BRAZIL CURRENT STRUCTURE AND VARIABILITY: THE REPRESENTATIVENESS OF THE MOVAR-NOAA AX97 HIGH-DENSITY XBT TRANSECT

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Outline

① Introduction
② Data and Methods
③ Results
④ Summary/Conclusions

An assessment of the Brazil Current baroclinic structure and variability near 22° S in Distinct Ocean Forecasting and Analysis Systems

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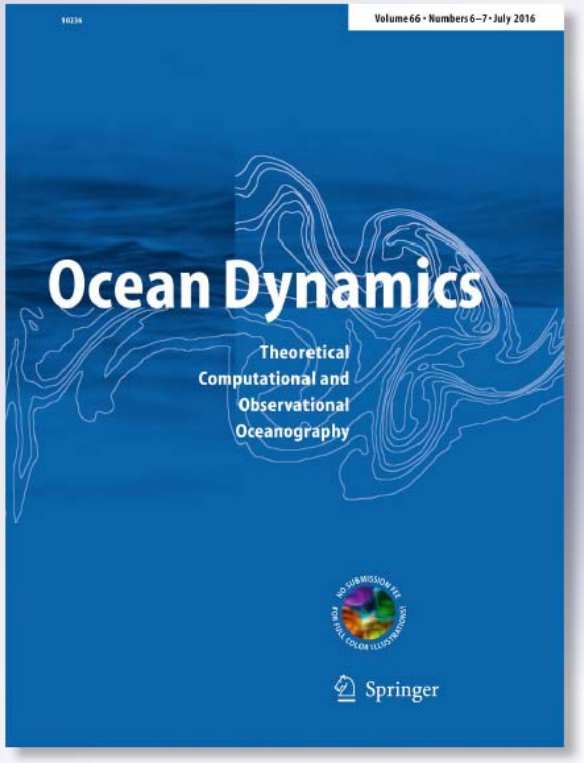
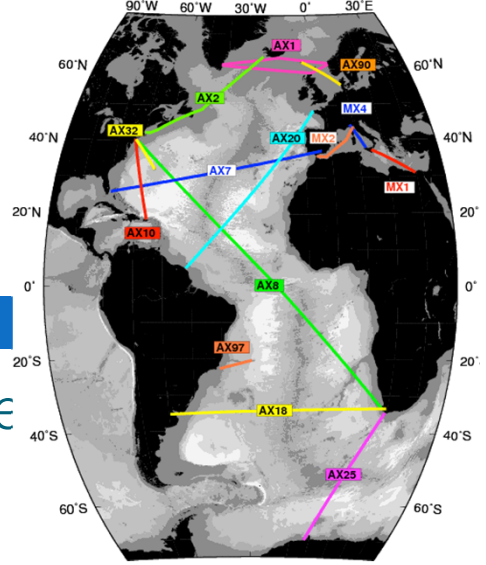


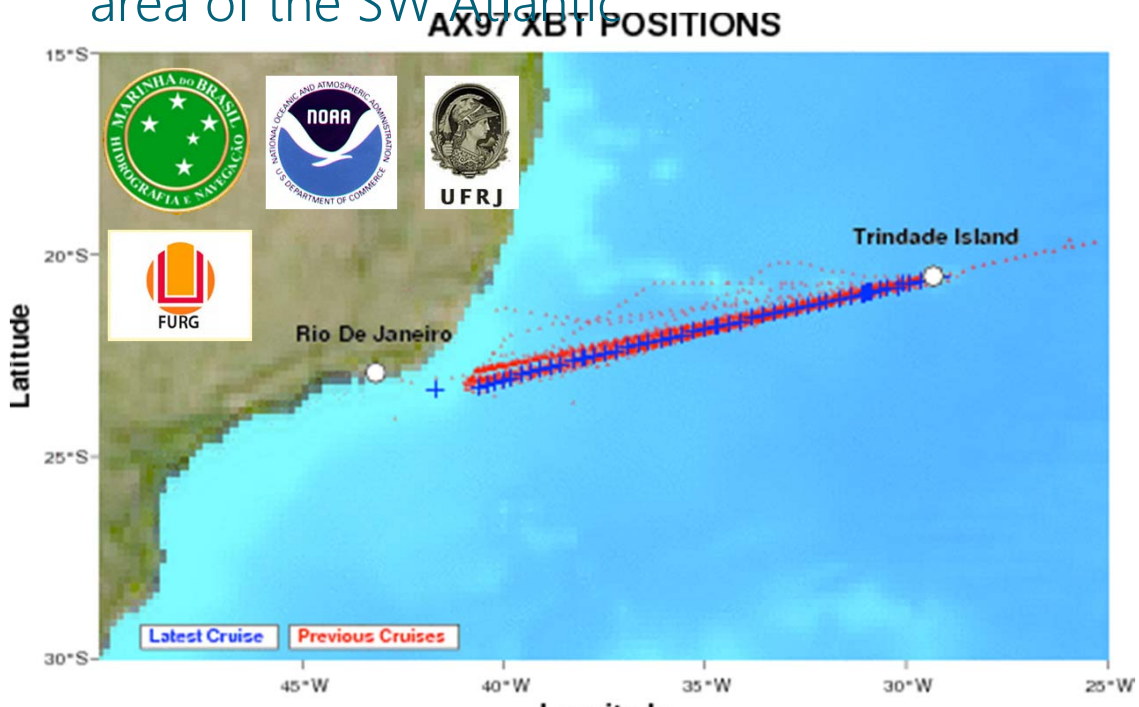
Springer

1 – Introduction



MOVAR: Observing the Brazil Current (BC) Variability betwe
Rio de Janeiro and Trindade Island - **AX97 HD transect**

Primary Objective: Take advantage of the Brazilian Navy regular supply ships to Trindade Is. to obtain a high-resolution time-series (spatial resolution ~15nm; ~3 months time resolution) of the upper ocean thermal structure in a sparsely sampled area of the SW Atlantic.



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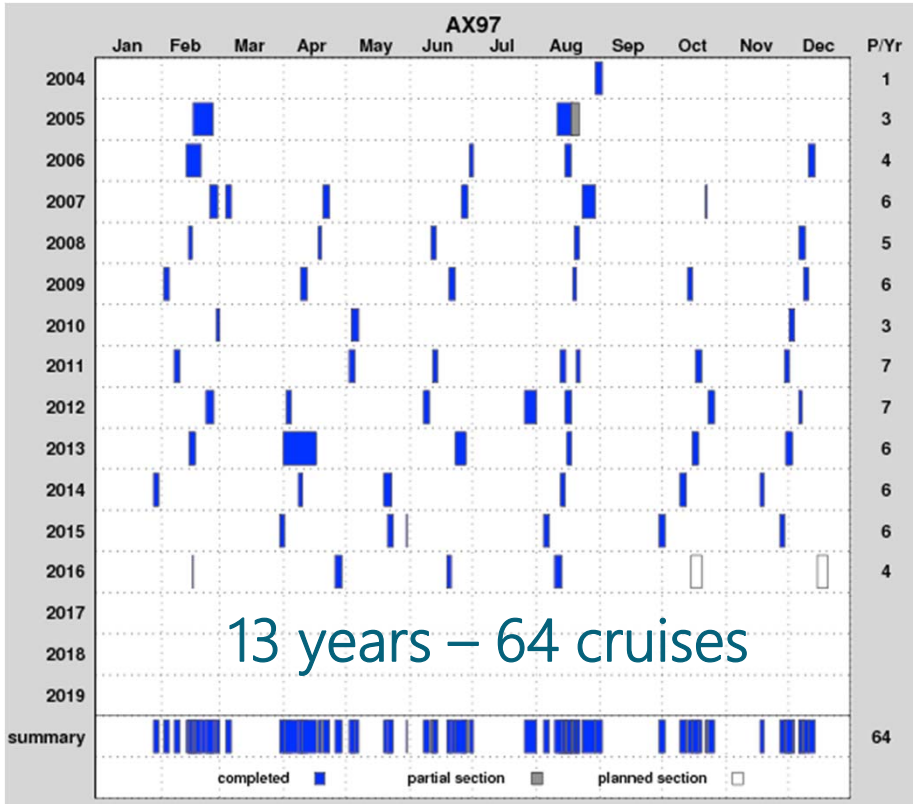


