Brazil-Malvinas Confluence

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Final Project

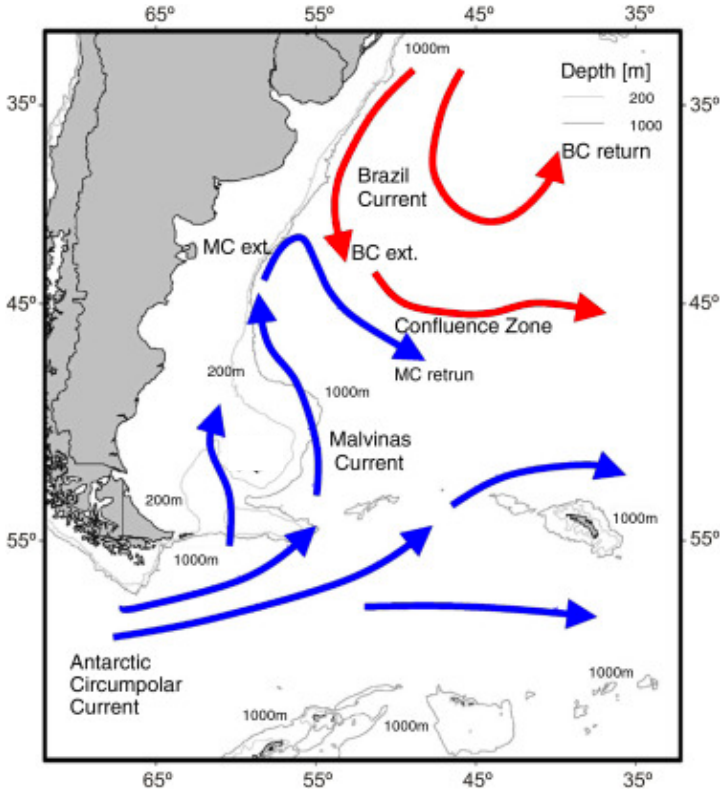
GFD 2

Outline

- Brazil-Malvinas Confluence (BMC)
- Drifter Dataset
- Surface Velocity
- Location of the BMC
- Takeaway notes

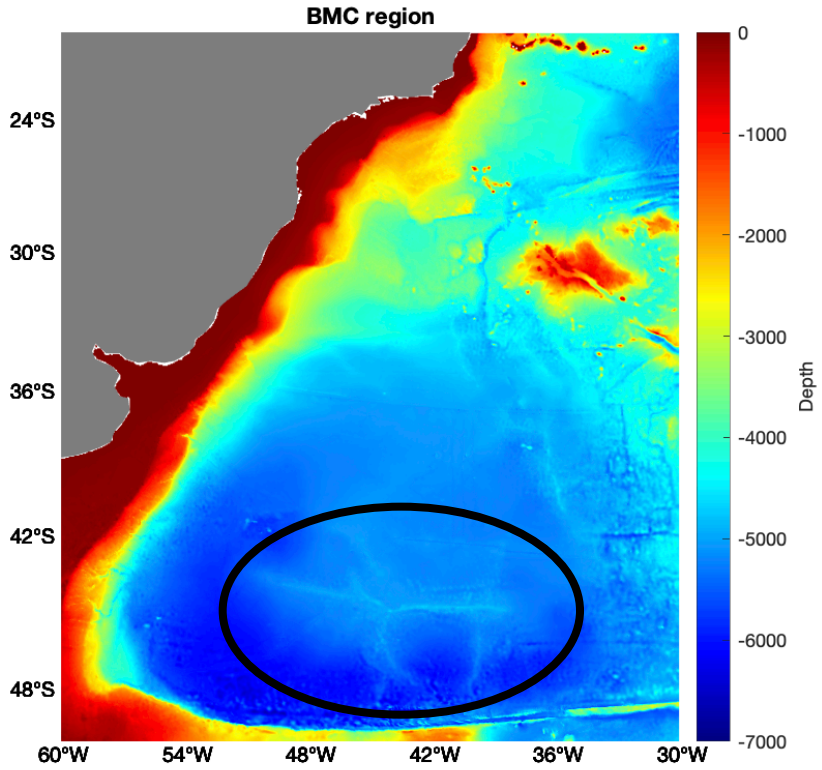
Brazil-Malvinas Confluence (BMC)

- The mean position of the BMC is located near 38 °S
  - Influenced by seasonality (Olson et al. 1988; Garzoli and Garaffo 1989).
  - The driving processes for this seasonal variability remain unclear (Julion et al. 2010).
  - Variability of the BMC position is partially influenced by variations in the MC transport (MODEL)
    - linked to fluctuations in the ACC transport and in the wind stress over the Southern Ocean (Matano 1993; Wainer et al. 2000; Fetter and Matano 2008).
  - Variability of the position of the BMC is forced primarily by the local wind field (Garzoli and Giulivi 1994) (OBS).



