GODAE OceanView

Observing System Experiments over the Atlantic with the REMO Ocean Data Assimilation System into HYCOM

Davi Mignac

Alex SANTANA, Filipe COSTA, Clemente TANAJURA

Oceanographic Modeling and Observation Network (REMO)

DATA ASSIMILATION SYSTEM

- **RODAS** ⇨ REMO Ocean Data Assimilation System
  - Ensemble Optimal Interpolation (Oke et al., 2005; Xie and Zhu, 2010; Tanajura et al., 2014)
  - Results of the **first version** of the full DA system

- **RODAS** consists of:
  1. 00 UTC ⇨ Assimilation of SST from UK MetOffice **OSTIA**
  2. 03 UTC ⇨ Assimilation of **T/S Argo** data
  3. 06 UTC ⇨ Assimilation of **along-track SLA** from all altimeters

  - Not the same employed today in the Brazilian Navy operational system (Argo DA still to be implemented)

DATA ASSIMILATION SYSTEM

- **Assimilation is performed every 3 days**

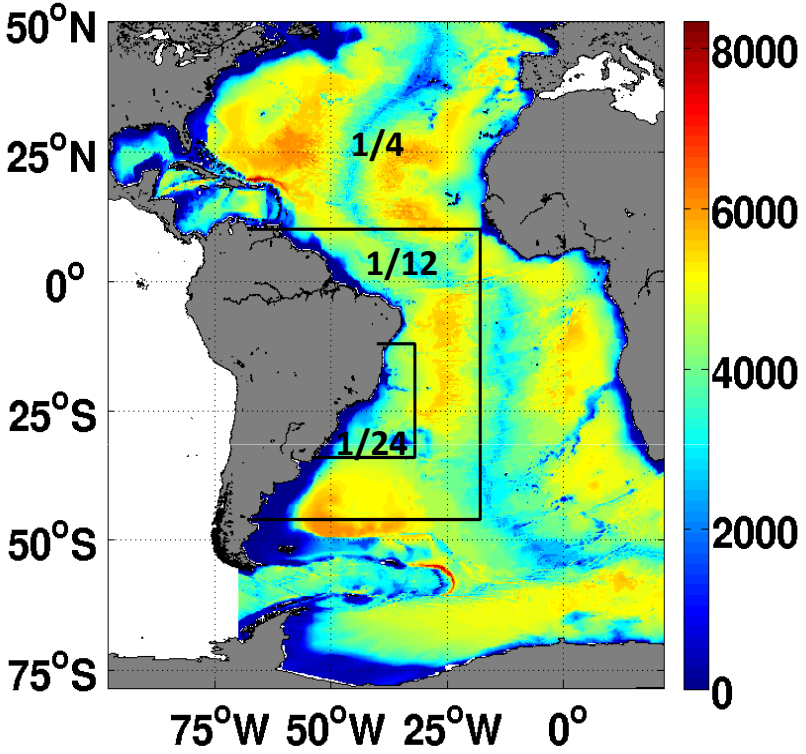
	A_SST	A_IN_SITU	A_SLA
Observational window	-	72h	72h
Covariance length scales	150 km	150 km	150 km
Superobs (grid cells)	2x2	-	2x2
State vector	ALL	DP, U,V, T, S	ALL

- **126 ensemble members**
  - 21 members per year
  - 60-day window centered in the corresponding assimilation day
  - 6 years to capture the variability spread

- **For more details about RODAS (Tanajura et al., 2014; Mignac et al., 2015)**

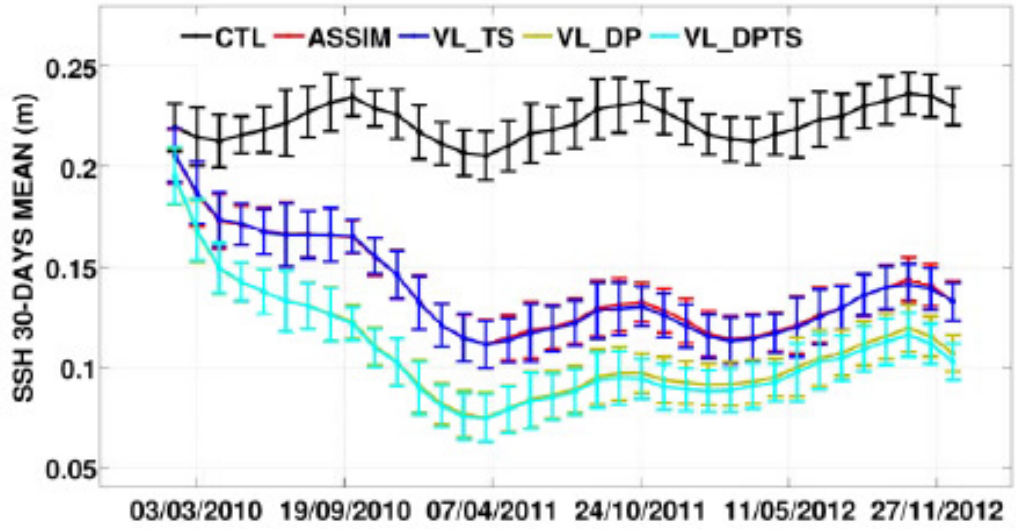
HYCOM CONFIGURATION

Numerical domain	Atlantic Ocean
Horizontal resolution	1/4º
Vertical resolution	21 layers
	30 years (COADS)
Spin-up	**1995–2014** (6h NCEP/CFSR Reanalysis forcing)

