Decadal Sea Level Variability in the Tropical Atlantic

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Motivations and relevant questions …

Use the links in this overview to navigate through the presentation

Challenges: Or have a quick look: **FAST**

Identify the interannual and

Tools: Decadal sea level fingerprints   **Results:**

The CMEMS   Regional sea level

Climatic index   Trends

GREP product   Correlation

SST, currents, SLP   **Main Findings:**   Steric components

Good correlation between TA & boxes

Upper Ocean stratification
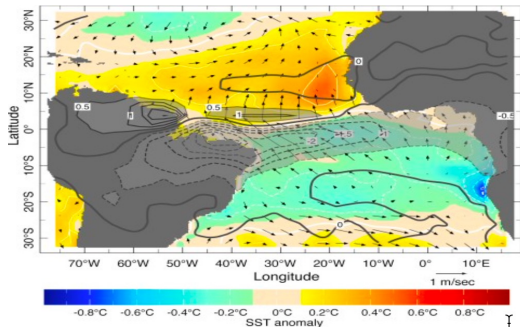
Interannual climatic modes
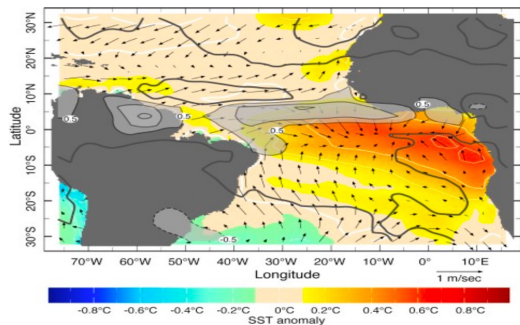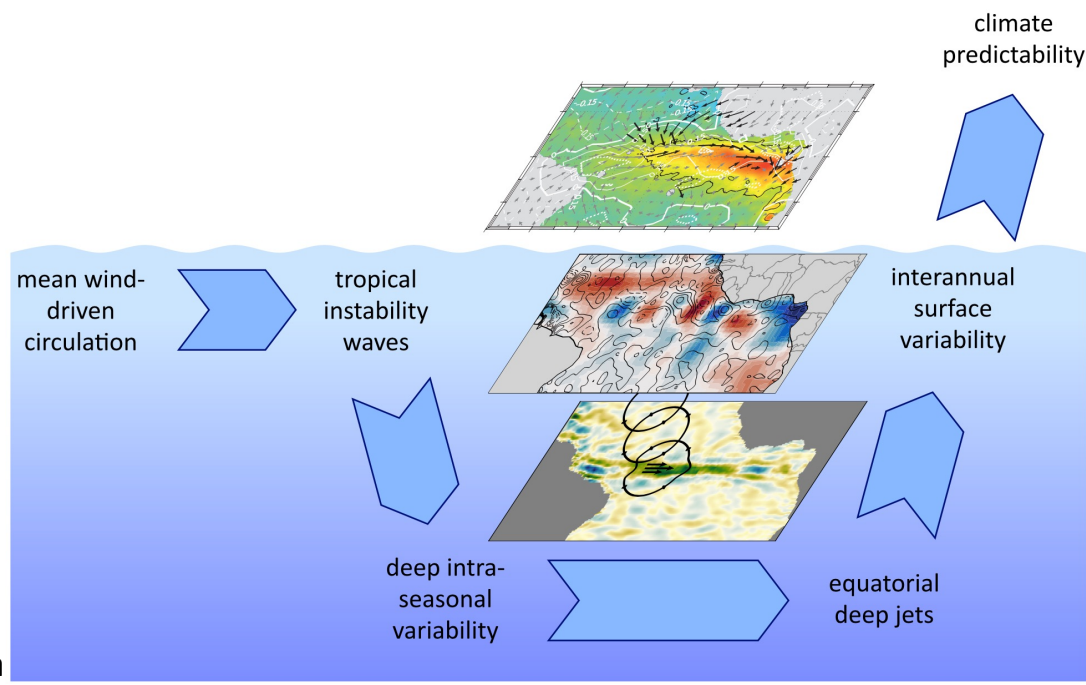
Meridional mode

Meridional mode
→ Peak in boreal spring
→ North-south SST gradient
→ Inter Tropical Convergence Zone migration (ITCZ)

