



# THE MALVINAS CURRENT FROM ITS SOURCE (DRAKE PASSAGE) TO THE CONFLUENCE WITH THE BRAZIL CURRENT

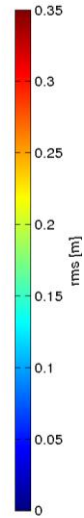
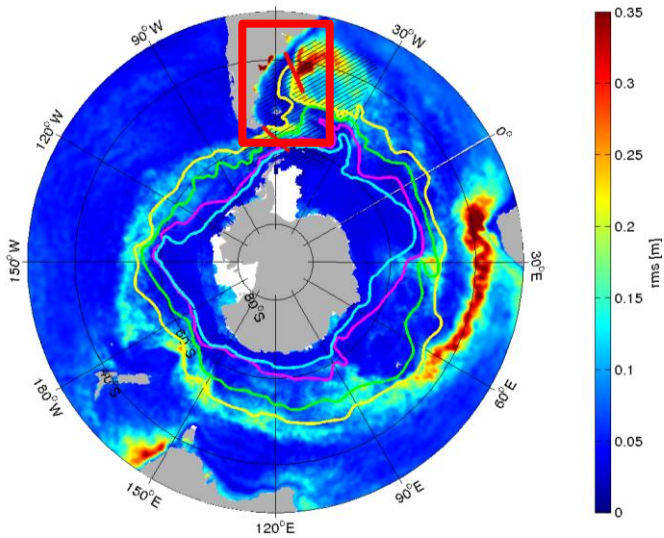
## SATELLITE ALTIMETRY & MERCATOR OCEAN GLORYS12 REANALYSIS

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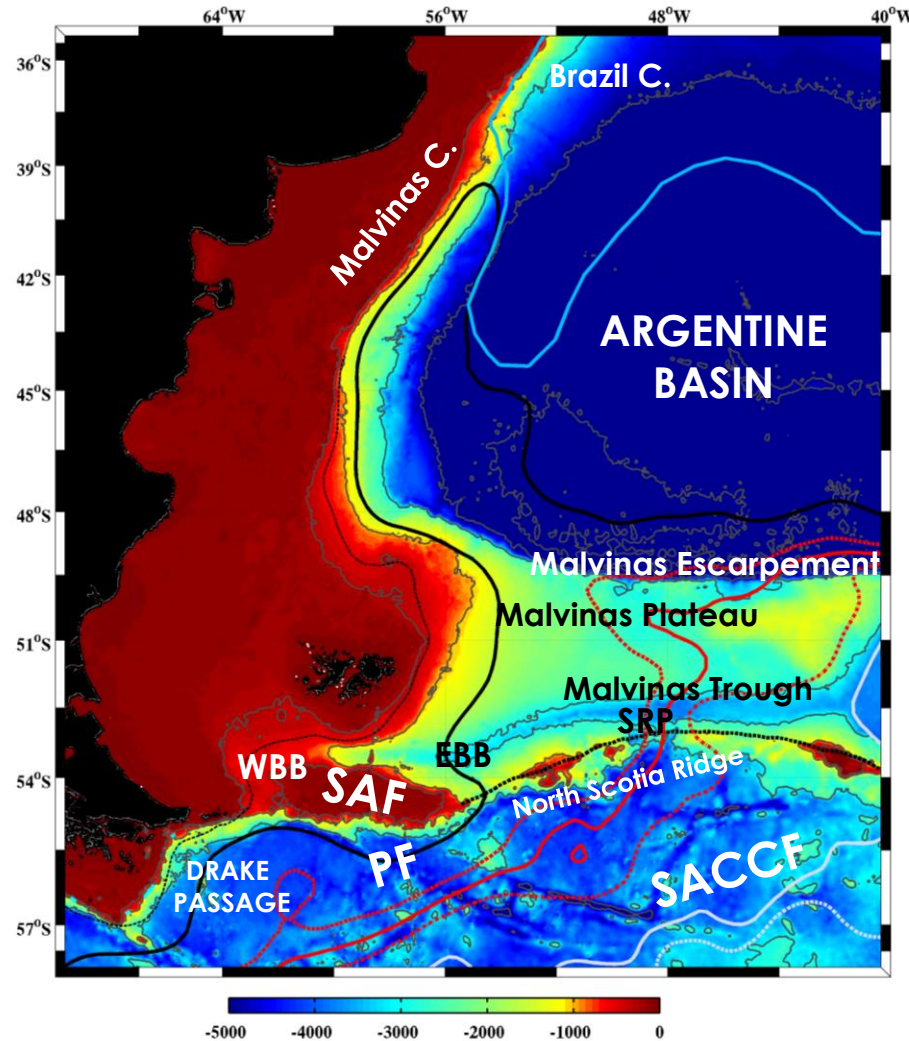


# INTRODUCTION

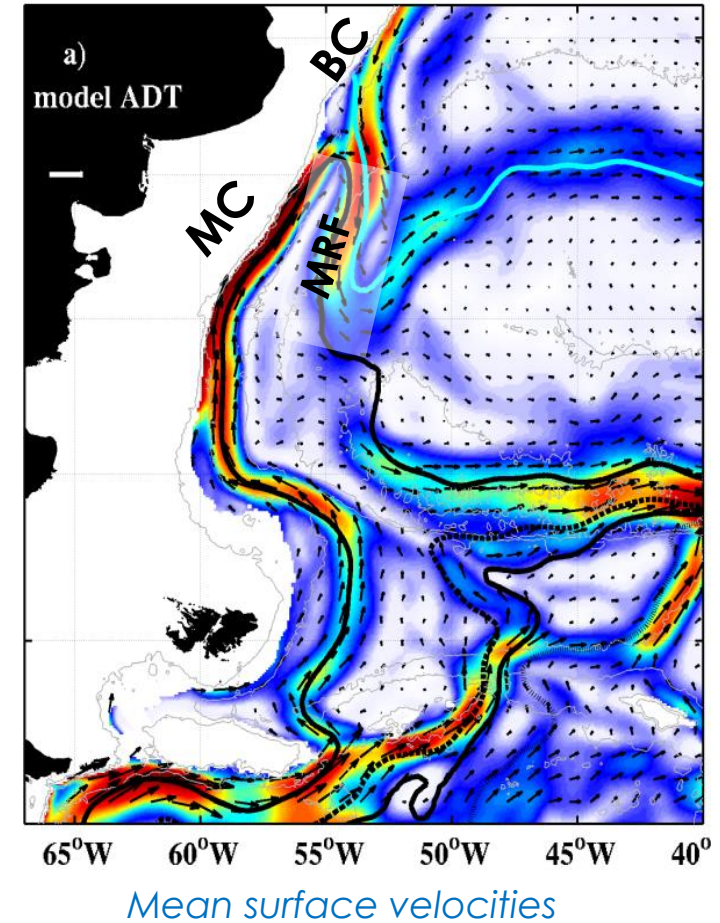
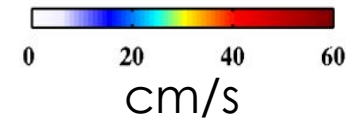
## The Malvinas Current



