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Observing System Experiment with PIRATA and XBT data and HYCOM+RODAS over the Atlantic Metarea V

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OceanPredict
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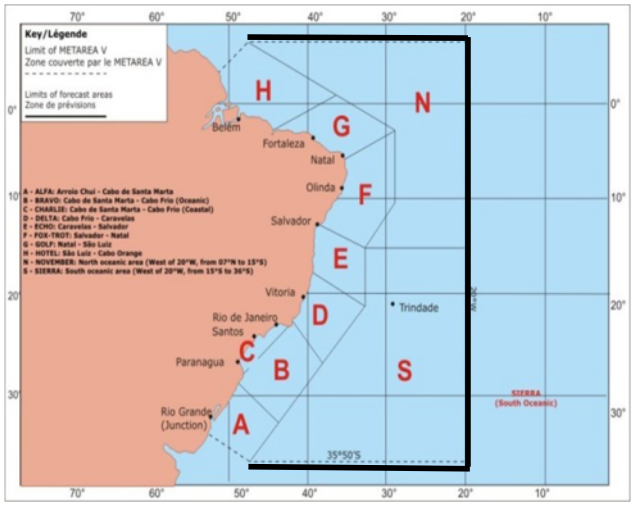
REMO is a research group

Research and technological development in operational oceanography and physical oceanography with focus on the South Atlantic and regions along the Brazilian coast using assimilative models and observational data. It was formed in 2007. OceanPredict member.

Products:

- Ocean weather forecasts
- Reanalyses

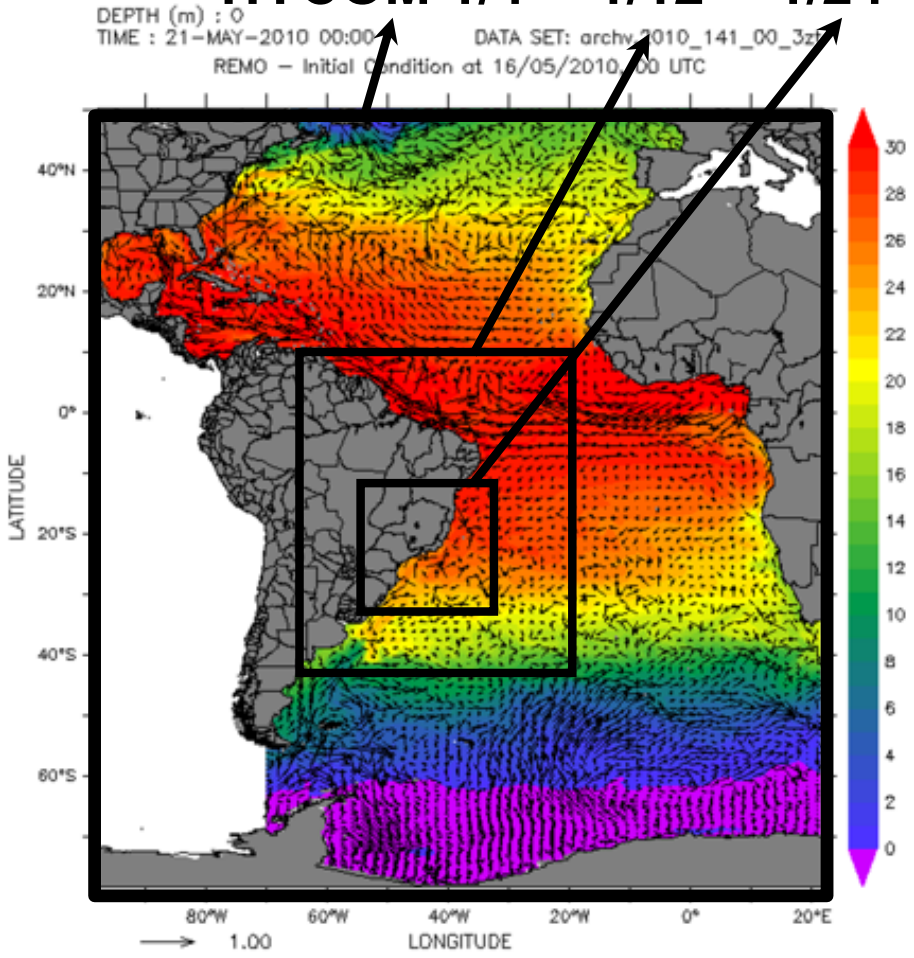


www.rederemo.org

Modeling and Data Assimilation in REMO

Large-scale circulation in the Atlantic and downscaling to METAREA V and region along the Brazilian S-SE coast in the Brazilian Navy CHM operational system.