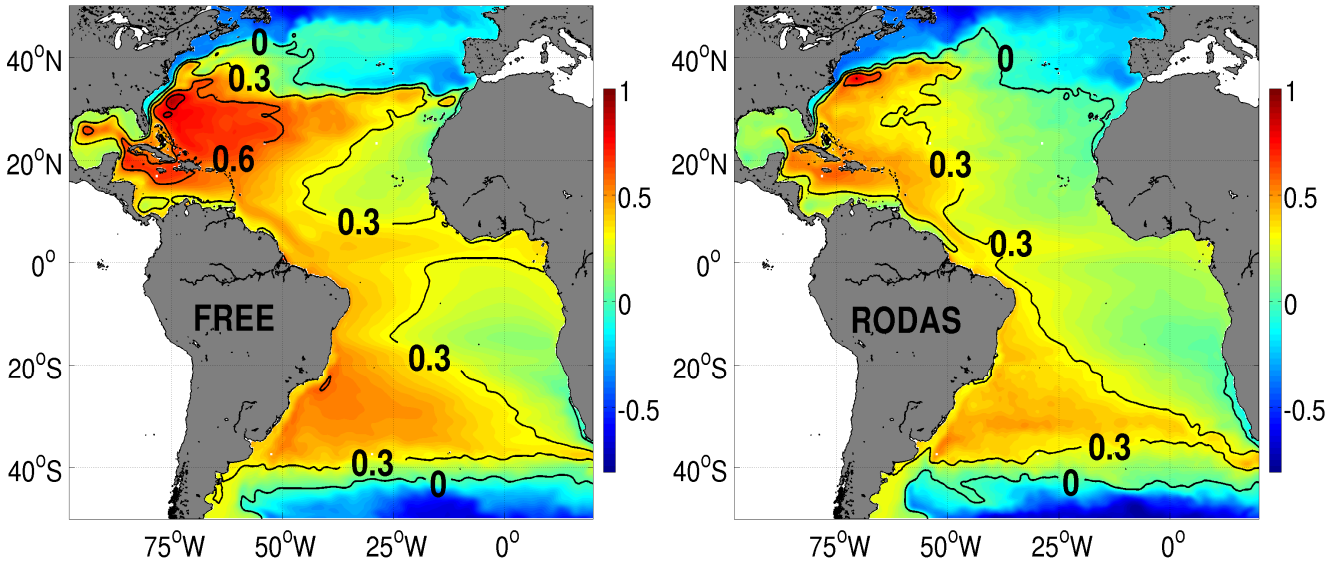


INITIAL CONDITION - OSEs

- 2002-2007 assimilation of SST + Argo ⇒ get a stable SSH mean
- 2004 – 2007 SSH mean
- 2008-2010 assimilation including SLA
- IC on 1 Jan 2010



Mignac et al., 2015



CONFIGURATIONS - OSEs

➡ **1 JAN 2010 – 31 DEC 2012**

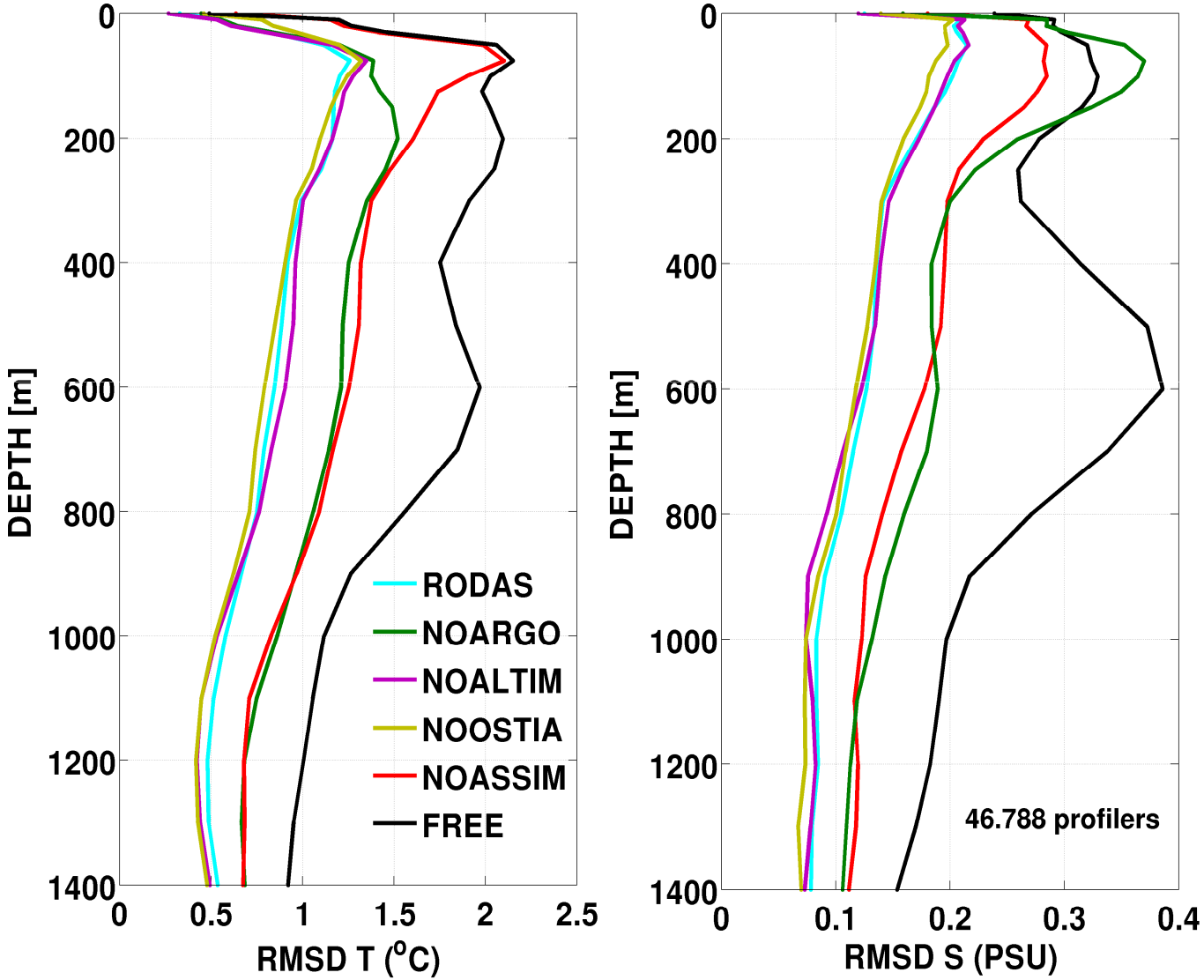
RODAS	Assimilation of SLA, SST and Argo
NOARGO	Withholding only Argo
NOALTIM	Withholding only altimeters
NOOSTIA	Withholding only OSTIA
NOASSIM	Withholding all observation types and turning off DA
FREE	Free run

➡ **Same model configurations for all the runs**

➡ **Evaluation will be based on the 24h, 48h and 72h after assimilation with observations that are not yet assimilated**

