New findings on the Brazil Current structure at its formation region

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General Review: Mean Circulation

General Review: Synoptic Circulation

Our Recent Results

Ongoing and Future Work

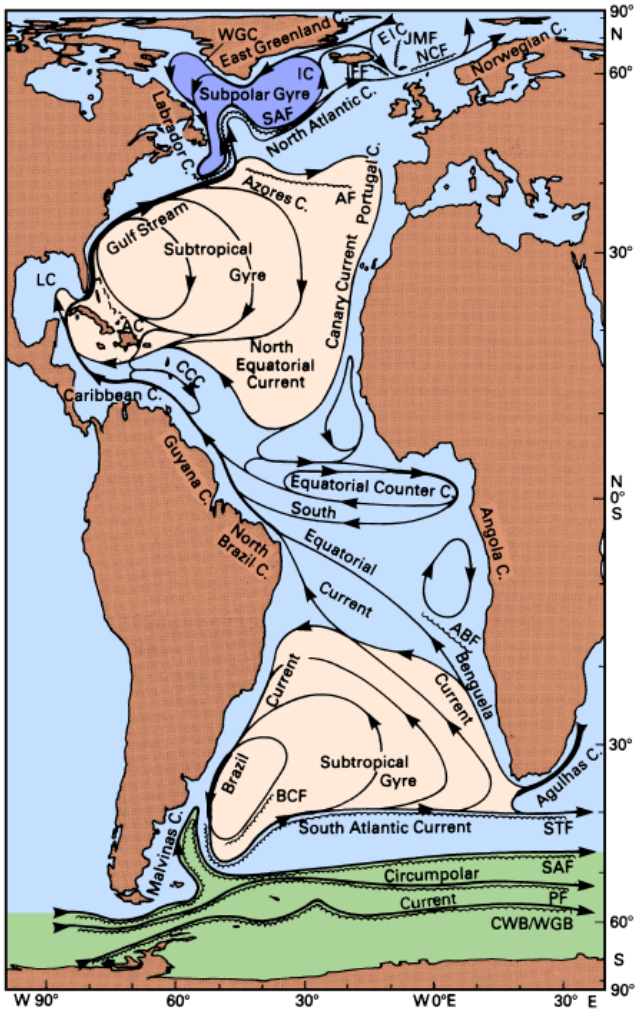
General Review: Mean Circulation

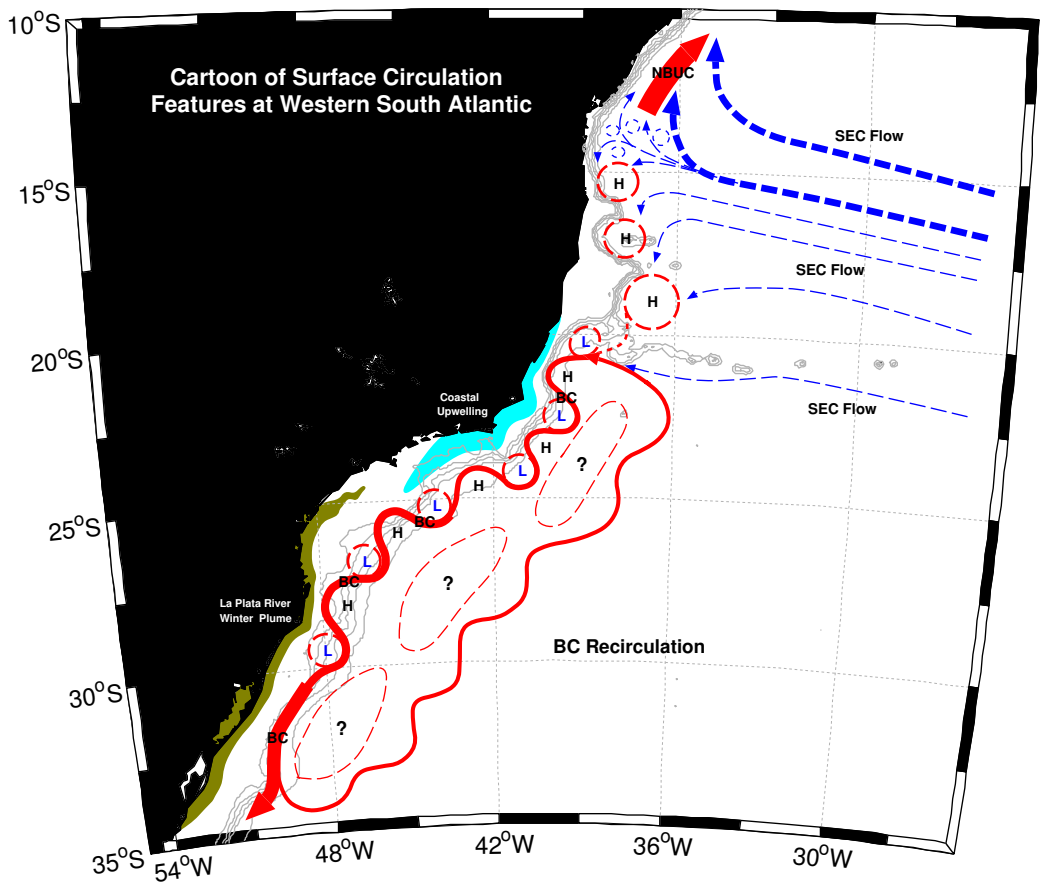
General Review: Synoptic Circulation

Our Recent Results

Ongoing and Future Work

Presenting the study area

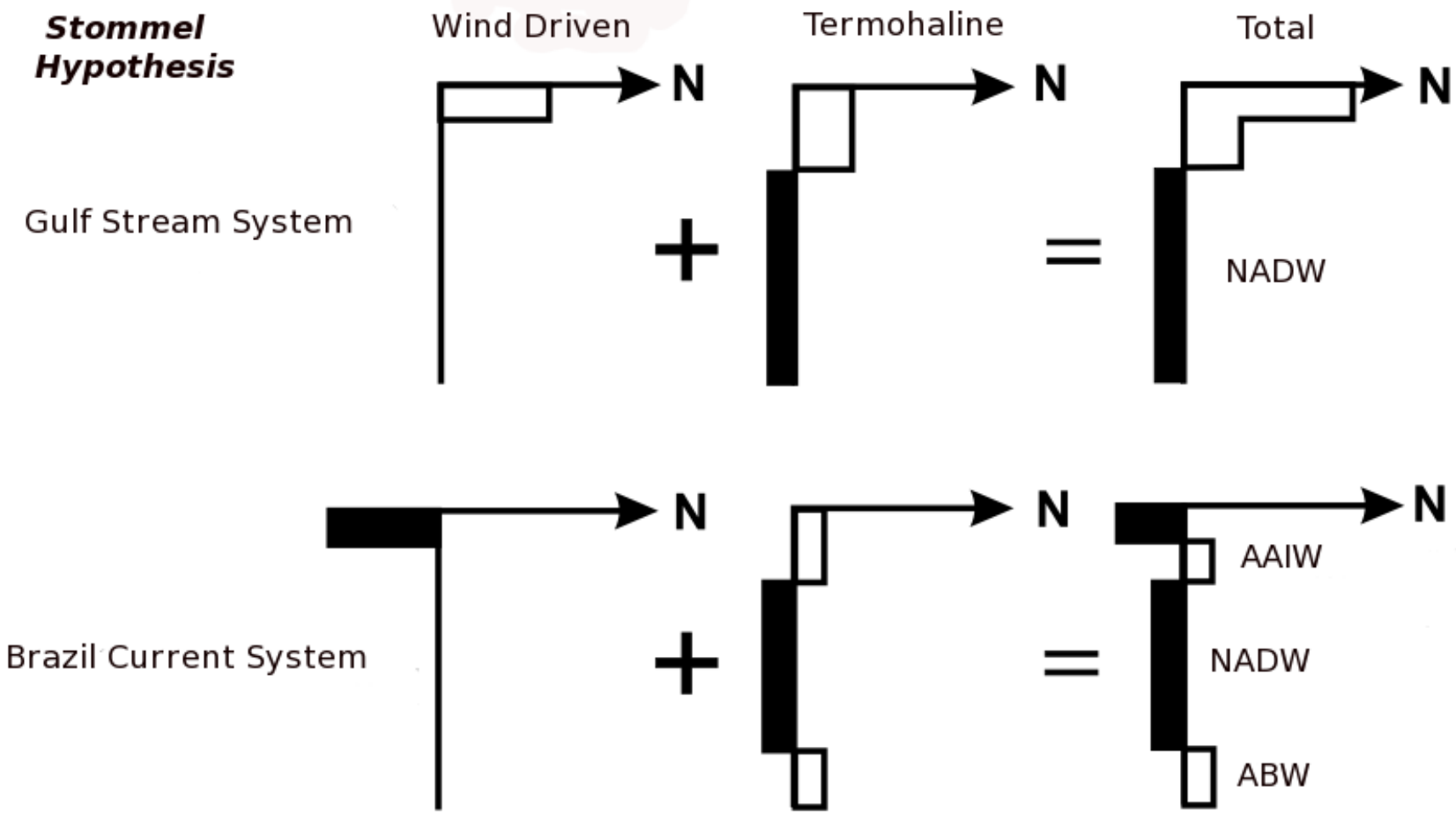




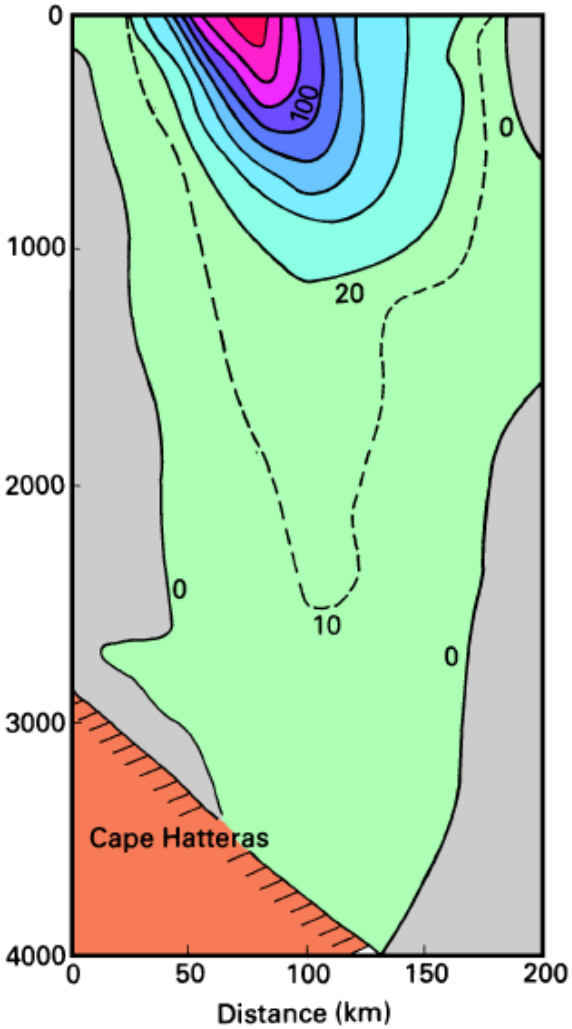