1 - Introduction

Goal:

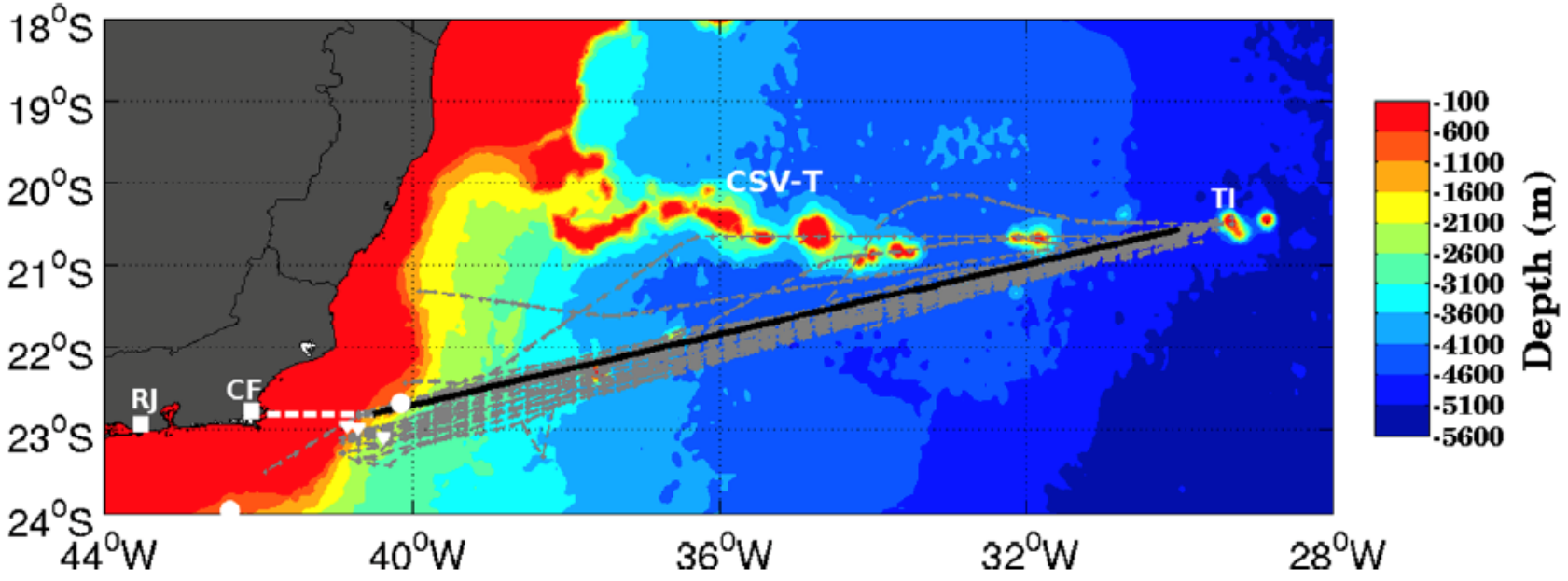
Evaluate the BC structure and variability at 22° S using observations from the high-density XBT AX97 transect, which are assessed against those obtained from three distinct **Ocean Forecasting and Analysis Systems (OFAS)** in the framework of the **Global Ocean Data Assimilation Experiment (GODAE) OceanView**

Objectives:

- Evaluation of the ability of the spatial-temporal design of the high-density AX97 transect to represent the BC average features
- Assessment of the different BC dynamic events identified by the XBT data

2.1 – MOVAR-NOAA AX97 HD XBT transect

- 37 cruises from 2004 to 2012
- Up to 6 annual cruises
- Most data collected above 760 m (Sippican Deep Blue)
- Data interpolated to a reference transect (1/4° longitude resolution) with a 10 m resolution in the vertical
- Salinity was obtained using historical T-S relationships (Thacker 2007a,b) and baroclinic velocity was calculated using the depth of the σ_θ=26.8 kg m^{-3} as the reference level



2.2 - Ocean Forecasting and Analysis Systems

Hybrid Coordinate Ocean Model (HYCOM – NCODA) Reanalysis

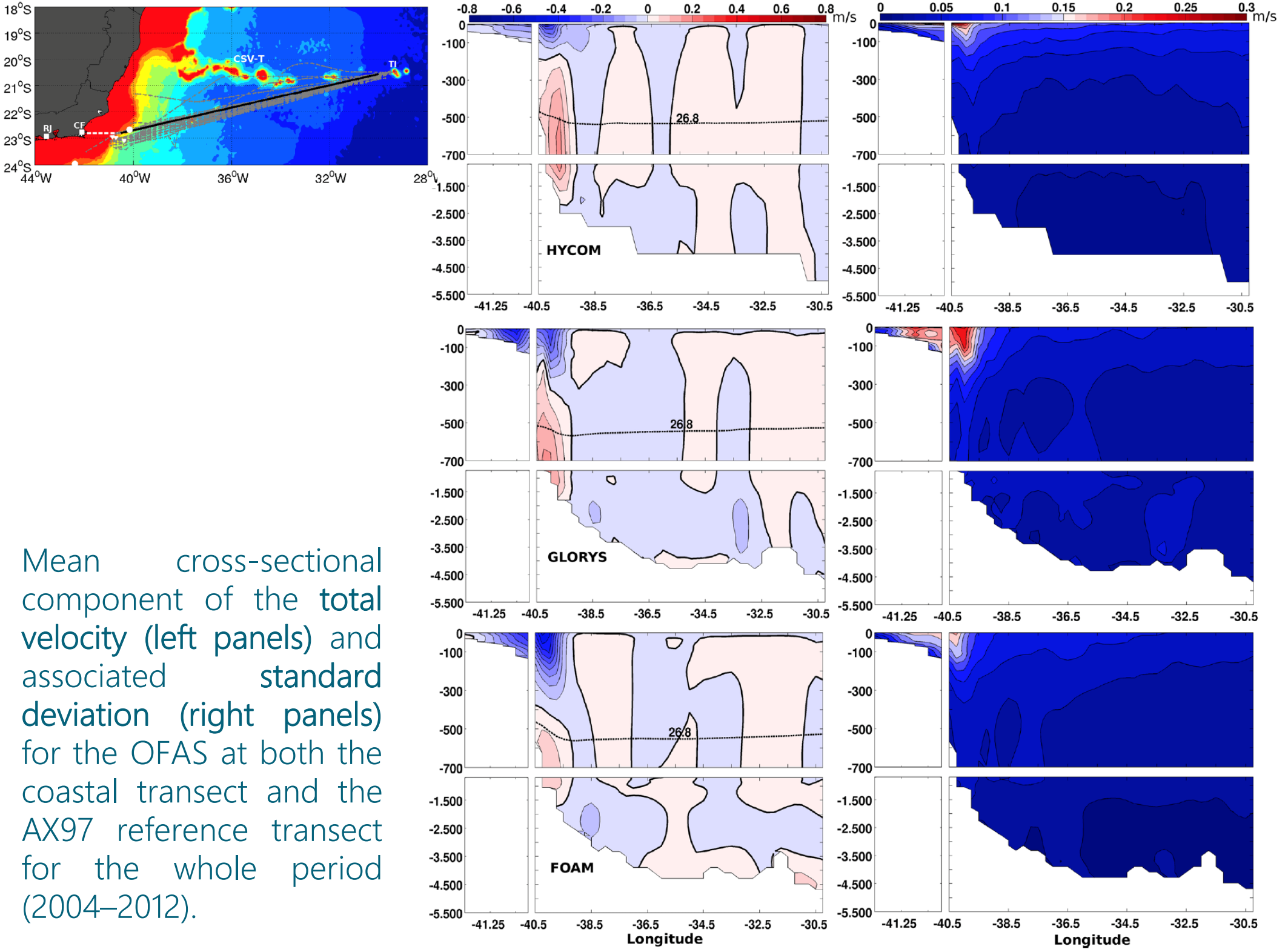
- 1/12° horizontal resolution (degraded to 1/4°)
- Exp 19.1 - Daily outputs between 1995 to 2012 (2004 to 2012 was used here)
- Hybrid coordinates