RESULTS – T/S

VERTICAL PROFILE OF RMSD WITH RESPECT TO ARGO



1. ARGO

-> T/S of subsurface

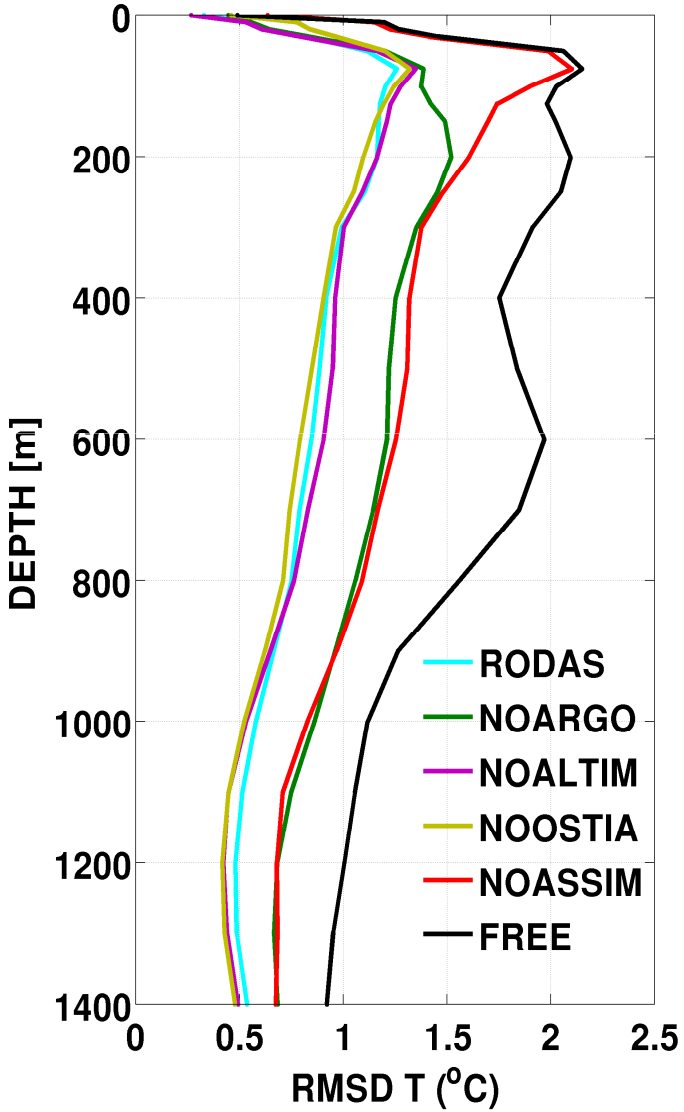
-> S in the upper ocean!

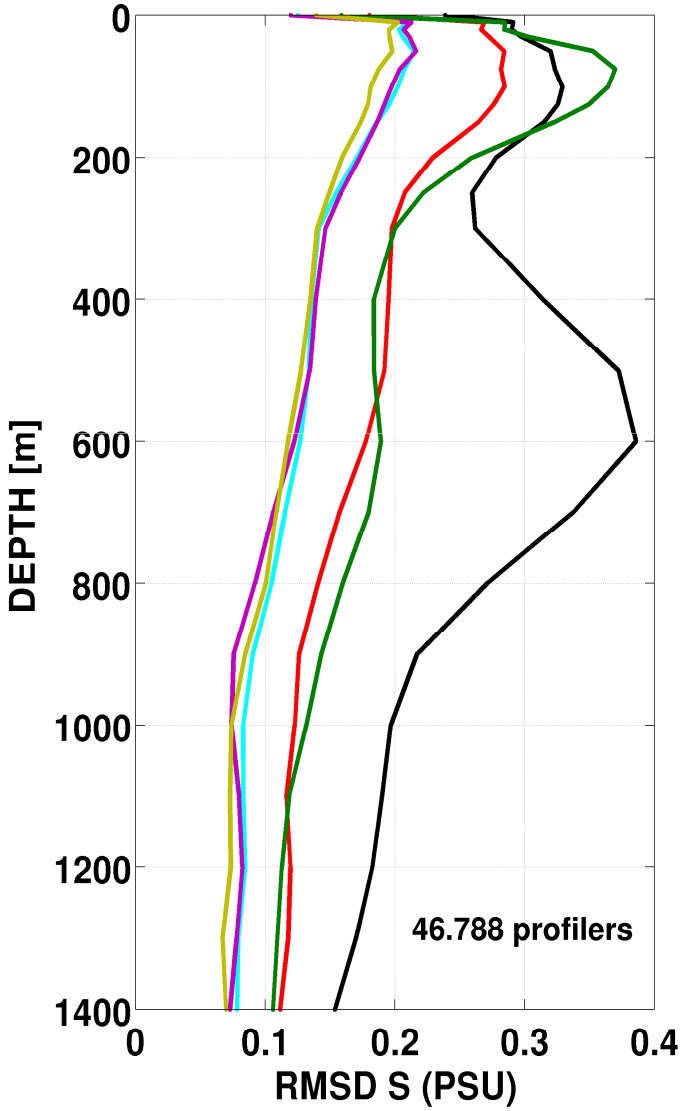
Oke and Schiller (2007)
Balmaseda et al. (2007)
Lea et al. (2014)

-> System is not optimal (covariances)

