Abstract View

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Some Eulerian-Scale Analysis Results: Eddy Terms in the Mean Heat, Momentum and Vorticity Equations

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ABSTRACT

The question of the importance of mesoscale motions in the long time averaged ocean circulation is examined from the viewpoint offered by Eulerian scale estimates of the magnitudes of the explicit eddy and largest inviscid mean flow terms in the mean heat, momentum and vorticity equations. Comparisons of these estimates reveal the quantities that must be known to obtain reliable estimates of the importance of eddy terms in the mean balances. Using historical information and long time series of data from the western North Atlantic, two distinct regimes ("near field" and "mid-ocean") are identified for this ocean region and the appropriate term comparisons are made for each regime. From estimates of the reliability of the ocean values used in these comparisons the robustness of the comparisons is examined. The momentum and vorticity equation estimates suggest that terms based on the eddy Reynolds stress can generally be neglected compared to terms involving f_0 and β in both the near field of the Gulf Stream and the mid-ocean. In the near field, mean advective terms appear to be at least as important as the eddy terms, but the eddy terms dominate these advective ones in the mid-ocean. The heat equation comparisons suggest that the eddy term is comparable to the mean horizontal advection of heat in the mid-ocean but is of somewhat reduced importance in the near field. Some remarks on the generality of results from numerical ocean models that contain mesoscale motions to the question of eddy importance in the ocean are offered.