Global Ocean Physical Reanalysis (GLORYS2V3)

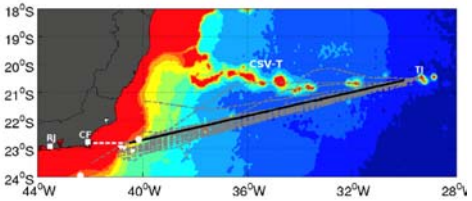
- Based on the version 3.1 of NEMO and the configuration is ORCA025
- ¼° horizontal resolution
- Daily outputs from 1993 to 2011 (2004 to 2011was used here)

Forecasting Ocean Assimilation Model (FOAM)

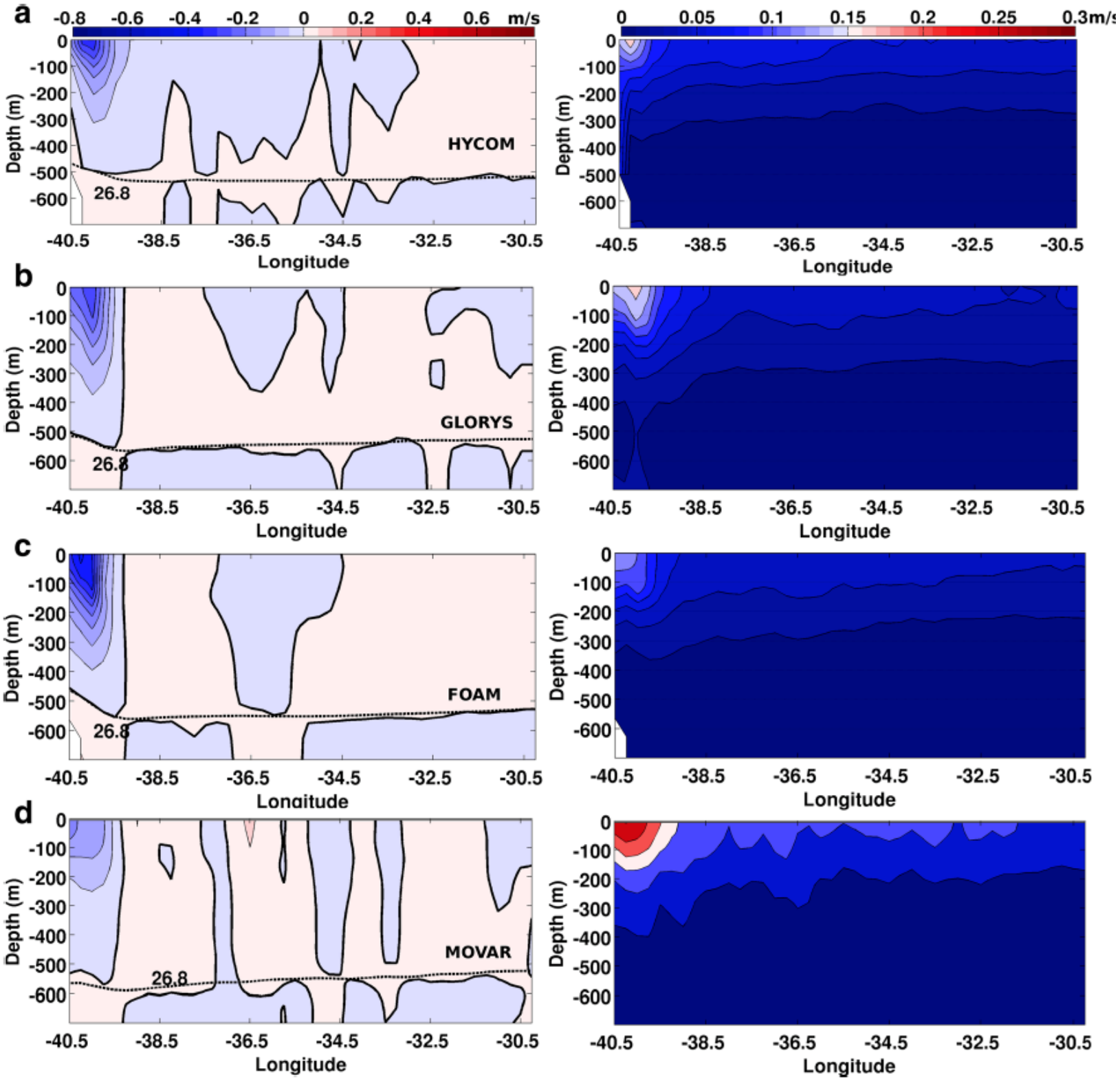
- ¼° horizontal resolution
- Daily outputs between 2004 to 2012
- ORCA025 configuration, run daily at the Met Office upgraded to use NEMO community model as the dynamical core



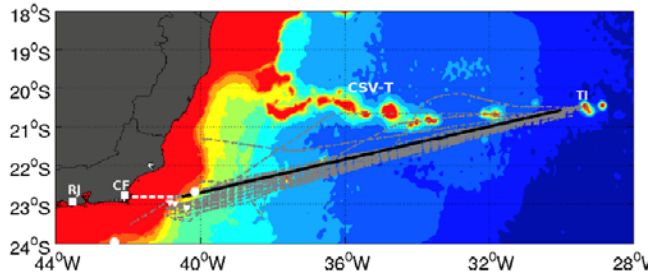
Mean cross-sectional component of the **total velocity (left panels)** and associated **standard deviation (right panels)** for the OFAS at both the coastal transect and the AX97 reference transect for the whole period (2004–2012).



Mean cross-sectional component of the **baroclinic velocity (left panels)** and associated **standard deviation (right panels)** for the OFAS and MOVAR at the AX97 reference transect for the

