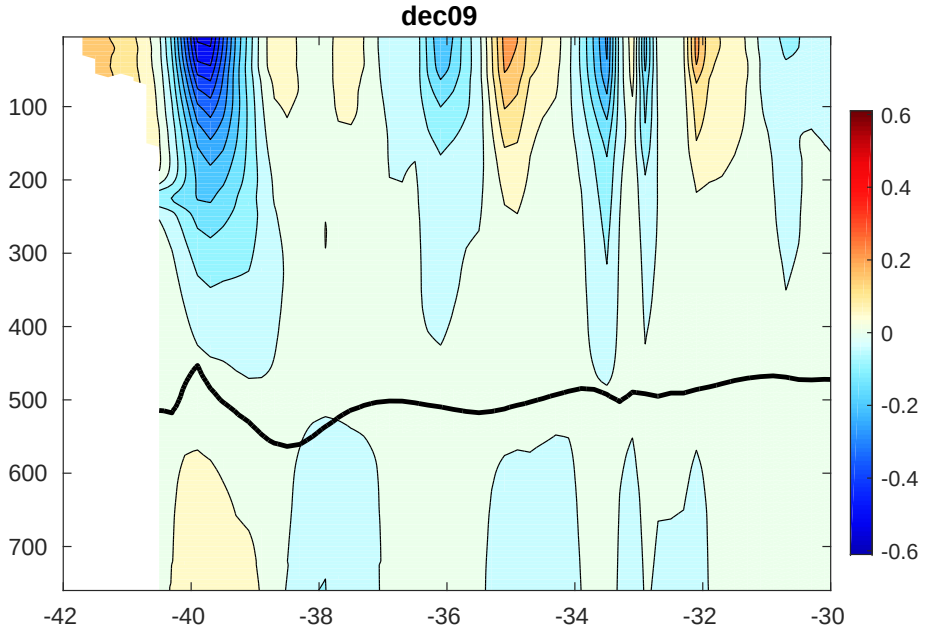
Argo reference climatology



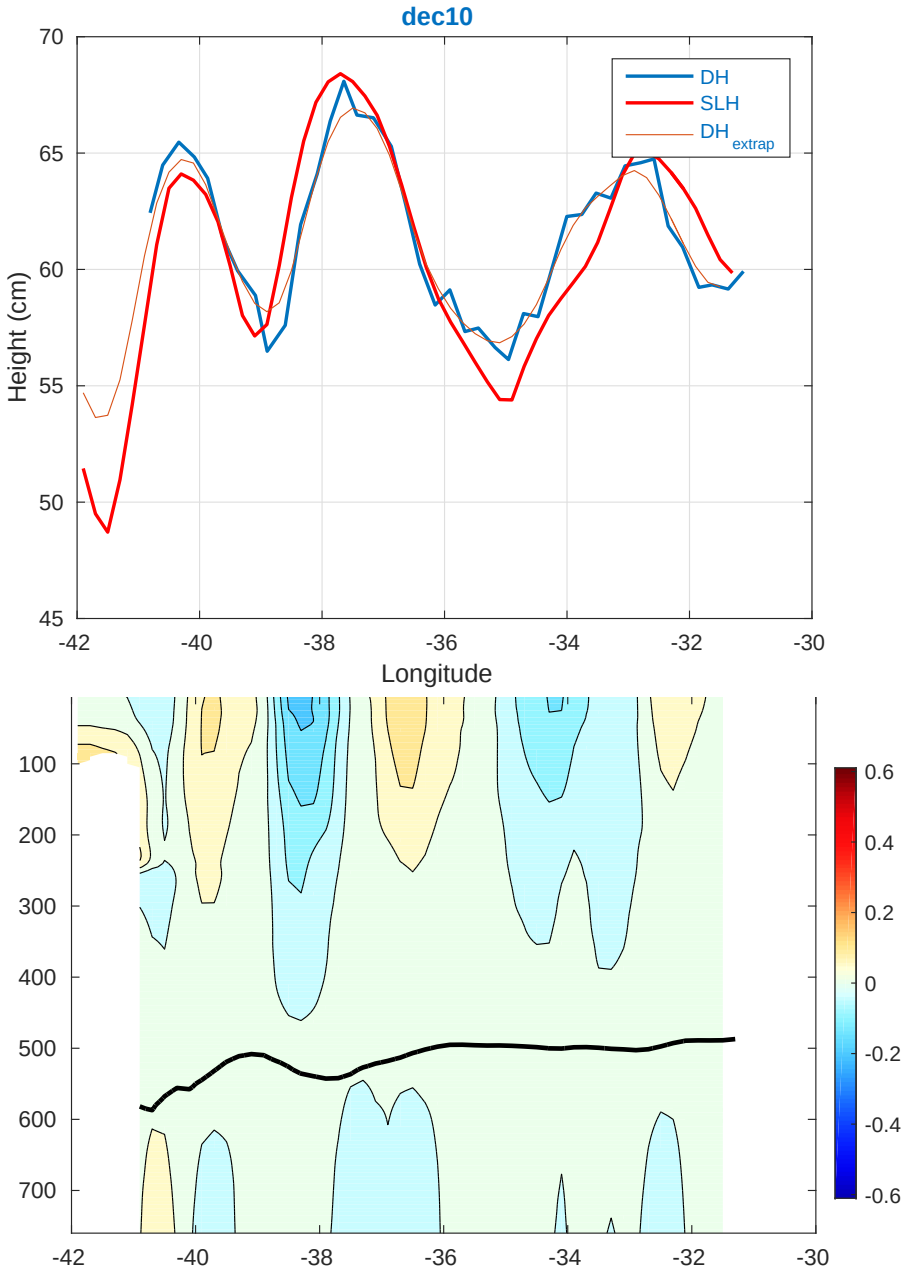
Extrapolation to the shelf

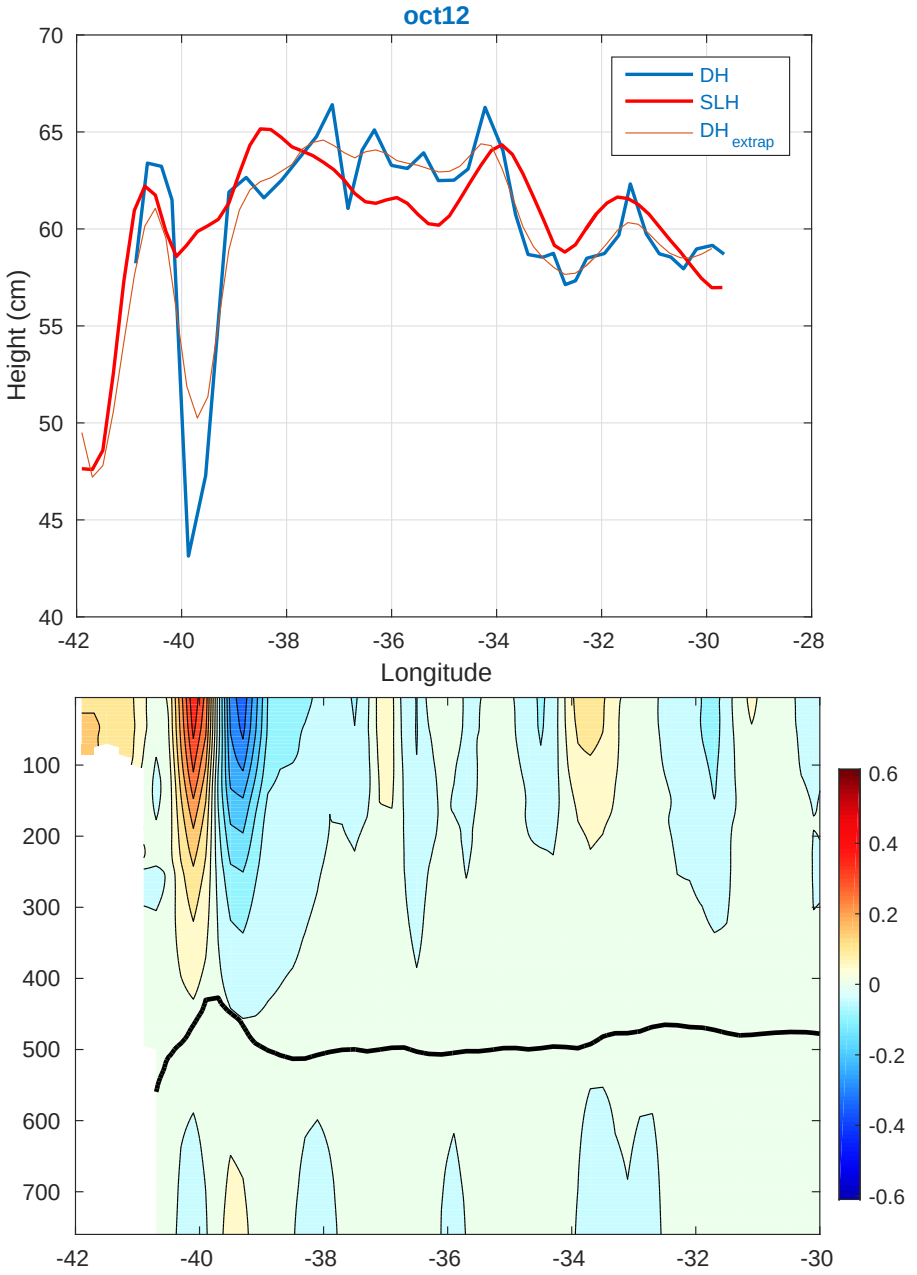
Use gradients of SSH to extrapolate the XBT dynamic height to the shelf, with an exponential decay with depth.