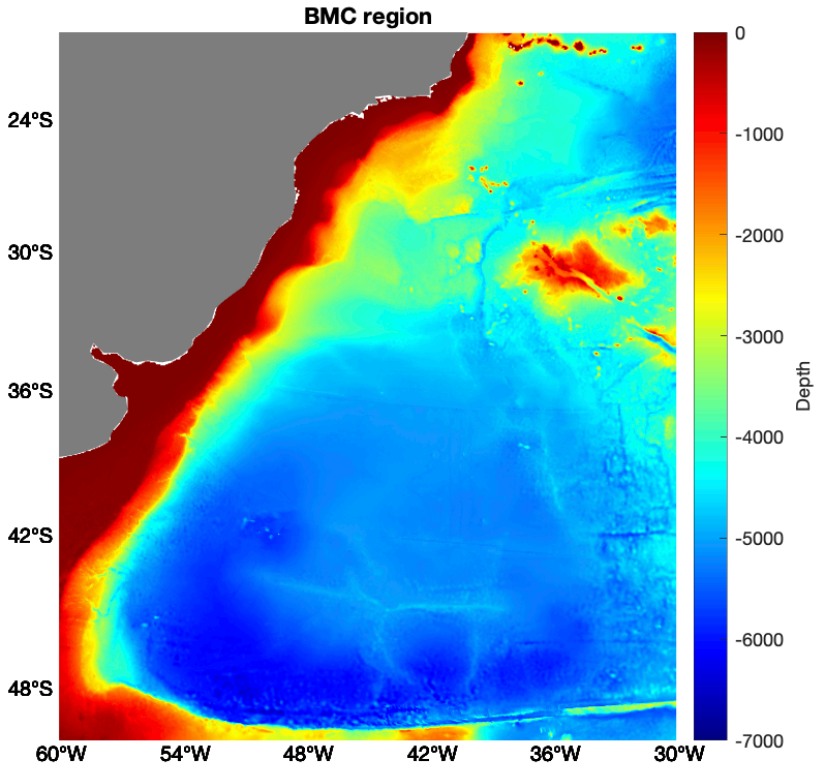
Brazil-Malvinas Confluence (BMC)

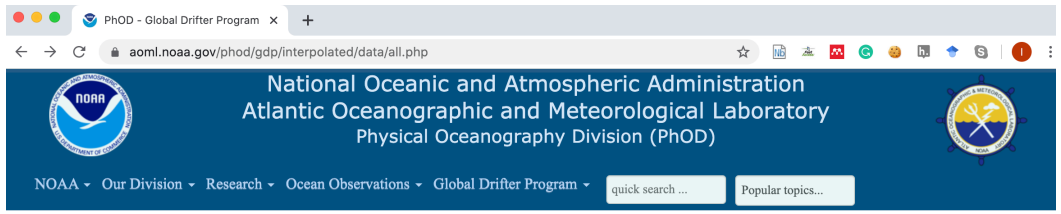
- The circulation of the BMC is greatly influenced by the presence of the Zapiola Rise
  - a sediment mount that extends zonally along 45 °S between 36° and 51 °W.
    - Strong (~ 100 Sv) anticyclonic circulation (Saunders and King 1995).
    - Region of low eddy kinetic energy (EKE) surrounded by high EKE.
    - Saraceno et al. (2004) argued that a closed planetary vorticity contour around the rise acts as a boundary isolating the center of the circulation cell from the highly variable BMC.



Drifter Dataset

- 6 hourly- interpolated data
- From 2000 to 2019
- -50 to -20° S
- -60 to -30° W





MetaData

Interpolated Data

Six-Hourly Interpolated Data

Citation: Lumpkin, Rick; Centurioni, Luca (2019). Global Drifter Program quality-controlled 6-hour interpolated data from ocean surface drifting buoys. [indicate subset used]. NOAA National Centers for Environmental Information. Dataset. https://doi.org/10.25921/7ntx-z961. Accessed [date].

AOML receives position data computed from Doppler measurements from Argos-tracked drifters or from GPS installed in all Iridium and some Argos drifters. Historically, these data are irregularly distributed in time and they also contain erroneous positions and/or bad Sea Surface Temperature values, therefore not suited for many kinds of analysis or displays. The Drifter Data Assembly Center (DAC) at AOML applies quality control procedures to edit these data (position and temperature) and interpolates them to 6-hour intervals using an optimum interpolation procedure called kriging, which is commonly used for two and three-dimensional analyses. Some drifters have other sensors attached such as barometric pressure, salinity, wind speed and direction, but these data are stored in their raw form and kept in the archives, with no further editing done at the present time. See Hansen, D.V. and Poulain

