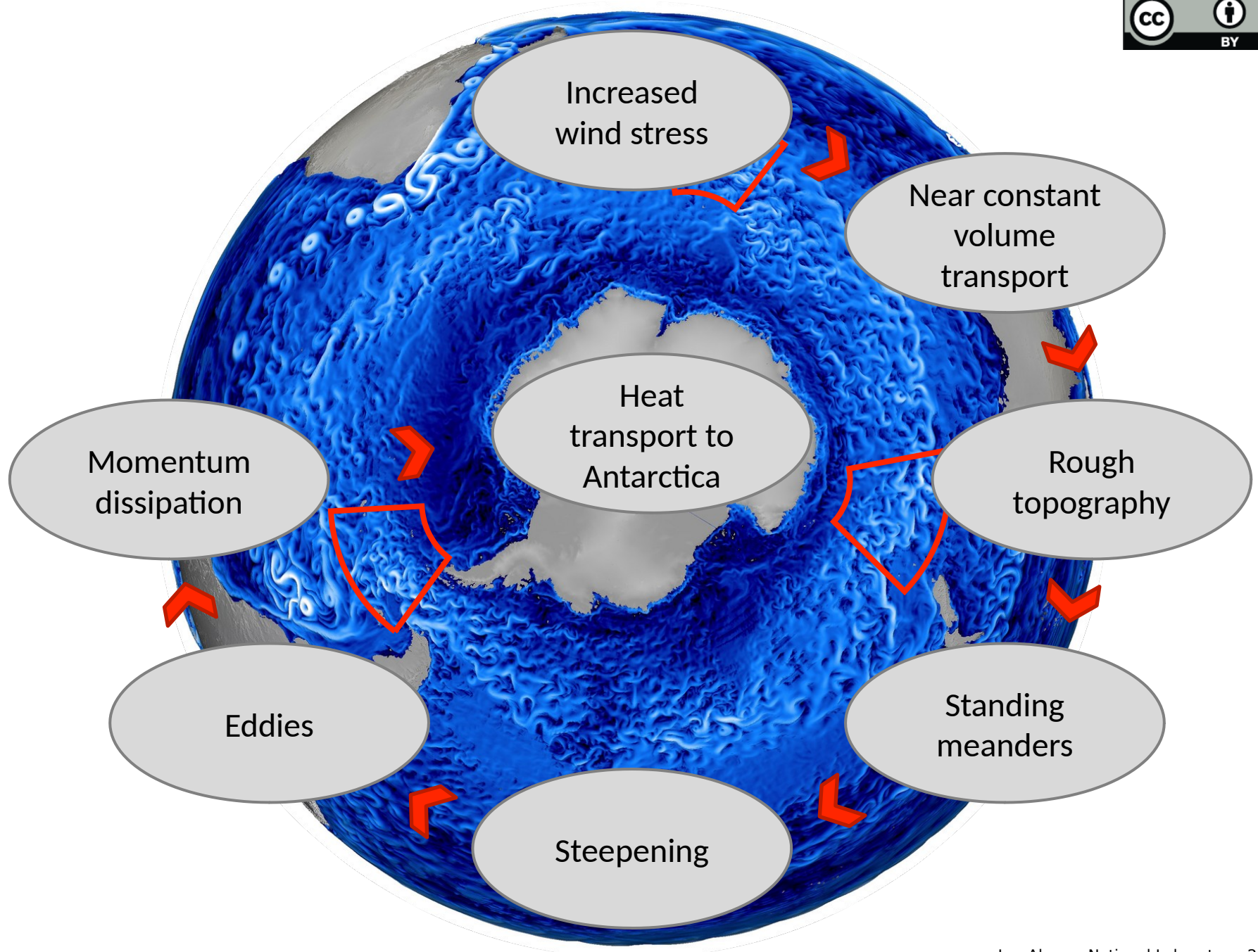


# Three-dimensional structure of a standing meander in the Antarctic Circumpolar Current

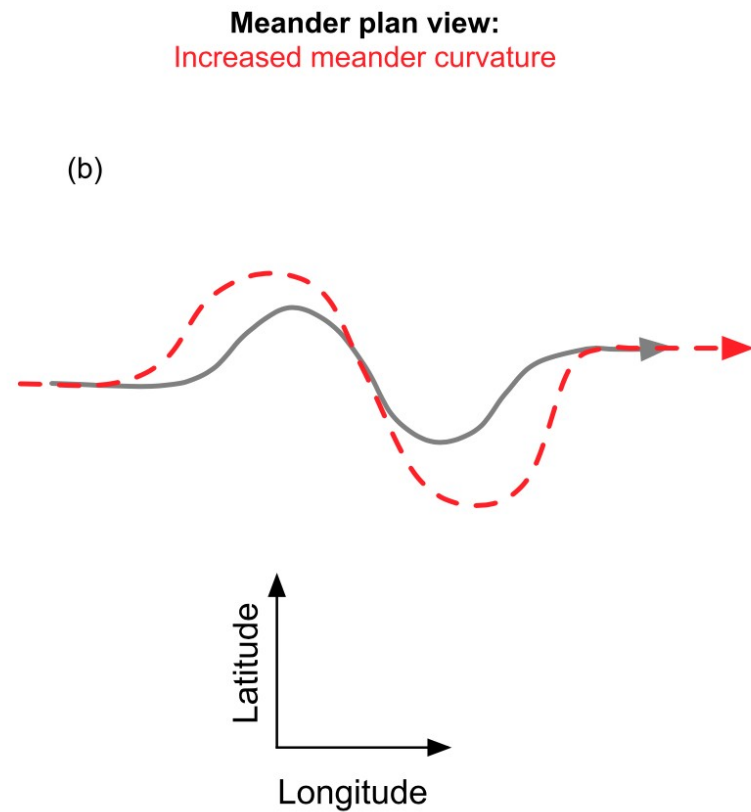
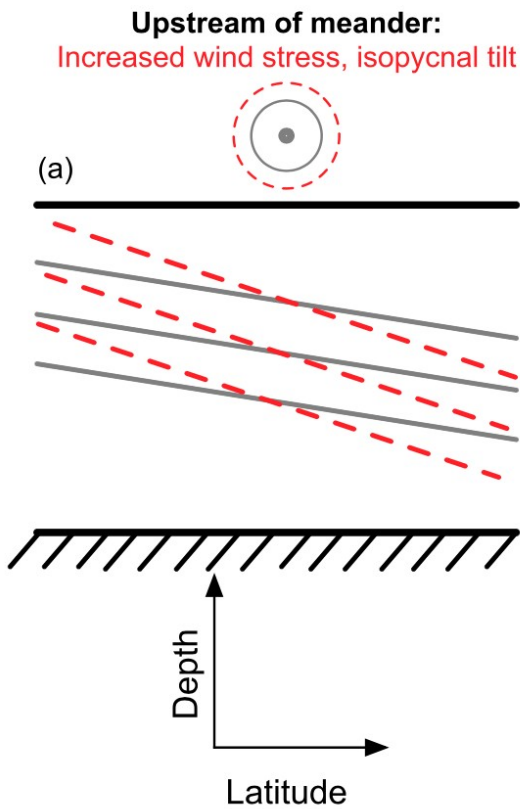
Jan Jaap Meijer, Helen E. Phillips, Stephen R. Rintoul and Nathaniel L. Bindoff

