



# Layered Ocean Model Workshop

2-4 of June 2015 - Copenhagen, Denmark

# The REMO Ocean Data Assimilation System into HYCOM

**Davi Mignac**

**Alex SANTANA, Filipe COSTA, Clemente TANAJURA**



**Oceanographic Modeling and Observation Network (REMO)**



**GODAE OceanView**

# 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 + **OSEs**
- **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

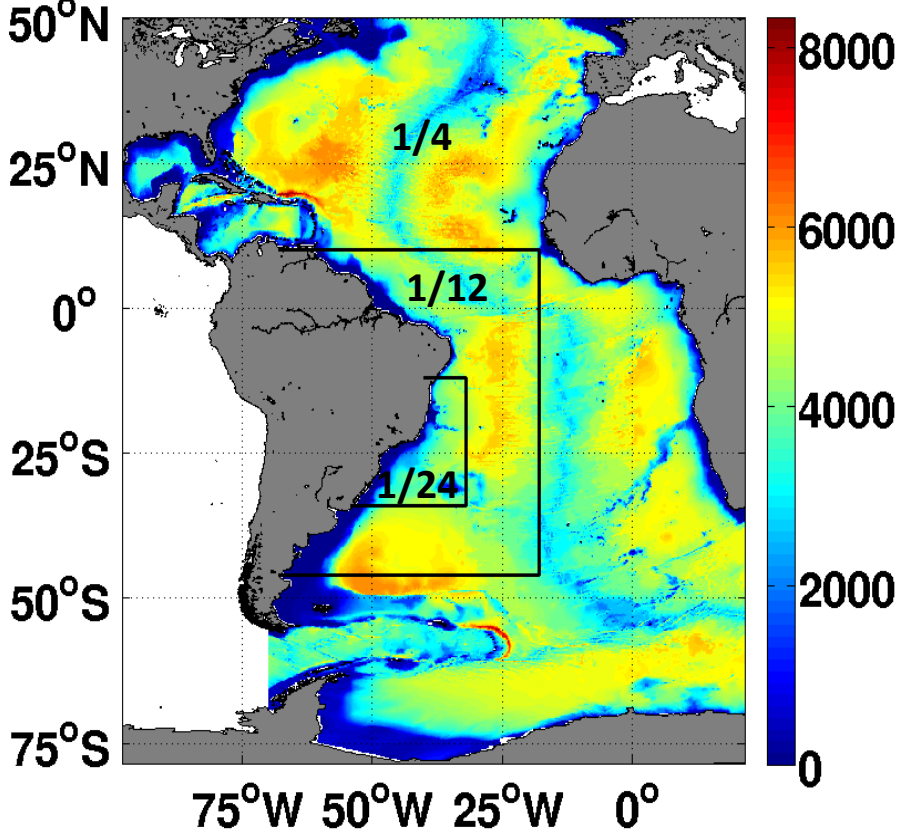
- Assimilation is performed every 3 days

	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

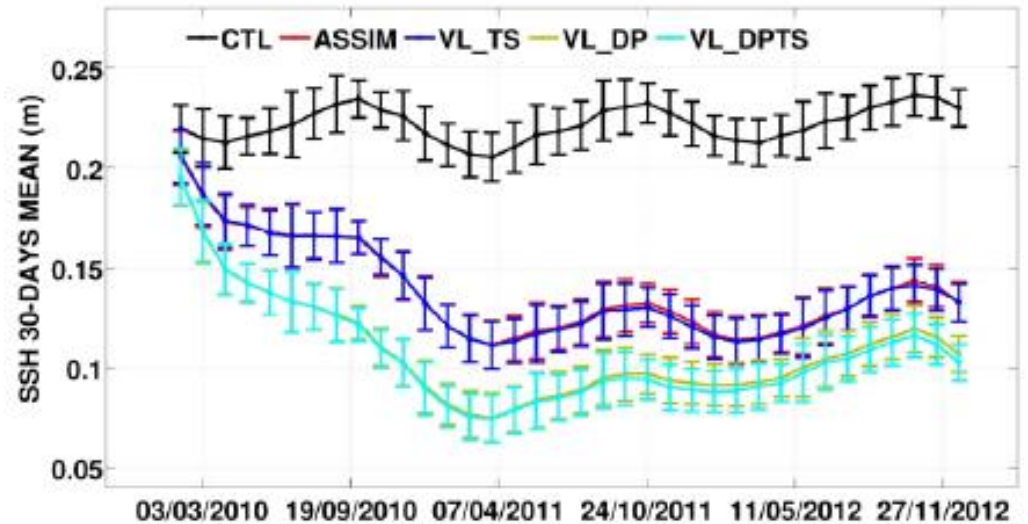
<b>Numerical domain</b>	Atlantic Ocean
<b>Horizontal resolution</b>	1/4°
<b>Vertical resolution</b>	21 layers
<b>Spin-up (free run)</b>	30 years (COADS) 1995–2014 (6h NCEP/CFSR Reanalysis forcing)



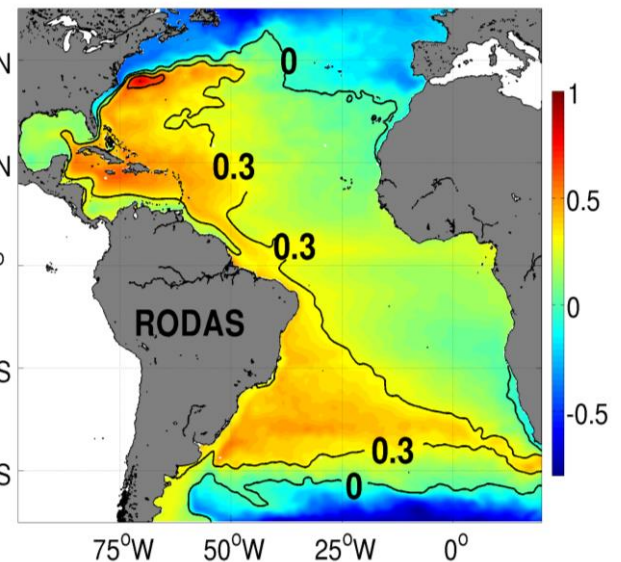
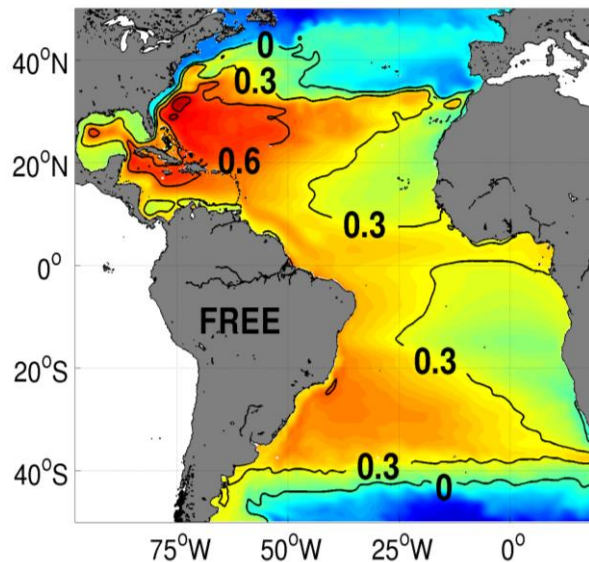
The map displays the Atlantic Ocean basin from 75°W to 0°W and 75°S to 50°N. A color scale on the right indicates salinity values from 0 to 8000. Three nested boxes represent different horizontal resolutions: 1/4° (outermost), 1/12° (middle), and 1/24° (innermost). The 1/24° resolution box is centered around 25°W and 0° latitude, covering the tropical Atlantic region.