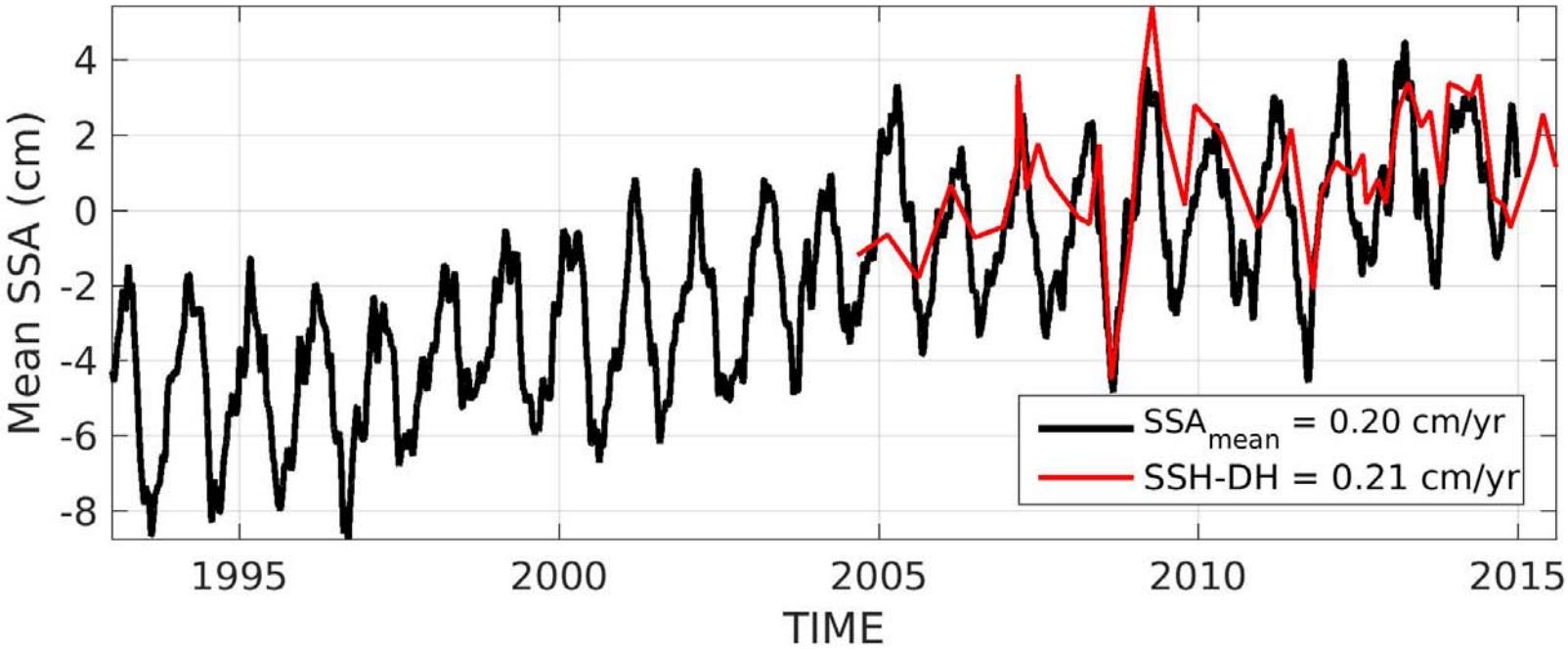


Extrapolation to the shelf



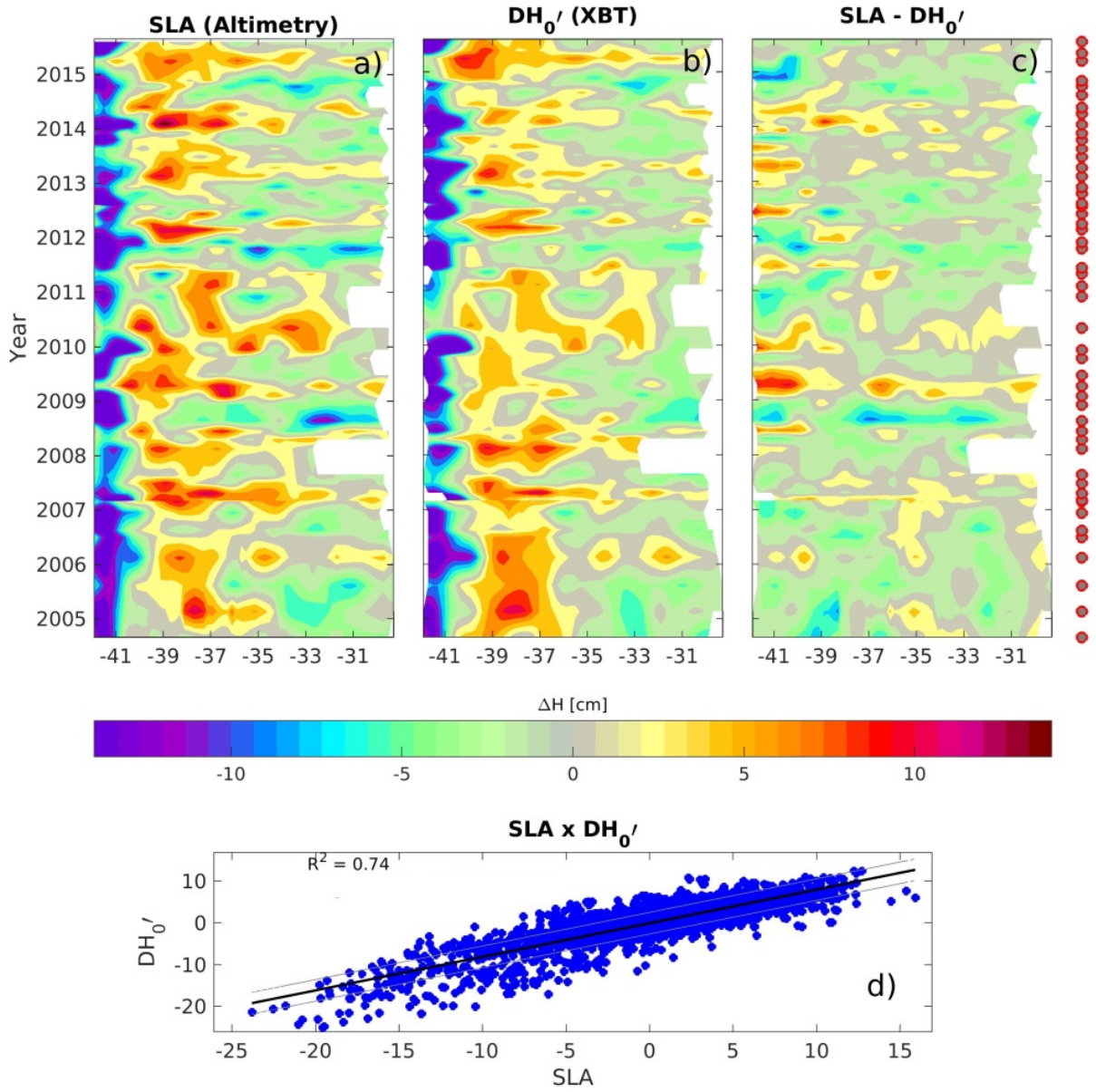


SSH correction

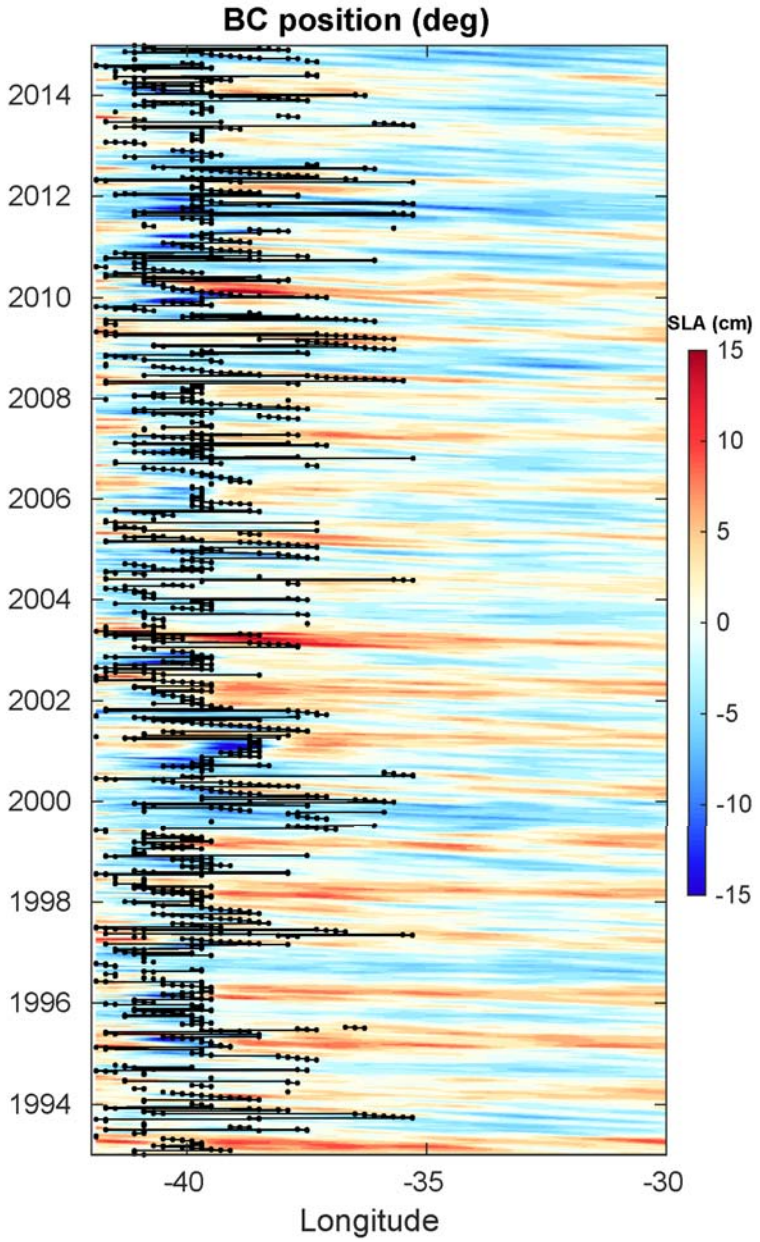


The non-steric component along the AX97 agrees broadly with the basin mean trends.

Comparison for corrected altimetry



Transport calculation using XBT-altimetry synergy



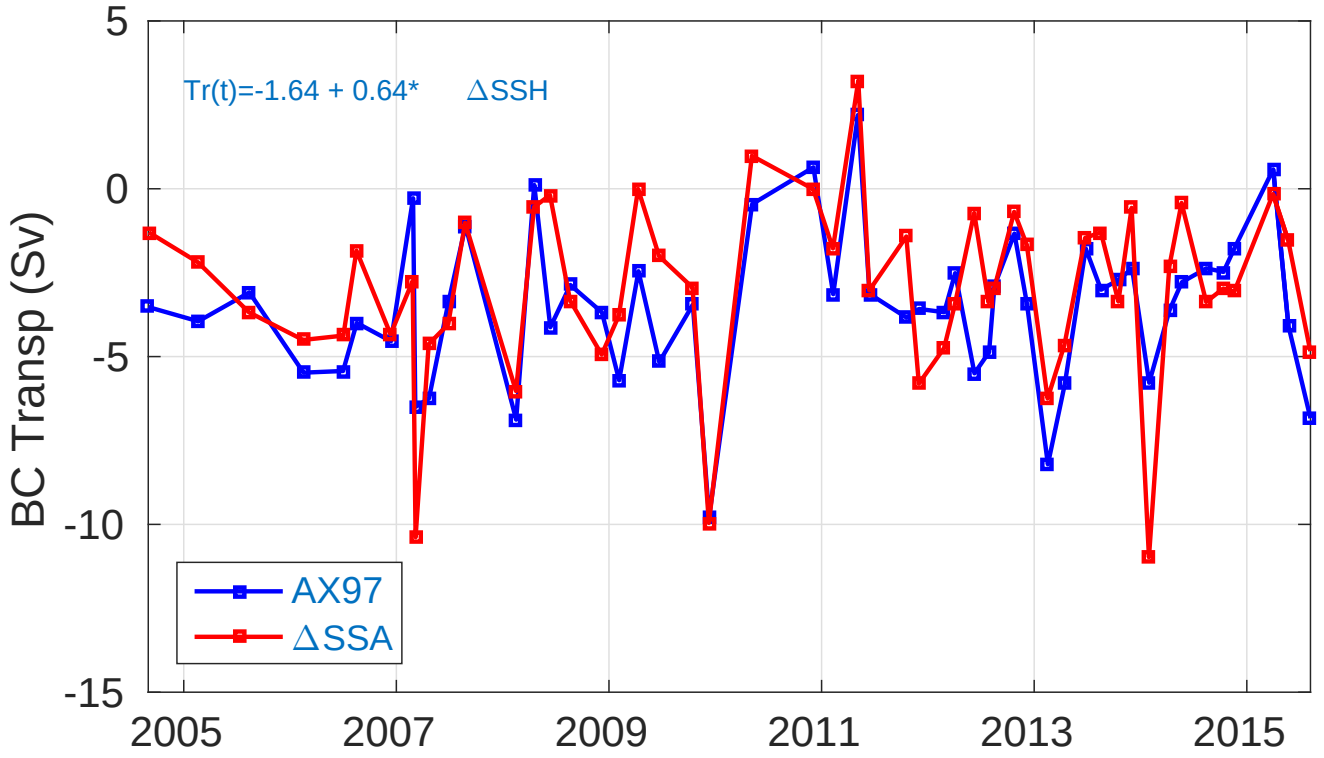
- SSH - Transport is calculated from the western boundary to the maximum SSH value.
- AX97 – Transport is calculated to the minimum cumulative transport.

Two methods will be tested to investigate the interannual variability of the BC transport.

Transport method 1 - ΔSSH

$$Transp = \frac{g\Delta SSH}{f \quad h}$$

Parameter ***h*** is calibrated against observations.



Transport method 2- Synthetic

- Anomalies of potential density (σ_θ) and anomalies of dynamic height (Dh') are linearly fit to anomalies of dynamic height at the surface.

$$D_H'(z) = c_1(z).D_H'(0) + c_2(z)$$

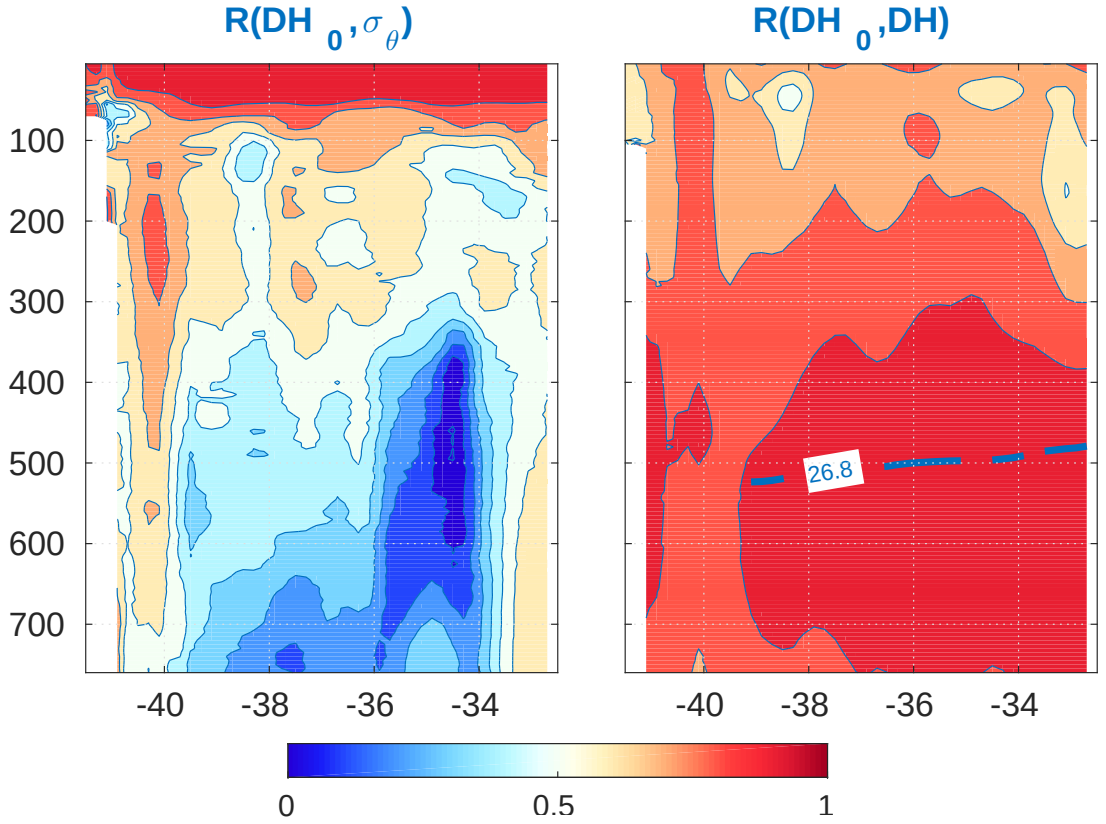
- The mean filed for σ_θ and dynamic height are derived from historical observations.

