EVALUATION OF FUTURE CHANGES TO THE ATLANTIC MERIDIONAL OVERTURNING CIRCULATION AND THE NORTH BRAZIL CURRENT RETROFLECTION EDDIES BASED ON BESM-ROMS DYNAMICAL DOWNSCALING.

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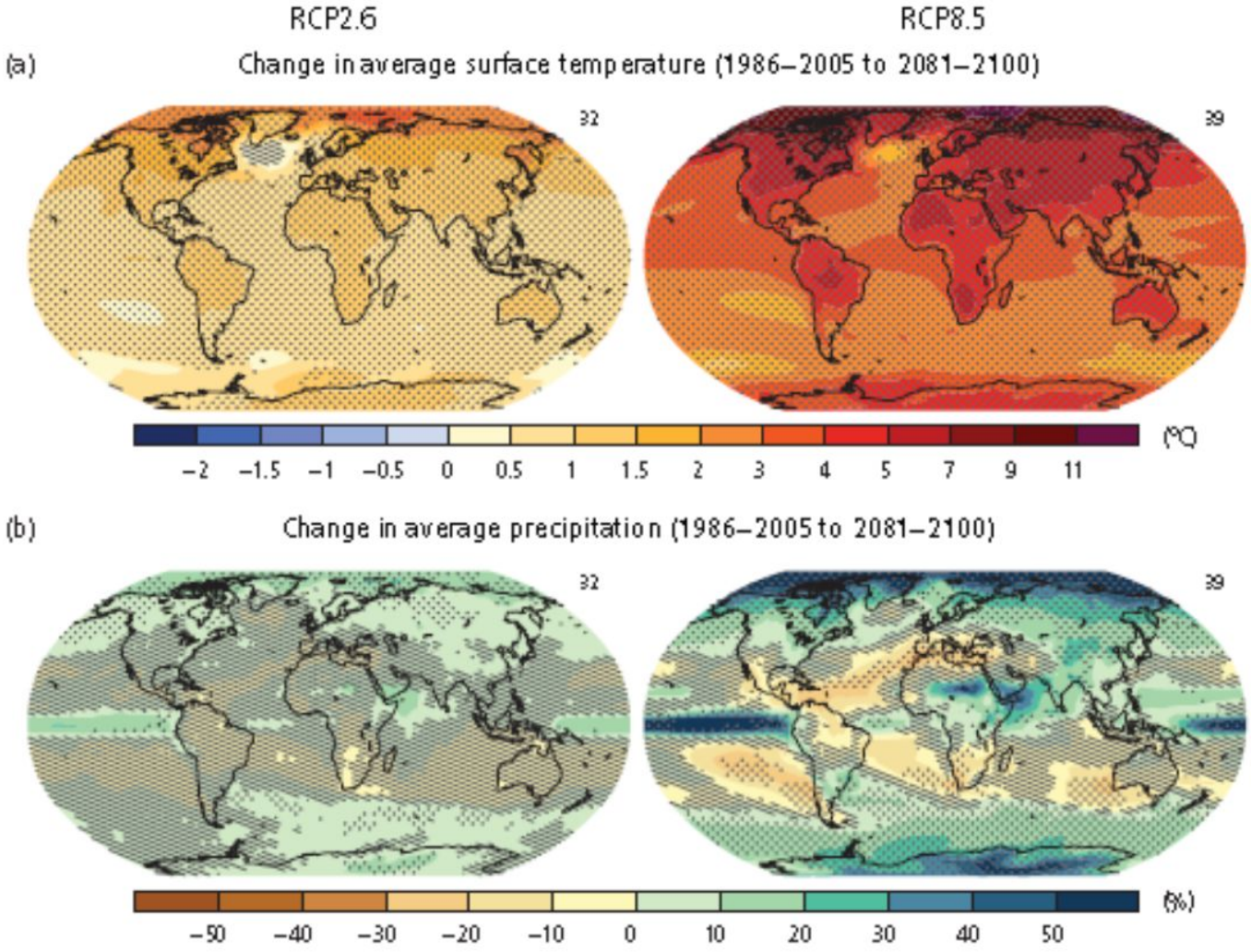
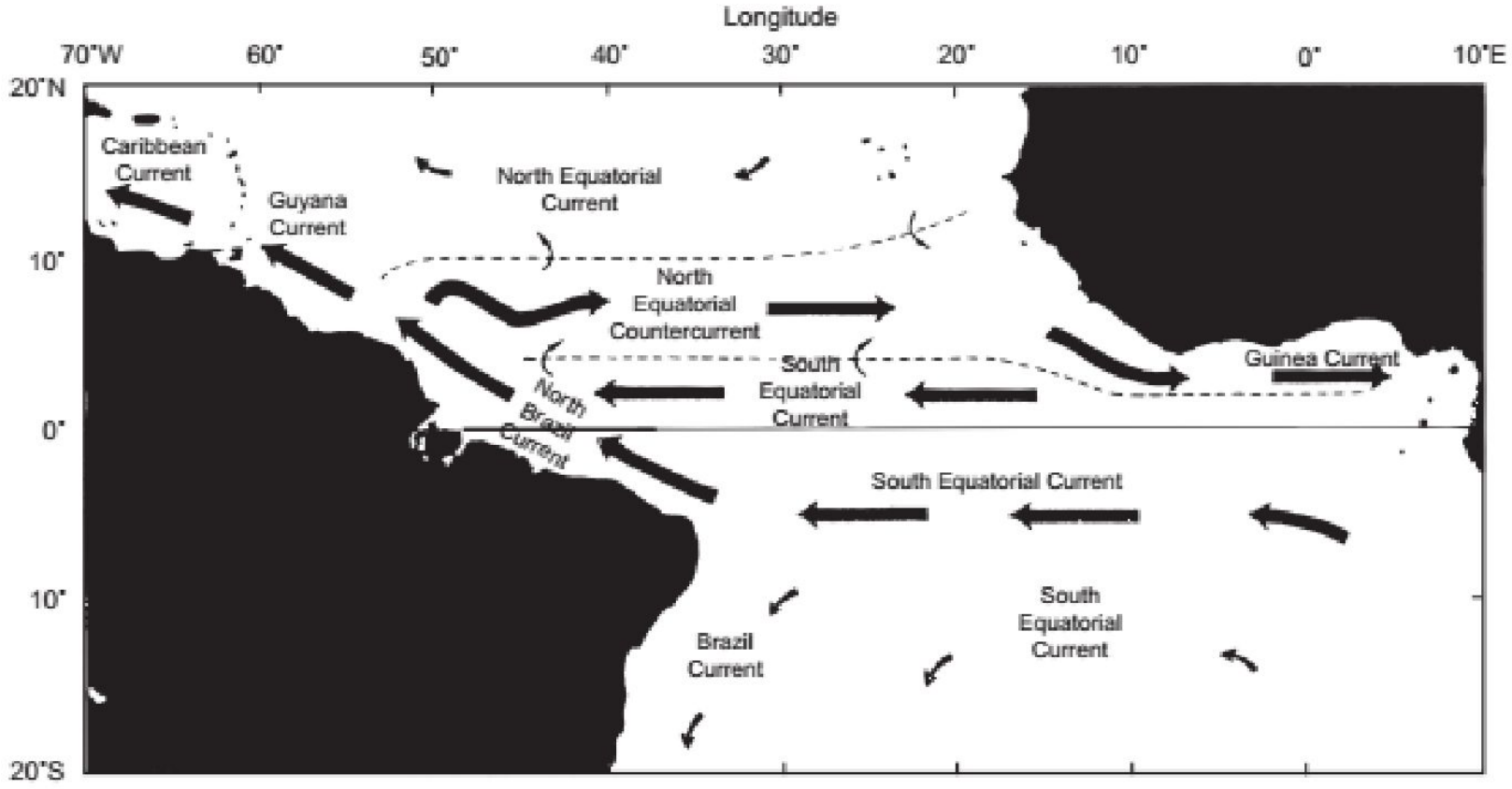
CMIP5 Climate Change Projections



