UNIVERSITY OF MIAMI
ROSENSTIEL SCHOOL of MARINE, ATMOSPHERIC & EARTH SCIENCE

In situ based Meridional Overturning Circulation and Brazil Current Volume Transport Estimations

Ongoing and Future work

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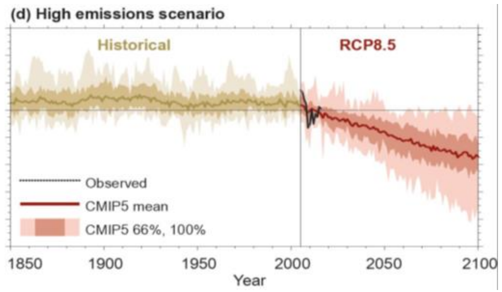
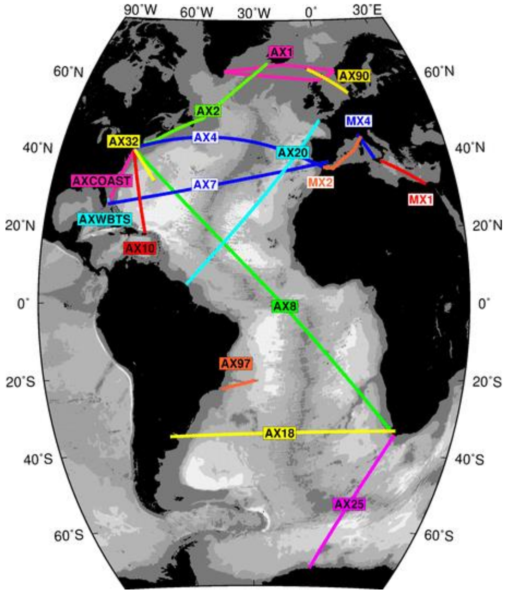
AMOC

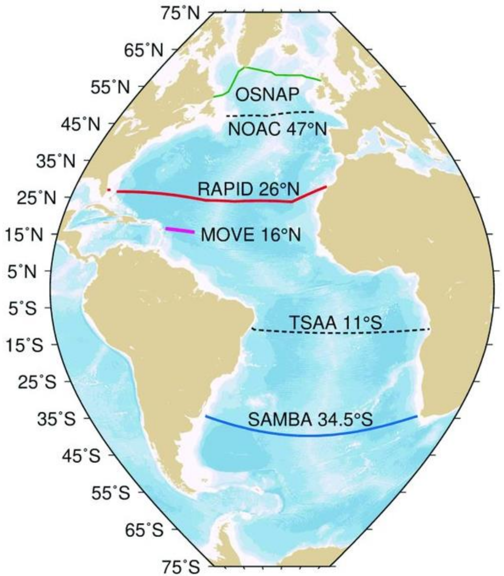
- Projected changes
- South Atlantic Observing system
- Synthetic estimates
- Existing sustained observations
  - Scattered and along transect profiles



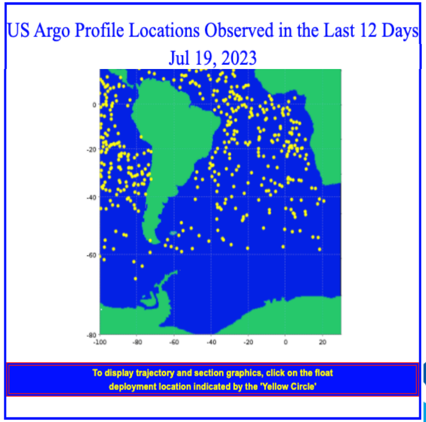
Source: IPCC



Source: AOML



Source: Frajka-Williams et al. (2019)



Source: AOML

AXMOC: Argo-XBT observing system for the Atlantic Meridional Overturning Circulation and Meridional Heat Transport

Goal:

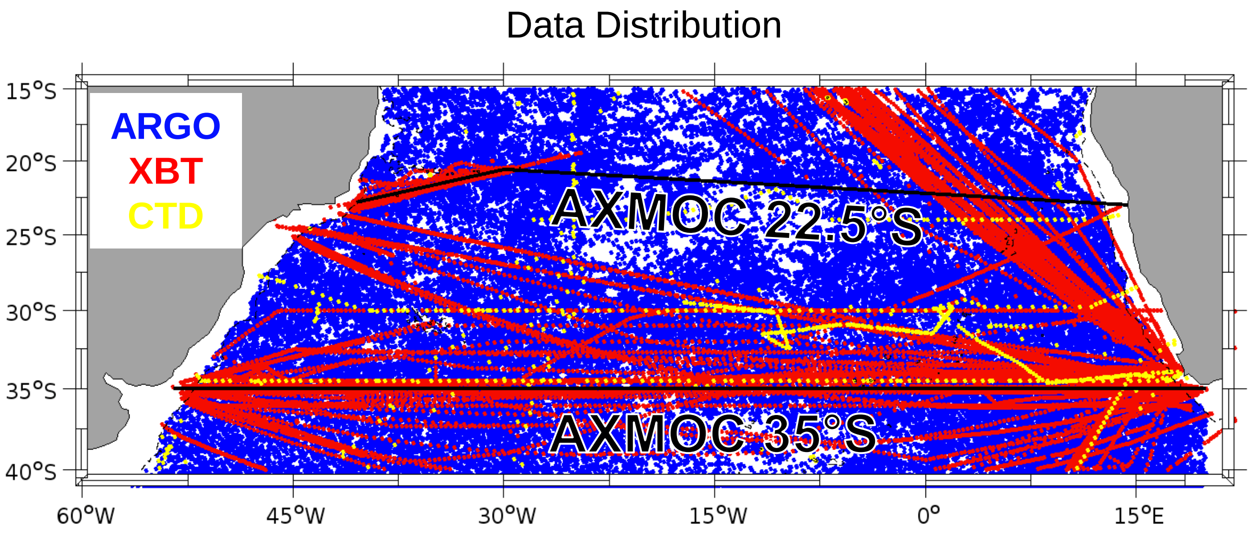
- Implement a cost-effective Atlantic Meridional Overturning Circulation (AMOC) and Meridional Heat Transport (MHT) observing system in the Atlantic Ocean

Main Objective:

- Use sustained observations (e.g. XBT, Argo) to derive Boundary Currents, AMOC and MHT using a mapping optimization method

