



South Africa: Where three oceans meet

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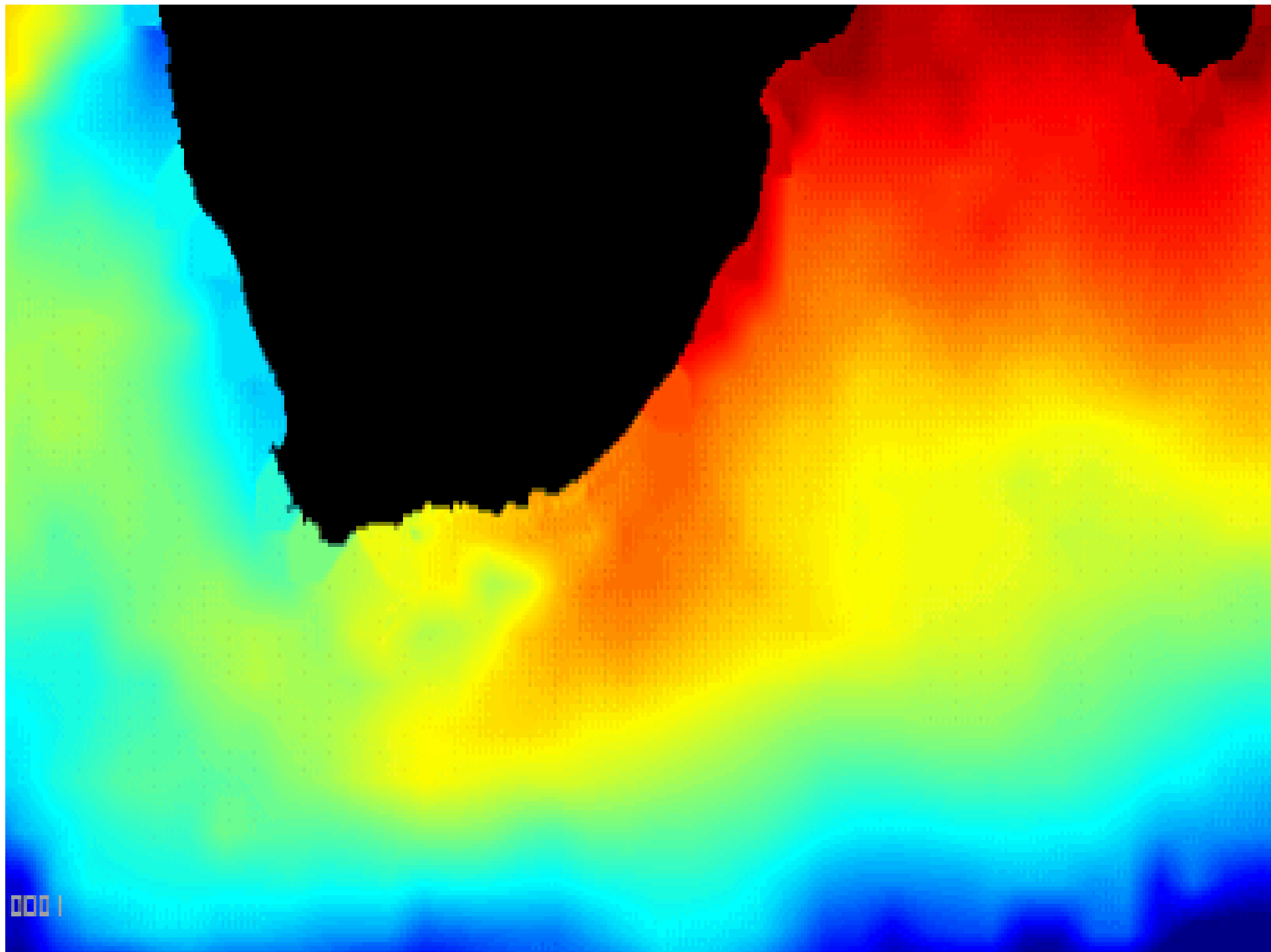


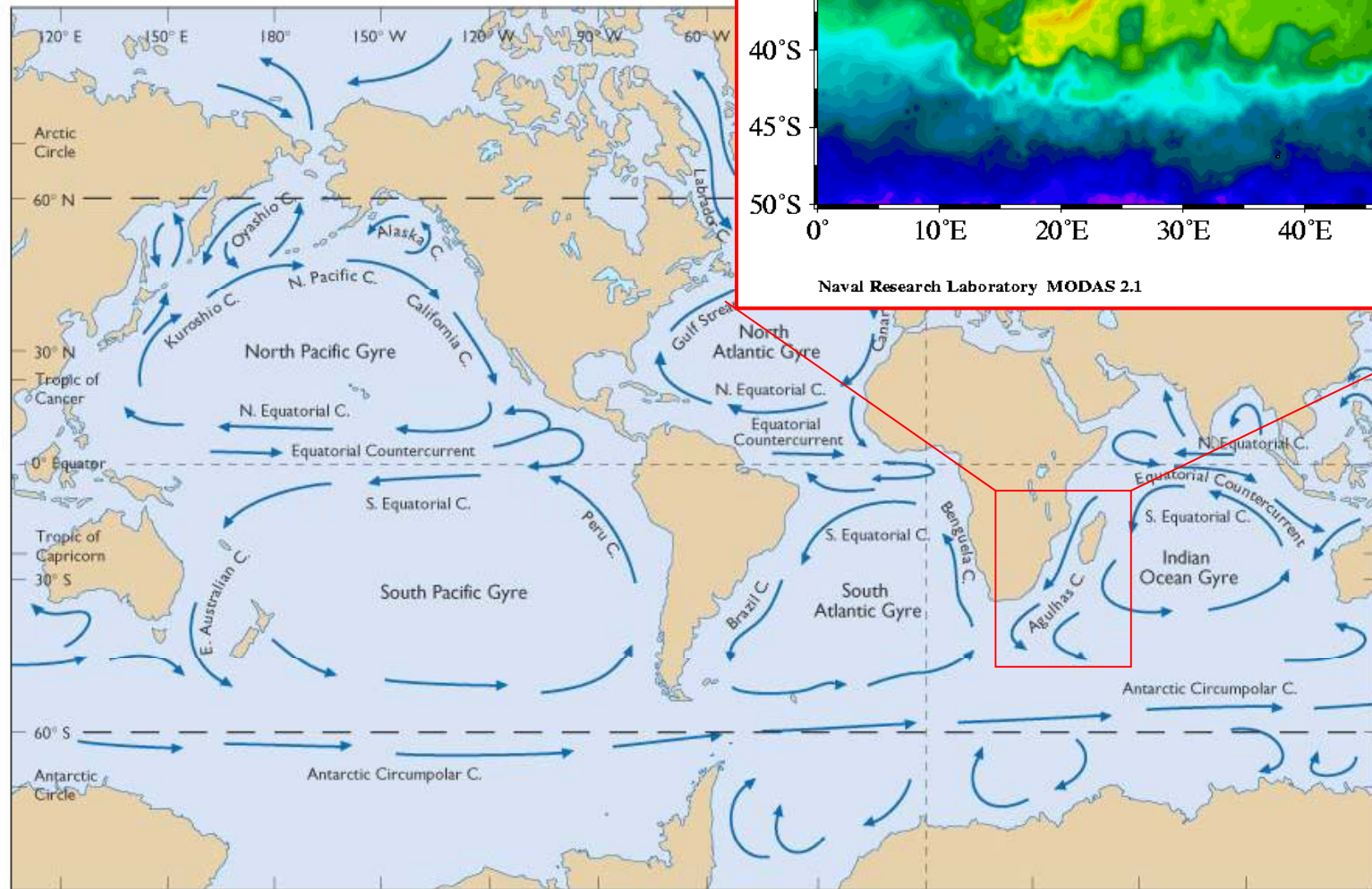
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Outline

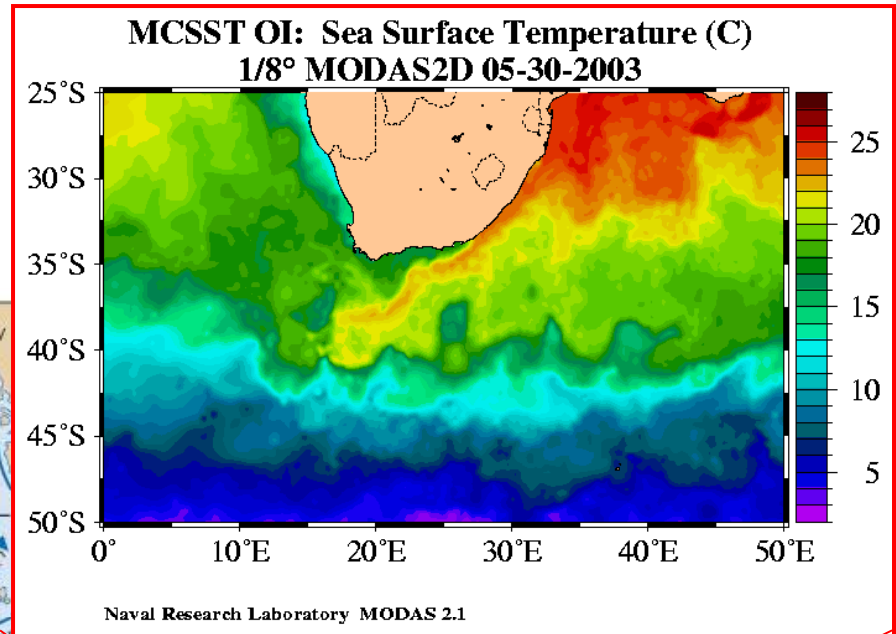


1. General Circulation
2. Why is this region so important?
3. GoodHope – a case study of a successful XBT line
4. Future work