Source: IPCC/AR5

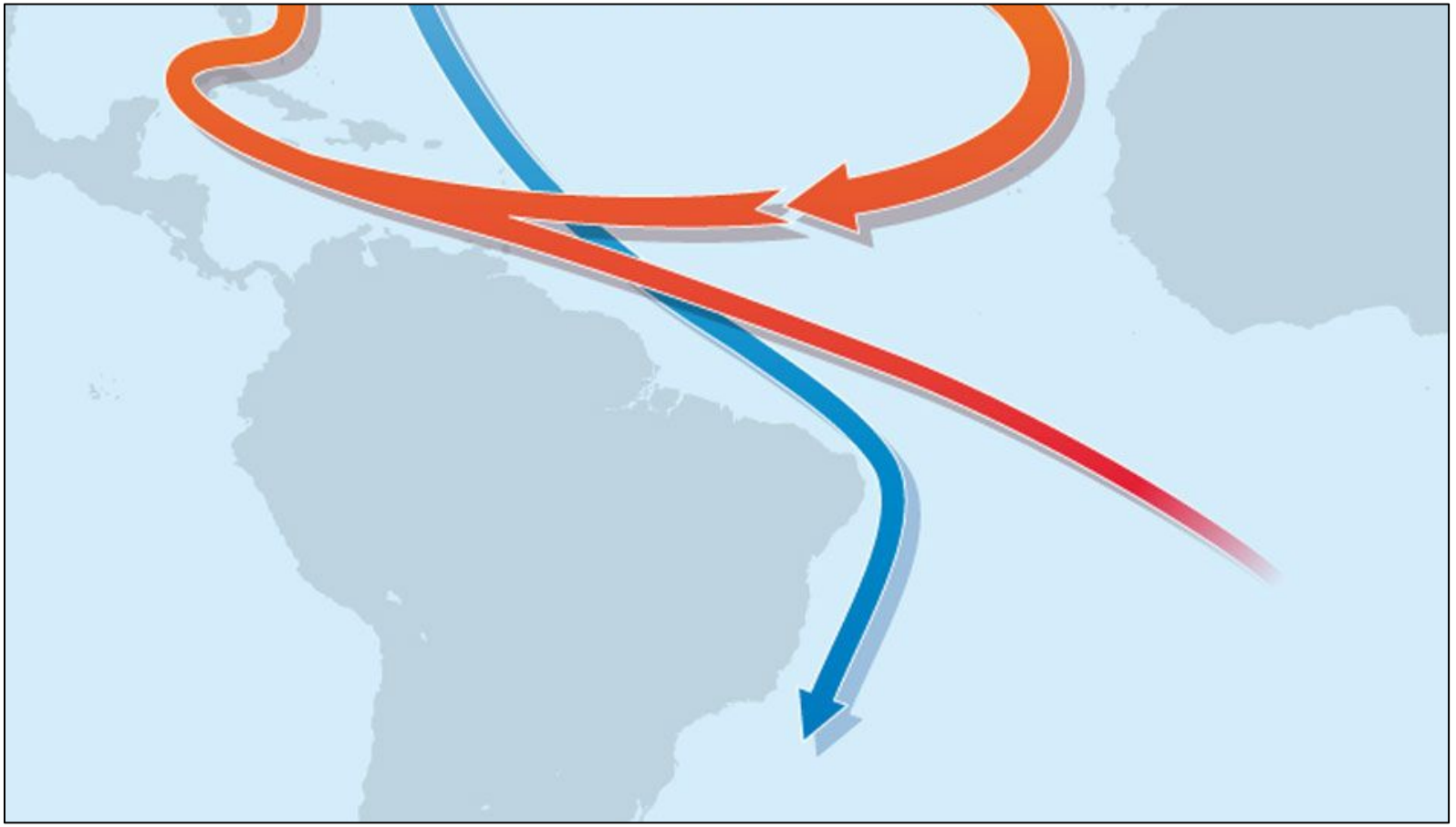
North Brazil Current

- Northward heat transport.



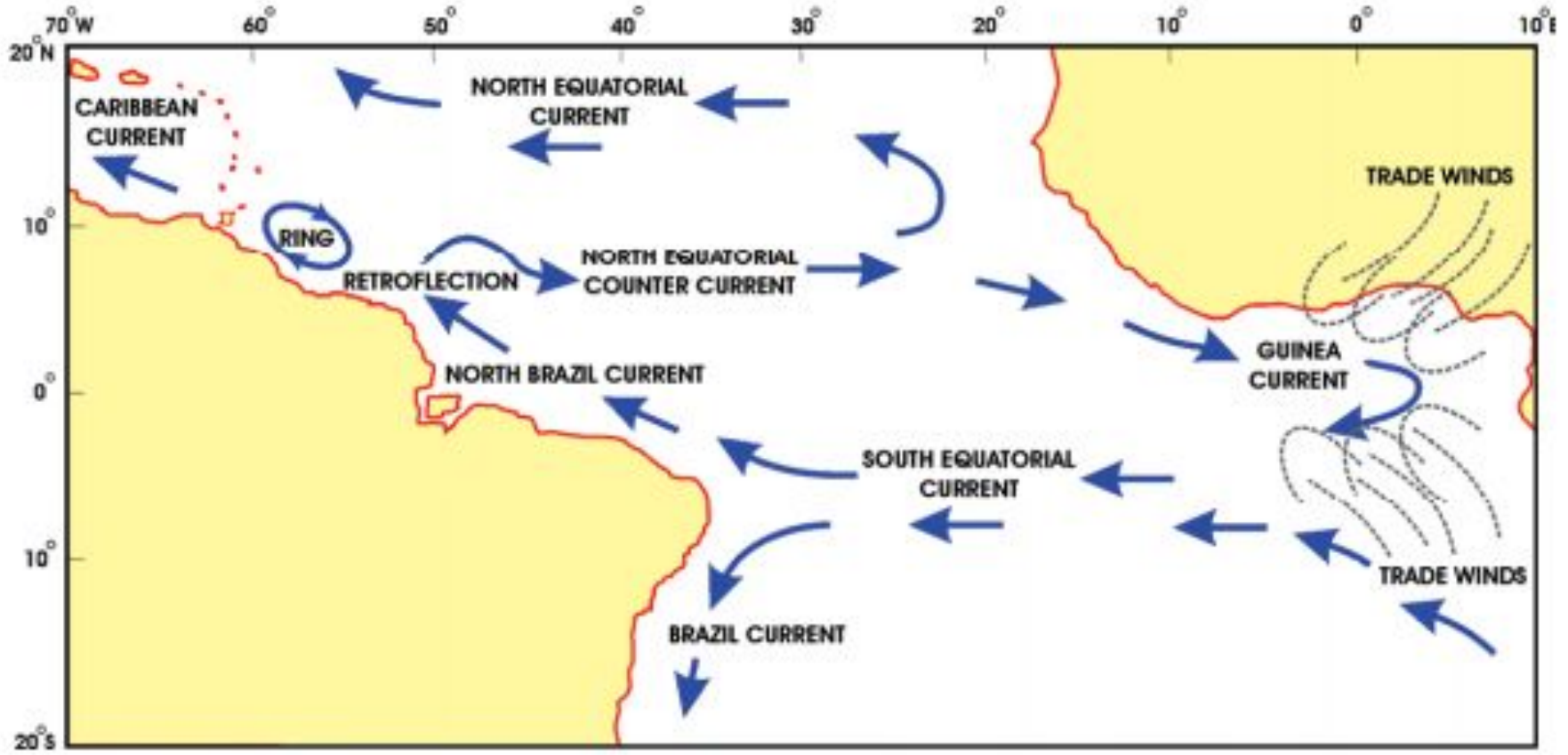
Source: Philander (2001)