RESULTS – T/S

VERTICAL PROFILE OF RMSD WITH RESPECT TO ARGO





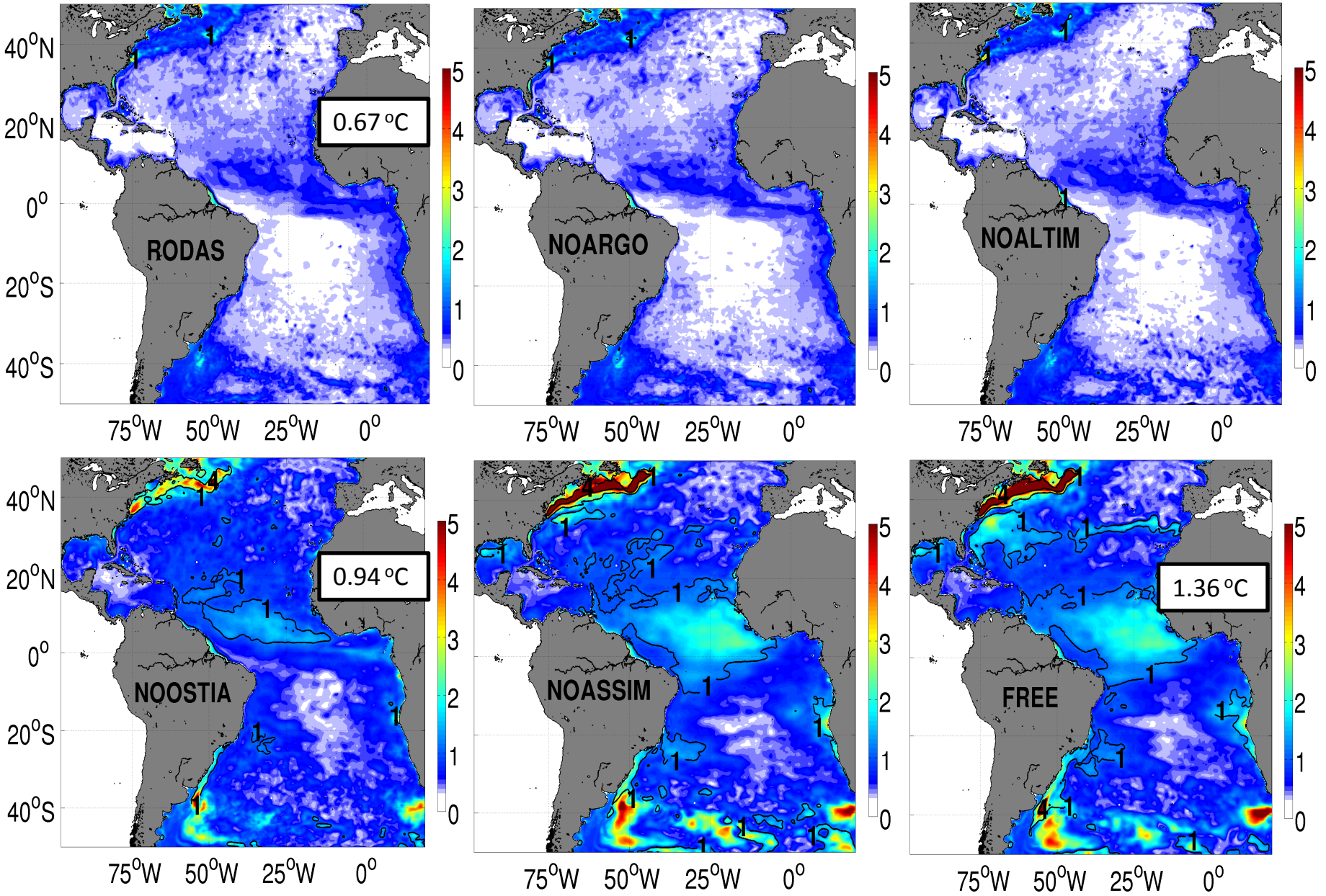
2. OSTIA

-> T of the mixed layer