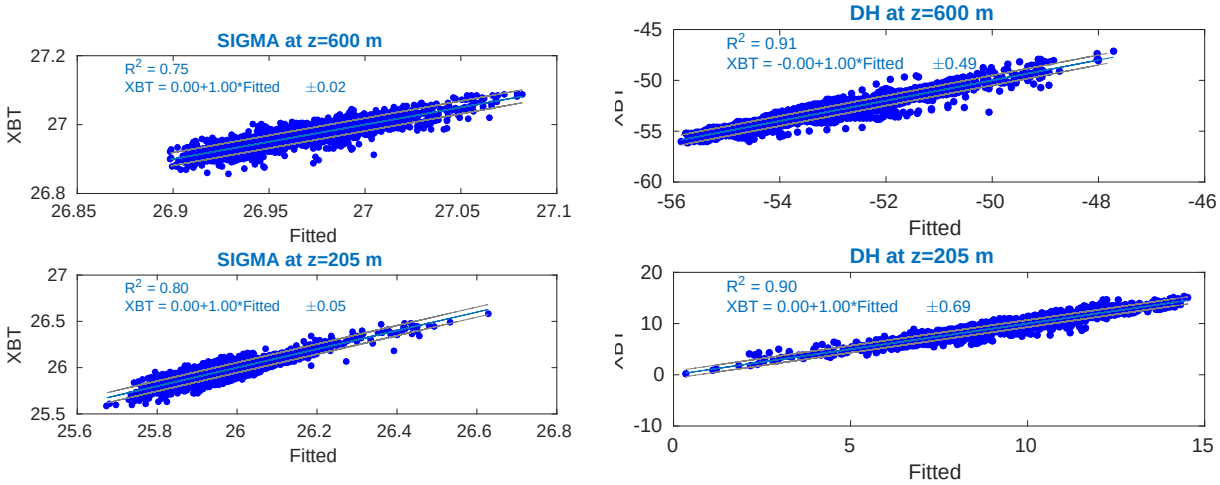
$$D_H(0)' = D_H(0) - \overline{D}_H(0)$$

- Surface dynamic height relative to Argo climatology is linearly fit to sea surface height (SSH) derived from altimetry.

