IMOS Integrated Marine Observing System

Decadal Variability in the East Australian Current

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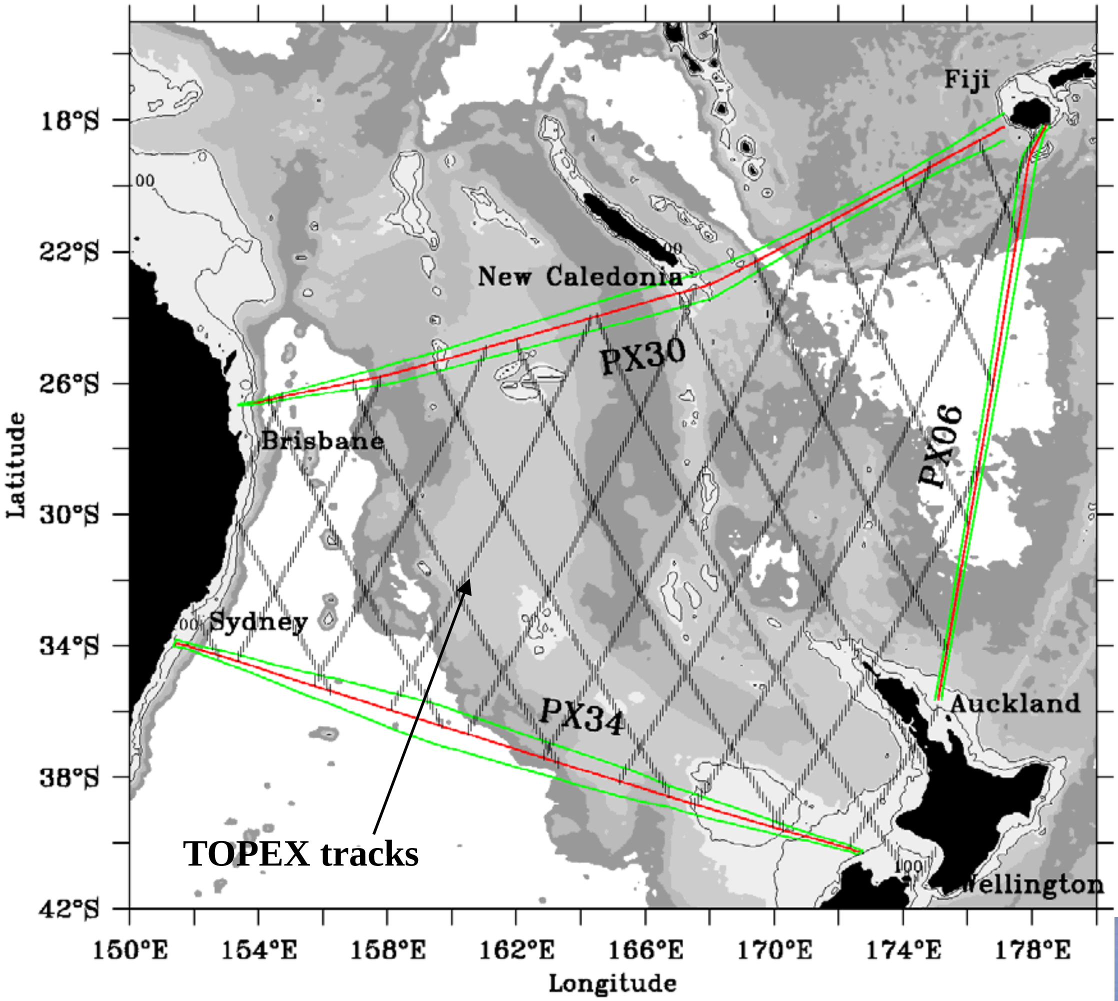
Outline

- Estimating transports from the Tasman Box XBT lines.
- Comparing transports across PX34
  - from XBT, CTD and Altimeter data.
- Decadal variability in the East Australian Current.
  - The Tasman Box XBT lines
  - Comparing transports from observations and ocean state estimates
- Conclusions
- An integrated western boundary current observing system
  - Existing and planned IMOS EAC Observations

Estimating transports from

THE TASMAN BOX XBT LINES

The Tasman Box:



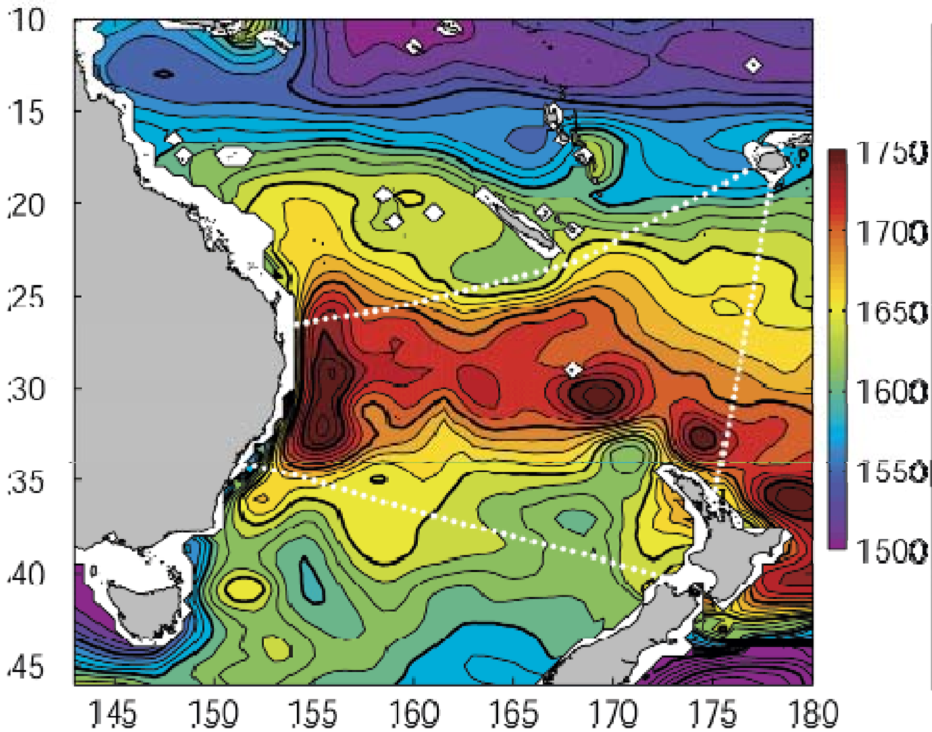
High Resolution XBT lines:

Quarterly sampling
Eddy-resolving
Red: mean track
Green: rms deviation

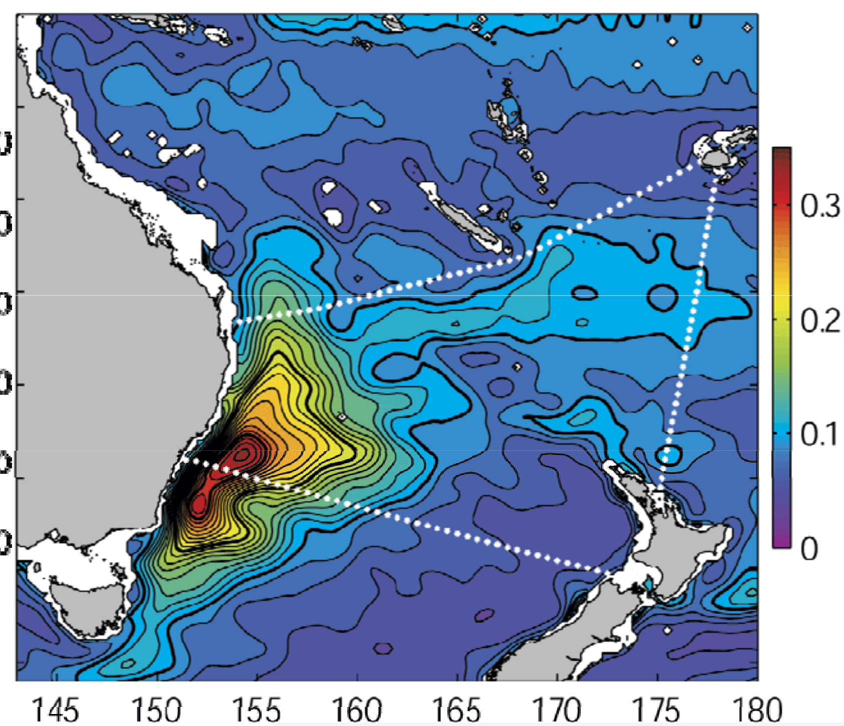
PX06: 1986 - present
PX30: 1991 - present
PX34: 1991 - present

Captures Main Gyre Components

Depth-averaged steric height shows the western end of the gyre circulation – inflows and outflows to the region are captured by the Tasman Box – even though tracks were dictated by available shipping routes

