

# The SAMOC (South Atlantic Meridional Overturning Circulation) program

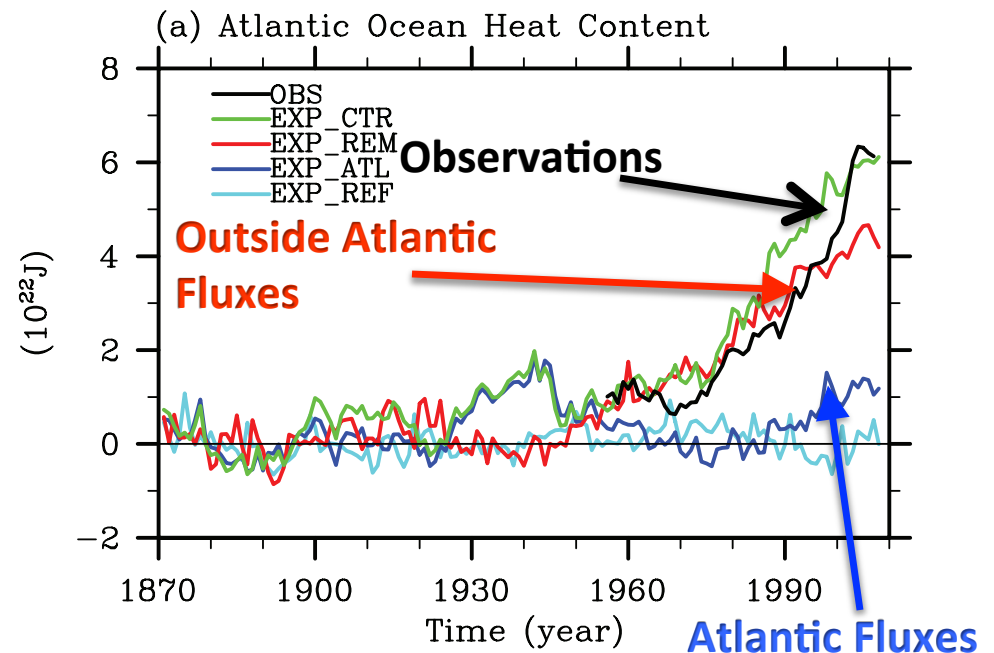
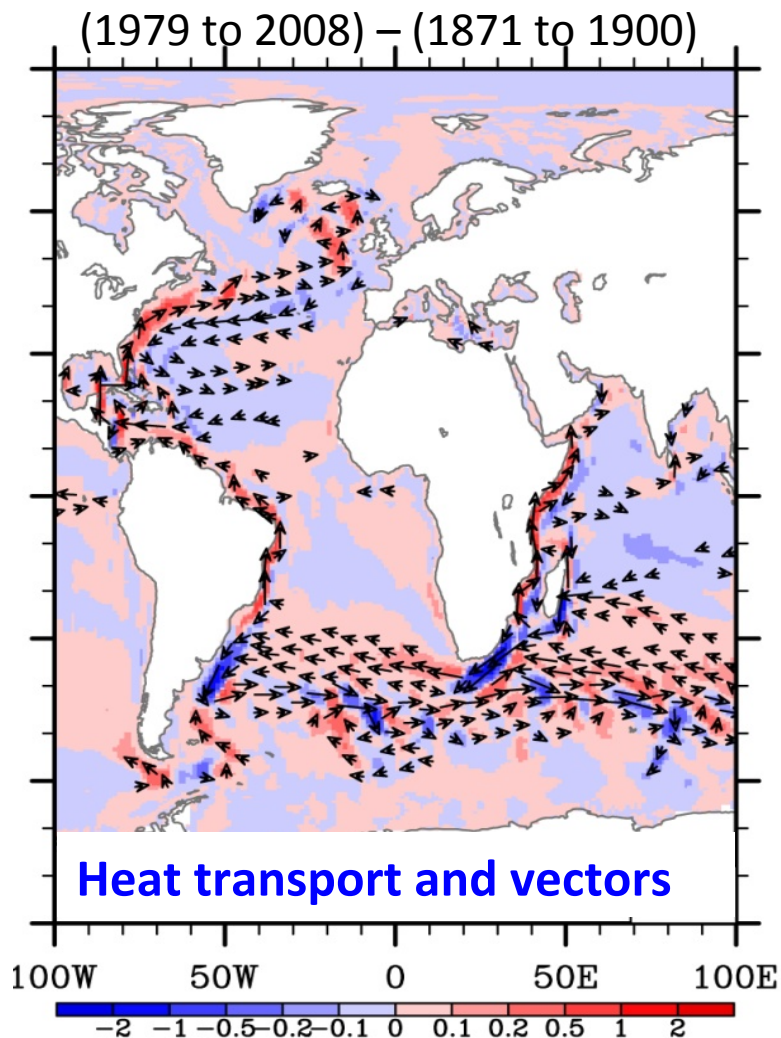
Renellys C. Perez, Silvia L. Garzoli, Alberto R. Piola,  
Sabrina Speich, Edmo Campos, Christopher S. Meinen,  
Michael Roberts, and the SAMOC team

- ❖ **Overarching goal of the SAMOC initiative** is to observe and understand the mechanisms that control the mean and time-varying MOC in the South Atlantic and the interocean exchanges
- ❖ SAMOC is an **international cooperation** between Argentina, Brazil, France, South Africa and the USA with **collaborators** from Germany, Russia, Spain, UK
- ❖ **Funding**: NOAA, CNPq/INCT, FAPESP/FACEPE, IAI, IFREMER/ANR, DEA

