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Thermobaric cabbeling over Maud Rise

Ramsey R. Harcourt
Applied Physics Laboratory, University of Washington, USA

A Large Eddy Simulation (LES) of the wintertime upper ocean below seasonal Antarctic ice cover over Maud Rise (Harcourt, *in press*) demonstrates an instability of the deep water column that can drive free convection within the ocean interior, forming a thick, homogeneous mixed layer without direct surface contact. As surface mixed layer salinity increases due to ice formation, a local cabbeling instability develops in the lower thermocline, due to the nonlinear dependence of density on temperature. Fluid from within this density inversion detrains cold thermocline fluid in plumes that subsequently grow more negatively buoyant with depth due to themorbaricity, the nonlinearity of density in the product of temperature and pressure. Interior deep convection driven by this thermobaric cabbeling instability produces an interior mixed layer hundreds of meters thick, wherein surface water contributes only a small fraction to homogenized fluid properties. Further LES results demonstrate this mechanism may account for the formation of open ocean polynyas in the seamount vicinity, as well as for deep, thick, double-diffusive steps observed downstream from Maud Rise. Similarities with observations of isolated plumes and localized chimney structures associated with deep convection in the Greenland Sea are considered.

Harcourt, R. R. (2005) Thermobaric cabbeling over Maud Rise: Theory and Large Eddy Simulation. *Progress in Oceanography, in press*.