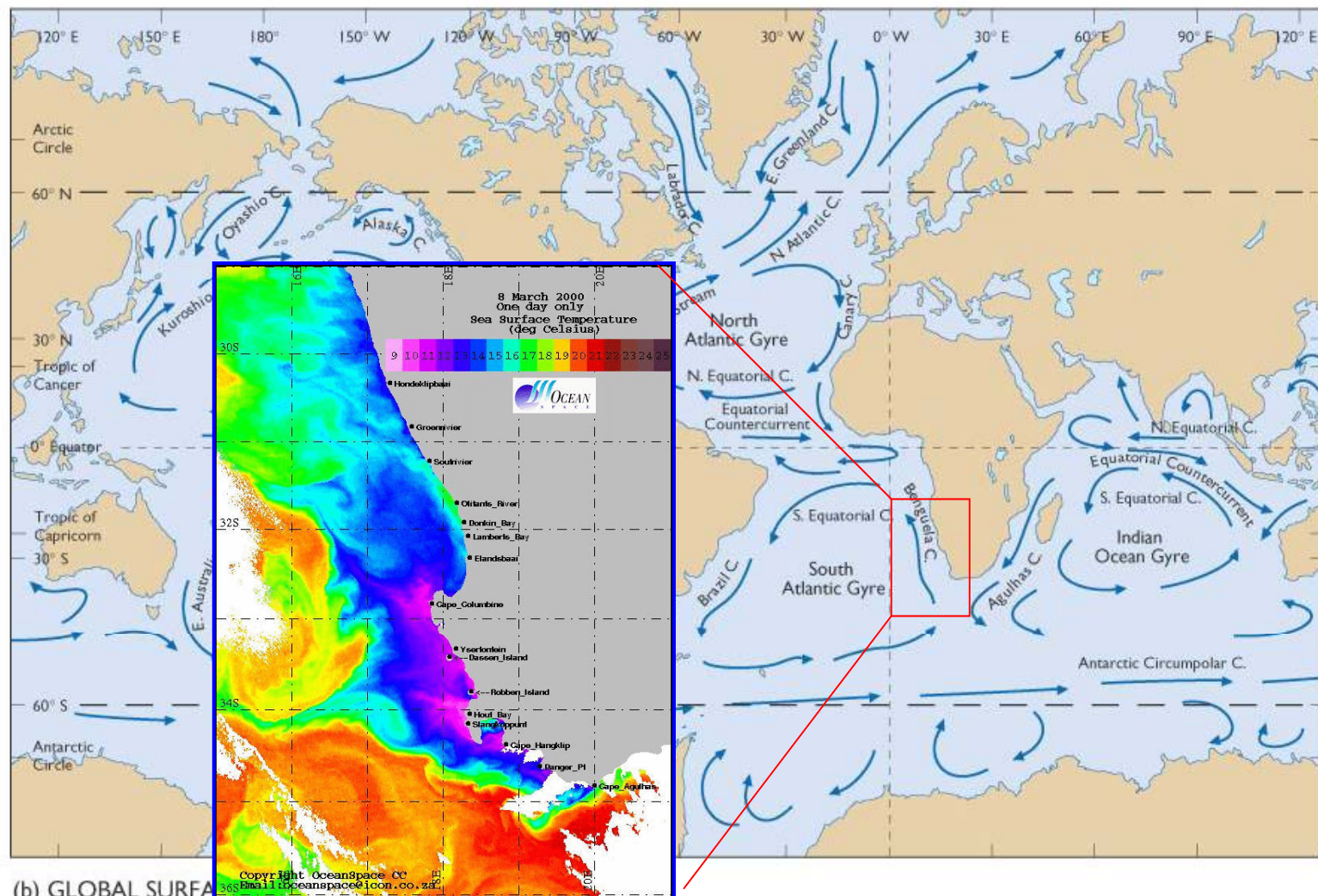




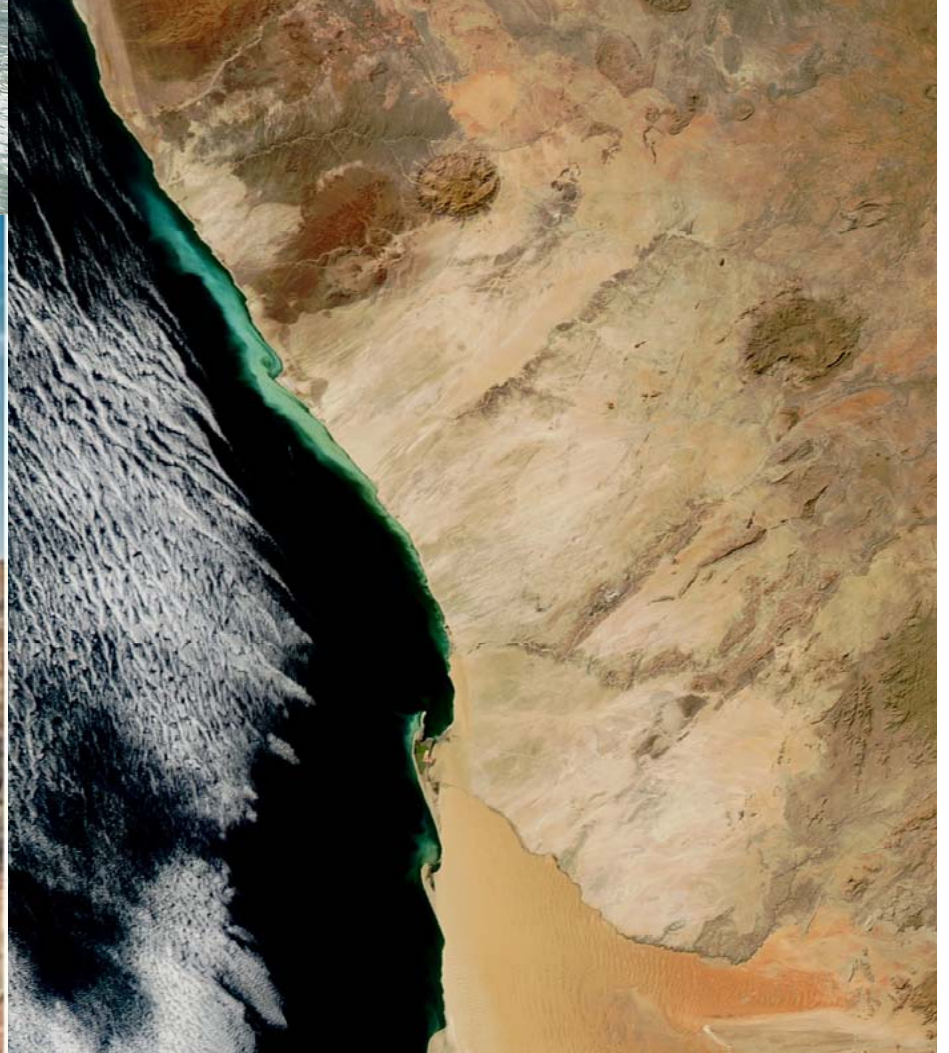
(b) GLOBAL SURFACE-WATER CURRENT PATTERN