More details:

[http://www.aoml.noaa.gov/phod/SAMOC\\_international/](http://www.aoml.noaa.gov/phod/SAMOC_international/)

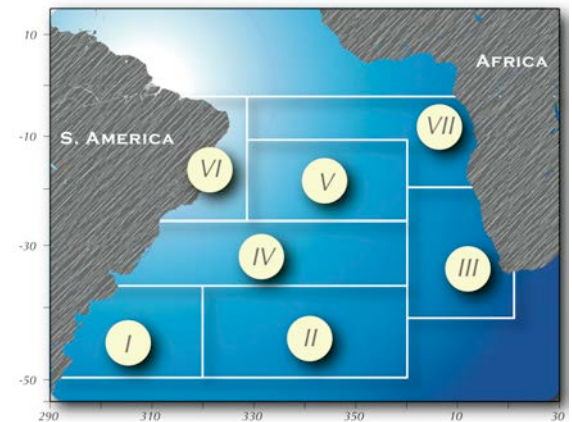
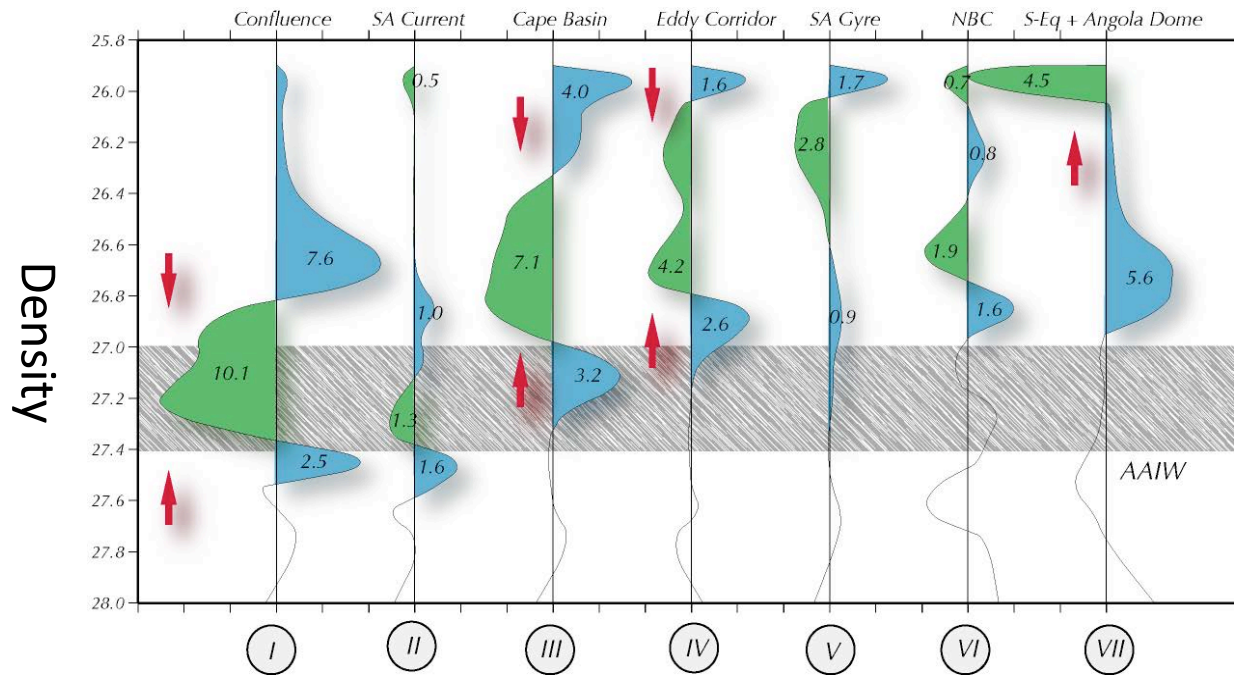
# AMOC pathway into South Atlantic affects North Atlantic SST (explains warming)



- NCAR CCSM3 model forced with fluxes isolated from the **Atlantic only** vs. **outside Atlantic**
- Flux forcing outside the Atlantic induces large heat advection south of Africa following the MOC pathway
- The **South Atlantic MOC pathway** can **modulate warming** in the Atlantic Ocean

# South Atlantic upper ocean water mass transformations and pathways

## Transport



- The **South Atlantic not a passive conduit** for NADW and other water masses
- Models show largest **water mass transformations** occur in highly energetic boundary regions
- AAIW created in **SW Atlantic** by surface/deep waters
- AAIW transformed into surface waters in **Cape Basin**

Garzoli and Matano (2011)

