Session: C14 Poster: T31A

Sustained observations that contribute to understanding the Meridional Overturning Circulation

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The meridional overturning circulation (MOC) is a global circulation cell wherein surface waters in the high latitudes are cooled, thereby becoming denser; this dense water sinks and flows towards the equatorial regions. In tropical and subtropical regions around the globe these waters eventually mix with other waters, becoming less dense, and they return to the sea surface to ultimately flow towards the higher latitudes and complete the circulation. In the North Atlantic, NOAA contributes to the programs listed below that quantify the transport of the MOC, its heat transport, and key components of the circulation that dominate the MOC variability. The Western Boundary Time Series (WBTS): This project consists of two components to monitor the western boundary currents in the subtropical Atlantic: the Florida Current transport measurements using a submarine telephone cable plus calibration cruises and the Deep Western Boundary Current transport and property measurements using dedicated research ship time and moorings. The Rapid-Watch (United Kingdom) and Meridional Overturning Circulation and Heat Transport Array (National Science Foundation) projects, along with WBTS, have deployed a system that will continuously observe the meridional mass and heat transport in the subtropical Atlantic. This system will document the variability of the subtropical Atlantic and its relationship to observed climate fluctuations. Thus, it will help improve and validate model-based decadal climate predictions. While the North Atlantic is the sole provider of North Atlantic Deep Water (NADW) to the global ocean, the South Atlantic is also the sole recipient for upper and bottom waters flowing into the North Atlantic to balance the NADW export. Export of NADW to other ocean basins is compensated for by net northward flow through the South Atlantic and across the equator of surface, intermediate and bottom water layers. Modifications of the water masses participating in the return flow within the South Atlantic can potentially lead to alterations of the thermohaline circulation and the associated meridional heat and freshwater fluxes. In the South Atlantic AOML contributes to understanding the MOC with: Starting in 2009, the pilot array implemented in the Southwest Atlantic that captures key components of the MOC in a hitherto under-sampled region. The initial array deployed involves a zonal line of three pressure-equipped inverted echo sounders (PIES) and one current-and-pressure-equipped inverted echo sounder (CPIES) deployed near the western boundary at 34.5oS. Data from these instruments will be used to monitor the Brazil Current and the Deep Western Boundary Current as they carry components of the MOC along the western boundary of the basin. In addition, XBT transects provide estimates of the flow across the North and South Atlantic and, hence, estimates of heat transport and MOC. Quarterly reports assessing the state of the Atlantic oceanic heat transport are derived using data collected from AX07 and AX18, two zonal high density XBT transects in the North and South Atlantic, respectively, as part of the NOAA/OCO Global Observing System for the North and South Atlantic. This presentation shows recent scientific advances on MOC studies done using the above mentioned components of the ocean observing system.