# 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 (OS)



# CONFIGURATIONS - OSEs

 1 JAN 2010 – 31 DEC 2012

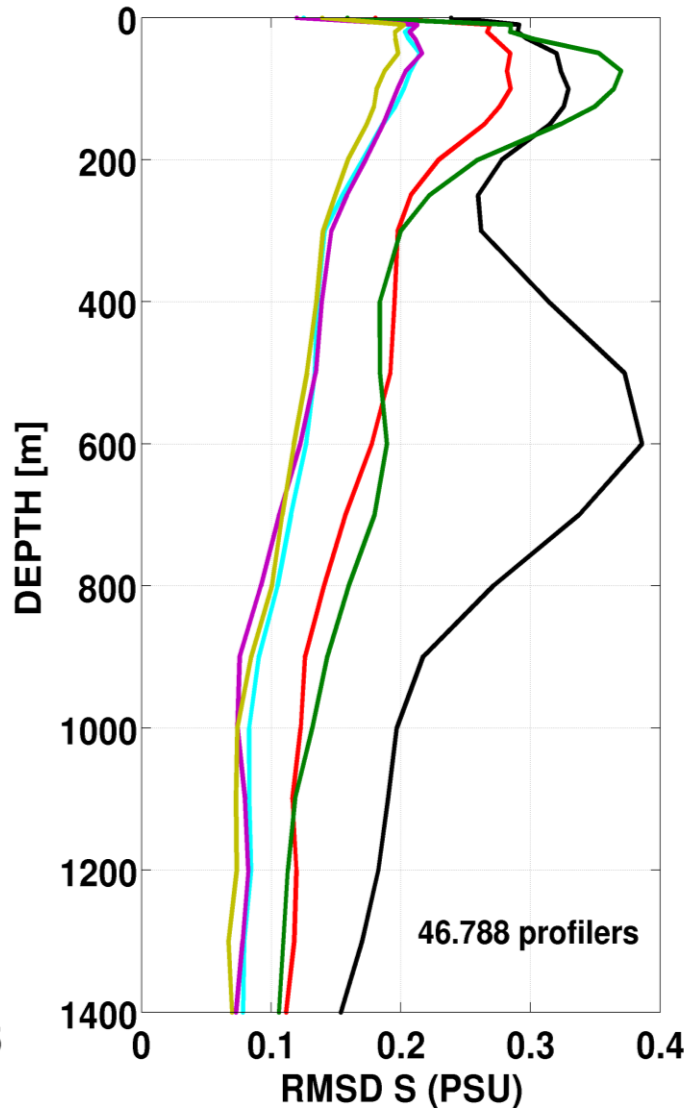
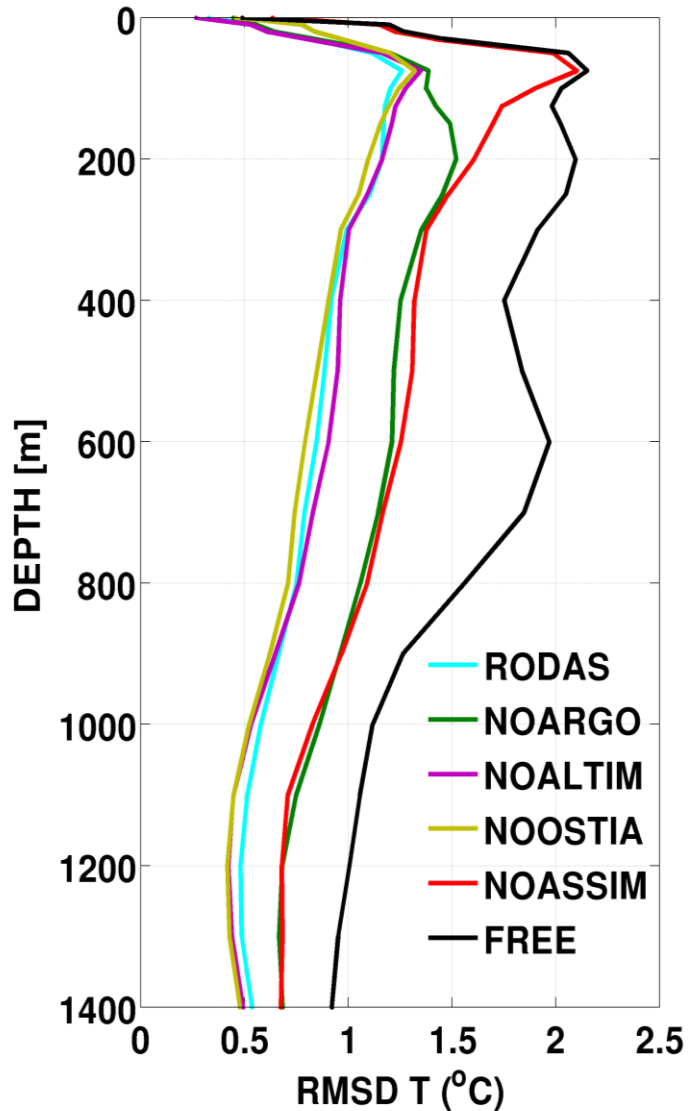
---