Atlantic Meridional Overturning Circulation



Source: Praetorius (2018)

North Brazil Current Retroflection Eddies



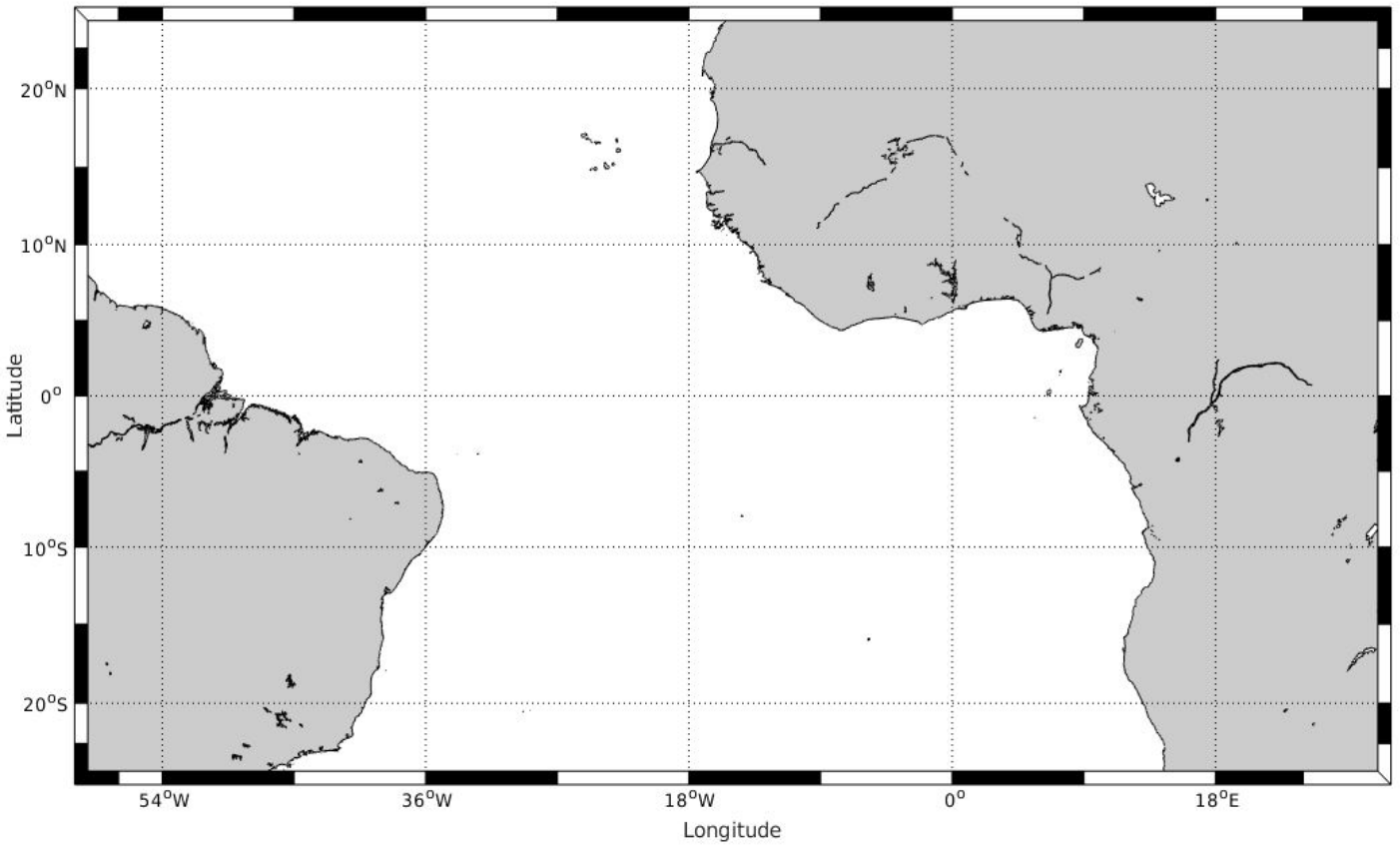
Source: Sharma *et al.* (2009)

Main Objectives

- Assess the changes to the AMOC and NBC eddies in a CMIP5 future scenario.
- Assess the spatio-temporal variability and trend of the AMOC in the Tropical Atlantic Ocean, under different climate scenarios.
- Determine the behavior of the mesoscale ocean eddies generated at the NBC retroflection, under downscaled future climate scenarios.