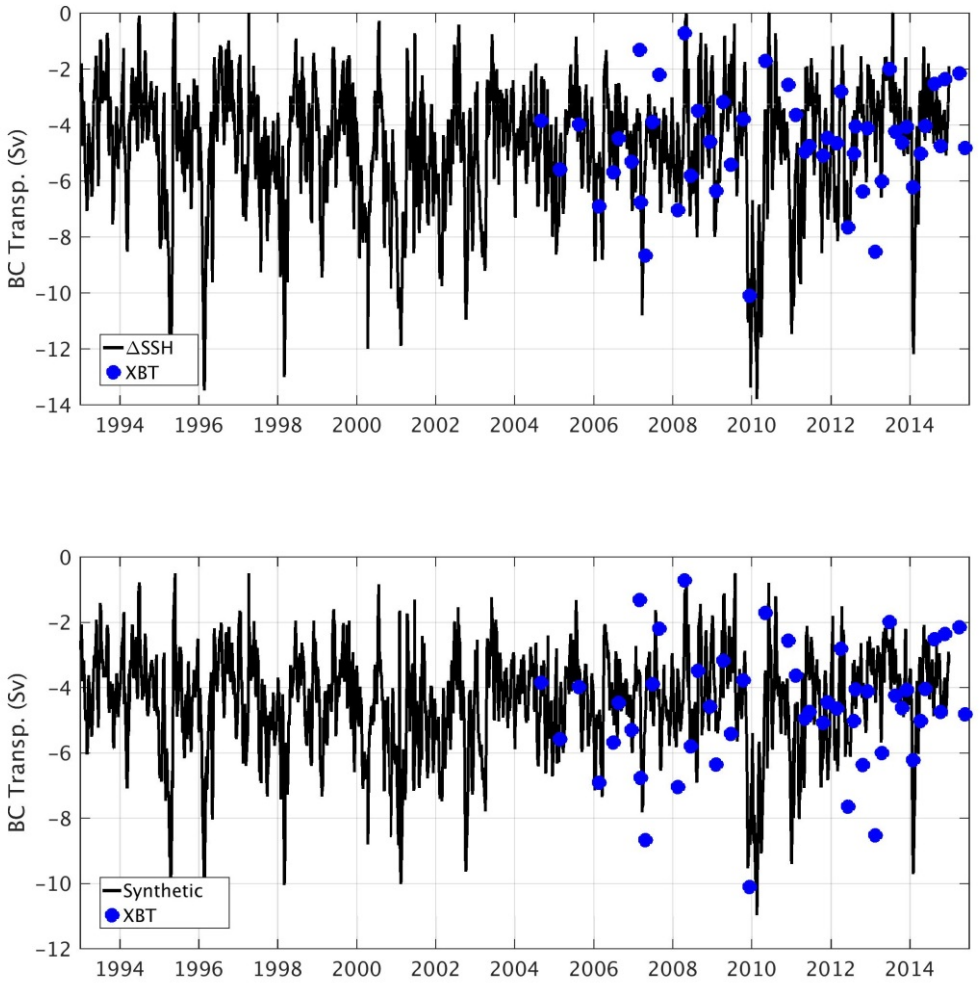
$$D_H(0) = c_3.SSH + c_4$$

Transport method 2- Synthetic

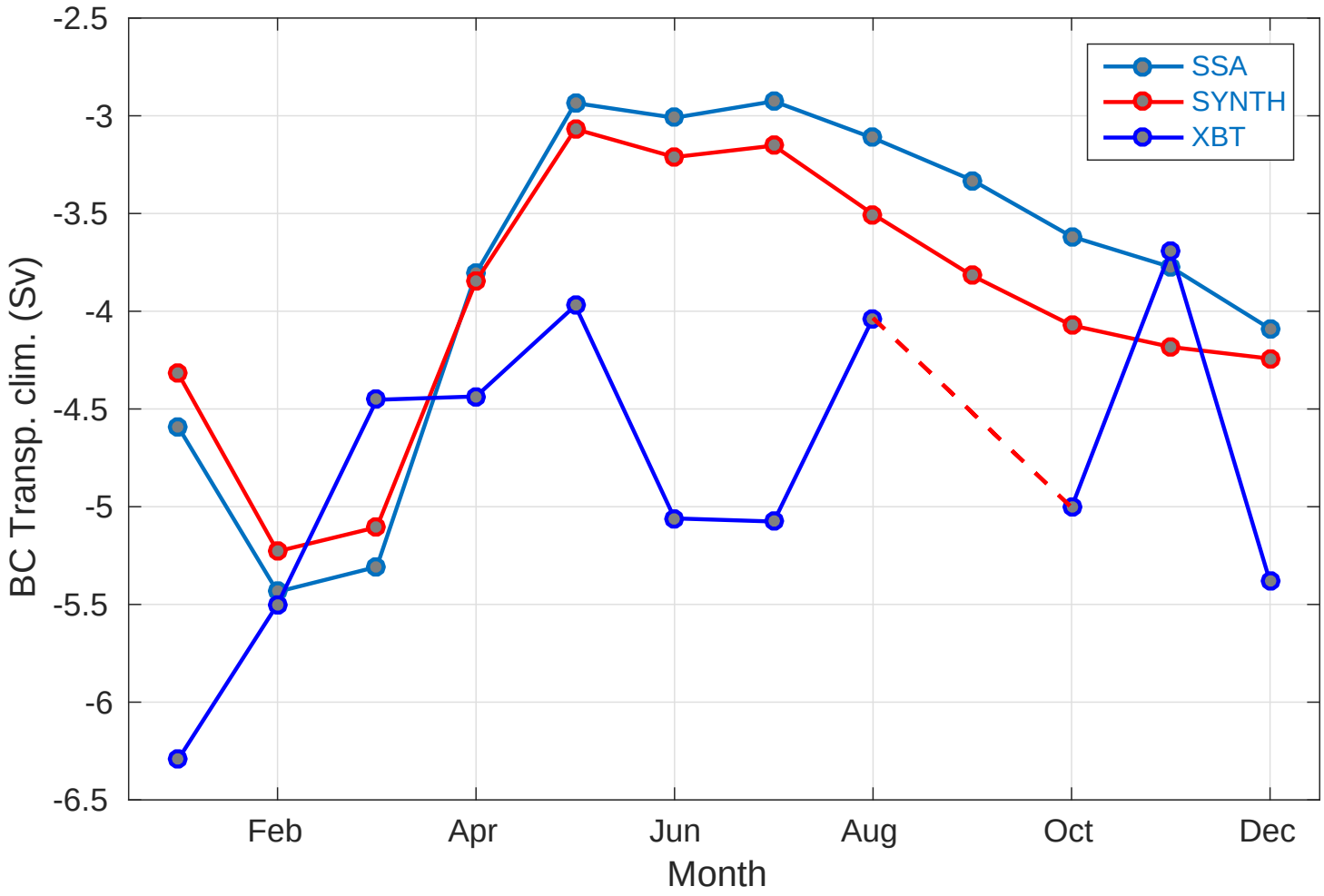




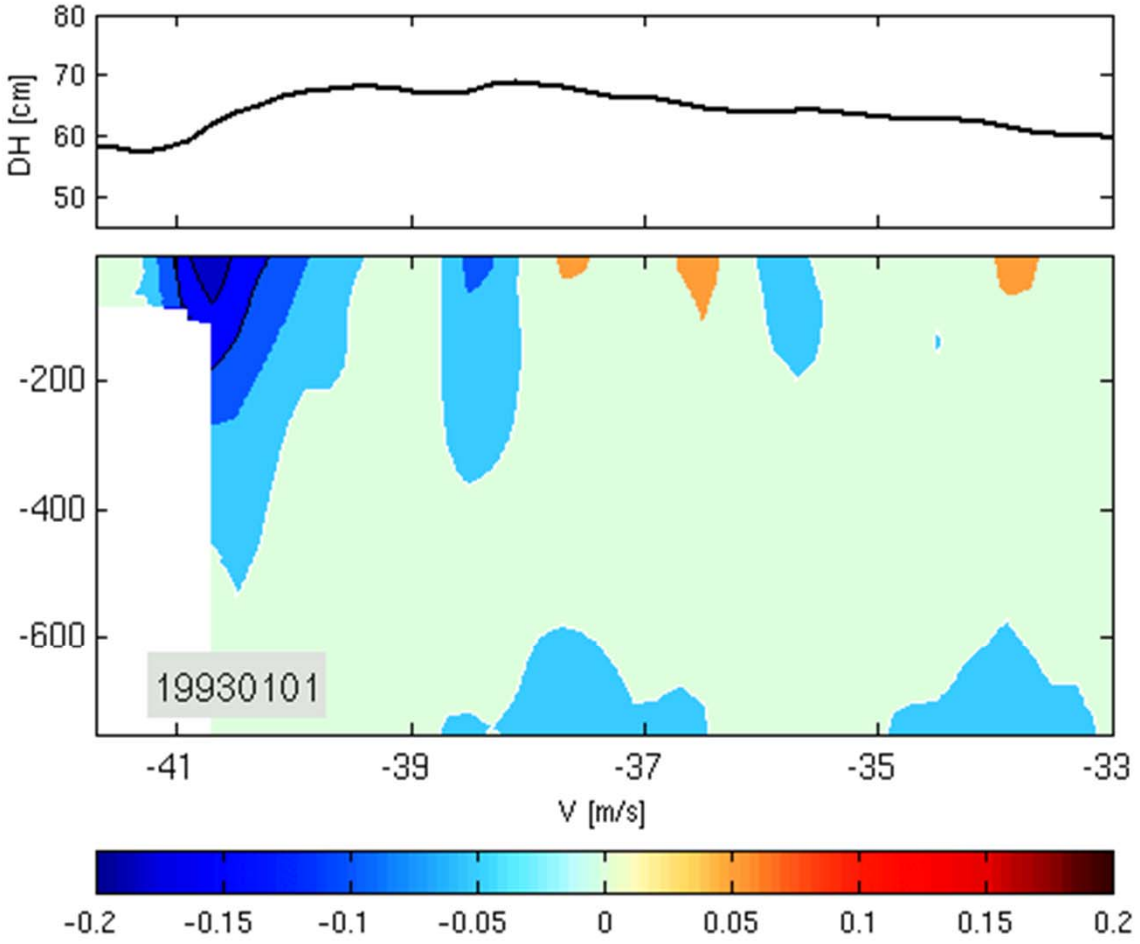
Reconstructed Timeseries



