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Mesoscale eddies and vertical mixing in the ocean¹

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Mesoscale eddies are fundamental players in the vertical transport and mixing in the ocean. Here we investigate the vertical velocities associated with coherent vortices using a high-resolution primitive-equation model in an idealized configuration and in a simulation of the Gulf of Mexico. In the vortex cores and inside intense vorticity filaments, the motion is strongly ageostrophic, and vertical velocities associated with vortices can reach unexpected magnitudes and levels of spatial complexity. Mesoscale anticyclones appear as “islands” of increased penetration of wind energy into the ocean interior. The wind energy injected at the surface is transferred at depth through the generation and subsequent straining effect of Vortex Rossby Waves (VRWs), and through near-inertial internal oscillations trapped inside anticyclonic eddies.

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