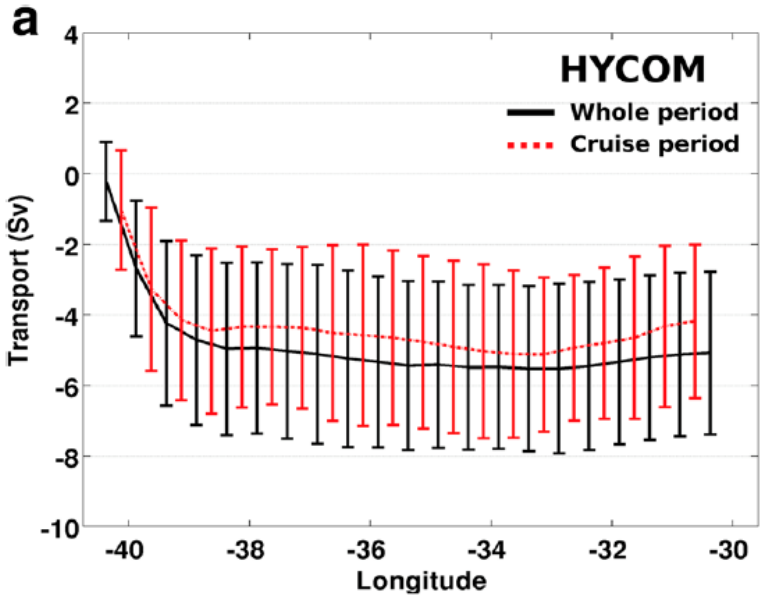


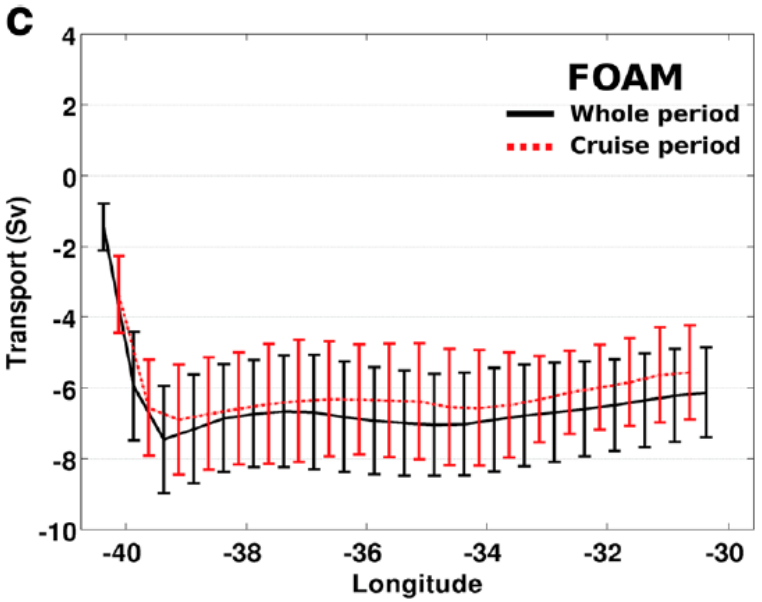
3 - Results

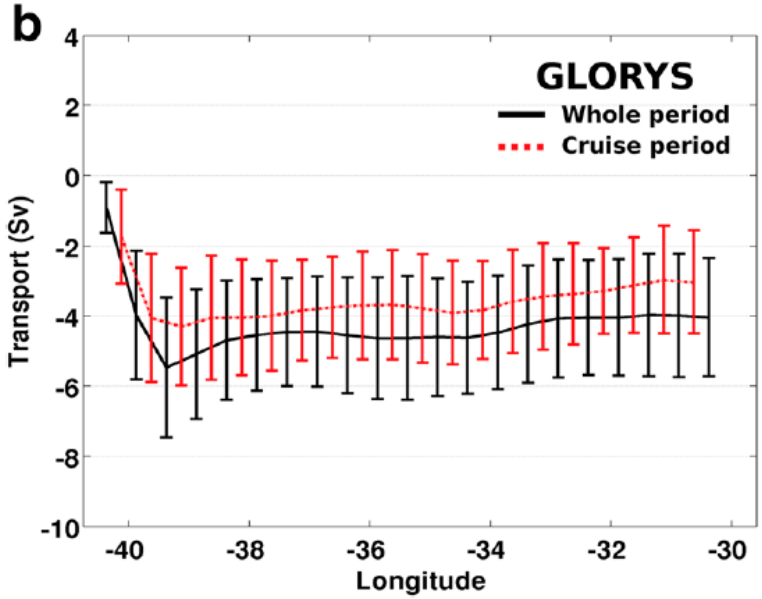


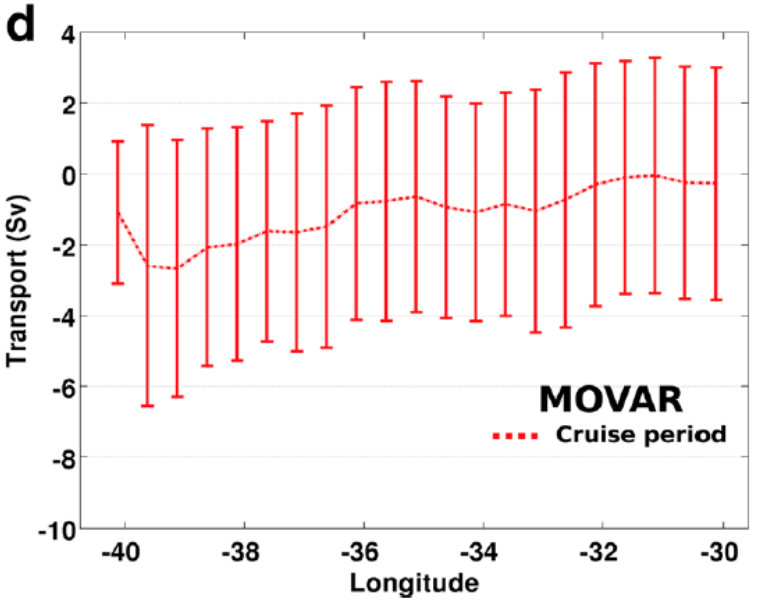
- The OFAS transports are larger than MOVAR
- The transports are smaller when only cruise periods are used

Mean cumulative depth integrated (surface to the depth of the σ_θ = 26.8 kg m^{-3}) **baroclinic volume transport** along the AX97 reference