interpolated_gld.20200330_051718

```
id date time lat lon t ve vn speed varlat varlon vart
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    3274 2003-05-03 12:00:00  -49.938  -54.119    6.148   -6.364   28.598   29.298
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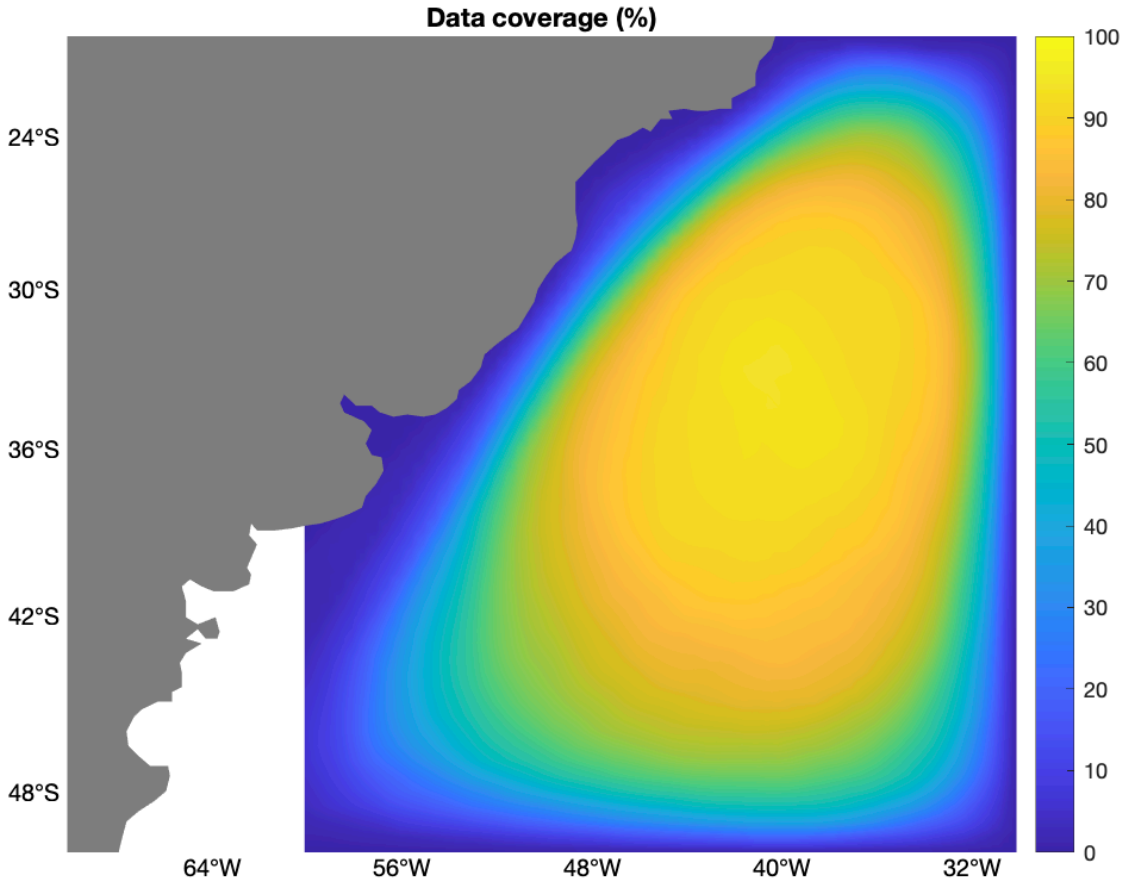
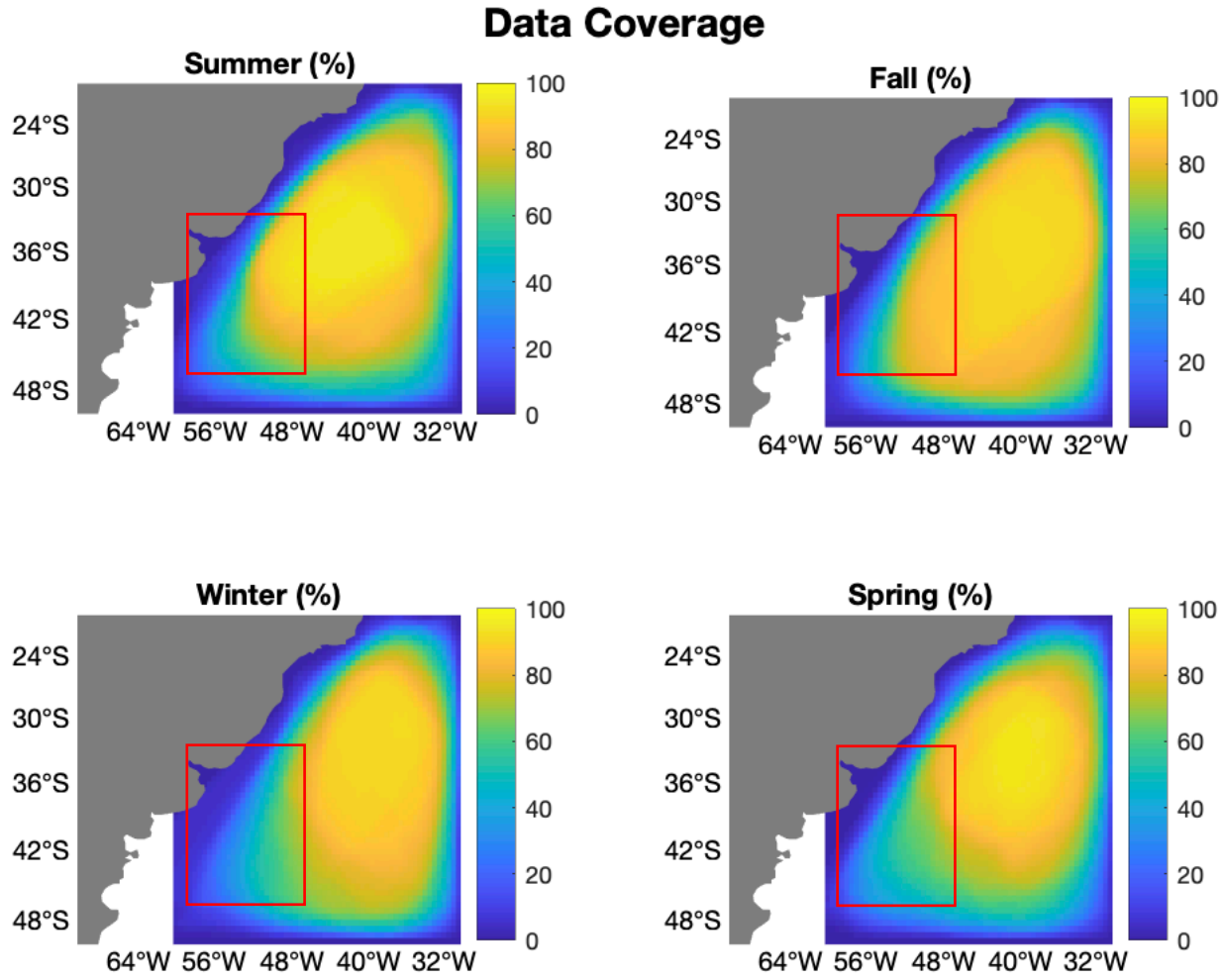
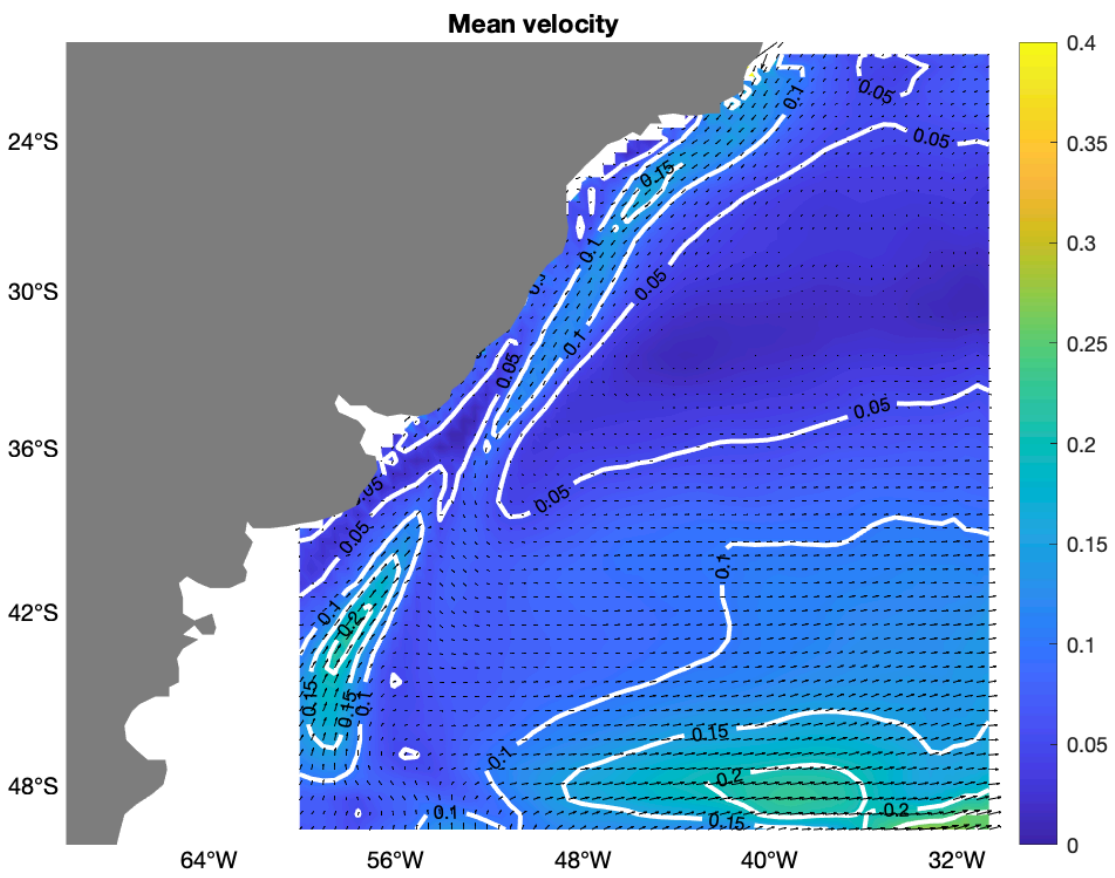