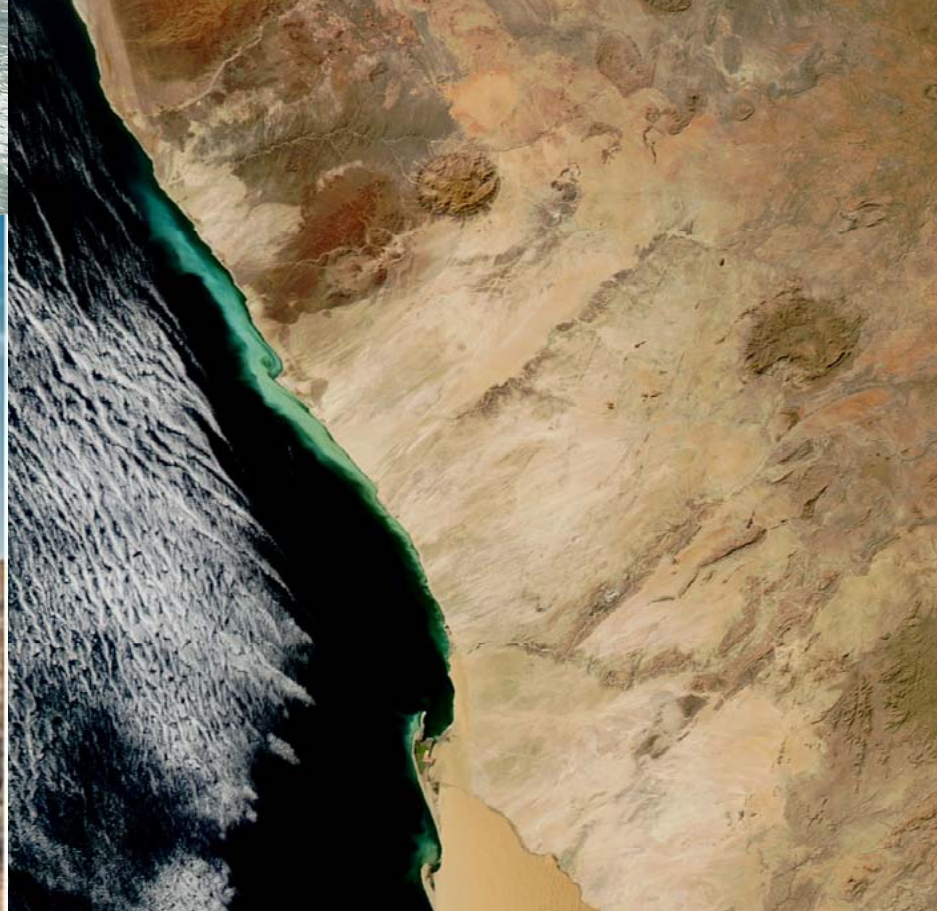






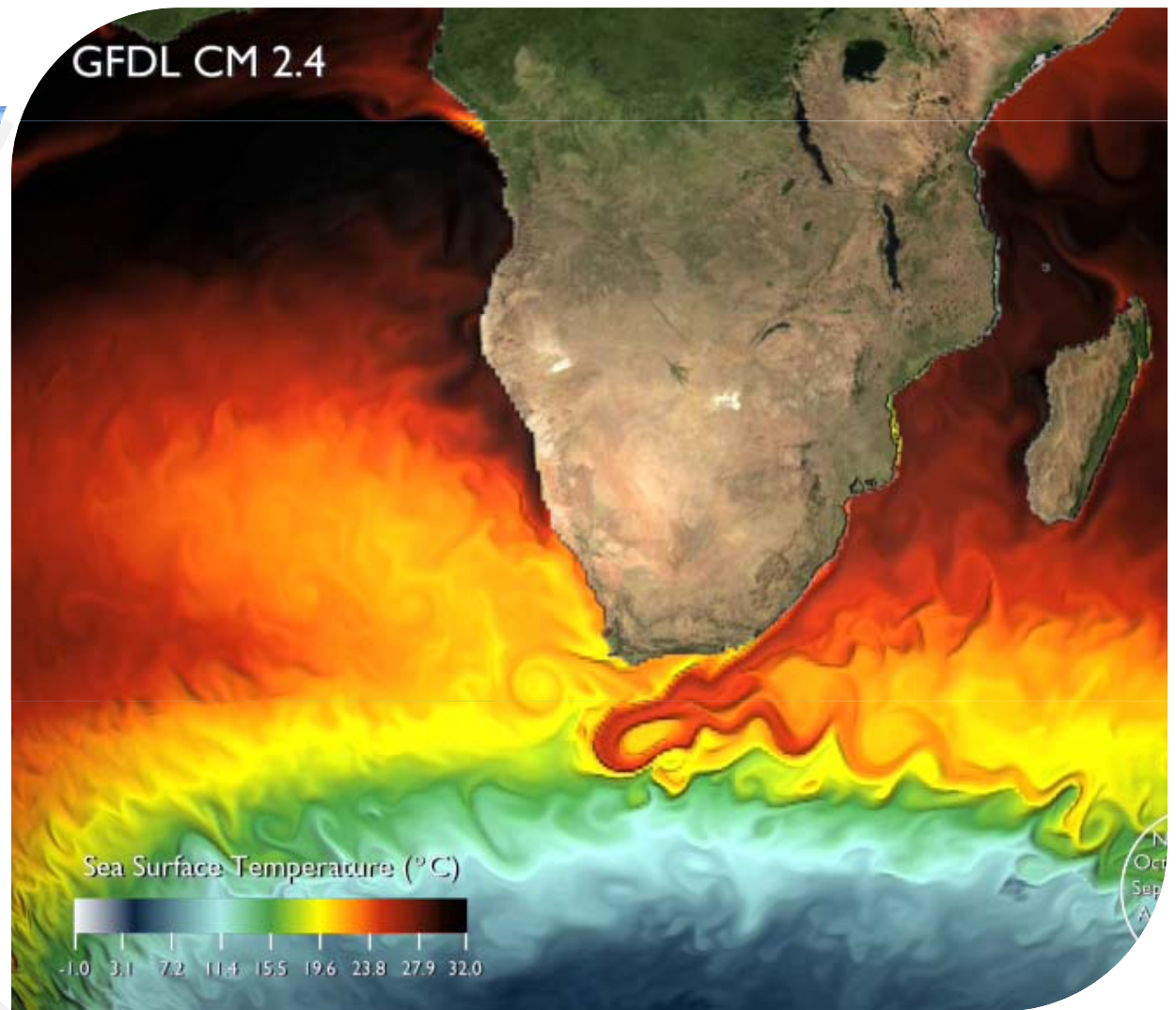
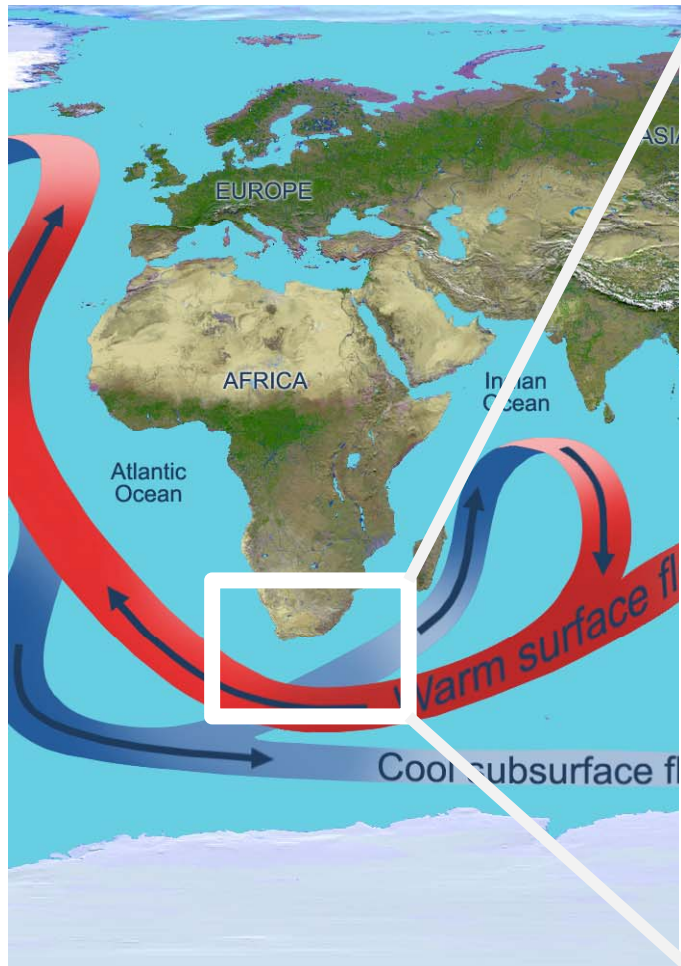
(b) GLOBAL SURFA





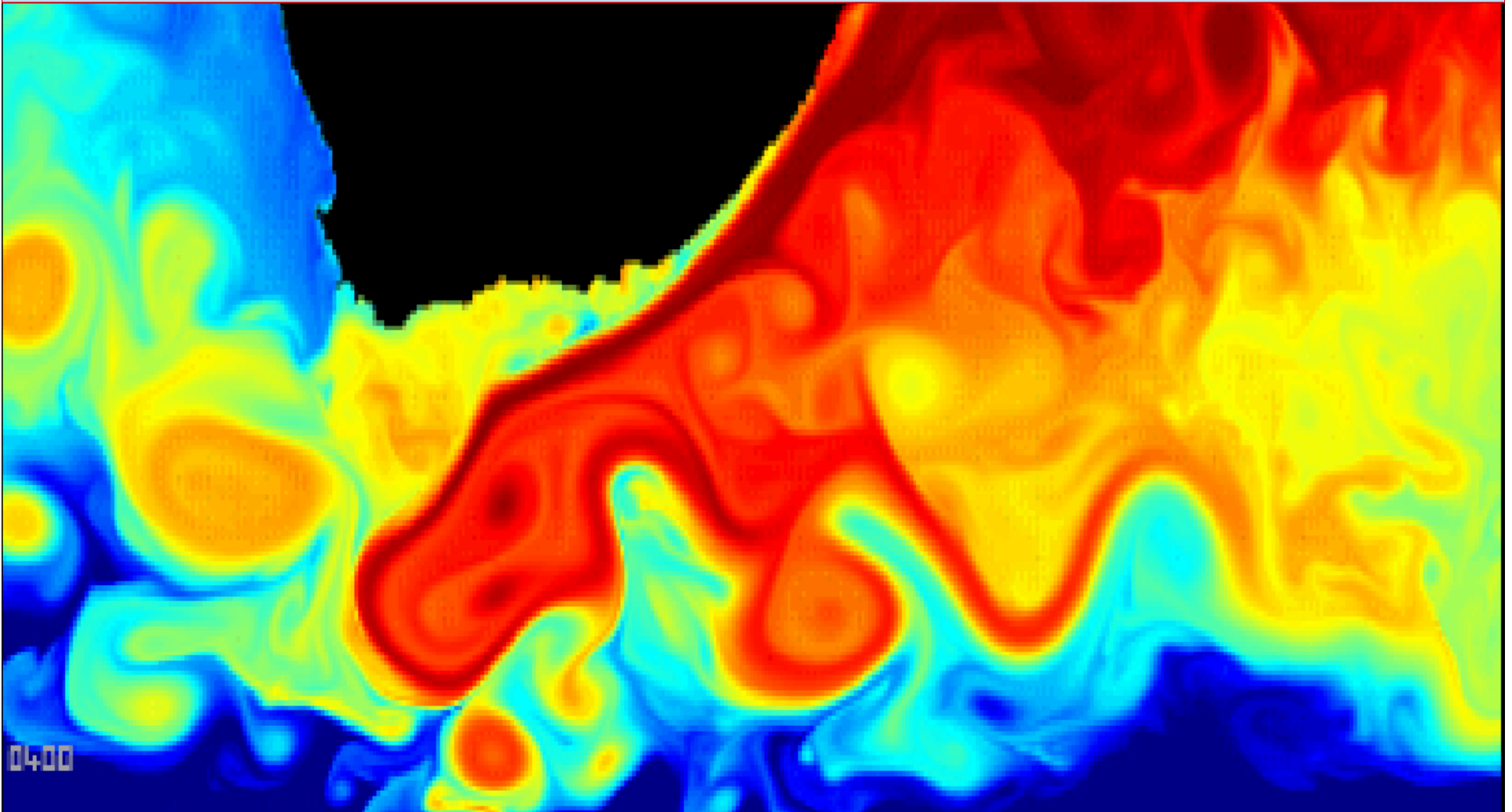
Ideal region to study the influence of both western and eastern boundary currents

A major link in the global conveyor belt



1. Variability due to Agulhas Rings
2. Need to investigate transport fluxes between the Indian and Atlantic Oceans
3. Trajectory of Agulhas Rings and influence of topography
4. Variability of the ACC south of Africa

.....however.....



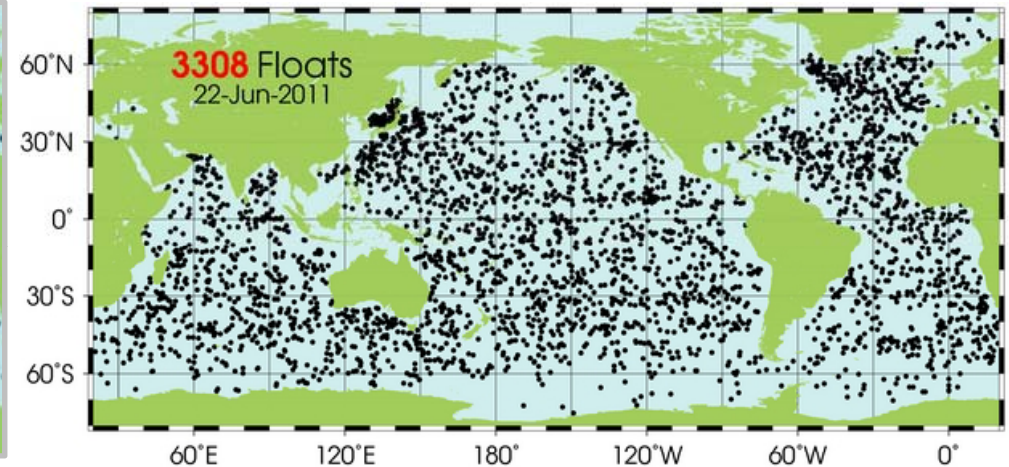
South of Africa and Southern Ocean:

Serious **lack of observations** coupled with the problem of 4000 km ACC crossing makes for **poor sampling resolutions**.