Seasonal cycle

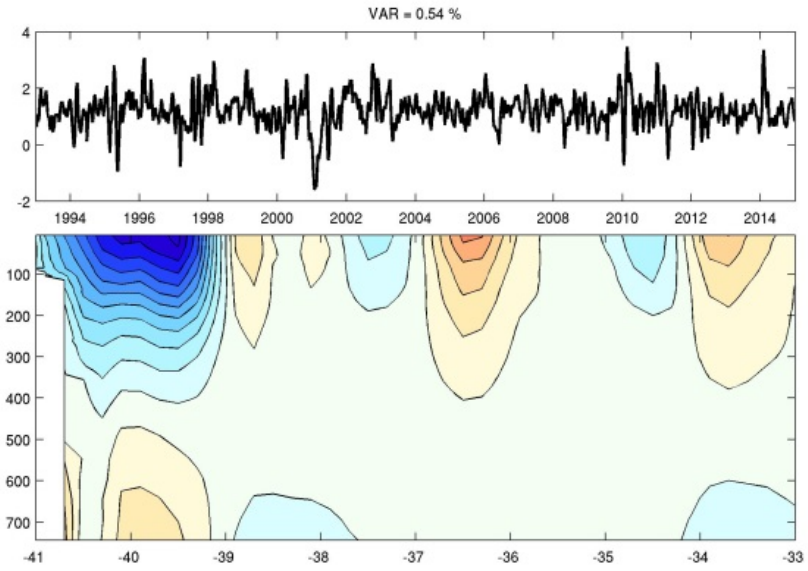


Reconstructed velocity along the AX97

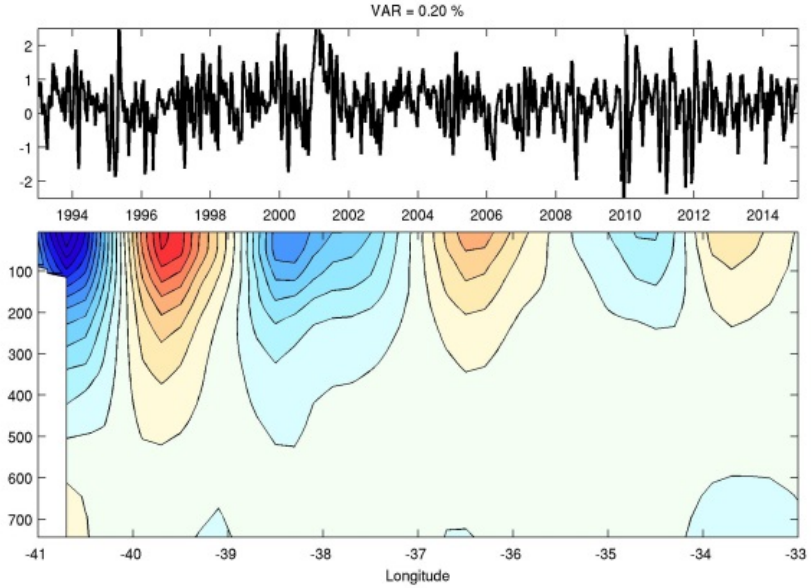


Modes of Variability of the BC

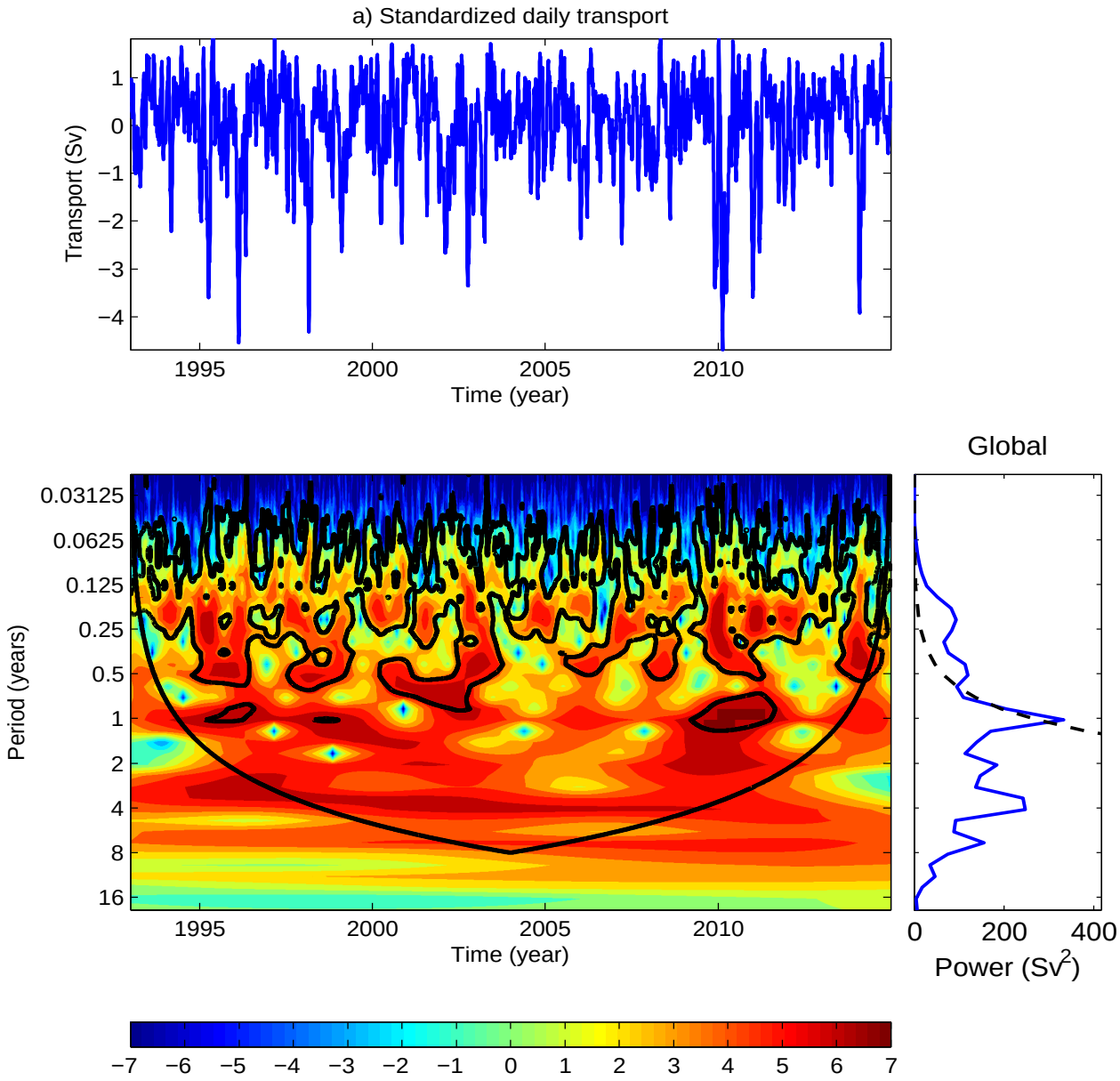
EOF-1



