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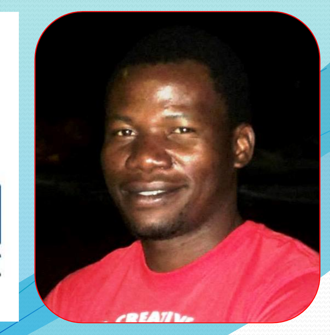

VARIABILITY OF TOTAL ALKALINIY AND TOTAL INORGANIC CARBON IN THE WESTERN TROPICAL ATLANTIC OCEAN

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INTRODUCTION

Seawater surface Total Alkalinity (TA) and Total Dissolved Inorganic (C_T) are two main carbonates system. Their variabilities and their controlling processes remain unknown because of complexity of ocean carbon chemistry. TA is affected by river discharge, precipitation-evaporation, and organic matter production (primary). The Western Tropical Atlantic (WTA) is affected by the Amazon River discharge and by the seasonal migration of the Intertropical Convergence Zone (ITCZ) associated with the atmospheric high precipitation being both sources of freshwater. Identification of the controls processes on surface TA and C_T is becoming increasingly important for understanding the effects of ocean acidification resulting from the addition of anthropogenic CO_2 into surface waters

In this poster we use physical/biogeochemical data obtained from different cruises to achieve a better description and comprehension of the CO_2 parameters distribution in the western tropical Atlantic. After describing the TA and C_T variability in these areas, we propose a new relationship for C_T to better take into account the influence of the Amazon in the WTA

DATA and METHODS

-The dataset includes all available cruises in the western tropical Atlantic (20°S-20°N, 20°W-60°W), where TA, C_T, Sea Surface Temperature(SST) and Sea Surface Salinity (SSS) were measured from the surface to 10m (Fig. 1a). The dataset covers the period between 1989 and 2014 through 35 surveys

-The standard deviation of anomaly of SSS grid data were extracted from Reverdin data base of (http://www.legos.obs-mip.fr/observations/sss/) updated from 1970-2013 (Fig1.b).The SST grid data were extracted from Objectively Analyzed air-sea flux (OAflux) in section of turbulence from 1958-2013 (Fig1.c)

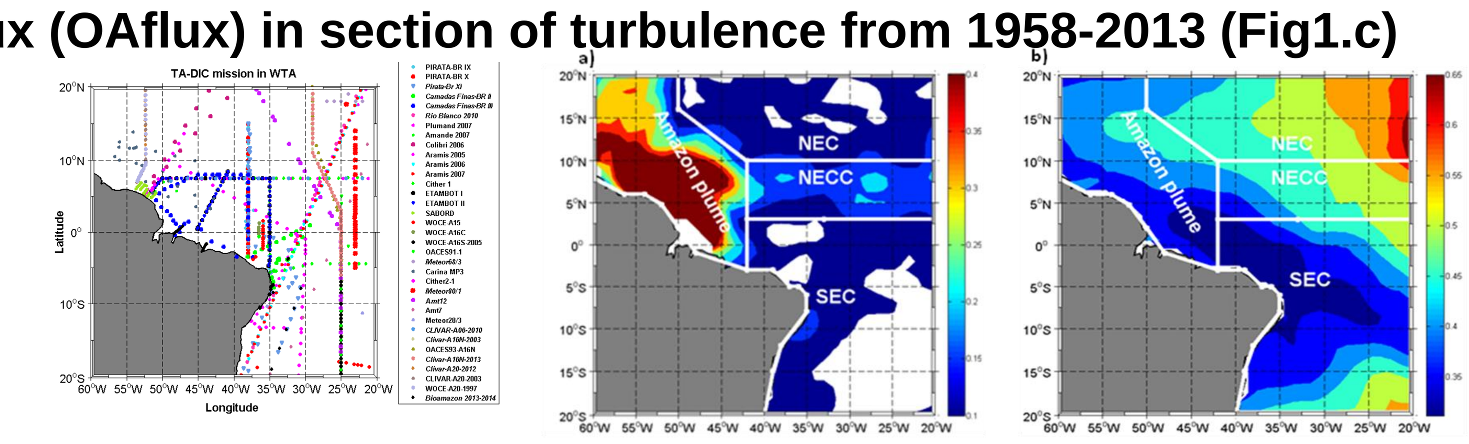

Figure 1:a) Tracks of the different cruises considered in this work, indicating the location of Total Alkalinity (TA) and Total Inorganic Carbon (C_T) measurements b) Standard deviation of western tropical Atlantic WTA monthly SSS anomalies relative to the 1970-2013 period. The white lines separates the different regions of SSS variability, Amazon plume, NECC, NEC and SEC. c) Standard deviation of western tropical Atlantic WTA monthly SST anomalies relative to the 1958-2013 period.