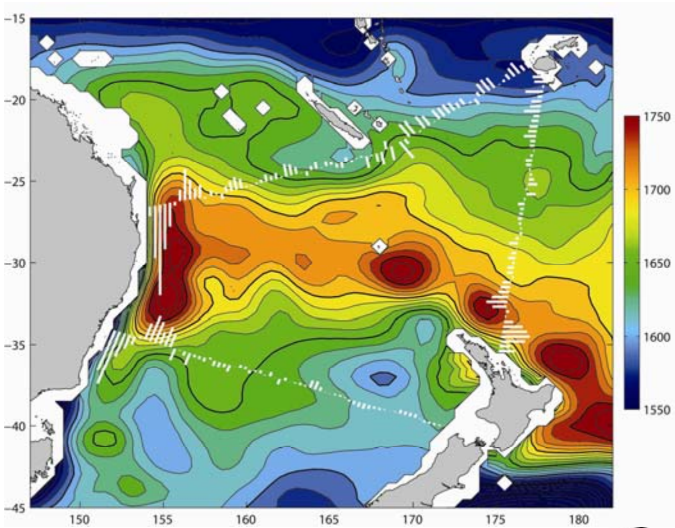


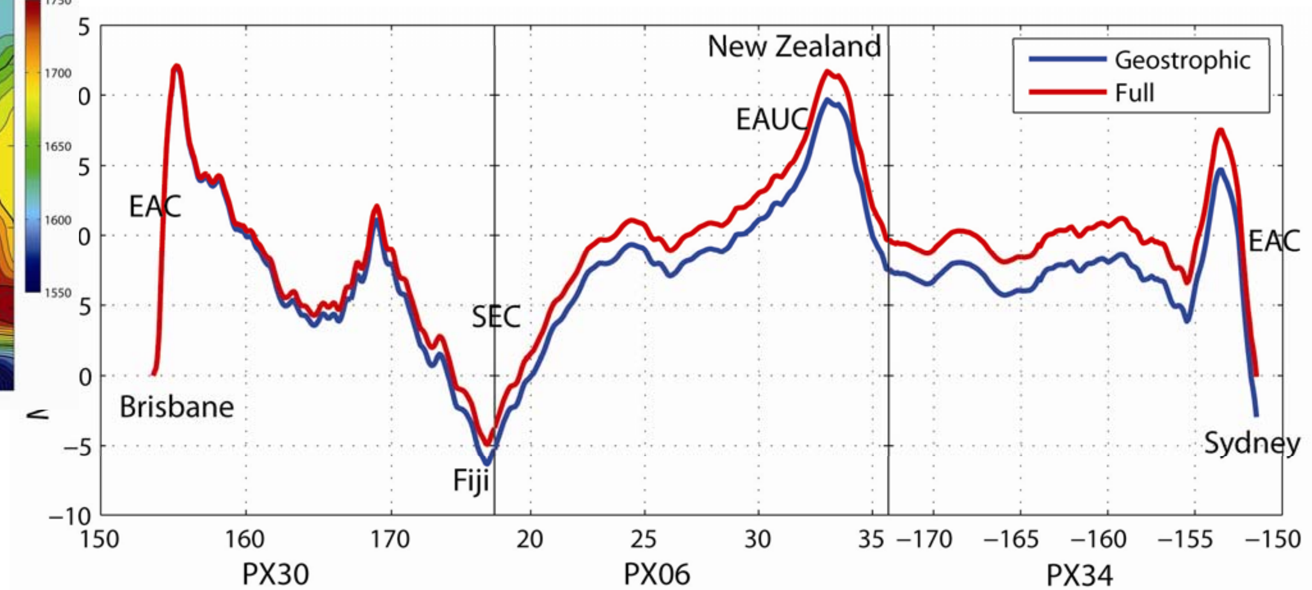
Depth Integrated Steric height (P0/2000)



RMS variability

Mean Transport balance in ‘Tasman Box’

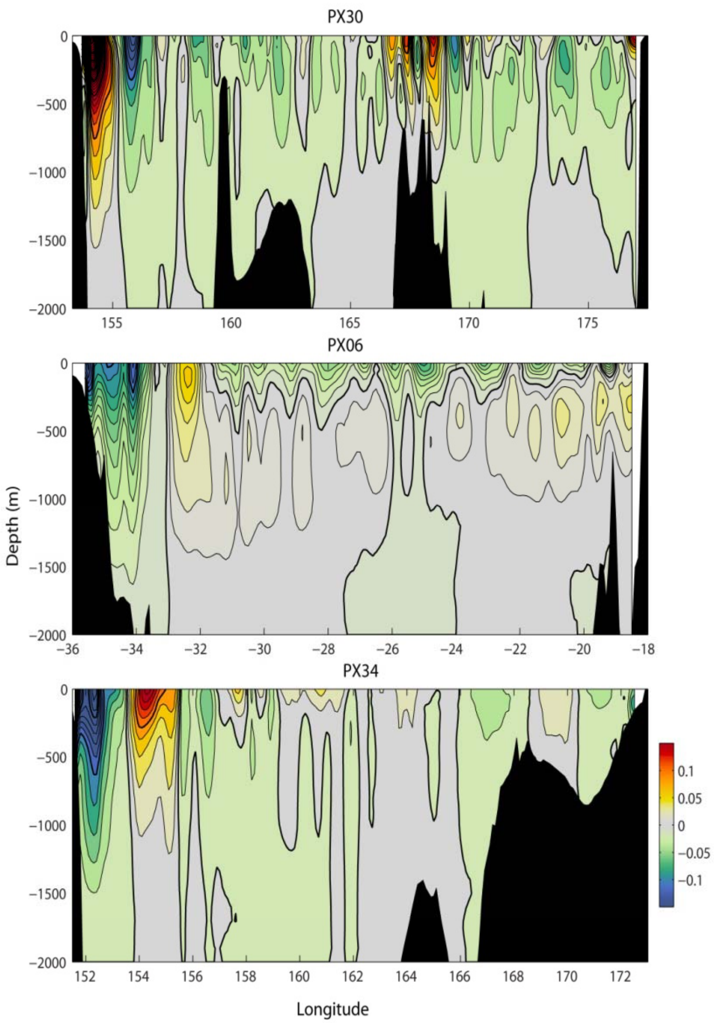


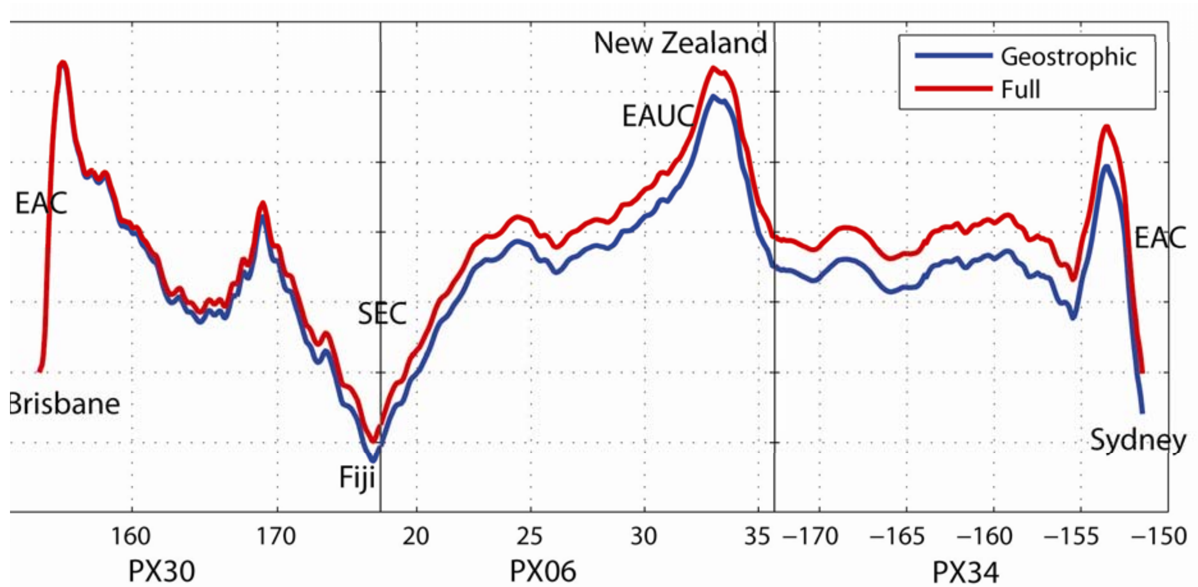


Geostrophic + Ekman = 0

Relative to 2000m

Mean Transport balance in 'Tasman Box'