South of Africa and Southern Ocean:

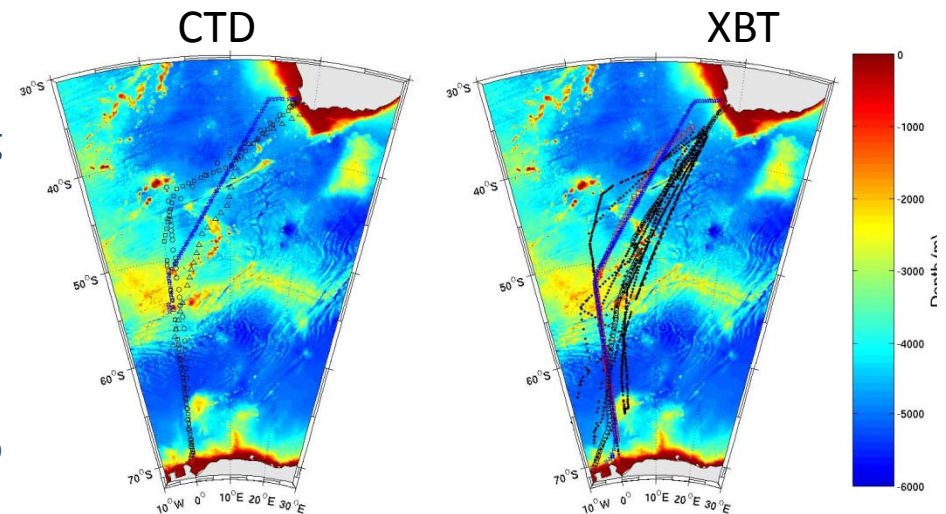
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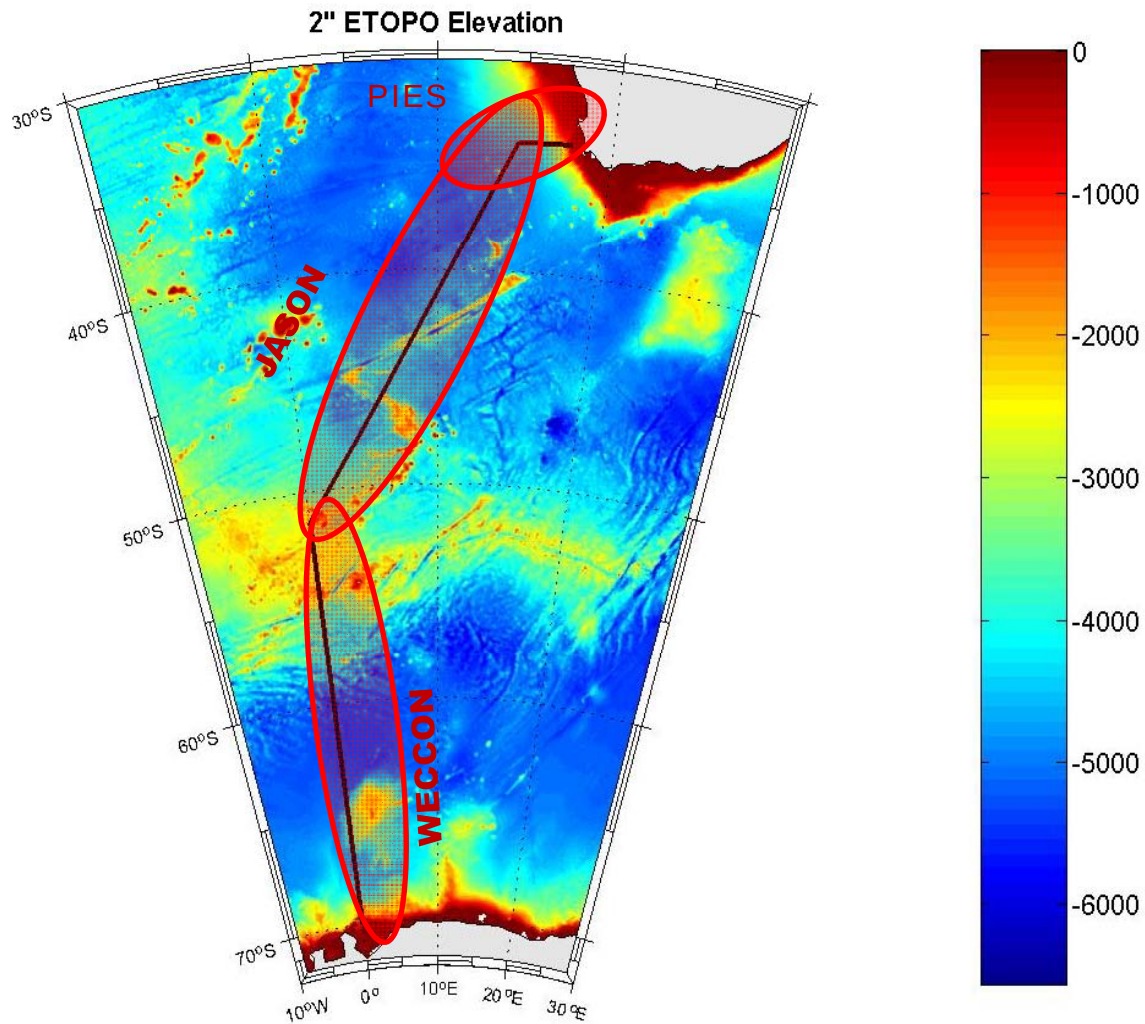
Therefore **AIM** was to provide methods which:

1. Improve **transport and circulation** understanding of the ACC
2. Estimate **heat and salt content** in the ACC and bordering ocean domains

Real benefits of ARGO program are now starting to be realised...



Case Study – AX25 Programme

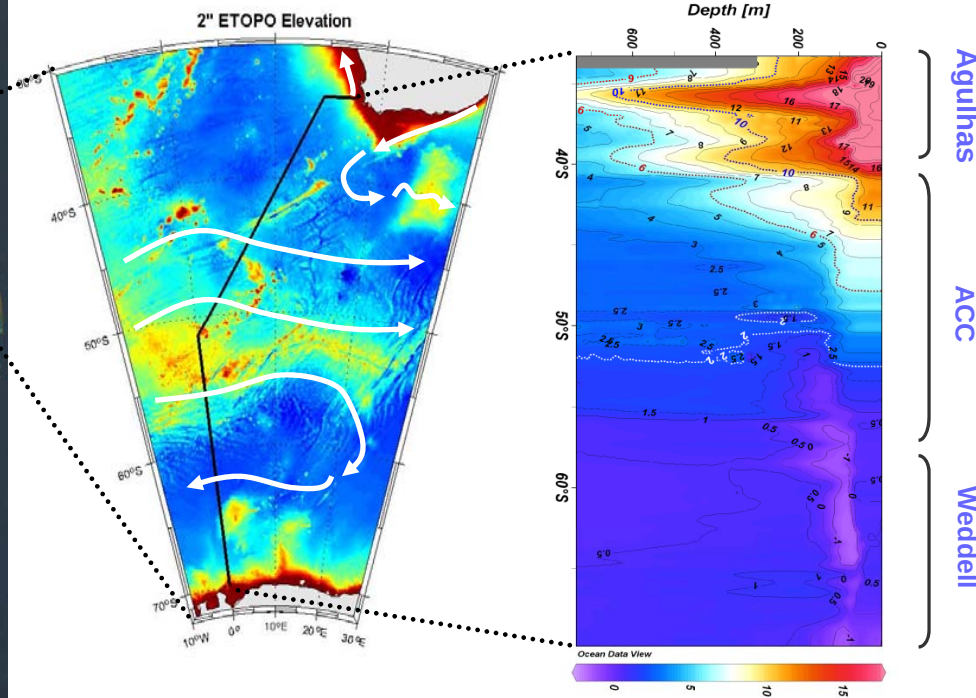
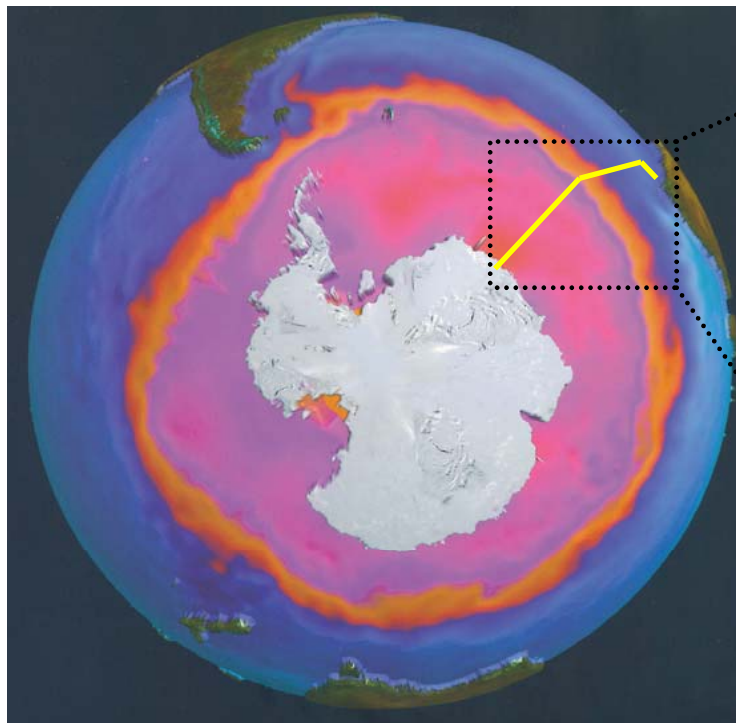
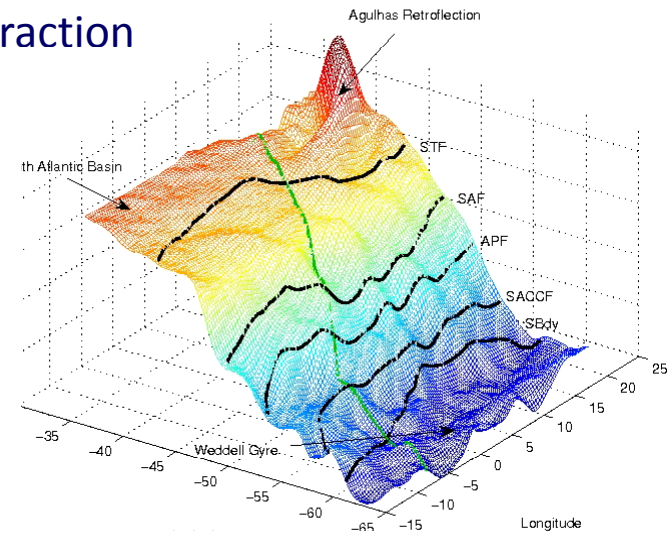


