Oceanographic Modeling and Observation Network (REMO)

IMPACTS OF DIFFERENT STRATEGIES TO ASSIMILATE ARGO DATA INTO THE HYBRID COORDINATE OCEAN MODEL OVER THE SOUTH ATLANTIC

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Outline

- Introduction
- Methods
- Results
- Conclusions

Introduction

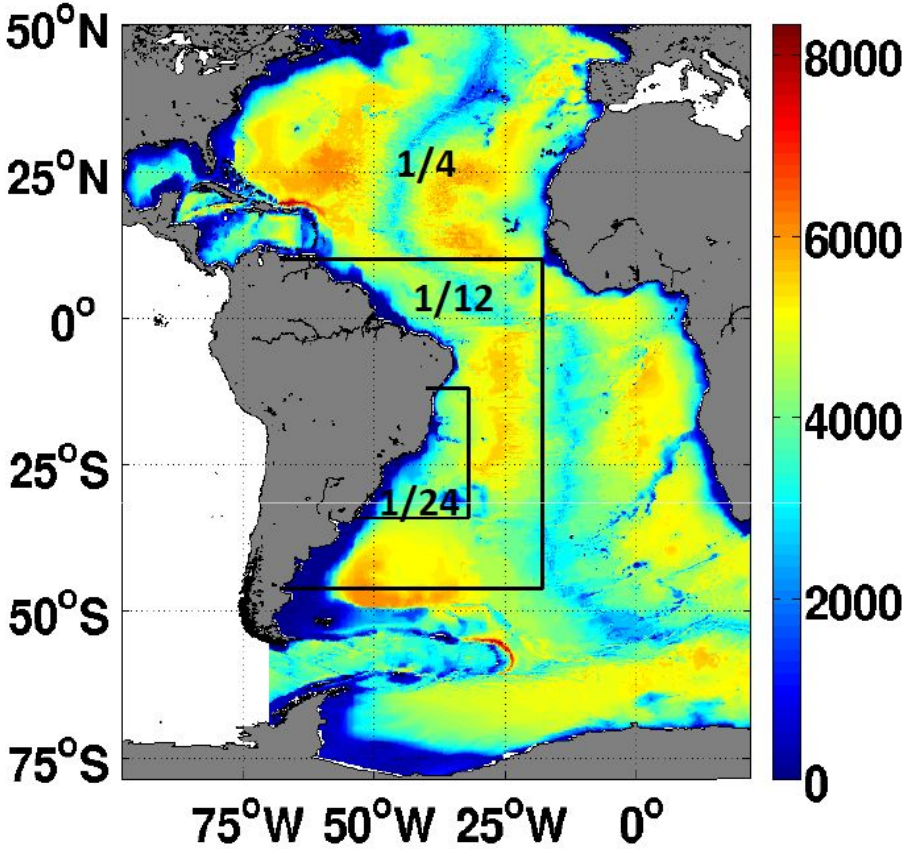
- Argo data can substantially impact model SSH due to its relationship with the subsurface thermohaline structure as well as the multivariate nature of assimilation techniques.

- Few works have showed this impact (Fu et al. 2011; Mignac et al.2015), but it doesn’t compare with observations.

- Also, they don’t show impacts that assimilation of ARGO can have on currents.

- Here we propose to investigate these impacts by assimilating Argo data into the HYbrid Coordinate Ocean Model (HYCOM).

Methods



- HYCOM 2.2.14
- 1/12o Horizontal Resolution
- 21 Layers
- CFSR
- Ensemble Optimal Interpolation (EnOI)
- 126 Ensemble Members

Methods

- Due to isopycnal nature of HYCOM -> two ways of assimilating Argo data (Xie and Zhu 2010).
  - Interpolate the observed data into the model vertical layers (ARGOdp) creating a synthetic DP.
  - Interpolate model variables from the model layer to z-coordinate to calculate the innovation (ARGOz).