- We combined in situ, satellite data, and operational model outputs to revisit the MC from its southern part to its northernmost tip



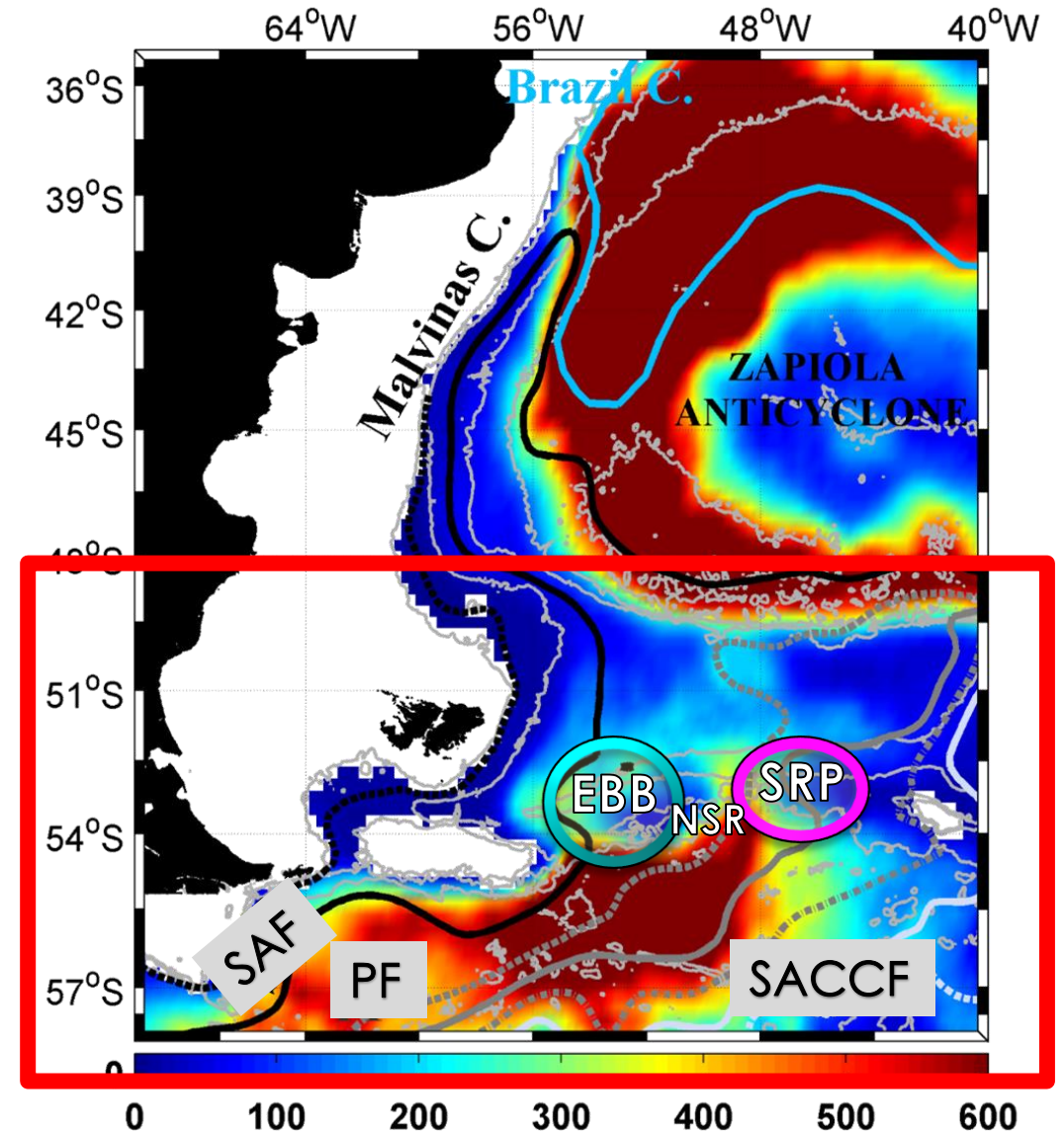
Bathymetry





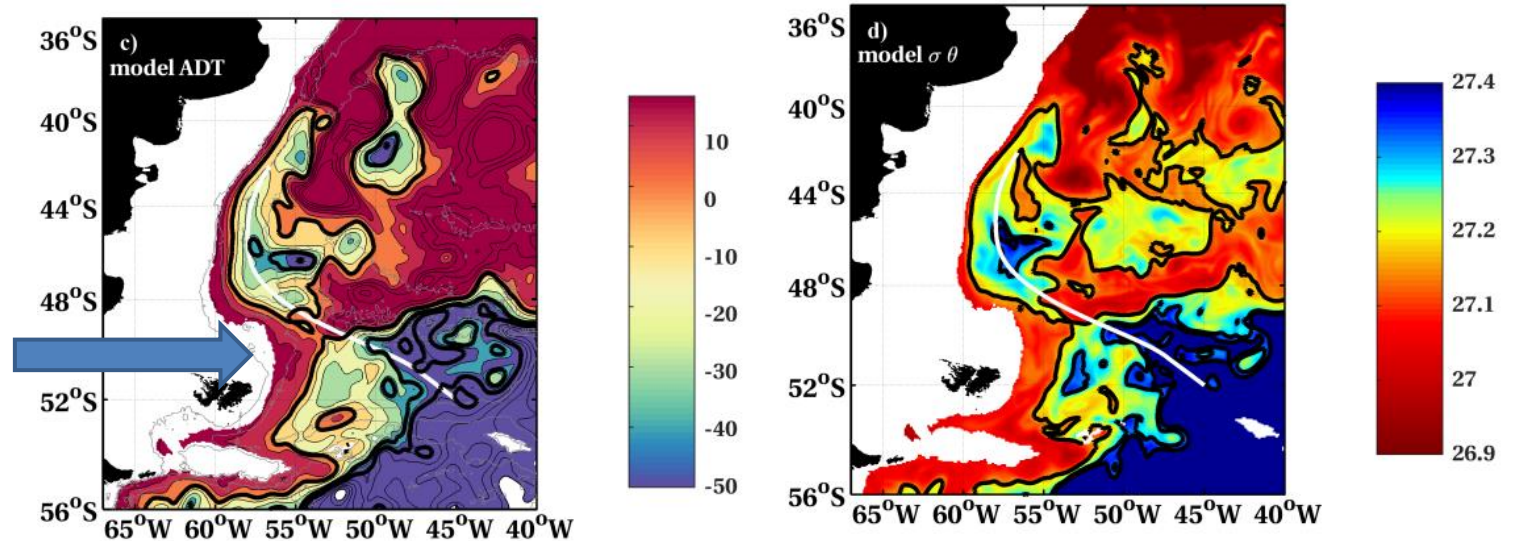
# THE MC & THE ACC

- In contrast to the Brazil Malvinas Confluence (BMC) and Drake Passage, the MC exhibits moderate a Eddy Kinetic Energy (EKE).
- EKE from Drake Passage leaks through narrow topographic passages (EBB and SRP) through the North