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

 Same model configuration for all the runs

# 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)

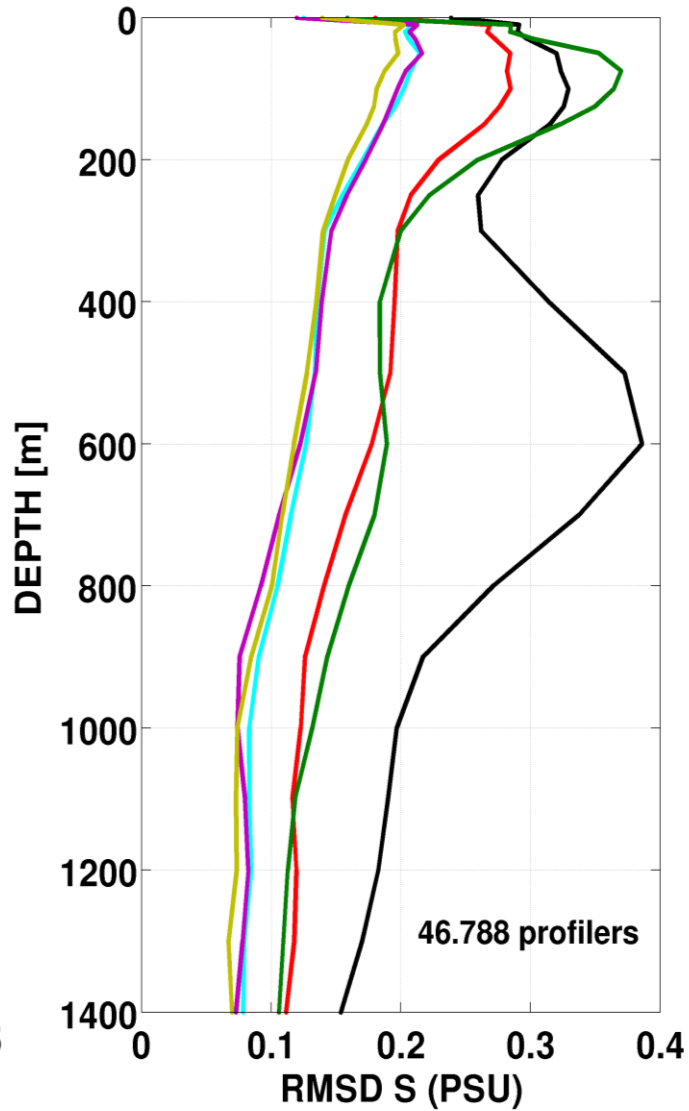
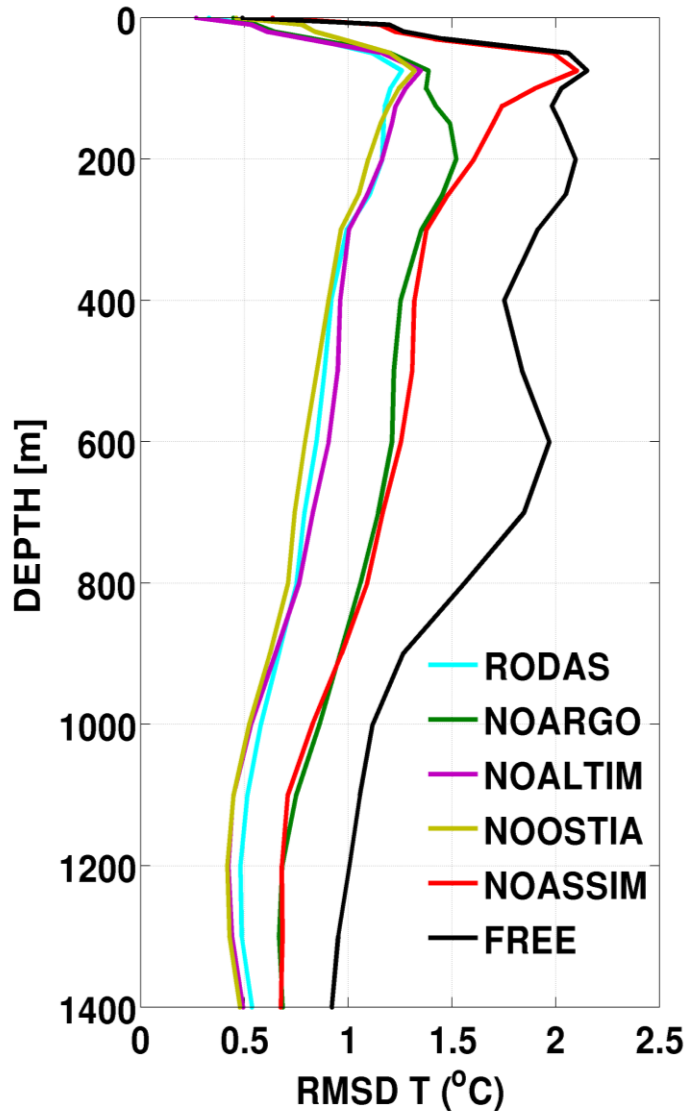
Balmaseda et al. (2007)

Lea et al. (2014)

-> System is not optimal (covariances)