→ $X^a = X^f + K[Y - H(X^f)]$

→ $K = BH^T(HBH^T + R)^{-1}$

- Four experiments (2008-2013) (a) Control, (b) ARGOdp, (c) ARGOz (d) ARGOzT. Evaluation -> 2010 - 2013

Methods

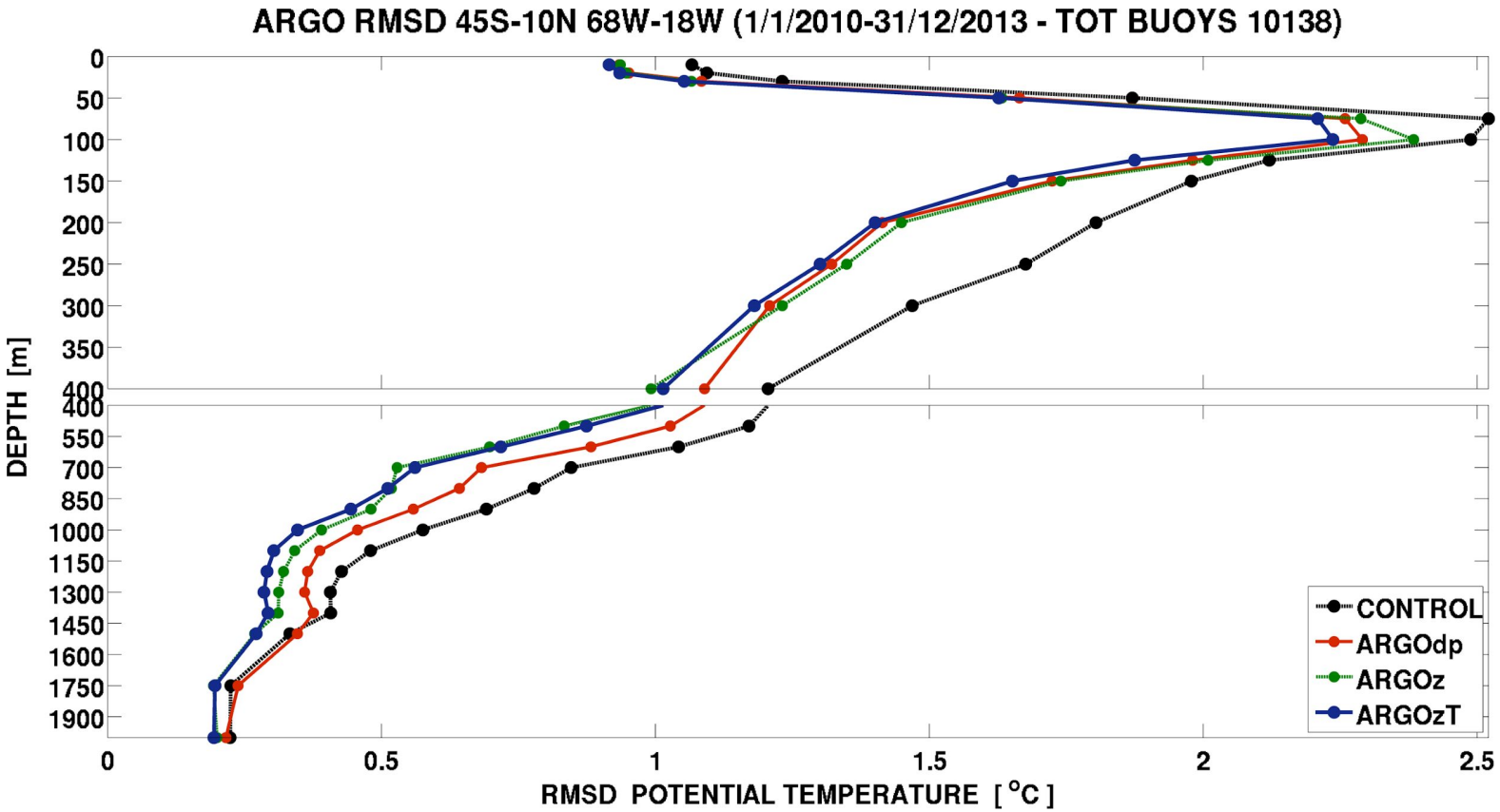
ARGOdp (ISOPYCNAL)

- Vertical localization of DP.
- Diagnoses T.
- Sequential assimilation.
- Assimlates T and S obs. and synthetic DP.
- S obs. are indinspensable.
- Low vertical resolution. (17 – 19 layers).
- High error for the synthetyc DP at layers >10.

