Diving in Western Equatorial Atlantic deep waters

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Introduction

The oceanic and atmospheric circulations are fundamental mechanisms in the Earth's climate regulation. Oceans are essential for the thermic balance in the planet's system; more than 90% of the heat excess of the last 50 years is stored in the ocean. The Atlantic Meridional Overturning Circulation (AMOC), composed in the deep layers by North Atlantic Deep Water (NADW) and Antarctic Bottom Water (AABW), is one of the main climate regulators of the planet, interconnecting and redistributing heat, oxygen and nutrients in the Atlantic Ocean.

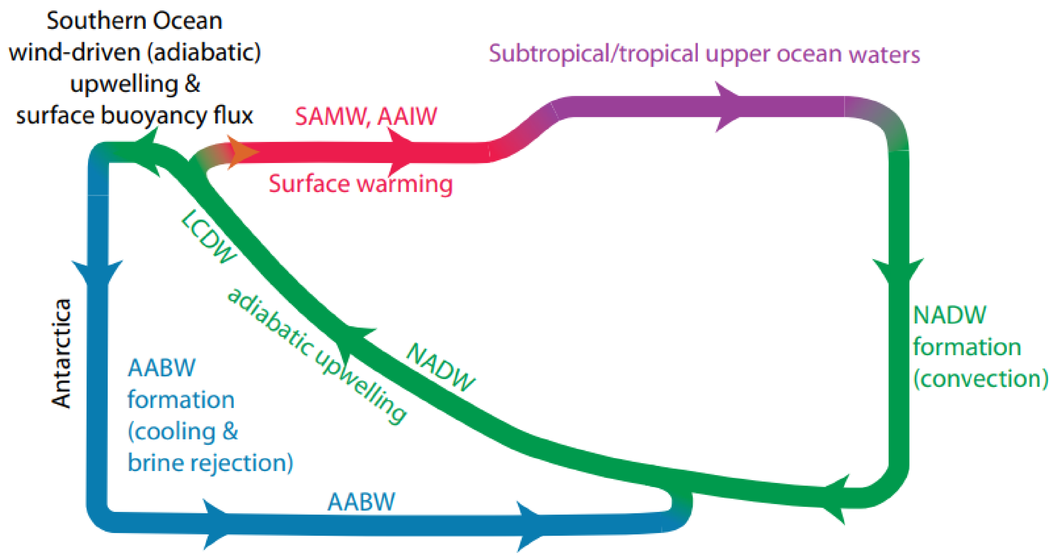

Figure 1: Representation of the Atlantic Meridional Overturning Circulation (AMOC). Source: TALLEY, 2013

Study Area

The study is focused in the Wester Equatorial Atlantic, region which plays a key role in the development of researches about inter-hemispheric exchanges.

The deep water circulation in the region is dominated by the topographic features, mainly the Fracture Zone of Vema, the Fracture Zone of Romanche e Chain and the Equatorial Channel.