# RESULTS – T/S

## ➔ VERTICAL PROFILE OF RMSD WITH RESPECT TO ARGO



## 2. OSTIA

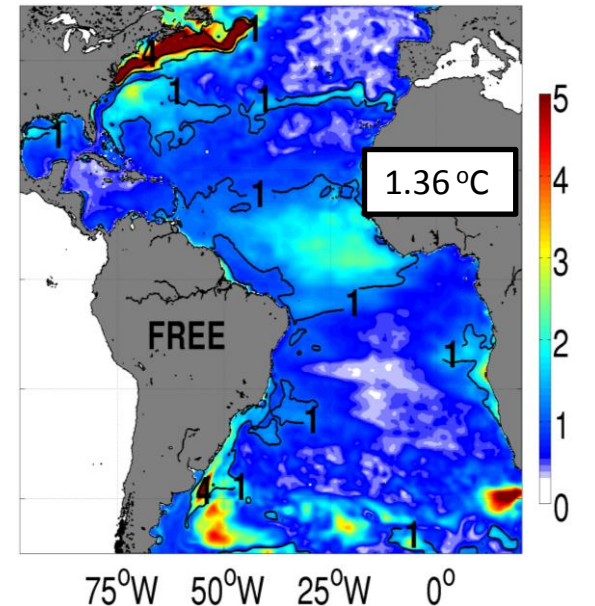
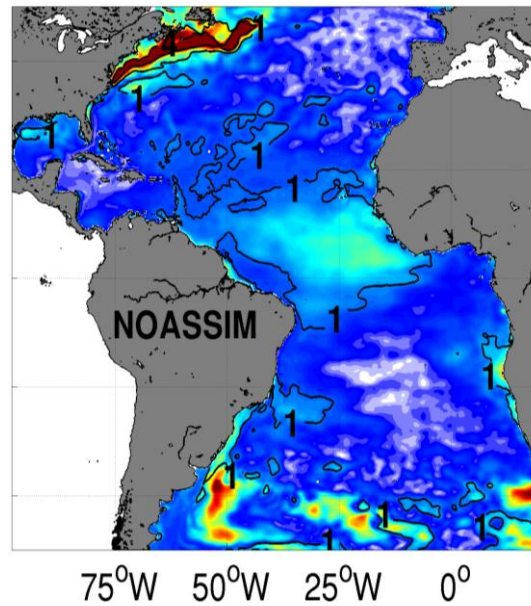
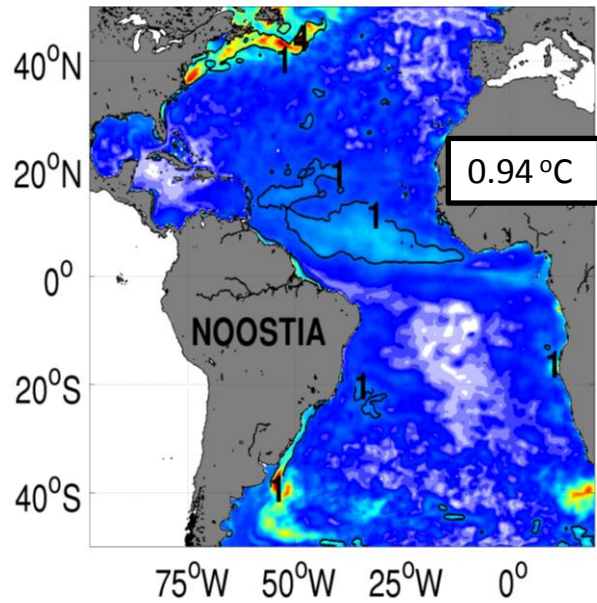
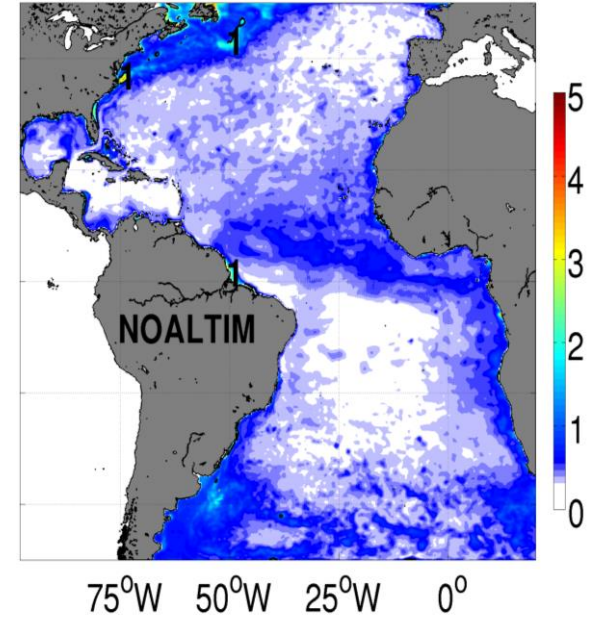
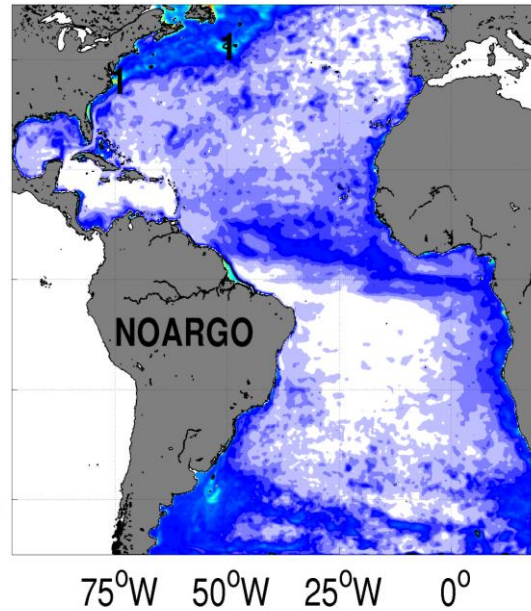
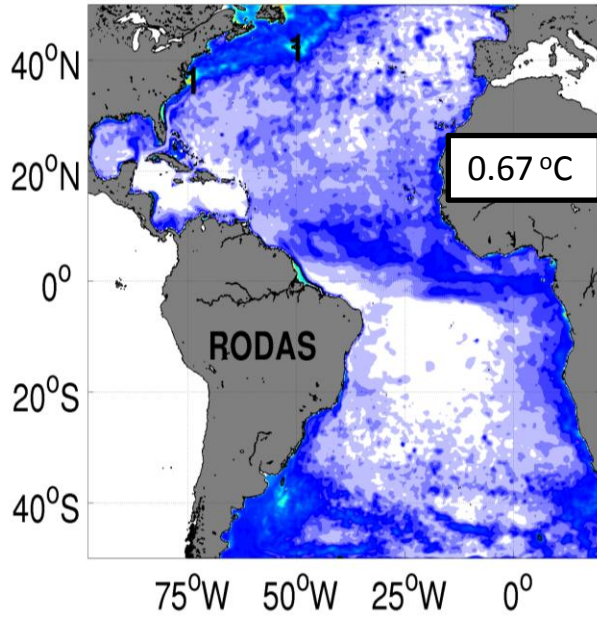
-> T of the mixed layer

