Abstract View

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Solutions of the Ideal Fluid Thermocline with Continuous Stratification

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ABSTRACT

From an examination of possible ways to satisfy the essential upper boundary conditions, a general way to solve the ideal fluid thermocline is proposed. Through specifying the functional relation between the potential vorticity, the density, the Bernoulli functional [$f\rho_z = F(\rho, B)$], and the sea surface pressure on the western/eastern walls, the problem is reduced to one of repeatedly integrating two first-order ordinary differential equations.

The present model is essentially a diagnostic model. With appropriate choice of F, this model produces three-dimensional thermocline and current structures in a continuously stratified wind-driven ocean that are quite realistic. It also emphasizes the importance of diffusion and upwelling/downwelling in the western/eastern boundary currents and diffusion in the abyssal ocean. The model confirms the conjecture that to solve the ideal fluid thermocline problem, information is needed wherever fluid moves into (or out of) the domain.

The calculated results are very similar to the observed thermocline and current structures in subtropical/subpolar basins.