Scotia Ridge (NSR) and dissipates over the Malvinas Plateau, a hotspot for dissipation.



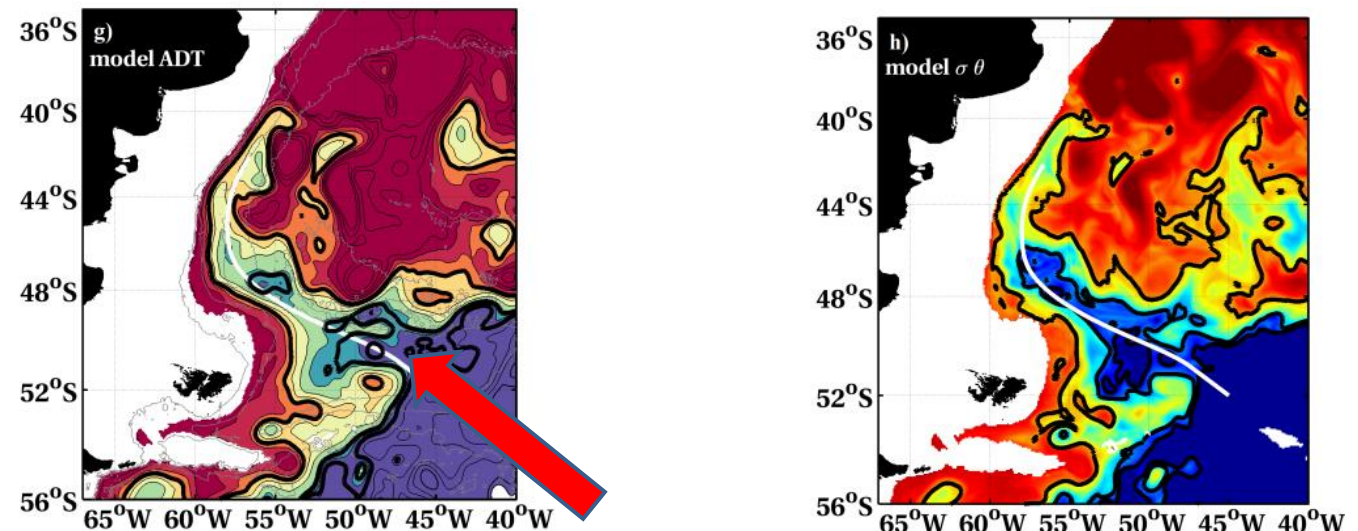
# BLOCKING AND FEEDING EVENTS

- Blocking events result from anticyclonic anomalies propagating westward and cutting the MC from its source.
- During those events the MC further downstream does not collapse as a recirculation cell is established to the north of the blocking region



GLORYS12 ADT and Potential density at 541 m (**Blocking event**).