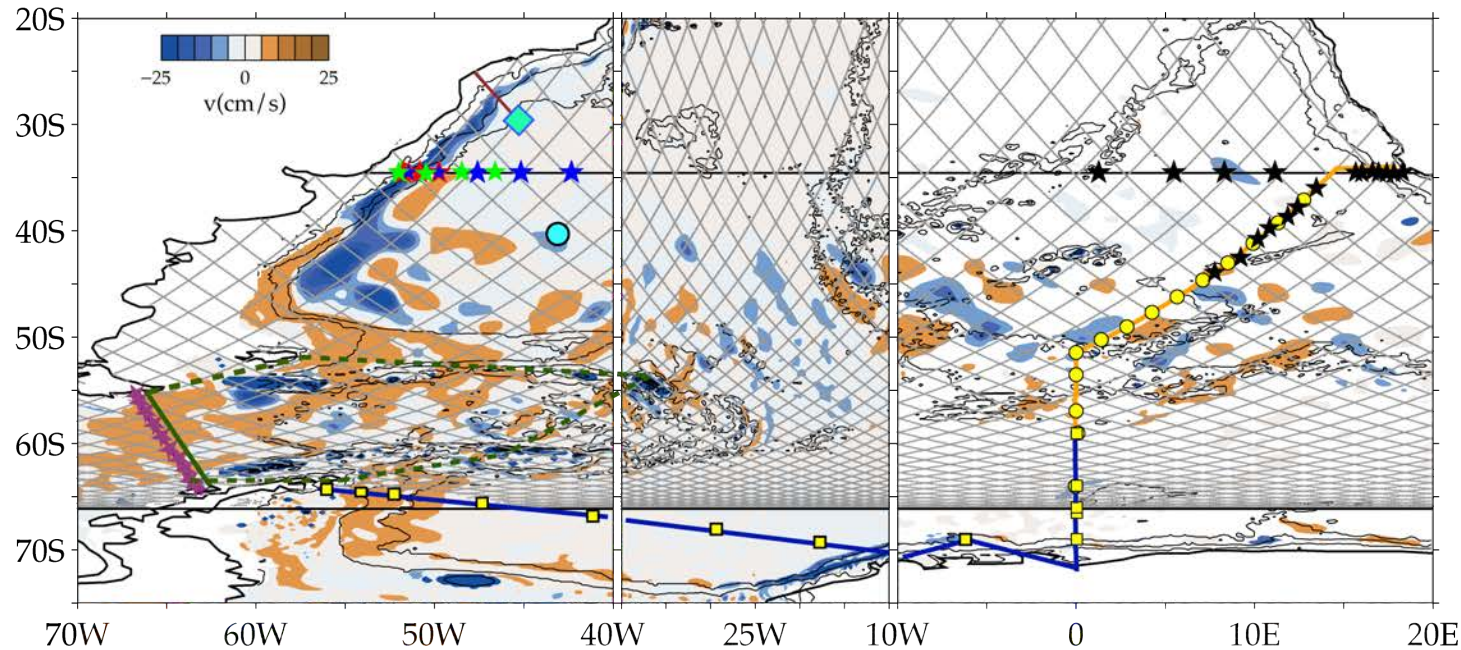
# **SAMOC**

**Update on observational components**



# SAMOC observational network “vision”

- |                                 |                           |                                            |                               |
|---------------------------------|---------------------------|--------------------------------------------|-------------------------------|
| ★ Moorings France, South Africa | ● CPIES/PIES Germany      | — CTD line Brazil, Argentina, South Africa | ◆ Atlas-B buoy INCT-MC Brazil |
| ★ Moorings Brazil               | ■ Tall moorings Germany   | — CTD line Russia                          | — CTD line INCT-MC Brazil     |
| ★ Moorings NOAA USA             | ★ CPIES CDrake NSF USA    | — CTD line Russia-South Africa             | — CTD Germany                 |
| ★ Moorings NSF USA              | ● OOI mooring Scripps USA | — CTD line CDrake NSF USA                  | --- SBE21 & VMADCP Russia     |



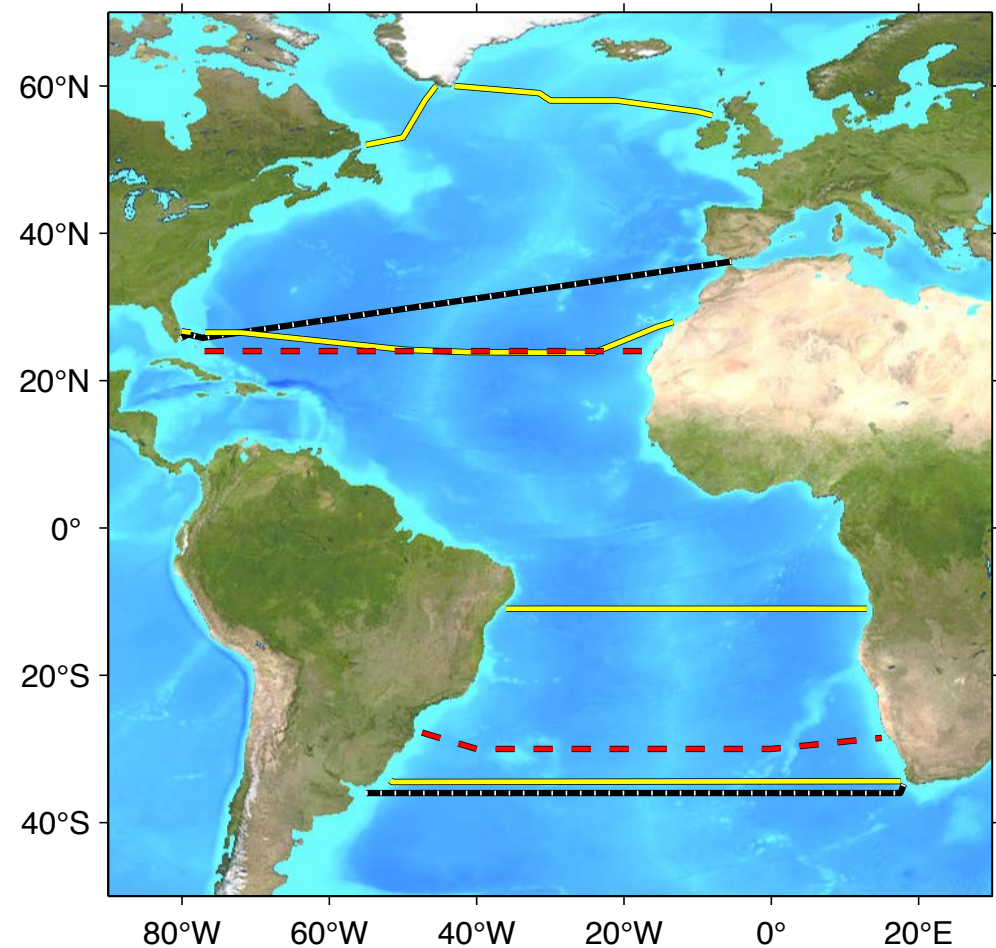
- SAMOC Basin-wide Array (**SAMBA**), **Oblique Goodhope transect**, **Drake Passage**
- Oct 2014: **Western boundary SAMBA** hydrography, PIES/CPIES telemetry cruise
- Oct 2014: **Eastern boundary SAMBA** tall mooring deployment, CPIES telemetry cruise
- Dec 2014: **Oblique Goodhope transect** PIES deployment cruise