Equatorial mode

Equatorial mode
→ Peak in boreal summer
→ "El Niño" Atlantic, lower than in Pacific
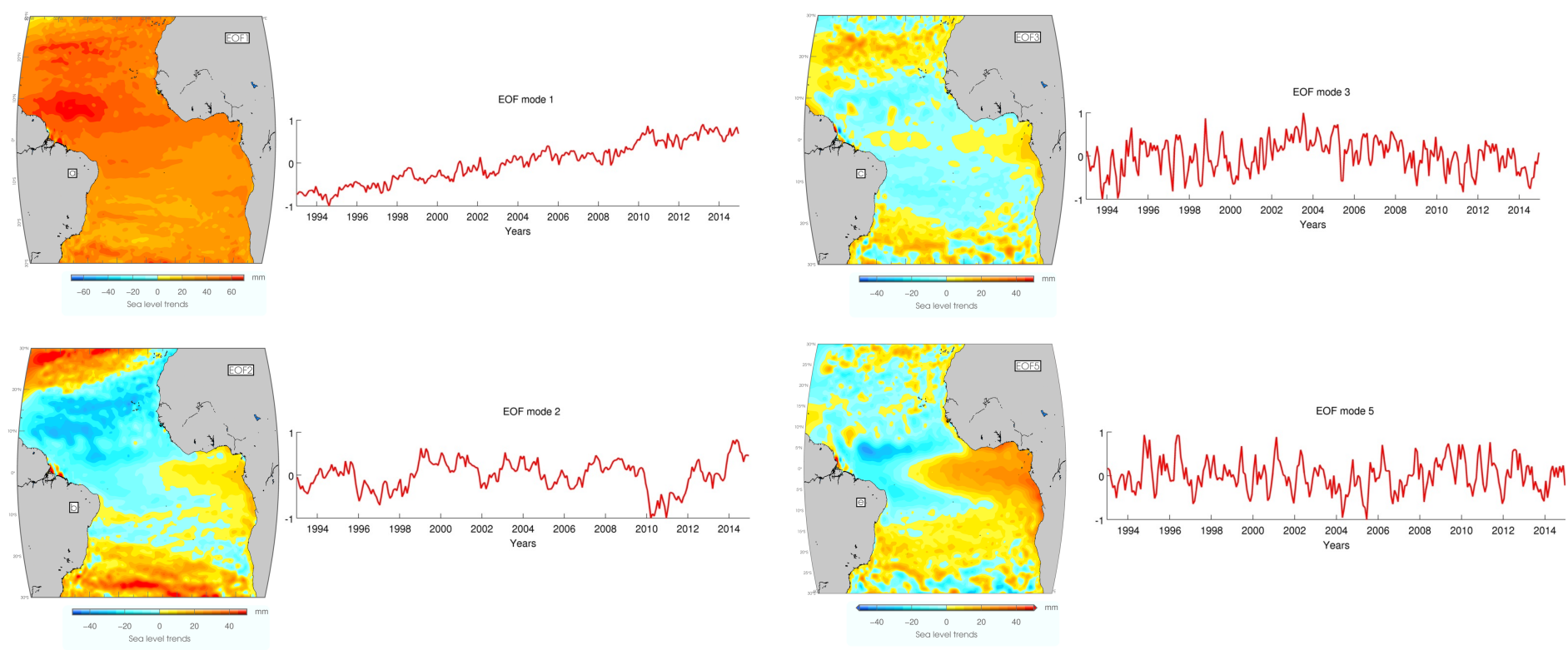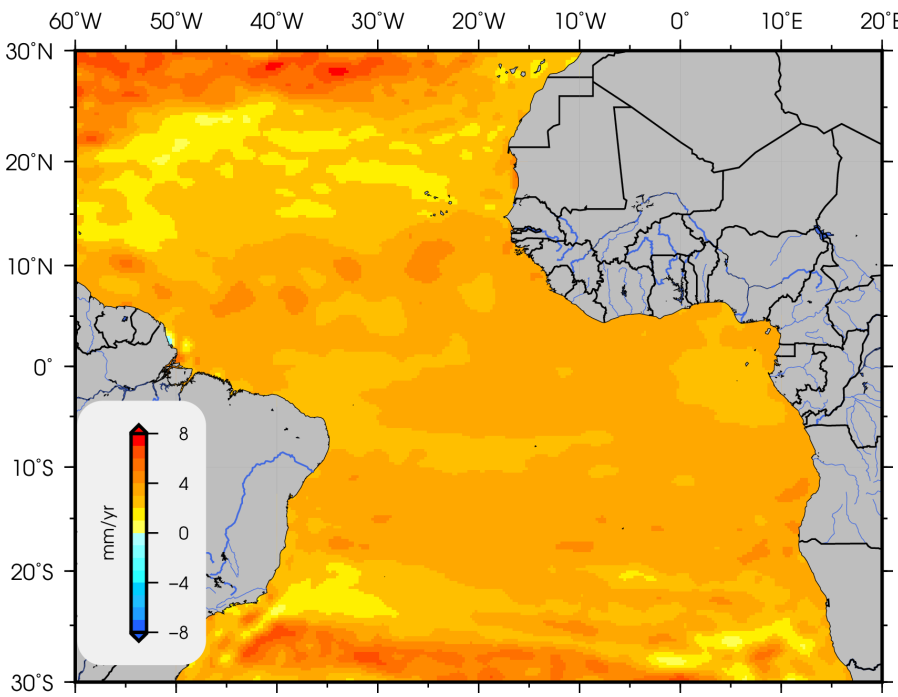→ Responsible for SST anomalies in Gulf of Guinea