SPATIAL VARIABILITY of TA and C_T

Table. 1 Mean values ±SD of SST, SST, C_T and TA respectively, in the different regions for winter and summer

Region	Season	Nb	SSS	SST(°C)	TA(umolkg^{-1})	C_T(umolkg^{-1})
Amazone Plume	winter	130	34.5±2.3	27.3±0.6	2280±138	1938±119
	Summer	193	31.0±5.8	28.1±0.7	2092±338	1763±279
NECC	winter	85	35.4±0.7	27.6± 1.1	2331±54	1978±45
	Summer	132	35.2±0.8	28.1± 0.8	2328±48	1970±42
NEC	winter	44	36.2± 0.5	25.8± 1.1	2372±34	2028±28
	Summer	131	36.3±0.3	26.2± 0.9	2380±16	2042±23
SEC	winter	174	36.4±0.6	25.7± 1.1	2389± 50	2045±40
	Summer	176	36.6± 0.5	26.3± 0.9	2406± 32	2058 ±22

The regions of Amazon plume, North Equatorial Counter Current(NECC), North Equatorial Current (NEC) and South Equatorial Current (SEC) are locate on Fig 1b,c.
Low TA and C_T are associated to low SSS in the Amazon Plume and are explained by Amazon river.
No signicant influence of SST (Spearman's correlation; ρ<0.7) on C_T or TA is observed in the region of SEC and NEC when SSS is highly correlate to the carbon parameters

SSS controls TA and C_T in the WTA

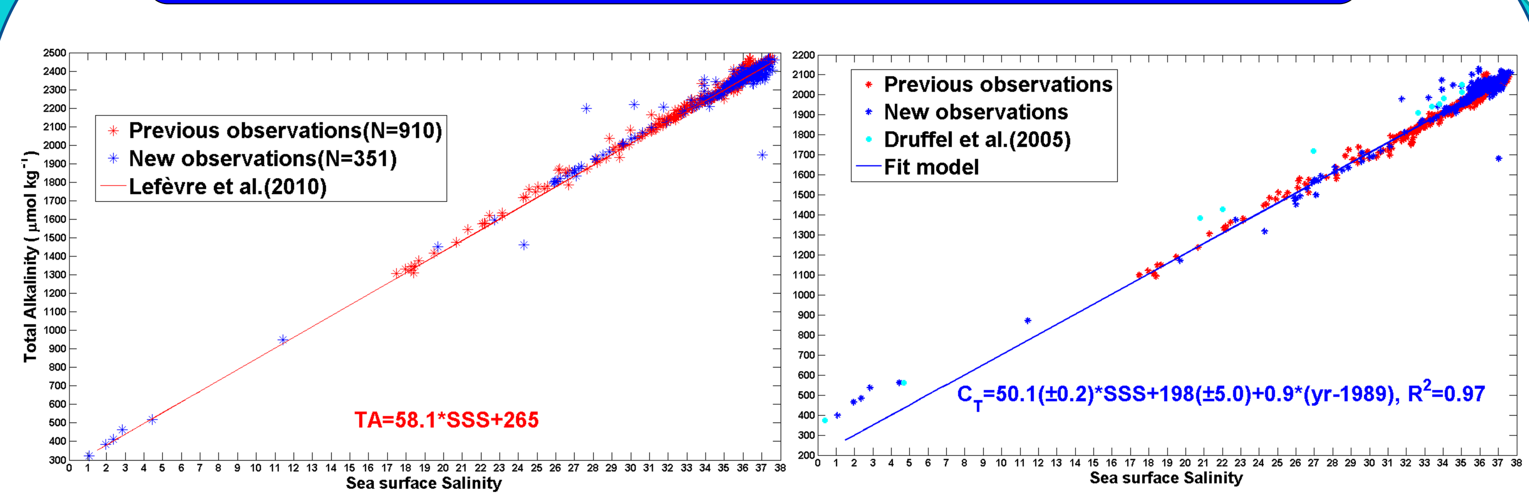

Figure 2:a) TA as a function of SSS, the red line corresponds to the TA-SSS relationship determined by Lefèvre et al.(2010) and the stars to the observations they used. New observations considered in this study are in blue. b) C_T as a function of SSS, the blue line corresponds to the equation of our fit model, the red stars correspond to published observations and the blue stars to new data, the blue stars the new observations and the cyan stars corresponds to the Druffel et al.(2005) data

$TA = 58.1(\pm0.5)\times SSS+265(\pm18.0)$, $R^2= 0.98$ Lefèvre et al.(2010) valid for salinity between 1 and 38 (1989-2014).
We determined 0.9 umol kg^{-1} yr^{-1} as the trend on C_T due to the ocean acidification and climate change. This trend is include in our next relationship.
$C_T=50.1(\pm0.1)\times SSS+198(\pm5.1)+0.9*(year-1989)$, $R^2=0.97$, with $\alpha= 0.95$ for 1161samples Std=±16.7umolkg^{-1} valid for salinity between 1and 38 (1989-2014).

SUMMARY

•Using the available cruises in the WTA, we observed a strong correlation for TA and C_T with SSS.

•No influence of SST on TA and C_T has been observed.

•In the SEC, C_T increases at a rate of 0.9(±0.3) umol kg^{-1} yr^{-1} over the period 2003-2014. This trend is considered valid for all the regions of the WTA.

FUTURE WORKS

•From the climatology of SSS, we can map the distribution of TA and C_T in the WTA.

•From these maps we can calculate pH, pCO_2 and CO_2 flux for the WTA.

•Our results can be used to make the comparison and validation of numerical models.

FACEPE Fundação de Amparo à Ciência e Tecnologia do Estado de Pernambuco
BrOA Brazilian Ocean Acidification Research Group
CNPq Conselho Nacional de Desenvolvimento Científico e Tecnológico
LOFEC Laboratório de Oceanografia Física Estuarina e Costeira