**Seeking funding** for augmenting, expanding, or reinstating components of SAMOC

# AMOC observations



Moored arrays

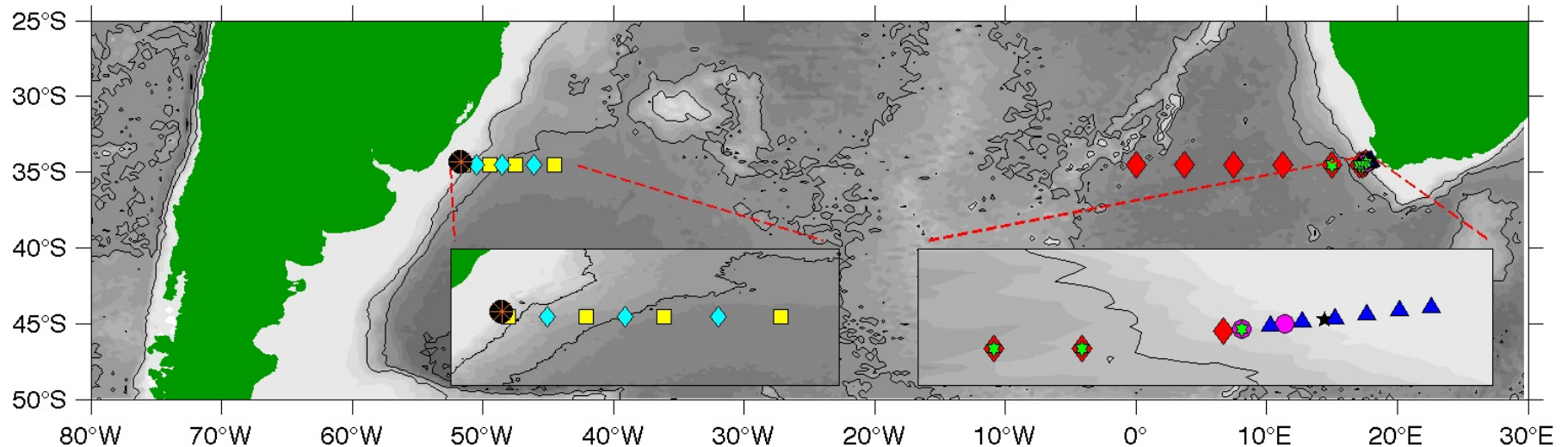


Trans-basin measurements



# SAMOC/SAMBA

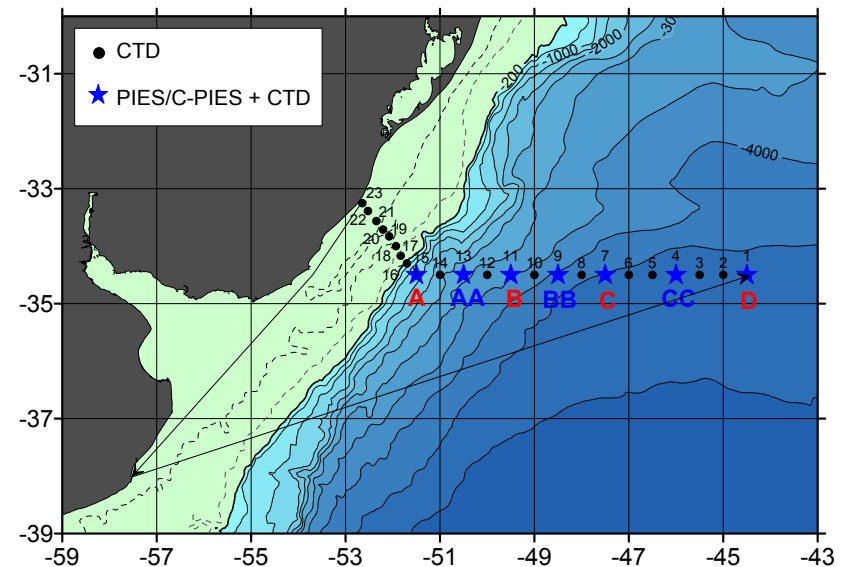
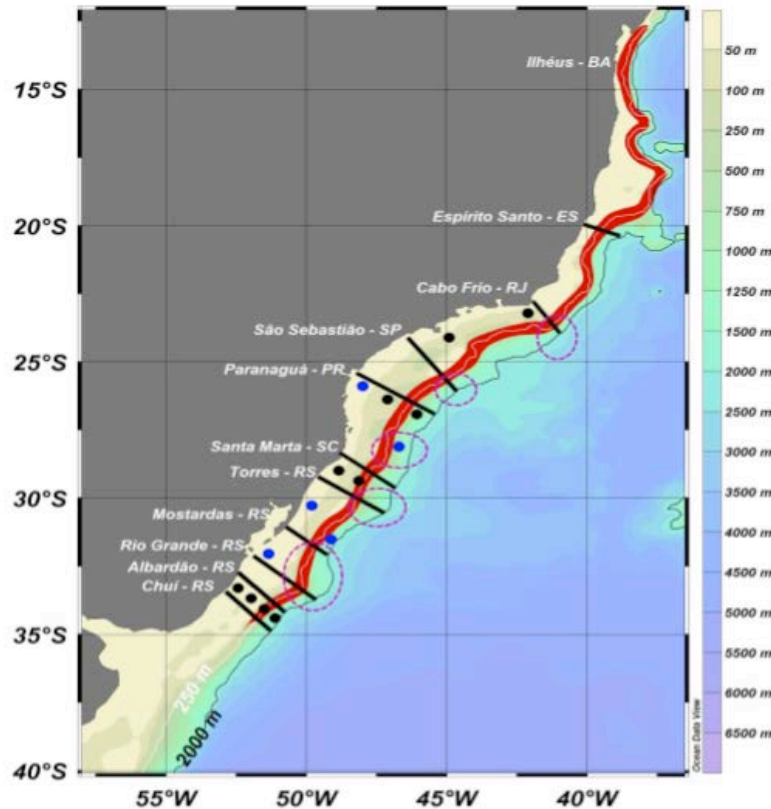
- PIES - NOAA - In place since March 2009
- ◆ CPIES - Brazil - In place since December 2012
- Bottom pressure - Brazil - In place since December 2013
- ✱ Bottom ADCP - Brazil - In place since December 2013
- ◆ CPIES - France - In place since September 2013
- Bottom ADCP - France - In place since September 2013
- ▲ Short mooring - South Africa - To be deployed in mid 2014
- ★ Thermister mooring - South Africa - To be deployed in mid 2014
- ★ Tall mooring - South Africa - To be deployed in mid 2014