Tomczak - Regional Oceanography

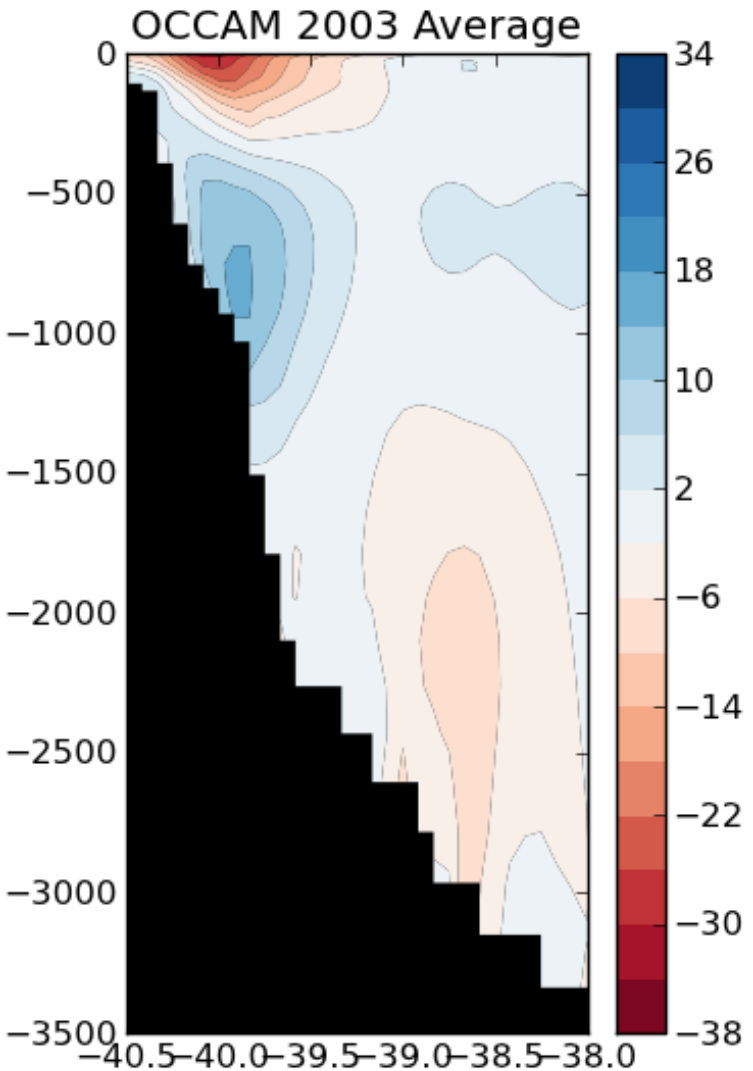
According to previous research

Gulf Stream System vs Brazil Current System



Gulf Stream System vs Brazil Current System

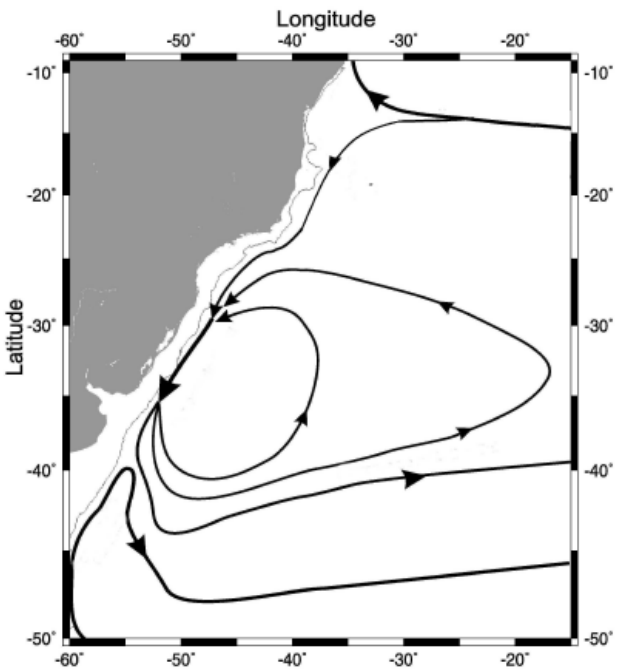




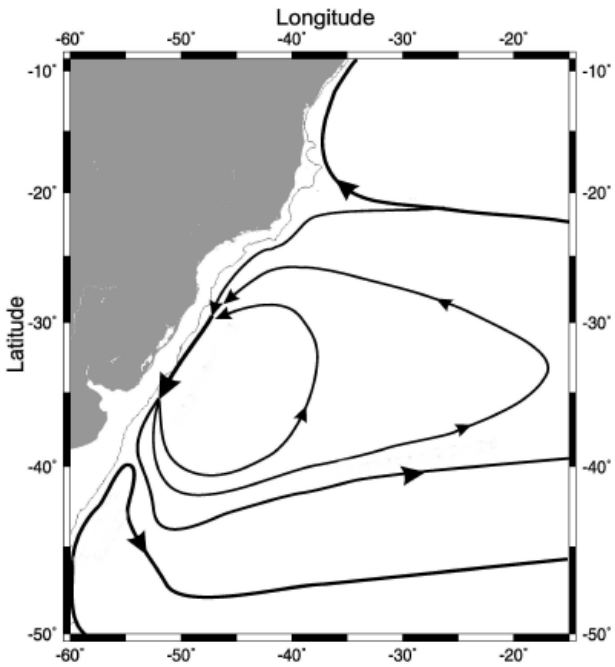
Tomczak - Regional Oceanography

Brazil Current System large scale review

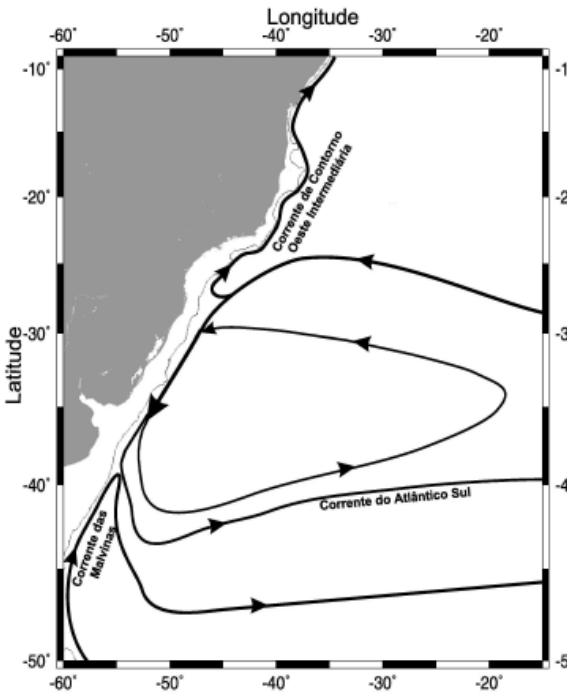
Near-surface



Pycnocline

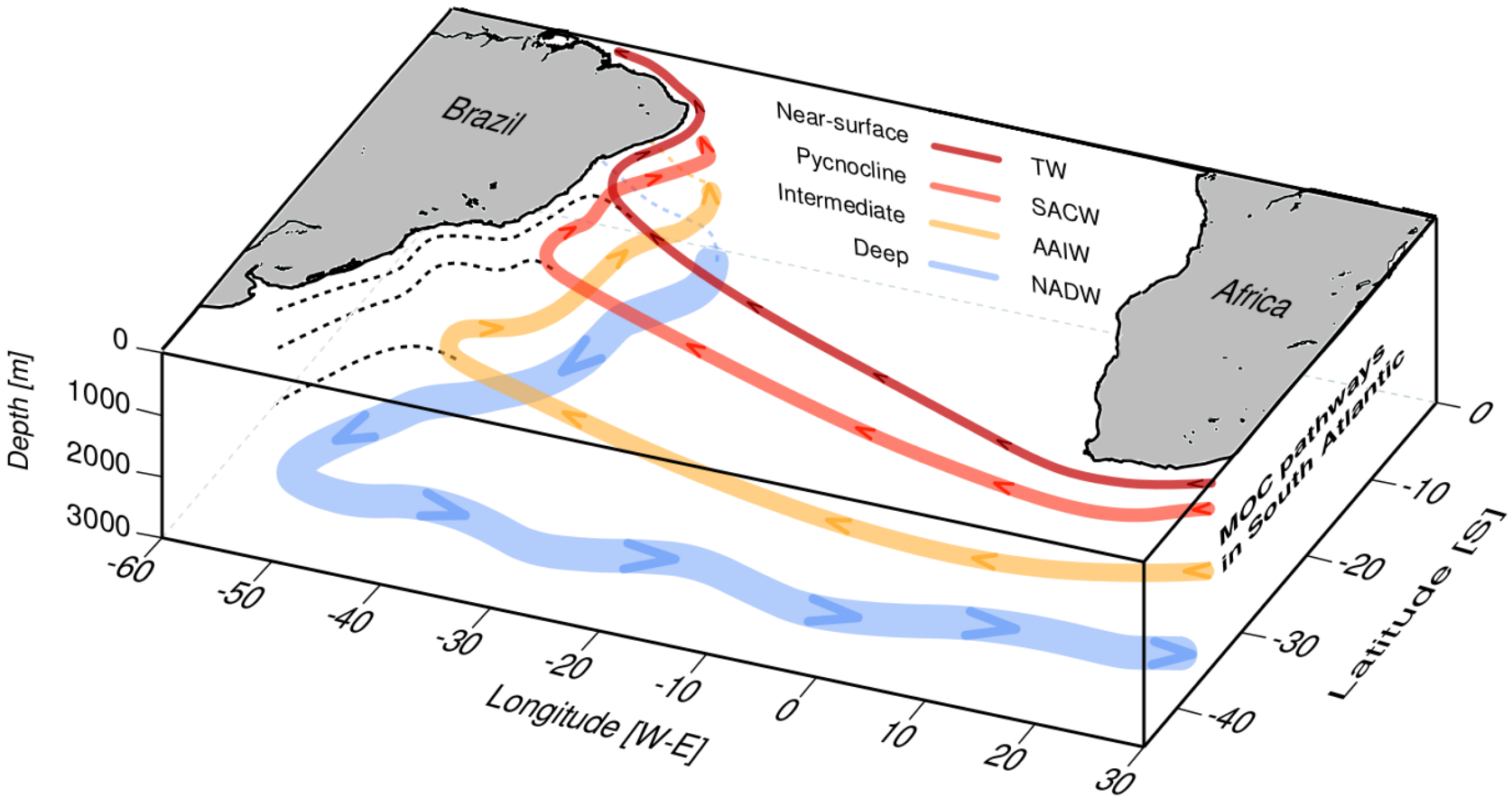


Intermediate Level



Silveira et al (2000); Stramma & Englang (1999)