AX25

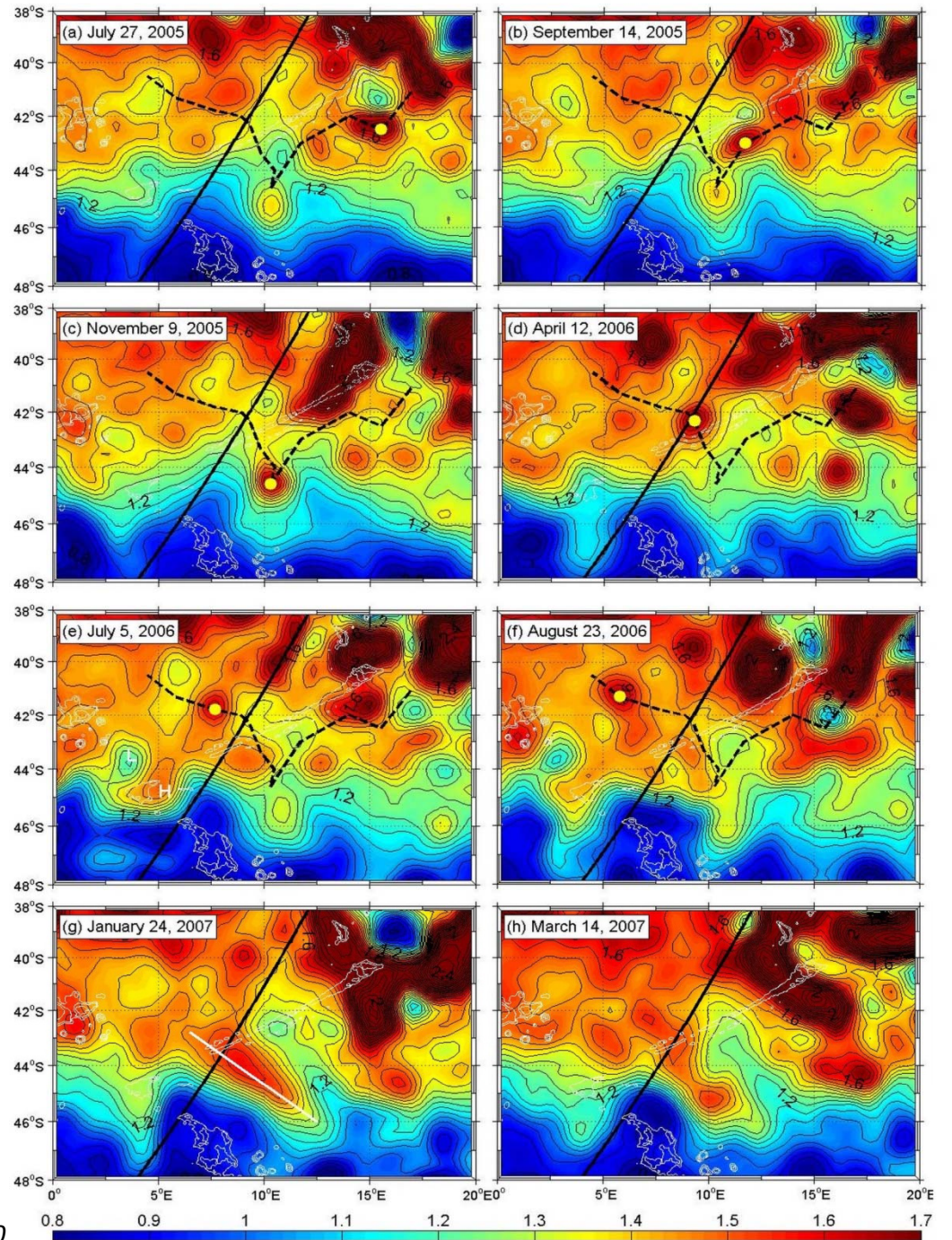
- Initiated February 2004...
- Links into Bonus-GoodHope
- 5 CTD transects
- 18 XBT transects
- PIES
- Float deployment opportunity
- (>150 ARGO to date)

Importance of the AX25 Line

1. Western Boundary / Eastern Boundary / ACC interaction
2. Indo-Atlantic exchanges & effects on THC
3. Impact on southern African climate variability
4. African ACC chokepoint- little research



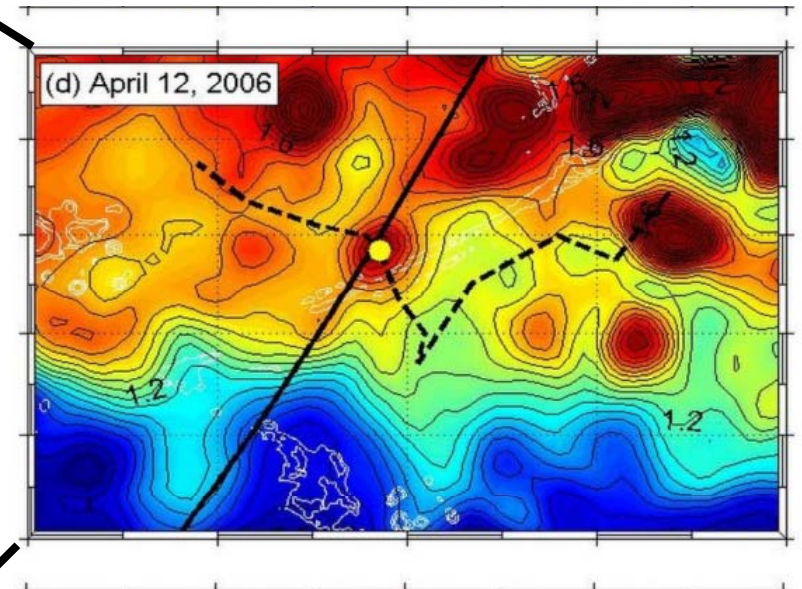
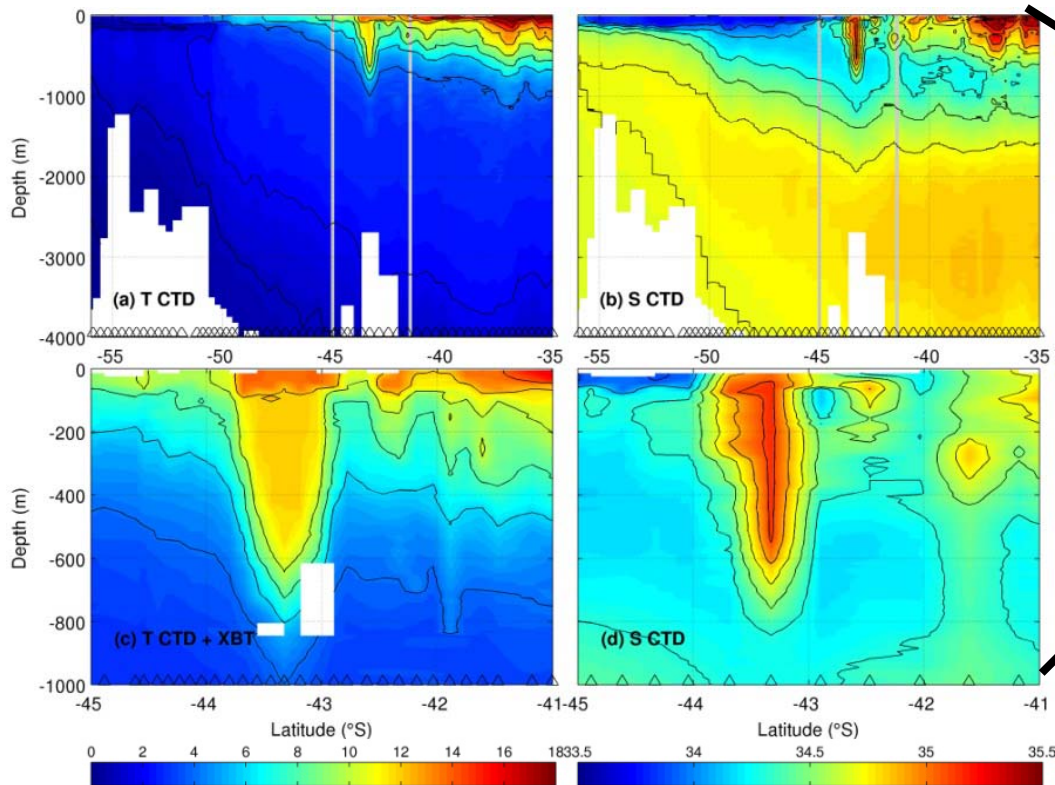
Subtropical-Subantarctic communication



Swart & Speich, 2010

Subtropical-Subantarctic communication

Rings are formed approximately 2.7 times a year!



Swart & Speich, 2010
Vianello et al., 2011

Problem : Restricted to December – February season

How do we get more out of XBT data?