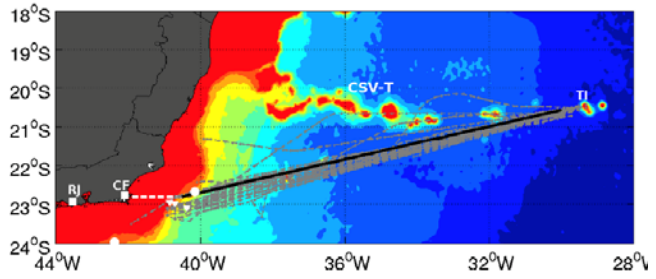






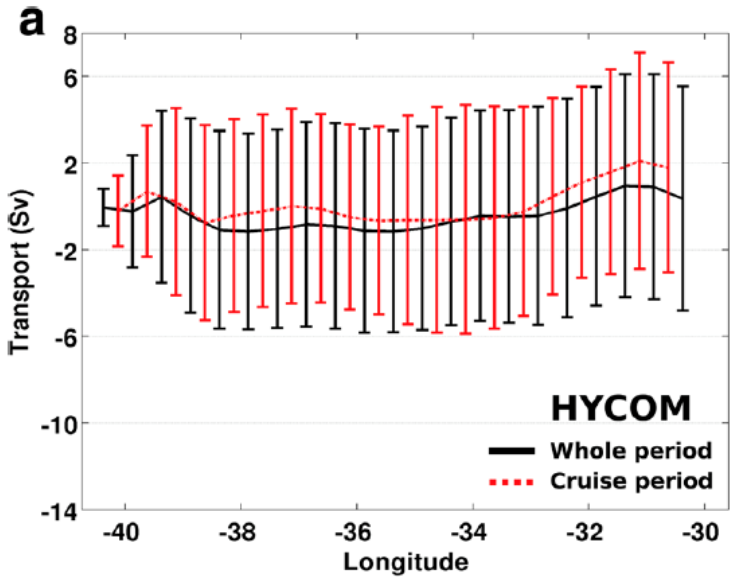


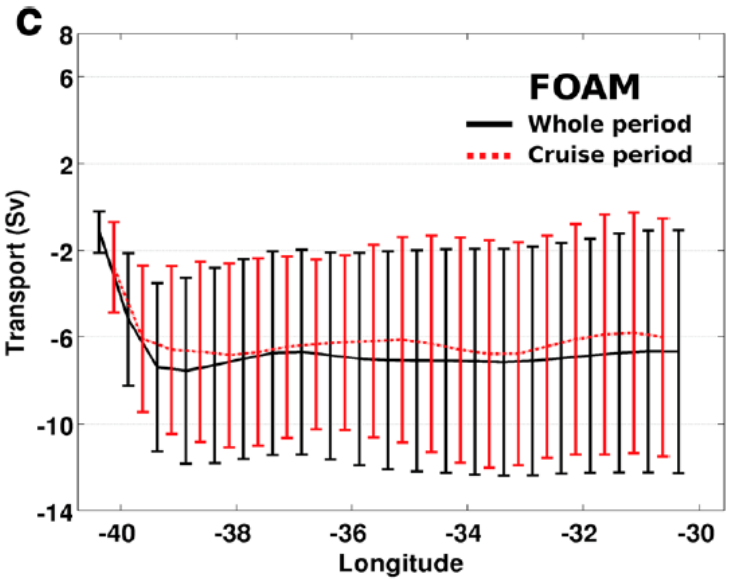
3 - Results

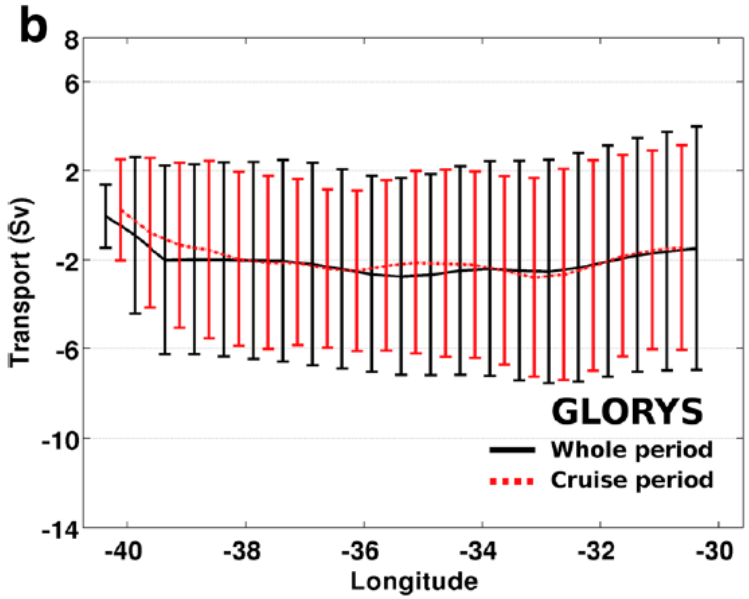


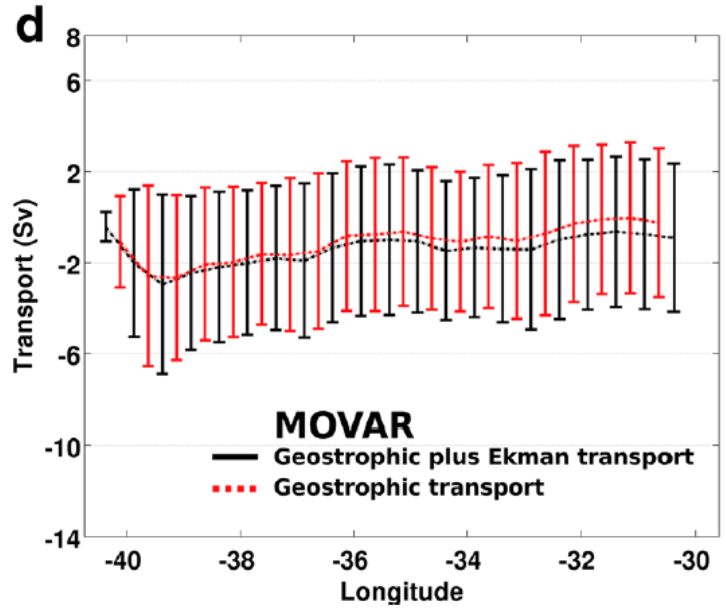
- The mean maximum depth of the BC varies among the OFAS

Mean cumulative depth integrated (surface to the depth of the σ_θ = 26.8 kg m^{-3}) **total volume transport** for the AX97 reference transect.

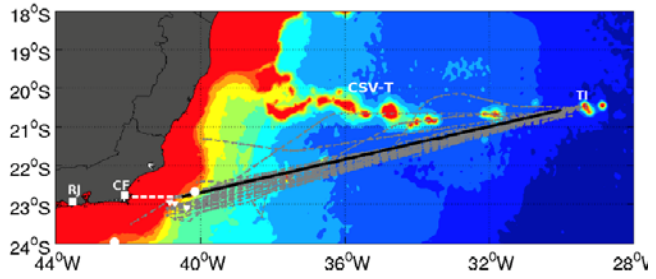






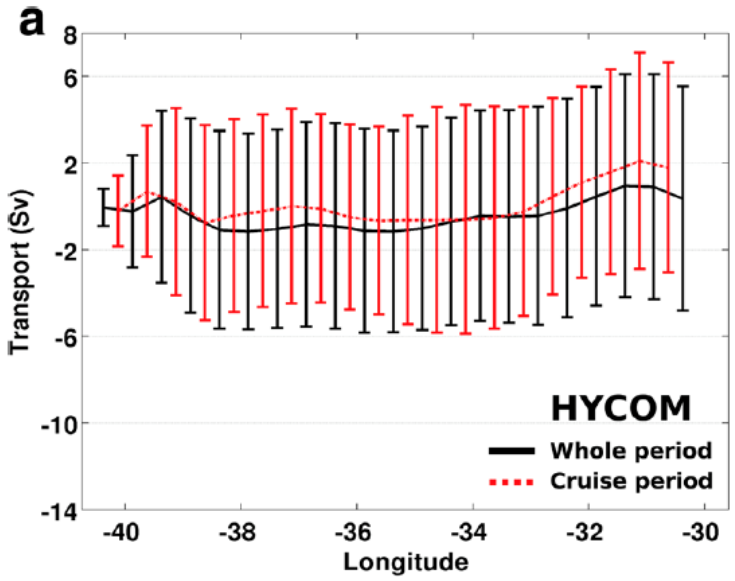


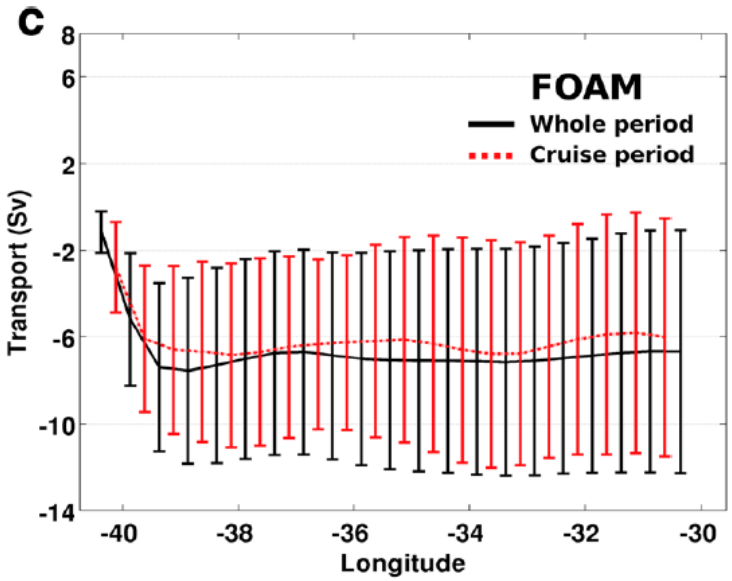
3 - Results

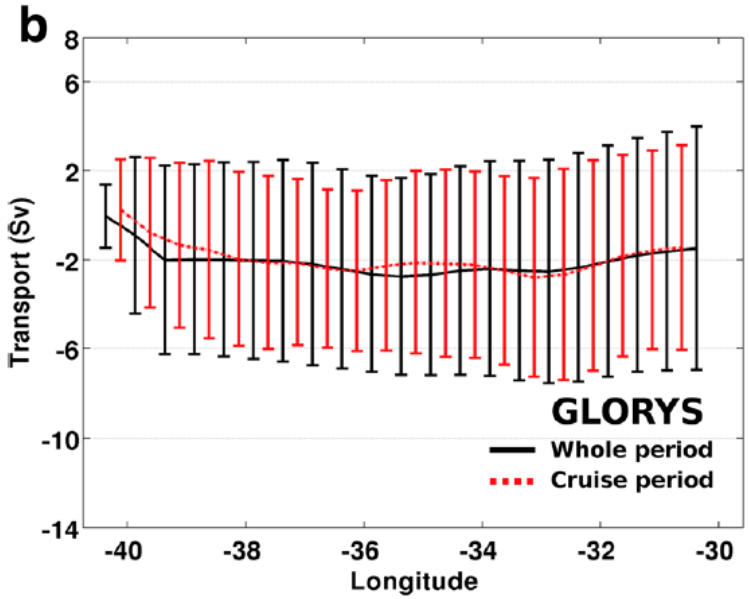


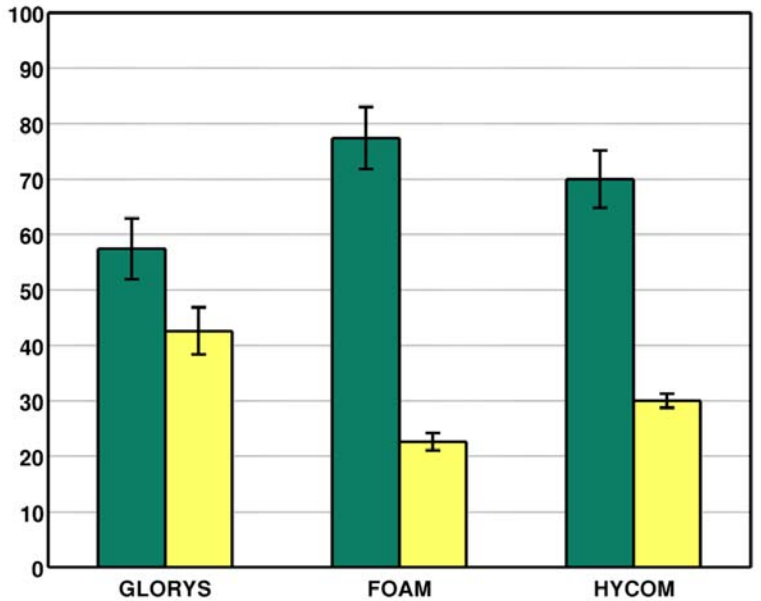
- The mean maximum depth of the BC varies among the OFAS
- Part of the BC transport flows onshore of the AX97 transect.