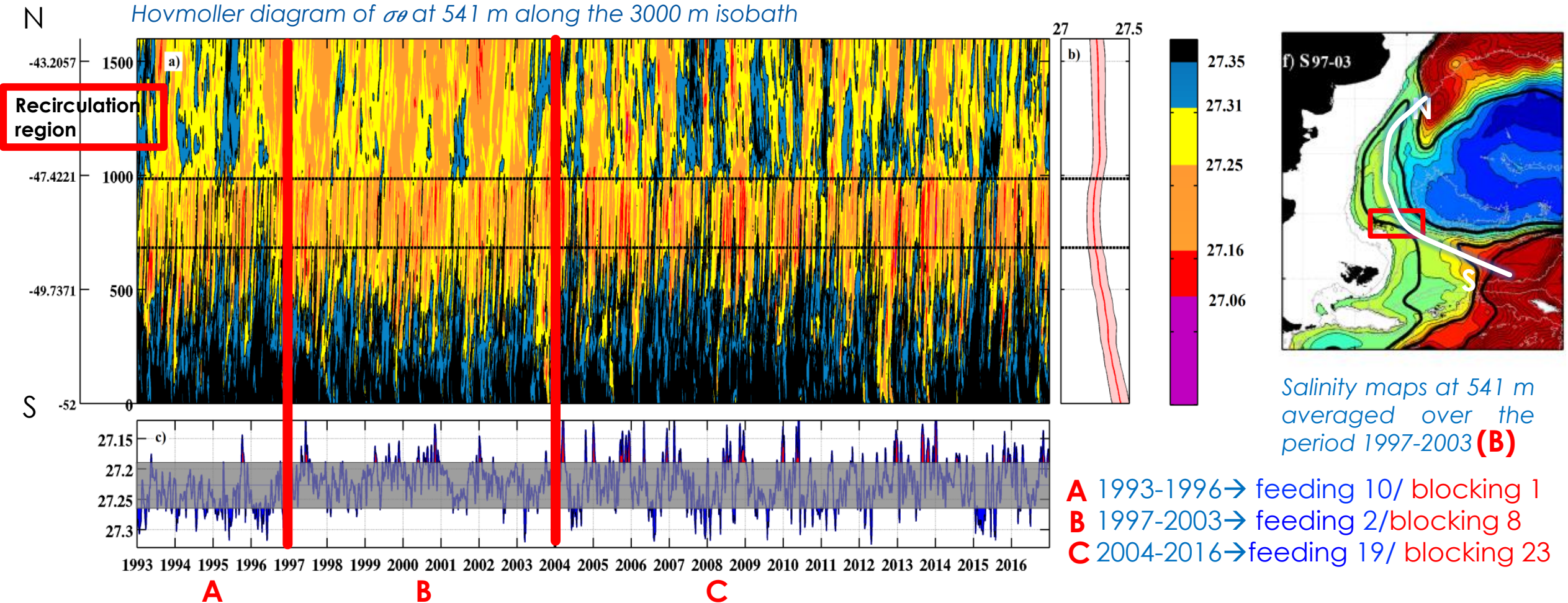
- Waters from the South of the Polar Front are recurrently injected into the MC as feeding events.
- Polar waters accumulate in the recirculation region between the MC and the Malvinas Return Flow



GLORYS12 ADT and Potential density at 541 m (**Feeding event**).



# RECIRCULATION - LONG TERM MODULATIONS

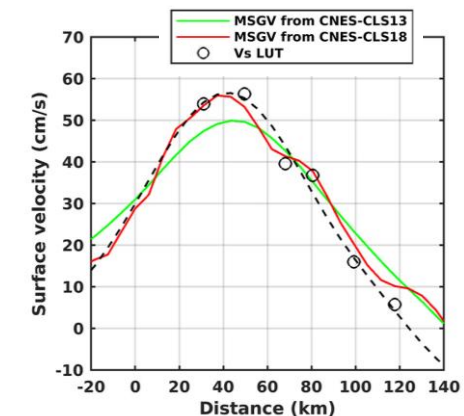
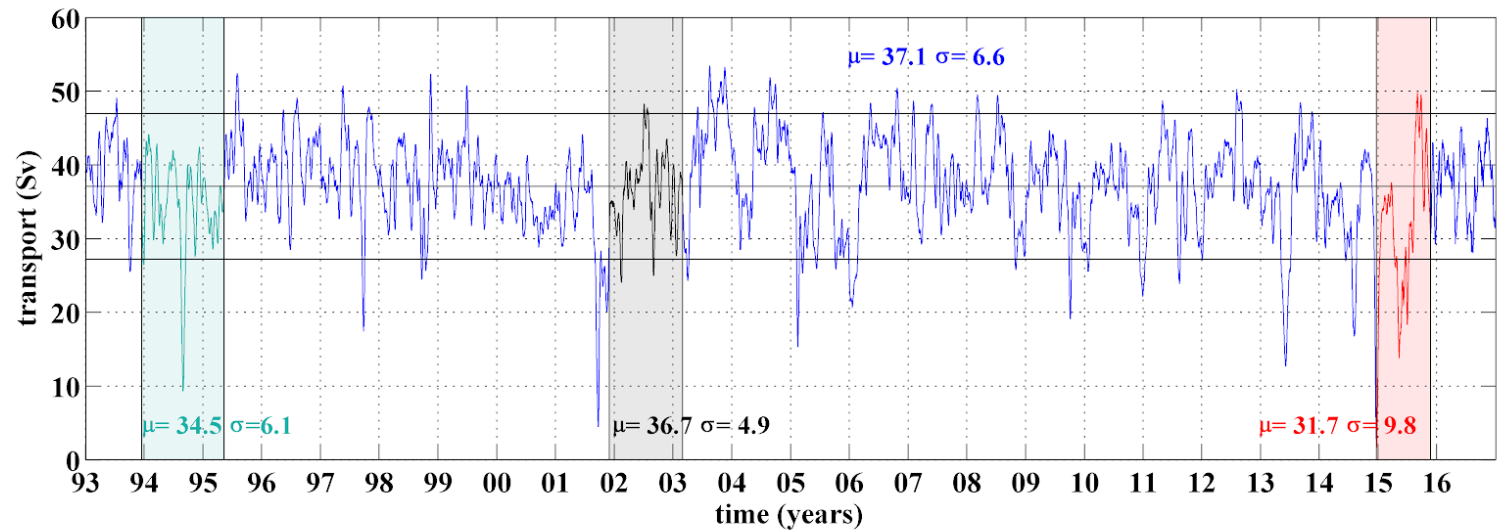


Time series of  $\sigma_\theta$  at 541 m averaged over a box centered at 48.5°S. Shaded grey: std. Red peaks: blockings. Blue peaks: feedings.

- Blocking and feeding events induce a low frequency modulation in the water characteristics of the recirculation region. A salinity minimum observed in the 1997- 2003 period in the recirculation region corresponds to a period with reduced feeding events.