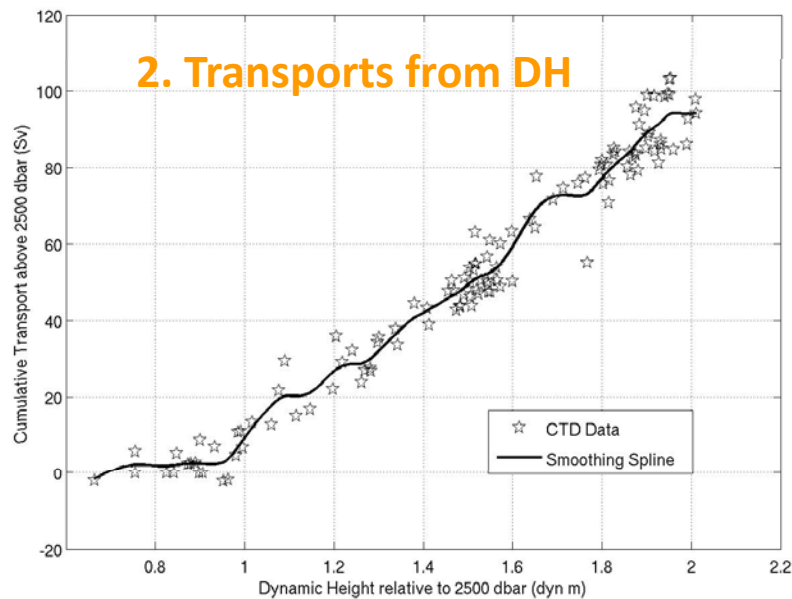
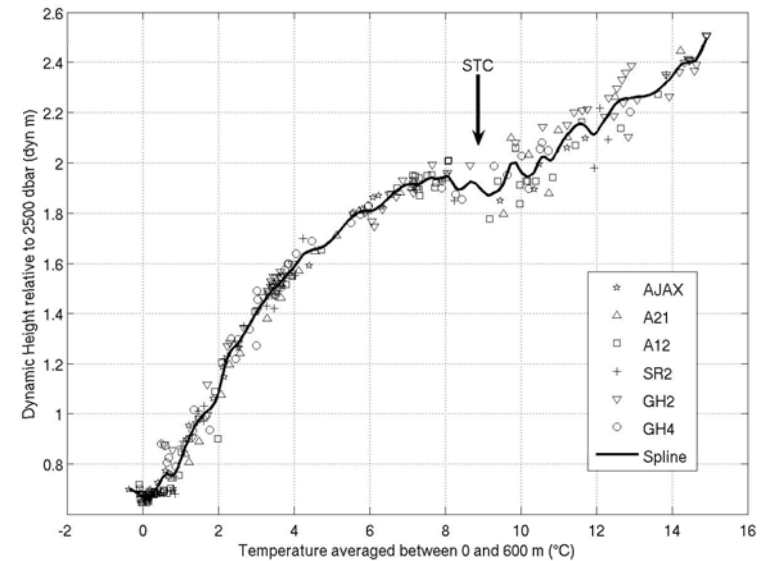
1. DH & T_{0-600}

Following work by Rintoul and Sokolov 2002

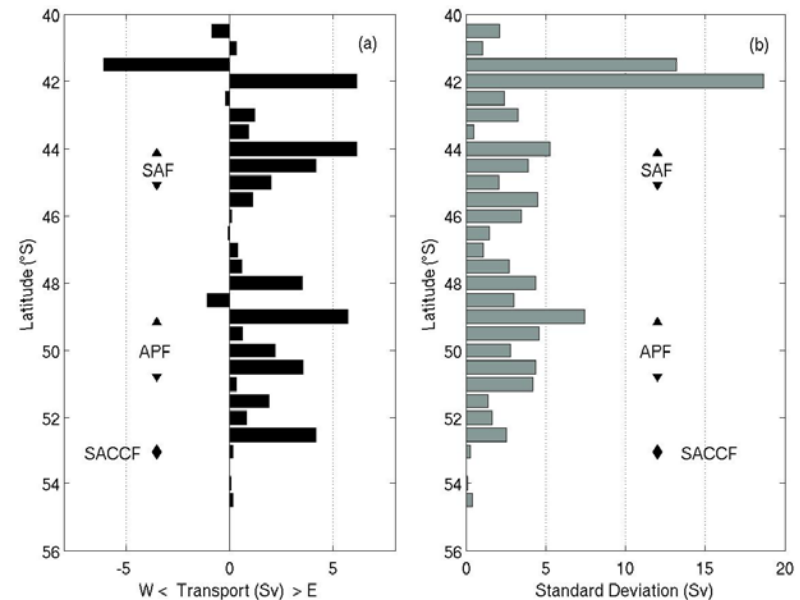
From 18 XBT crossings:

$$Tr_{2500} = 90 \pm 2 \text{ Sv}$$

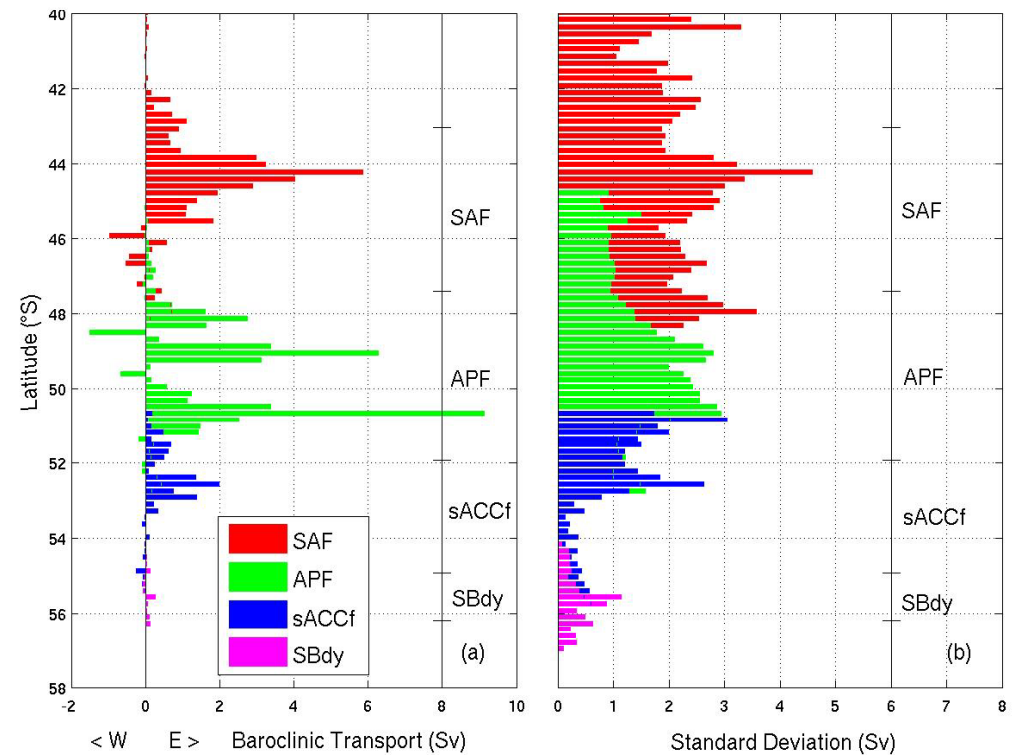
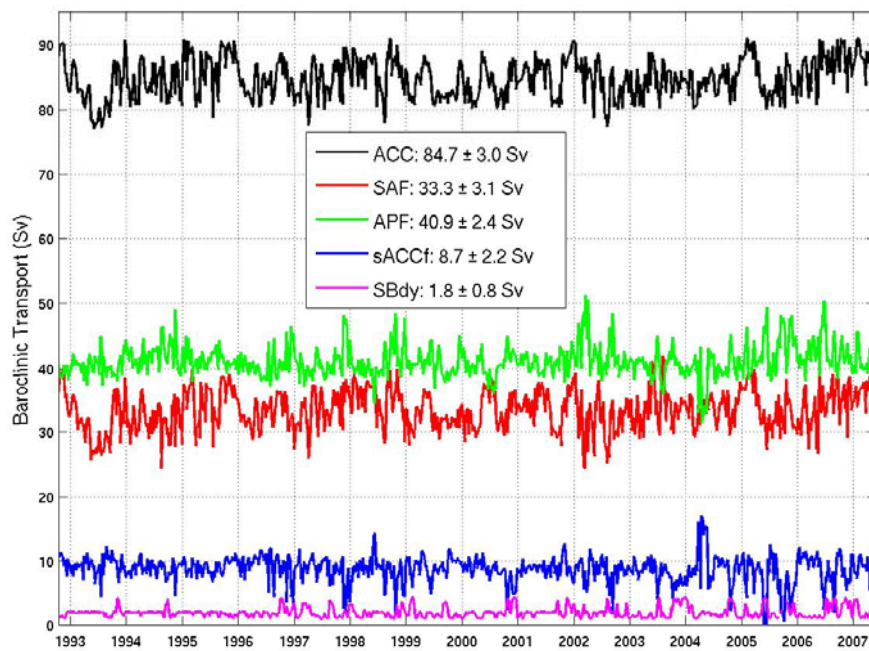
$$Tr_{\text{bottom}} = 145 \pm 4 \text{ Sv}$$