EOF-2



Decomposition of BC transport



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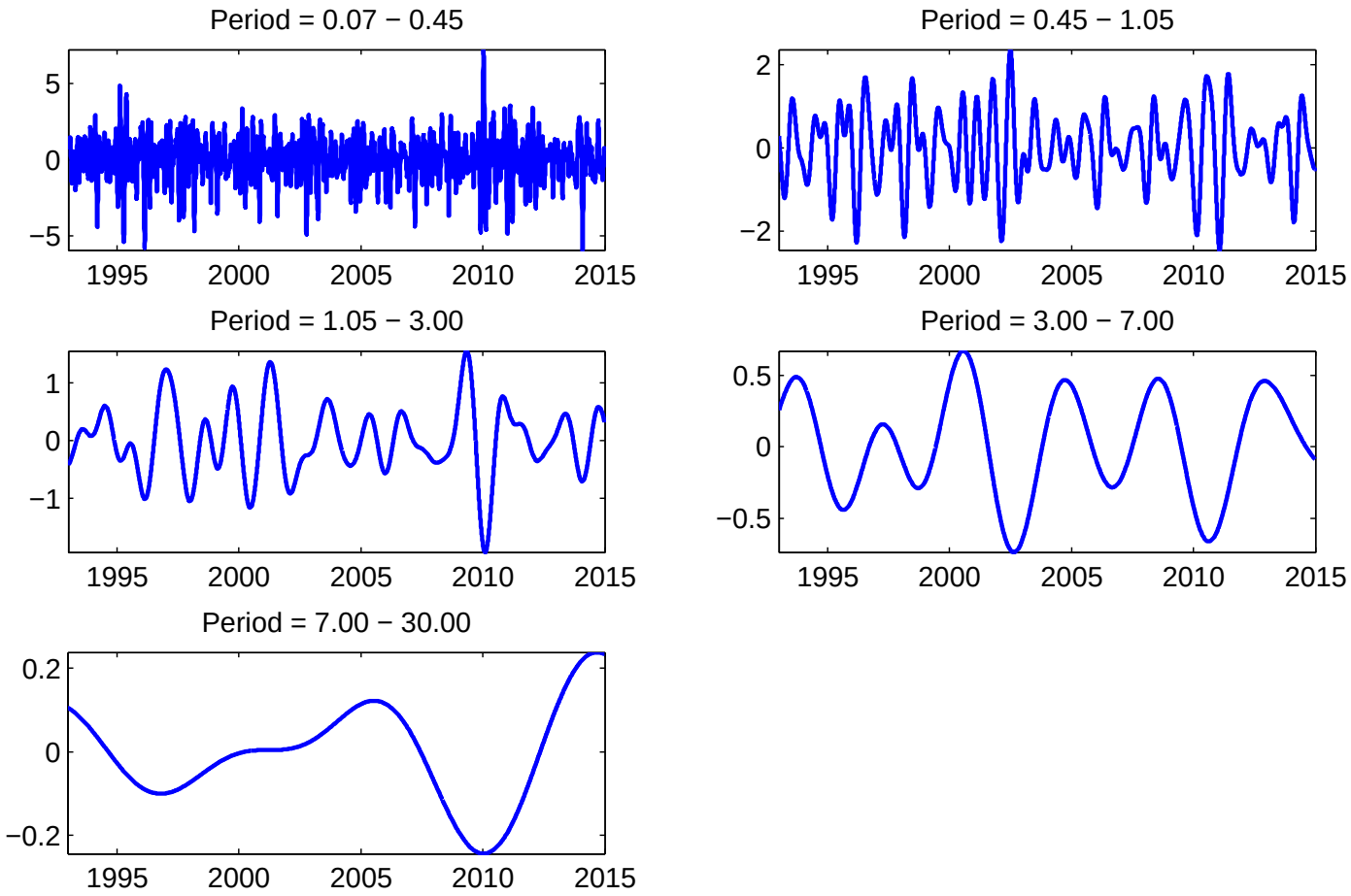
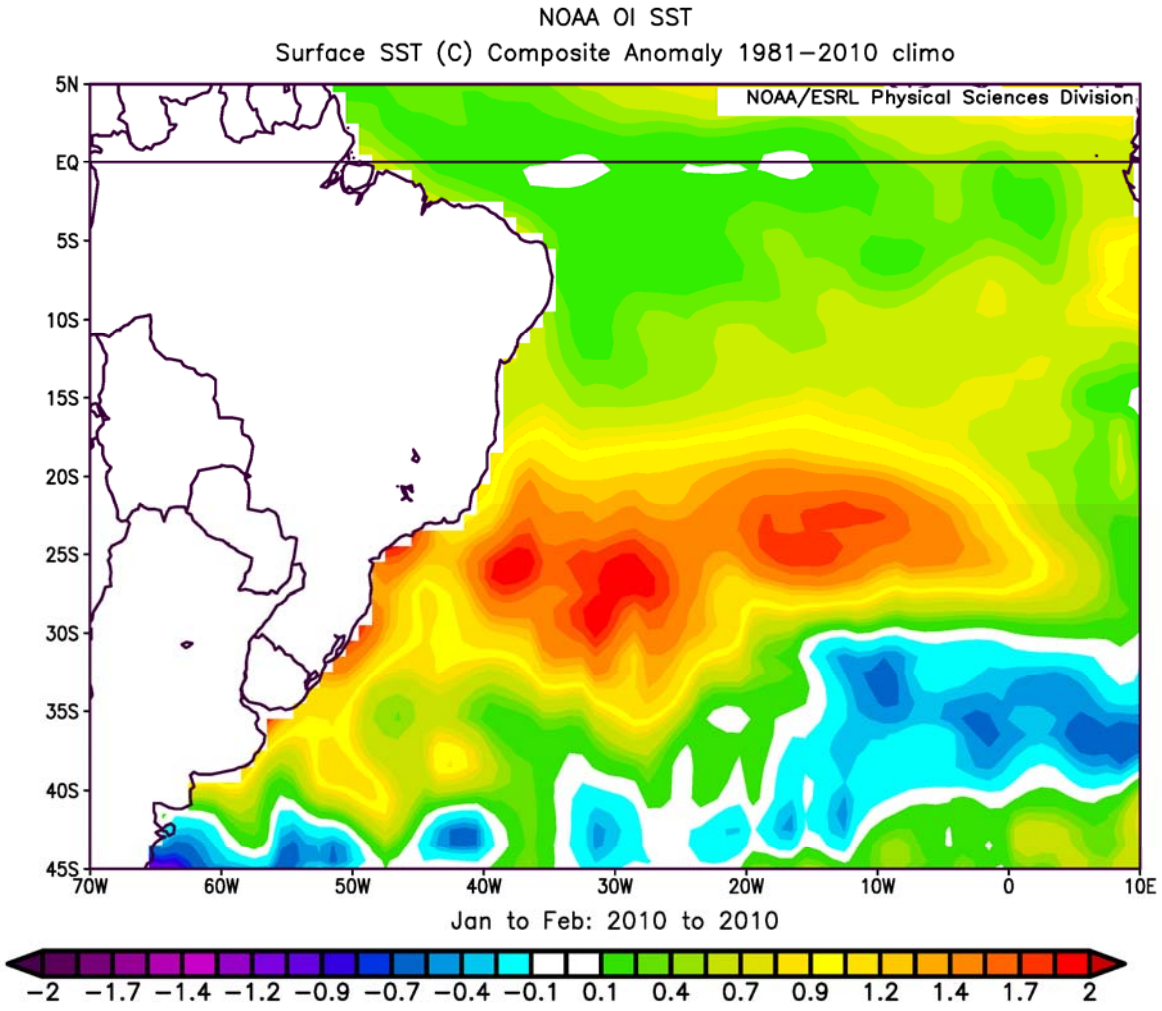
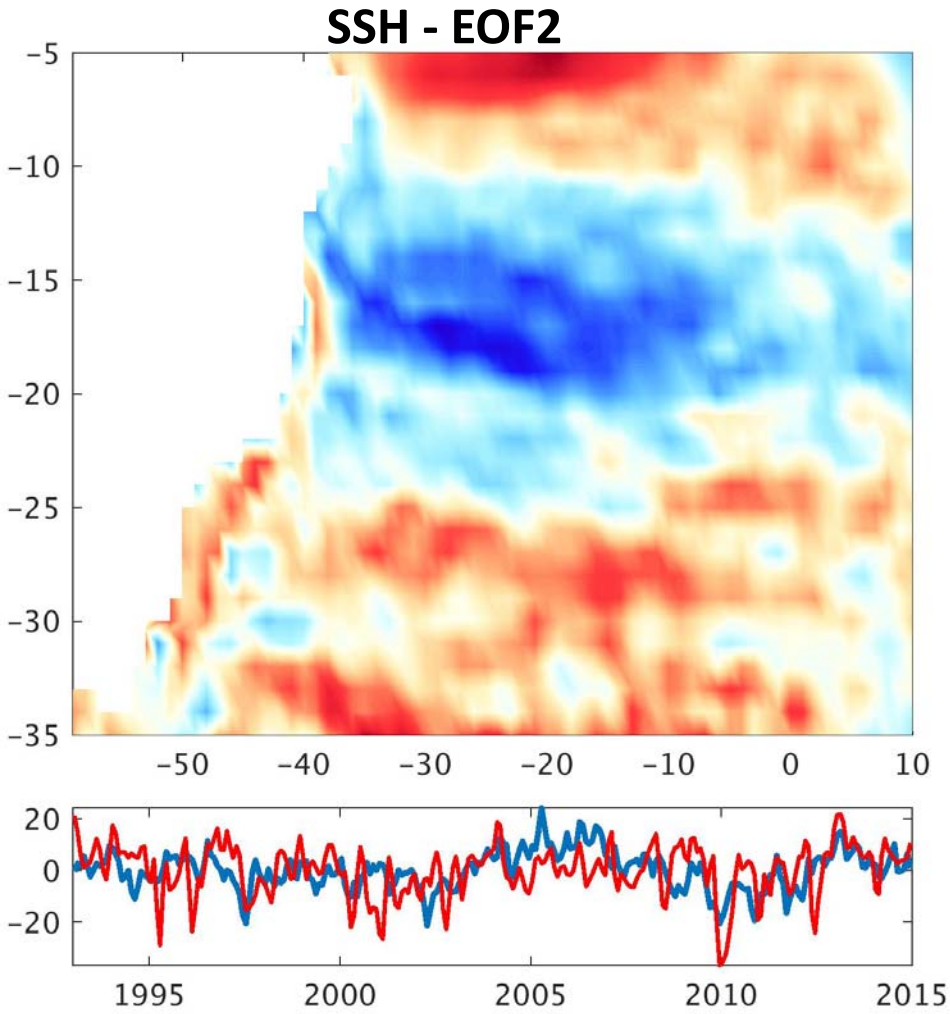


