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Strong connections between altimetric sea-surface elevation and heat-content in the upper 700m of the N. Atlantic are found in decadal to multidecadal variability. Altimetric SSH continues to be dominated by an increase of about 14 cm 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. During the altimeter period the observed 0–700 m ocean heat content (OHC) in the subpolar gyre mirrors the increased SSH by its dominantly positive trend. Over a longer period, 1955–2011, fluctuations in the subpolar OHC reflect Atlantic multidecadal variability (AMV) which can be attributed to advection driven by the wind stress ‘‘gyre mode’’ bringing more subtropical waters into the subpolar gyre. The anomalous heat content in the recent 5 years wraps in a warm arc around the subpolar gyre, while accompanied by slowing surface cyclonic circulation. The warmth extends more than 800m below the surface, in both lobes of the warm arc.

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, interannual anomalies propagate westward and are expressed strongly in the Gulf Stream recirculation and North Atlantic Current region. The first empirical orthogonal function SSH time series shows an abrupt change 2009–2010 reaching a new minimum circulation in 2010 which continues to persist. This coincides with the change in the meridional overturning circulation at 26.5N as observed by the RAPID project, showing it to be a basin-wide event, and with extreme behavior of the wind stress gyre mode and of atmospheric blocking. While the general relationship between northern warming, Atlantic meridional overturning circulation (AMOC) and atmospheric storm track variability remains undetermined, there are increasing signs of correlation among them, with model results suggesting upward influence of OHC anomalies on the atmospheric storm track.
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