2. Transports from DH



Swart et al., 2008



ACC = 85 Sv

SAF = 33 Sv

APF = 41 Sv

Sthn Fr= 11 Sv

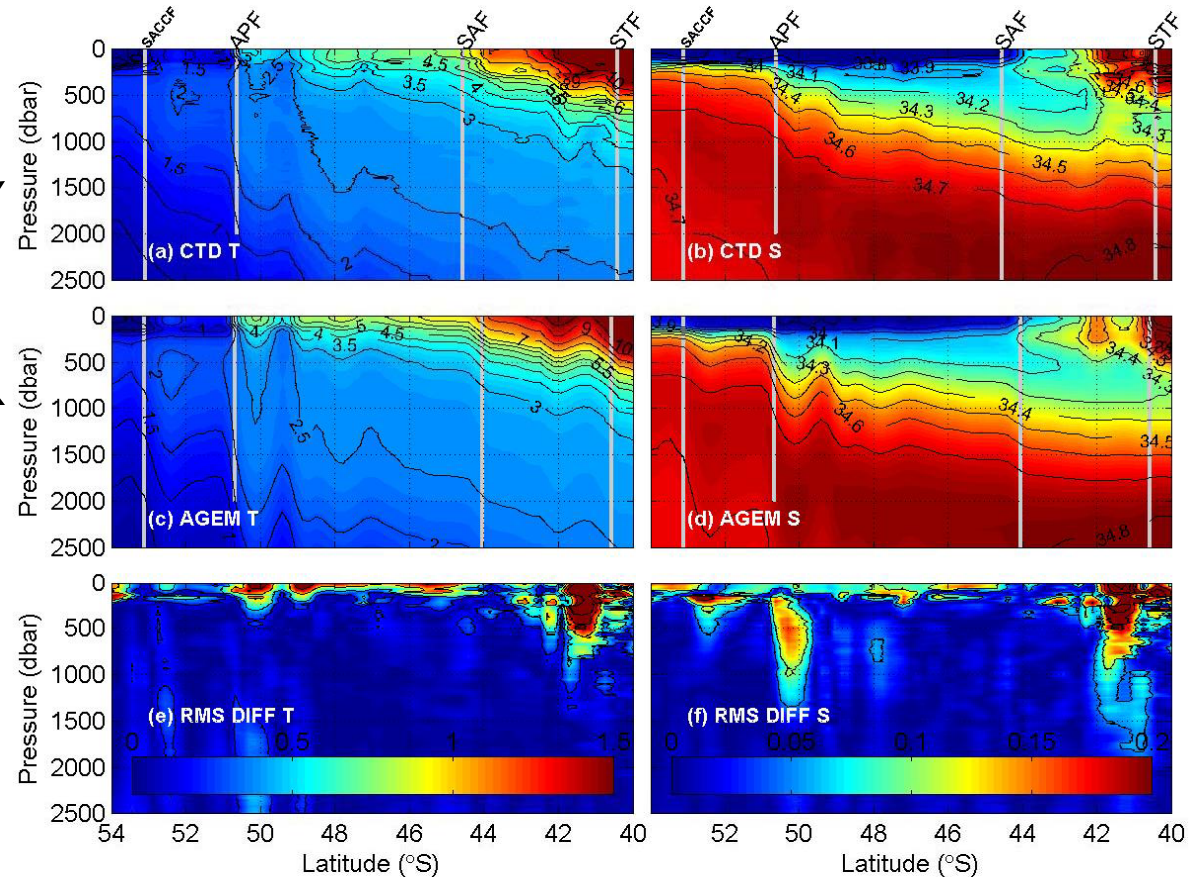
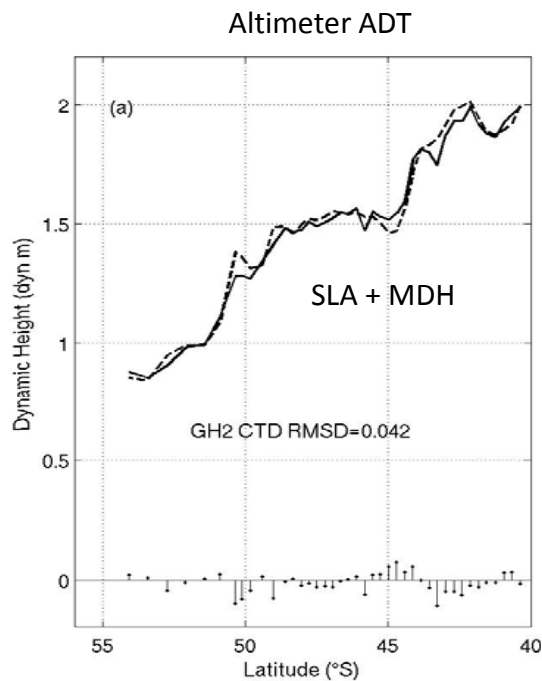
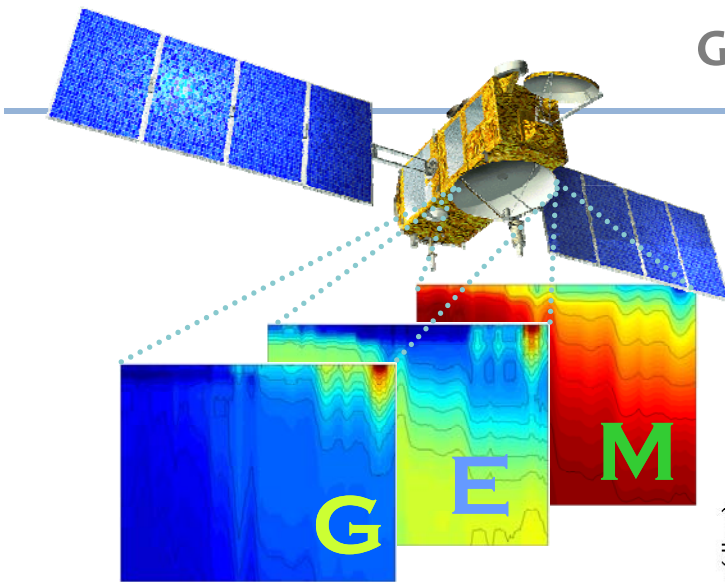
88 %

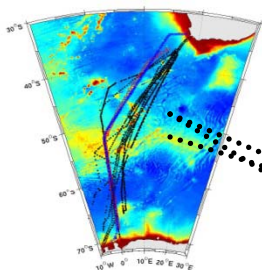
Using this method enables us to measure the transport fluxes

Swart et al., 2008

GEM applied to altimetry

The GEM is created by projecting the hydrographic data from eight CTD transects onto streamline coordinates of pressure and dynamic height - see Swart and Speich 2010



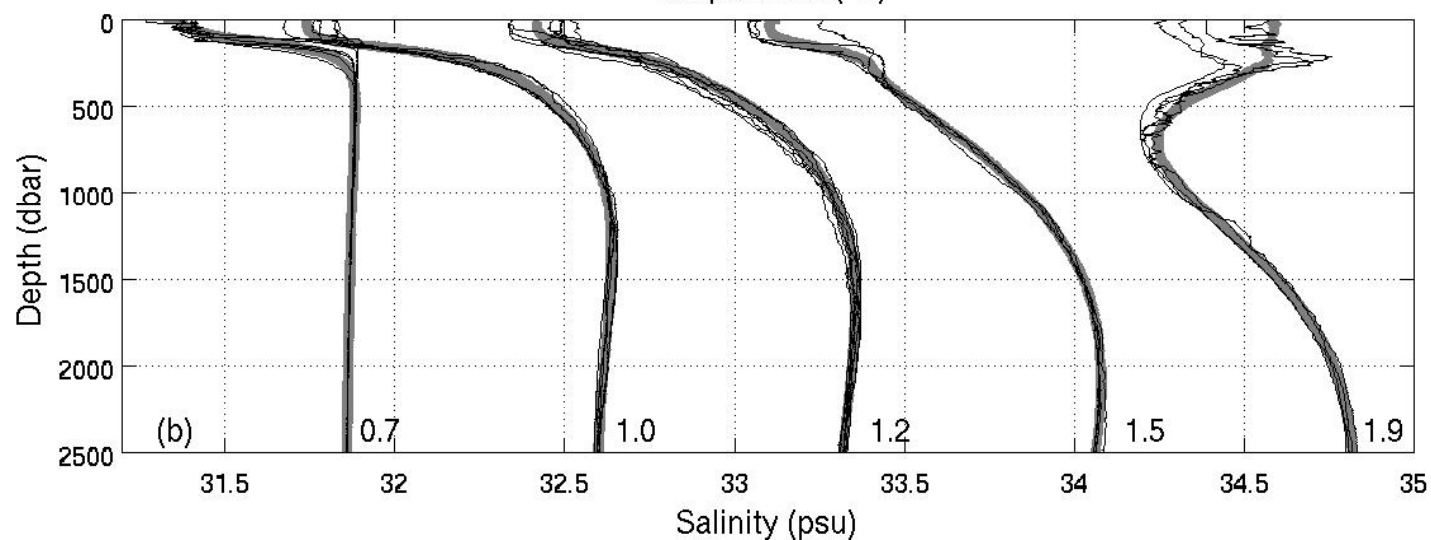
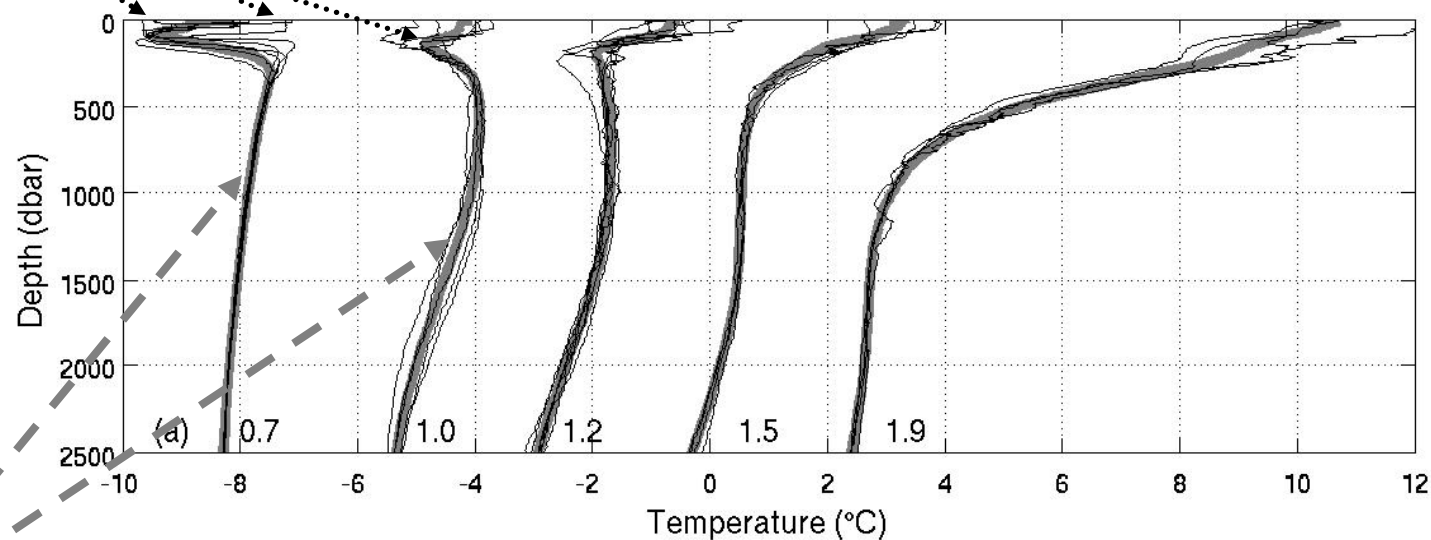
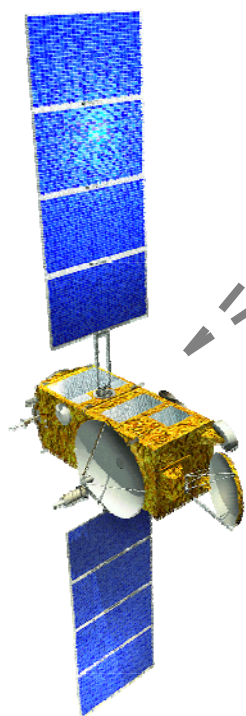