## 3. ALTIMETERS

-> small impact on T and S

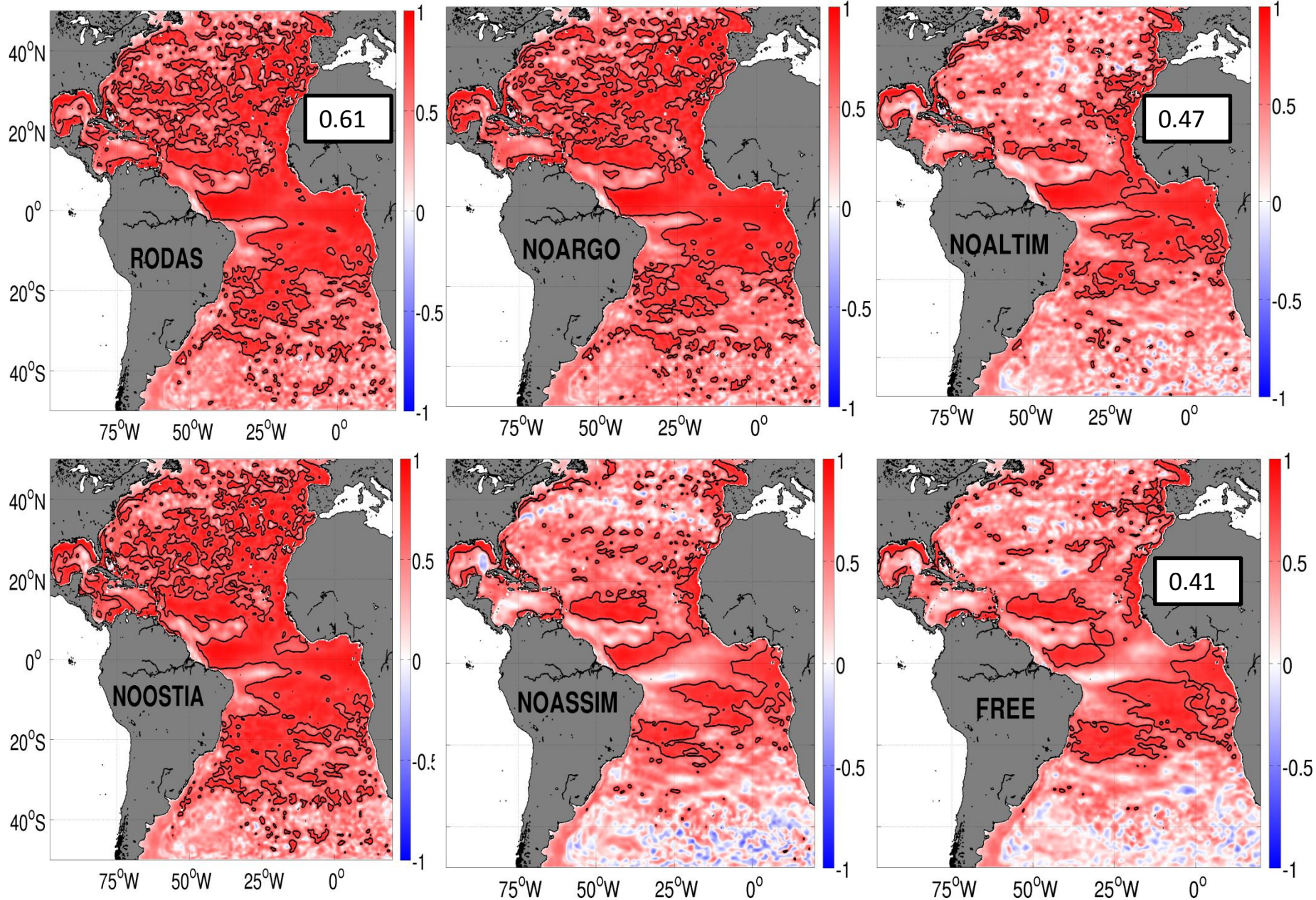


# RESULTS – RMSD OSTIA (°C)



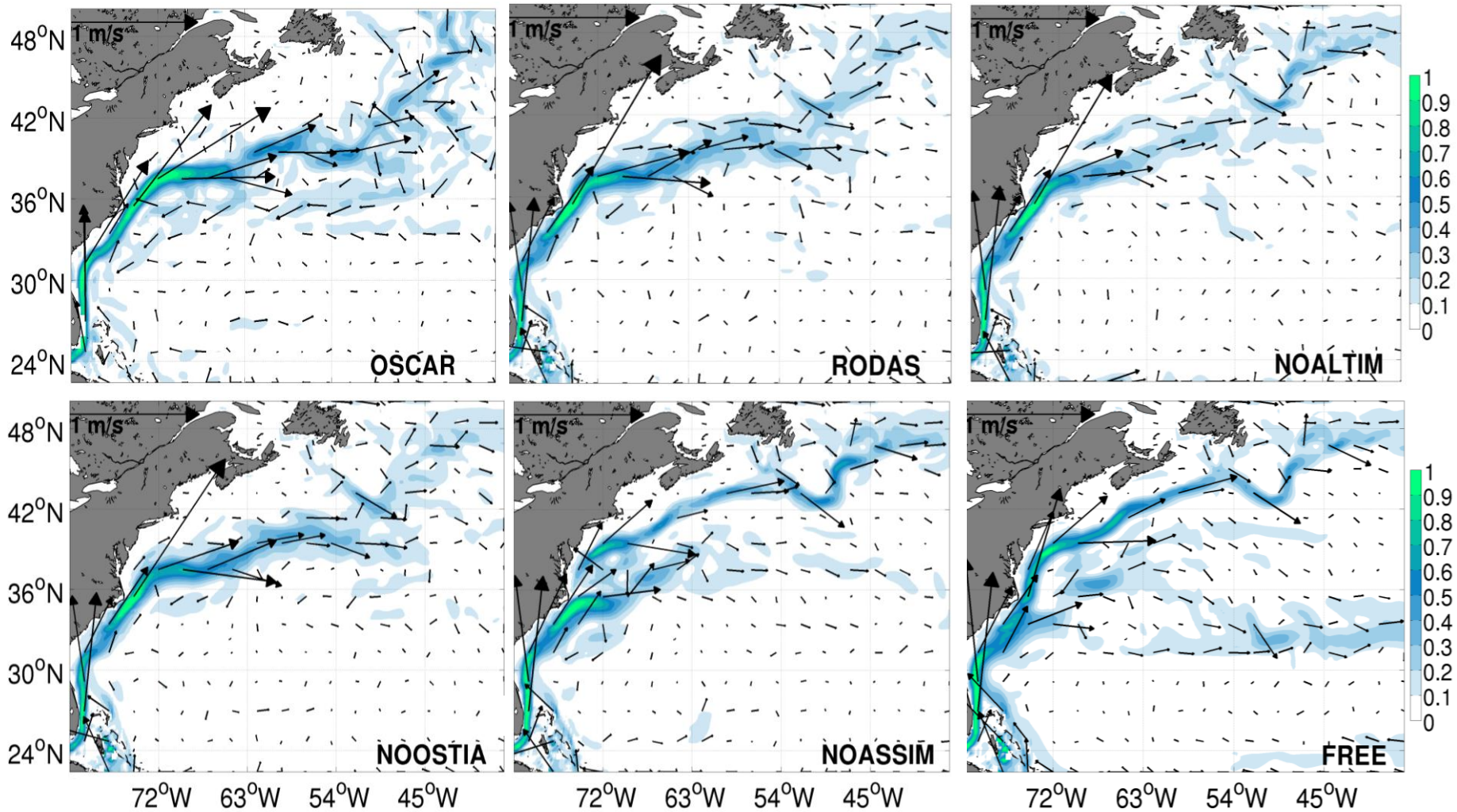