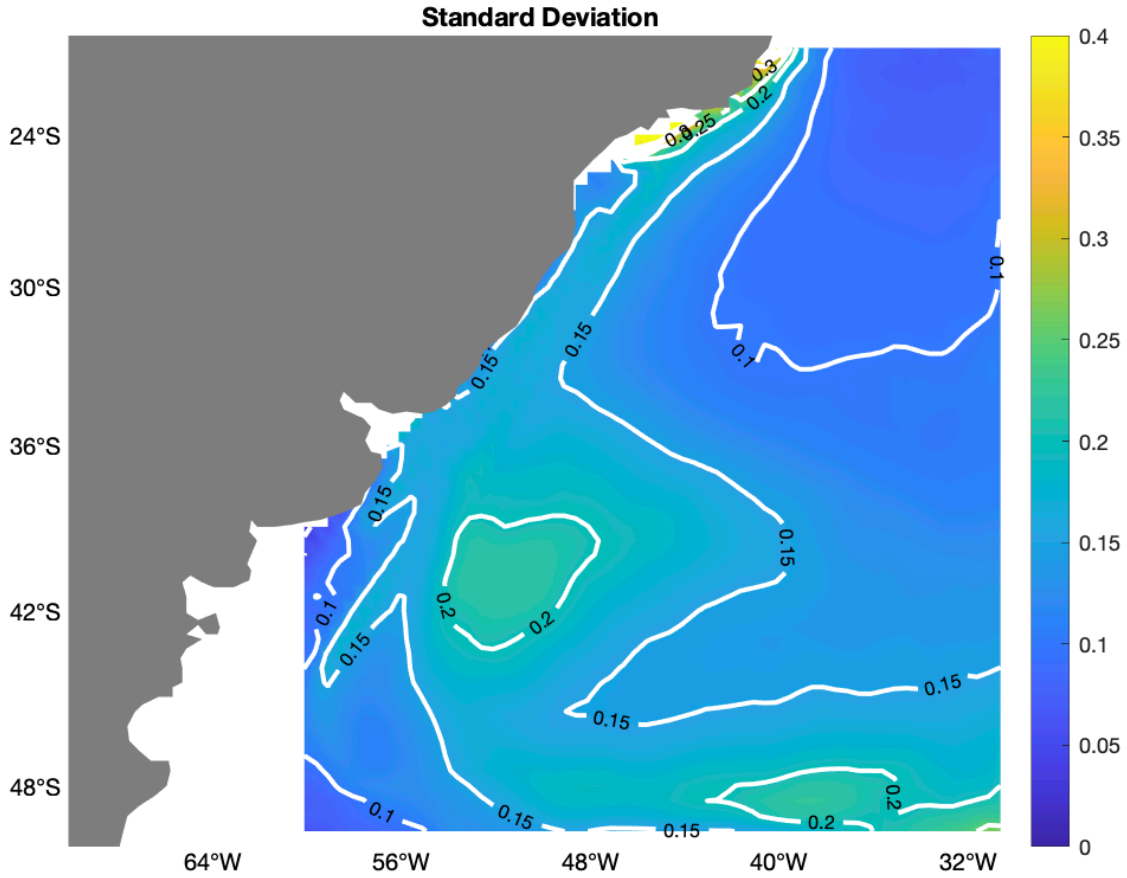
Drifter Dataset





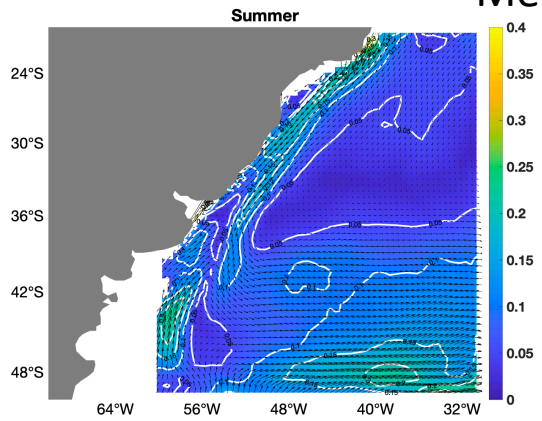
Surface Velocity

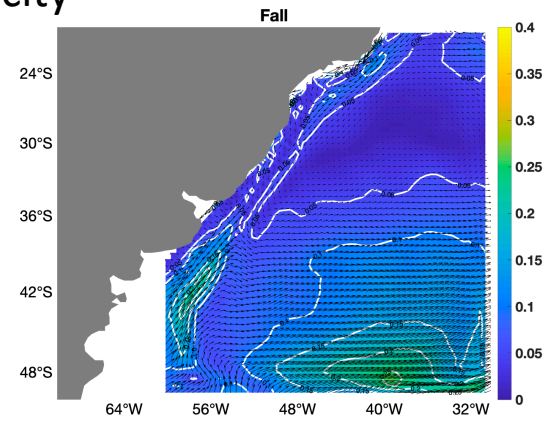


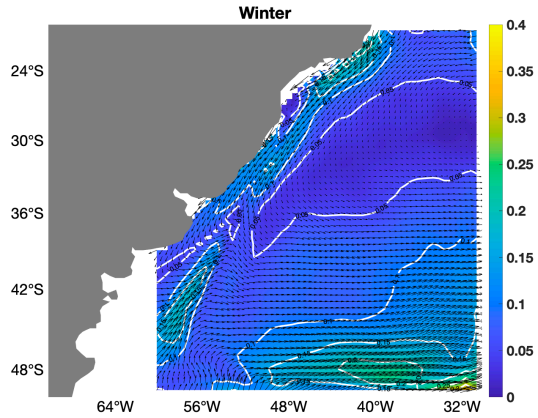


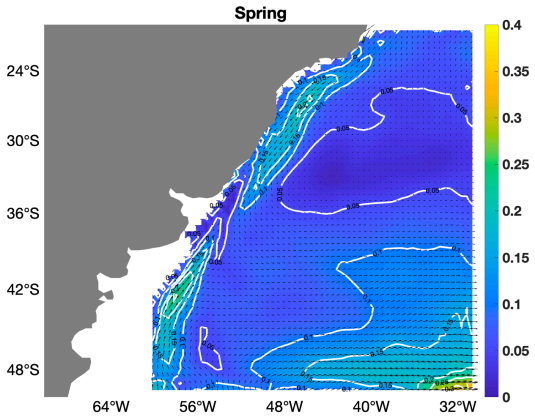
Surface Velocity (Seasons)

Mean Velocity

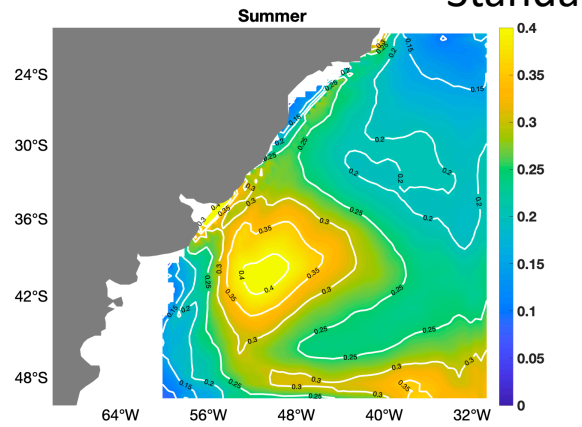


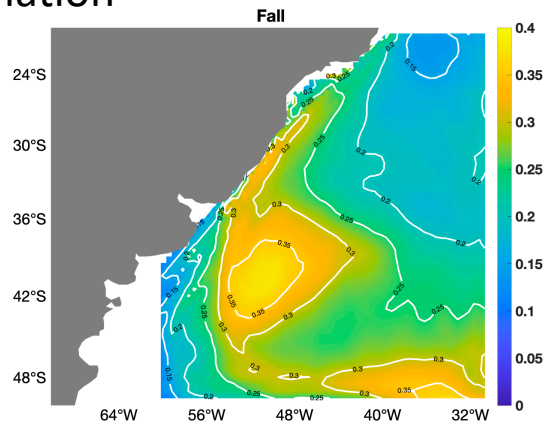


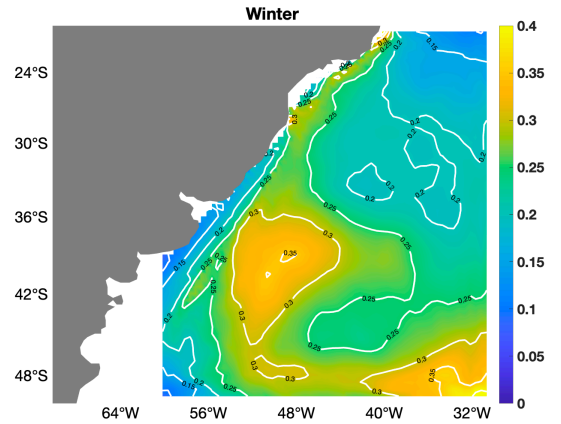