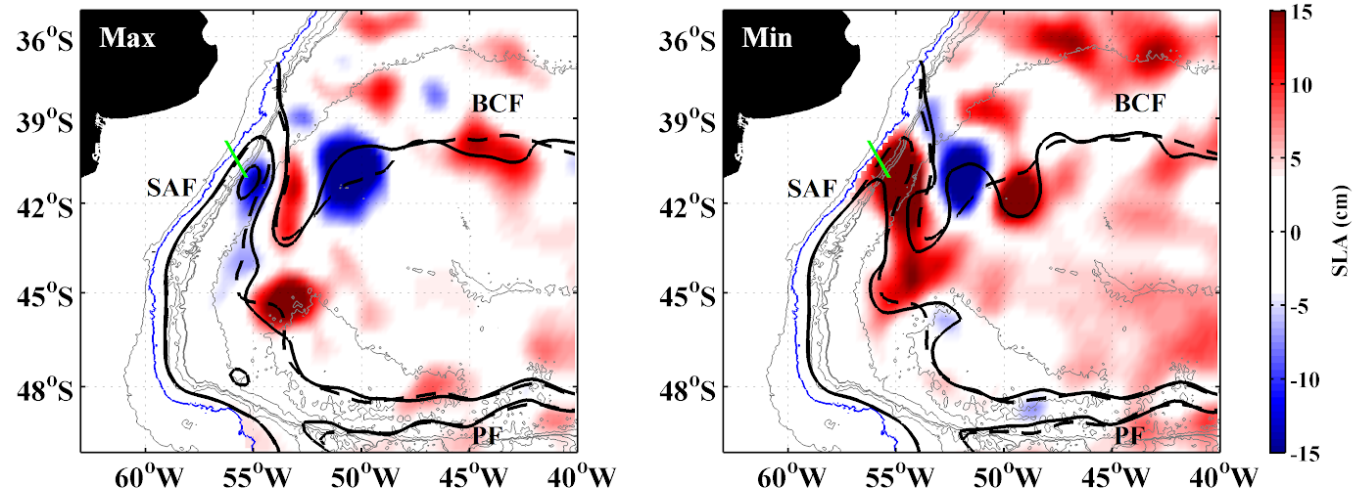
# THE NORTHERNMOST TIP

- GLORYS12 transport at 41°S compares well with MC transport computed combining mooring data with satellite altimetric data.
- Extreme maxima and minima in the transport at 41°S are not wind-forced nor ACC-forced: they are associated with eddies from the deep Argentine Basin. Cyclonic eddies detached from the Polar Front induce transport maxima whereas large positive SLA from the Brazil Current induce transport minima.



- Assessment of the new MDT18 at 41°S

Mean surface geostrophic velocities (MSGV) from CNES-CLS13 and CNES-CLS18 MDT. The dots: MSGV at the mooring position derived from an iterative method

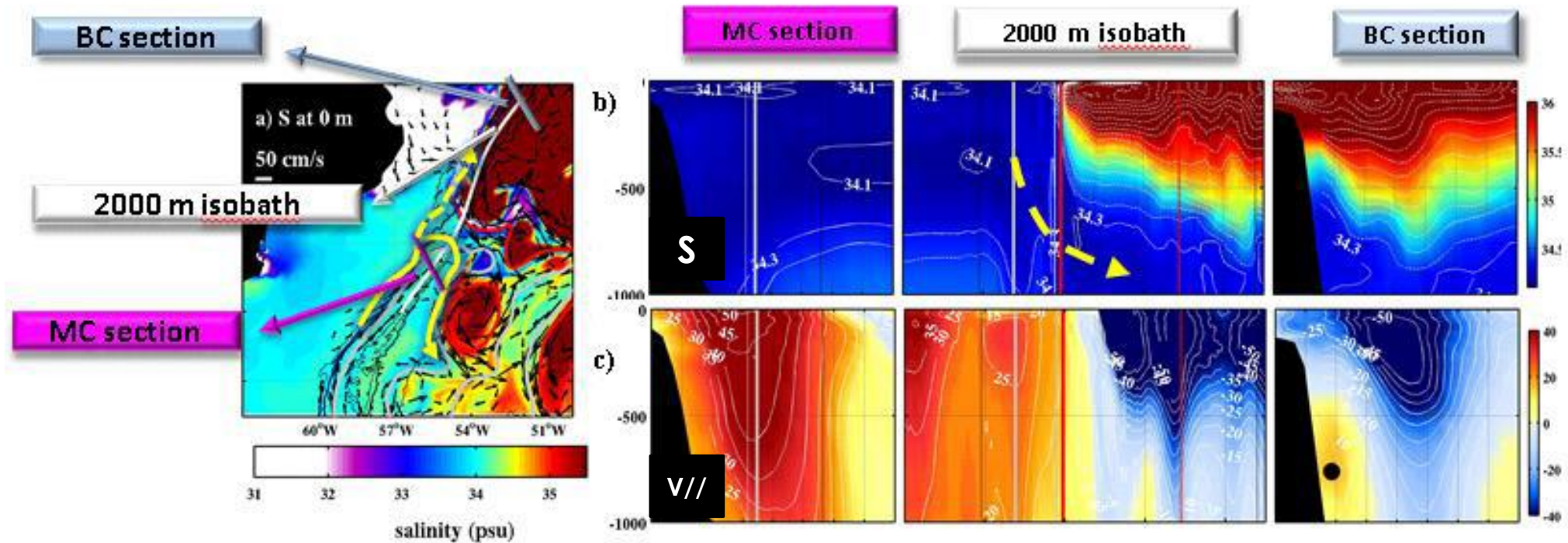


Sea level anomaly composites corresponding to the 23 maxima and 25 minima of the transport time series