climate predictability

mean wind-driven circulation

tropical instability waves

interannual surface variability

deep intra-seasonal variability

equatorial deep jets

Regional Sea Level EOF decomposition

Figure 1: TASL EOF decomposition over 1993–2015

Overview High variability observed in three boxes (ATL3, SEEA and Amazon) **Overview**
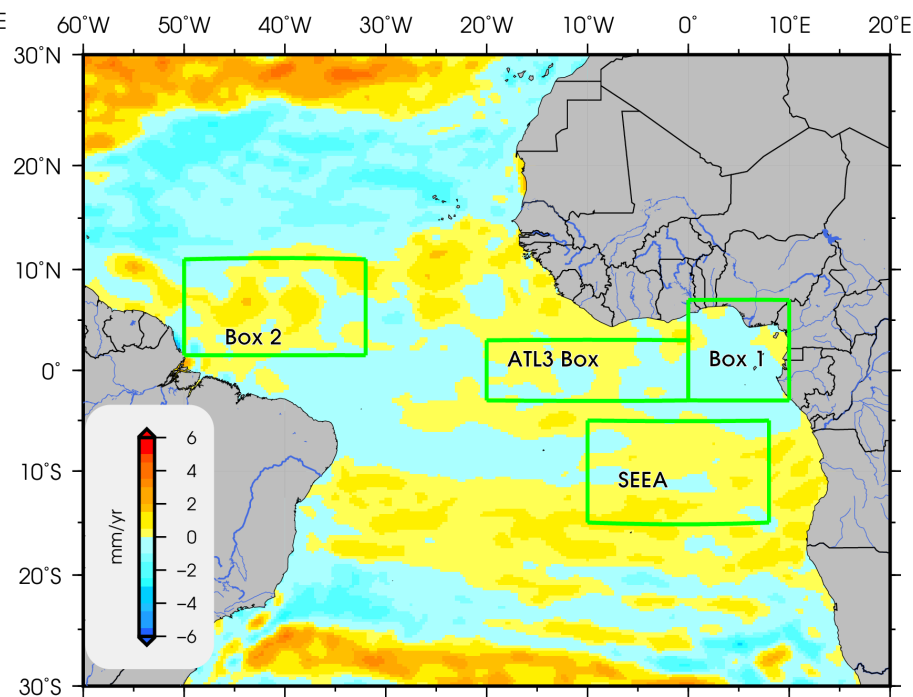
Figure 2: **(a)** Map of TASL trend over 2005–2015, **(b)** Map of Tropical Atlantic sea level trend over 2005 - 2015 with the global mean trend of 3.3 mm/yr removed.