# Contents

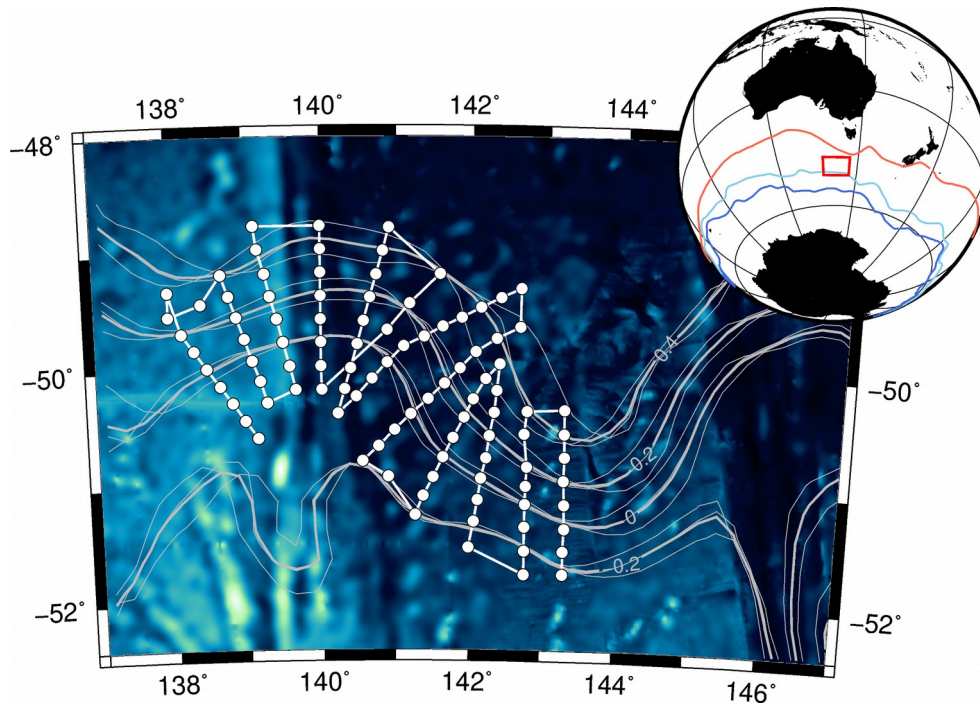
- Standing meanders in the ACC
- Observations voyage
- Vertical T, S and density structure
- Gravest Empirical Mode (GEM)-field and anomalies
- Mixing regions and front separation
- Horizontal velocity structure



