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Estimation of Meridional Heat Flux in the North Atlantic by Inverse Methods

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ABSTRACT

Hydrographic sections spanning the Atlantic Ocean at 24, 36 and 48°N are used to make an estimate of meridional heat flux in the ocean. An inverse method provides reference level velocities for geostrophic calculations, consistent with assumptions of conservation of mass and salt in a multilayered ocean. The heat-flux calculation is made on the total geostrophic velocity together with observed temperature.

It is found that the dominant mechanism for heat transport in the North Atlantic is a meridional cell of northward flowing surface water balanced by deep southward flow. The strength of the meridional cell is determined best by the data at 24°N. This is attributed to higher information content and lower noise, from topographic roughness, in the southern transect. An ageostrophic correction to the heat flux is estimated, and the resulting total northward heat flux is 120×10^{13} W at 24°N and about 80×10^{13} W at 36°N. The heat flux was poorly determined at 48°N. It is concluded that the technique could be used to combine hydrographic data with other relevant measurements, such as air-sea heat exchange, to construct a heat budget for the world oceans.

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