MOVE

(Meridional Overturning Variability Experiment)

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Project Summary

The meridional overturning circulation (MOC) in the Atlantic Ocean is one of the major oceanic climate drivers of the globe since it is the mechanism for most of the large heat transport carried by the Atlantic Ocean, with demonstrated impacts and control on northern hemisphere and global climate. Variations in this circulation and the associated heat transport, both due to natural or anthropogenic effects, are of utmost importance but have been impossible to observe directly to date. MOVE is the first program which tackled this problem, starting in the year 2000, by installing and sustaining an observing system for the lower branch (deep, cold return flow) of the overturning circulation in the Atlantic.

MOVE operates the circulation monitoring array in the subtropical west Atlantic along 16N, with the objective to observe the transport fluctuations in the North Atlantic Deep Water layer. Two "geostrophic end-point moorings" and bottom pressure sensors, plus one traditional current meter mooring on the slope have been used to cover the section between the Lesser Antilles (Guadeloupe) and the Midatlantic Ridge. The geostrophic transport fluctuations through this section are determined using dynamic height and bottom pressure differences between the moorings. It has been shown that on long timescales this is a good approximation to the total southward (and by mass balance also northward) MOC transport.

To date, the array has been collecting 13 years of temperature/salinity data (for relative geostrophic transports), 13 years of current meter data (for boundary slope transports), and 11 years of bottom pressure data (for barotropic transports, a data gap exists from 2005-2007). Due to the built-in redundancy, transports are available now for the complete period observed by instruments recovered in December 2010 (nearly 11 years), while the next two years of data are expected after mooring recovery in May 2013. Interannual and long-term changes in the circulation and its vertical distribution are starting to be visible. Joint analyses with other arrays like RAPID and also with modeling teams are under way, in order to assess the basin-scale significance of the data and understand differences.

The MOVE array also contributes to closing one of the gaps in the sustained ocean climate observing system which was identified by the global community at OceanObs09: techniques and programs for monitoring the circulation and mass/heat/freshwater transports of major current systems. For broad-scale and deep-reaching circulations, the MOVE approach of fixed-point horizontally integrating installations is promising. MOVE is one of the first sustained sites which are aimed at filling this gap in the global ocean observing system.

The supported activities include operation of three moorings and several bottom pressure sensors along 16N and processing of the data. This includes construction of moorings, execution of cruises, servicing and calibration of sensors with extreme accuracy, upgrading of technology, and participation in the OceanSITES effort.

The anticipated products and outcomes include:

- long records of the deep transports in the southward branch of the Atlantic thermohaline circulation (AMOC) at this latitude
- data sets to validate and constrain circulation and climate models
- integration of the data at this latitude with Atlantic-wide observing efforts via US-AMOC and international collaborations.

The users/applications include climate modelers and forecasters, climate impact studies, IPCC assessments, and the observational and modeling and data assimilation research community.