# Adjustment mechanism



# Existing observational data

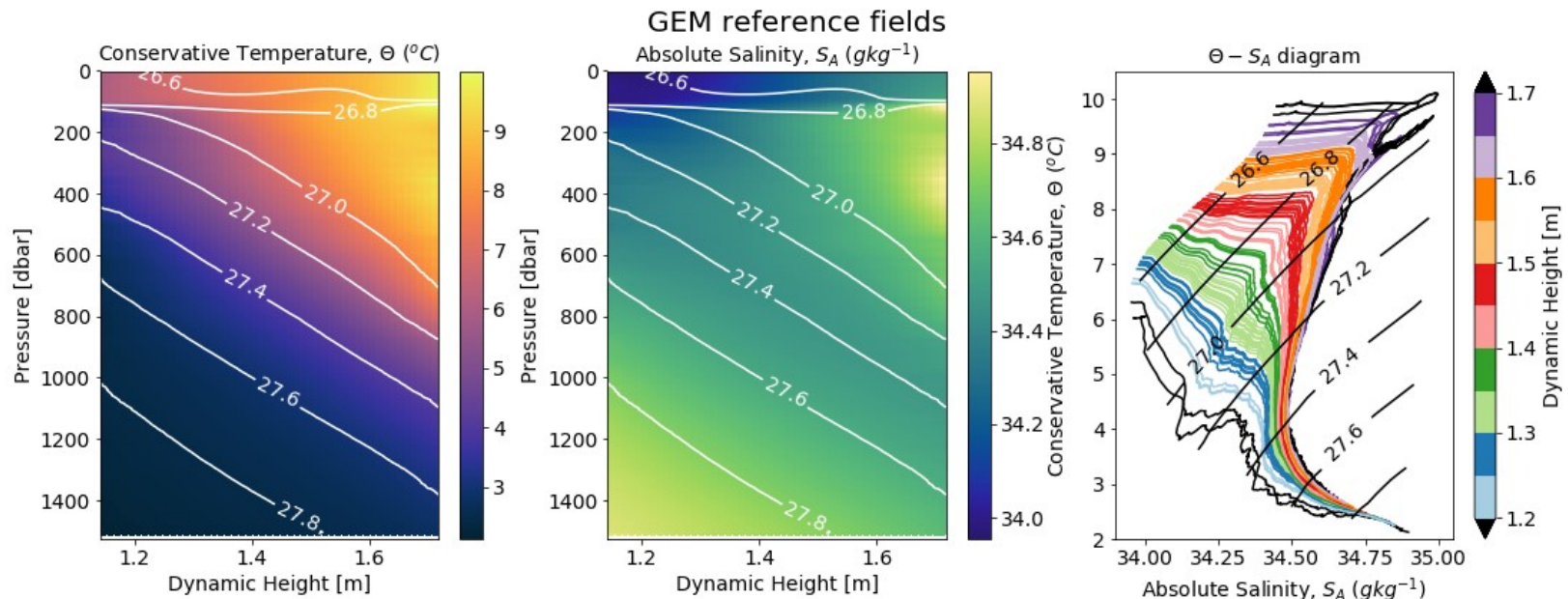


# RV Southern Surveyor 1998

# SW of Tasmania/ Downstream of South East Indian Ridge

- 99 CTD profiles
- 11 transects
- 1526 dbar depth