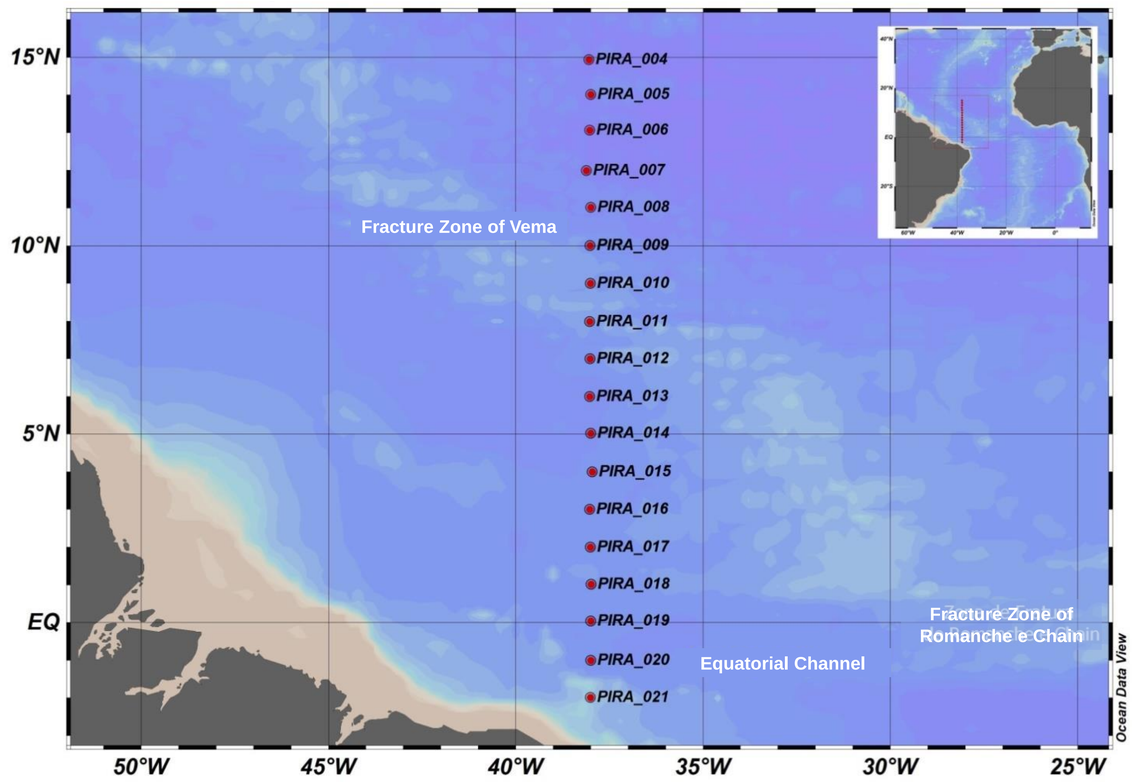

Figure 2: Map of the study area, in red the oceanographic stations and in white the manly topographic features

Methodology

The data was collect during the PIRATA XVII expedition cruise, which occurred between October of 2017 and January of 2018. There were 18 oceanographic stations in a section over 38ºW, from 2ºS until 15ºN. In each station the CTD-Rosette was lowered and oxygen and pH samples was collected. The oxygen was analyzed by the Winkler Method, described by GRASSHOFF *et al.* (1988), and the results were applied to calibrate the oxygen sensor in the CTD. The pH was measured using the pH ProLab 3000 equipment, based on the potentiometric method. The results were compared with the *Global Ocean Data Analysis Project version 2* - GLODAP v2 data collection.

Acknowledgment : PIRATA Project, a FAOC e a all work field team.

Results and Discussion

The results evidenced the presence of two water masses: the North Atlantic Deep Water (NADW) and the Antarctic Bottom Water (AABW). The AABW is restrict to the deepest part of the Equatorial Channel. Although the vertical profile of the dissolved oxygen concentration and pH indicate the spatial differences inside the same water mass. The waters in the south part of the transect presents higher DO and pH indicating local circulation.