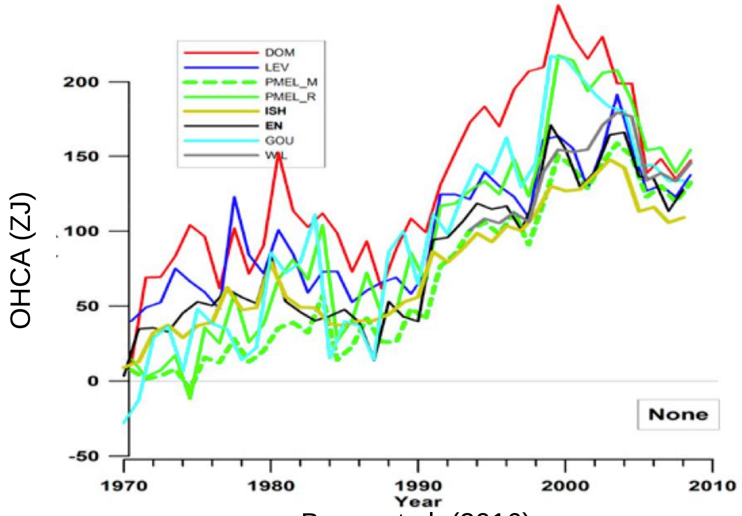
Data

- XBT, Argo, CTD
- Altimetry SSH

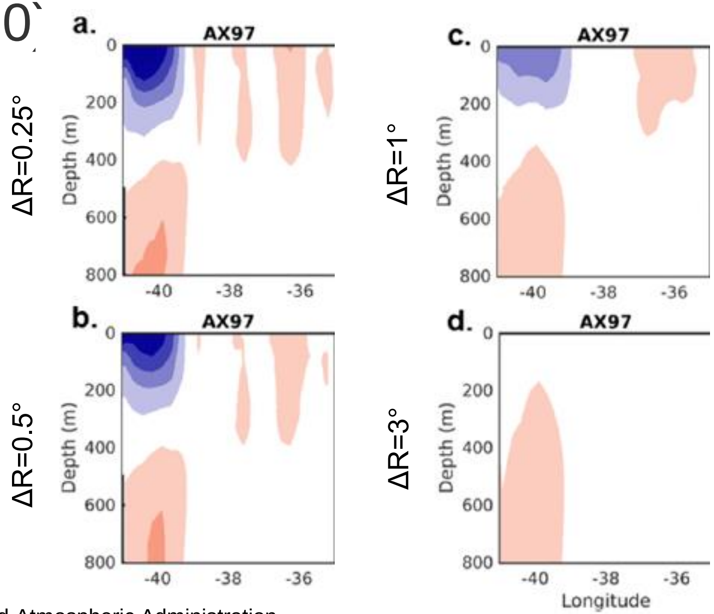


Mapping Strategy

- High uncertainty in long-term OHC estimates (Boyer et al., 2016)
- ARGO and XBT jointly improves estimates of MOC, MHT and Boundary Currents (Goes et al., 2020)



Boyer et al. (2016)

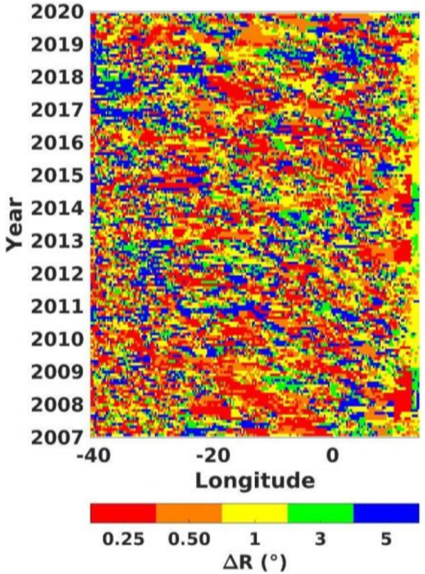


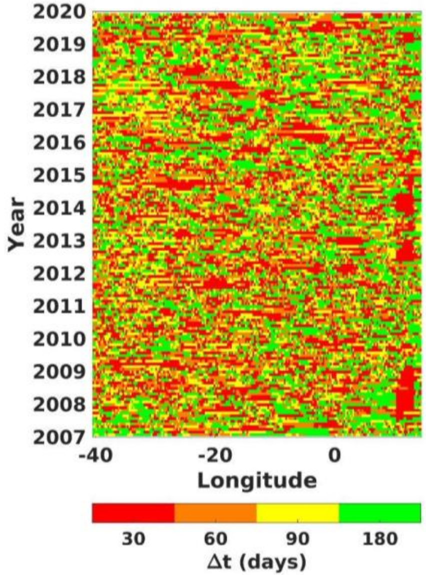
Goes et al. (2020)

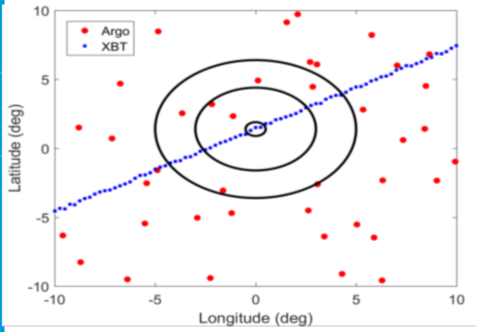
Mapping Strategy

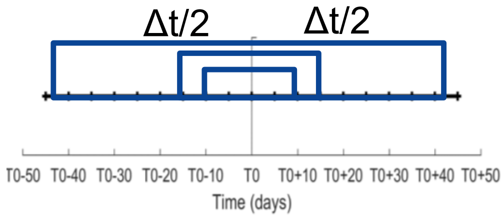
- Monthly, ¼ degree, 140 z levels
- Weighted average of the profiles
- Cost Function: RMSE (SSH,DH)