- Underway ADCP 200-350 dbar

# Reference GEM-field



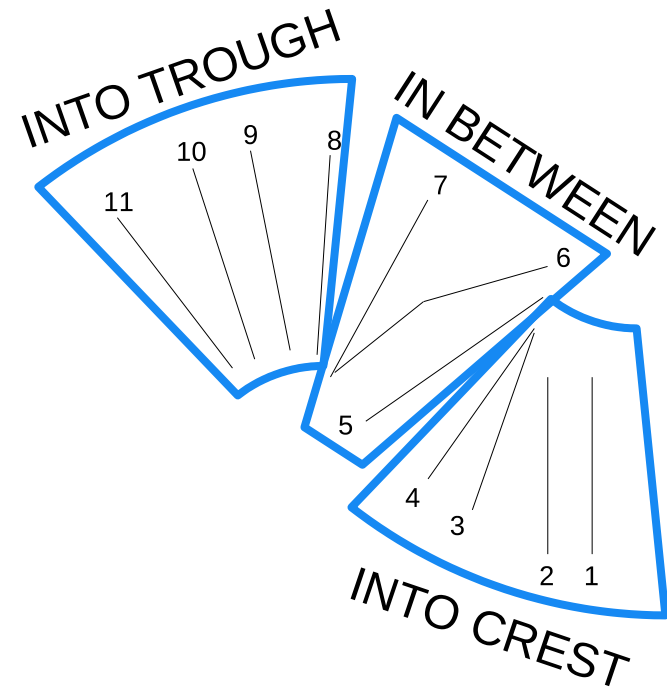
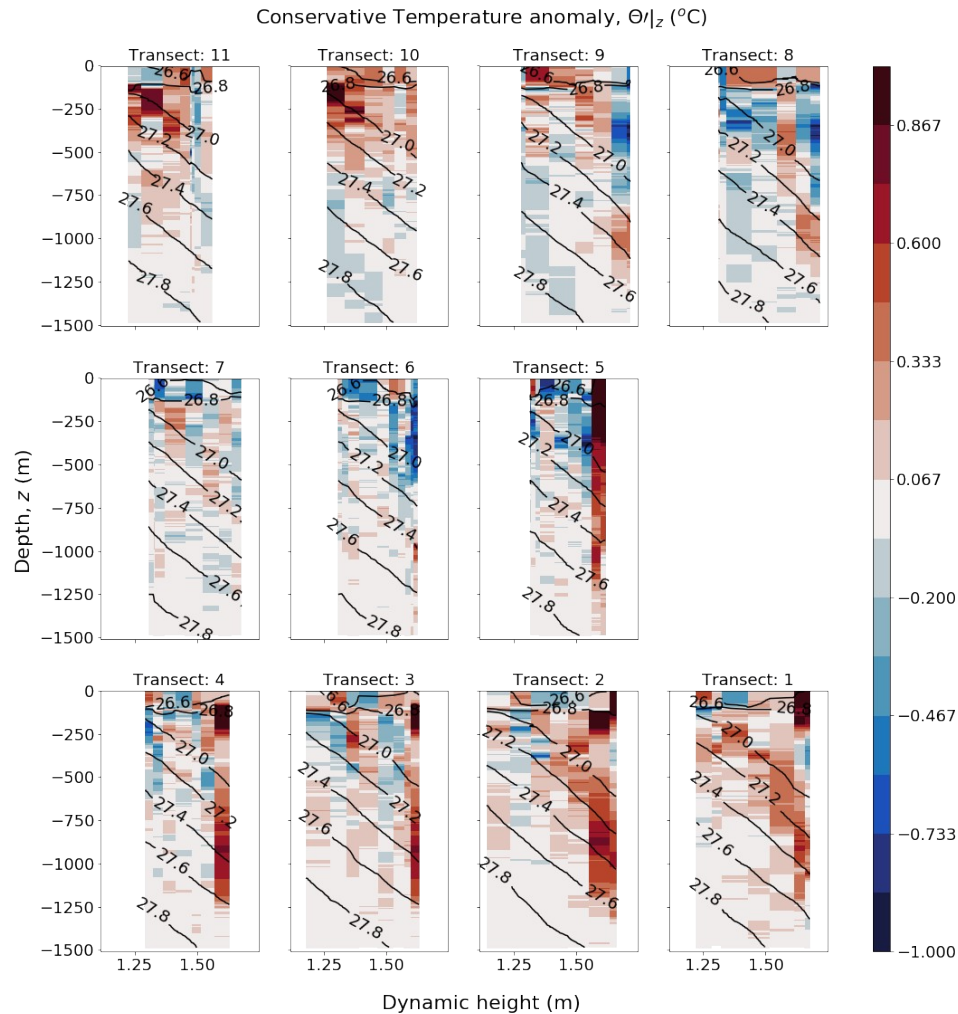
- Steep isopycnals
- 2D lookup-table from 99 CTD profiles
- Strong relation  $\Theta(D, p)$   $S_A(D, p)$