Overview High variability observed in three boxes (ATL3, SEEA and Amazon) **Overview**

SL trends correlation

(a) Atl3 Box: 3.02 mm/yr — Study area — corr: 0.80; pvalue=<2.22e-16

(b) Gulf of Guinea: 3.82 mm/yr — Study area — corr: 0.89; pvalue=<2.22e-16

(c) SEEA Box: 3.49 mm/yr — Study area — corr: 0.87; pvalue=<2.22e-16

(d) Amazon: 3.39 mm/yr — Study area — corr: 0.30; pvalue=7.1287e-05
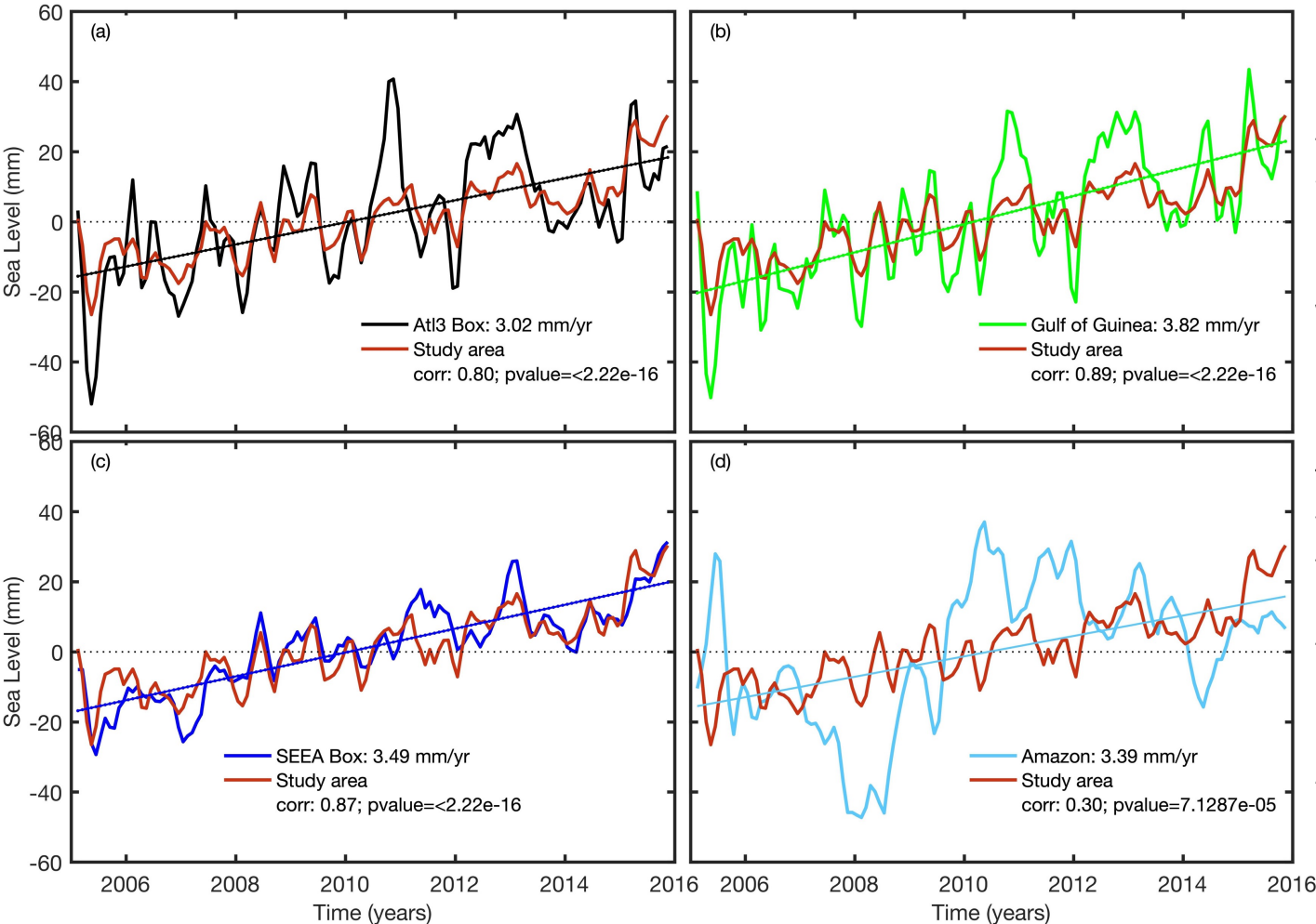
Good correlation between TA trends and boxes found in the western Basin.
Relating the dominance of the Equatorial upwelling in the variability.

The Amazon box SL shows high variability potentially due to the variability of fresh water influx from Amazon. Visually the trend of Amazon seems lower than of study area (a) due to the high variability of Amazon box.

