***Título* / Title**

*Resposta da porção oeste do Oceano Atlântico às mudanças na circulação meridional do Atlântico: Variabilidade milenar a sazonal* / Response of the western Atlantic Ocean to changes in the Atlantic meridional overturning circulation: From millennial to seasonal variability

Cristiano M. Chiessi et al.

***Metas* / Goals**

The Atlantic meridional overturning circulation (AMOC) plays a fundamental role in the oceanography and climate of the Atlantic realm. Atmosphere-ocean general circulation models have predicted a weakening in AMOC strength for the coming decades. Thus, a comprehensive understanding of the response of the western Atlantic Ocean to changes in AMOC on different time scales is a key issue. Here we propose to:

- Examine changes in the stratification of the upper water column (i.e., mixed layer and permanent thermocline) since Marine Isotope Stage 3 in the western Atlantic Ocean;
    - Reconstruct mixed layer and permanent thermocline oxygen isotopic composition, temperature, and salinity;
- Assess changes in deep water geometry with emphasis on the glacial chemocline (i.e., interface between Glacial North Atlantic Intermediate Water and Lower Circumpolar Deep Water) in the western Atlantic Ocean;
    - Reconstruct the carbon and oxygen isotopic compositions of deep water masses;
- Detect changes in precipitation over South America to the east of the Andes Cordillera since Marine Isotope Stage 3;
    - Reconstruct the terrigenous input of the major South American drainage basins (e.g., Plata, Amazon) to the western Atlantic Ocean;
- Determine the presence/absence of a correlation between changes in the AMOC and the western Atlantic Ocean on millennial to seasonal timescales.

Therefore, we will analyze a suite of 18 carefully selected sediment cores from the tropical and subtropical western Atlantic Ocean. Through this project we expect to significantly contribute to the debate of possible impacts that future changes in AMOC may have over the western Atlantic Ocean, and set up at the University of São Paulo a cutting-edge laboratory specialized on stable oxygen and carbon isotope analyses on very small carbonate samples (i.e., ca. 10 μg).

***Resultados alcançados* / Achieved results**

This project is linked to two funding schemes at FAPESP, namely FAPESP Research Program on Global Climate Change and the Young Investigators in Emerging Institutions. We started our activities on March 2013 and the project is supposed to last until 2017. Within these first seven months, we were able to: (i) sample half of the marine sediment cores that will be investigated; (ii) analyze half of the cores with an X-ray fluorescence scanner; (iii) obtain radiocarbon ages and

preliminary age models for half of the cores; (iv) recruit undergraduate and graduate students to work on the project as well as a post-doctoral researcher; and (v) prepare the laboratorial infrastructure to host the first Isotope Ratio Mass Spectrometer (Thermo Scientific MAT253 coupled to a KielIV) in the State of São Paulo able to determine the stable oxygen and carbon isotope analyses on carbonate samples as small as 10 μg.

While results and publications entirely based on this project are still under development due to the project´s recent kick-start, a significant body of publications that relied to some extent on this project are already available. Below, four examples are listed.

In Prado et al. (2013. Climate of the Past) and Prado et al. (2013. The Holocene) we made a thorough compilation of previously published records of the mid-Holocene climate of eastern South America and compared our results to the late-Holocene scenario as well as to mid-Holocene PMIP3/CMIP5 model outputs. Our data suggest a water deficit scenario in the majority of eastern South America during the mid-Holocene if compared to the late Holocene, with the exception of northeastern Brazil. Low mid-Holocene austral summer insolation caused a reduced land–sea temperature contrast and hence a weakened South American monsoon system circulation. Although the analyzed models showed regional differences, they were able to capture the reconstructed mid-Holocene scenario.

In Bender et al., (2013. Paleoceanography) and Razik et al. (2013. Palaeogeography, Palaeoclimatology, Palaeoecology) we investigated the interaction of tropical and mid-latitudinal circulation in the western South Atlantic during the Holocene and its interaction with continental precipitation over the Plata River drainage basin. We described a northward migration of the Southern Westerly Winds during the early-to-mid-Holocene that significantly affected the surface oceanic circulation in the western South Atlantic, and a strengthening of the El Niño Southern Oscillation (and of precipitation over the Plata River drainage basin) during the late-Holocene.

On top of those publications, some papers have recently been submitted or are under advanced stage of preparation, as exemplified below. While in Chiessi et al. (submitted) we characterized that centennial-scale oscillations on the Brazil Current (BC) strength were associated to changes in the AMOC (i.e., strong BC, weak AMOC), in Strikis et al. (under preparation) we investigate the internal structure of one of the most relevant events of AMOC slowdown of the recent past, namely the Heinrich Stadial 1.

With the installation of the Thermo Scientific MAT253 coupled to a KielIV in the PI´s laboratory scheduled for the end of 2013 / beginning of 2014, we expect even more exciting scientific results to be made available by this project in the near future.

***Equipe* / Team**

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