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Winter Circulation in the Western Gulf of Maine: Part 1. Cooling and Water Mass Formation

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ABSTRACT

The mean circulation on the northeast continental shelf in the region of the Gulf of Mexico is discussed in terms of a simple box model, based on volume transports and mean salinities estimated from existing data. The results of this calculation indicate that warm salty water from the continental slope must mix with colder, fresher water at intermediate depths within the Gulf. Field measurements obtained as part of a study of the winter circulation in an offshore region in the western Gulf of Maine suggest that winter storms may be responsible for most of this vertical mixing. Ten 1-day hydrographic cruises were conducted between the passage of seasonal storms from November 1974 to January 1975. A description of the early winter evolution of the density field was thus obtained concurrently with moored measurements of current, temperature and bottom pressure, and coastal measurements of sea level and atmospheric variables. The principal vertical mixing process observed during this period was an intermittent overturning of the near-surface water caused by surface cooling by offshore winds. The observed vertical homogeneity suggests that the fresher near-surface Gulf of Maine water and the more saline deep basin water are frequently mixed during the early winter in the western region to produce Gulf of Maine Intermediate Water.

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