Geophysical Research Abstracts
Vol. 18, EGU2016-282, 2016
EGU General Assembly 2016

What controls the mass transport by mode-2 internal solitary-like waves?

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Horizontally propagating internal waves are a regular occurrence in the coastal ocean. Their most commonly observed vertical structure is mode-1 in which isopycnals rise and fall in concert at all depths. Second mode waves, where isopycnals expand from and contract toward the pycnocline centre, have been found in recent observations to occur more frequently than previously thought. For the more common convex configuration, these waves mix the pycnocline, and under certain conditions form recirculating cores which efficiently transport material. In the laboratory, mode-2 waves are easily formed by releasing a mixed region into an ambient stratification. Using high resolution, three dimensional, direct numerical simulations of a laboratory configuration we describe the mass transport efficiency of mode-2 waves under a variety of different parameter regimes and initializations. We identify pycnocline configurations for which transport is especially efficient, and explore the structure of recirculating cores during their formation, propagation and disintegration and its implications on mass transport.