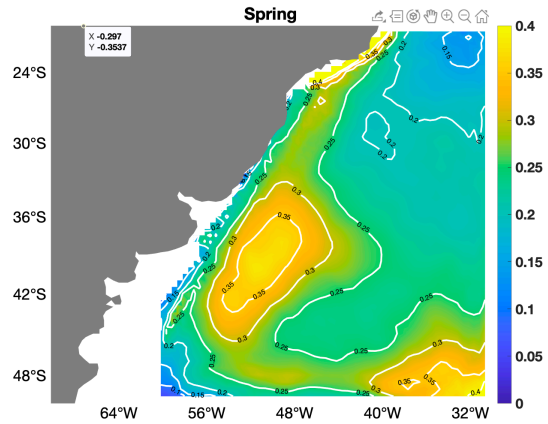


Standard Deviation



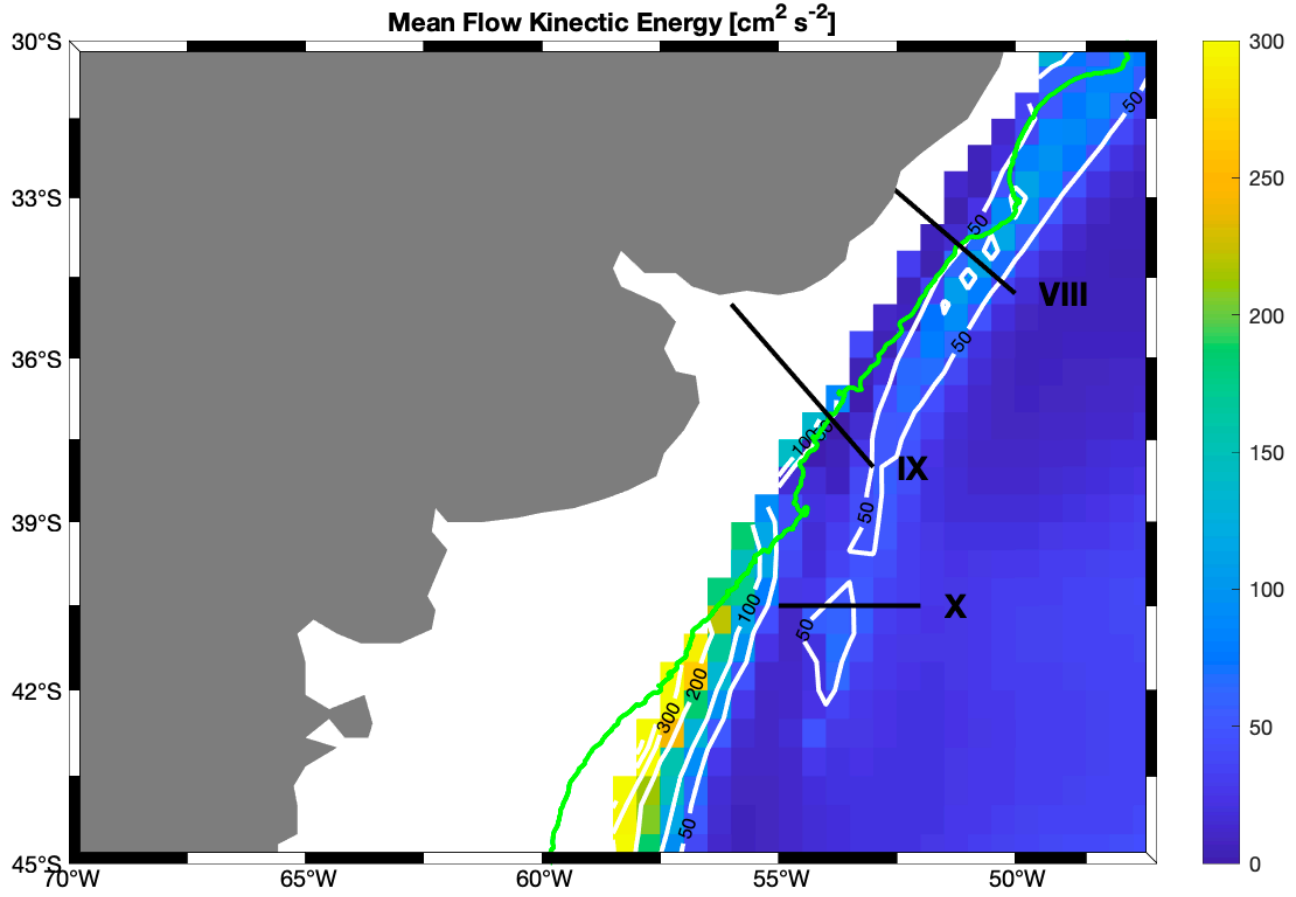






Mean Flow Kinetic Energy $MKE = \frac{1}{2}\left(\overline{u}_b^2 + \overline{v}_b^2\right)$

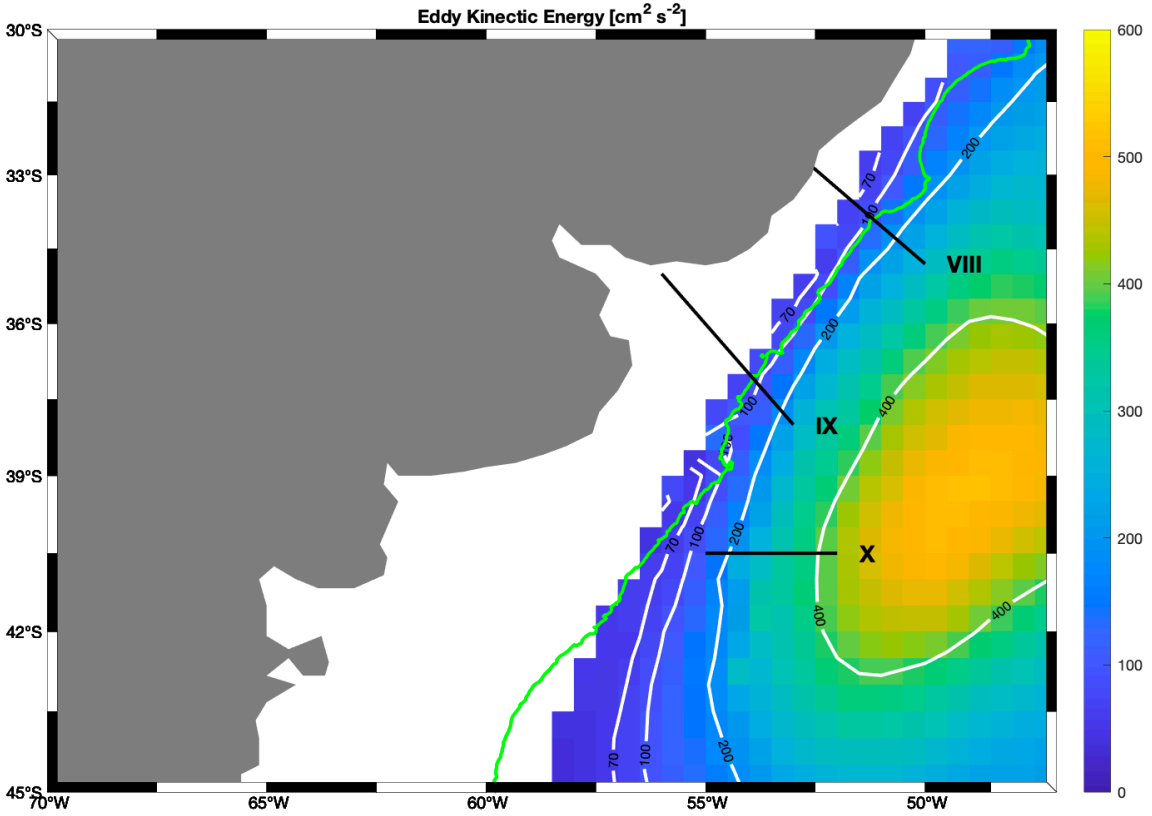
- MKE
  - Energy of the large-scale mean circulation
  - WBCs

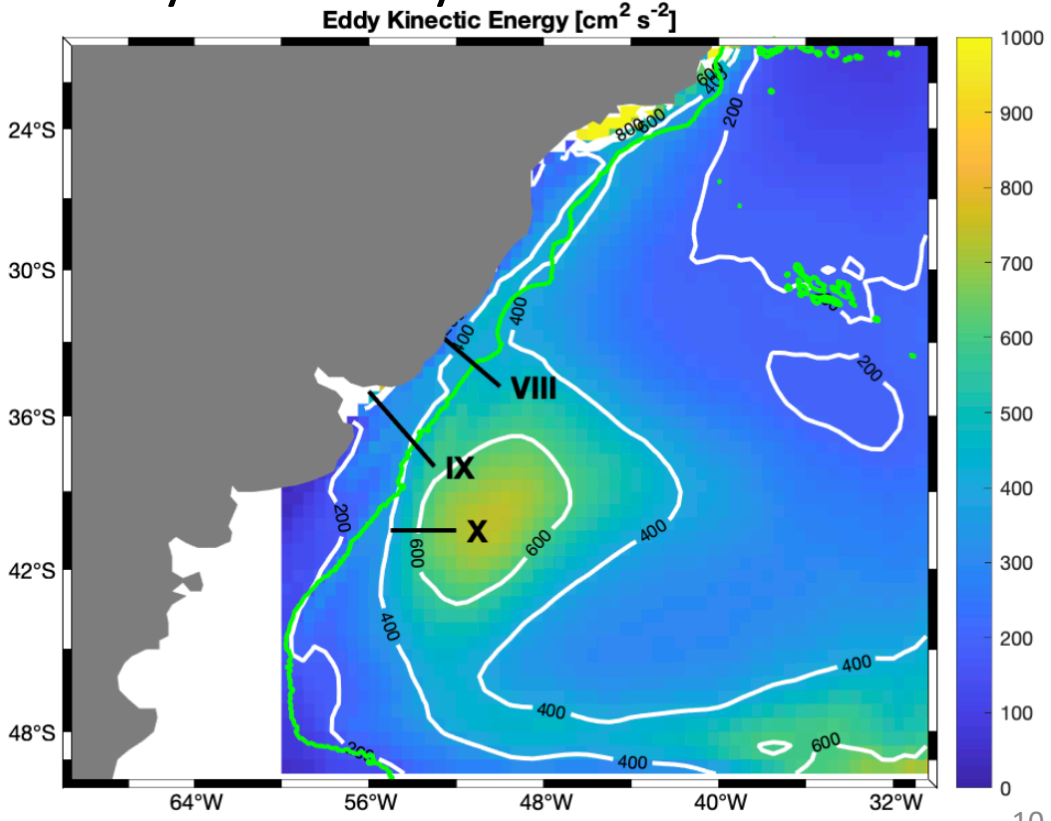


Eddy Kinetic Energy

$$EKE = \frac{1}{2}\left(\overline{u'u'} + \overline{v'v'}\right)$$

