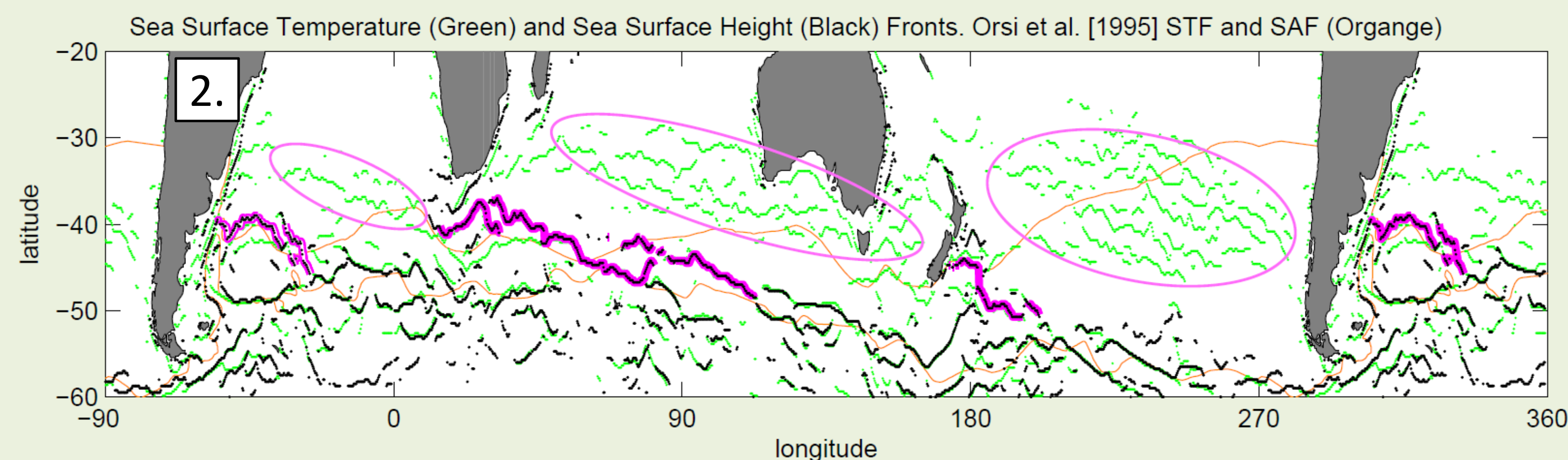


Introduction

- Theory predicts that the latitude of the Subtropical Front (STF)/Super Gyre boundary is set by the zero wind stress curl (WSC) and determines the width of the Agulhas Leakage Gate Way (Fig 1). A more northern STF is thought to equate to less leakage. The salt flux from Agulhas Leakage is considered a vital component of the meridional overturning circulation¹.
- However, it is unclear from literature whether the STF is shallow^{2,3} or deep^{4,5}; continuous^{6,7} or discontinuous^{2,3}; a single front^{4,6} or frontal zone^{2,7}; a strong current^{4,5} or density compensated^{2,3}; has a large^{3,8} or small^{2,9} seasonal cycle; etc.
- Here we show that two distinct physical features (The Dynamical Subtropical Front (DSTF) and the Subtropical Frontal Zone (STFZ)) exist at the Orsi et al. [1995] STF surface water mass boundary, and that the STF does not coincide with the zero WSC.

Figures: 1) Schematic of existing view of the Atlantic/Indian STF system. 2) Location of SST (green) and SSH fronts (black), identified as local maxima in the mean SST and SSH gradients. Orsi et al. [1995] STF and SAF (Orange). New DSTF climatology (Pink lines) derived from SSH fronts. 3) 1999-2009 Satellite SST gradients^{10,11}. 4) 1999-2009 Satellite SSH gradients. (delay time mean annual dynamic topography, AVISO). 5) 800 dB Salinity. 1 degree resolution gridded ARGO data¹². 5) Mean annual wind stress curl (1999-2009, satellite)¹⁰, smoothed by 6° lat x 10° lon. Zero WSC line is shown in back. STF climatologies as given in title.