HYCOM 1/4º 1/12º 1/24º L21



Temperatura e Correntes Superficiais

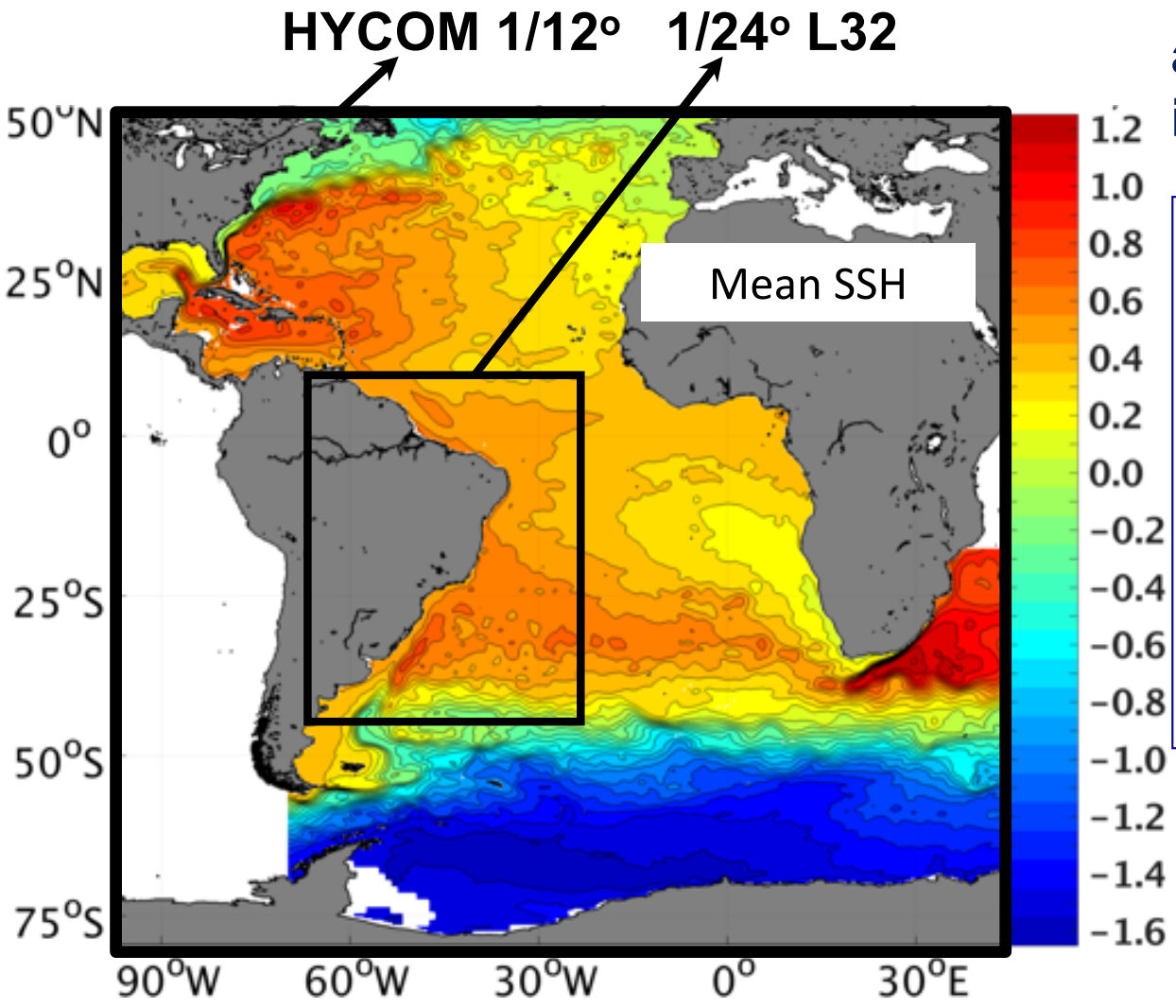
Brazilian Navy Hydrography Center (CHM) Operational System

- 3-5 day forecasts
- NCEP/NOAA GFS and COSMOS forcing
- Simplified version of the **REMO Ocean Data Assimilation System (RODAS)** based on EnOI
- Assimilation of OSTIA SST, AVISO SLA and Argo T/S profiles
- Dissemination by the CHM web page

Lima et al. 2013, BrazJGeophys;
Santana et al. 2020, OceanDyn;
Tanajura et al. 2020, OceanDyn

Modeling and Data Assimilation in REMO

Large-scale 1/12º domain increased, Metarea V domain now with 1/24º resolution L32 with tides.



This and the other system are running operationally in CHM today

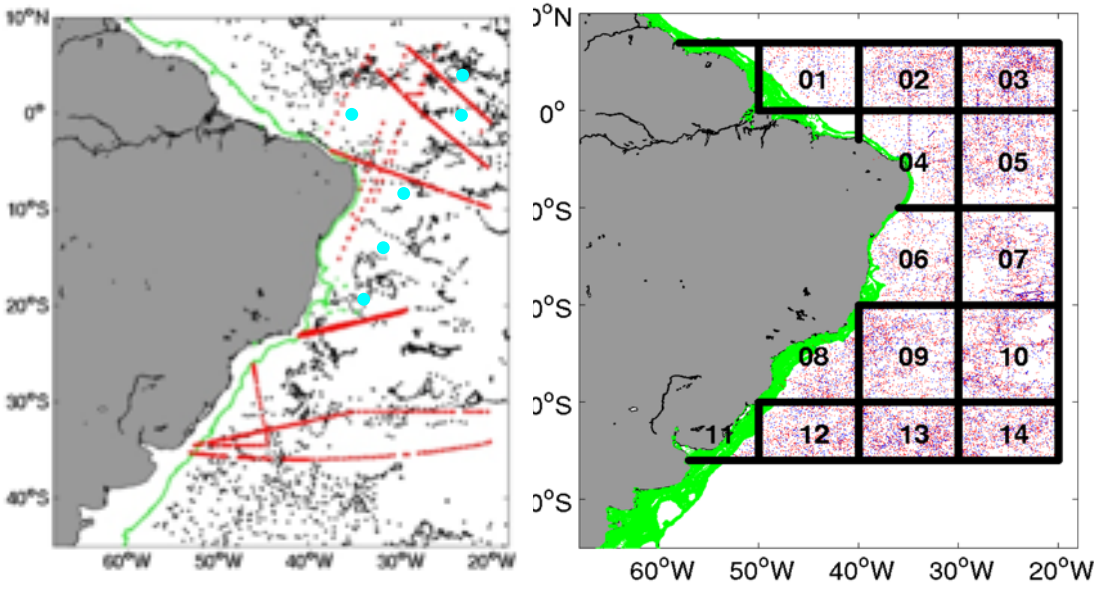
- 3-5 day forecasts
- NCEP/NOAA GFS and COSMOS forcing
- Simplified RODAS version
- Assimilation of OSTIA SST, AVISO SLA and Argo T/S profiles
- Not yet disseminated

