2012 Project Summary

Assessing Meridional Transports in the North Atlantic Ocean

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The goal of this study is to explain observed decadal anomalies of heat and freshwater in terms of the mechanisms that move water properties poleward. Analyses of high-resolution ocean models and altimetry and related observations focus on property transport anomalies and on the forcing mechanisms responsible for those anomalies.

Recent Results

(1) In an analysis of the contributions to North Atlantic sea level variability, graduate student Jinting Zhang found that surface heating makes a substantial nonseasonal contribution and that the baroclinic Sverdrup balance accounts for much of the intergyre variability. Zhang received her M.S. degree in September 2011 and will continue to work towards Ph.D. She is currently working on a manuscript (Jiang et al, 2012 to be submitted to J. Geophys. Res.)

(2) An analysis of the Atlantic heat budget using thermosteric sea level and a simple Kalman filter reveals a high degree of meridional heat transport (MHT) coherence, from 30$_o$S to 40$_o$N. The analysis also shows the recent drop in MHT and two previous periods of low MHT, which are all associated with decreased heat loss in the subtropical gyre. (Kelly et al 2012, to be submitted to J. Climate).

(3) An analysis of the heat budget in the Gulf Stream and the North Atlantic Current using four different modeling systems shows that upper ocean heat transport convergence drives the heat budget in both regions with surface heat flux a much smaller contributor on interannual time scales, confirming earlier results by Kelly and Dong (2004). In addition, an analysis of a high resolution prognostic model shows that heat transport convergence variations result from changes in current structure and strength at the boundaries of the region rather than changes in temperature. A manuscript is in preparation on this topic (Thompson et al, 2012, to be submitted J. Geophys. Res.)

(4) Kelly and Dong (2004) also showed that the upper ocean heat content leads the flux of heat to the atmosphere by 3 months on interannual time scales. This relationship was confirmed in a high-°©-resolution model. By examining each month of the year separately, we showed that the coupling between the ocean and atmosphere happens two times of the year, in late fall when the mixed layer nears its maximum depth, and in early summer, when the atmospheric boundary layer north of the Gulf stream is stable. A manuscript is in preparation (Thompson et al, 2012, to be submitted to Geophys. Res. Let.).

(5) An analysis of SST variability in the Kuroshio Extension in a coupled climate model and comparisons with satellite observations of SST and SSH appeared in Journal of Climate (Thompson and Kwon, 2010).

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