

## Warming of subsurface waters of the subtropical North Atlantic Ocean

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Warming of the North Atlantic Ocean is investigated using SODA ocean reanalysis and observed ocean heat content (OHC) data for 1955-2011. The observed OHC and reanalysis subsurface temperature are dominated by two modes accounting about 50-60% of all variability. The dominant mode is a trend, with a strong positive center over the Gulf Stream-North Atlantic Current (GS-NAC) region, and a weaker negative signal in the subpolar gyre. The second mode of variability is associated with the Atlantic Multi-decadal Variability (AMV), exhibiting a negative center over the GS-NAC, and strong positive anomalies over the subpolar gyre and in the eastern basin extending to the tropics. These modes can be found also at deeper density levels, but their spatial appearance is quite different. By dividing the upper ocean into density layers between the surface and permanent thermocline we find that the subducting subtropical mode waters ( $\sigma_{\theta} = 26.0$  to  $27.0$ ) have gained the most heat over the 57 years, with an abrupt downturn after 2008. A significant portion of this heat gain has come from northward migration of the density surfaces. We will also discuss the OHC variability due to heaving and water mass change.