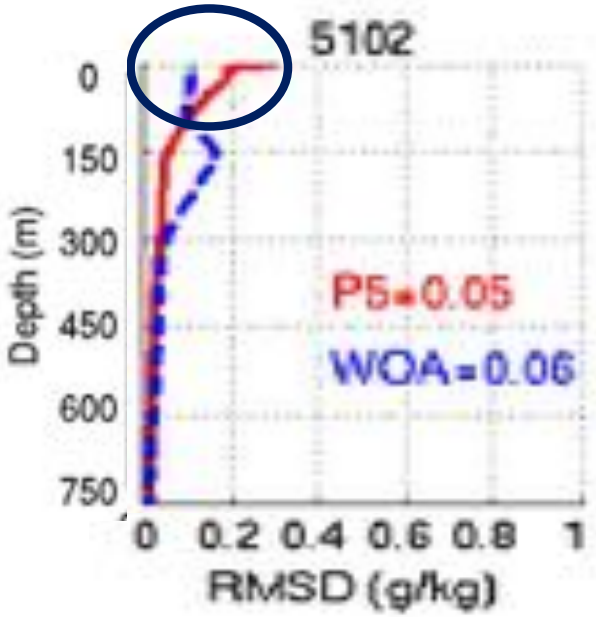
Lima et al. 2013, BrazJGeophys;
Santana et al. 2020, OceanDyn;
Tanajura et al. 2020, OceanDyn

OSE with XBT and PIRATA

- 1 year integration (2012) with HYCOM 1/12° L21+RODAS (assimilation each 3 d)
- Atmospheric Forcing NCEP/NOAA CFSR each 6 h
- Free run
- **Assimilation of OSTIA SST, AVISO SLA and 2,329 Argo T/S (RODAS_Old)**
- **Assimilation of SST, SLA and Argo T/S + 701 XBTs (RODAS)**
- **Assimilation of SST, SLA, T/S, XBTs + 6 PIRATA buoys (RODAS_PIR)**

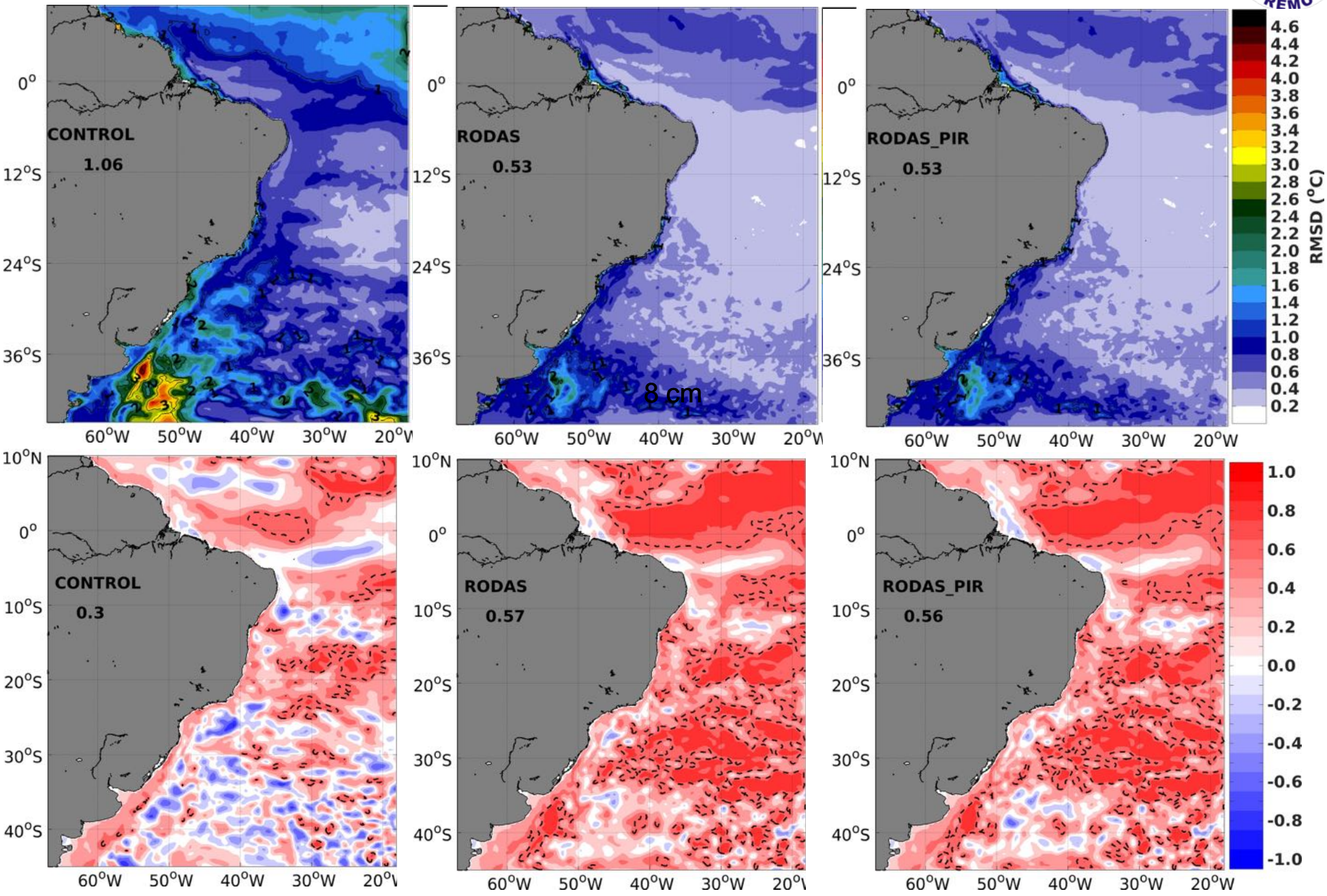
Strategy to use synthetic S to pair single T profiles
Combines WOA at sfc with 5th order polynomial S(T)