# Anomalies from GEM-field

INTO TROUGH

IN BETWEEN

INTO CREST

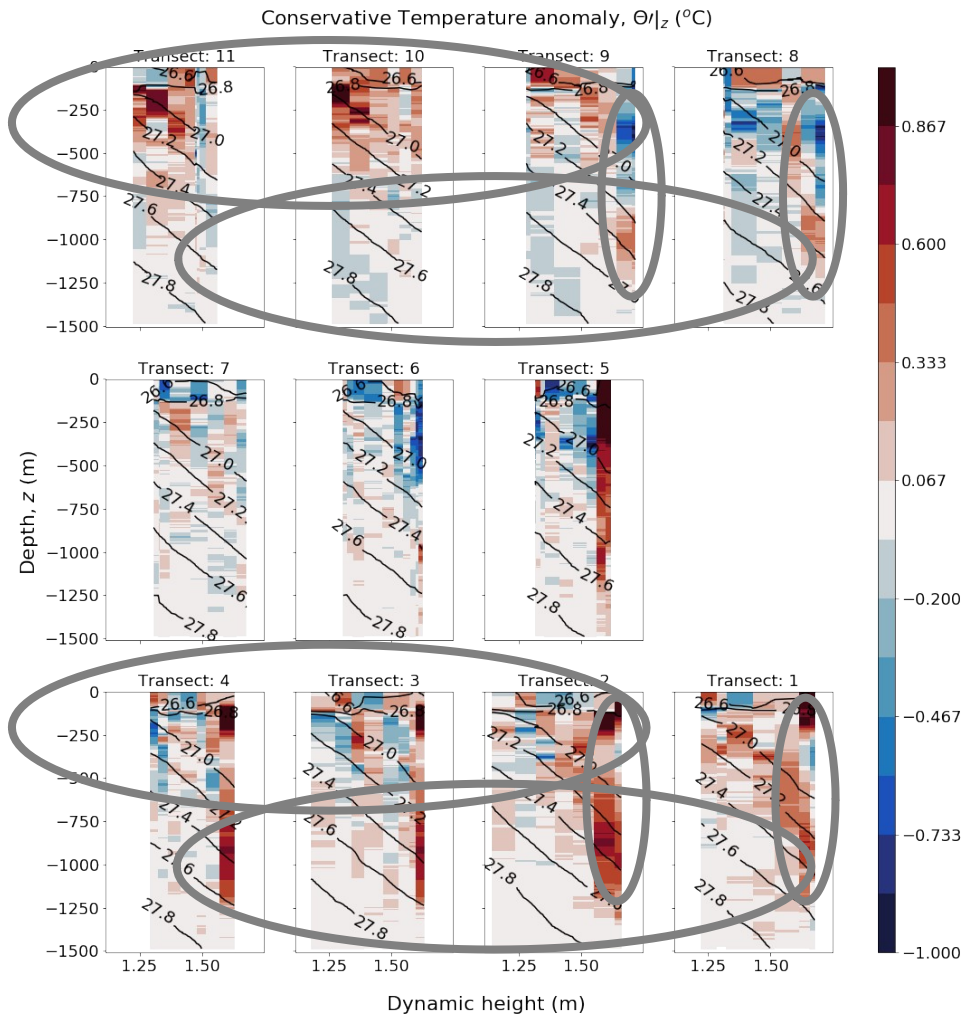


# Anomalies from GEM-field

INTO TROUGH

IN BETWEEN

INTO CREST



$$\Theta'|_z = \Theta(z) - \Theta^{GEM}(z)$$

$$\Theta'|_z = \Theta'|_{\gamma_n} - h' \frac{\partial \Theta}{\partial z} \bigg|_{\gamma_n}$$

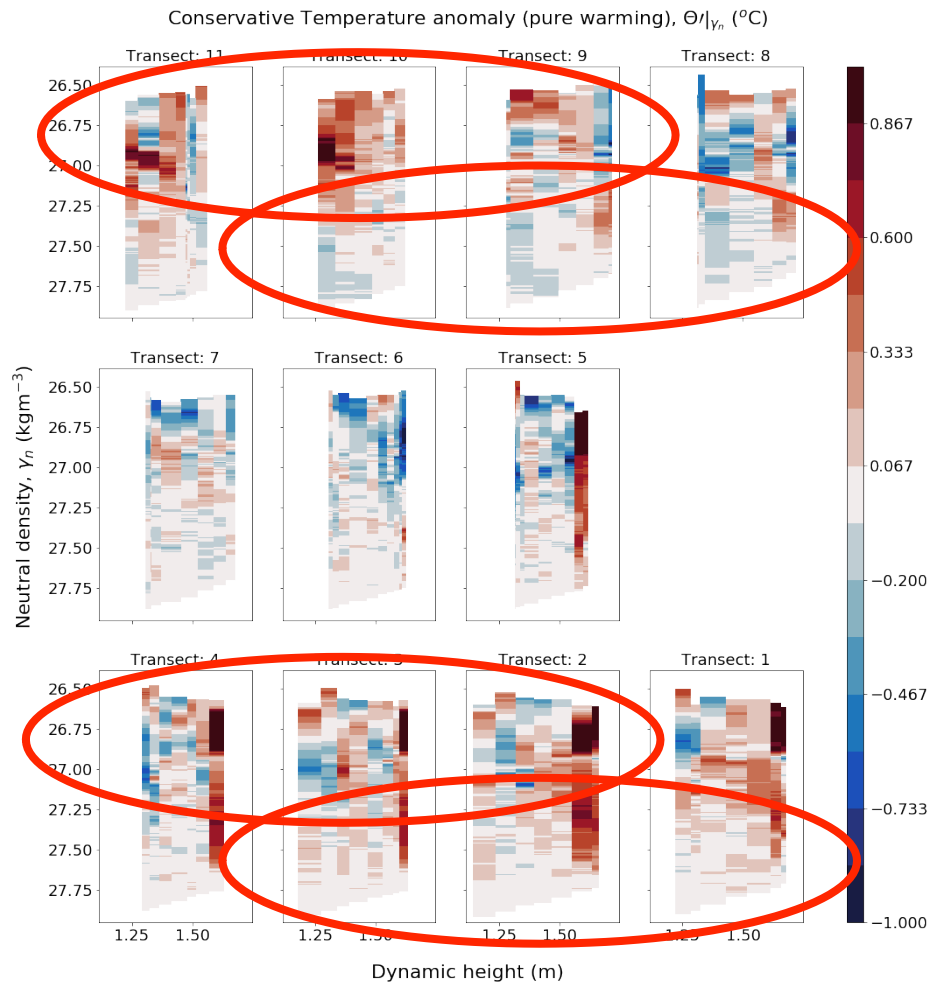
Warming / cooling  
relative to GEM-field