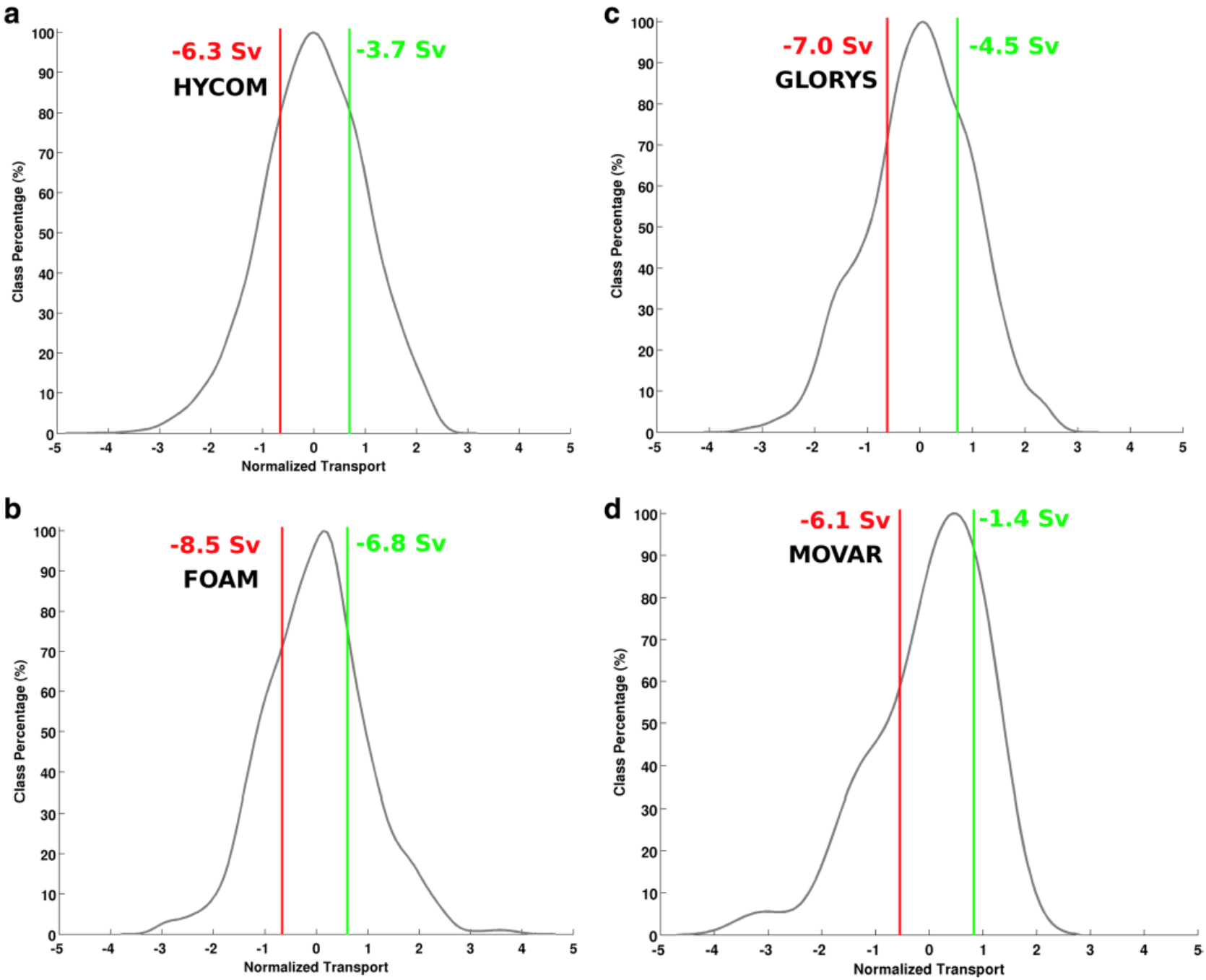
Mean cumulative depth integrated (surface to the depth of the σ_θ = 26.8 kg m^{-3}) **total volume transport** for the AX97 reference transect.