Brazil Current System large scale review



According to previous research

General Review: Mean Circulation

General Review: Synoptic Circulation

Our Recent Results

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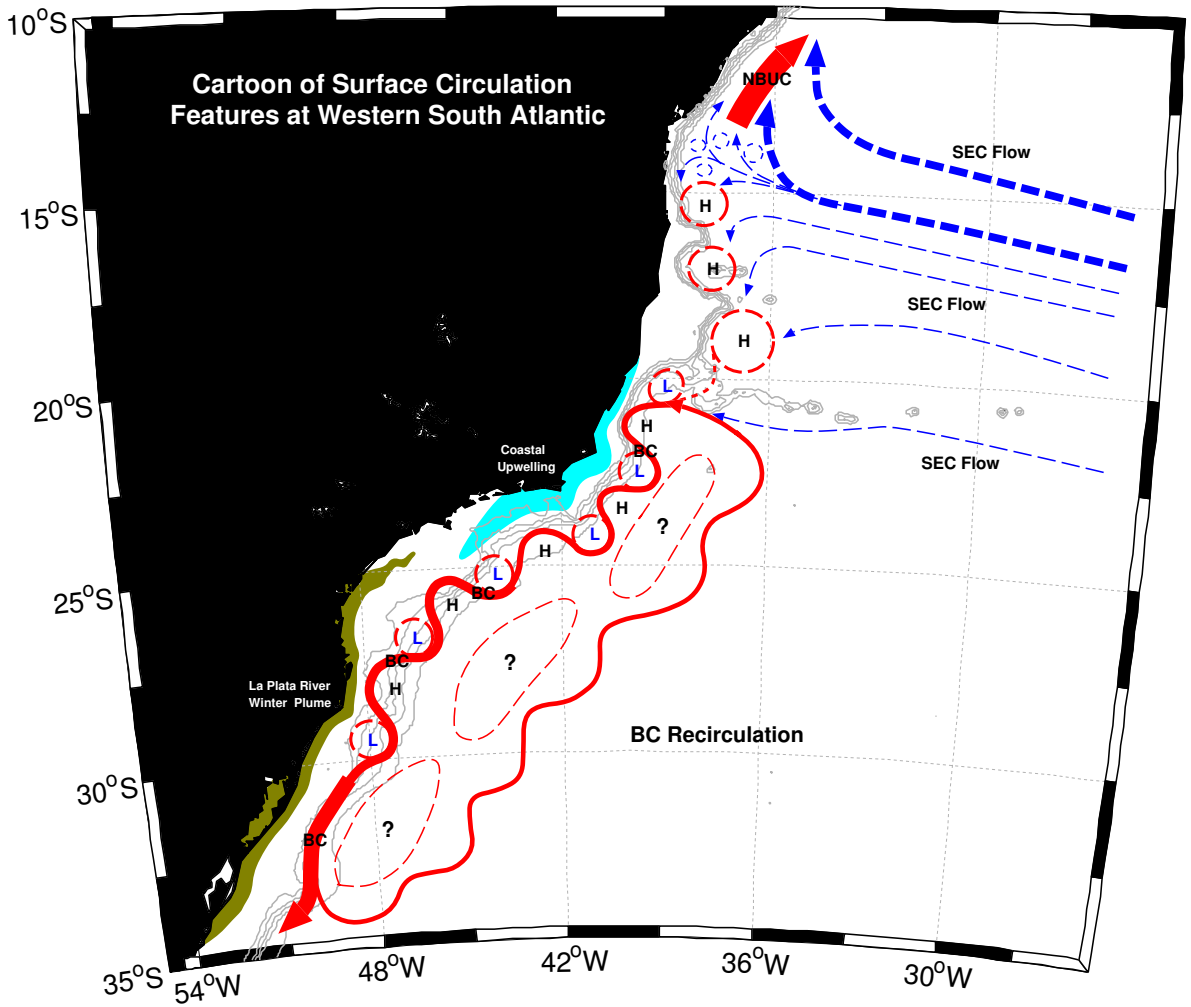
Broad impacts

Motivation to study synoptic circulation at BC origin

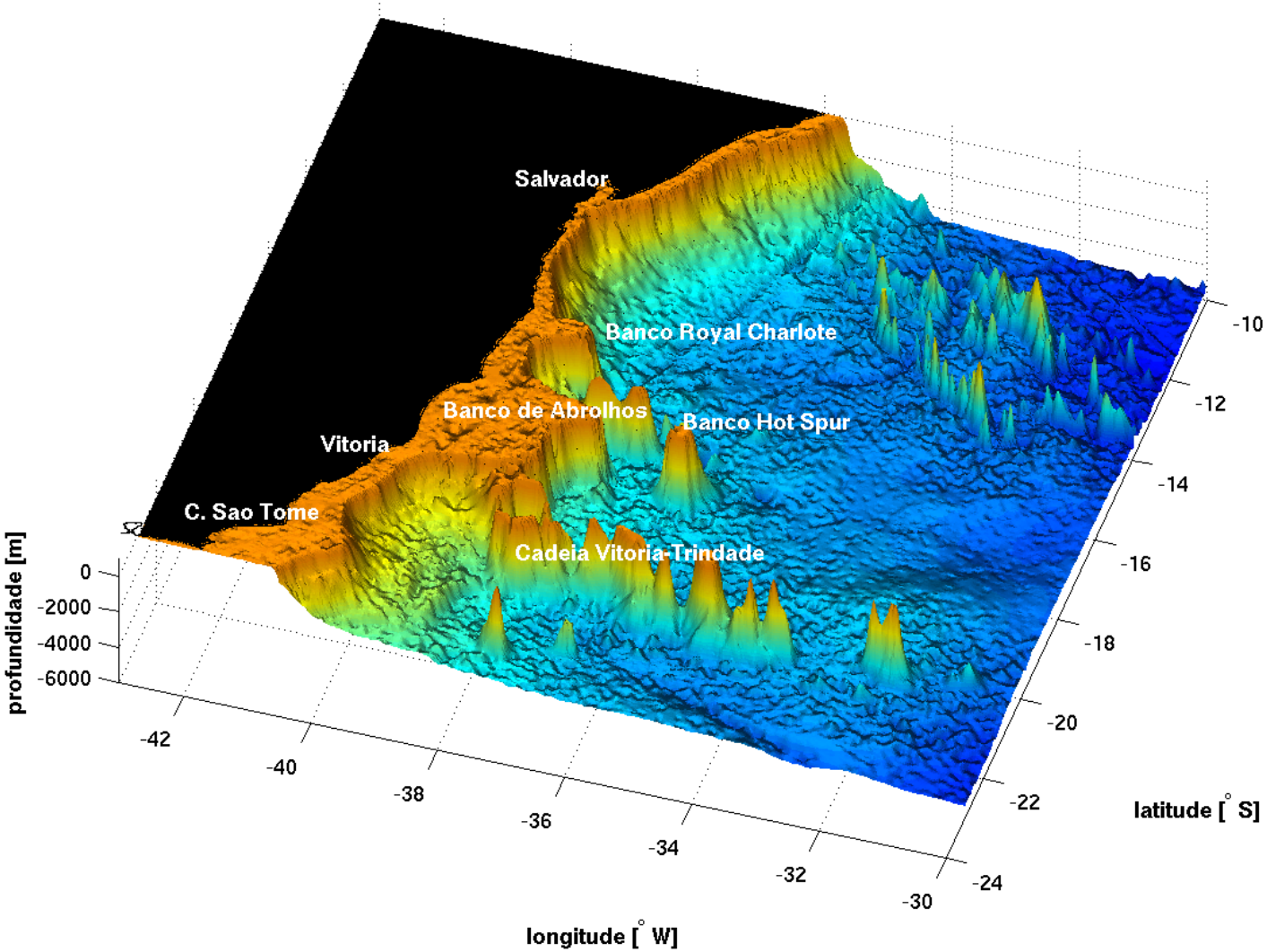
- ✓ Verify which typical mesoscale features occurs;
- ✓ Accurately represent real dynamics in numerical simulations, important to process understanding, nowcasting and forecasting;
- ✓ Annual and interannual variability - meridional overturning circulation;
- ✓ Shelf-slope interactions and exchanges;
- ✓ Sedimentological implications of deep currents;
- ✓ Biological implications of eddy activity.