$$RMSE = \sqrt{\frac{\sum_{i=1}^{N} \|SSH(i) - DH(i)\|^2}{N}}$$



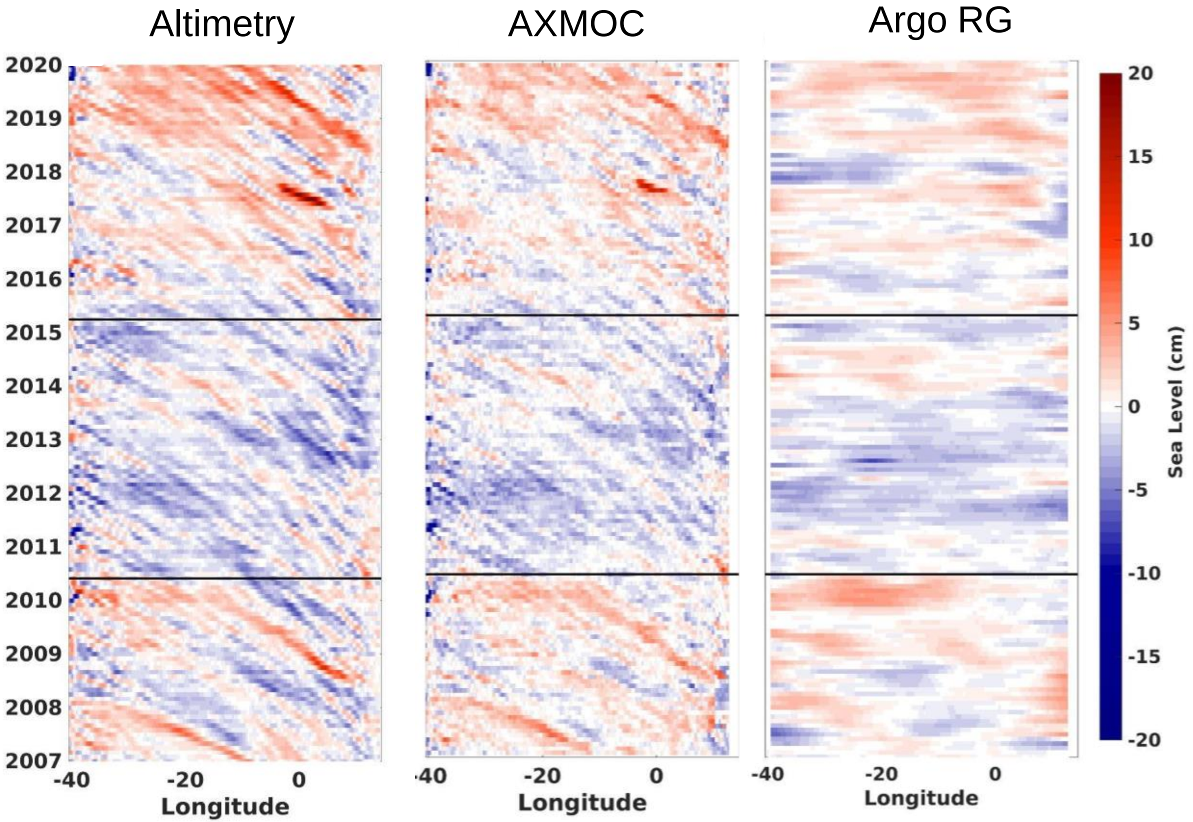






Δt (days)	30	60	90	180	
ΔR (°)	.25	.50	1	3	5

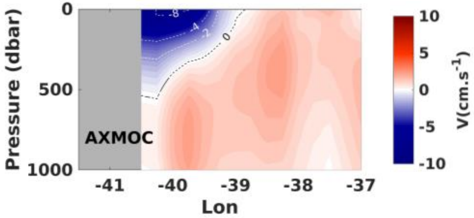
SLA comparison

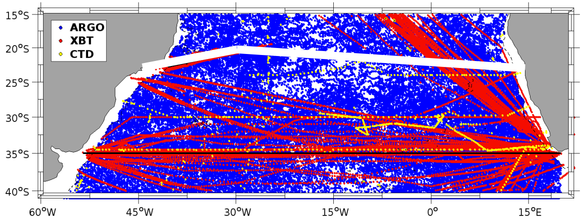


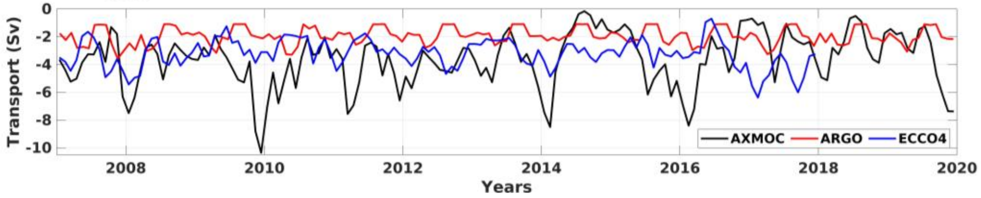
AMOC and MHT calculations

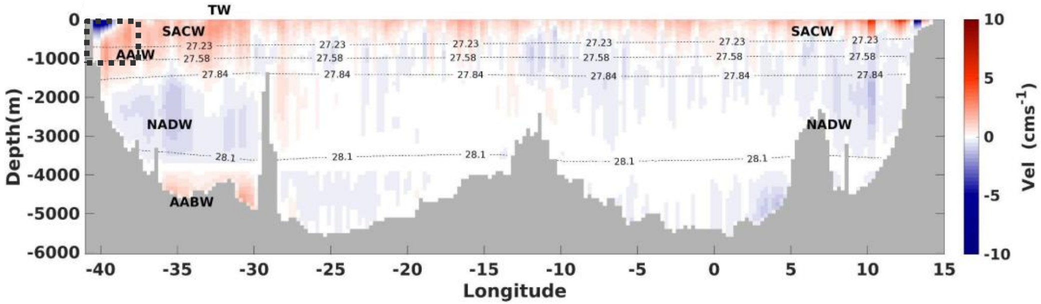
- Geostrophic
  - Optimal T S sections
  - Reference Level: 3700m
  - WOA18 padding
  - Mass balance
- Ekman
  - Surface wind stress (ERA 5)