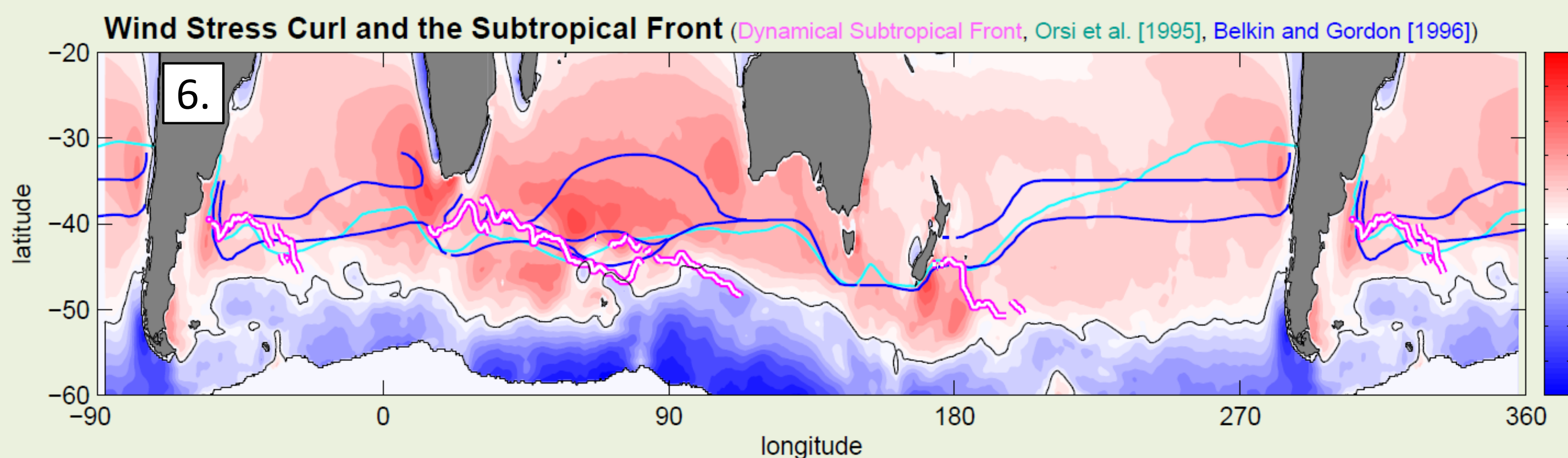
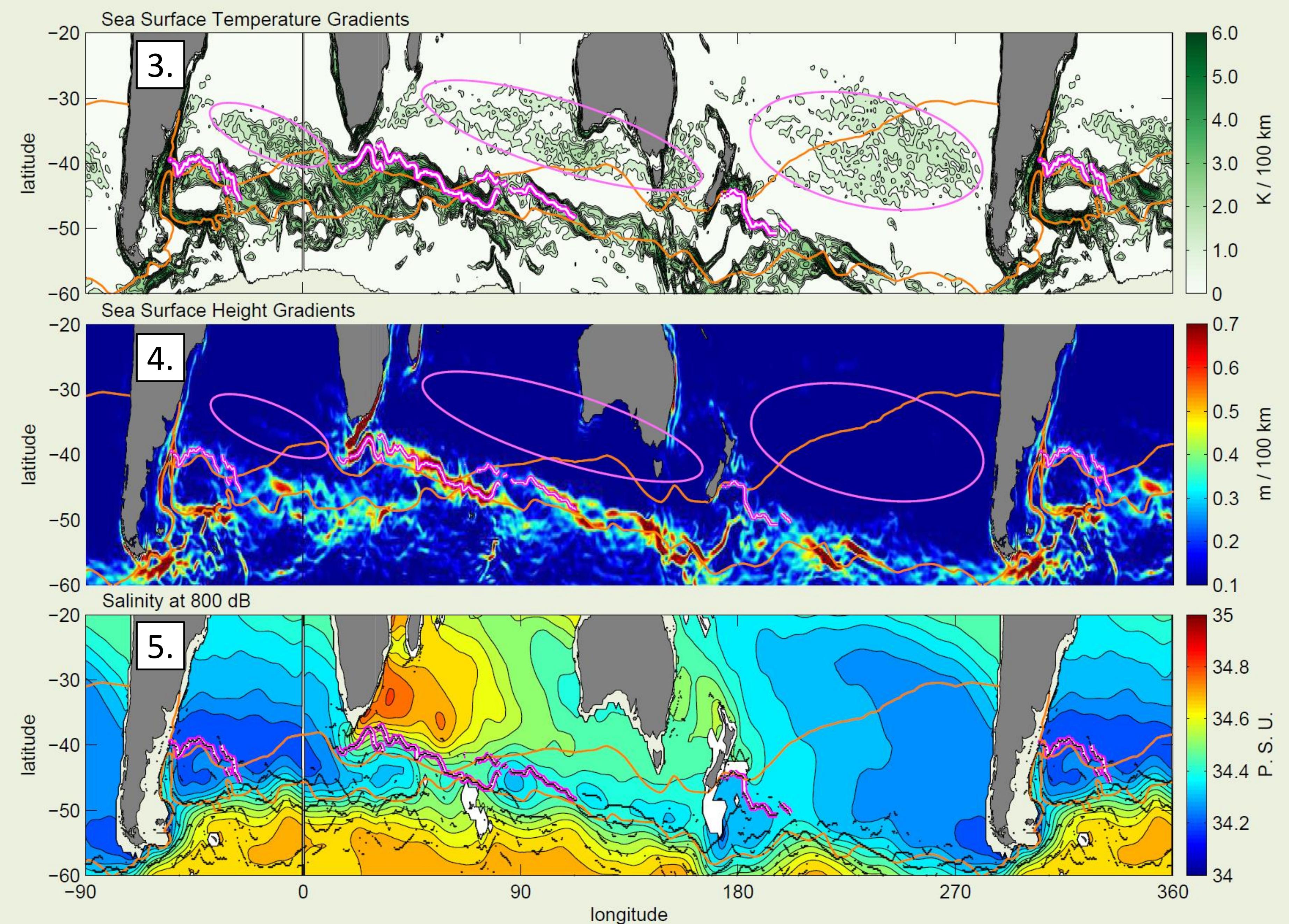