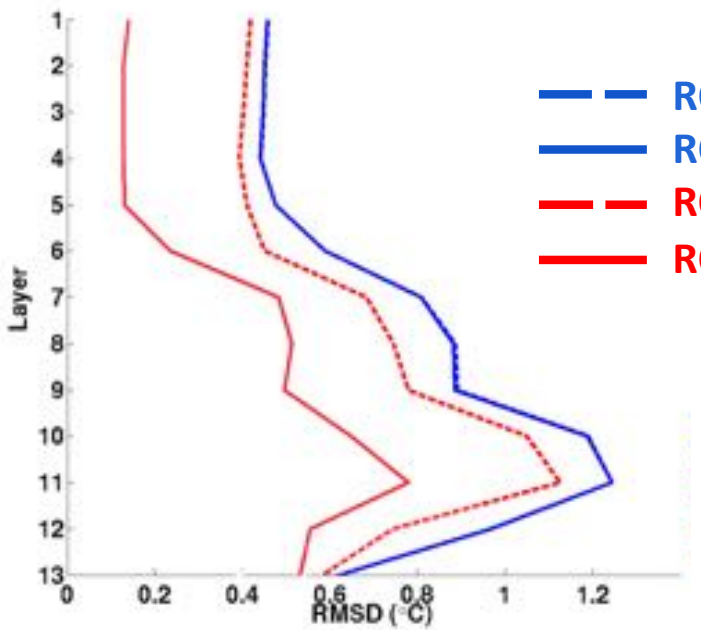
Dorfschäfer et al. 2020, JGR

OSE: SST RMSD (°C) and SSH Correlation

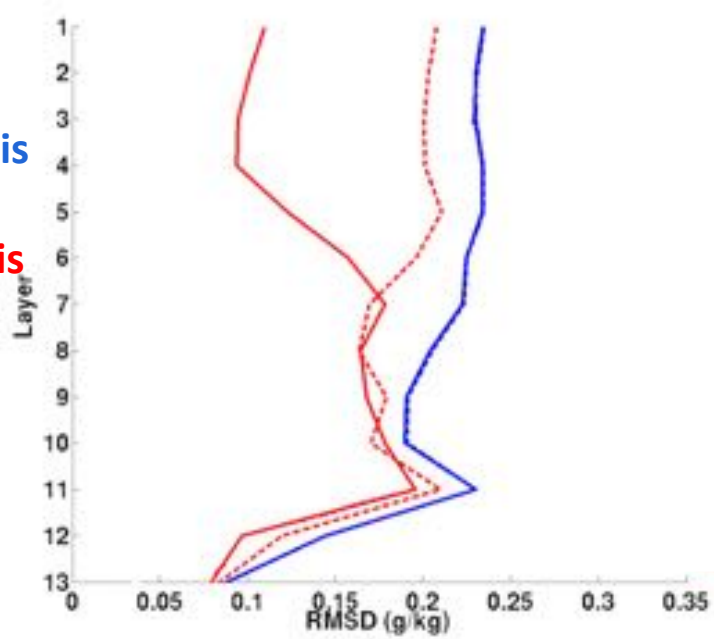


OSE: T RMSD (ºC) and S RMSD (psu)

