The Role of Western Boundaries in Wind Driven Energetics

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The dynamics of the wind-driven circulation are examined in a combined theoretical and numerical study. A multiple scales analysis is used in an attempt to combine ventilated thermocline dynamics with mesoscale dynamics. In keeping with classical results, we find the mesoscale field is strongly affected by the ventilated thermocline, but in the interior, no feed back from the eddies to the large scale is found. We then conduct an analysis of the western boundary region, and argue western boundary jets fall into two categories. Those neighboring coasts are largely inviscid in character and marked by transfers to kinetic energy from mean potential energy. The open ocean extensions of these jets, often call 'separated jets', are the primary locations where the mesoscale is energized by the mean field. This leading order feedback between the large scale and mesoscale fields is consistent with theoretical approaches which emphasize anisotropy in the mesoscale. Wind forcing, although essential for establishing the interior recirculation is a rather weak energy source, with the general circulation otherwise characterized as recirculating energy. The predictions of the theory, with particular emphasis on energetics, are examined in a 1/12 degree numerical model of the North Atlantic.