Synoptic Circulation - SW Atlantic



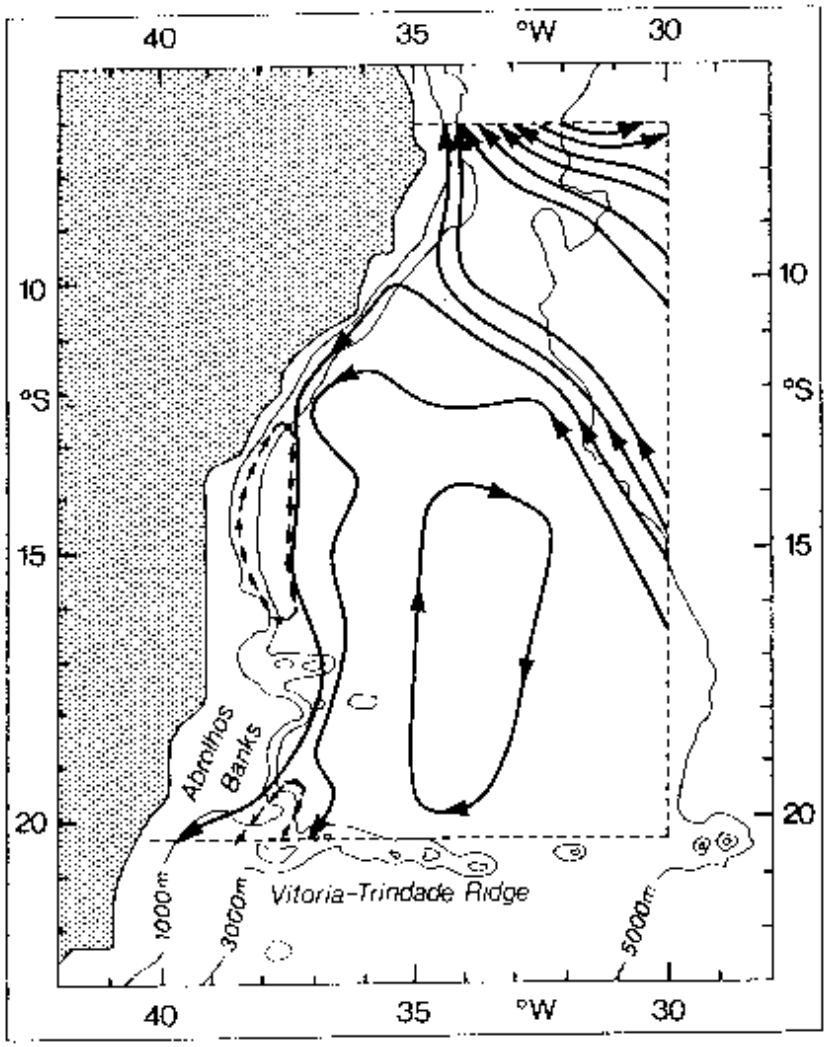
According to previous research

Synoptic Circulation - E Brazil review



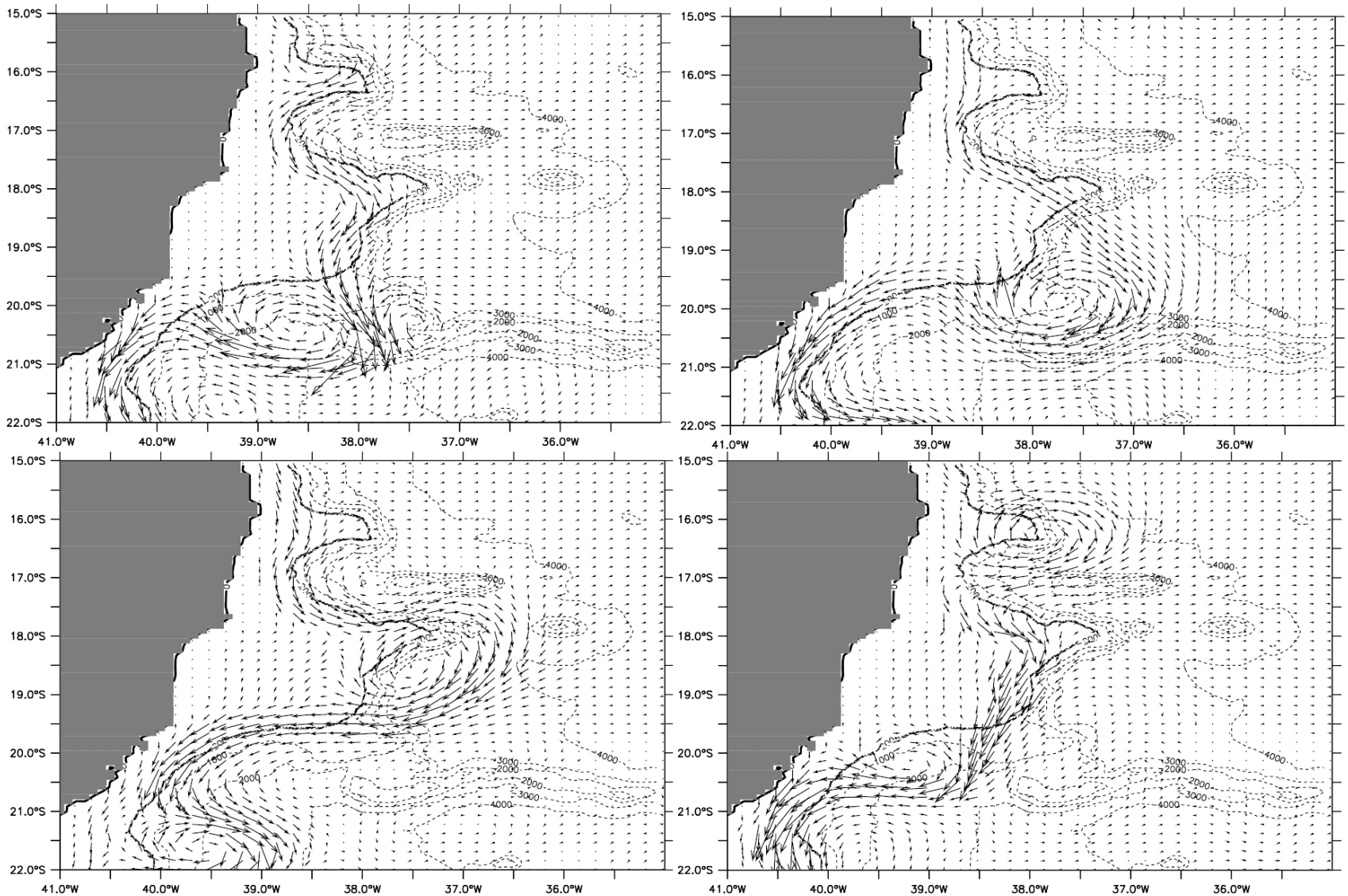
Mapped from ETOPO 2'

Synoptic Circulation - E Brazil review



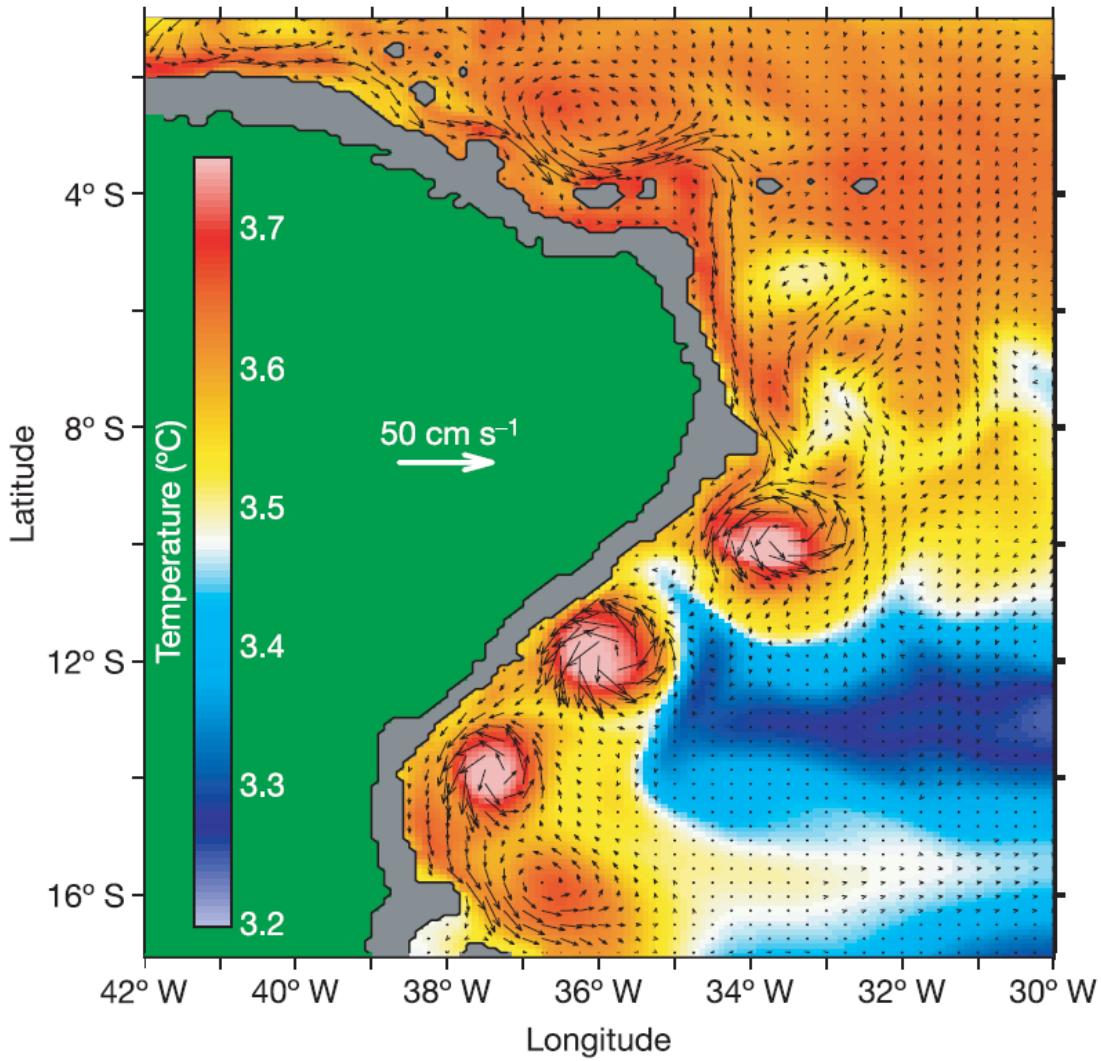
Stramma et al. (1990)

Synoptic Circulation - E Brazil review



Campos (2006)

Synoptic Circulation - E Brazil review



Dengler et al. (2004)