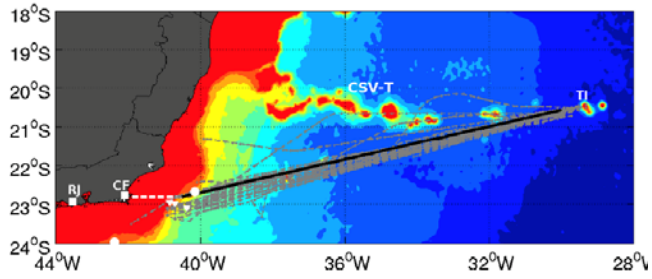


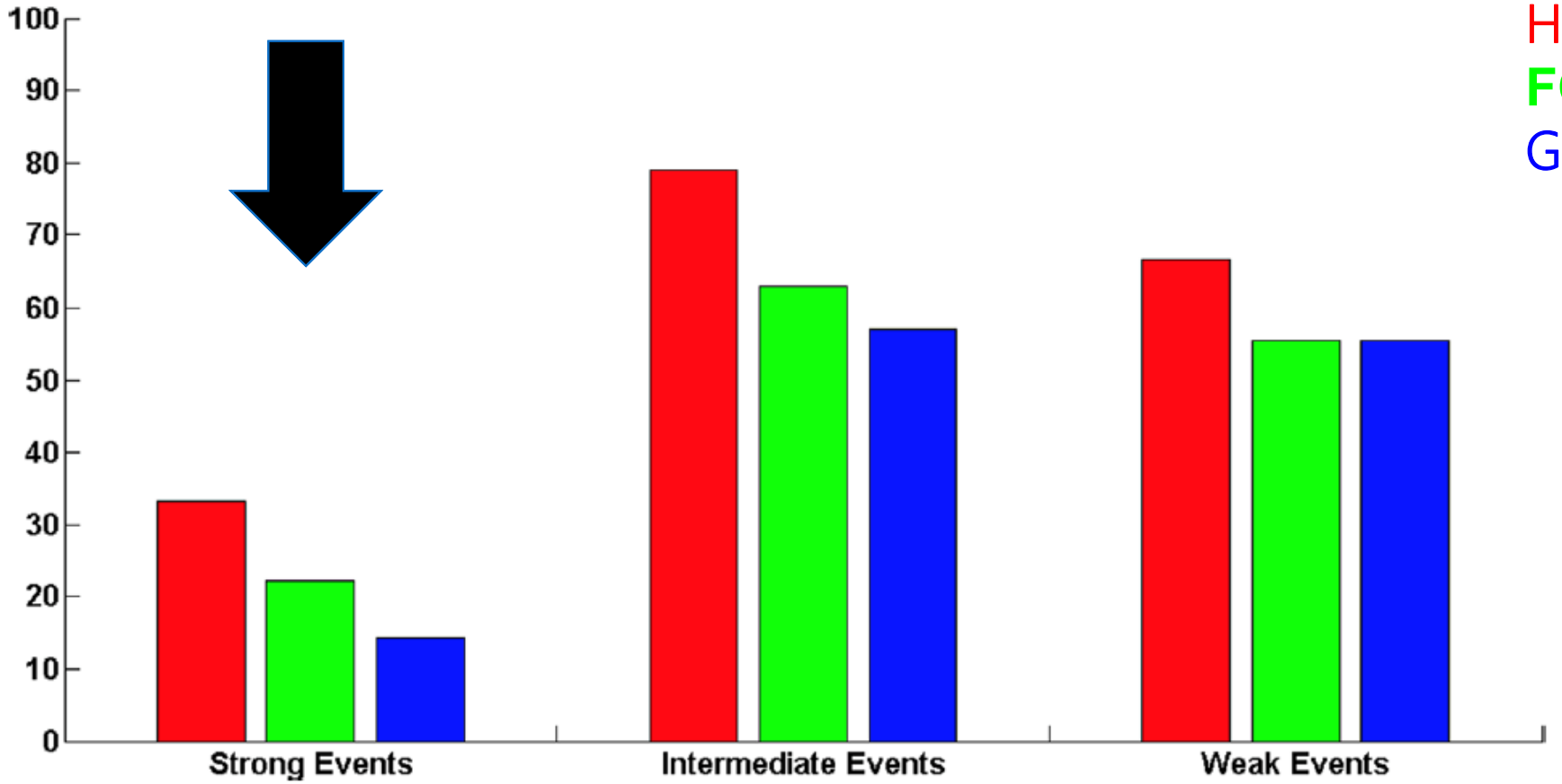




Normalized histogram of the depth integrated (surface to the depth of the σ_θ = 26.8 kg m^{-3}) baroclinic volume transport of the Brazil Current (considering only the southward transport) at the AX97 reference transect westward of 39° W.