# THE NORTHERNMOST TIP

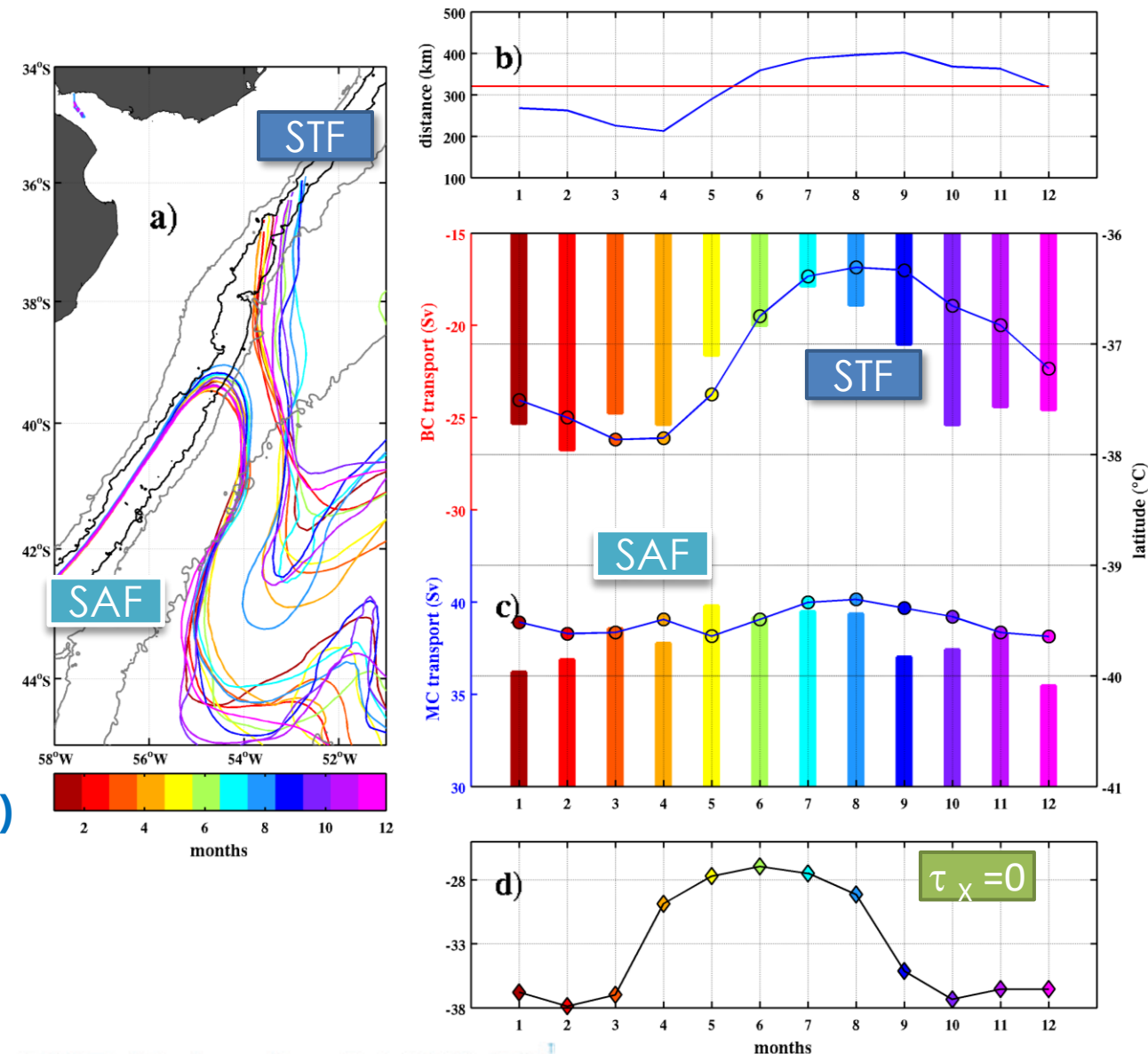
- The MC branches at the Confluence: Outer part veers offshore and back to the south, inner part subducts and flows north along the slope.



GLORYS12 snapshots on 19/03/2015 illustrating the branching of the Malvinas Current at the Confluence (yellow arrows). (a) Salinity map at the surface with velocities superimposed. Note the rich mesoscale field and the export of fresh Rio de la Plata waters via the Confluence. Vertical structure of (b) salinity and (c) along slope velocities ( $V_{//}$  in cm/s) along three sections shown in (a): A section crossing the MC  $41^{\circ}\text{S}$ , a section following the 2000 m isobath and a section crossing the BC at  $36^{\circ}\text{S}$ . The sections show the contrast between the northward flowing fresh MC and the poleward flowing salty BC. At the Confluence the inner branch of the MC subducts below the BC (dashed yellow arrows)

