

Interactions of Planar Waves with a Baroclinic Vortex

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We investigate the interaction of inertia-gravity waves on the dynamics of a baroclinic vortex in a rotating stratified fluid using WKB theory – adapted to cylindrical coordinates – in combination with experimental observations. The vortex is either lenticular or elongated in shape and interacts with a planar wave-field emitted by an oscillating cylinder. The trapping of the wave energy is characterized as a function of the vortex aspect-ratio, H/R , the wave-Froude-number, Fr_w , based on the wavelength and the maximum azimuthal velocity of the vortex and wave frequency. With increasing Fr_w the trap-region focuses, implying energy amplification, leading to wave-breaking or damping by viscous effects. In the latter case, the maximum amplification of wave energy is a function of Fr_w and Reynolds number based on the vortex shear. The results show that waves break in the periphery of mainly tall vortices, resulting in a deposit of momentum, which modifies the vortex velocity profile.

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