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Mesoscale- and submesoscale-resolving simulations with an anisotropic Smagorinsky subgrid model SANJIV RAMACHANDRAN, AMIT TANDON, University of Massachusetts Dartmouth, AMALA MAHADEVAN, Woods Hole Oceanographic Institution — The oceanic submesoscales are motions of scale O(100m-1km) that lie between the large, O(100km), mesoscales and the smaller, O(10m), three dimensional eddies. Past studies showed submesoscales are critical to the evolution of fronts in the ocean and to the ecological cycle. This study discusses results from submesoscale-resolving simulations with a nonhydrostatic ocean model employing an anisotropic Smagorinsky subgrid model. Our simulated domain is O(100km) in the horizontal and O(100m) in the vertical with highly anisotropic grid resolutions, O(500-1000m) and O(10m), respectively. The domain resolves both mesoscale and submesoscale eddies. Past studies with similar domains have achieved horizontal subgrid mixing either through constant eddy-viscosities or implicitly through the underlying numerical algorithm. We present results from simulations with and without surface winds. Intense submesoscale activity occurs near the fronts and is associated with O(1) Rossby numbers. With winds, the subgrid dissipation of resolved kinetic energy is strongest in regions with negative potential vorticity and the vertical buoyancy flux is enhanced in the presence of baroclinicity below the mixed layer. Without winds, the subgrid dissi pation and vertical velocity are smaller than in the wind-driven case.

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