# SEASONAL VARIATIONS IN FRONTS LOCATION

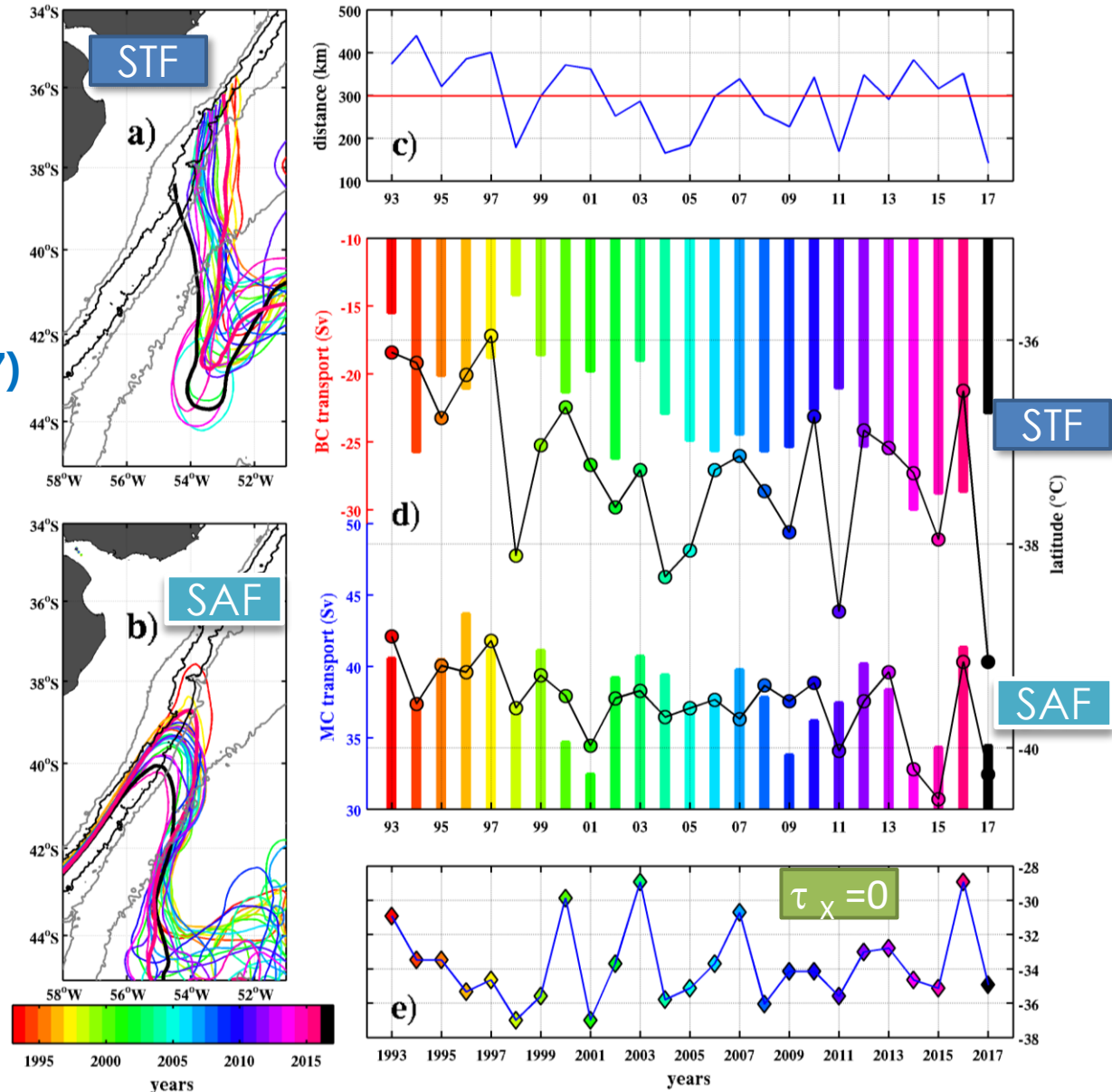
- Fronts move N (S) in winter (summer)
- Small displacements
  - STF : 150 km
  - SAF : 50 km
- Marked seasonality in BC transport (7 Sv/ 23 Sv)
- Small seasonality in MC transport (3 Sv/ 37Sv)
- Wind  $\tau_x=0$  : large seasonal migrations (1500 km)
- STF and BC transport covaries with  $\tau_x=0$  (2 m lag)





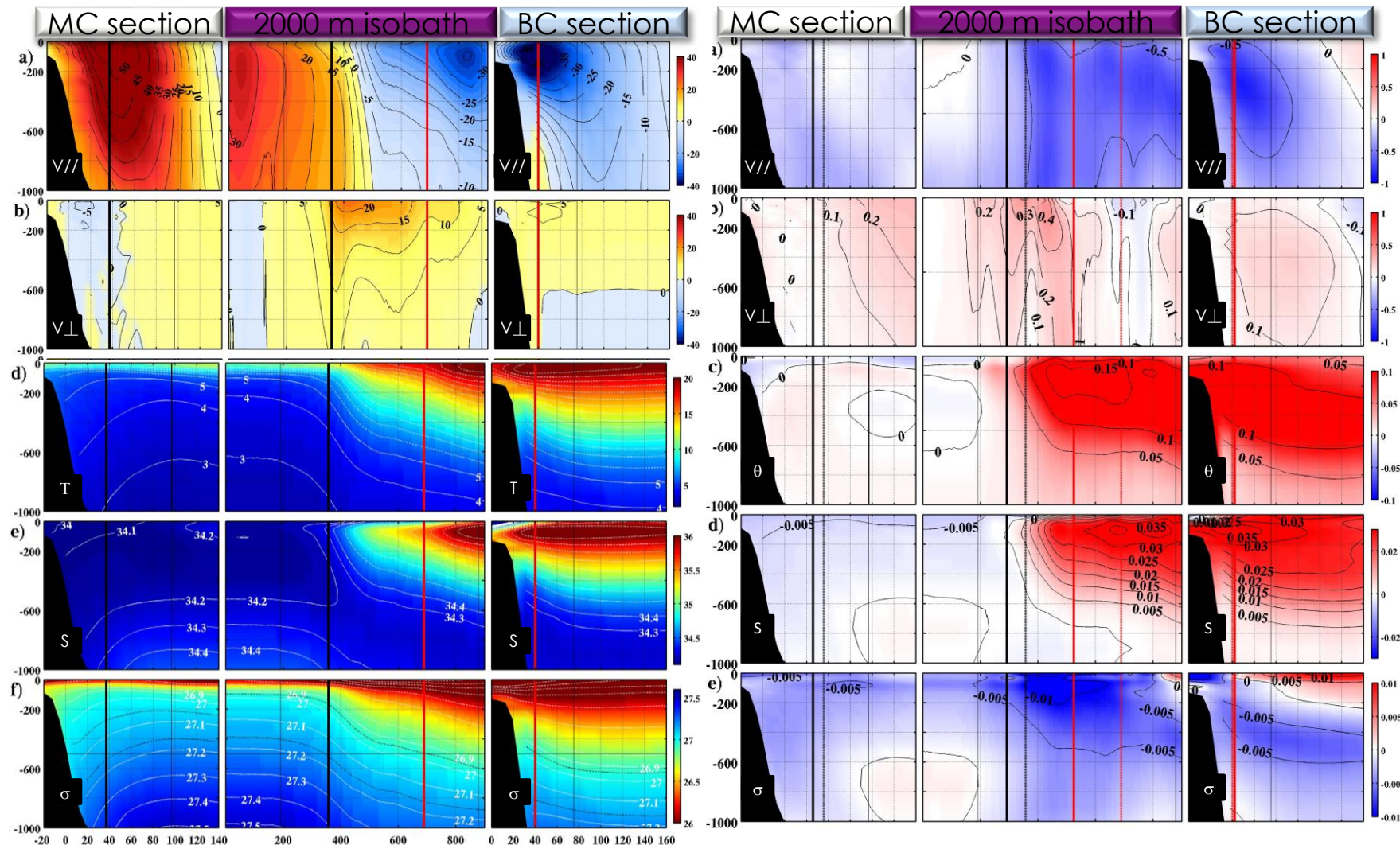
# INTERANNUAL VARIATIONS IN FRONTS LOCATION