# RESULTS – CORR AVISO SLA GRIDDED DATA

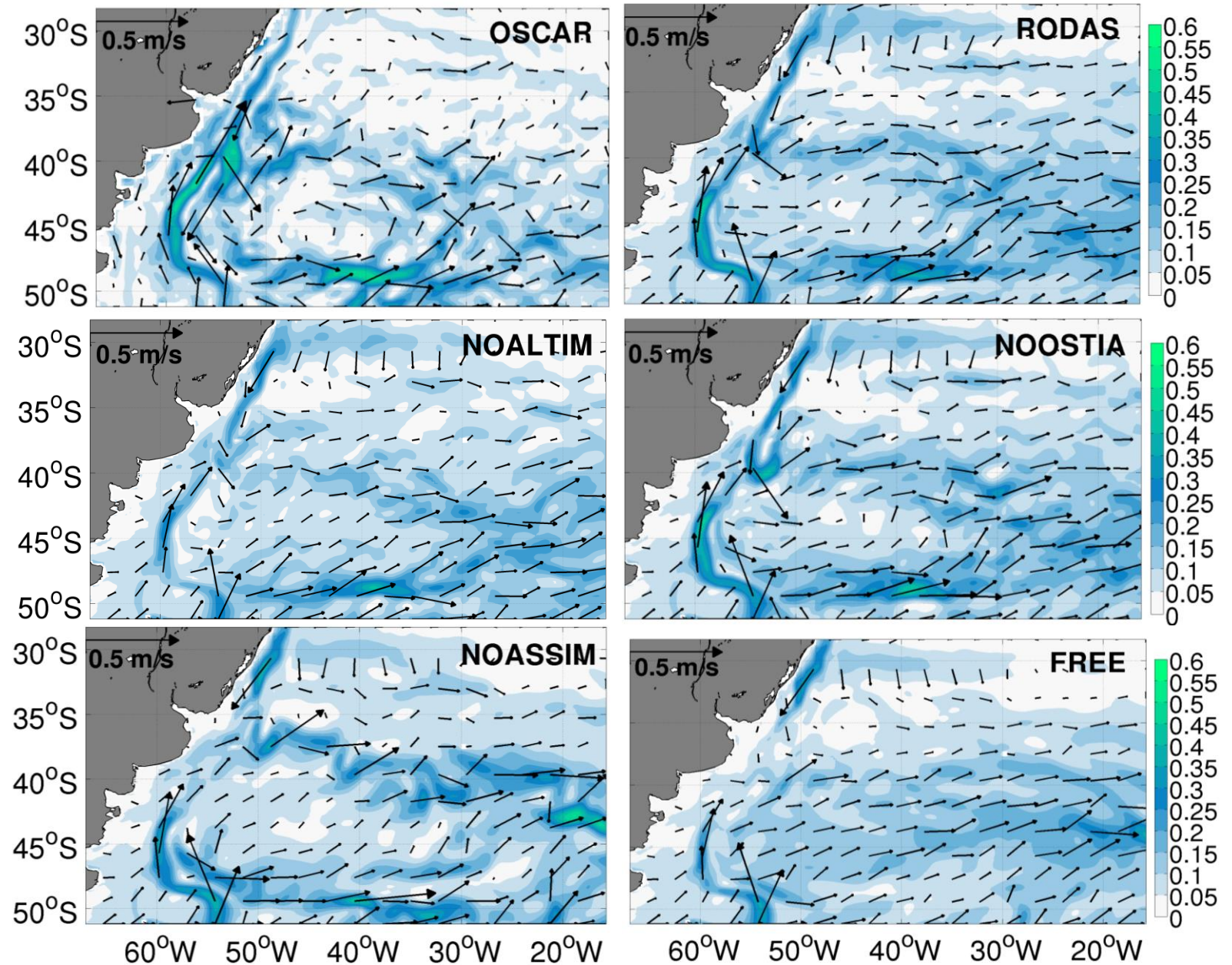




# VELOCITY - GULF STREAM (m/s)

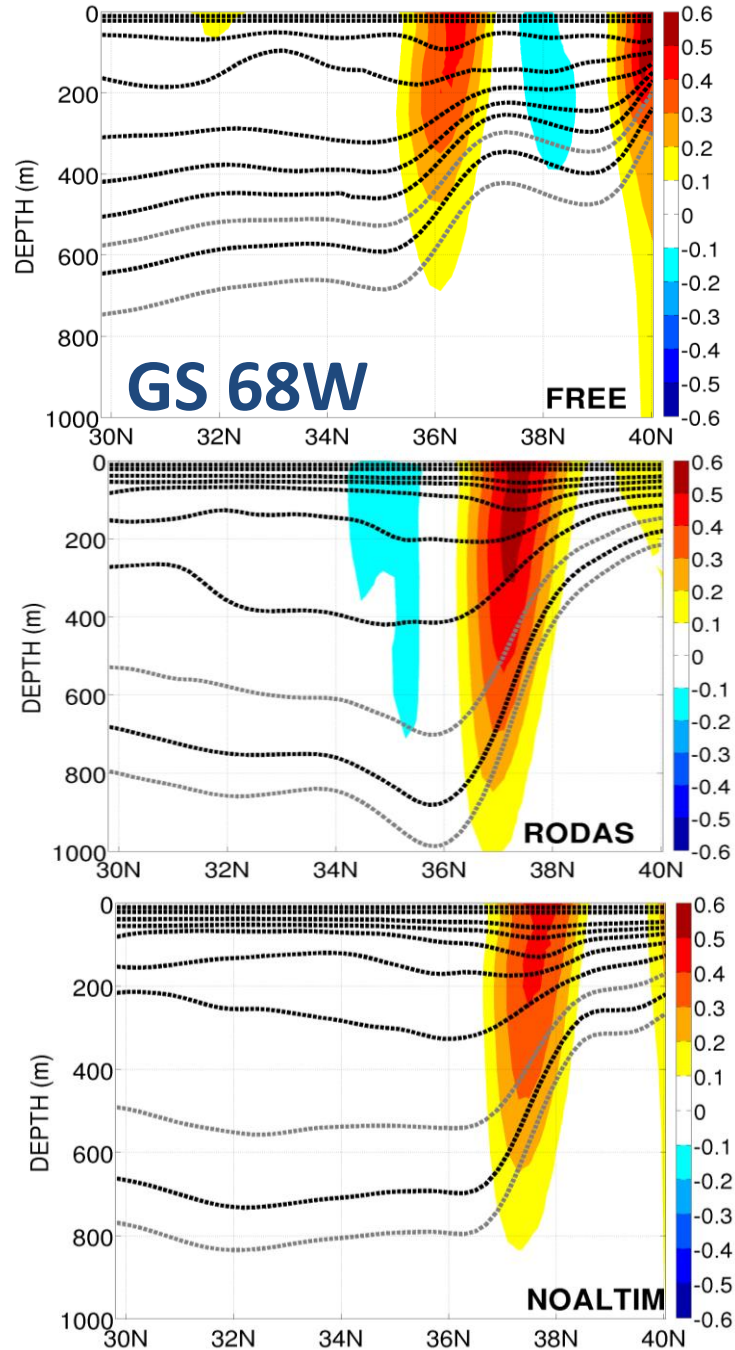
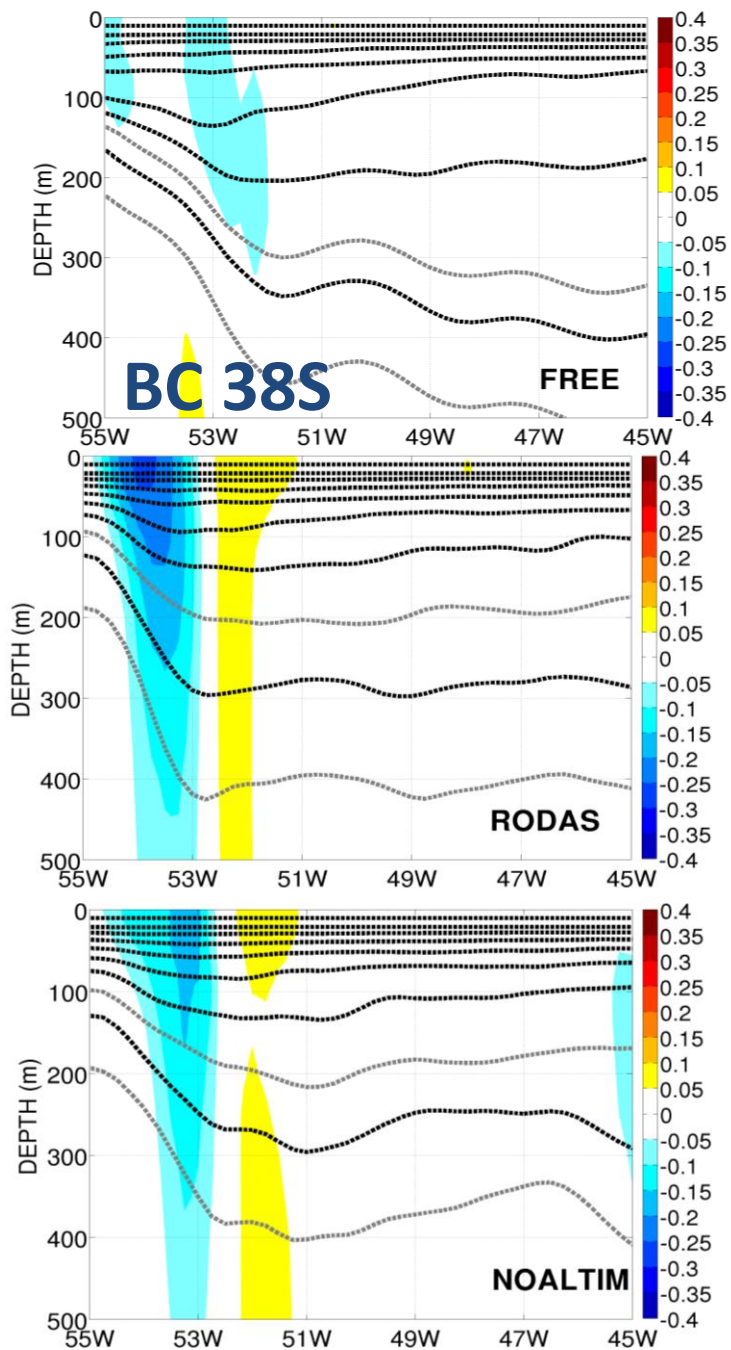