SST anomalies in the summer 2010



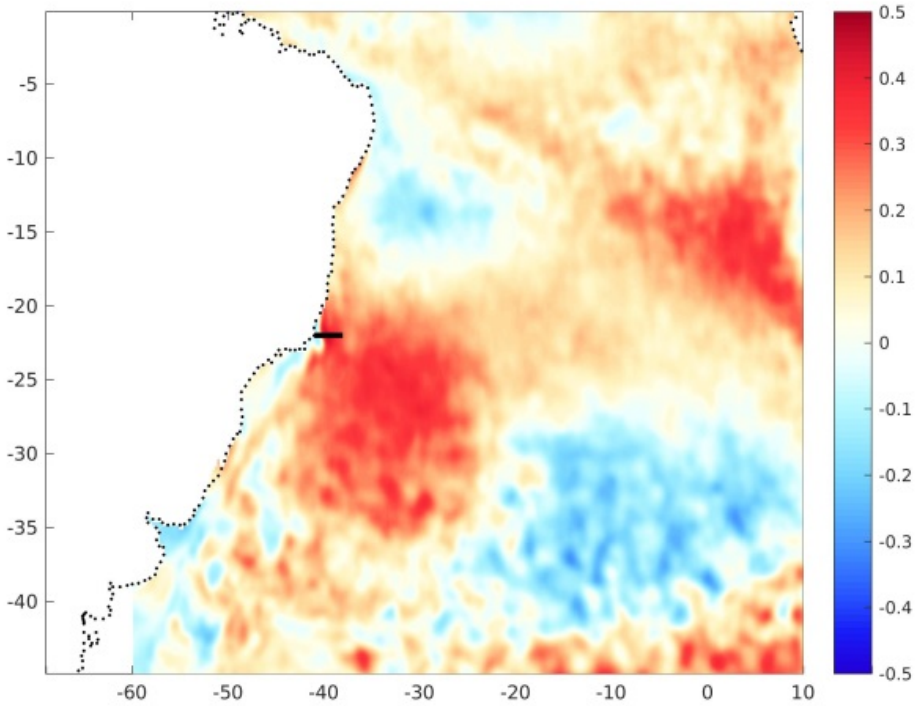
Modes of variability and BC



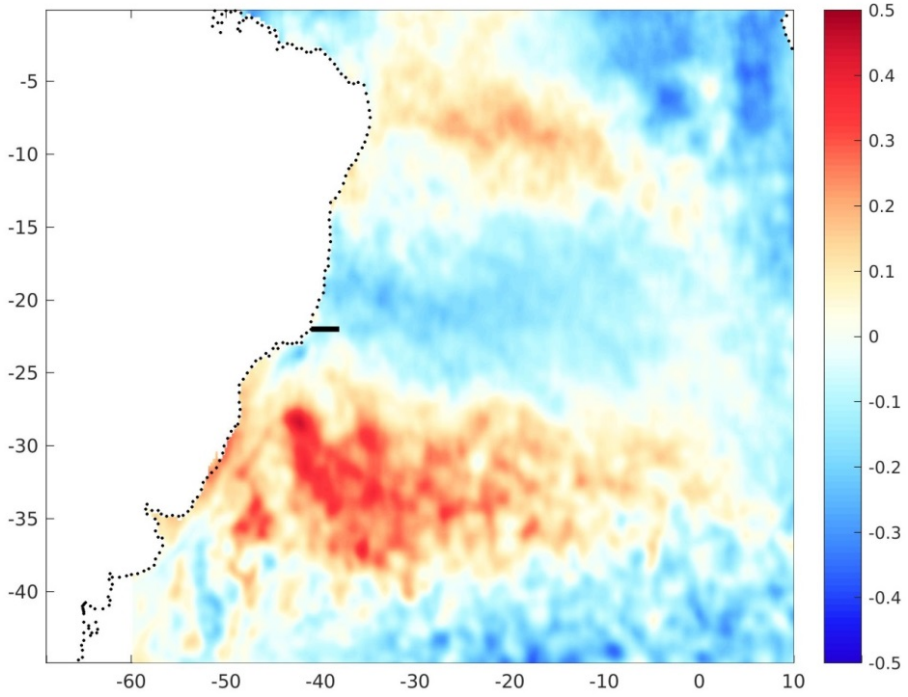
- EOF analysis is applied to the detrended SSH field
- Relatively strong correlation between northern cell variability and BC at 22°S