Brazil Current

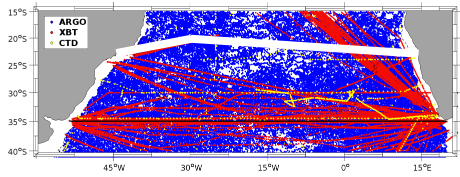


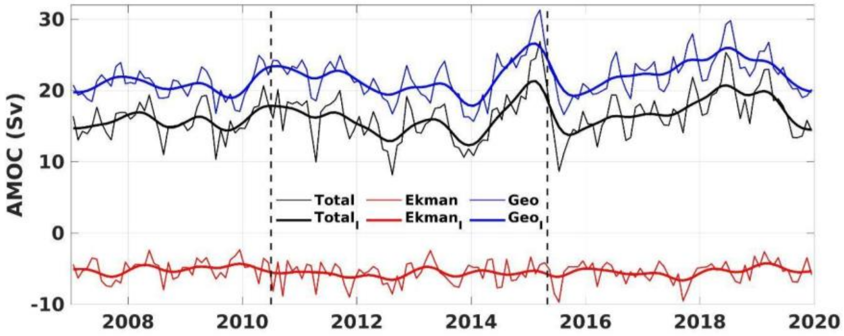


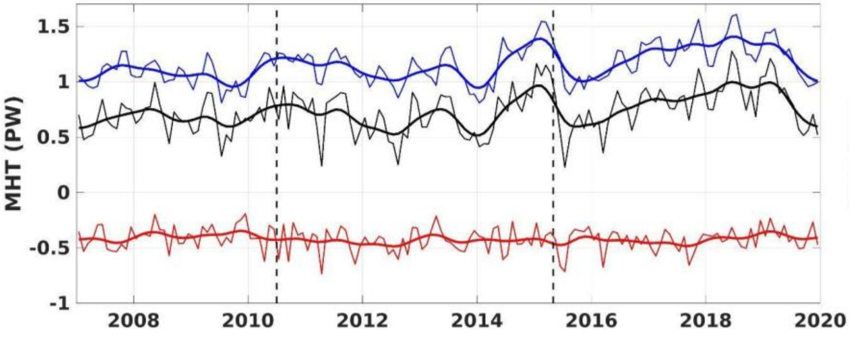




AMOC, MHT and BC

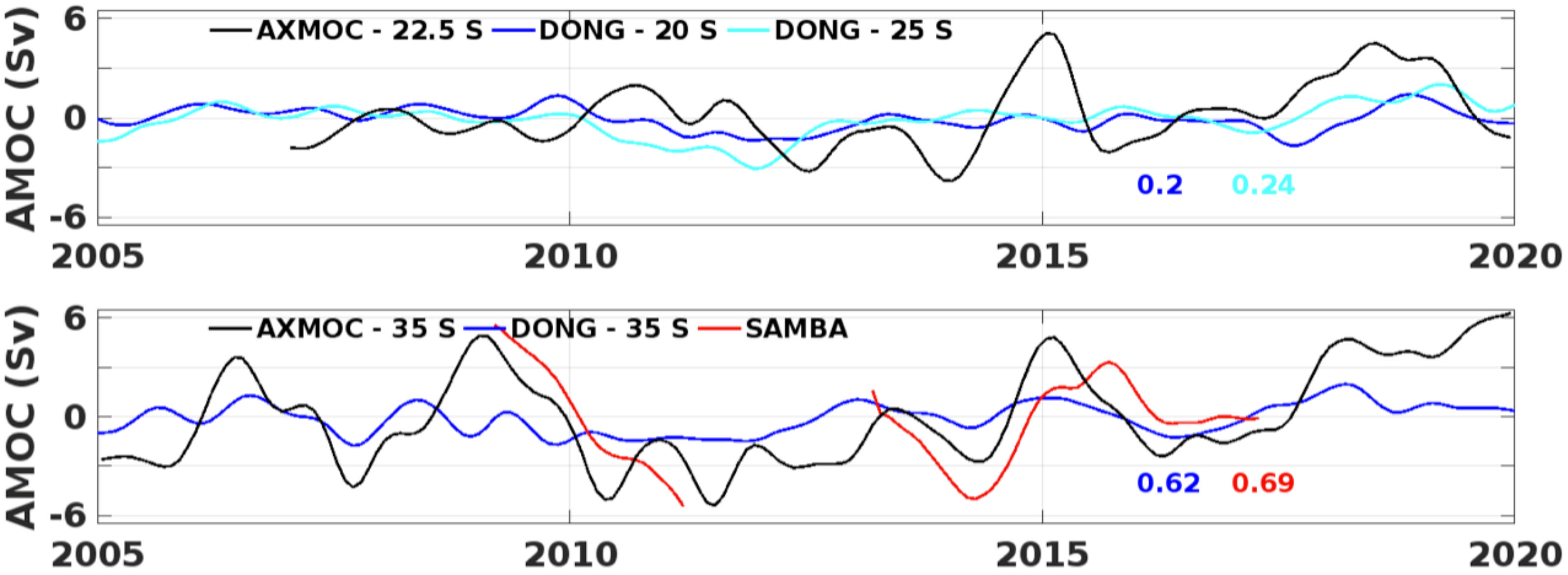






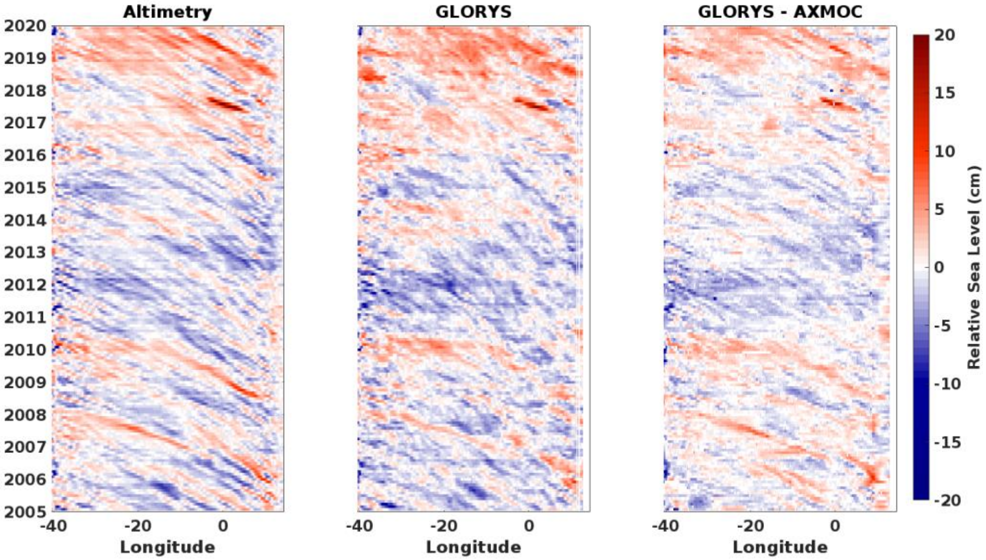
AXMOC, synthetic and SAMBA

- Increased variability at 22.5°S
- Good agreement with in situ data at 35°S



Ongoing and Future steps

- Pita et al., (2023): in review
- Data availability
- System optimization with Ocean Reanalysis (GLORYS
- Heat Budget Analysis



$$\frac{dOHC}{dt} = \underbrace{Q_{SW} + Q_{LW} + Q_S + Q_L}_{Q_{net}} + \underbrace{MHT_{35°S} - MHT_{22°S}}_{Advective\ Term}$$

Thank You!

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