The Dynamical Subtropical Front (Pink Lines)

- Western side of basins (Figs 2 and 4).
- Detached Western Boundary Current.
- SST and SSH gradients (Figs 3 - 4)
- Deep front (Fig 5).
- Tracks south-eastwards and merges with the SAF (Figs 2 and 4).
- No seasonal cycle¹³.
- Subtropical Gyre Boundary – NOT Super Gyre Boundary (Fig 5).

The Subtropical Frontal Zone (Pink Ovals)

- Eastern side of basins (Fig 3).
- Multiple SST fronts (Figs 2-3).
- No SSH gradients (Fig 4).
- Shallow (Fig 5).
- Separated from DSTF by region of weak SST gradients (Fig 3).
- Large seasonal cycle¹³.
- Wide latitudinal span (Figs 2-3).
- Flow perpendicular to SST fronts¹³.



- Regardless of definition / climatology the STF is >5° north of zero WSC (Figure 6).
- Area south of STF is controlled by bottom pressure torque¹⁴.
- Unclear how a shift of the Westerlies would impact the location of the STF.

Take Home Message

- The STF is currently used to describe several completely different physical features. This is misleading.
- We suggest using the term DSTF when referring to the strong current on the western side of basins.
- Similarly the term STFZ refer to the area of enhanced temperature gradients towards the east.
- The STF is not the super gyre boundary or zero WSC.
- It remains unclear how a shift in the SH westerlies would impact the latitude of the STF or Agulhas Leakage.