Pure warming/  
cooling

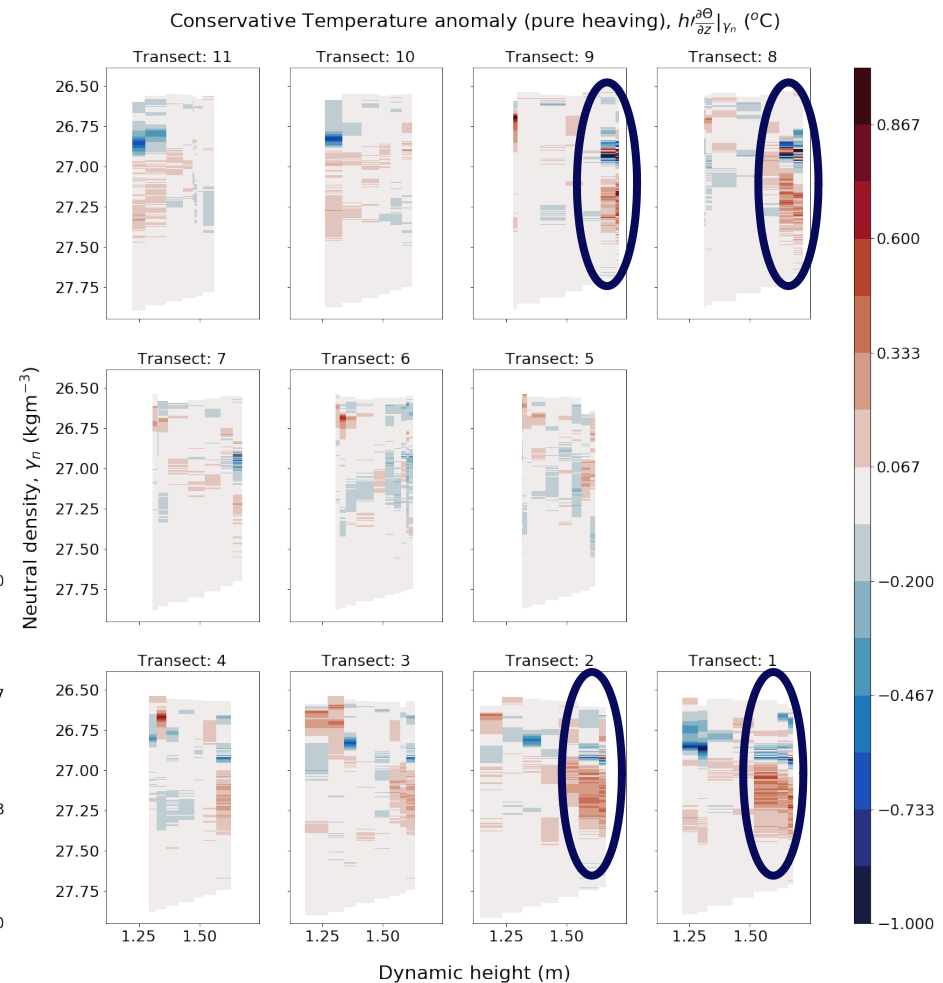
Pure heaving

# Warming/ cooling or heaving?

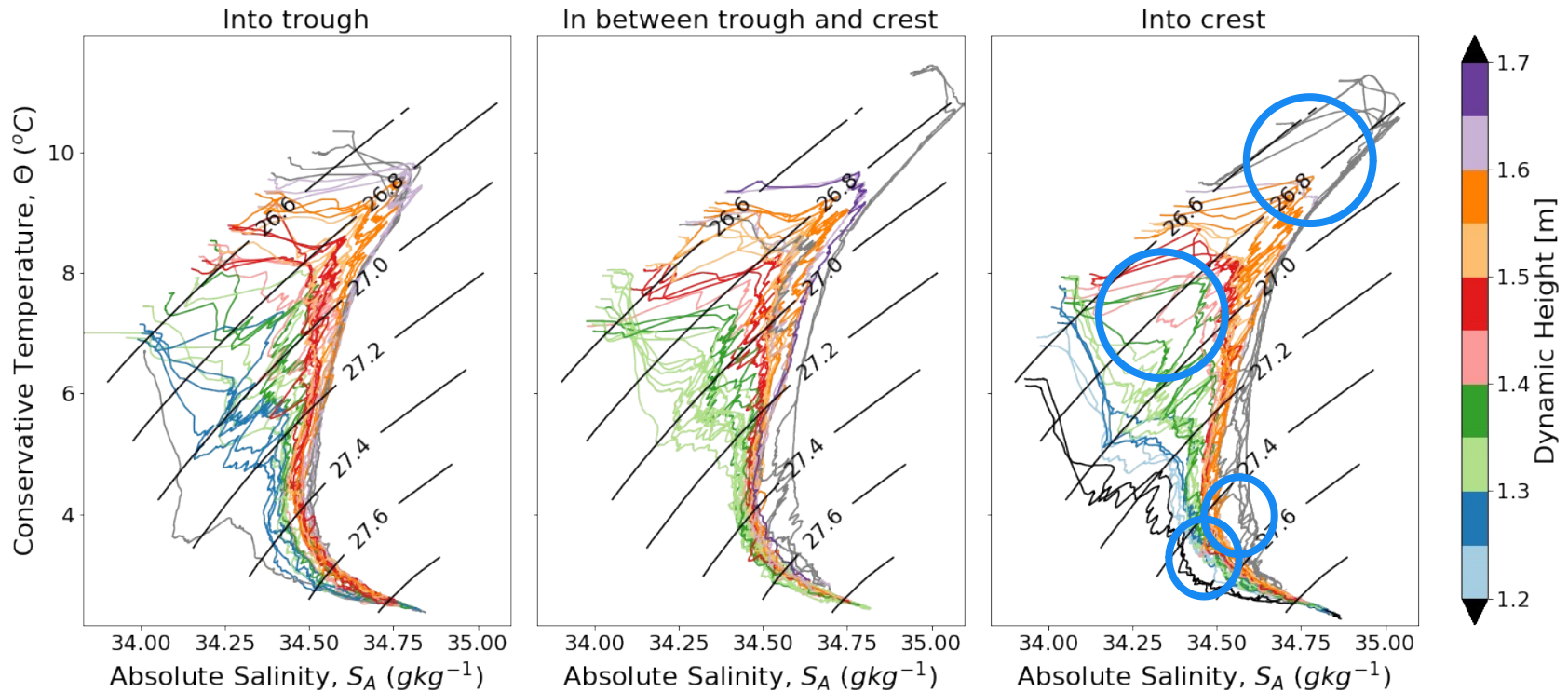
## Pure warming or cooling



## Pure heaving



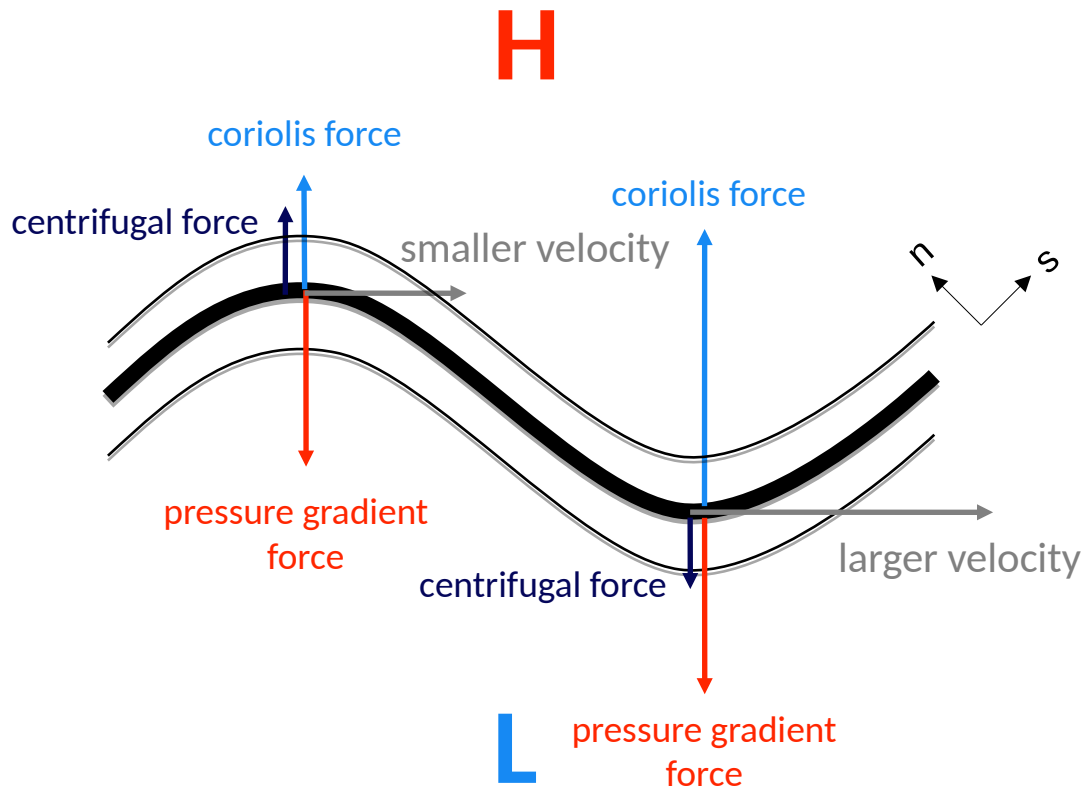
# Mixing and front separation



- Upper water column ( $<27.2$ )
- Lower water column ( $>27.2$ )
- Mixing upper and lower water column
- Front separation in upper and lower water column

