On the Potential Vorticity Dynamics of Eighteen Degree Water

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Mode waters are a distinctive baroclinic feature of the world ocean characterized by relatively weak vertical stratification. They correspond dynamically to low potential vorticity (PV). In the North Atlantic subtropical gyre, the mode waters have become known as Eighteen Degree Water. Their dynamics involves air--sea interaction, diapycnal and isopycnal mixing and subduction. Understanding mode water dynamics is therefore both challenging and important since it connects several aspects of the ocean circulation. Mass and PV budget of the mode water’s core, evaluated in a realistic primitive equation North Atlantic model, are used to characterize mode water maintenance. It is shown that the surface PV flux has very little impact on mode water; the surface buoyancy fluxes in combination with eddy mass flux are the most important controls on mode water structure. A mean PV formalism is used to show that the PV and water mass formation budgets are intrinsically linked. A decomposition of the budget demonstrates the role of the mean PV field in permitting the eddy mass flux to discharge the net formation to the surrounding fluid.