2012 Project Summary

Pathways of Meridional Circulation in the Ocean Climate System

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Our goal is to understand the variability of the upper limb of the AMOC such as the recent intense warming and salinization of the subpolar North Atlantic after year 2000. This subpolar warming coincides with a warm phase of the Atlantic Multidecadal Variability (AMV).

Recent Results

(1) In SODA assimilation data we identified three periods (1960s, 1980 and 2000s) with enhanced warm, saline Gulf Stream waters reaching high latitudes. Atmospheric forcing of these warm events was analyzed by focusing on the wind stress curl. The second mode, the gyre mode, which represents amplitude fluctuations of the climatological wind stress curl pattern, was found to be important for the northward penetration of warm subtropical waters acting through weakening gyre circulation.

(2) We extended the analysis of the wind stress curl variability using a 20th century reanalysis (Compo et al. 2011) to develop linkages to the AMV. Our findings can be summarized as follows: the gyre mode represents strengthening and weakening of blocking activity in the northern North Atlantic and the associated storm track changes; decades of enhanced blocking activity are associated with a warm phase of AMV; a warm phase of AMV has contribution from the gyre circulation (as discussed in Häkkinen et al 2011) but also from the heat flux anomaly associated with blocking, which supports net heating of the North Atlantic from the subpolar waters to the Tropics (with a narrow cooling anomaly in the subtropics). Wind stress curl gyre mode and blocking variability appear more fundamental than North Atlantic Oscillation index in describing the Atlantic Ocean variability.

Bibliography