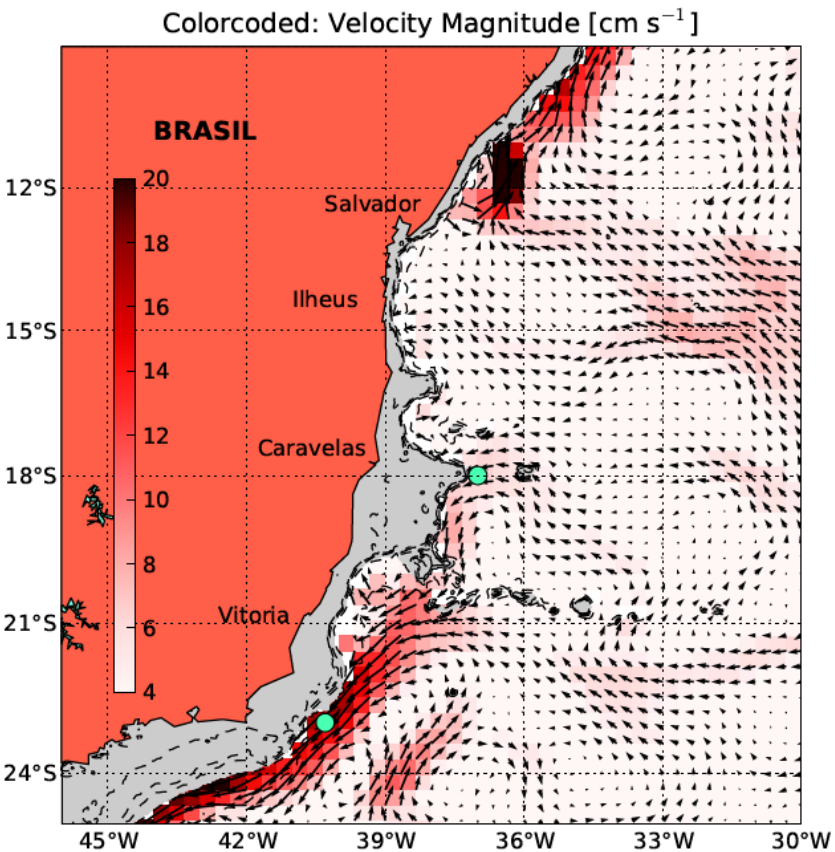
General Review: Mean Circulation

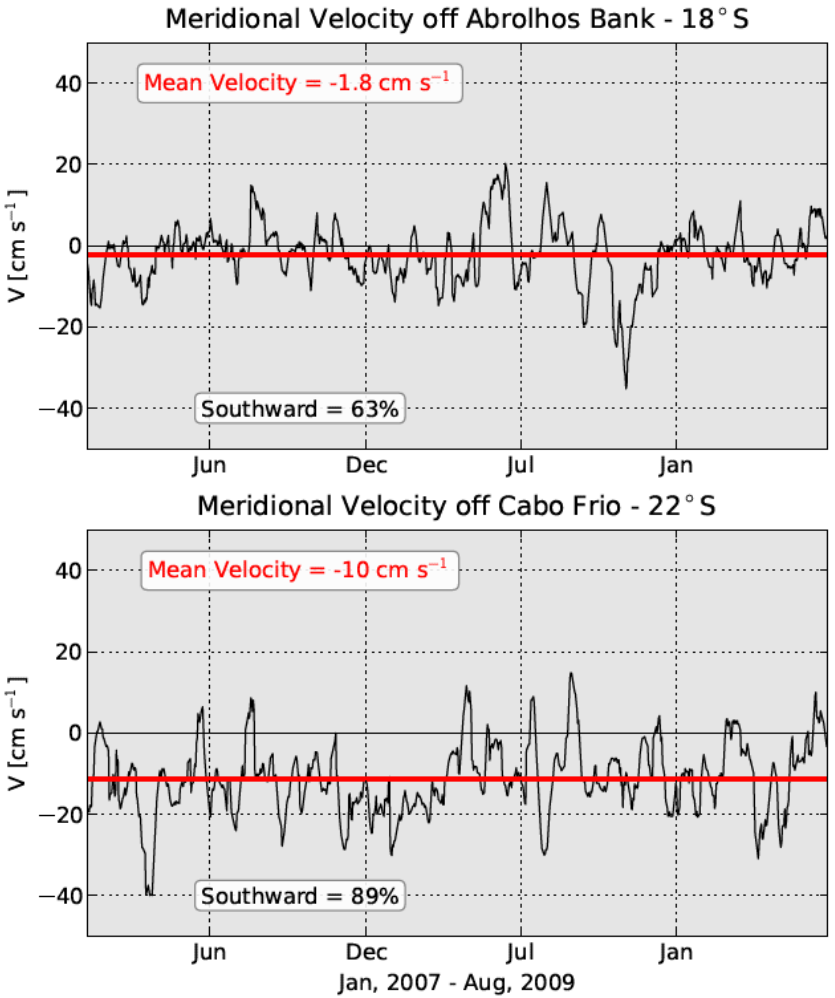
General Review: Synoptic Circulation

Our Recent Results

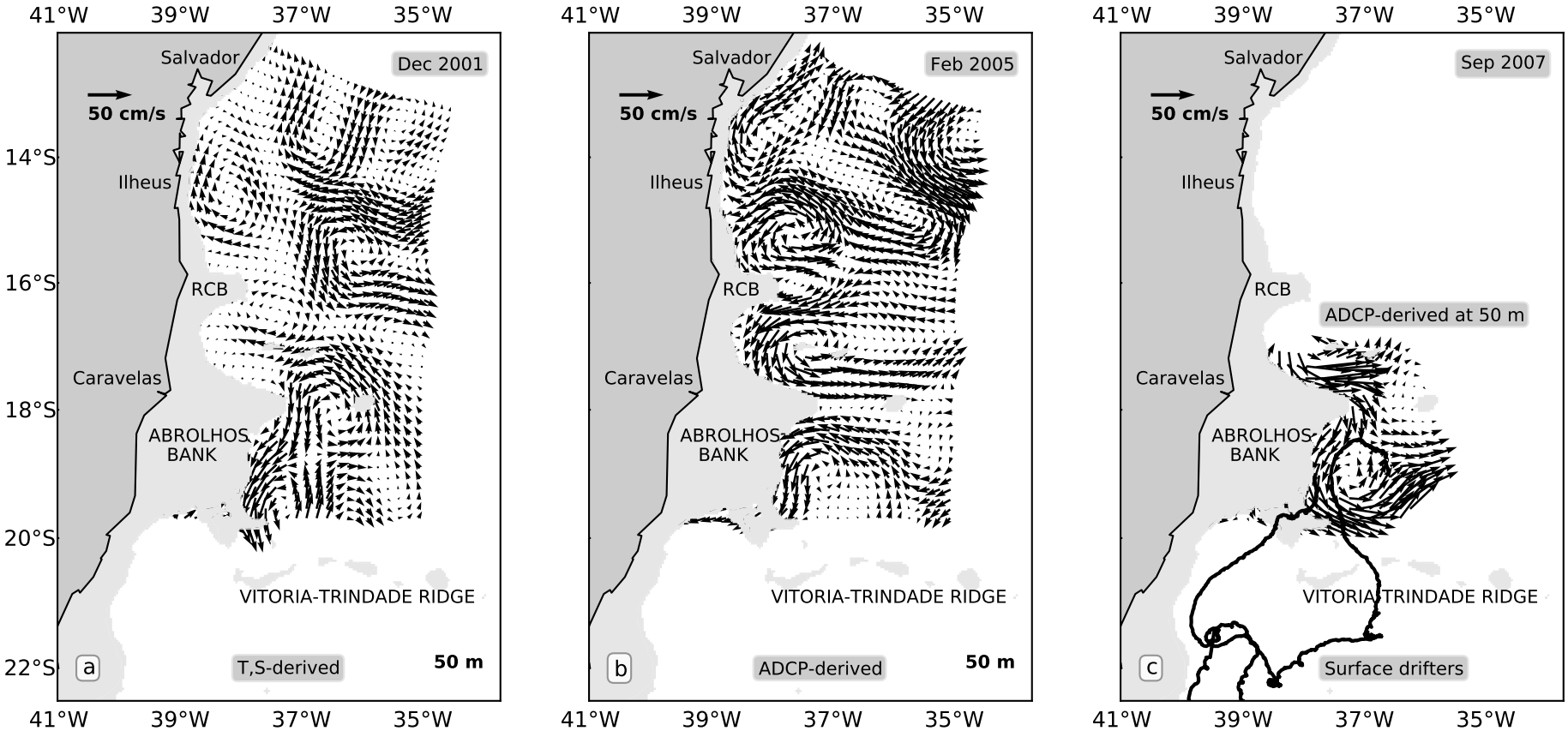
Ongoing and Future Work

Synoptic Circulation - E Brazil - recent results



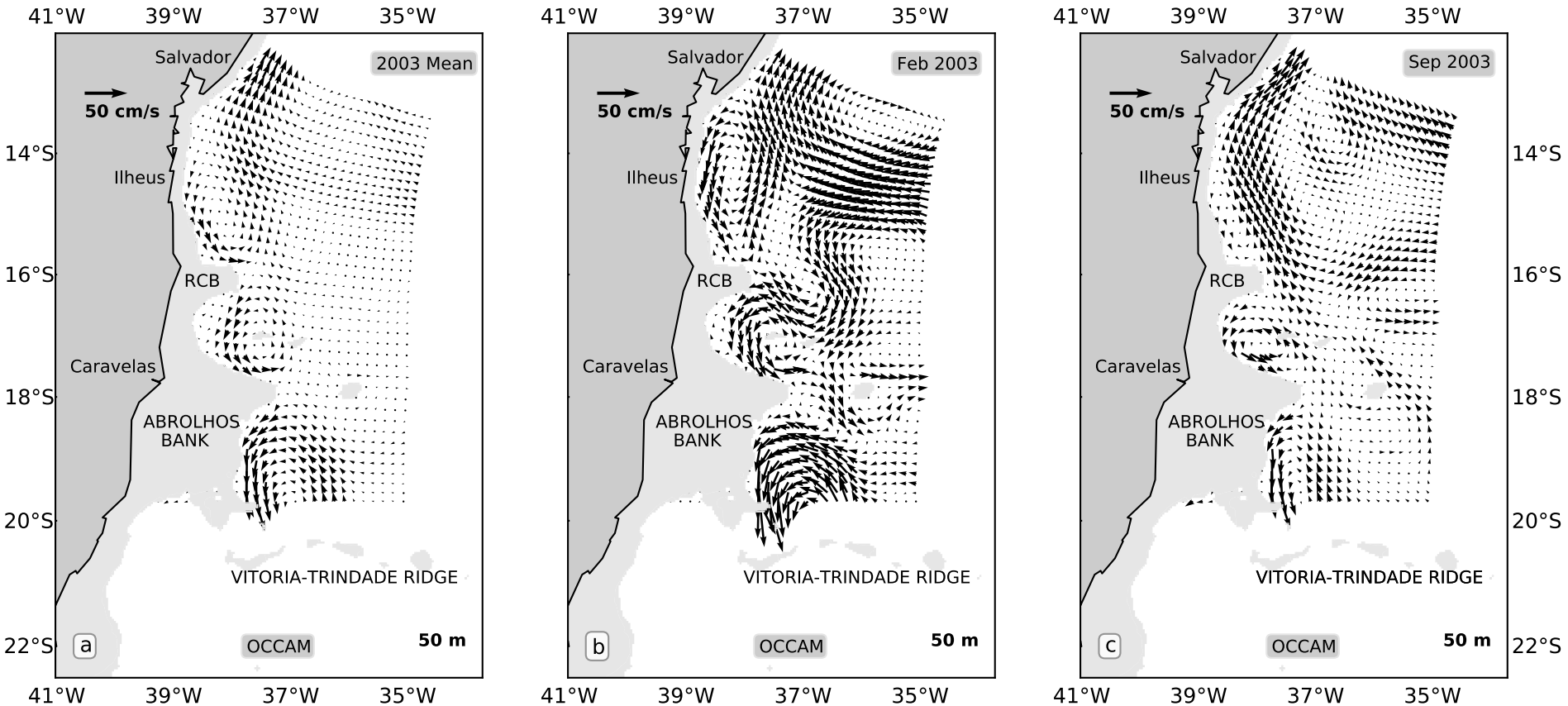


Synoptic Circulation - E Brazil - recent results



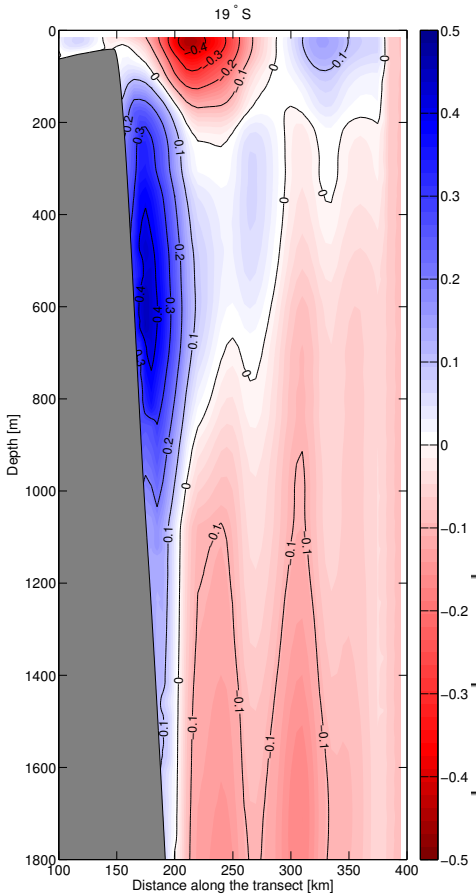
Soutelino et al. (2011)

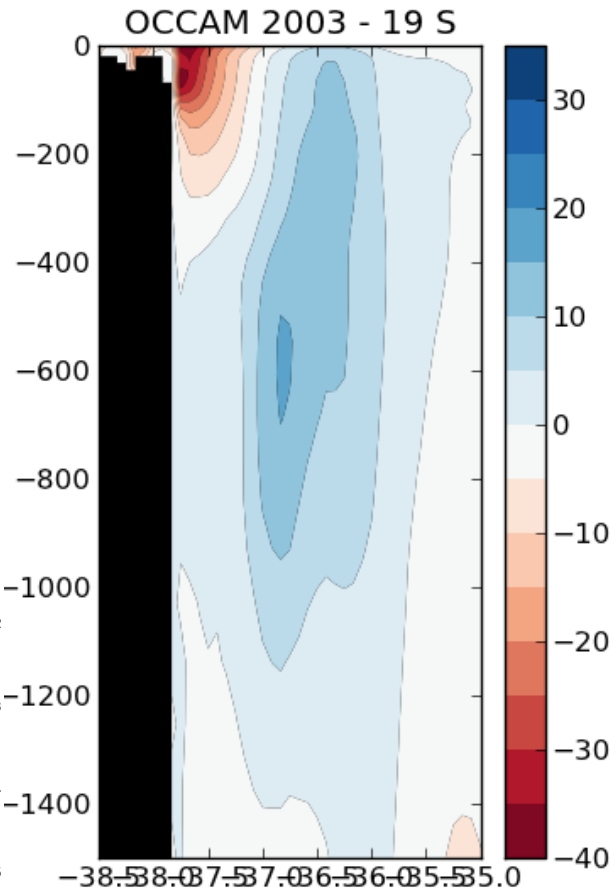
Synoptic Circulation - E Brazil - recent results



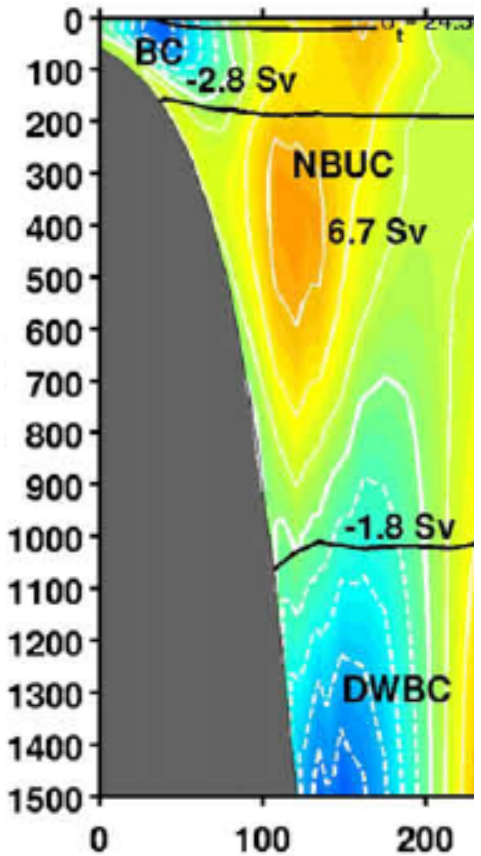
Soutelino et al. (2011)