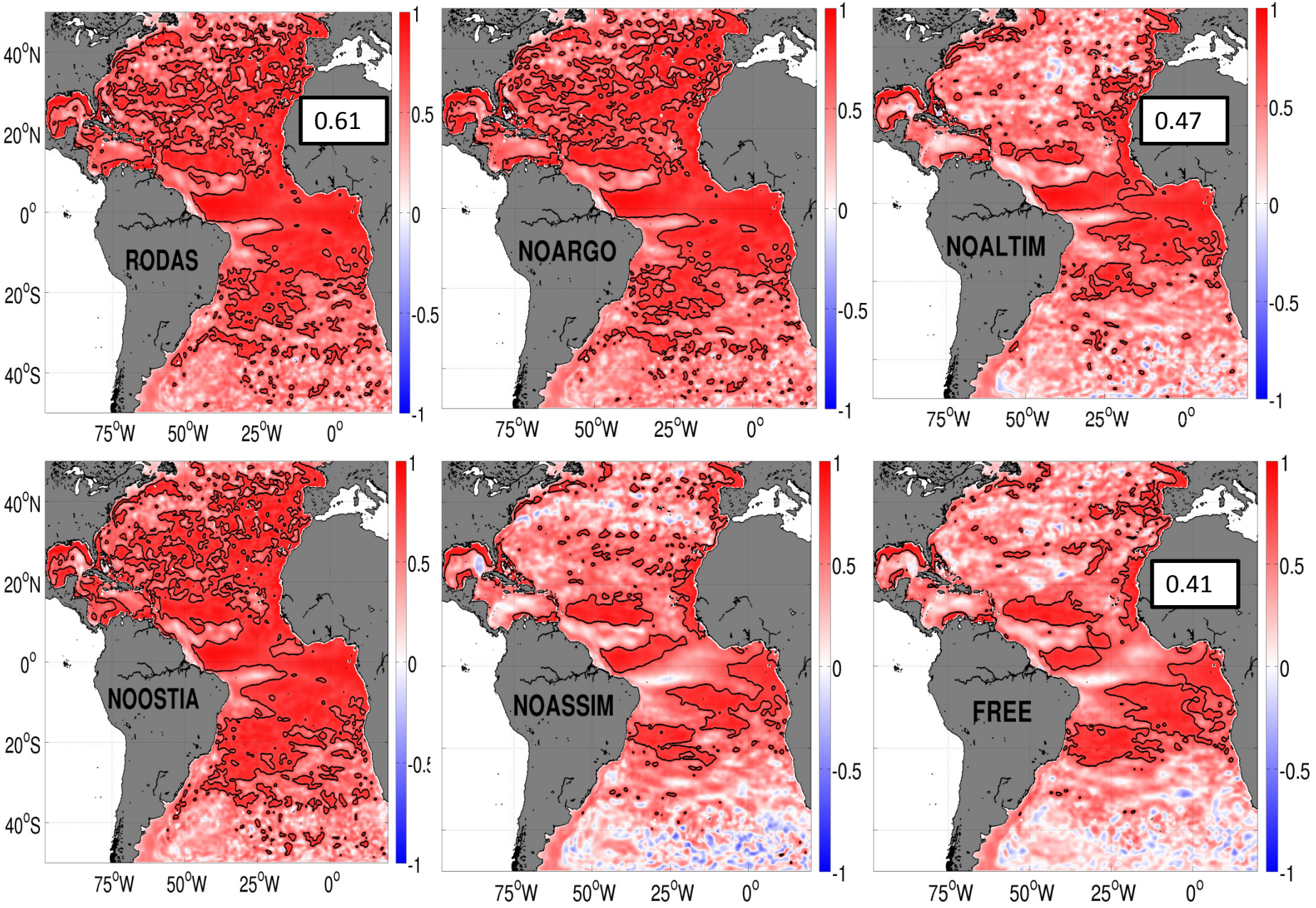
3. ALTIMETERS

-> small impact on T and S

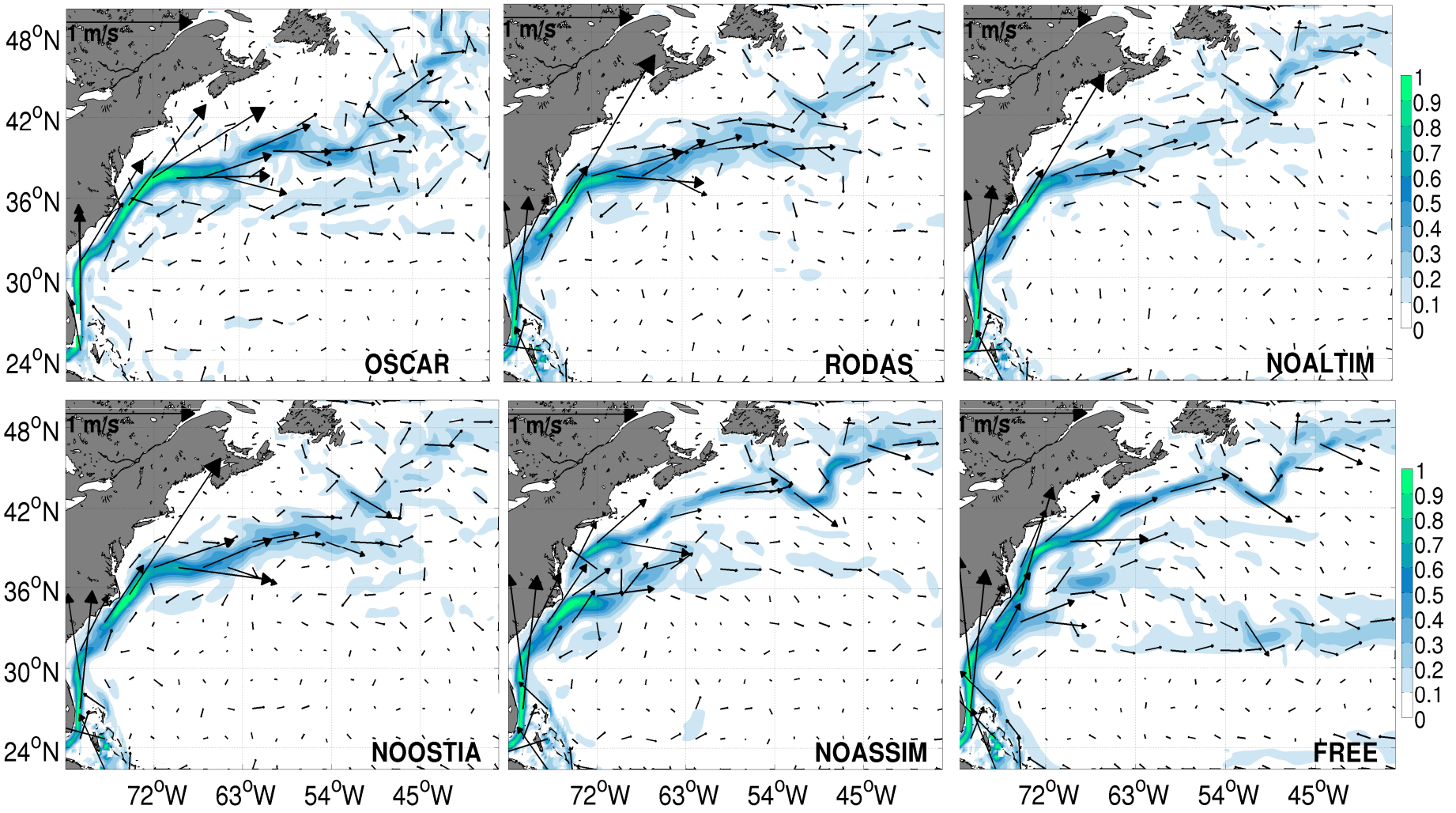
RESULTS – RMSD OSTIA (ºC)