# VELOCITY - BRAZIL-MALVINAS CONFLUENCE (m/s)



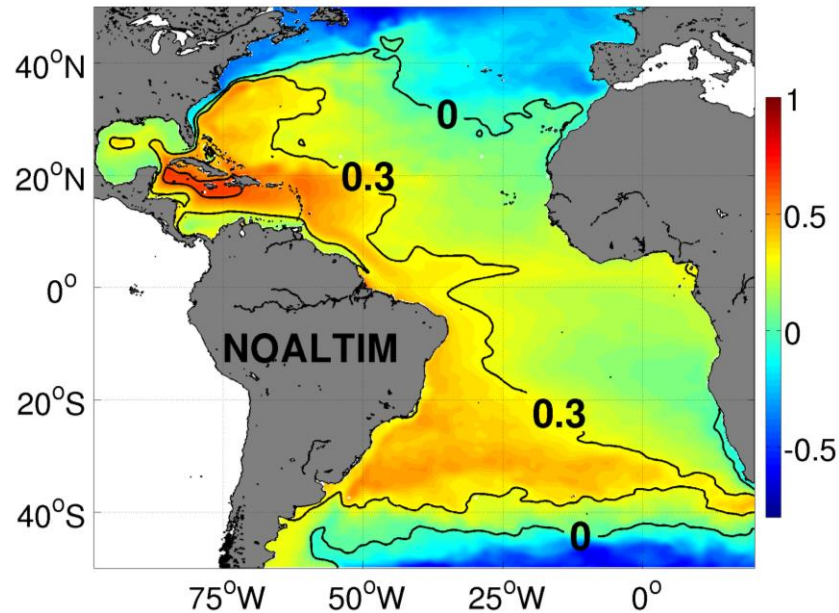
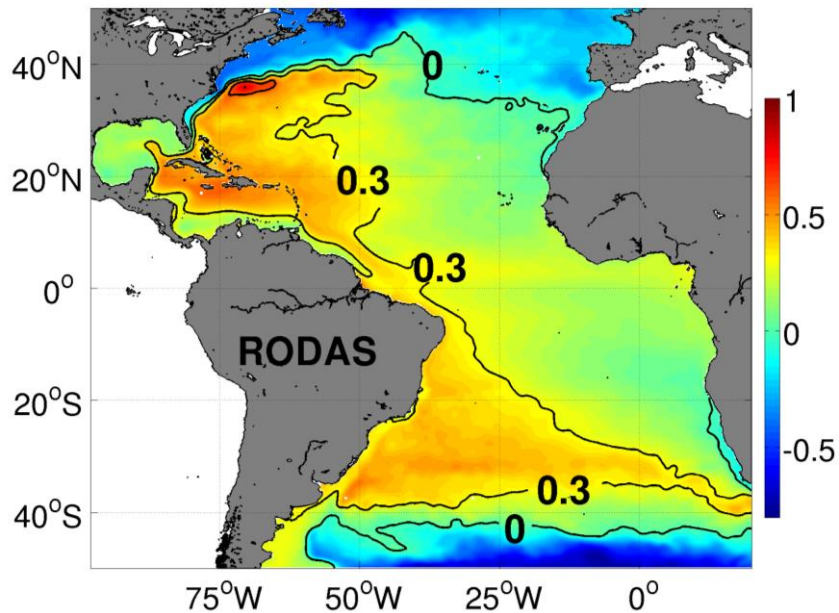