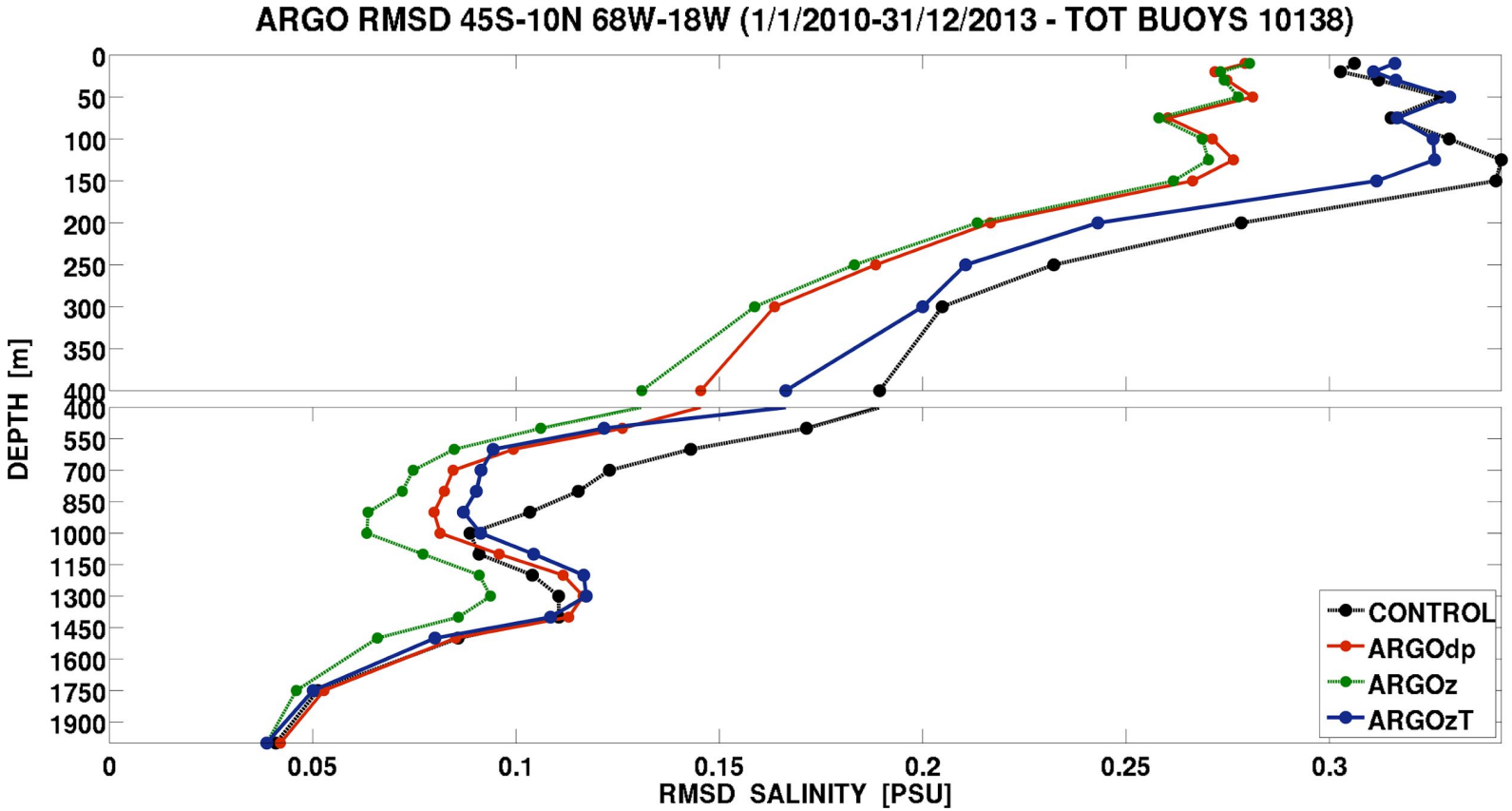
ARGOz (Z Coordinates)

- No vertical localization.
- No diagnostic.
- Joint assimilation.
- Assimilates only T and S observations.
- High vertical resolution.
- If DP_{back} = 0 -> Analysis increment = 0.