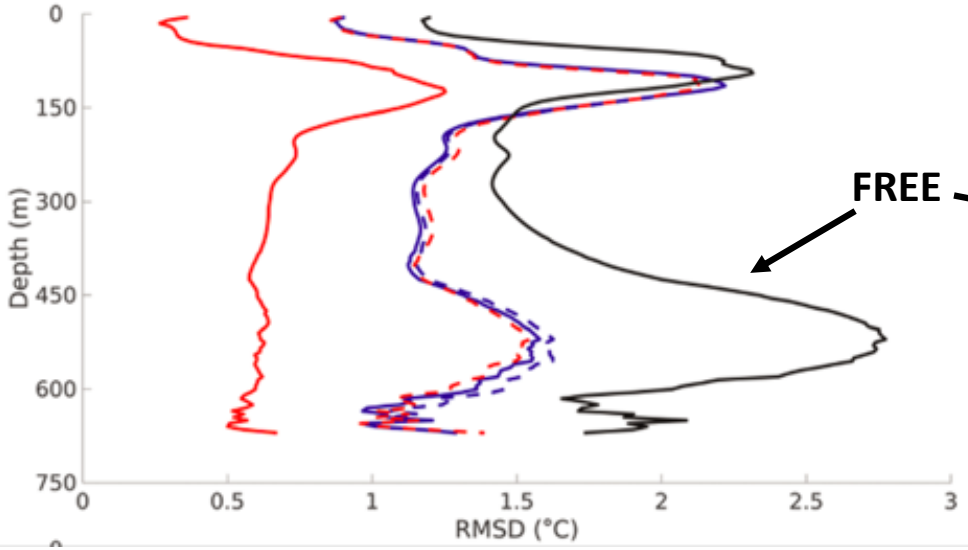
RMSD wrt PIRATA T data



RMSD wrt Synthetic S data

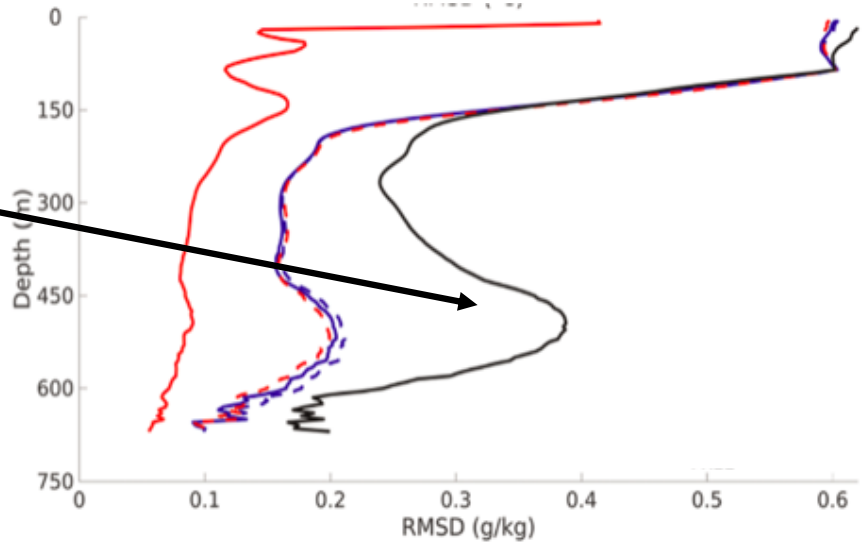


RMSD wrt XBT data



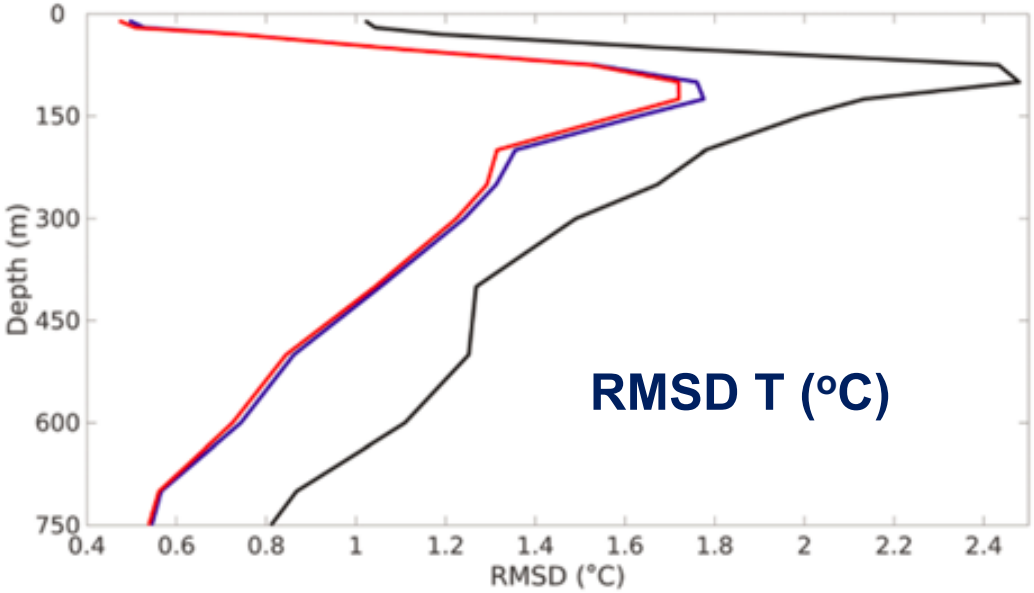
FREE

RMSD wrt Synthetic S data