- In both 2012 and 2013, **SAMBA doubled** in size!
- 2012-2013: 3 CPIES, 1 ADCP, 1 BPR deployed on **western boundary**
- 2013: 8 CPIES, 2 ADCPs deployed on the **eastern boundary**
- Oct 2014: 10 short/tall moorings will be deployed on the **eastern boundary**

# Shelf – deep ocean

The mooring array off Rio Grande is designed to serve as the shelf boundary of the western portion of SAMBA

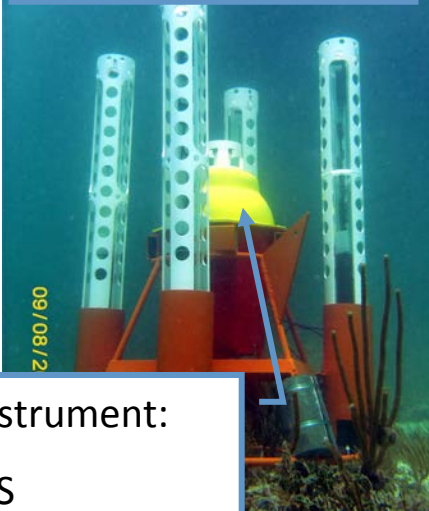


- Main regions where field activities are planned within scope of INCT-Mar ICO
- **Hydrographic/velocity measurements** by **Argentina** and **Brazil** on shelf will aid in SAMBA MOC calculations until more moorings funded
- **Mooring servicing** and **data telemetry** done on these cruises



# Datapod technology: ABIISS(US)/SYREDOMY (France)

**ABIISS** (4 datapods)

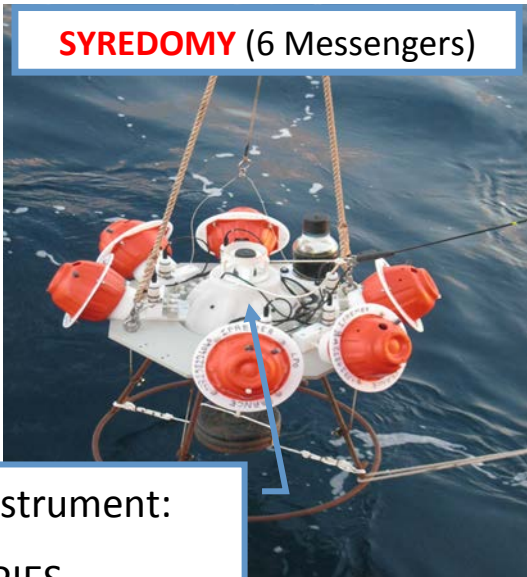


Instrument:

IES

- Successful **6 month US ABIISS test deployment** in the Florida Straits (800 m)
- Launch of two data pods and data transmission via satellite
- Instrument recovery in fall 2014

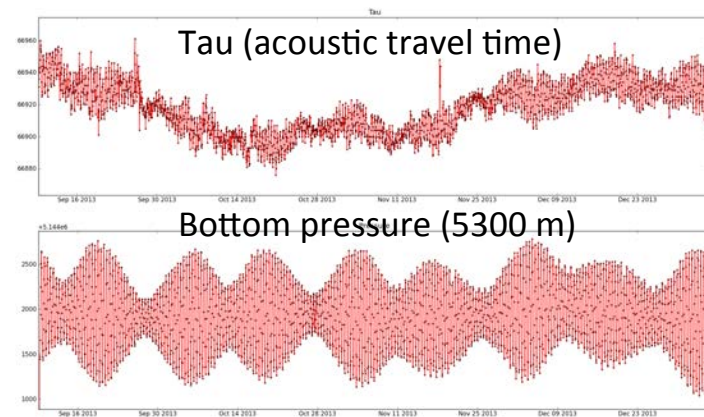
**SYREDOMY** (6 Messengers)