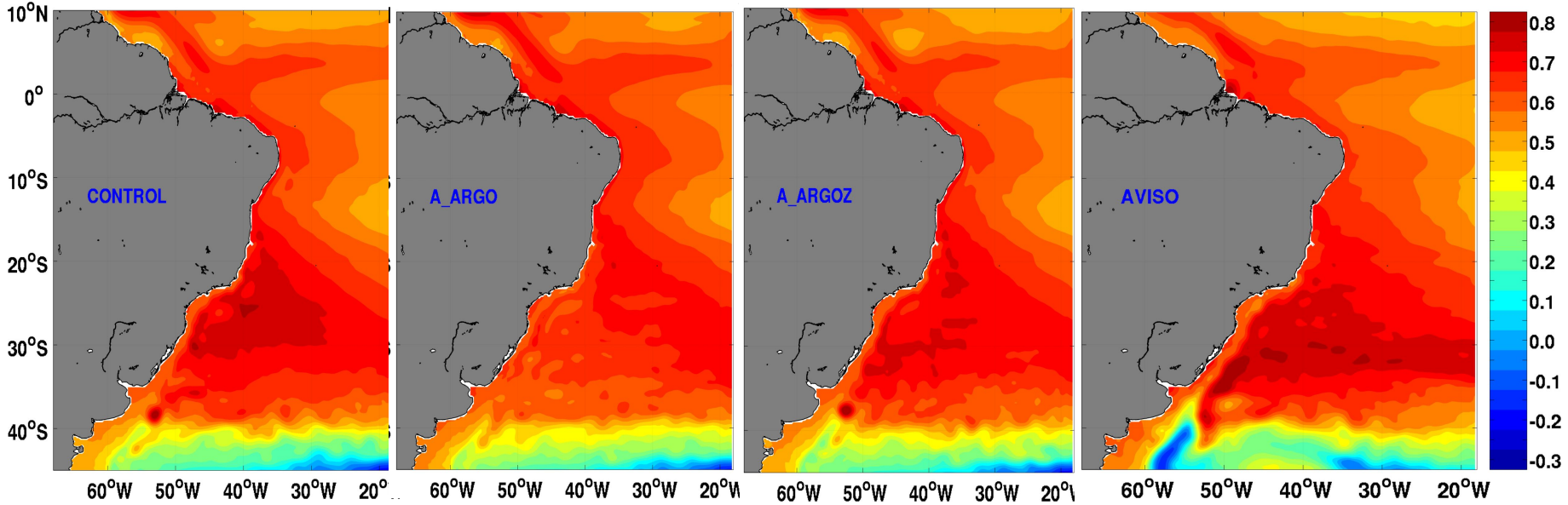
Results: T RMSD PROFILE



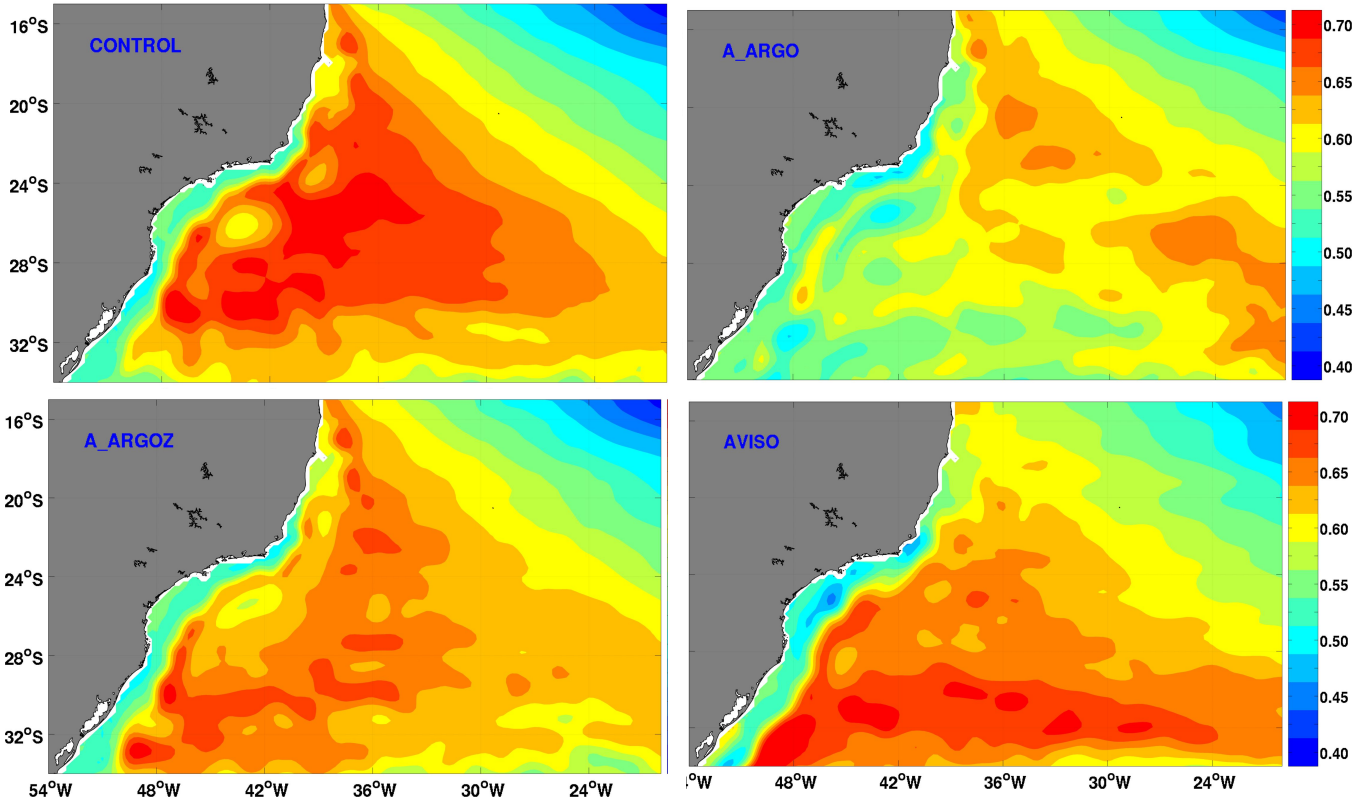
Results: T RMSD PROFILE