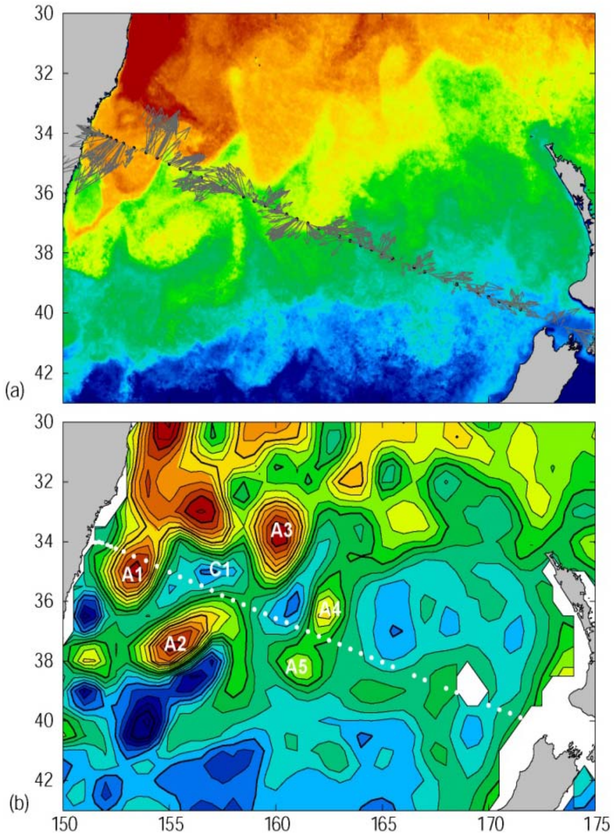
Geostrophic + Ekman = 0

Relative to 2000m

Comparing

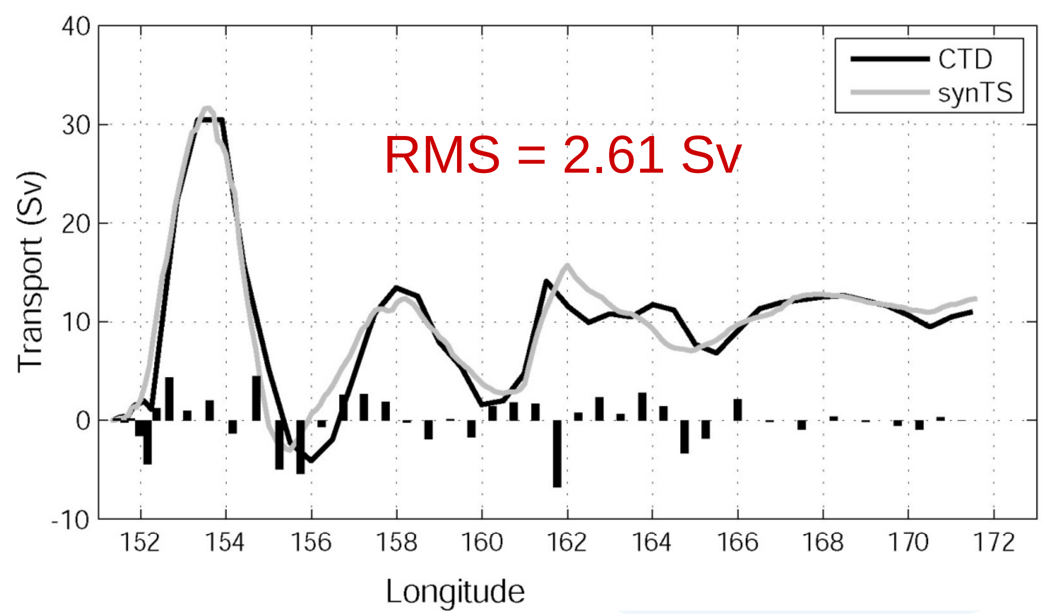
TRANSPORTS ACROSS PX34

Transport from surface altimetry



46 CTDs along PX34 section

Transport inferred from Satellite properties interpolated along CTD section



Comparison of XBT & SynTS Transport

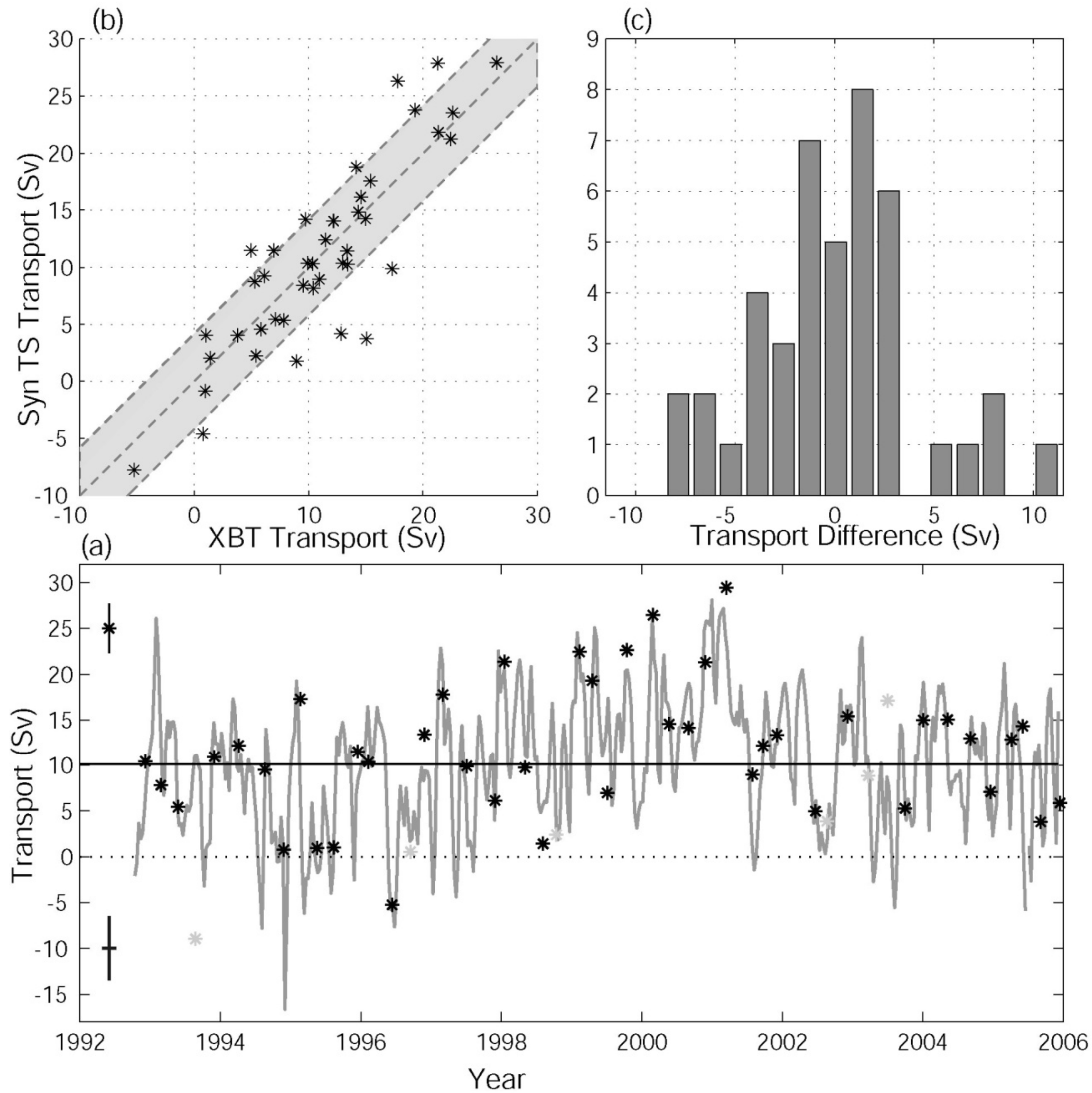
Tr_X and Tr_S transport estimates are strongly correlated