- Associated to mesoscale activity (meander and eddies) when high-frequency removed)
- High EKE – BMC (obs. of mesoscale eddies and meanders)
- Low EKE contours close to ZR
- MC – Dominance of mean flow over eddy variability

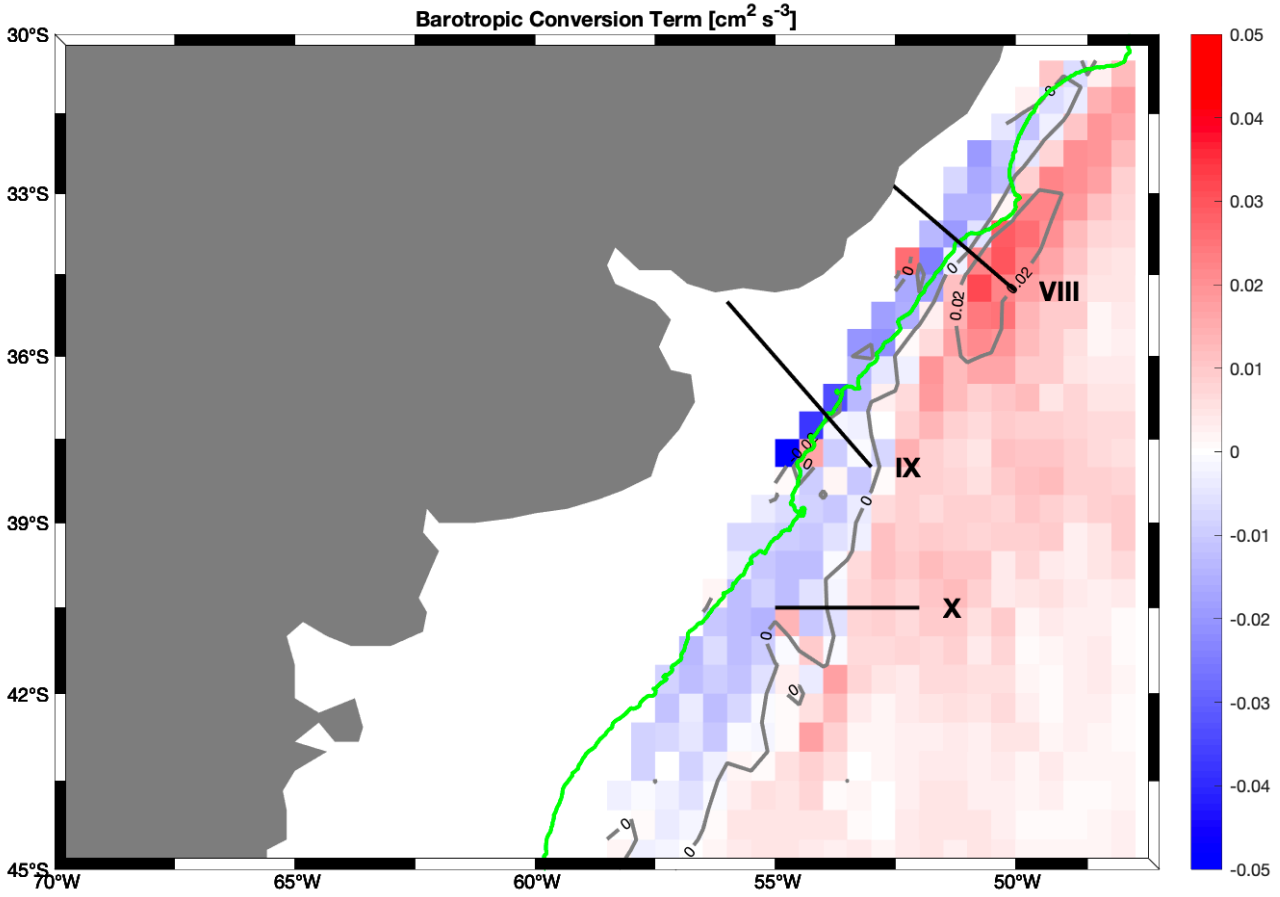




Barotropic Conversion Term

$$BT = -\left[\overline{u'u'}\frac{\partial \bar{u}}{\partial x} + \overline{u'v'}\left(\frac{\partial \bar{u}}{\partial x} + \frac{\partial \bar{v}}{\partial y}\right) + \overline{v'v'}\frac{\partial \bar{v}}{\partial y} + \overline{w'v'}\frac{\partial \bar{v}}{\partial z} + \overline{w'u'}\frac{\partial \bar{u}}{\partial z}\right]$$

- BT
  - Barotropic conversion of energy from the mean flow to the eddy field.
    - Vertical shear neglected
    - Indicator of Barotropic Instabilities
  - BT>0
    - Indicate conversion of MKE into EKE
  - Small BT values
    - Suggest that eddies decay and feed energy into the mean flow through KE



Takeaway notes

- MC – Dominance of mean flow over eddy variability
- BMC has greater EKE - > Frequent observation of mesoscale eddies and meanders
- Lower EKE region close to Zapiola Rise
- BC
  - Conversion of MKE into EKE
  - Eddies decay and feed energy into the mean flow through KE

Thanks!