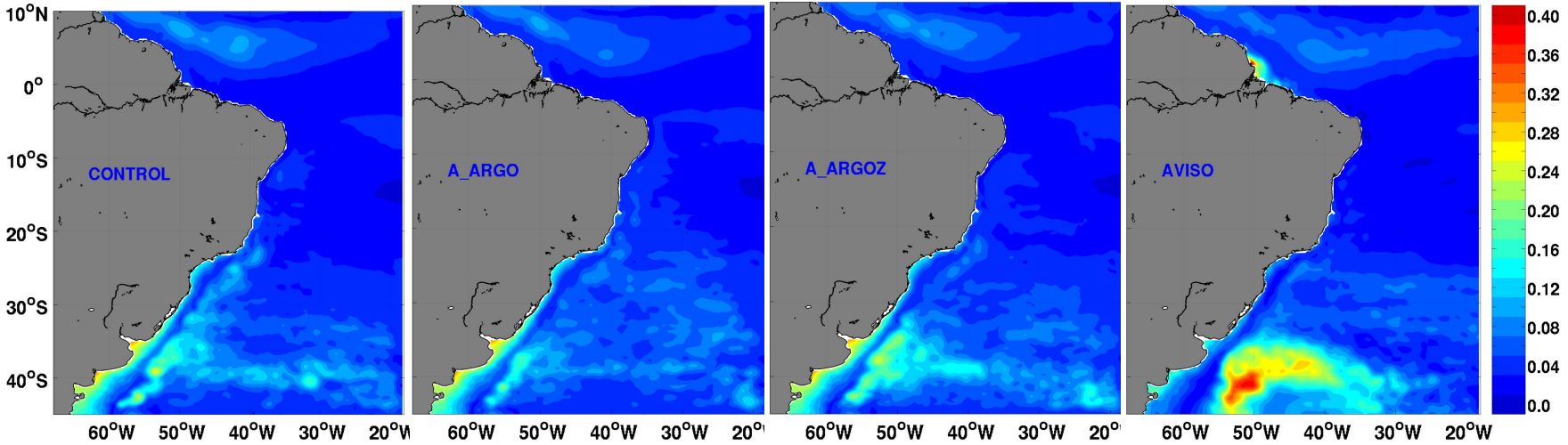
Results: MEAN DYNAMIC TOPOGRAPHY



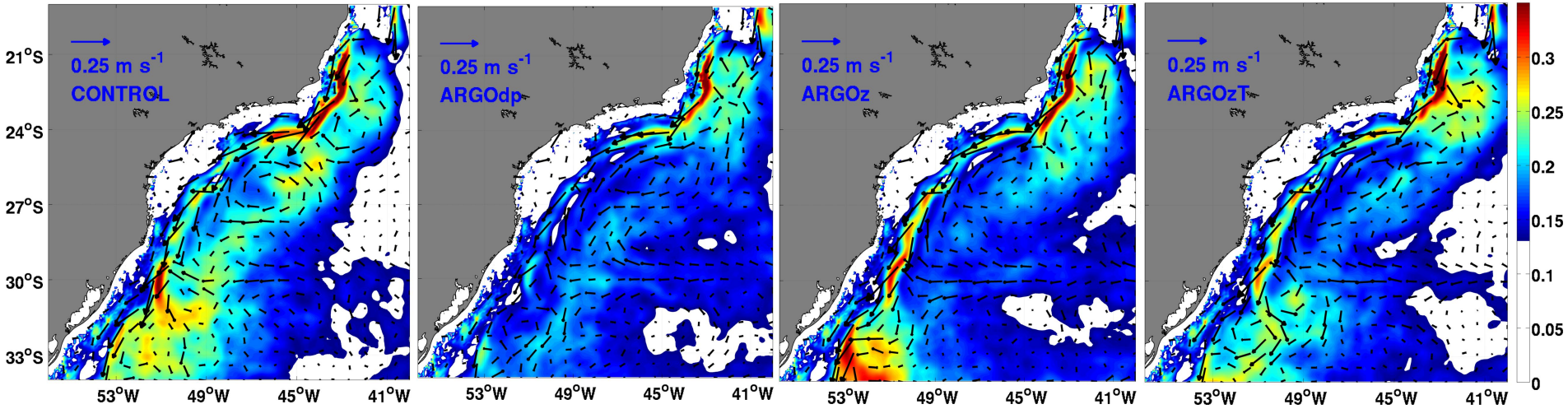