43 transects followed PX34 track

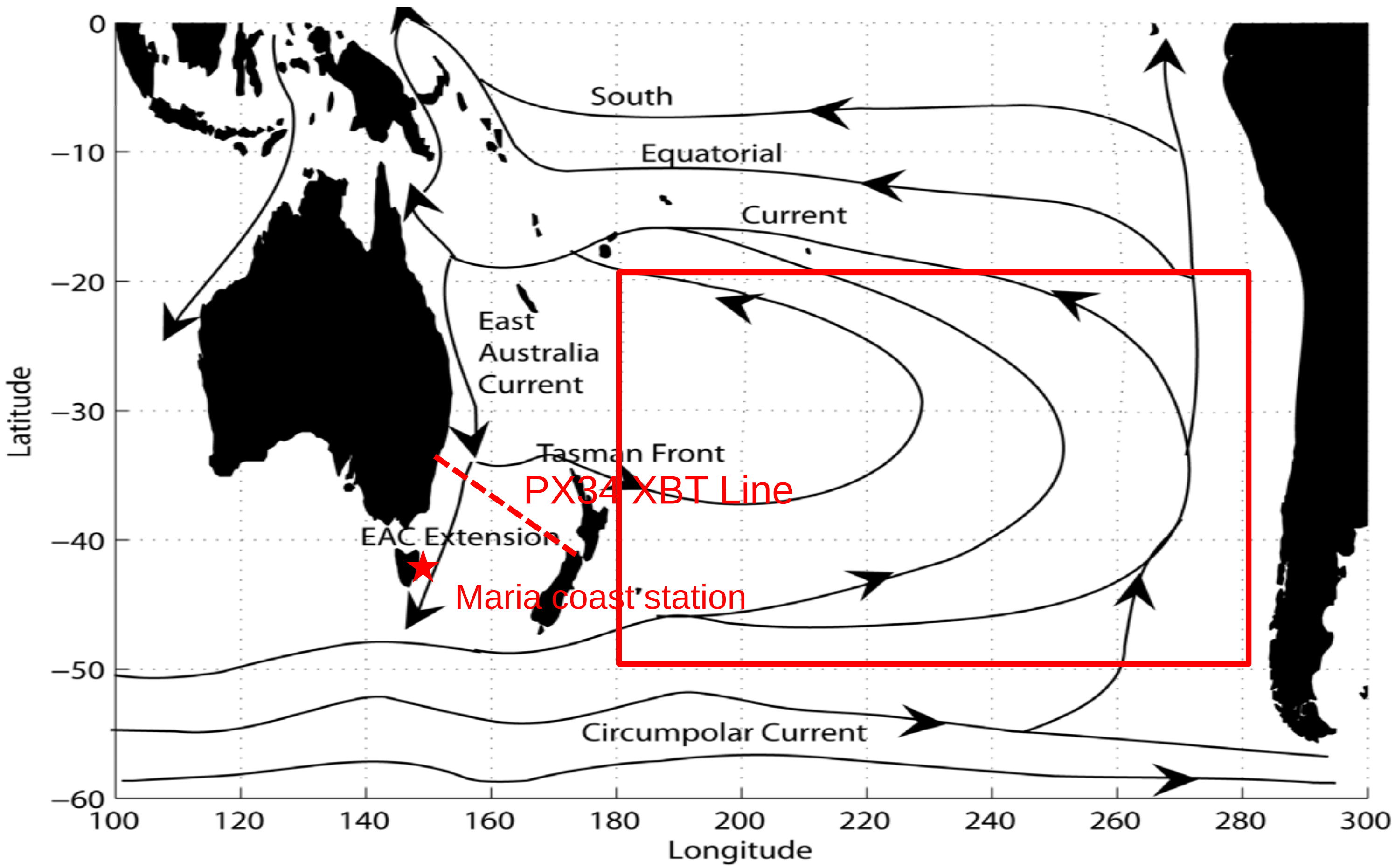
RMS = 4.2-4.8 Sv

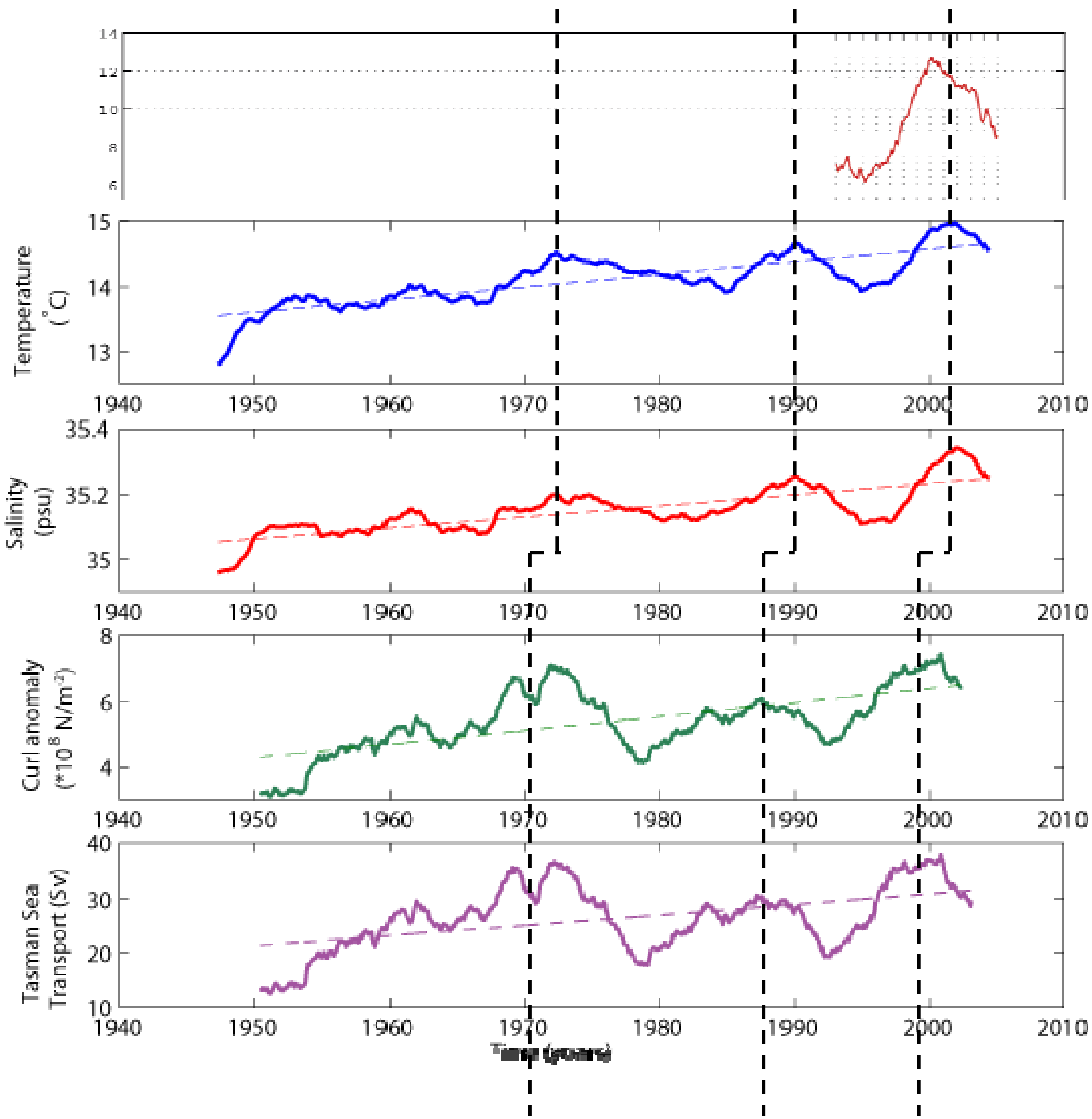
Tr_S obtained every 10 days from altimetry along PX34

Ridgway et al, 2008



South Pacific Circulation





Transport through the Tasman Sea (from XBT)

SST at Maria

Salinity at Maria

South Pacific Wind Stress Curl (180-280E, 20-60S)

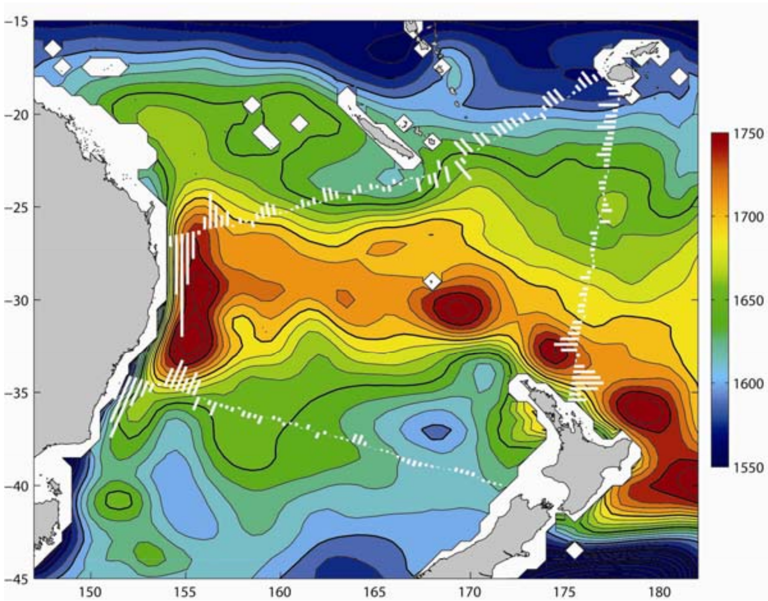
Transport through the Tasman Sea (Island Rule)