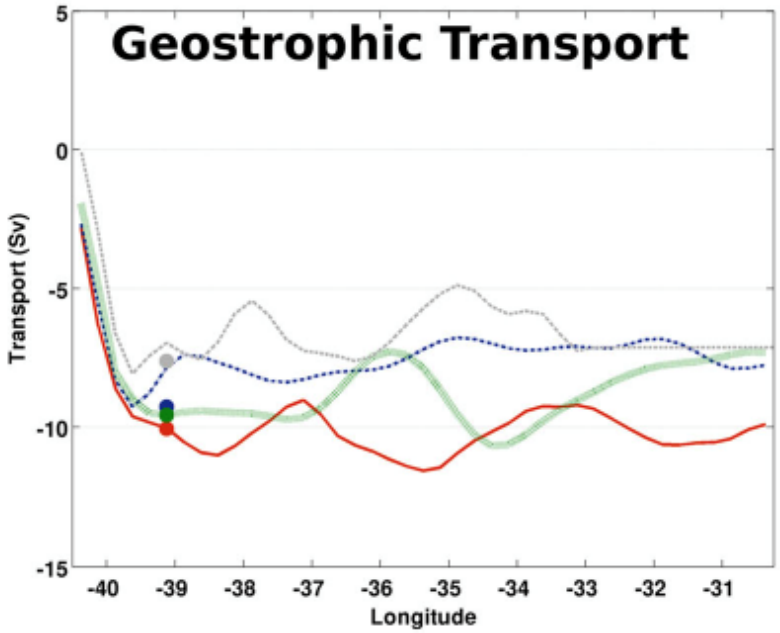
3 - Results

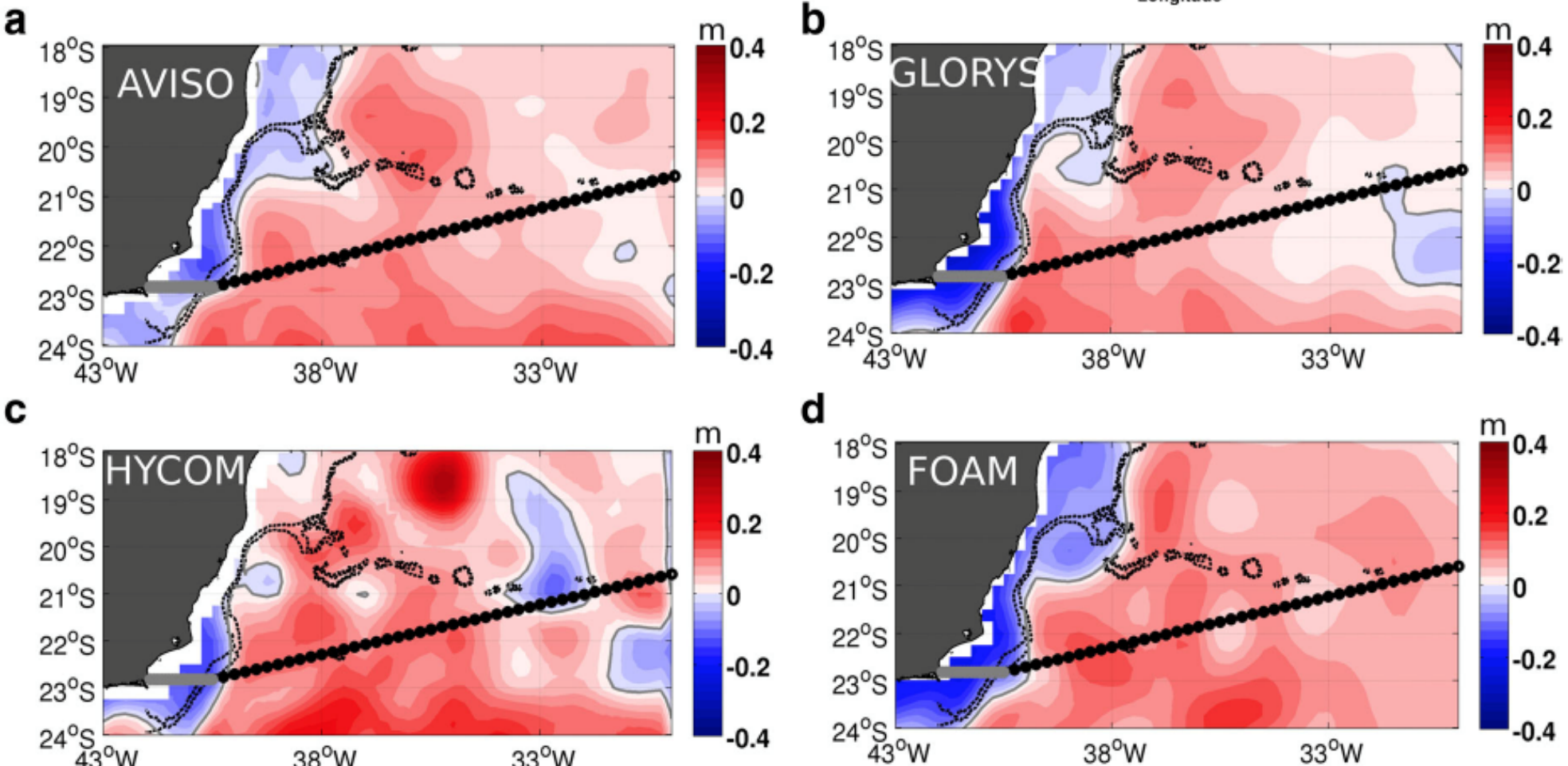


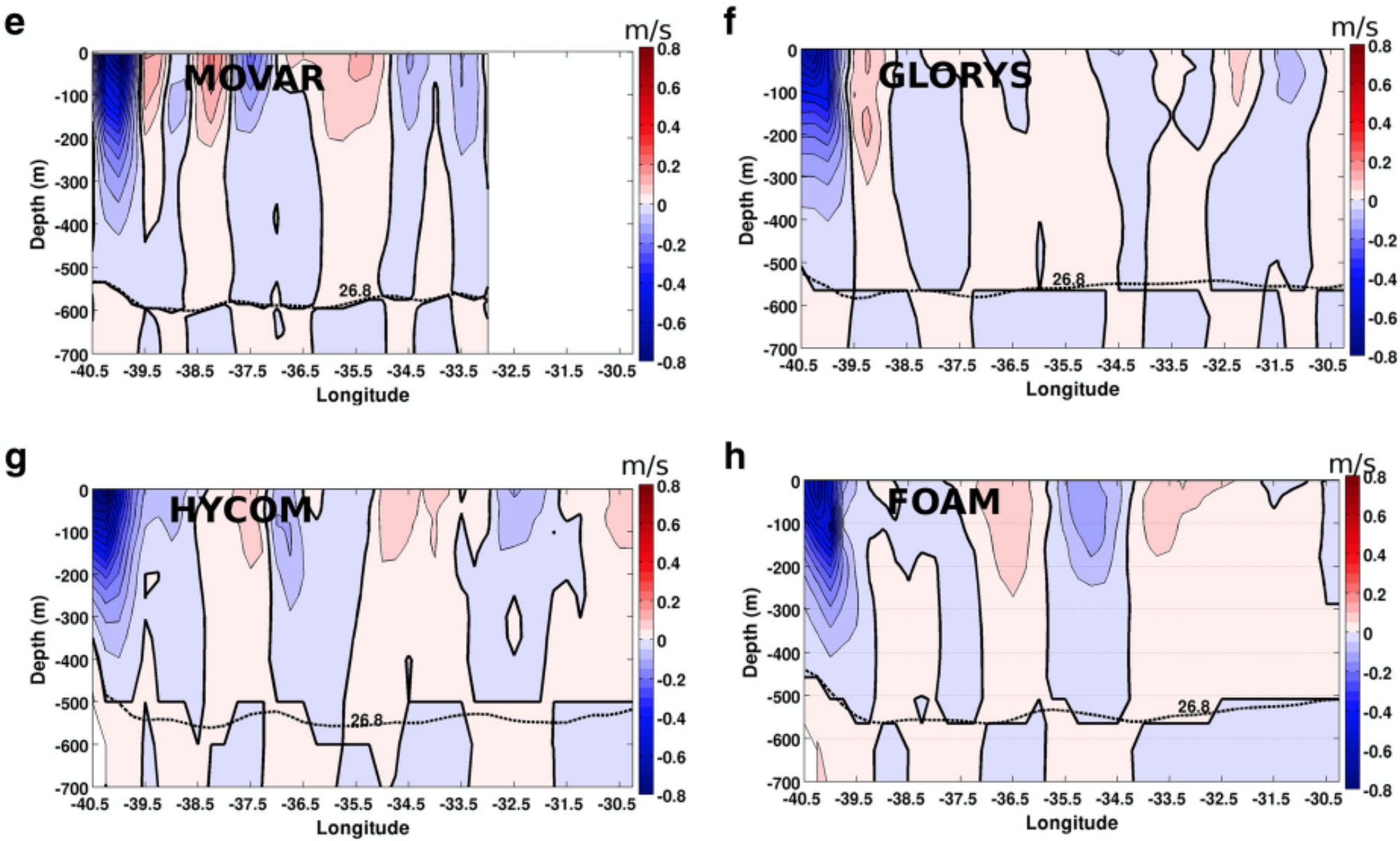


Percentage of representation of the MOVAR events by the OFAS.

A case study of a strong Brazil Current descriptive event: period of 14th to 16th of February 2008 for MOVAR, HYCOM, and GLORYS and the 14th to 16th of February 2006 for FOAM.



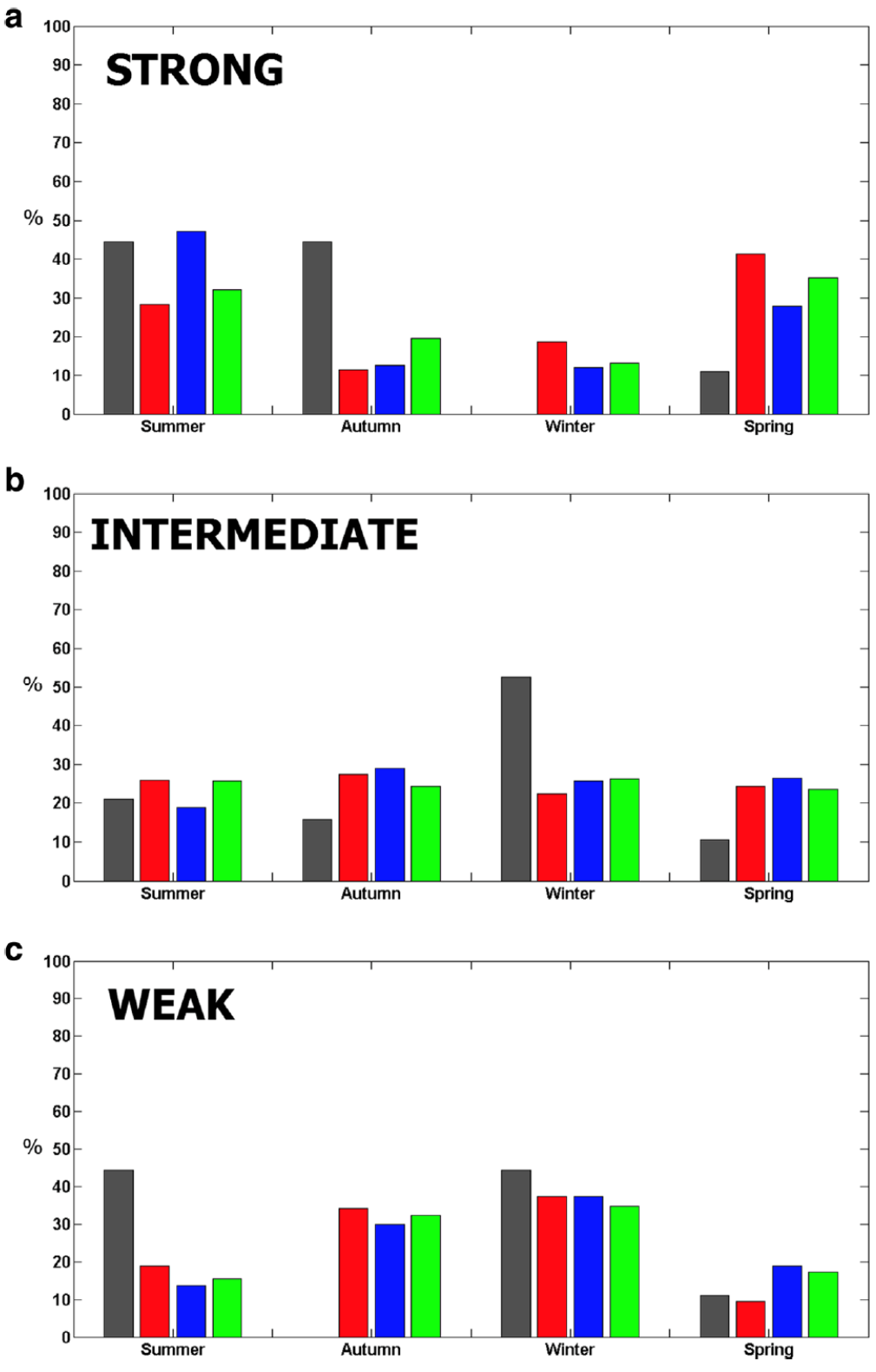




A case study of a strong Brazil Current descriptive event: period of 14th to 16th of February 2008 for MOVAR, HYCOM, and GLORYS and the 14th to 16th of February 2006

3 - Results

MOVAR
HYCOM
FOAM
GLORYS



Seasonality of the strong (a), intermediate (b), and weak (c) events for the MOVAR cruises (gray bar) and OFAS whole time series. HYCOM, GLORYS, and FOAM are indicated by the red,blue, and green bars.

4 – Summary and Conclusions

- The comparison between the observations and models can be used to identify **major deficiencies** on the ability of these products to represent the dynamics in the region and to **recommend improvements** in the sampling strategy along the AX97 transect
- The three models analyzed (HYCOM, GLORYS and FOAM) generally present a **higher transport and less variability** of the BC when compared with the observations
- One aspect of the BC variability that is not sampled by the data is the along **shelf transport**, that depending on the model can be quite significant. Therefore, it is recommended that the AX97 transect extends its sampling closer to the coast (~200 m depth)
- When analyzing the BC transport values distribution for the MOVAR, it was observed a long tail for strong values, and the **median skewed toward the lower value**. Therefore, another recommendation for the AX97 sampling is to extend the time series
- While **seasonality** is important in defining the weak/strong events, **meso-scale** activity also plays an important role in these events

JAMSTEC 国立研究開発法人 海洋研究開発機構
JAPAN AGENCY FOR MARINE-EARTH SCIENCE AND TECHNOLOGY

Thank you

GODAE OceanView

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