# MERIDIONAL VELOCITY

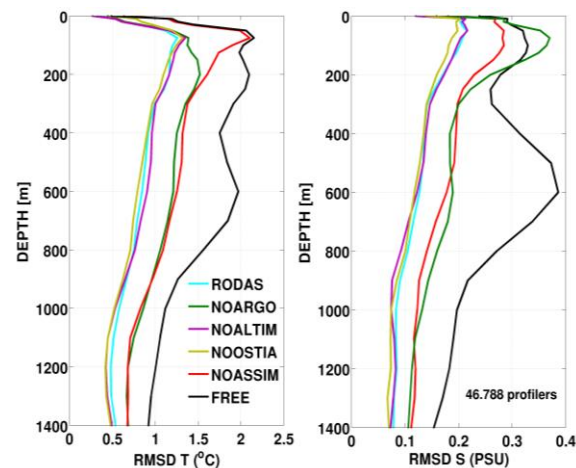
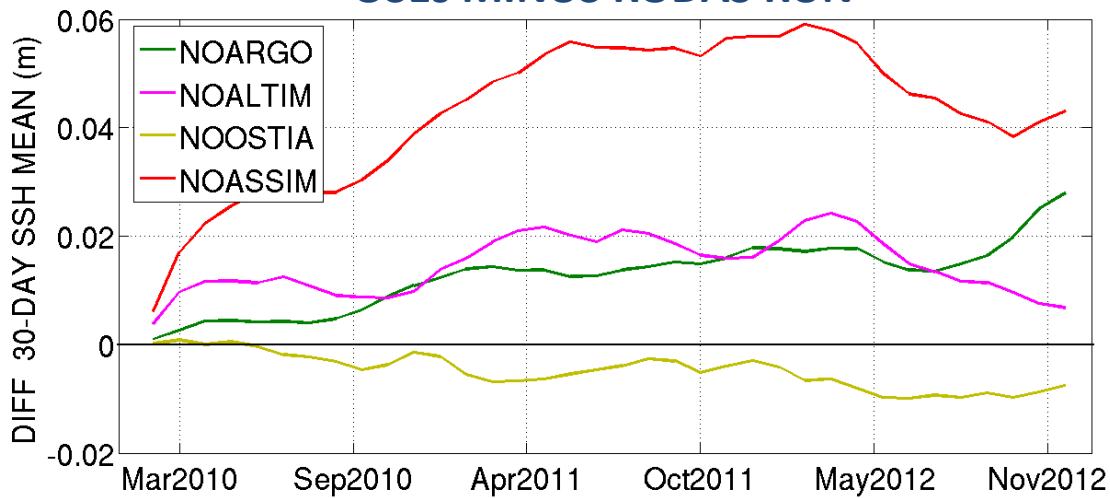


# ZONAL VELOCITY

# SSH MEAN (m)



## OSes MINUS RODAS RUN

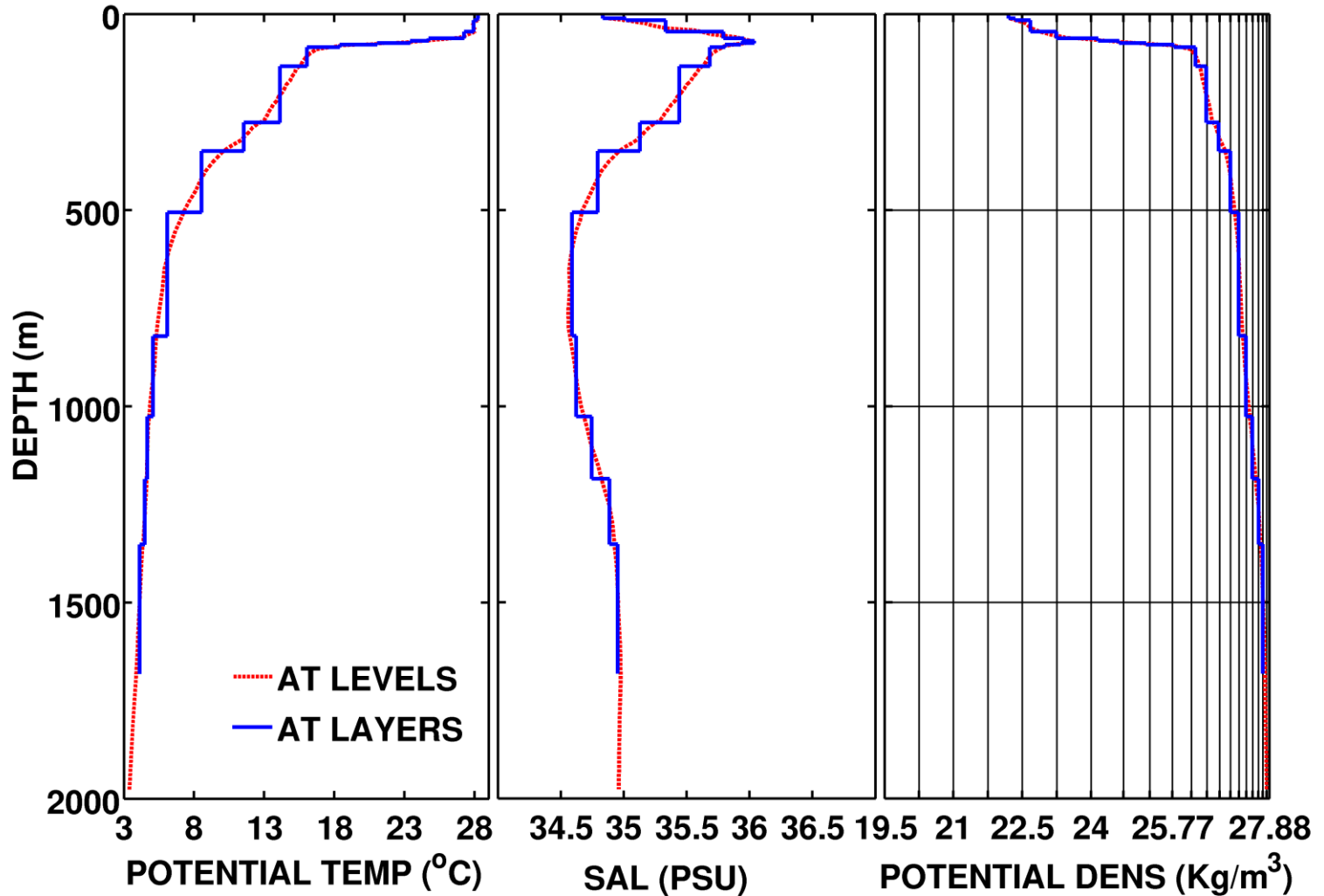


## SUMMARY

- **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

# ADDITIONAL FIGURES

➔ THE PRE-PROCESSING OF ARGO DATA FOR ASSIMILATION





# ADDITIONAL FIGURES

## ➔ CORR SST AND S AT 30N