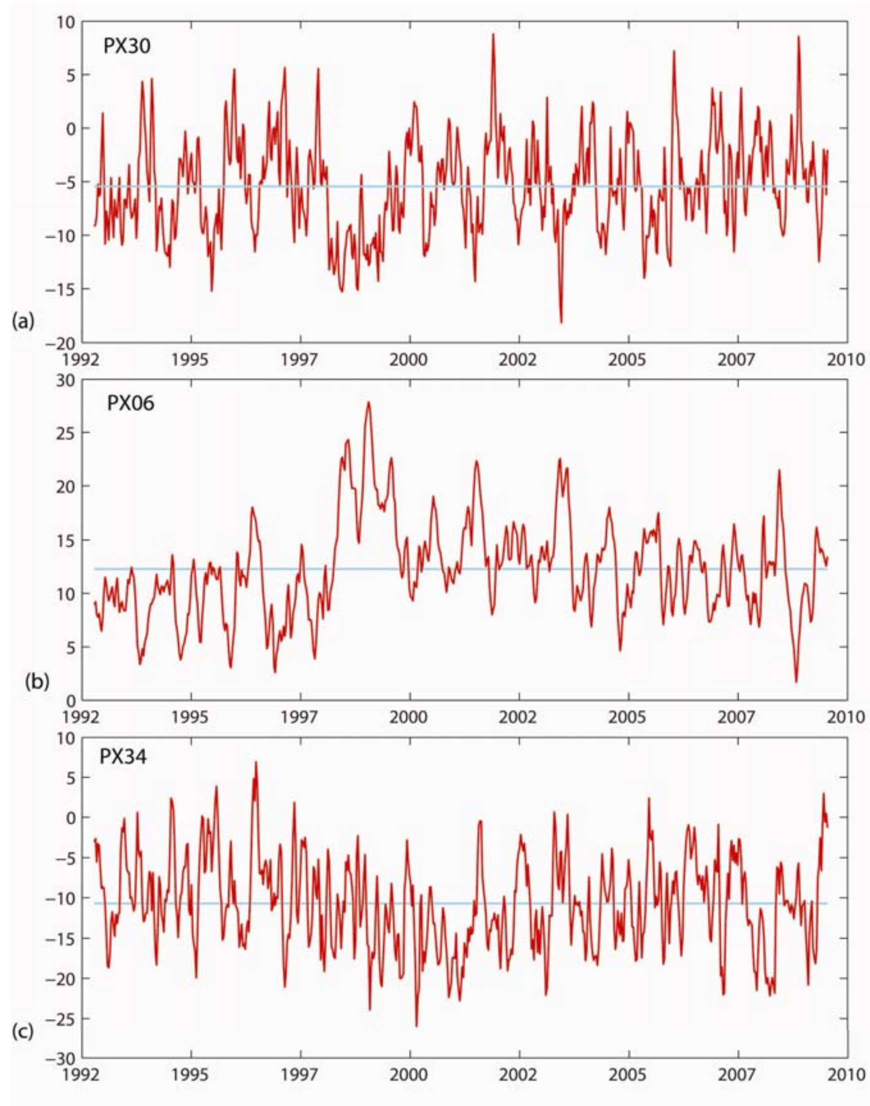
Hill et al 2008

Variability in

TRANSPORT THROUGH THE TASMAN BOX

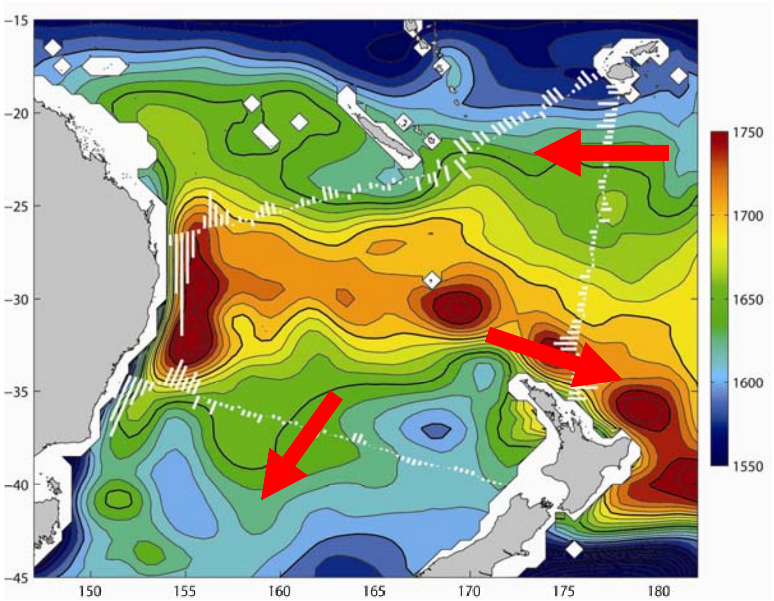
Transport Time Series

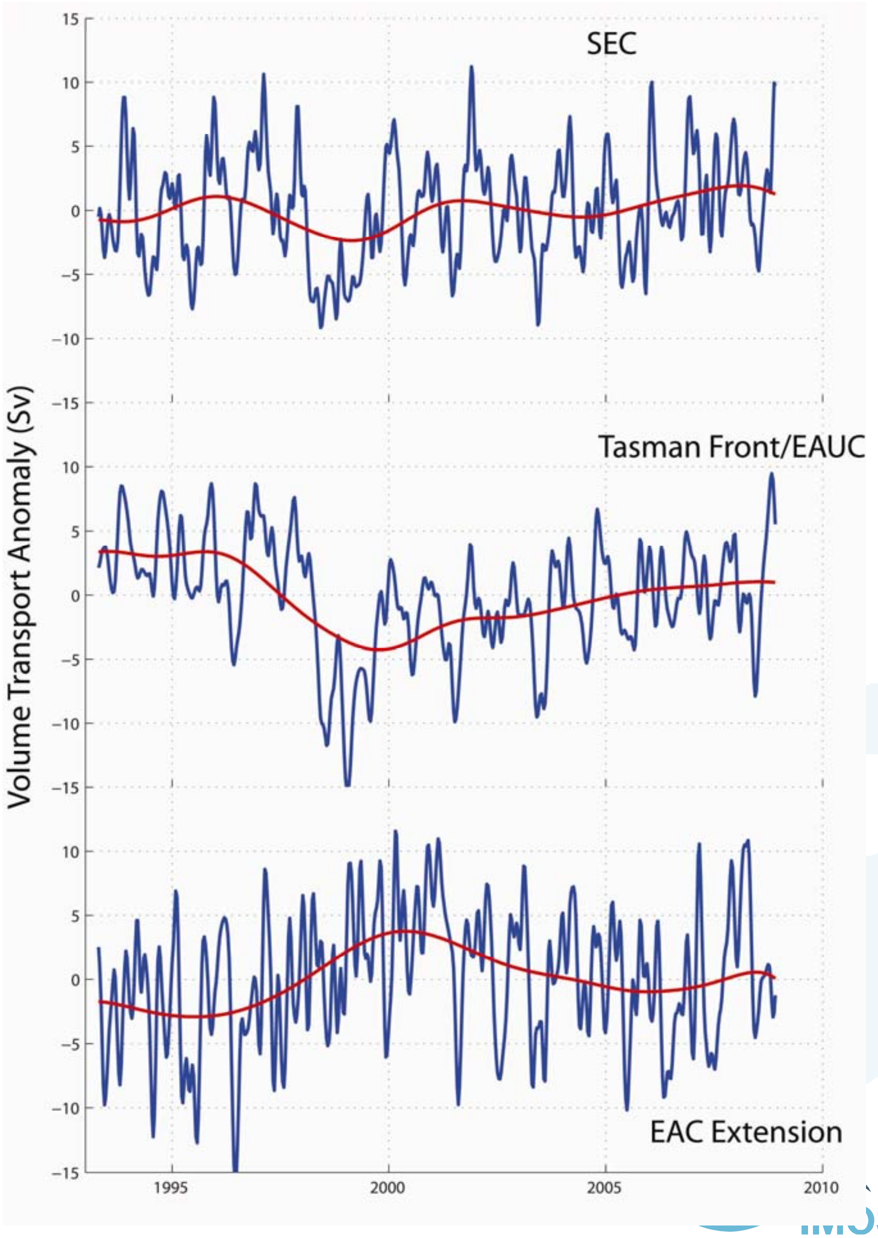




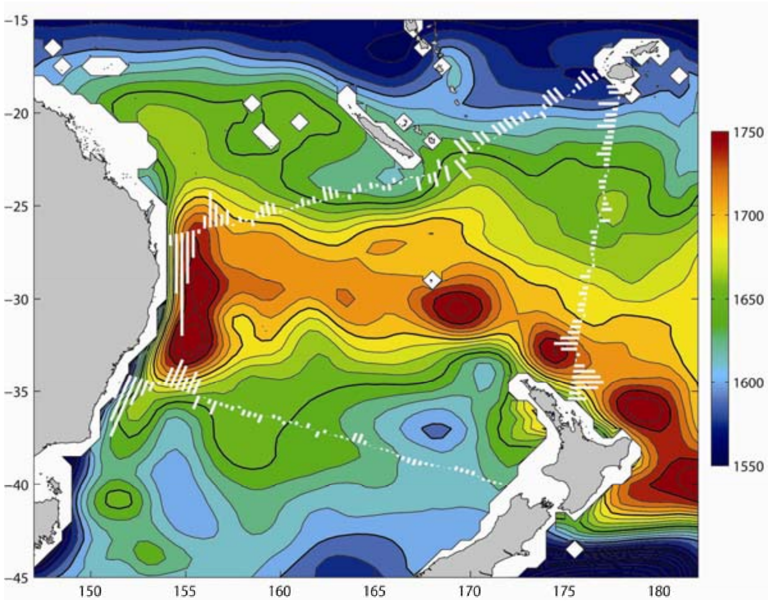
Full range of signals observed over 17-year period through each transect

