

## ABSTRACT – Hakkinen & Rhines

The evolution of 20 years of altimetric sea surface height (SSH) is investigated to understand its association with decadal to multidecadal variability of the North Atlantic heat content. The altimetric SSH is dominated by an increase of about 14cm in the Labrador and Irminger Seas from 1993 to 2011, while the opposite has occurred over the Gulf Stream region over the same time period. This same evolution is expressed by the first empirical orthogonal function (EOF) of the altimetric SSH. During the altimeter period the observed 0-700 meter ocean heat content (OHC) in the subpolar gyre mirrors the increased SSH by its dominating positive trend. Over a longer period, 1955-2011, fluctuations in the subpolar OHC reflect Atlantic Multidecadal Variability (AMV) and can be attributed to advection driven by the wind stress 'gyre mode' bringing more subtropical waters into the subpolar gyre. The extended subpolar warming evident in SSH and OHC during the altimeter period represents transition of the AMV from cold to warm phase. In addition to the dominant trend, the SSH EOF time series shows an abrupt change in 2010, occurring over much of the North Atlantic. The abrupt change coincides with the change in the Meridional Overturning Circulation (MOC) at 26.5N as observed by the RAPID project, and with extreme behavior of the wind-stress gyre mode and of atmospheric blocking.