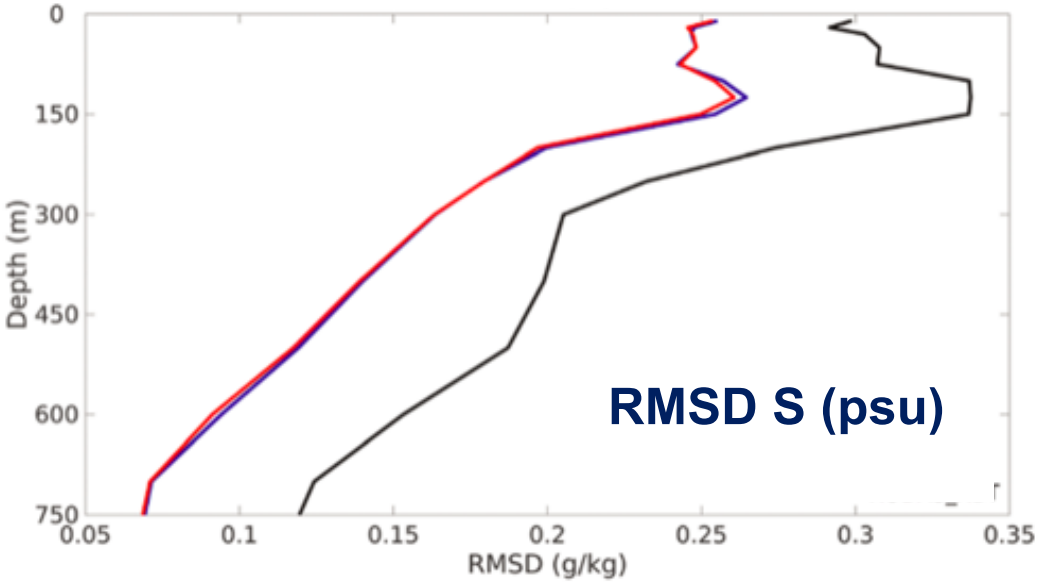
OSE: T RMSD (ºC) and S RMSD (psu)

3-day "forecast" RMSD wrt Argo data

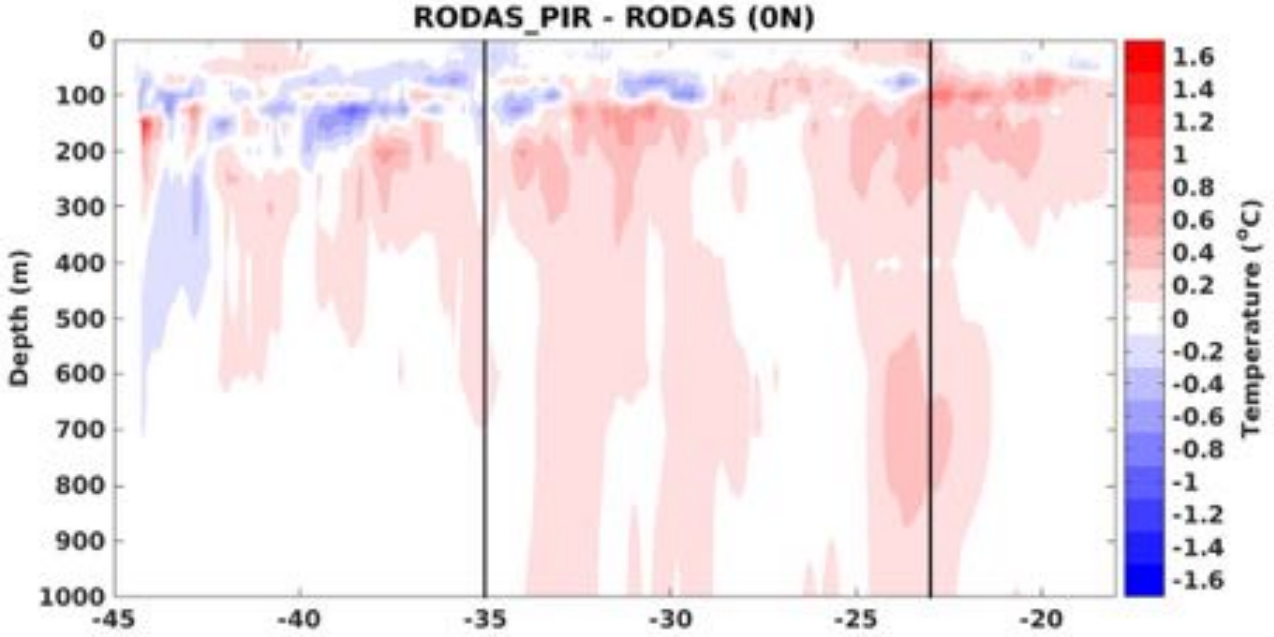


3-day "forecasts" with RODAS_PIR evaluated against 2,329 Argo profilers show negligible impact of PIRATA and XBT data