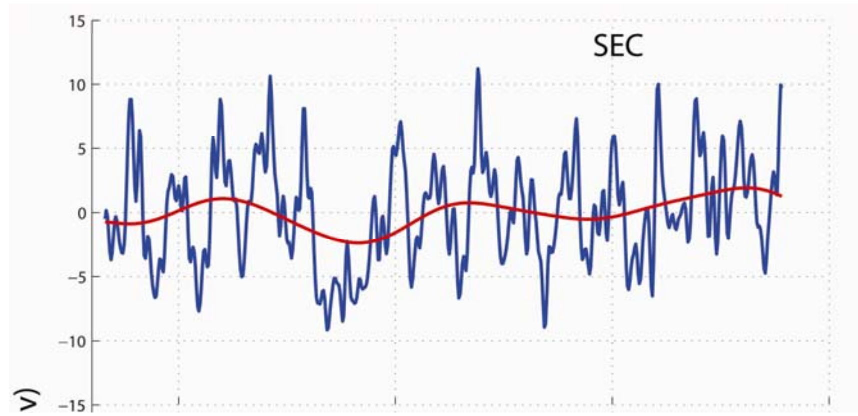
Decadal Signals

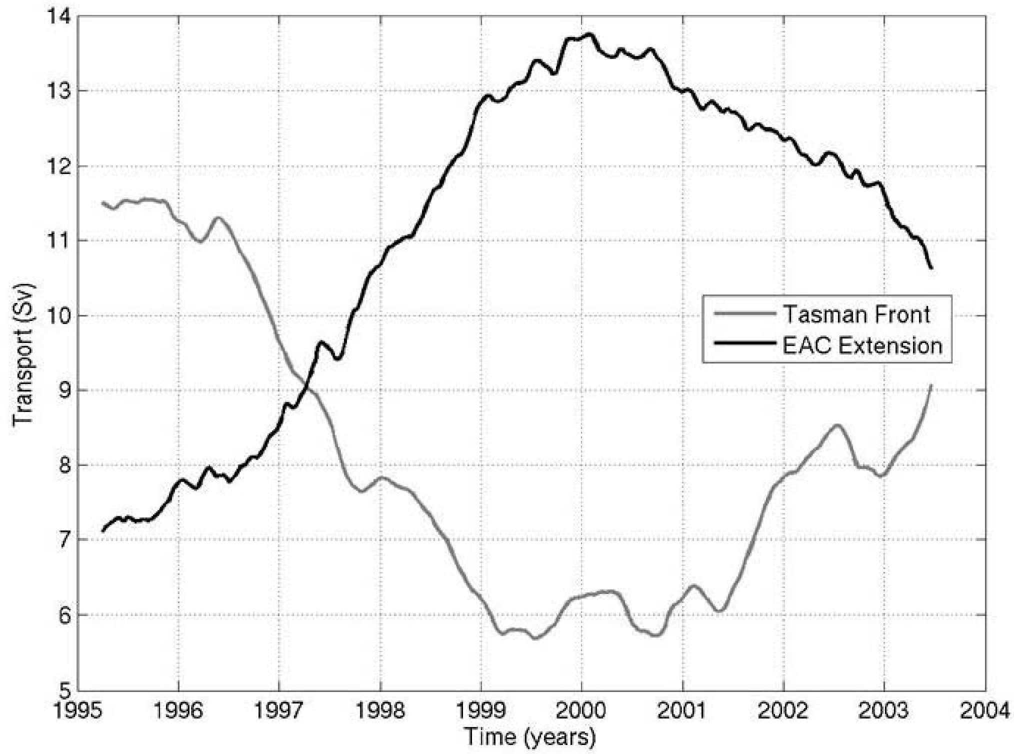




- Focus on 3 components
- ‘Decadal’ signal observed in Tasman Front & EAC Extension



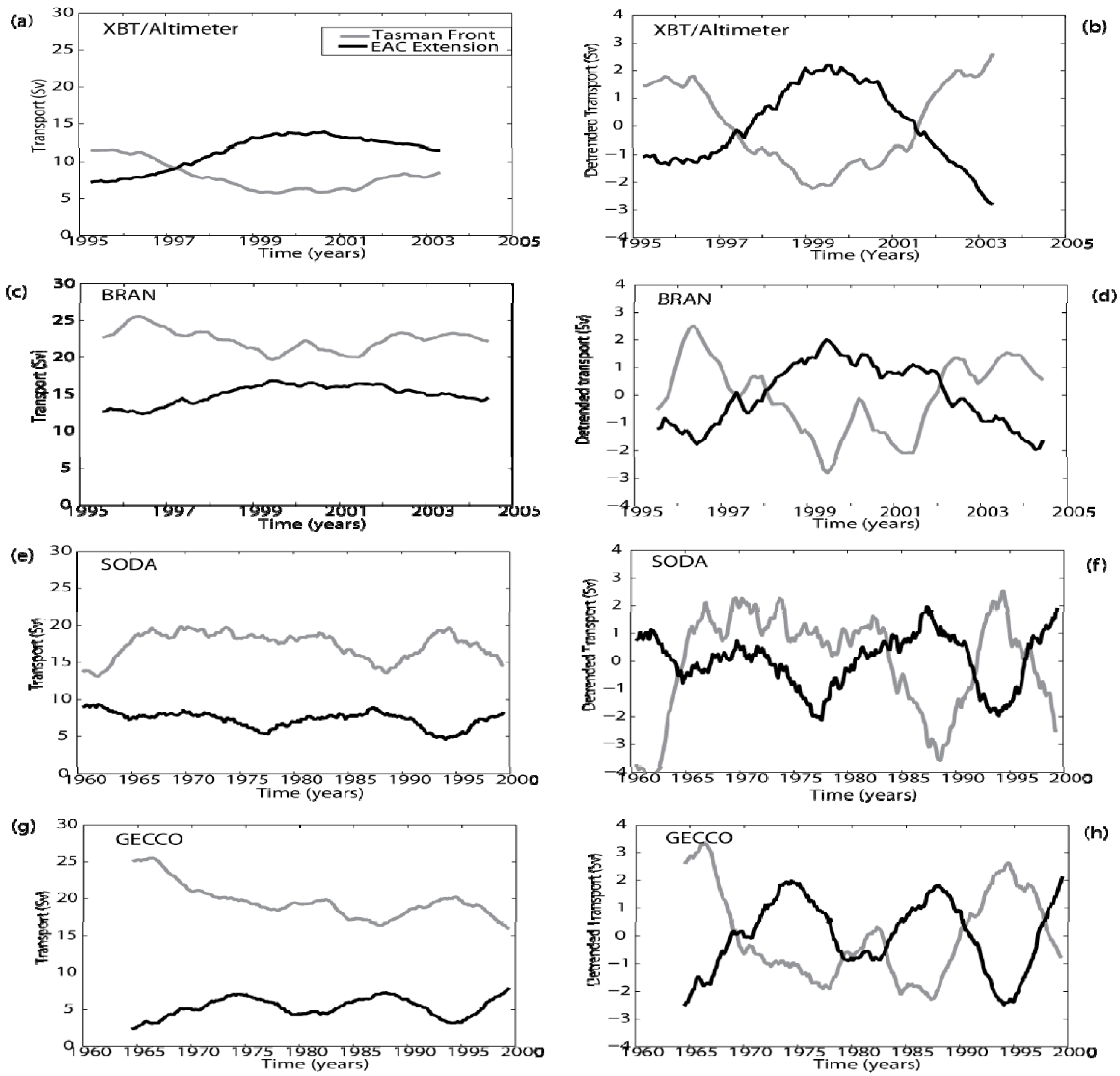




- Decadal change in EAC flow opposite in phase to Tasman Front outflow
- Increase in EAC
- Decrease in Tasman Front