Synoptic Circulation - E Brazil review





Miranda (2007)



Silva et al. (2009)

General Review: Mean Circulation

General Review: Synoptic Circulation

Our Recent Results

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Possible genesis mechanisms for the anticyclones

- Local dynamics:
  1. Topography
  2. BC-NBUC vertical shear-based instabilities
- Remote dynamics:
  1. Impinging WNW propagating Agulhas Rings

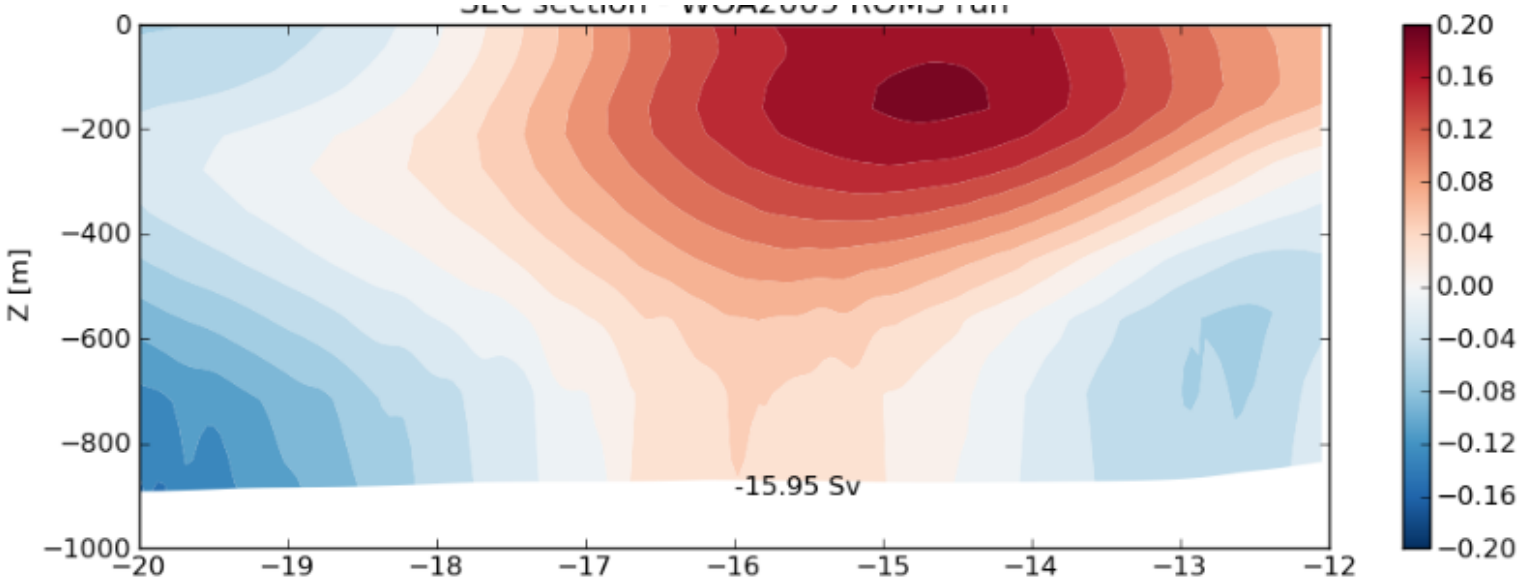
Strategies to test the hypothesis

FORMS Technique: *Gangopadhyay et al. (1997)*

- ✓ Identify the synoptic circulation features;
- ✓ Build parametric representations of the features (Feature Model - FM);
- ✓ Combine obtained FMs in idealized regional simulations.

Present work FORMS approach: ROMS FM-based semi-idealized numerical process studies to identify the role of each feature or the combination of them in the eddy generation in the region.

Realistic SEC



SEC-FM Formulation

$$\mathcal{U}(y,z) = u_0(z).exp\left[-\frac{(y-y_0(z))^2}{2\delta^2}\right]$$

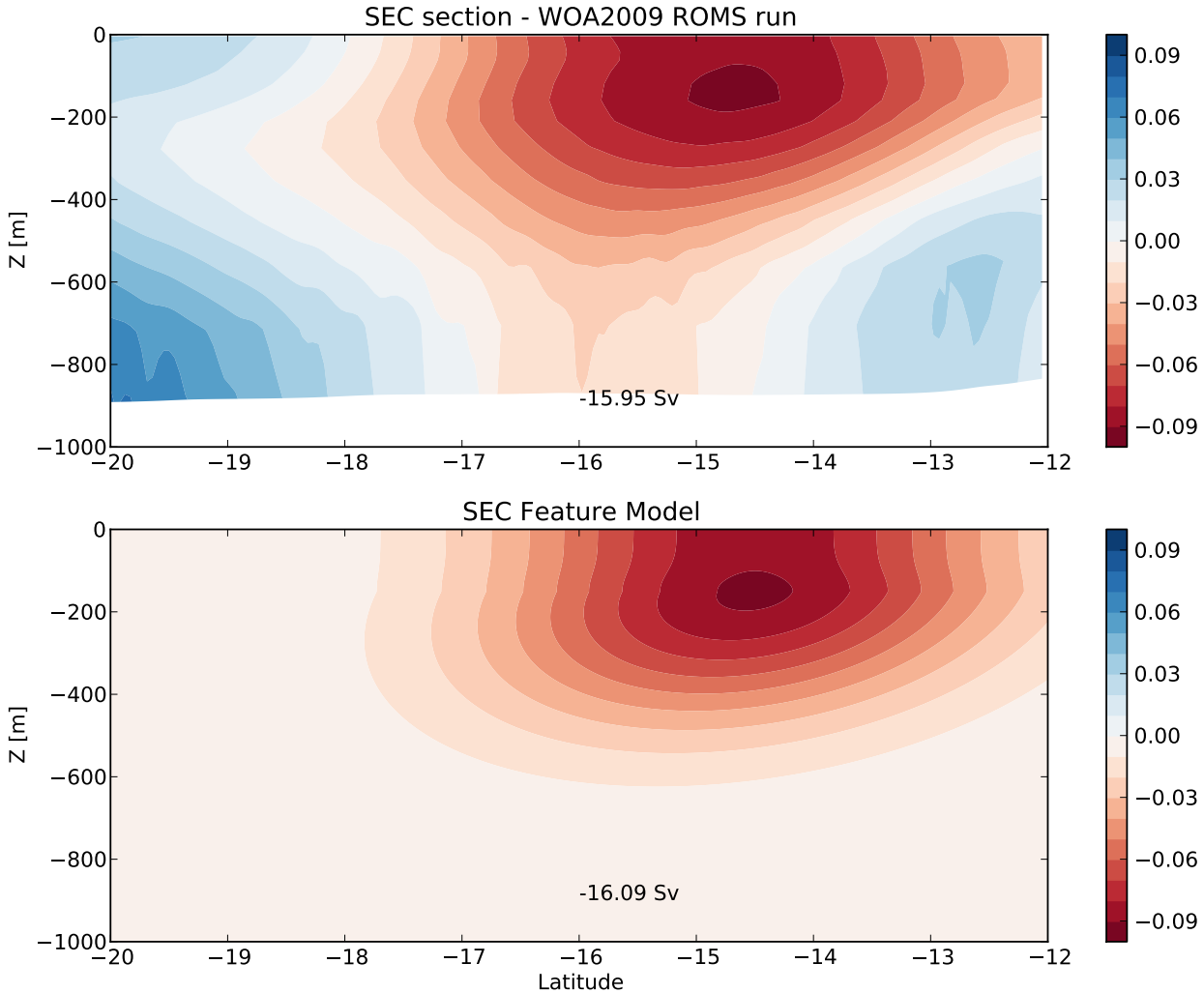
$$u_0(z) = (u_{core} - u_{surf}).exp\left[-\frac{(z-z_{core})^2}{2\delta_s^2}\right] + u_{surf}, \quad @ \quad z_{core} < z < 0$$

$$u_0(z) = (u_{core} - u_{bot}).exp\left[-\frac{(z-z_{core})^2}{2\delta_b^2}\right] + u_{bot}, \quad @ \quad z_{bot} < z < z_{core}$$

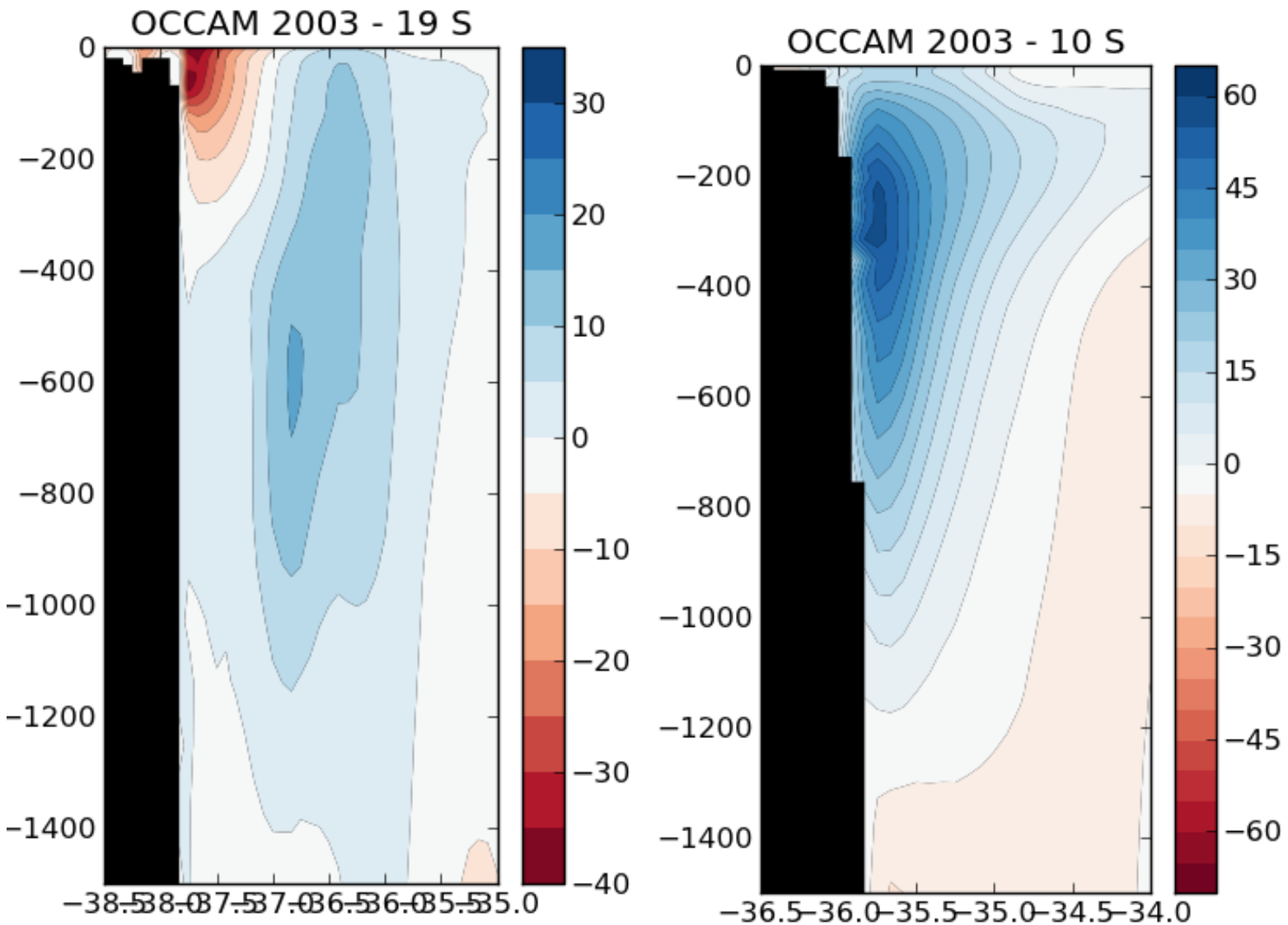
$$y_0(z) = y_{core}, \quad @ \quad z_{core} < z < 0$$

$$y_0(z) = 2x10^{-1}z + 6x10^2, \quad @ \quad z_{bot} < z < z_{core}$$

Realistic SEC vs SEC-FM



Realistic NBUC



NBUC-FM Formulation

$$\mathcal{V}(x,y,z) = v(y,z).exp\left[-\frac{(x-x_{core})^2}{2\delta^2}\right]$$