# Horizontal kinematics

Southern Hemisphere



Geostrophic balance:

$$fV_g = -\frac{\partial \eta_{SSH}}{\partial n}$$

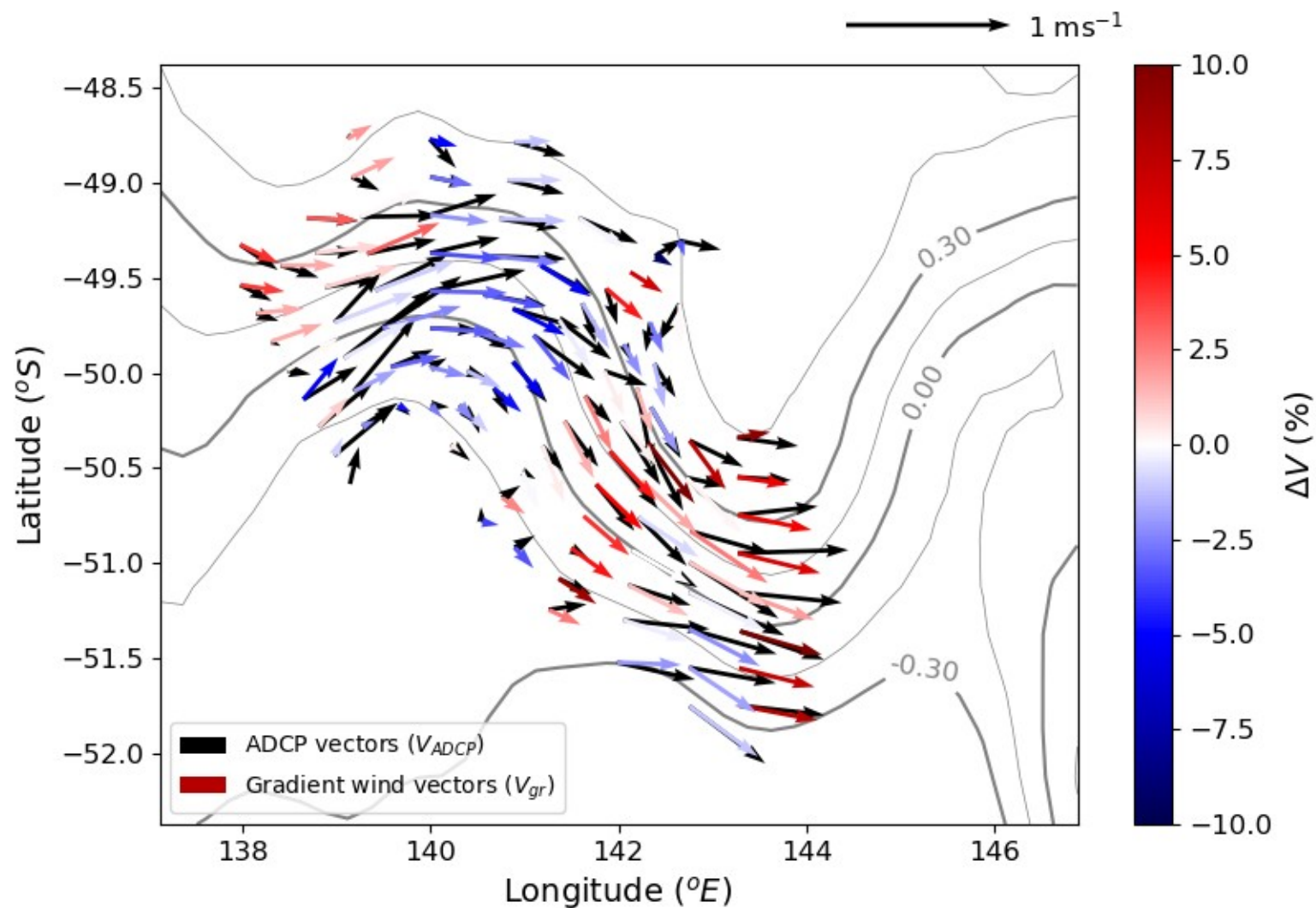
Gradient wind balance:

$$\frac{V^2}{R} + fV = -\frac{\partial \eta_{SSH}}{\partial n}$$

Normalised speed difference:

$$dV = \frac{V - V_g}{V_g} \cdot 100\%$$

# Horizontal velocity structure



# Conclusions

- Water transformations in upper/ lower layer
- Heaving important in trough and crest
- Mixing in between trough and crest
- Front separation in crest, when flow accelerates
- Increase in velocities  $\leftrightarrow$  isopycnal tilt/  
gradient velocity
- Upwelling/ downwelling?
- Heat transport across front?

Thank you for listening!

Questions?