Vertical proxies: GEM and XBT



IUGG: Melbourne, 2011

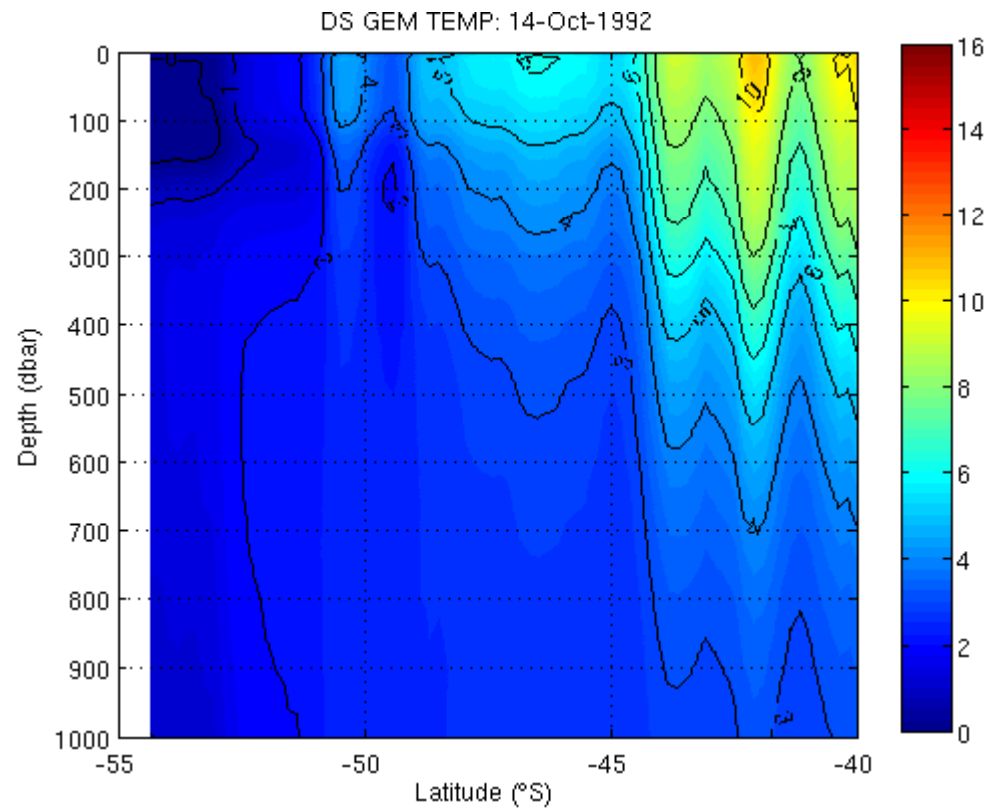
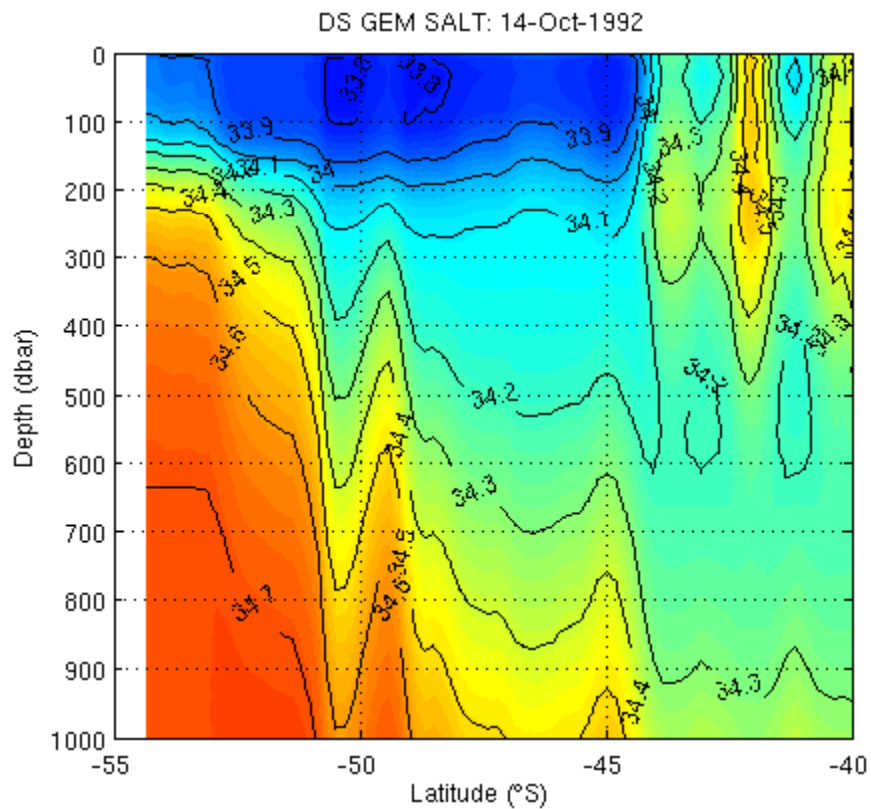
Following Watts et al, 2001; Sun & Watts, 2002...



Swart et al., 2010

Altimetry-GEM timeseries

17 years, weekly



Main Points

Upper ocean temperature measured using XBTs provides a good proxy for dynamic height

Dynamic height directly related with Tr_{2500} = altimetry transports

Well organised structure of the ACC allows for firm DH to T, S relationships

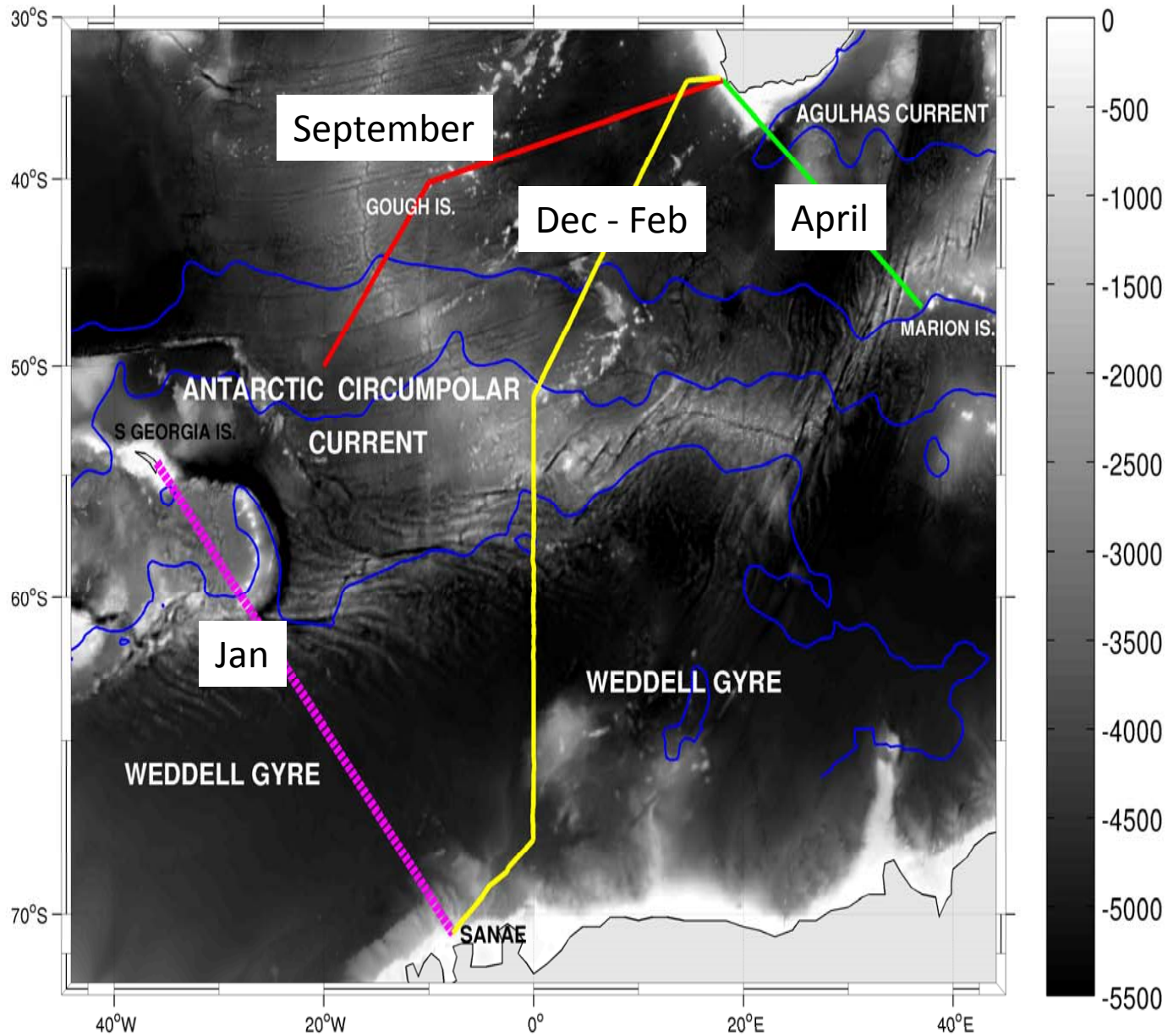
Which provides T and S slices of the ACC over altimetry period and spatial coverage

The AGEM allows for estimating the HC and SC anomalies to identify mesoscale structures at fronts and of subtropical origin entering ACC

THANKS TO...
SANAP & NRF
NOAA
CNRS, LPO

AND SPECIAL THANKS TO IAPSO FOR SUPPORT

Opportunities to collect underway measurements on all relief voyages



Future of XBT research in South Africa

- Improved ocean-going facilities 2012
- Link XBT with UCTD and glider studies
- Call for national/international proposals 2011 - Involvement in large scale projects i.e. SAMOC and Lisa Beal's planned Agulhas Observing system including Agulhas Return Cruise (NRL – J. Book)

SA Agulhas II delivery 1st May 2012
June 2012 Winter (shakedown) AX 25 cruise



Thank you!