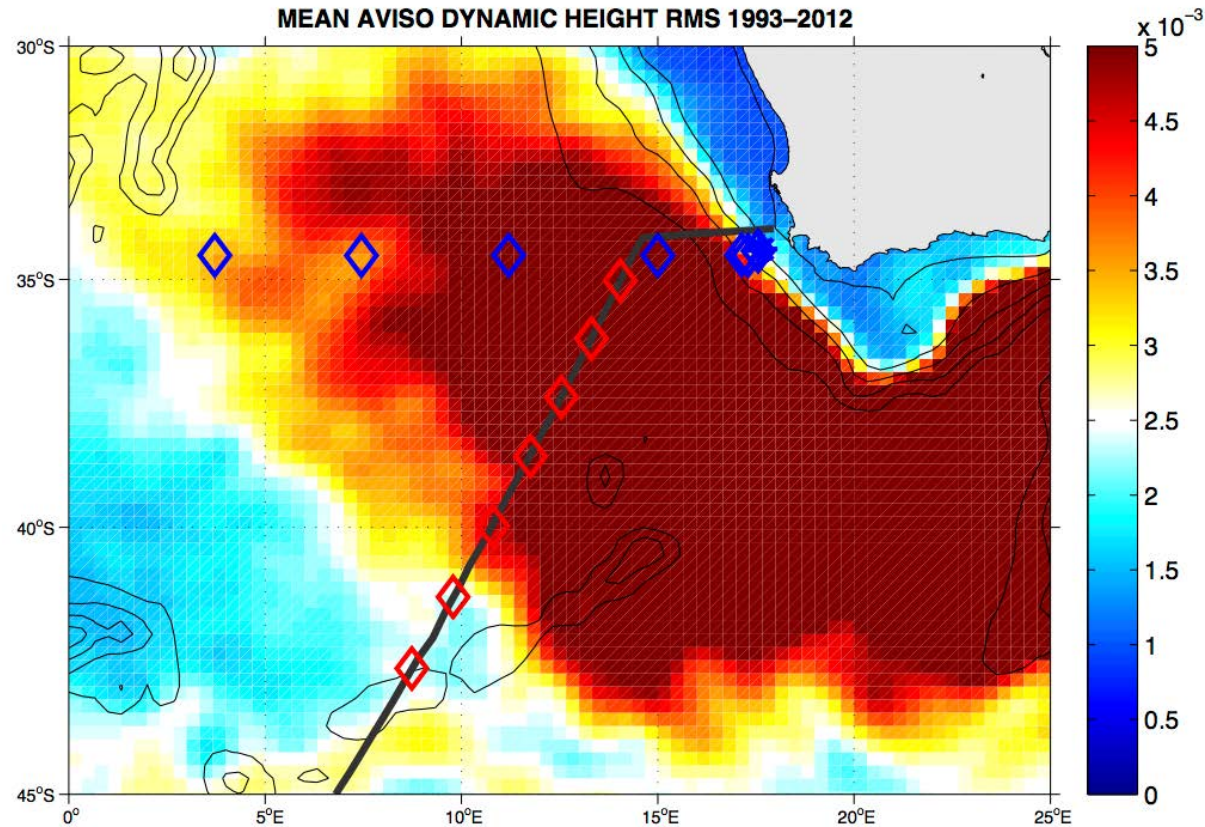
Instrument:

CPIES

- Successful **data transmission** via satellite from first set of **French SYREDOMY** messengers (example: SAMOC/SAMBA CPIES, 5300 m)

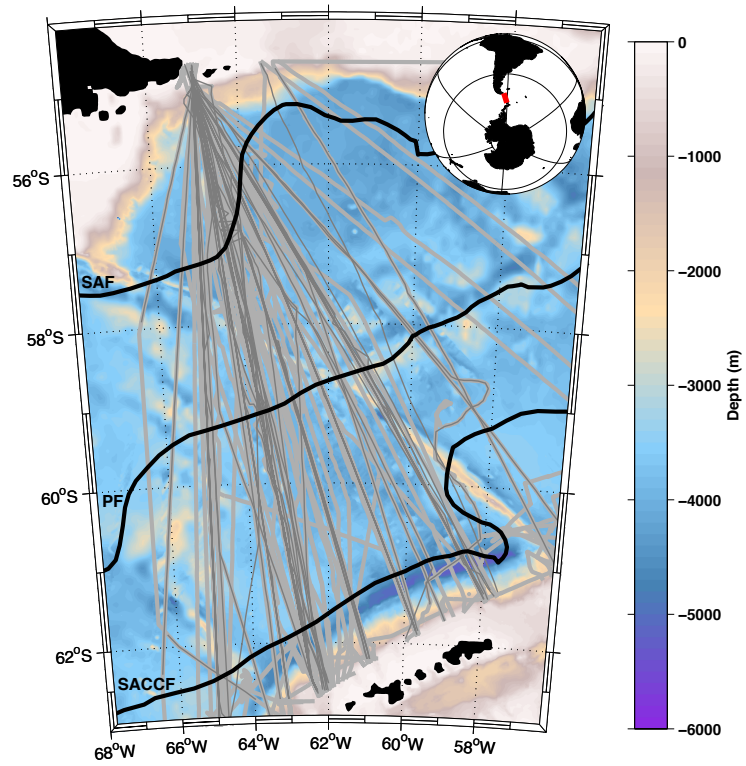
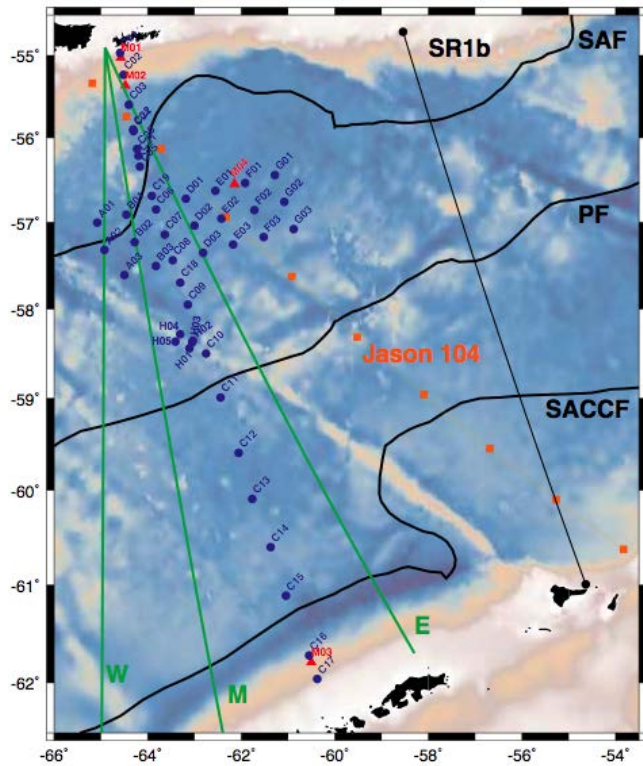