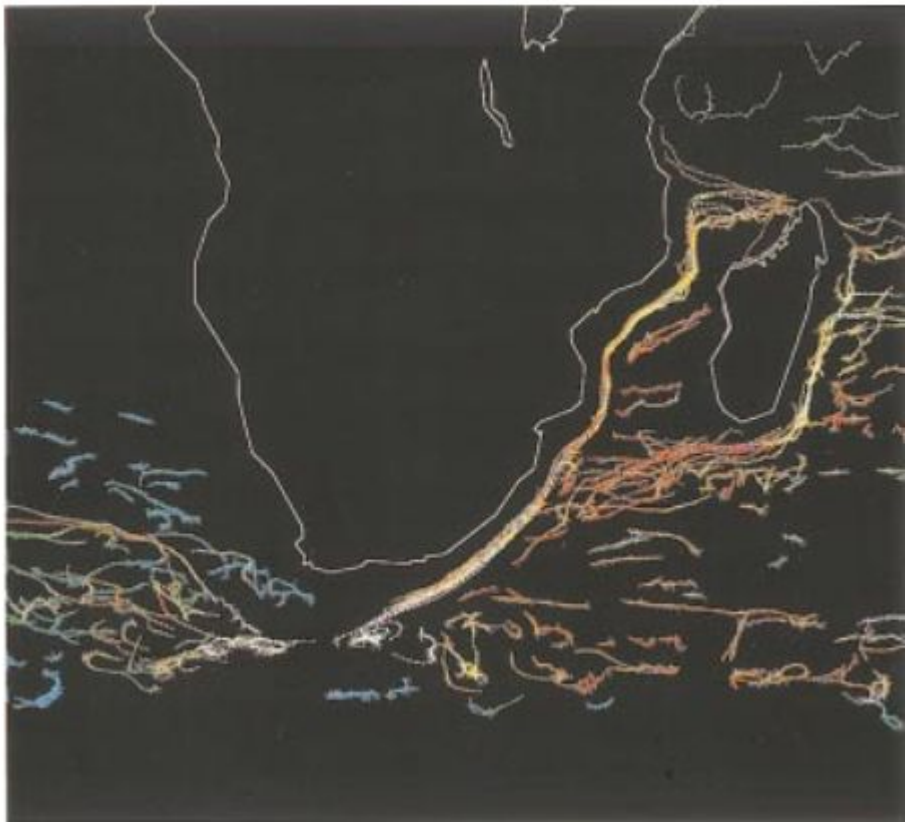
Downscaling experiment

- Dynamical downscaling was done using the Regional Ocean Modelling System (ROMS).
- Two 20-year experiments: Historical (1986-2005) and RCP 8.5 (2081-2100).
- Initial and boundary conditions: Brazilian Earth System Model (BESM).



Tracking of NBC Eddies

- Automated tracking via an algorithm called **TRACK**.
- Identifies features, tracks them and generates statistics:
  - Maximum speed,
  - Mean lifetime,
  - Trajectory, genesis and lysis density,
  - Growth/decay rate,

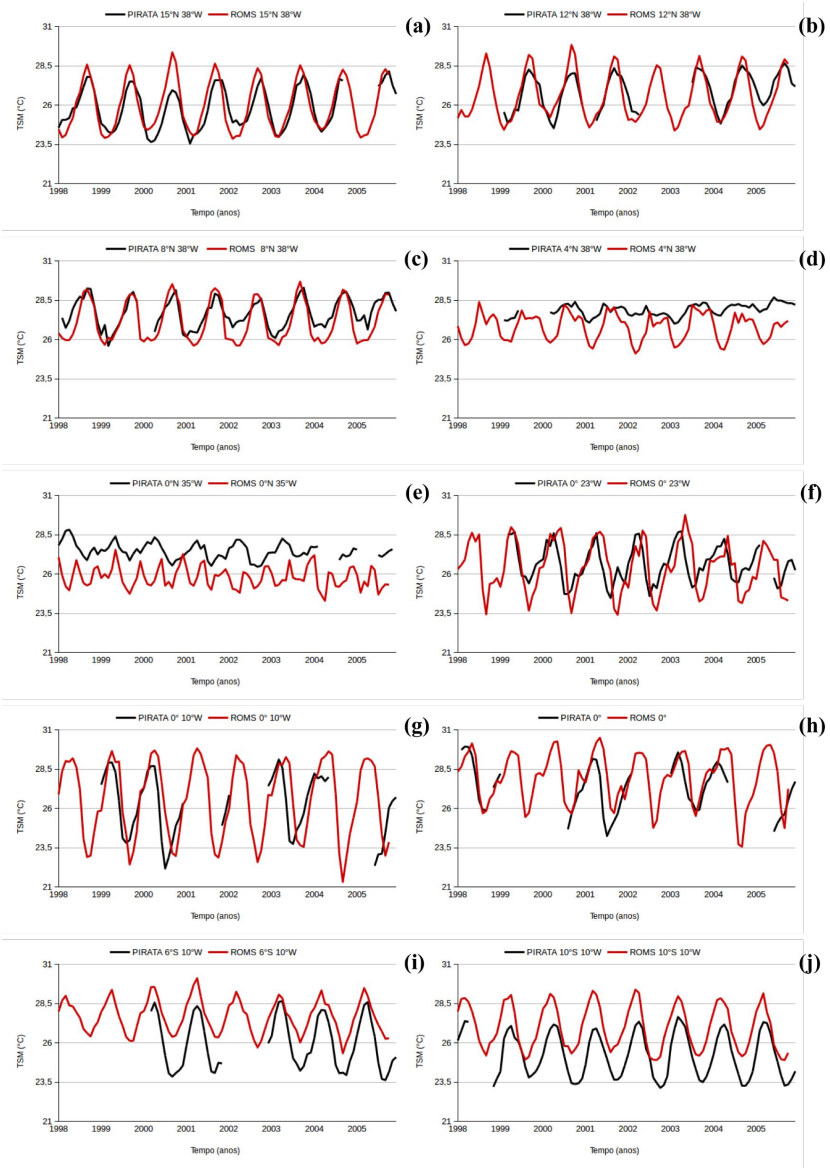


Source: Hodges (1999).

ROMS/PIRATA Comparison

SST Time series

- Good representation of SST variability.
- Higher accuracy at the Northern and eastern regions of the domain.
- Overestimation at the Southern hemisphere.

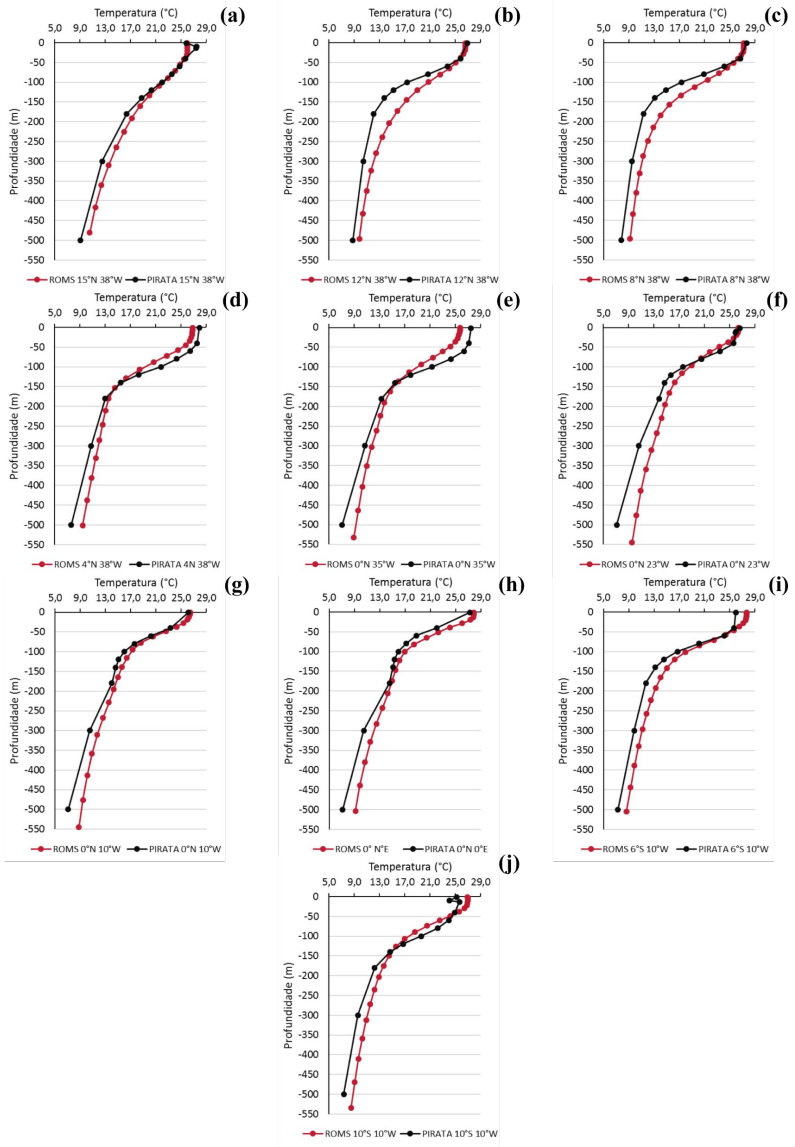


Comparison between SST time series from the ROMS Historical experiment and PIRATA buoys.