Results: MEAN DYNAMIC TOPOGRAPHY



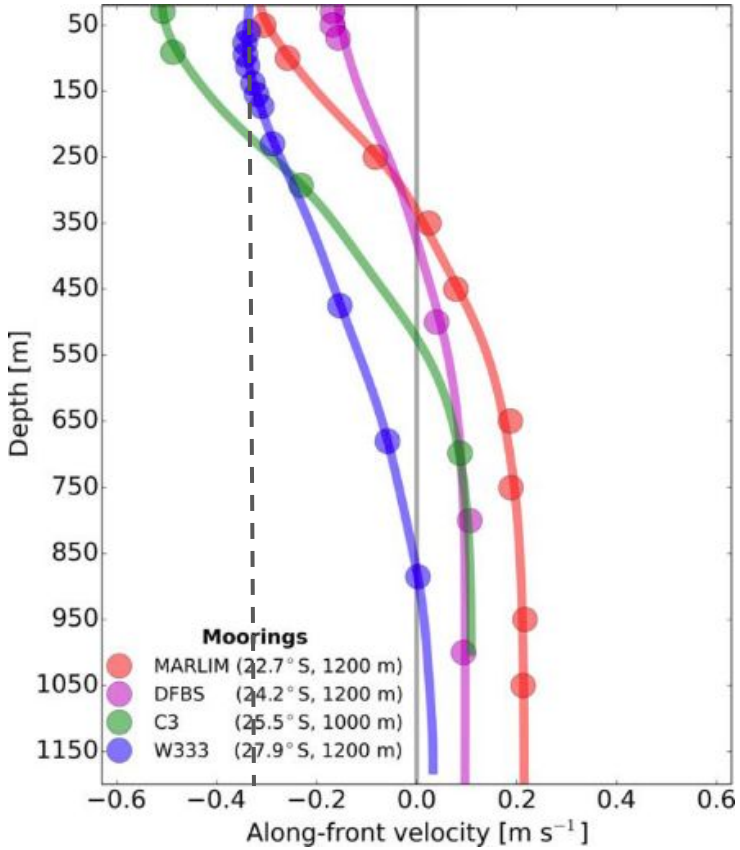
Results: STD DYNAMIC TOPOGRAPHY



Results: MEAN VELOCITY (0 - 100m)

