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# Variability from 1992 to 2009 of the thermal structures in the tropical Atlantic using inversion methodology

Yves Tanguy (1) and Sabine Arnault (2)

(1) Université Pierre et Marie Curie, LOCEAN, France (ytlod@locean-ipsl.upmc.fr), (2) Université Pierre et Marie Curie, LOCEAN, France (sa@locean-ipsl.upmc.fr)

This study is part of the ARAMIS project (Altimetrie sur un Rail Atlantique : Altimétrie et Mesure In-Situ), which surveys the thermohaline structures and their variabilites in the tropical and subtropical Atlantic, along the WOCE AX11 merchant ship route from Le Havre - France to Santos – Brazil from July 2002 to October 2008.
The inversion method uses topologic map built with combination of T profiles, latitude, satellite ADT (Absolute Dynamic Topography) and satellite SST (Sea Surface Temperature). It allows to reconstruct the T profiles over 650 m with reasonable rms of 0.8°C on T, but good precision of 230°C.m on integrated temperature and 12 m on 20 °C isotherm depth in the equatorial region.
The heat content (TC) is defined as the integrated temperature and computed between October 1992 and October 2009. We check that the seasonal cycle of these T structures is well represented in accordance with previous studies in the Atlantic.
We focus on the region between 5°S and 35°N. The interannual variability shows 3 main periods: (1) before 2000 the TC anomaly is cold, (2) between 2000 and 2003 we have an intensification of the seasonal cycle around a null average value and (3) after 2003 a heating period marked by a strong warm event in 2005 in the equatorial region. These different periods are more evident in the equatorial region (5°S-10°N) than in the north region (17°N-35°N).
A wavelet analysis shows that these two regions have their own evolution. In particular after 2001, energy in the low frequency bands increases for the equatorial domain and decreases in the northern part.
The link between the TC variations and thermocline depth (defined as the 20°C isotherm) in the equatorial region confirms that the main part of TC variability is directly linked to the mixed layer thickness with an anti correlation of 0.87. In the northern region where the equatorial 2-layers structure is no more dominant, the link still remains but other mechanisms may contribute.
Investigations on the wind influence on thermocline depth show wind stress curl from ERA-interim reanalysis in excellent correlation after 2001.
From these results, discussion on the different characteristics of the low frequency variability of the tropical Atlantic, such as the equatorial or the inter-hemispheric modes, can be developed.