Geophysical Research Abstracts,
Vol. 11, EGU2009-13194, 2009
EGU General Assembly 2009

The impact of gyre dynamics on the mid-depth salinity signature of the eastern North Atlantic

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The Mediterranean Overflow Water (MOW) is widely recognized for its role in establishing the mid-depth salinity signature of the subtropical North Atlantic. However, recent work has revealed an intermittent impact of MOW on the salinity signature of the eastern subpolar basin. This impact results from a temporally variable penetration of the northward flowing branch of the MOW past Porcupine Bank into the eastern subpolar basin. It has been shown that the salinity signature of the eastern subpolar basin, in particular the Rockall Trough, varies with the state of the North Atlantic Oscillation (NAO): during persistent periods of strong winds (high NAO index), when the subpolar front moves eastward, waters in the subpolar gyre block the northward flowing MOW, preventing its entry into the subpolar gyre. Conversely, during persistent periods of weak winds (low NAO index), the front moves westward, allowing MOW to penetrate north of Porcupine Bank and into the subpolar gyre. Here, we investigate the manner in which the spatial and temporal variability in the northward penetration of the MOW and the position of the eastern limb of the subpolar front affect the mid-depth property fields not only in the subpolar gyre, but in the subtropical gyre as well. Using approximately 55 years of historical hydrographic data and output from the 1/12º FLAME model, we analyze the temporal variability of salinity along the eastern boundary and compare this variability to the position of the subpolar front in both the observational record and the FLAME model. We conclude that when the zonal position of the subpolar front moves relatively far offshore and the MOW is able to penetrate to the north, high salinity anomalies are observed at high latitudes and low salinity anomalies are observed at low latitudes. Conversely, when the frontal position shifts to the east, the MOW (and thus, the high salinity signature) is blocked, resulting in a drop in salinity anomalies at high latitudes, and a corresponding increase at low latitudes.