ROMS/PIRATA Comparison

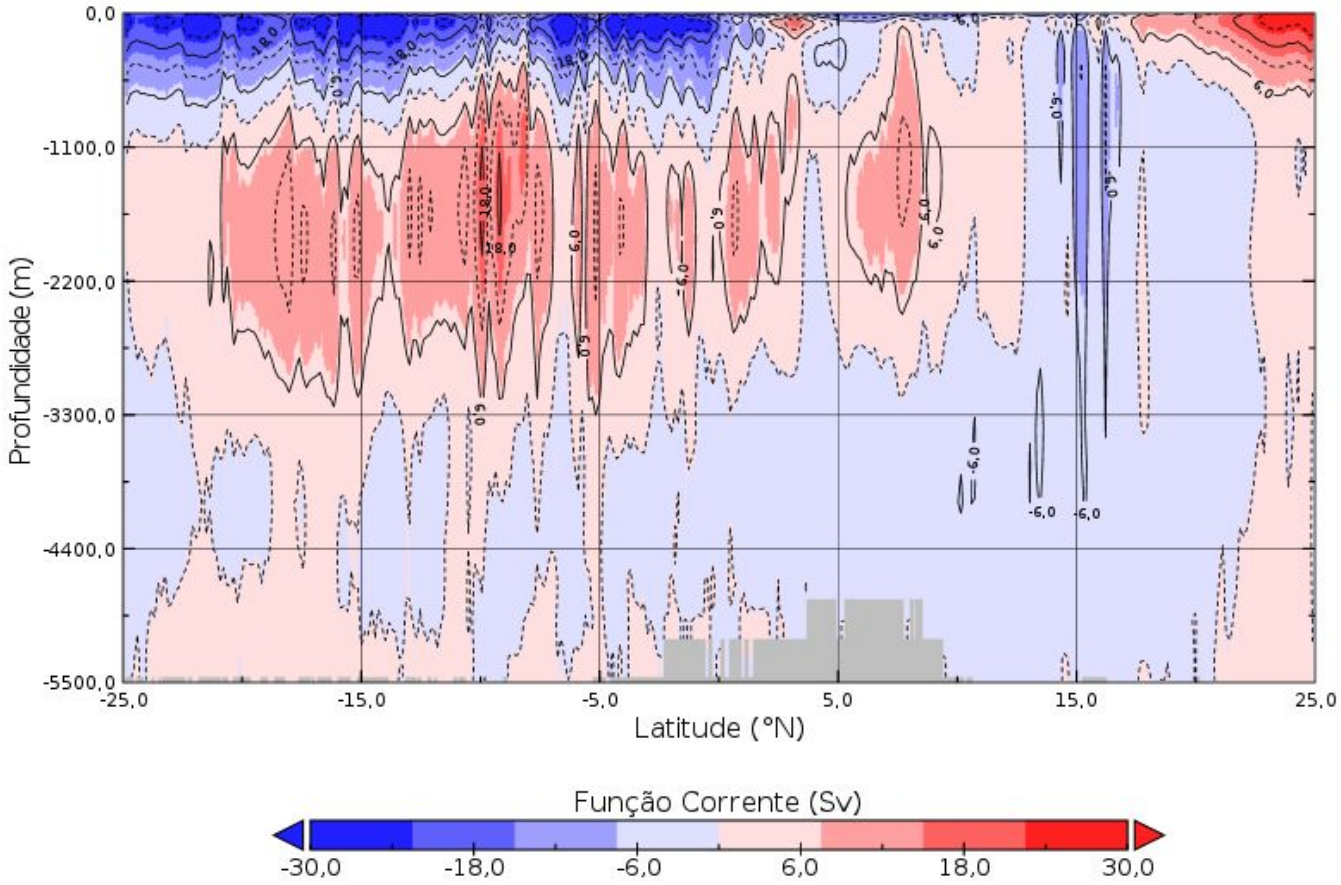
Mean vertical temperature

- Thermocline depth and temperature gradientes were well simulated.
- Surface biases near the equator and at the Southern hemisphere.



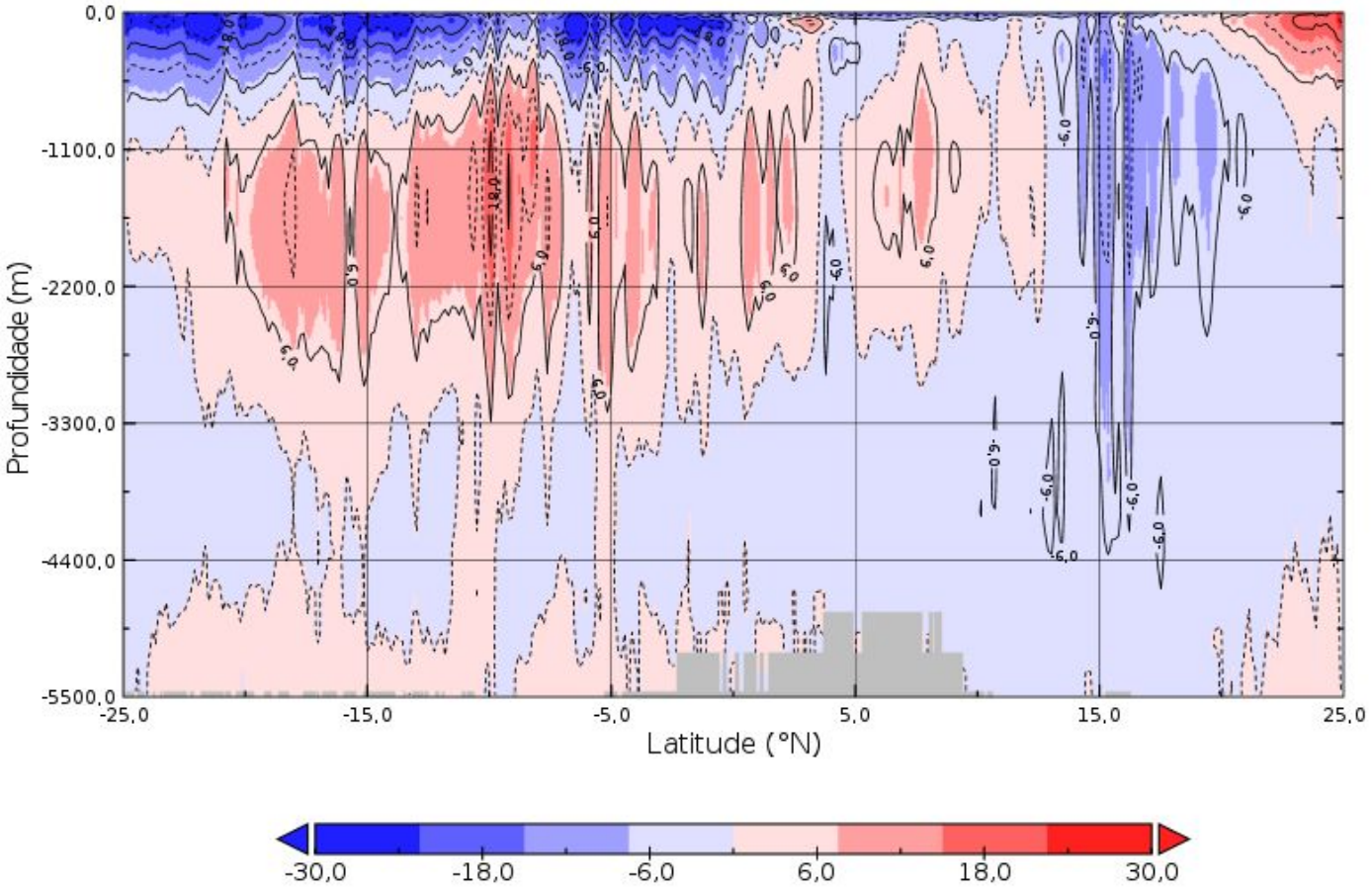
Comparison between vertical temperature profiles from ROMS and PIRATA.