Comparing transports from

OBSERVATIONS AND OCEAN STATE ESTIMATES

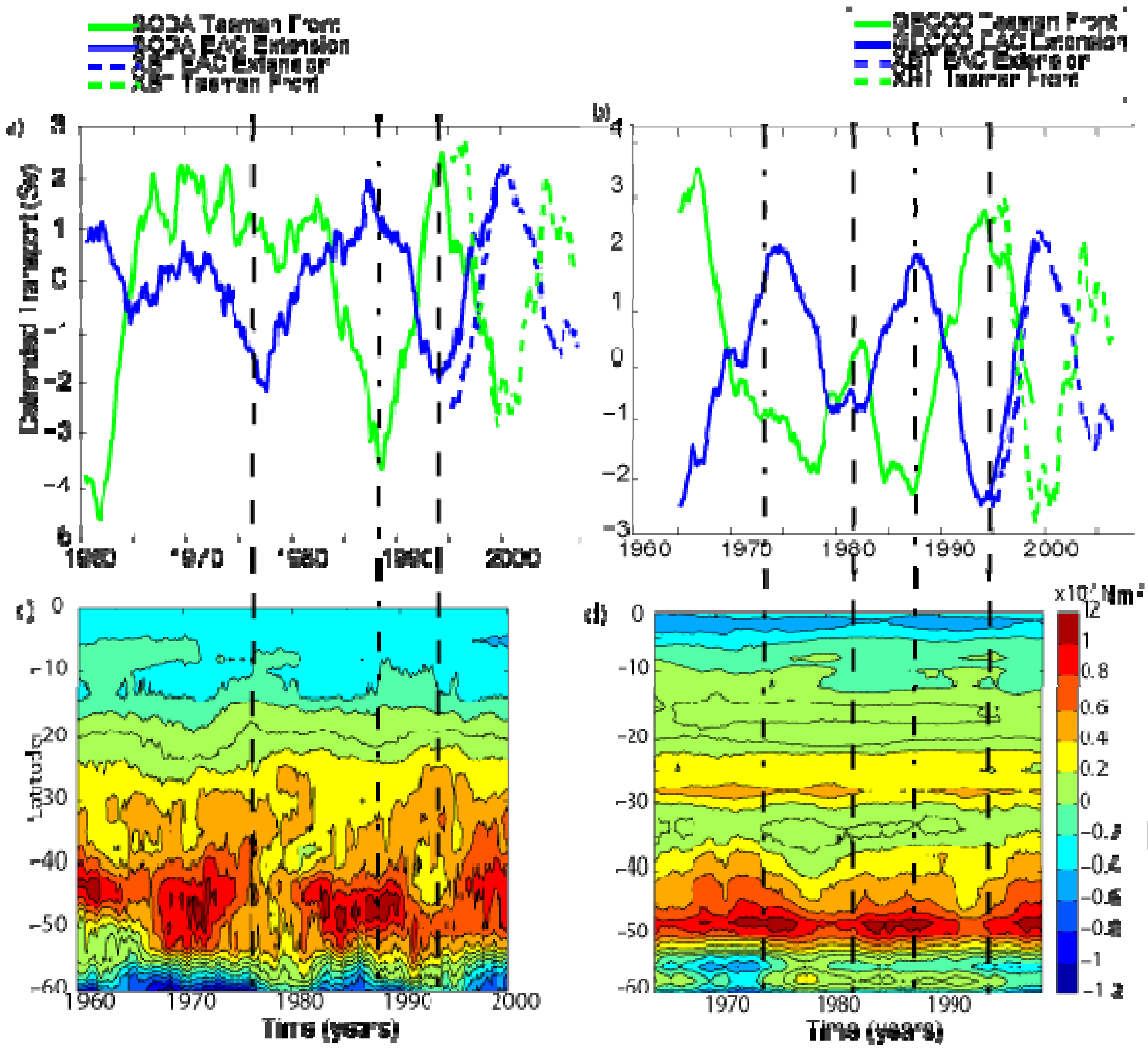


(a)
XBT/Altimeter
Tasman Front
EAC Extension
Transport (Sv)
Time (years)
(b)
XBT/Altimeter
Detrended Transport (Sv)
Time (Years)
(c)
BRAN
Transport (Sv)
Time (years)
(d)
BRAN
Detrended transport (Sv)
Time (years)
(e)
SODA
Transport (Sv)
Time (years)
(f)
SODA
Detrended Transport (Sv)
Time (years)
(g)
GECCO
Transport (Sv)
Time (years)
(h)
GECCO
Detrended Transport (Sv)
Time (years)
IMOS

Transports and South Pacific Wind stress curl

SODA R = -0.62

GECCO R= -0.8



Hill et al., 2011

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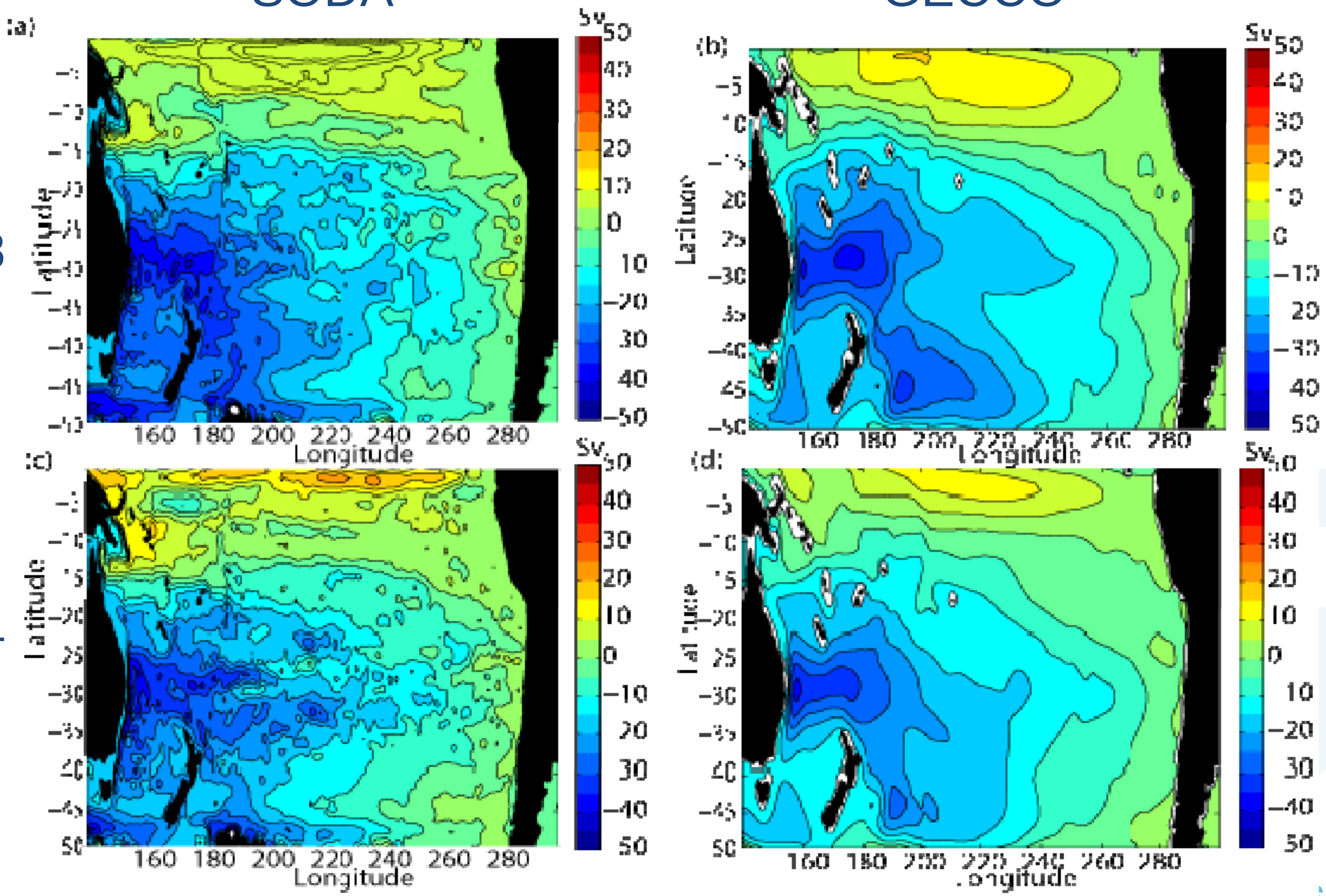
Streamfunctions: gyre scale response.