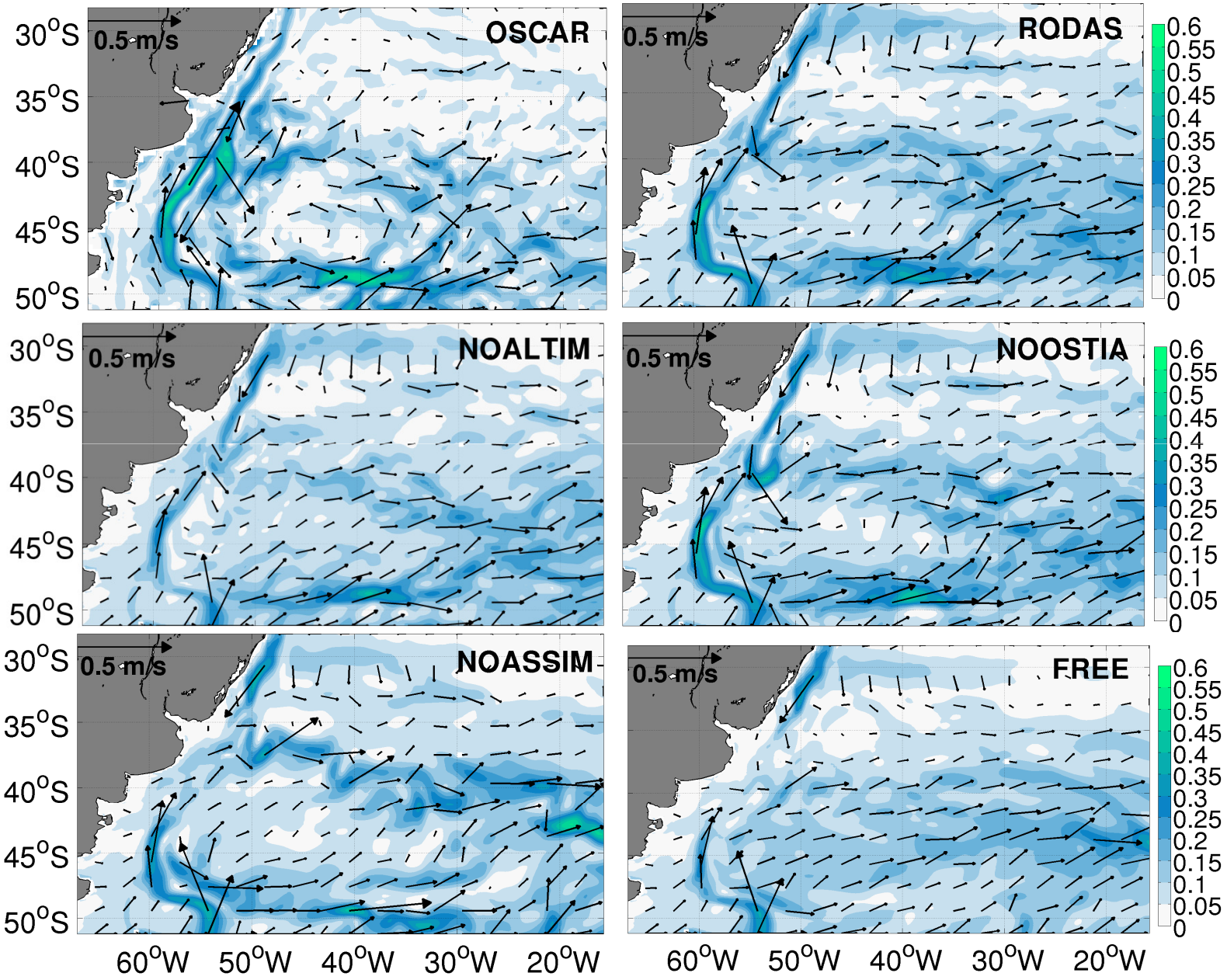
RESULTS – CORR SLA AVISO GRIDDED DATA

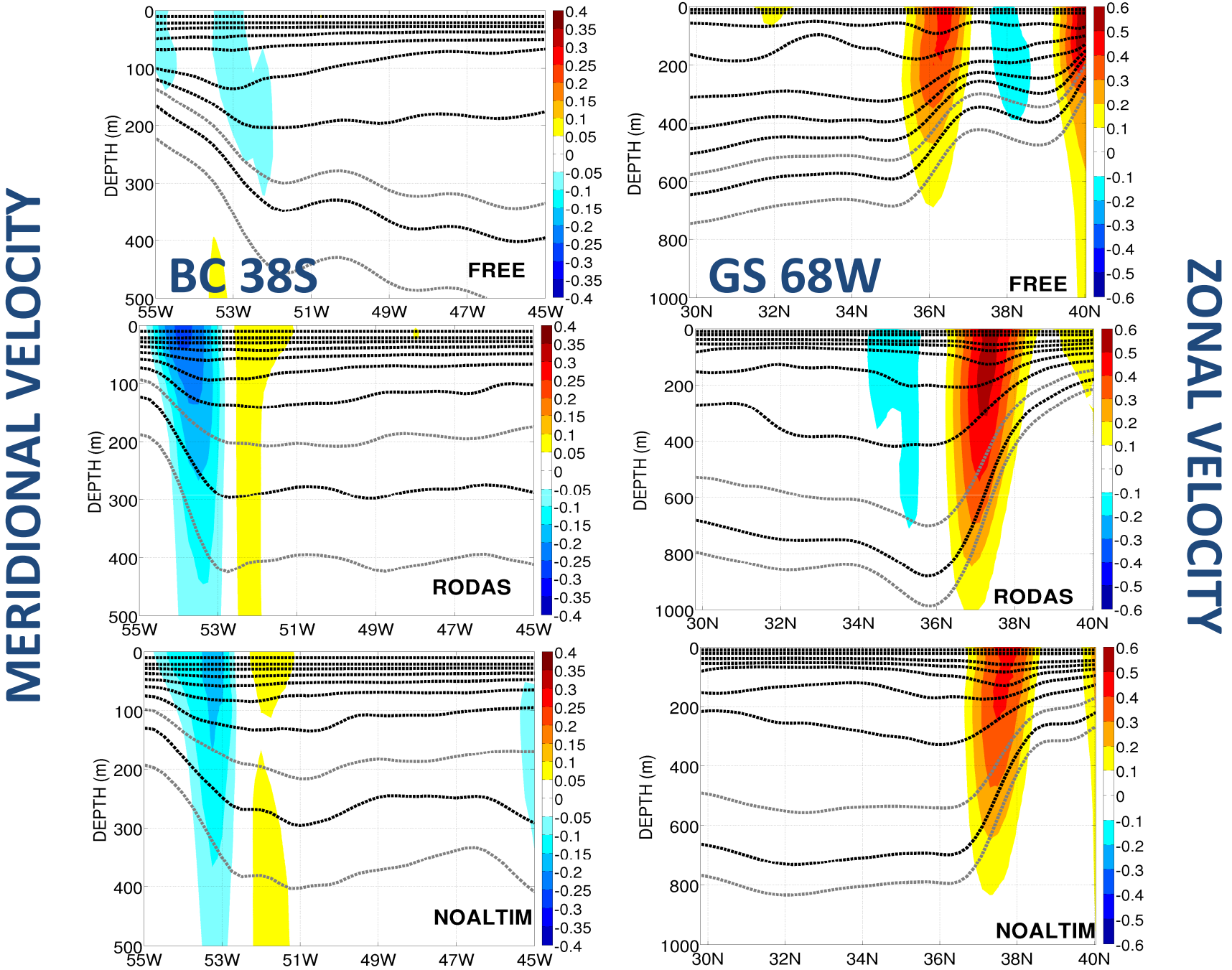


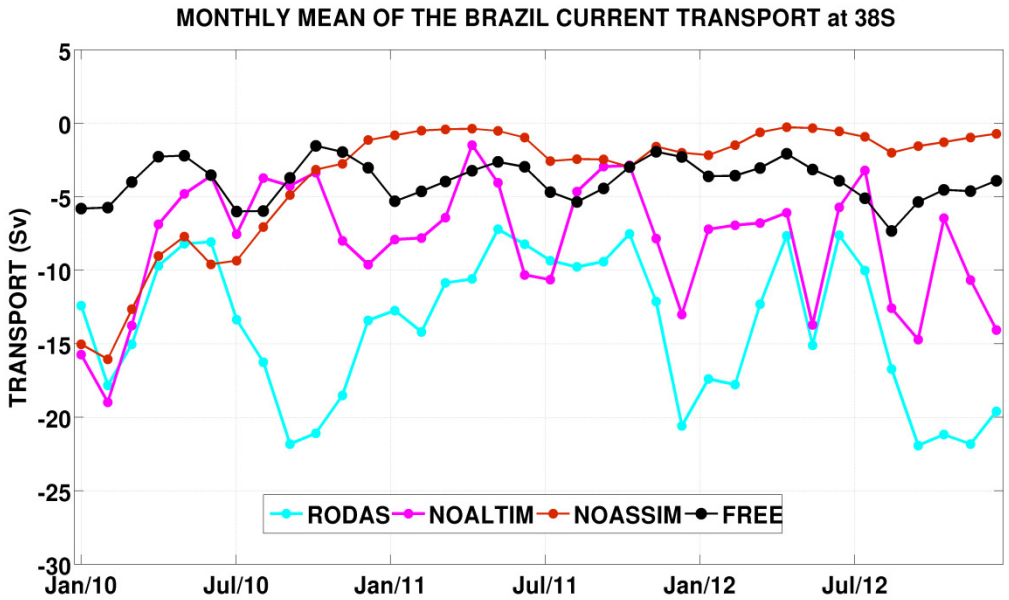
VELOCITY - GULF STREAM (m/s)



