Abstract View

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Wintertime Convection in a Gulf stream Warm Core Ring

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ABSTRACT

Wintertime convection creates deep mixed layers which determine the water mass characteristics and potential vorticity for waters in the main pycnocline of the world ocean. Diabatic cooling is most intense in the Northern Hemisphere near the northwestern boundary of subtropical gyres where outbreaks of cold, dry continental air over warm surfaces waters produce large sensible and latent heat losses from the ocean. Gulf Stream warm-core rings containing warm salty Sargasso Sea Water are cast off to the north of the Gulf Stream in close proximity to the northeastern coast of North America. We have observed the convective cooling of one these rings, 821, during January 1982 from the USNS *Bartlett*. During one cold air outbreak, we calculate a net surface hear loss from the ring to the atmosphere of 800 W m^{-2} and a deepening of the surface mixed layer form 50 to 190 m. The heat budget for the ring required a lateral heat exchange with the surrounding Slope Water, in order to achieve a balanced heat budget. This lateral transfer, most likely limited to the upper 50 m of the ring, can be expressed as a sub-ring scale diffusivity with values in the range of 200–500 m^2 s^{-1}. In addition, the permanent thermocline in the ring center was observed to deepen at a rate of 1 m day^{-1}, thus increasing the deep horizontal temperature contrast between the anticyclonic ring and its surroundings.