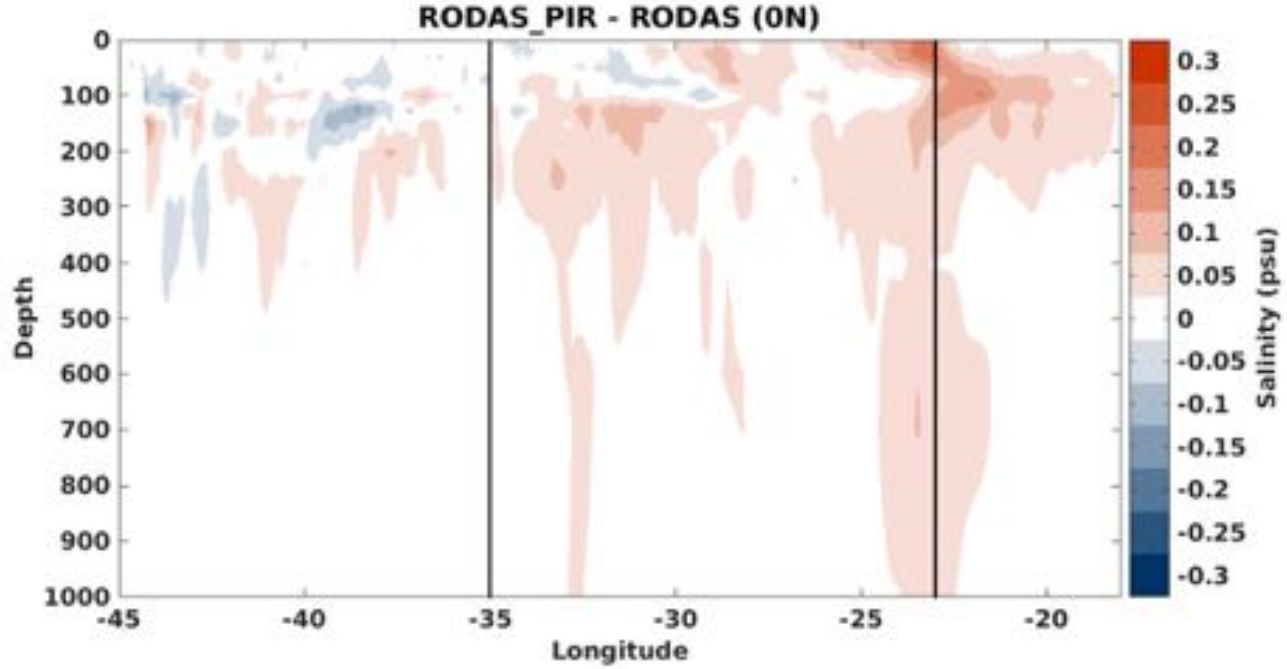
FREE
RODAS_Old
RODAS_PIR and RODAS



OSE: T(ºC) and S Difference RODAS_PIR – RODAS

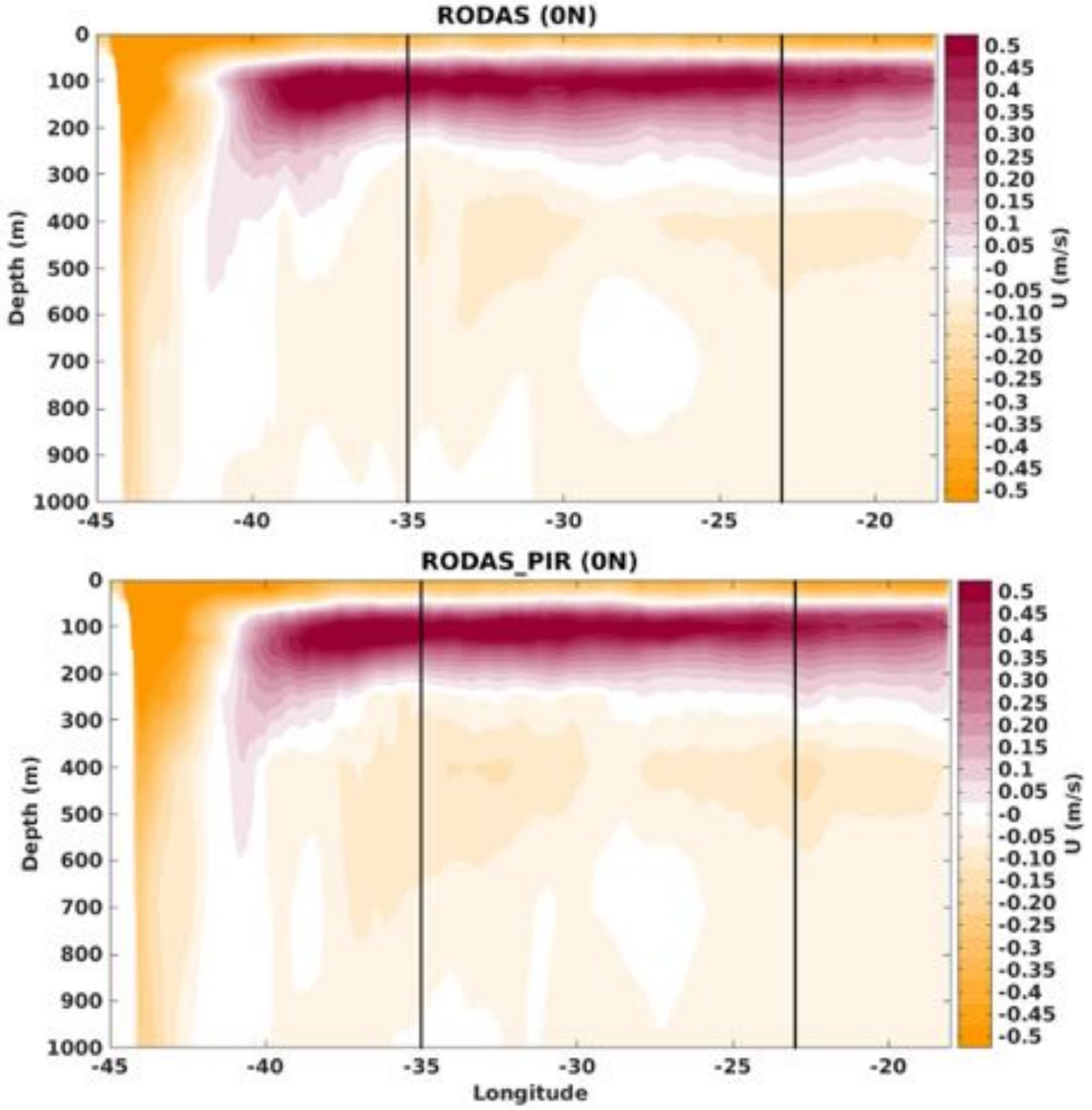


Difference of T (ºC) "forecasts"



Difference of S (psu) "forecasts"