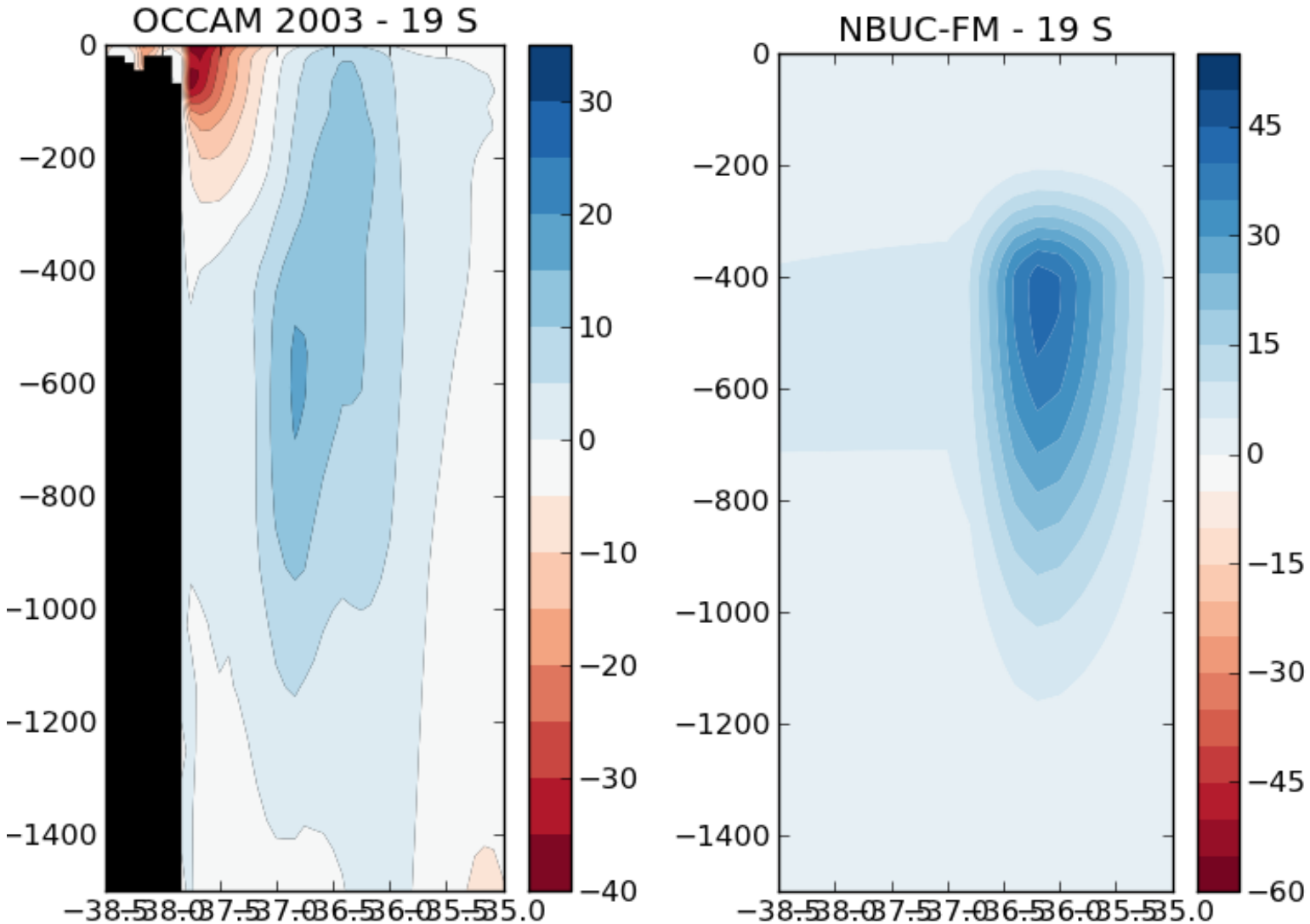
$$v(y,z) = v_0(y).exp\left[-\frac{(z-z_{core}(y))^2}{2\delta_s^2}\right], \quad @ \quad z_{core} < z < 0$$

$$v(y,z) = v_0(y).exp\left[-\frac{(z-z_{core}(y))^2}{2\delta_b^2}\right], \quad @ \quad z_{bot} < z < z_{core}$$