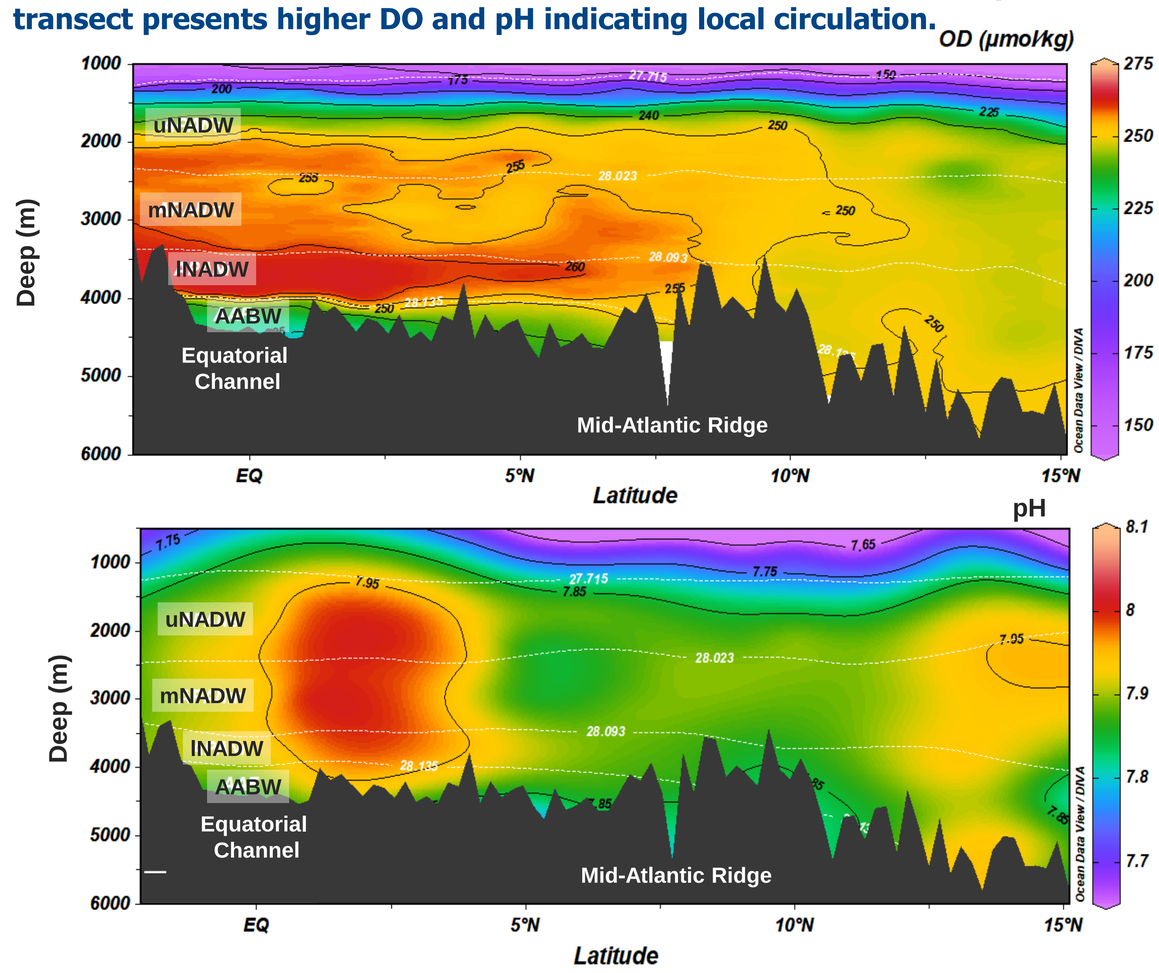

Figure 3: Vertical profile of the transect 38W, on the top the DO concentration, in the bottom pH. The data was interpolation using the DIVA (Data-Interpolating Variational Analysis)

The temporal variation of the PIRATA XVII data and GLODAP v2 indicate heating processes in the minimum temperature of the AABW. Although the identified trend, it is possible that the water masses do not respond to a linear regression.

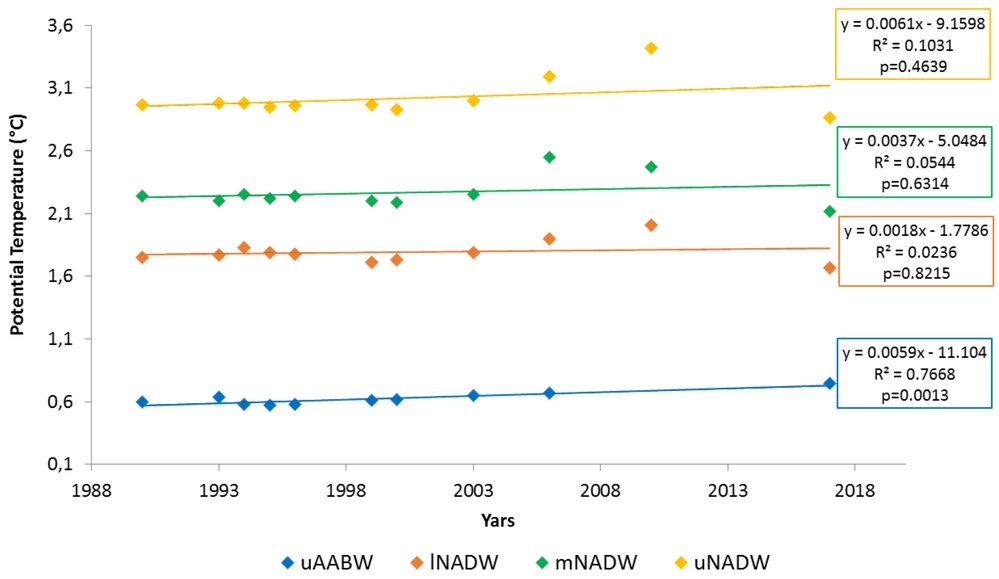

Figure 4: Minimum potential temperature observed in the water masses studies.

Conclusion

The analysis of non-conservative parameters, like pH and dissolved oxygen, indicated the presence of waters from different characteristics and regional circulations processes. Moreover, it was possible to investigate temporal variation comparing the results with oceanographic databases, the total period of 28 years, which point to a warming trend of the AABW at a rate at about 0.7ºCx10-2 per year. The scarcity of oceanographic data remains the biggest challenge, evidencing the demand for more studies in the area. Scientific marine researches developed in the Western Equatorial Atlantic are essential in a scenario of climatic changes, either to answer present questions and to inspire new ones.