Meridional Streamfunction



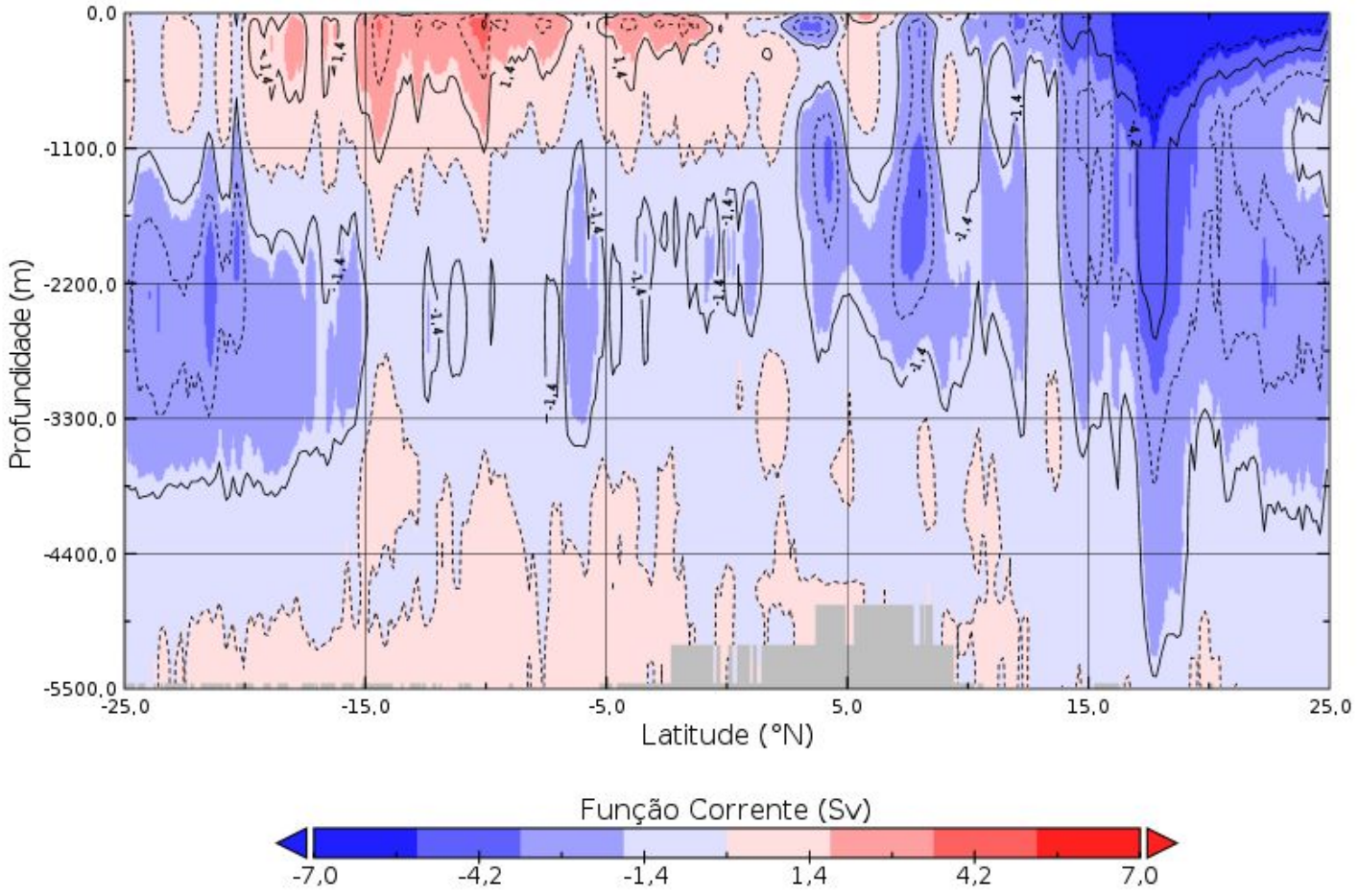
Mean streamfunction, from 1986 to 2005, in the ROMS Historical experiment.

Meridional Streamfunction



Mean streamfunction, from 2081 to 2100, from the ROMS RCP 8.5 experiment.