# Oblique Goodhope transect



- To assess impact of Indo-Atlantic exchange on SAMOC, **7 PIES** will be deployed in 2014 along **oblique Goodhope transect** (JASON-2 ground track) out to Agulhas Ridge
- Red diamonds: Planned locations of PIES
- Gray line: CLIVAR Goodhope line sampled twice/year

# cDRAKE field (2007-2011) and Drake Passage Underway Time Series programs



- Providing a wealth of information about the **variability** and **dynamics** of the **ACC**
- Left panel: **cDrake** locations
- Right panel: **Drake Passage Underway Time Series** transects



# **SAMOC**

## **Science results**

**Publications:** [http://www.aoml.noaa.gov/phod/SAMOC\\_international/](http://www.aoml.noaa.gov/phod/SAMOC_international/)

### **Presentations at US AMOC 2014 Meeting:**

**Session 3: S. Dong** “Meridional changes of the SA MOC from satellite measurements”

**Poster TT1: S. Garzoli** “Tracing the lower limb of the AMOC in the SA”

**Poster TT1: M. Goes** “An optimal XBT based monitoring system for the SA MOC at 34S”

**Poster TT1: C. Meinen** “Observed DWBC variability at 34.5S during 2009-2012”

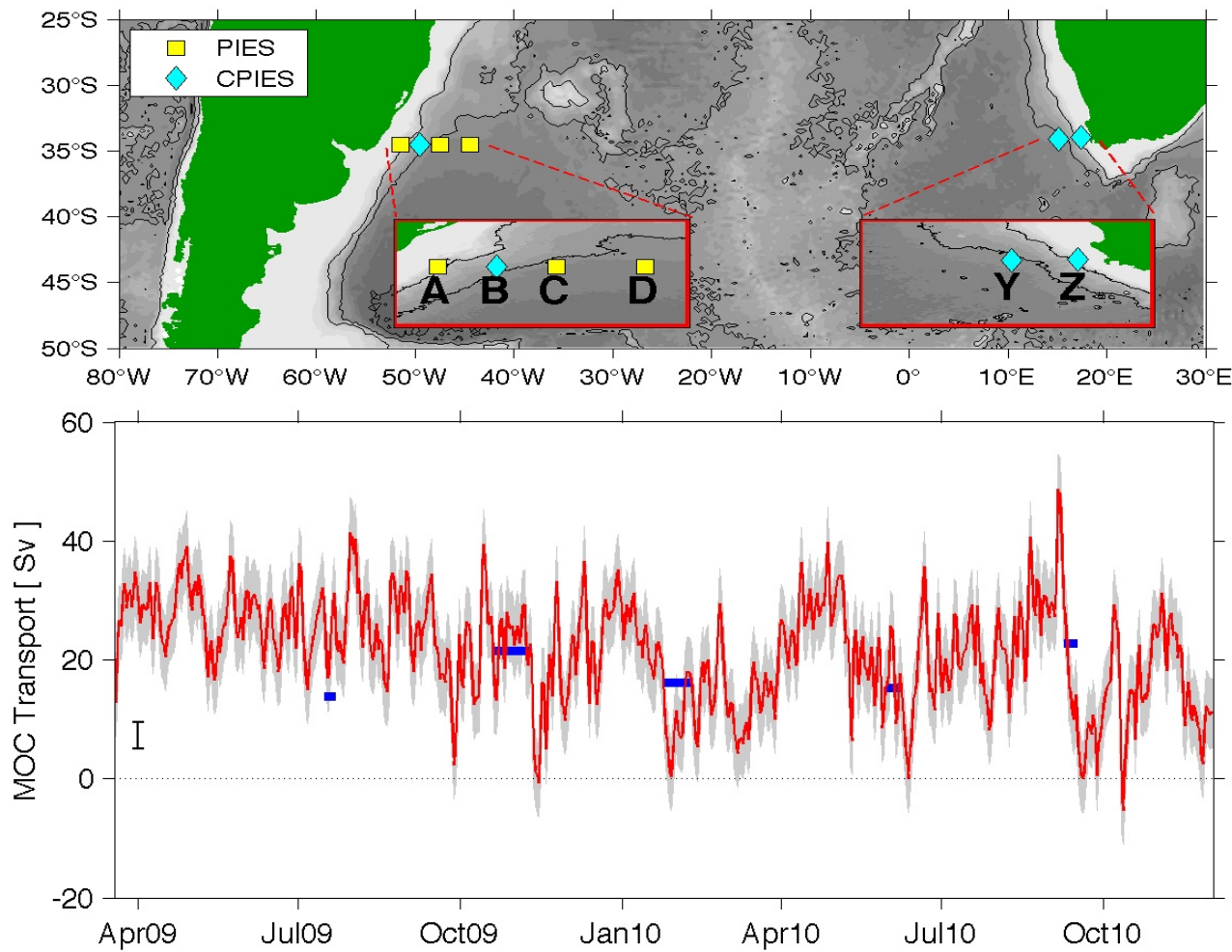
**Poster TT2: C. Schmid** “Variability and uncertainty of meridional transports in the SA”