VELOCITY - BRAZIL-MALVINAS CONFLUENCE (m/s)

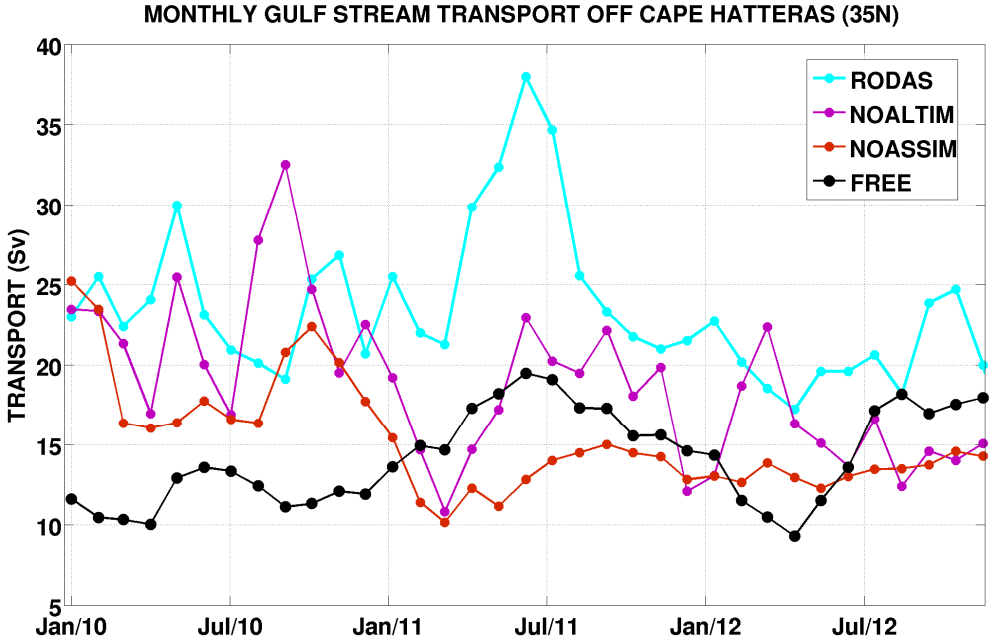



MERIDIONAL VELOCITY
ZONAL VELOCITY
BC 38S
FREE
RODAS
NOALTIM
GS 68W
FREE
RODAS
NOALTIM
DEPTH (m)
0
100
200
300
400
500
55W
53W
51W
49W
47W
45W
600
800
1000
30N
32N
34N
36N
38N
40N
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.4
0.6
0.5
-0.5
-0.6