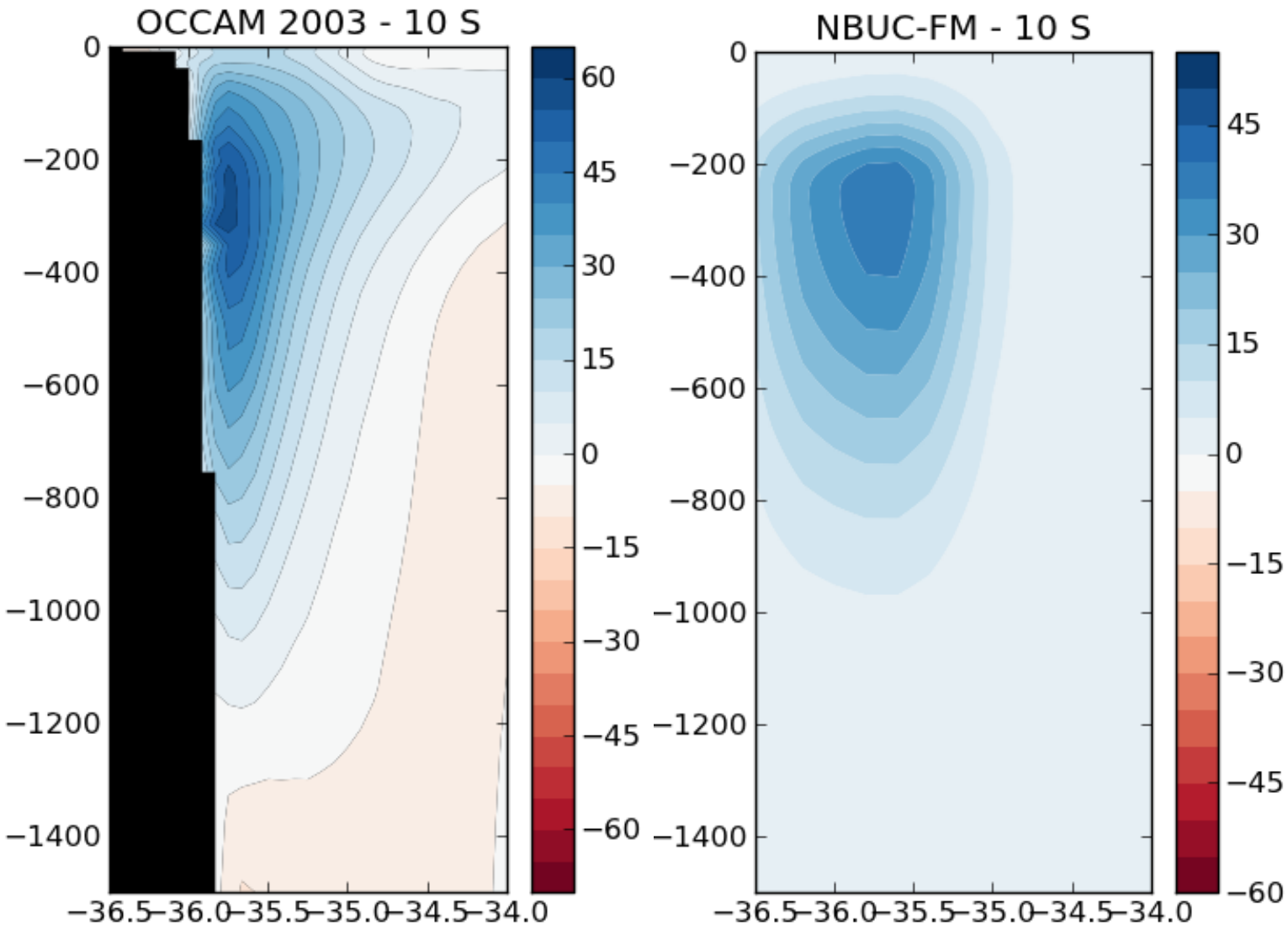
$$v_0(y) = 8.2x10^{-5}y + 7x10^{-2}$$

$$z_{core}(y) = 0.2y - 3.5x10^2$$

Realistic NBUC vs NBUC-FM



Realistic NBUC vs NBUC-FM



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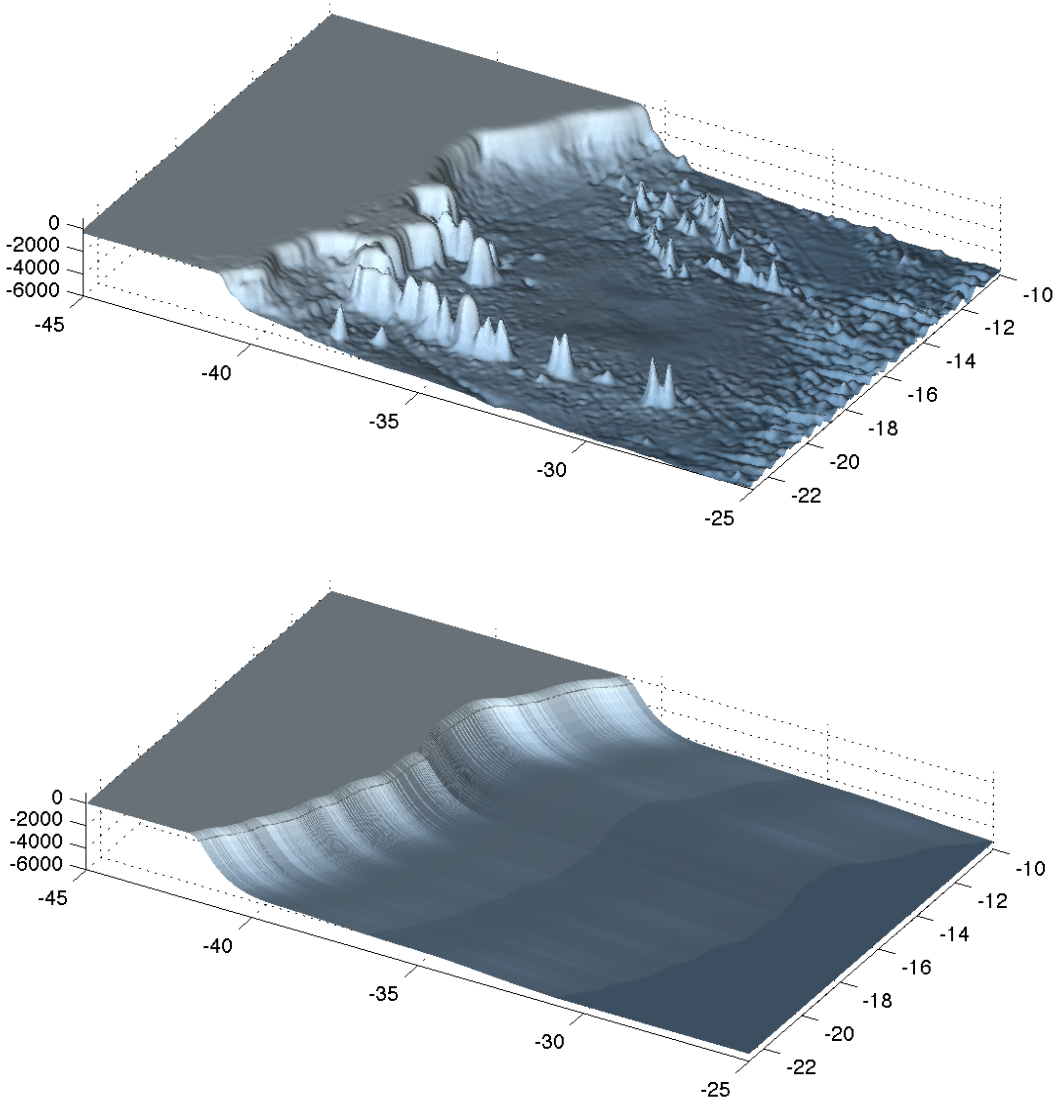
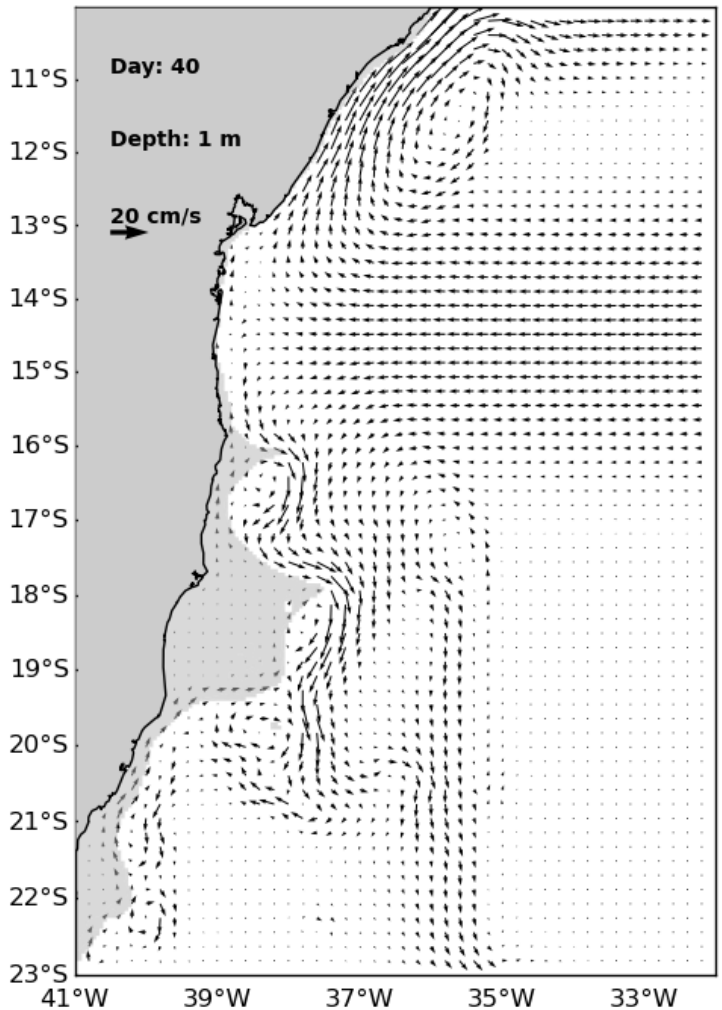
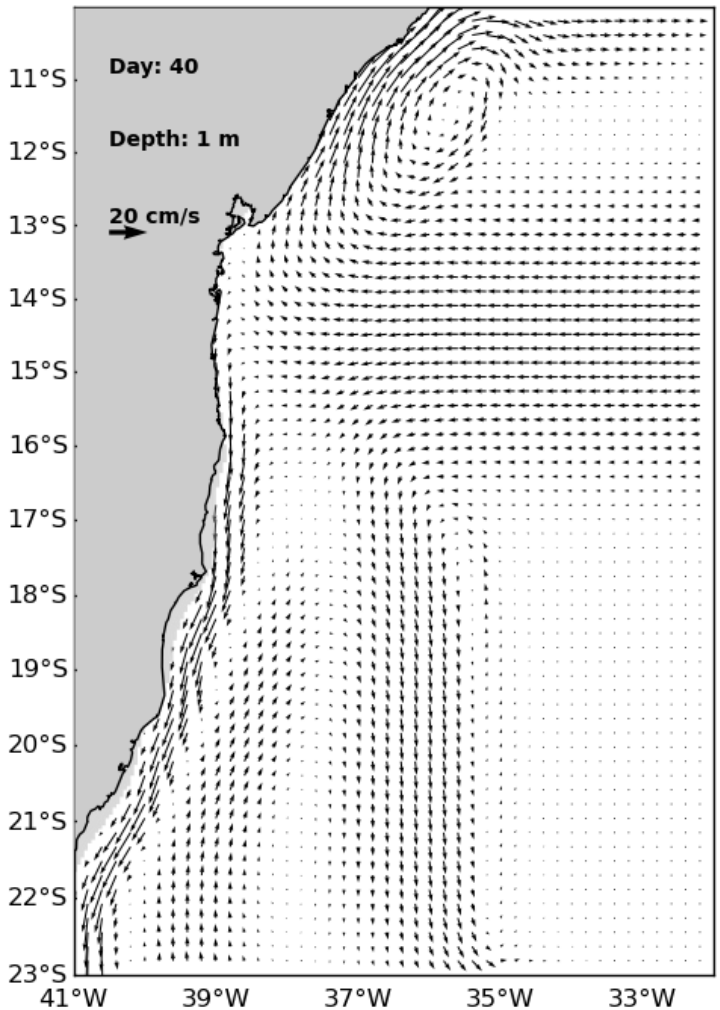
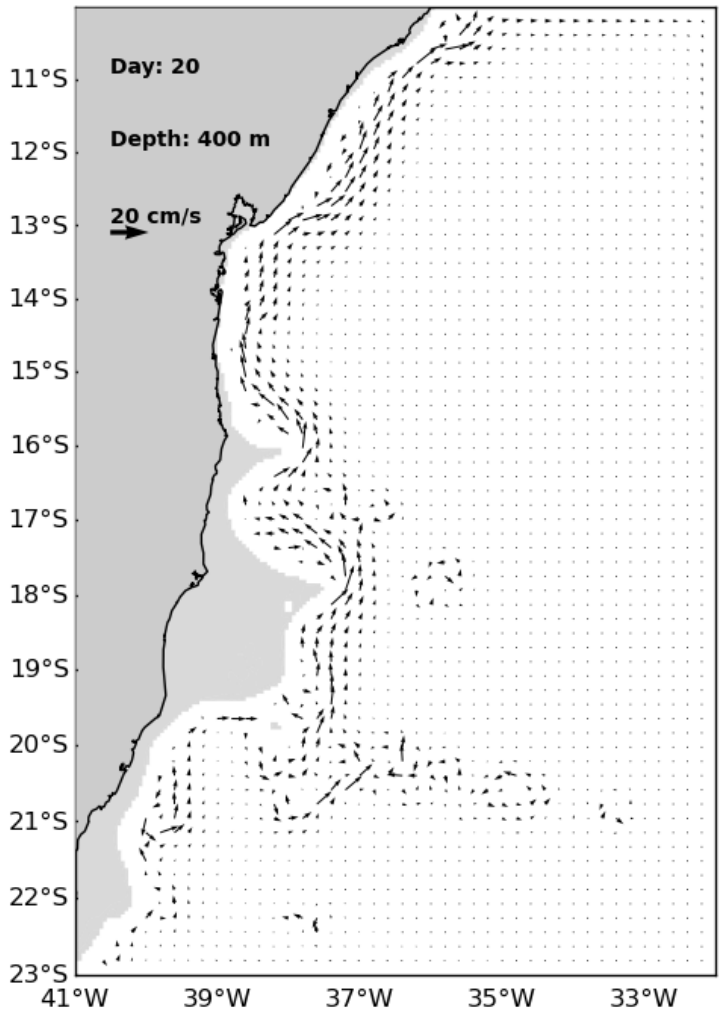


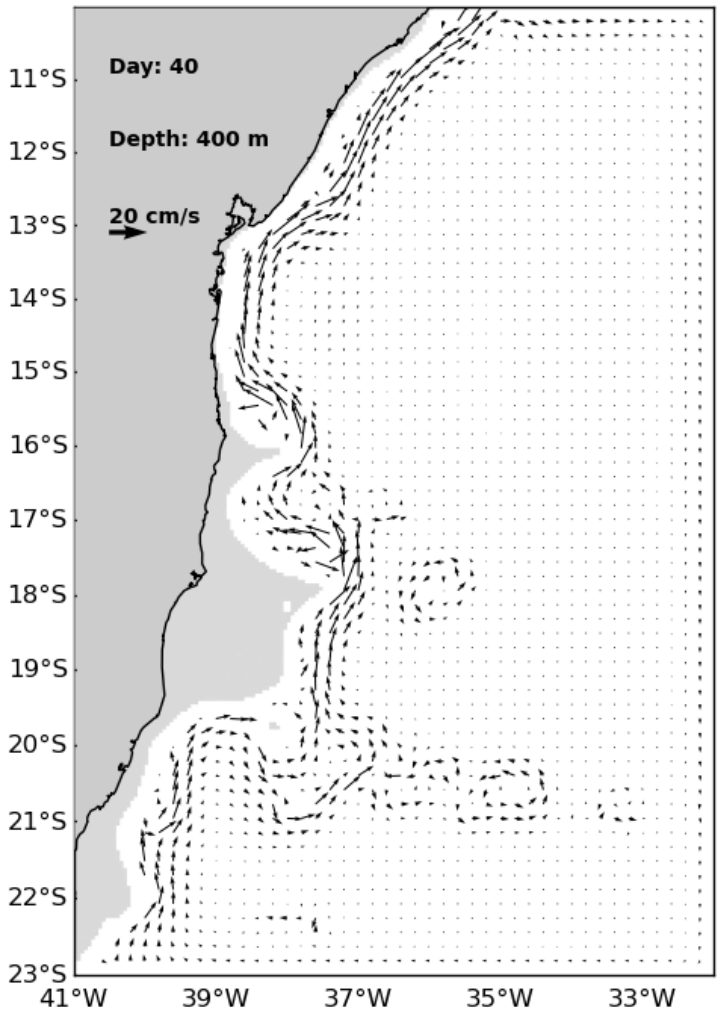
SEC-FM simple adjustment





NBUC-FM simple adjustment





Next steps

These next steps aim to obtain the yet not generated anticyclones through these local forcing mechanisms.

- Combine SEC and NBUC FMs with flat bottom;
- Combine SEC and NBUC FMs with real topography;
- Investigate the solution sensibility to variations in kinematic FM parameters.

Future experiments may include deep layer southward flow.

Thank you!

Obrigado!