**Poster TT4: R. Perez** “Simulating MOC water mass pathways and variability in the SA”



# Pilot array provides daily estimates of South Atlantic MOC

MOC estimated from a daily time series of dynamic height from inverted echo sounders (PIES/CPIES)

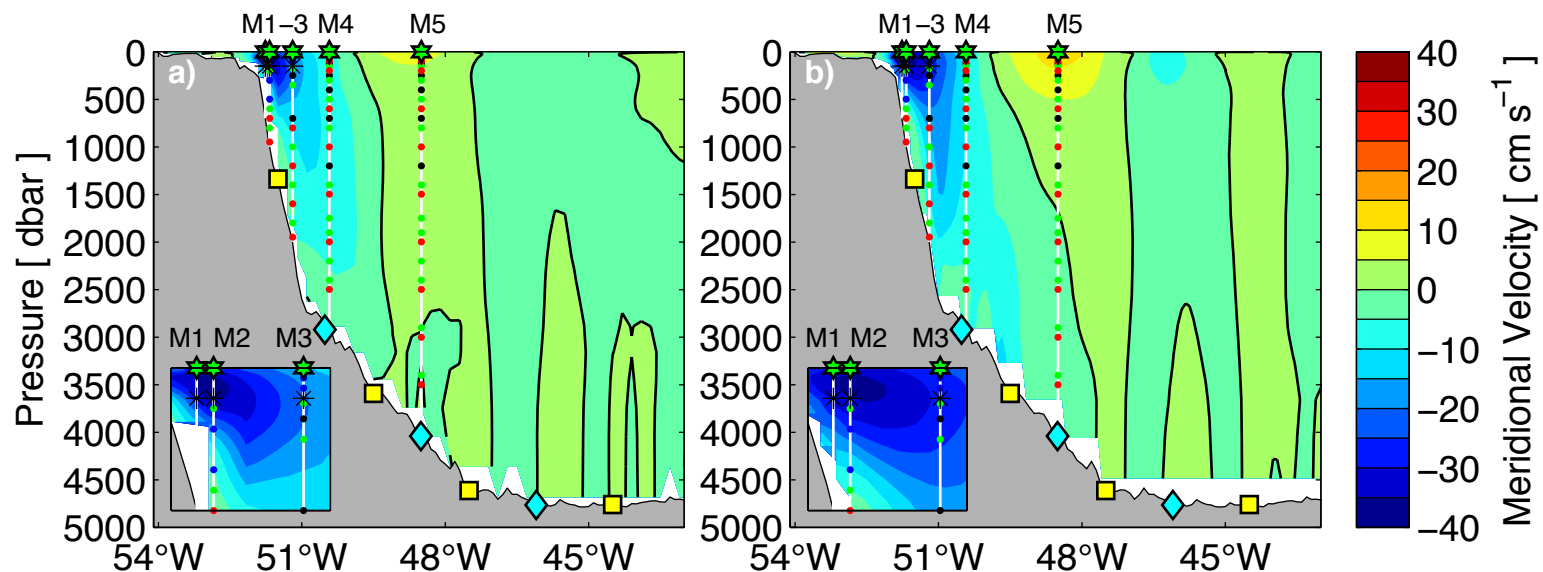


- An **20 month long pilot array** and a novel technique using model output and Argo data helps determine the **daily MOC strength at 35°S**
- MOC time series **compares favorably with XBT** derived time series
- **MOC variability is as large at that at 26°N**, with both boundary flows contributing equally to the variance
- **Eastern boundary array was reestablished in fall 2013** by France and South Africa

Meinen et al. (2013)

# Future expansion, augmentation, reinstatement

- ❖ **Short/tall moorings** (T, S, p, v) on the **western boundary** to better measure transport (BC, DWBC) and water mass (NADW) changes
- ❖ **PIES/datapods** in the **interior**
- ❖ **Drake Passage moorings** for ACC transport
- ❖ Trans-basin hydrographic/SADCP/tracer cruise
- ❖ **Challenges**: Funding, obtaining ship time (cruises by international partners)\*



\*New R/V: 2012, **S.A. Agulhas II** (133m, South Africa), **Alpha Crucis** (64 m, Brazil)  
2014, **Sonne** (Argentina, 97 m)

# SAMOC WORKSHOP

South Atlantic circulation variability and change:  
integrating models and observations

Buenos Aires, Argentina  
December 1-5, 2014