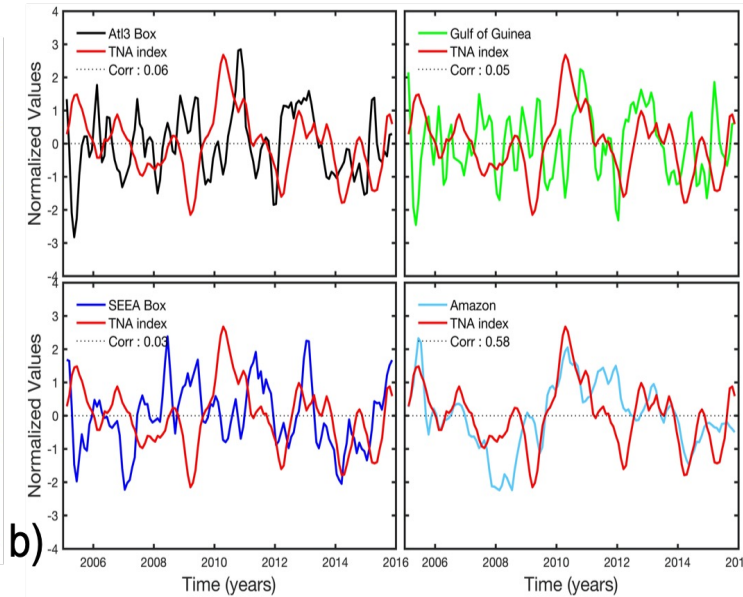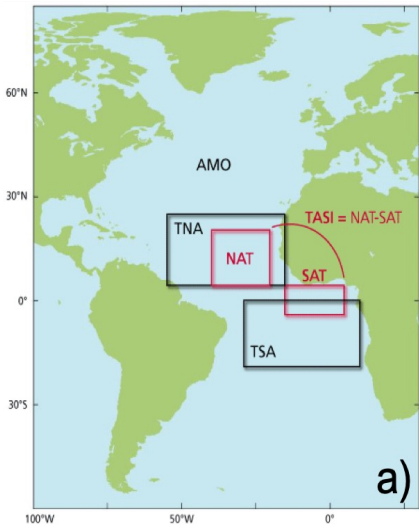→ List of model **Experiments** and **Simulations**

Overview
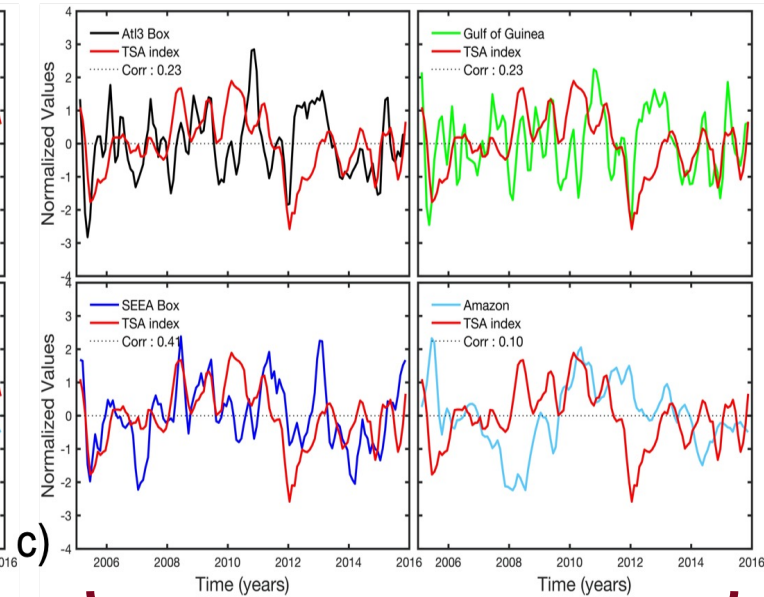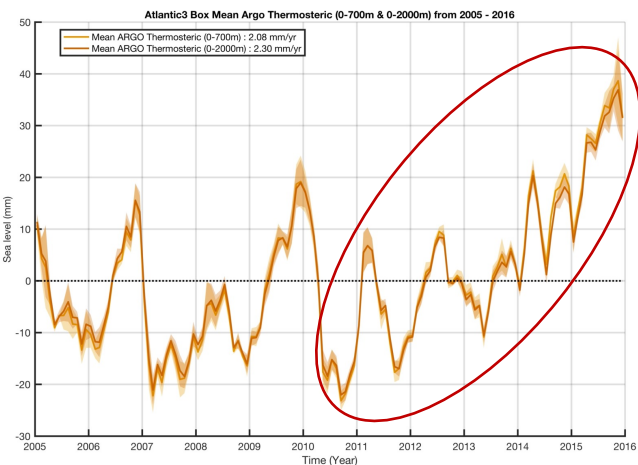
Comparison of two climate modes TNA and TSA

TNA (Tropical Northern Atlantic Index) has the highest correlation (r=0.58) with the Amazon basin.