Correlation gyre strength x SST

Northern Cell

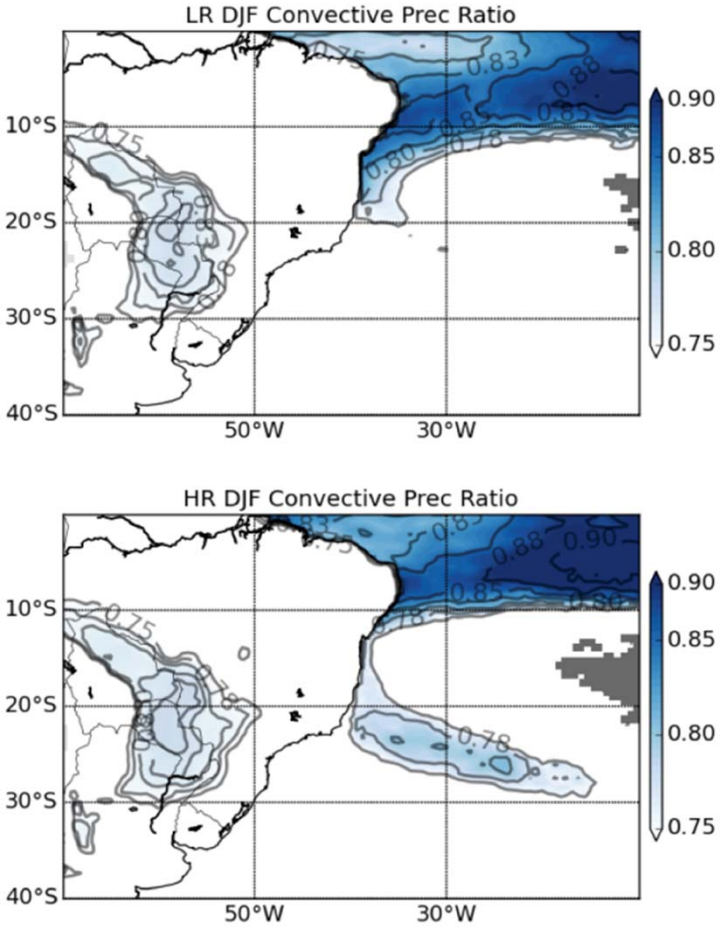


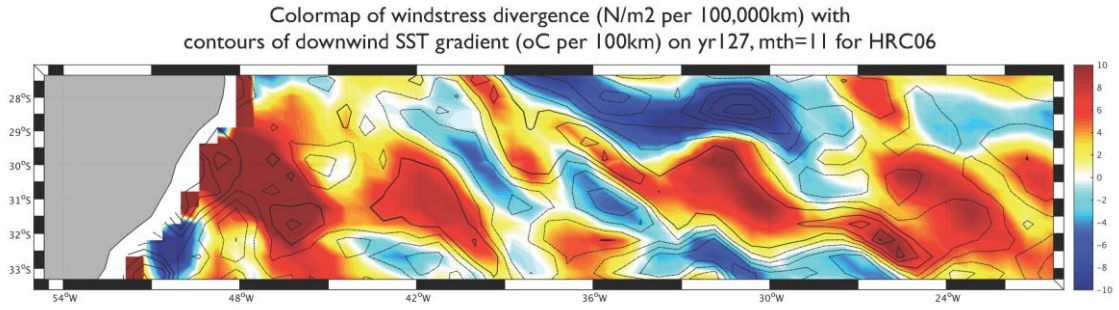
Southern Cell

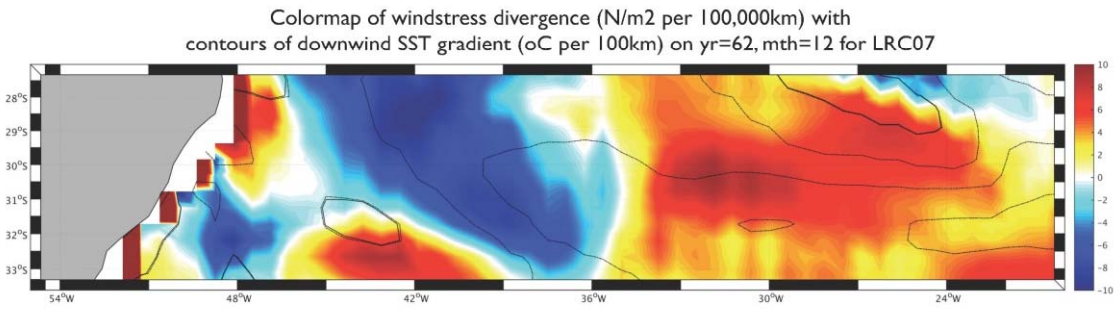


Strength of the cell is calculated as the latitudinal difference of SSH (Roemmich et al., 2007)

Importance of ocean circulation in a HR model





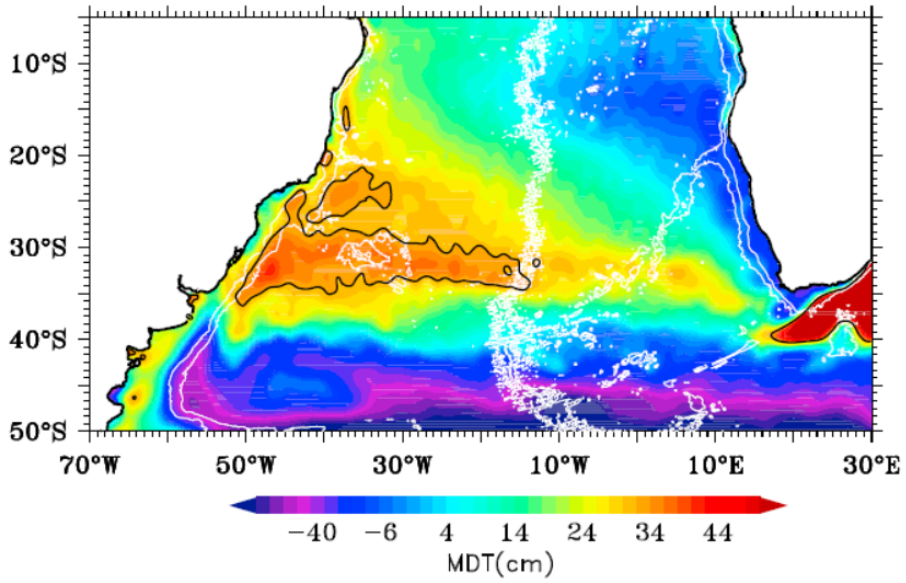


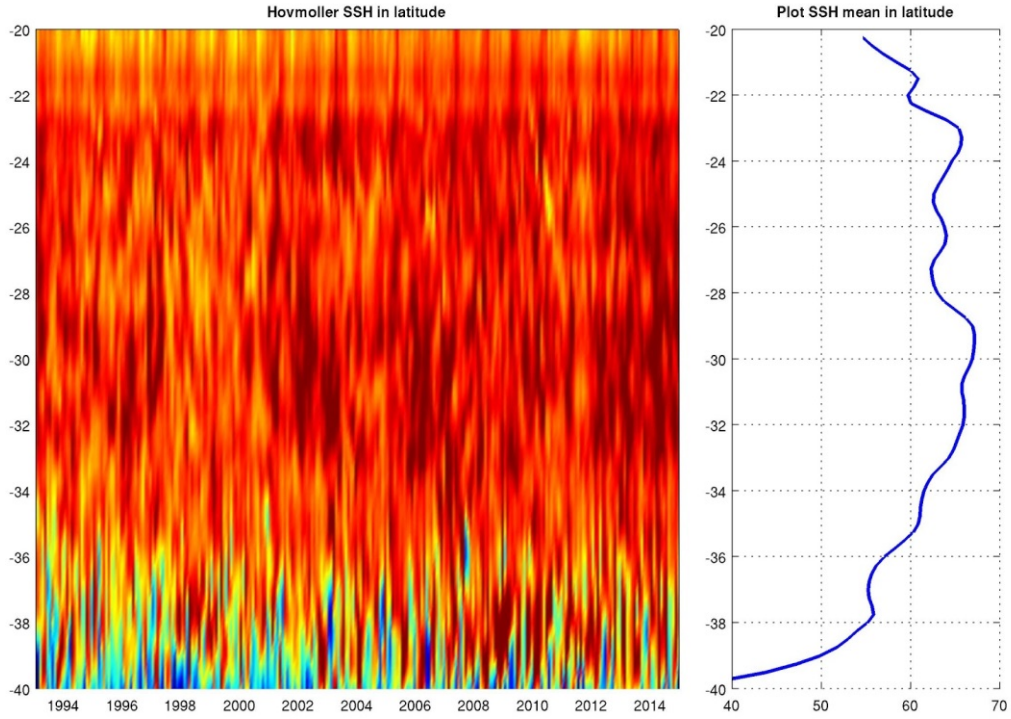
Ratio (convective/total) PREC

Conclusion

- The two methods to extend the timeseries of the BC transport bring similar results.
- The high mesoscale variability brings challenges to define a seasonal cycle of the BC.
- The first 2 EOF modes define 70% of the BC variability.
- The summer 2010 SST (PPT in South America) event must be linked to ocean dynamics.

Thank you


10°S
20°S
30°S
40°S
50°S
70°W
50°W
30°W
10°W
10°E
30°E
−40 −6 4 14 24 34 44
MDT(cm)


Hovmoller SSH in latitude
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014

Plot SSH mean in latitude
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
40
50
60
70