SODA GECCO

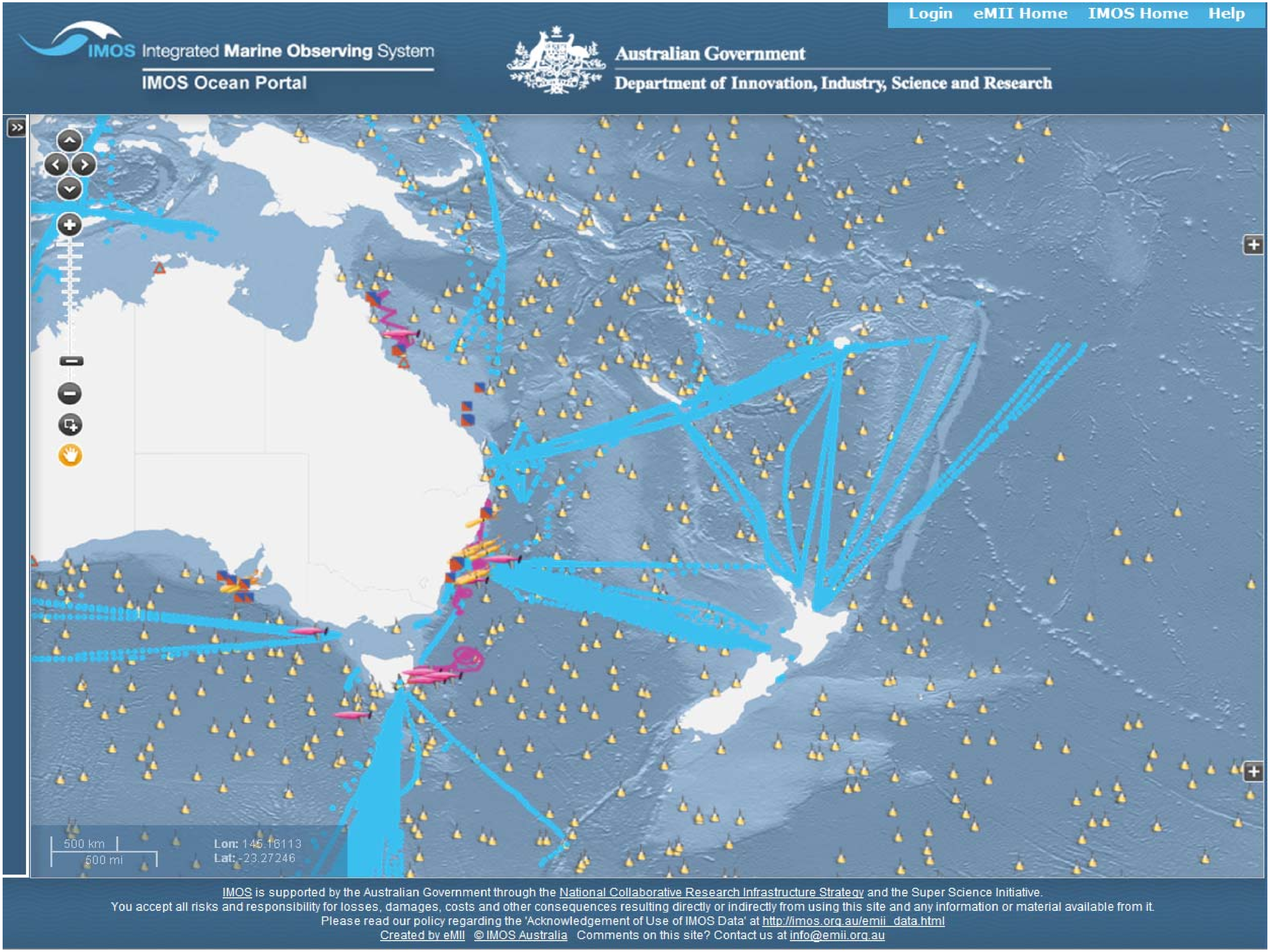
1988

1994



An Integrated Marine Observing System

OBSERVATIONS OF THE EAC SYSTEM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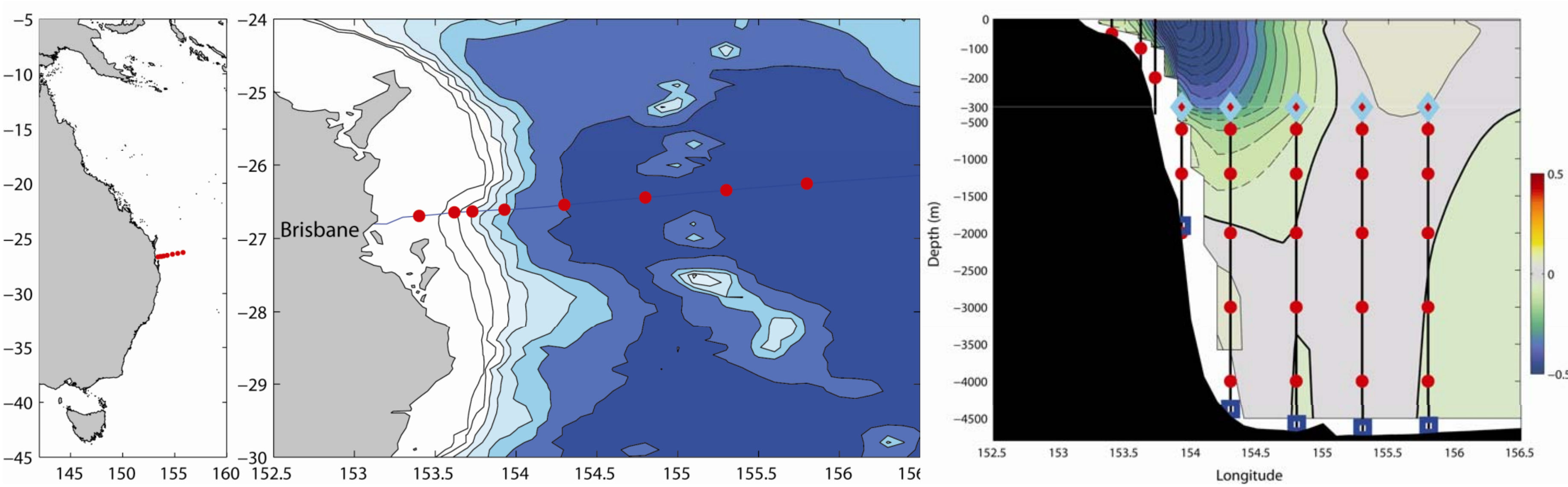
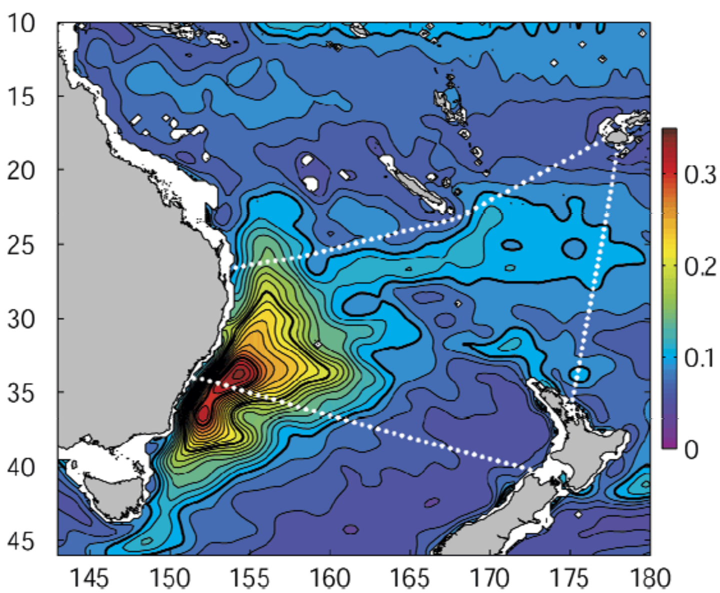
EAC mooring array off Brisbane





Deployment scheduled for April 2012

All IMOS data available at:

http://imos.aodn.org.au

IMOS

Conclusions

- High resolution XBT data can be used to make accurate estimates of geostrophic transport.
  - Combined with altimetry estimates (temporal resolution).
  - Combined with estimate of ekman from winds = total transport (balance)
- An anti-correlation between the transport of the EAC Extension and the Tasman Front on decadal timescales
  - Identified in XBT data, corroborated in 3 ocean state estimates
- Anti-correlation is a reflection of two gyre scale states
  - Enhanced wind stress curl, gyre extends south, more water flows through the Tasman Sea.
  - Weaker wind stress curl, gyre centered further north, more water flows to the north of New Zealand.
- Integrated Marine Observing System – monitoring boundary currents
  - Regional XBT lines and Argo array
  - Shelf/Deep mooring array to monitor EAC
  - Glider deployments in the EAC System (Hiri Current, EAC Eddies, EAC Extension, Tasman Outflow)

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