Connection between salinity decadal variations in the supolar North Atlantic and tropical Atlantic AMOC

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The importance of Labrador Sea deep convection and water mass anomalies on decadal variations of the Atlantic Meridional Overturning Circulation (AMOC) has been demonstrated in various theoretical and modeling studies. The observational evidence for such a link has been lacking, however, due to the lack of long term AMOC transport time series. In Zhang et al. (2011), we reported that the North Brazil Current (NBC) transport in the western boundary of tropical South Atlantic can be used as a "finger print" of AMOC variation, since most of the AMOC return flow is contained in the western boundary region in that particular latitudinal band. That result shows a quick response of the tropical Atlantic AMOC to the Labrador Sea deep convection. Here we will show that the tropical Atlantic AMOC, indicated by 5 decades of hydrographic data in the NBC, is highly correlated with the observed decadal temperature/salinity (T/S) anomalies of the upper ocean in areas from the western subtropical Atlantic to subpolar regions with progressively longer lead times to higher latitudes, suggesting that subsurface ocean responses to AMOC transport variations at 6°S are associated with slow oceanic transport processes. This result shows that at least part of the recently observed salinification in the subpolar North Atlantic is from the lower latitudes in addition to processes involving subpolar dynamics suggested by other studies. Further analyses reveal that these decadal water mass anomalies in the tropical/subtropical North Atlantic result from the interaction of tropical AMOC and northern Subtropical Cell. Diagnostics of both observation and forced ocean and coupled model simulations will be presented. Implication of this salinity transport from lower latitudes on mechanism and time scale of the AMOC decadal variability will be discussed.