TSA (Tropical Southern Atlantic Index) correlates at 0.41 with the SEEA box, 0.23 the Atl3

Atlantic3 Box Mean Argo Thermosteric (0-700m & 0-2000m) from 2005 - 2016

Mean ARGO Thermosteric (0-700m) : 2.08 mm/yr
Mean ARGO Thermosteric (0-2000m) : 2.30 mm/yr

Atlantic3 Box Mean Argo Ocean Heat Content (0-700m & 0-2000m) from 2005 - 2016

Mean ARGO data (0-700m) : 0.31×10^8 J/m^2
Mean ARGO data (0-2000m) : 0.39×10^8 J/m^2

Atlantic3 Box Mean Argo halosteric (0-700m & 0-2000m) from 2005 - 2016

Mean ARGO halosteric (0-700m) : 0.25 mm/yr
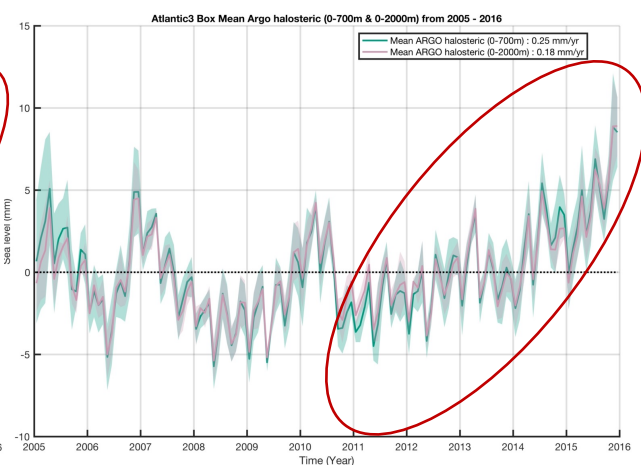Mean ARGO halosteric (0-2000m) : 0.18 mm/yr

The ATL3 Box is marked by an increase of the thermosteric since mid-july 2010
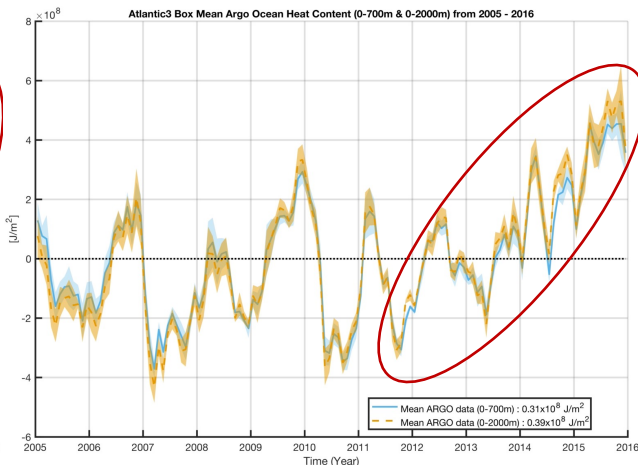
A rise of halosteric is also observed since mid-july 2010 with a value of 0.25 mm/yr from 0-700m.

- Meaning that we have an increase of density
- Deficit in precipitation.

The OHC is rising too with a significant contribution from 0-200m (0.39×10^8 J.m^{-2})is also observed since mid-july 2011.

Mean ARGO from (0 - 700m) and (0 – 2000m)

Overview

Conclusions

- **Signature: strong anomalies identified off Amazon plume**. → as mechanisms precipitation due to ICTZ migration and surface current by horizontal advection.

- During 2016 warm early event, halosteric component through Sea Surface Salinity caused a **very shallow mixed layer** and **enhanced upper ocean stratification** → **reduced upwelling**.

- **Work in progress:** Investigate the impacts of Benguela Niño/Niña on Sea level variability.

Overview

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