Observing the Boundary Currents and AMOC at 11°S

The tropical Atlantic plays an important role for climate variability in the whole Atlantic region. Especially, the western basin constitutes a key region for the exchange of water masses, heat and salt between the Southern and Northern Hemispheres. Therefore, it is a good place to monitor water mass signal propagation, changes in the transports of the Western Boundary Currents (WBC) and the Atlantic Meridional Overturing Circulation (AMOC).

The WBC Array off Brazil

- The North Brazil Undercurrent (NBUC) & the Deep Western Boundary Current (DWBC) off Brazil are observed with - 4x tall current meter moorings (2000-2004; 2013-today) - ship-based observations (10 sections) - Mean transports did not change significantly between 2000-2004 and 2013-2017 (Hummels et al., 2015).


Bottom Pressure observations

- From the pressure difference between the eastern and western boundaries basin-wide geographic transport variations above 1000m (T_{BP}) can be derived.
- Adding the local, wind stress forced Ekman transport (T_{EK}) gives AMOC transport variations:

\[ T_{AMOC} = T_{BP} + T_{EK} \]

- In the Tropics, T_{AMOC} as well as all BP & wind-stress time series, are dominated by the annual and semi-annual cycles. Seasonal AMOC variability is in good agreement with the INALT01 model (Hummels et al., in prep.).
- New mooring setup is planned off Angola with BP measurements at 1000m.

Observations off Angola

- The Angola Current (AC) is observed with moored current meter measurements since 2013.
- AC transport is weak & dominated by seasonal variability associated with remotely forced waves (Kopte et al., 2017; 2018).
- Maintenance cruises (M158) now and in spring 2021.

Work in progress/Outlook

- All available hydrographic measurements in the tropical South Atlantic will be combined to extend time series of the WBC system & AMOC and investigate long-term variability.
- In a synthesis phase, the assessed variability of the WBC system & AMOC at 11°S will be related to - variability of the equatorial circulation and its impact on rainfall over Africa based on observations near the equator, specifically at 23°W - AMOC variability in the Subtropics of both hemispheres
- The spreading of water mass anomalies within the AMOC and their long-term changes, which can originate from the South or North Atlantic, will be analyzed.
- The analysis of observations & models will allow for model validation, the identification of key processes of observed circulation & climate variability, and the assessment of model prediction skill.

This research received funding from the EU FP7/2007-2013 under grant agreement (603521) PREFACE project and from the EU-H2020 under grant agreement (863321) PREFACE project. It was further supported by the German federal Ministry of Education and Research (BMBF) in part of the SACOS 9 (SACOS9) BMBF (SACOS9), RACE & NAO 3 (SACOS9) projects. The CTD and shipboard AADP data acquired within the monitoring component of the marine program in cooperation with the Instituto Nacional de Investigación Pesquera (INIMP) in Angola are funded by the Norwegian Agency for Development Cooperation (NORAD). We want also to acknowledge the continuing support from the GEOMAR Helmholtz Centre for Ocean Research Kiel.