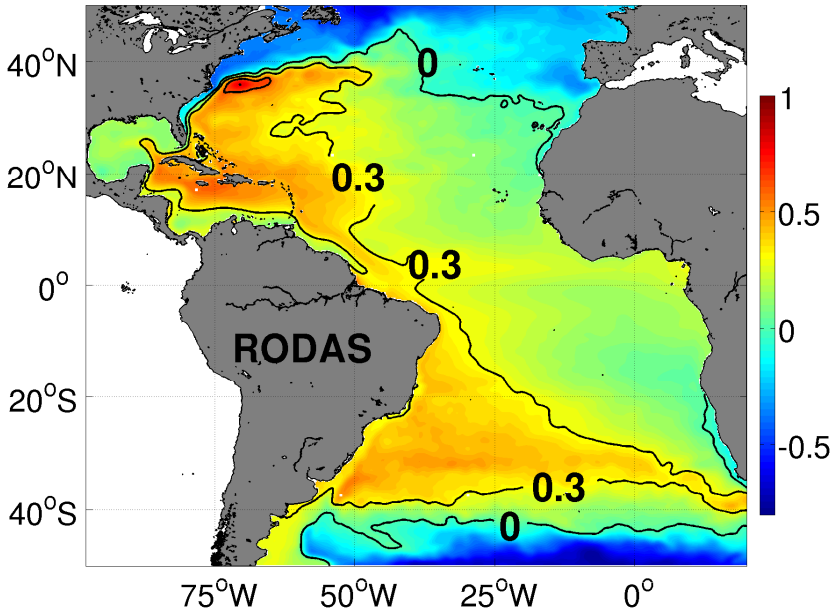
MONTHLY TRANSPORTS OF THE WBCs

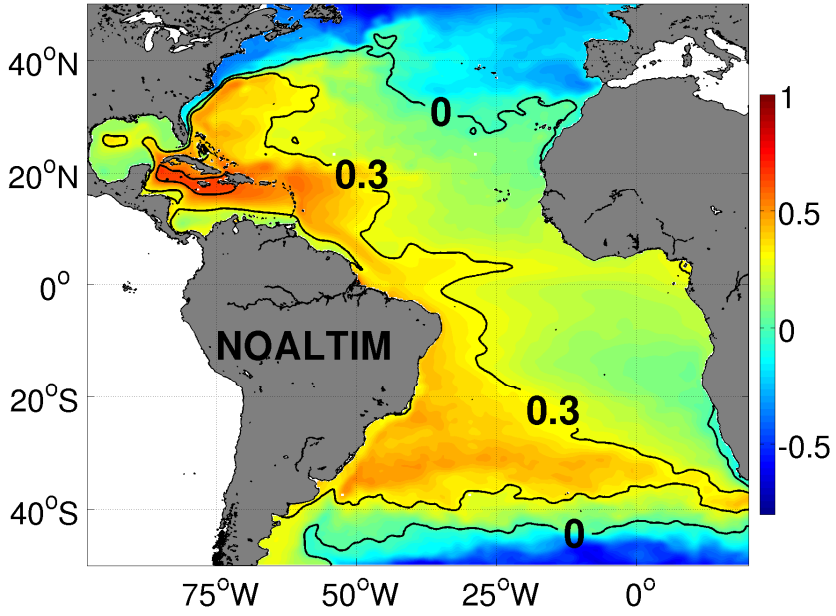
GARZOLI (1993) ➡ -20 Sv



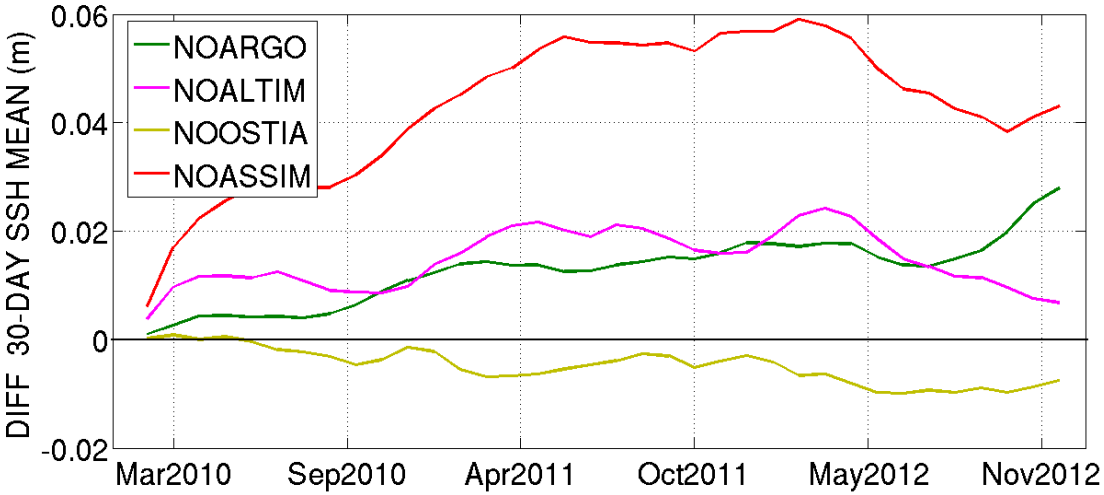
HOGG (1992) ➡ 45 Sv

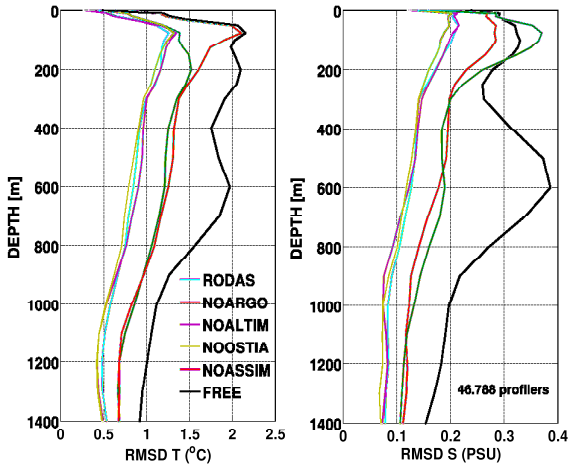
SSH MEAN (m)





OSEs MINUS RODAS RUN





SUMMARY

- **RODAS** ⇒ able to improve the SST, T/S subsurface structure and circulation into HYCOM

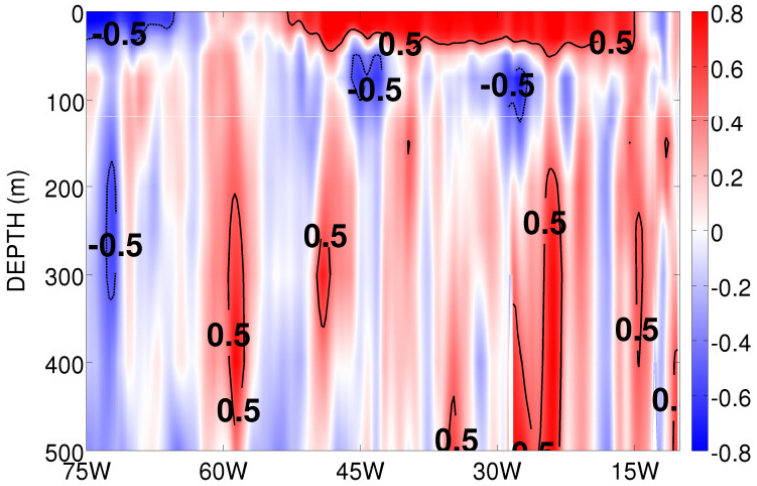
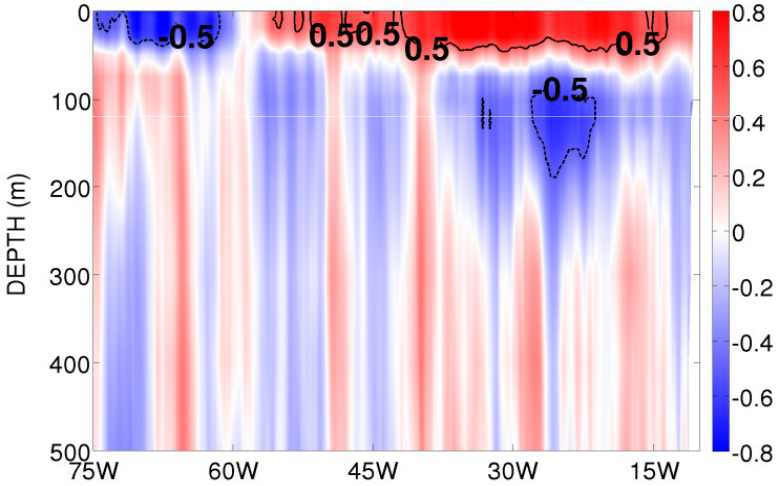
- Complementarity of the observation systems
  - OSTIA ⇒ quality of SST and T of the mixed layer
  - Argo ⇒ T of sub-surface and especially S
  - Altimeters ⇒ quality of SLA and mainly improve the large and mesoscale circulation

- New OSEs in the higher resolution grids along the Brazilian coast
  - XBTs, fixed moorings of the PIRATA array and gliders

QUESTION

We have found some relatively high correlations between the SST and other variables below the mixed layer in our ensemble. This seems to degrade the model state, for example, the salinity in the sub-surface. Have you experienced that in your DA systems? How to deal with that? Is vertical localization the best strategy?

ENSEMBLE



HYCOM_NCODA