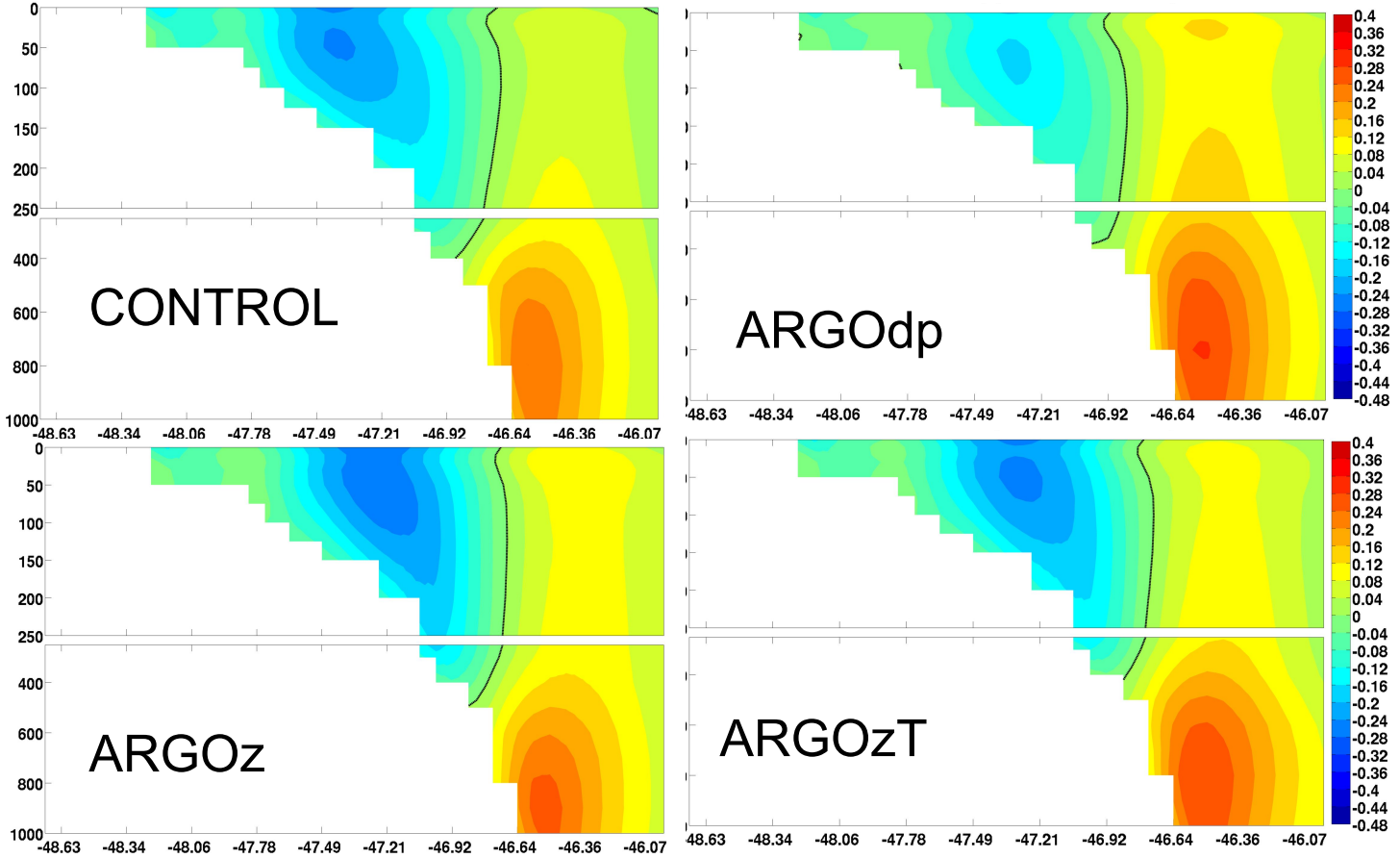


Results: Reference



Rocha et al. 2014

Results: Velocity Section 28oS



Conclusions

- For temperature RMSD w.r.t. ARGO observations the experiment ARGOdp showed slightly better results for the first 300m, while ARGOz presented smaller error elsewhere.
- For salinity the experiment ARGOz had the smallest error along the whole profile and the ARGOzT still got some salinity correction, despite no salinity observations were assimilated.
- MDT and the STD of dynamic topography were better represented by the ARGOz experiment.
- ARGOdp smoothed the SSH gradient on the brazilian coast leading to a weak and poorly represented BC.
- ARGOzT showed similar results to ARGOz indicating that XBT, moored boyu data can be assimilated in the absence of salinity