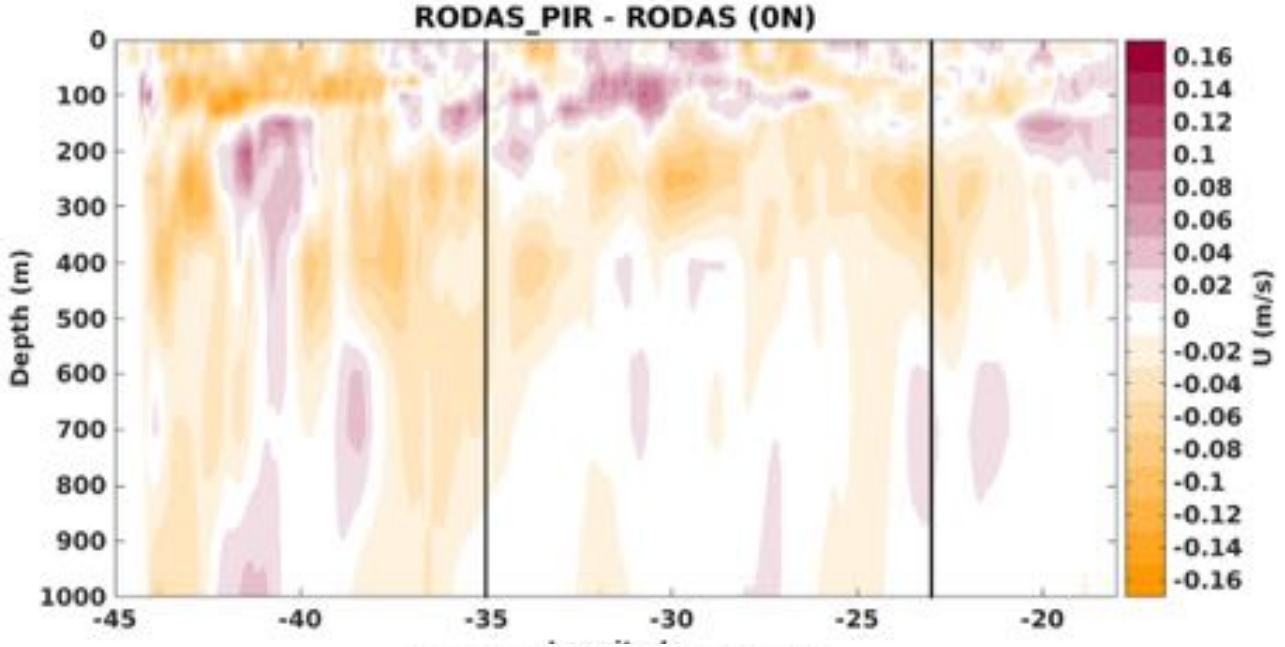
OSE: u (m/s) at the equator



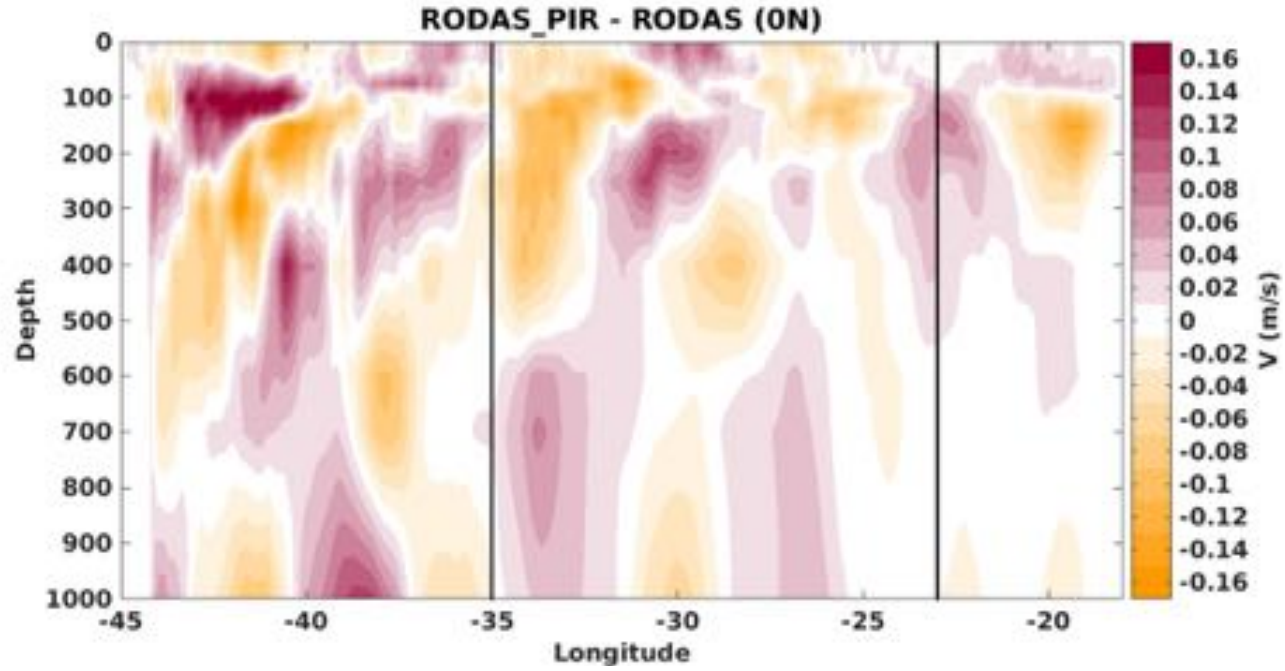
RODAS

RODAS_PIR

OSE: Difference RODAS_PIR – RODAS at the Eq.

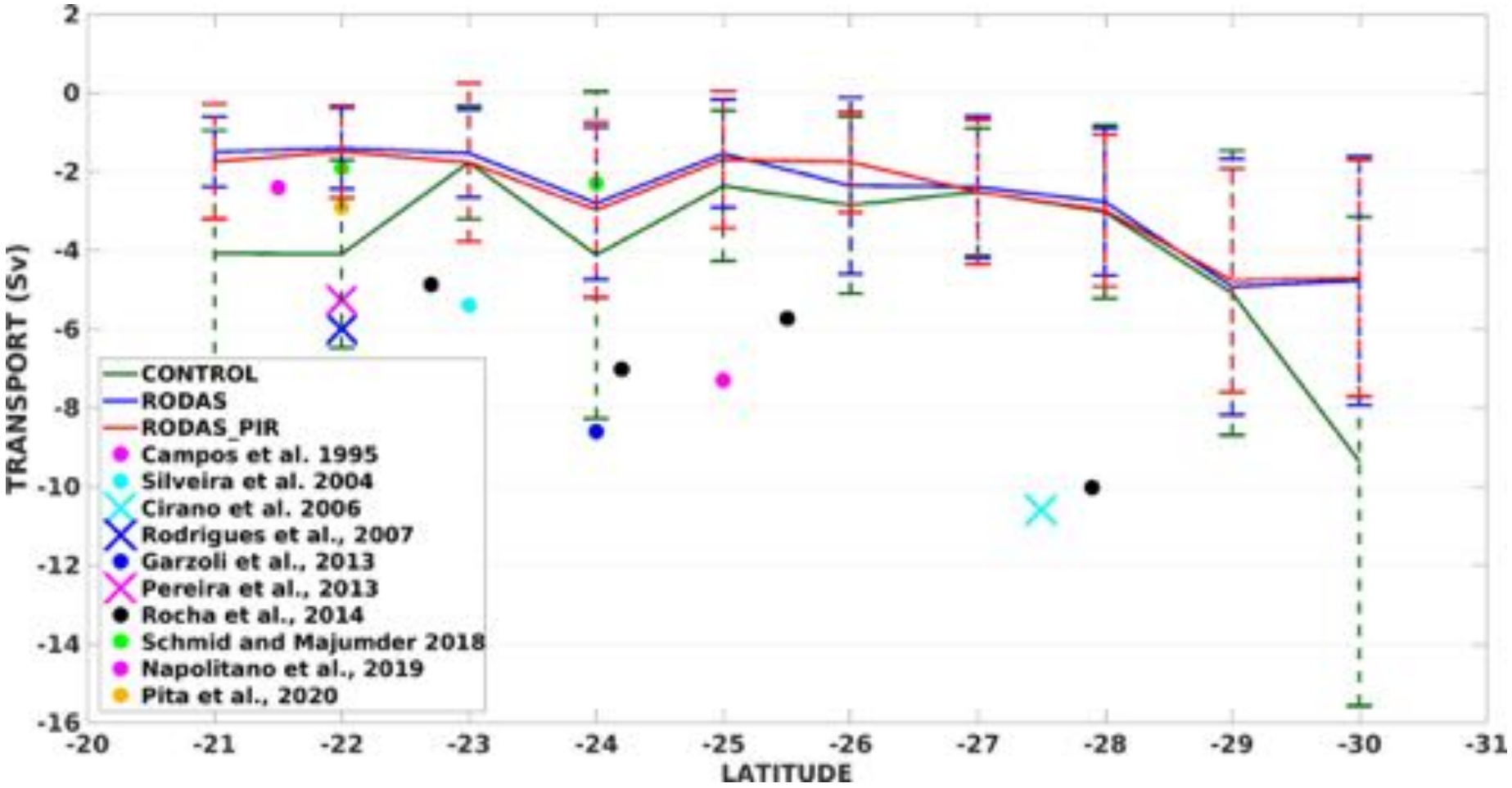


Difference of u (m/s)



Difference of v (m/s)

OSE: Brazil Current transport (Sv)



PIRATA data produced small impact in the Brazil Current transport with the current low resolution configuration.

Summary

- The HYCOM+RODAS system could be improved by the capability of assimilating single T profiles
- This improvement will soon be incorporated into the Brazilian Navy CHM operational forecasting system
- PIRATA and XBT data assimilated by HYCOM+RODAS system could produce substantial local impact in the analysis of T and S, but smaller impact in the 3-day “forecast” indicating the model bias should be playing an important role in the forecast
- However, PIRATA data produced strong impact on T, S, u and v in the equatorial region with possible consequences on the interhemispheric heat and salt transport by the North Brazil Current
- New OSE experiments should be performed with longer time series and the new higher resolution system