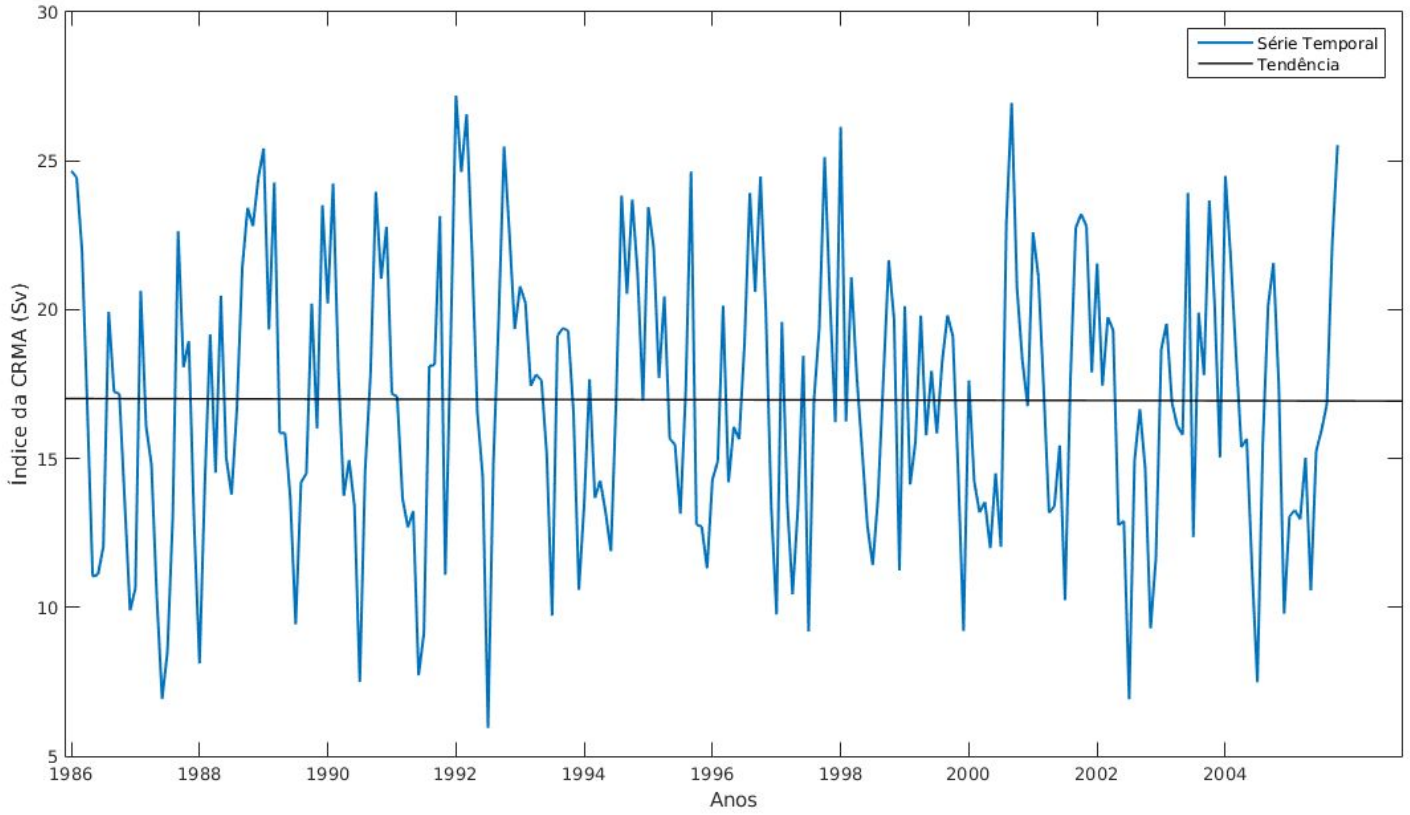
Meridional Streamfunction



Difference between the RCP 8.5 and Historical experiment streamfunctions.

AMOC Index

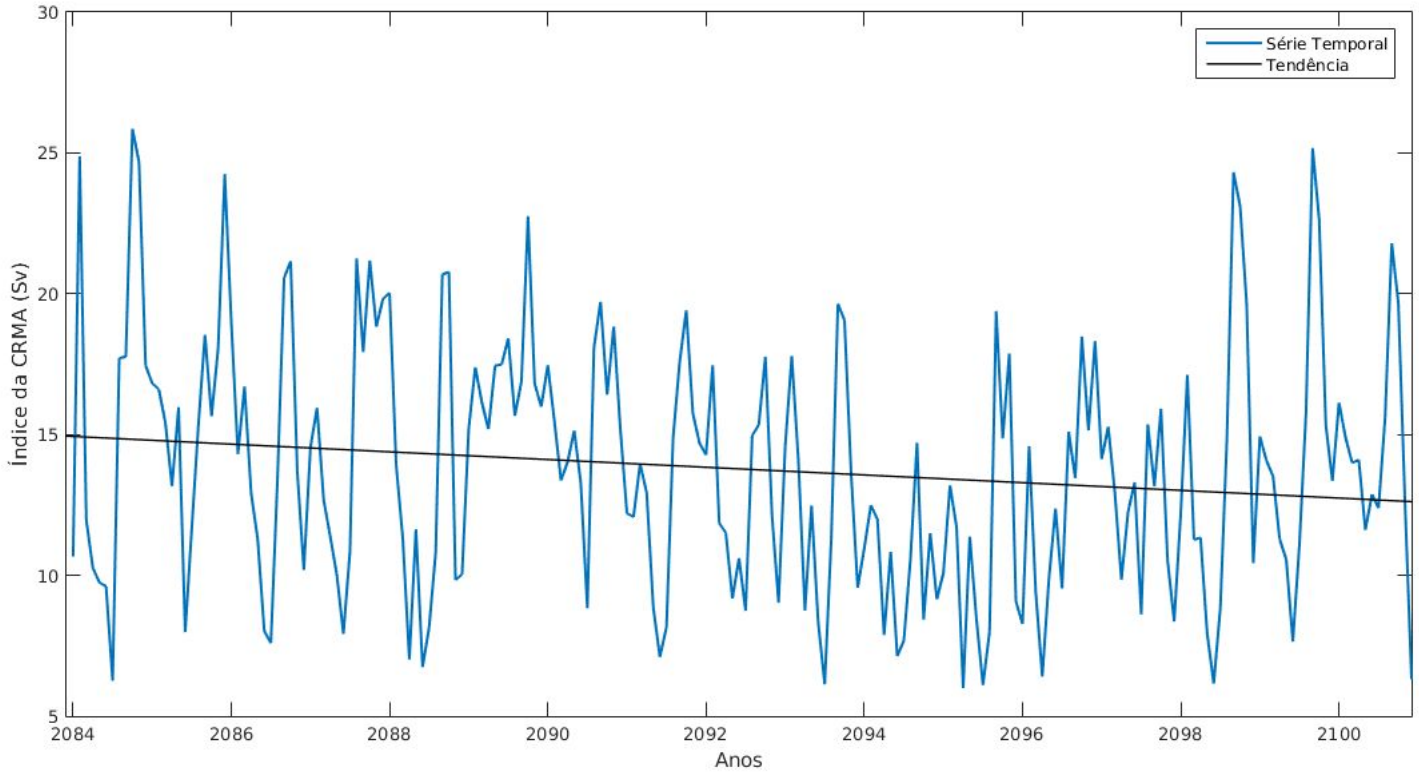
Mean volume transport of 16.9 Sv



AMOC index from the ROMS Historical experiment.