- Large interannual front displacements (300 km):
  - 1990s: fronts to the north
  - 2000-10: fronts to the south
  - 2010-17: large interannual variations (e.g. 16,17)
- $\tau_x=0$  : large interannual migrations 2000-2017



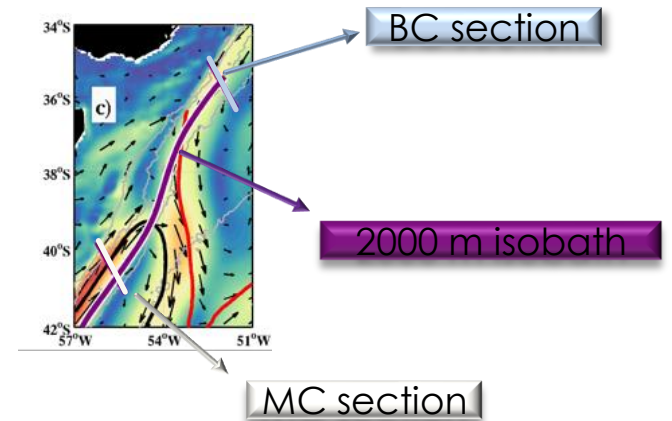


# 25-YEAR TRENDS IN THE BMC



25-year mean vertical sections

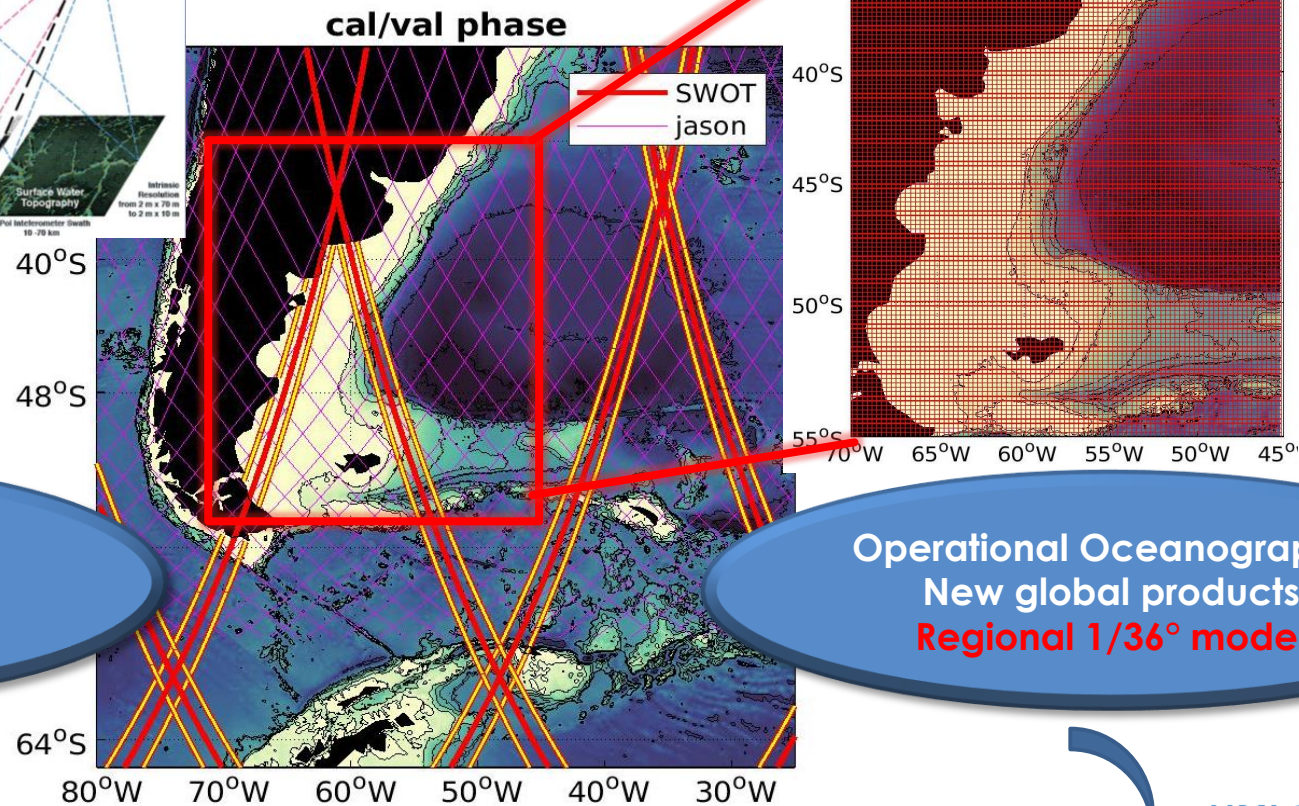
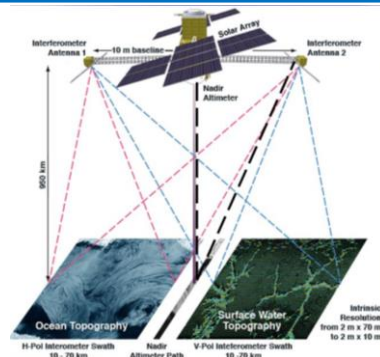
25-year trend vertical sections



- BC trends over 25 years:
  - more intense (12.5 cm/s)
  - warmer (2.5°C)
  - saltier (0.375 psu)
  - denser in first 200 m and lighter below
- MC trends are small
- Southwards displacement of the fronts:
  - SAF: 50 km
  - STF: 150 km



## BACI proposal submitted to OSTST call 2020



Satellite altimetry data:  
New regional products  
SWOT Nadir data

Operational Oceanography:  
New global products  
Regional 1/36° model



Increasing spatio temporal resolution  
Longer time series





An underwater photograph showing sunlight rays filtering through the water surface, creating a serene and deep blue environment. The text "Thank you!" is centered in the middle of the frame.

**Thank you!**