AMOC Index

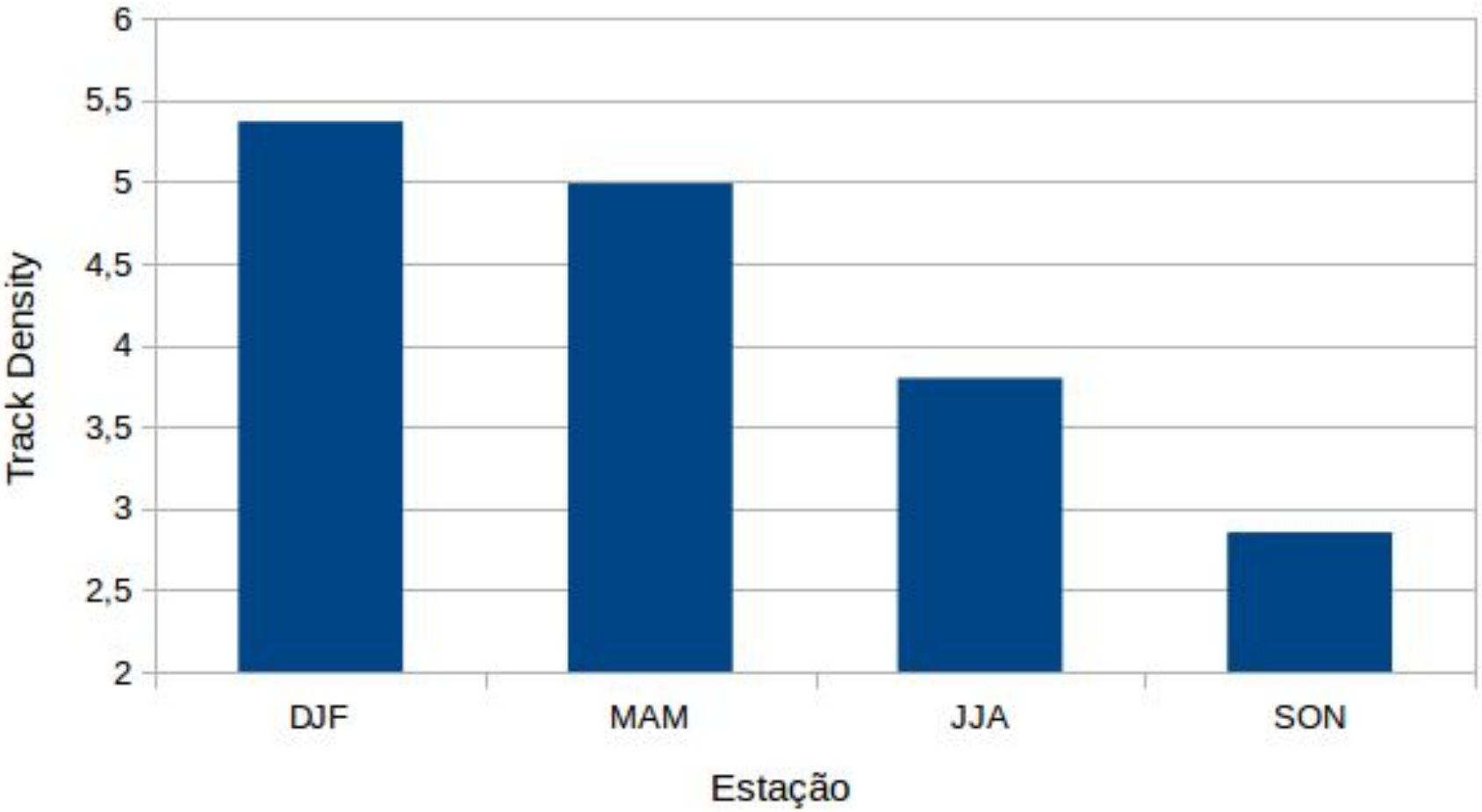
Volume transport weakened by 18%.



AMOC index from the ROMS RCP 8.5 experiment.

NBC Retroflection Eddies

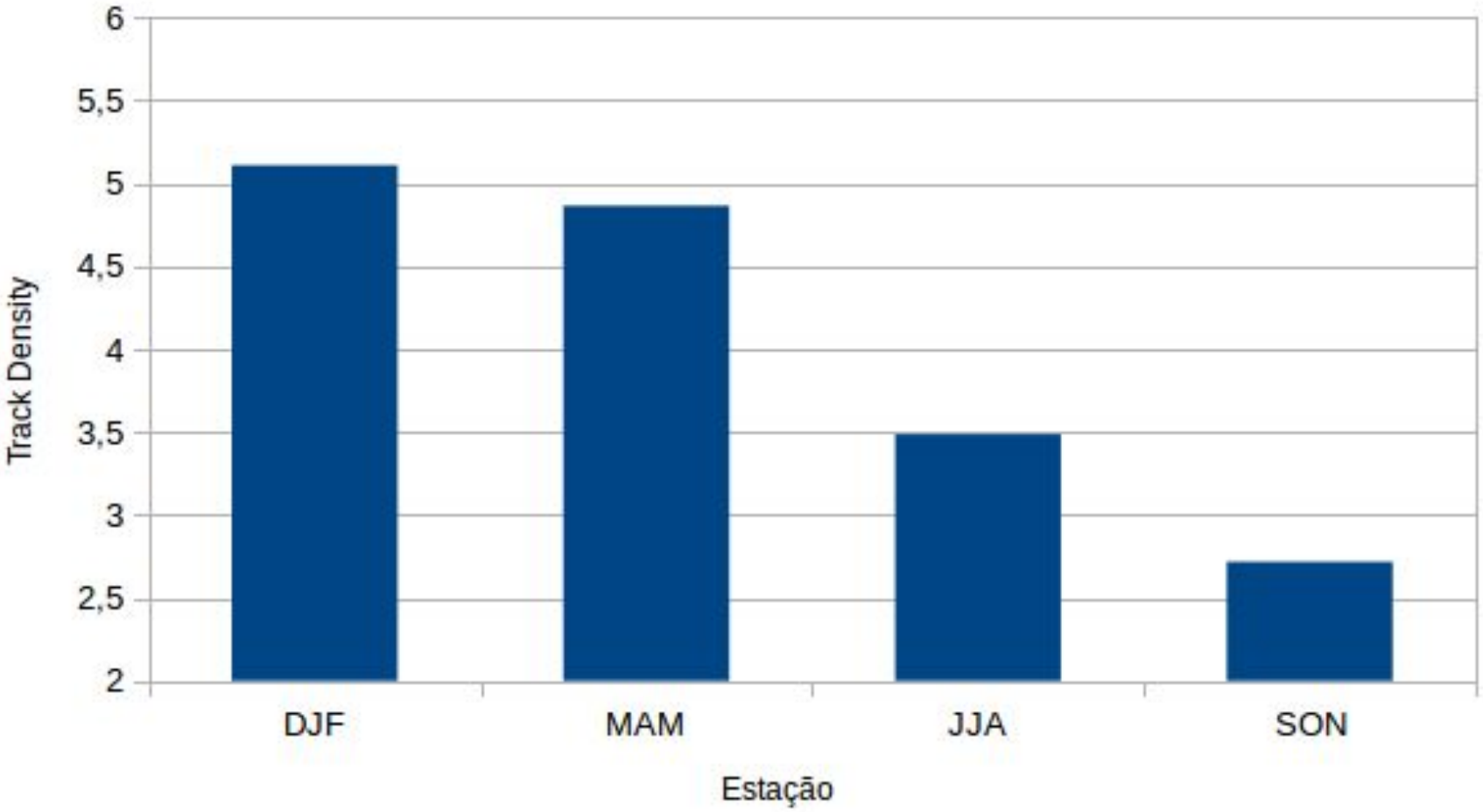
Higher density during the summer, decreases along the year..



Seasonal climatology of NBC Eddy track density, Historical experiment.

NBC Retroflection Eddies

Slight decrease in eddy occurrence.



Seasonal climatology of NBC Eddy track density, RCP 8.5 experiment.

Conclusions

- Anthropogenic forcing may weaken the AMOC until 2100, affecting both its northward and southward flow.

- Meridional streamfunction showed na 18% decrease in volume transport, in relation to the control period.

- NBC eddies maintain their rate of occurrence even under a weakening AMOC.