EGU22-10852
https://doi.org/10.5194/egusphere-egu22-10852
EGU General Assembly 2022

Internal Tide Scattering by an Isolated Cyclogeostrophic Vortex

Jeffrey Uncu and Nicolas Grisouard
University of Toronto, Physics, Toronto, Canada (jeffrey.uncu@mail.utoronto.ca)

Internal tides (ITs) are internal waves which oscillate at the tidal frequencies. ITs may cross entire ocean basins and along the way, they may be redirected, break, and dissipate. The latter is due to changes in stratification, bottom turbulence, wave-wave interactions, and of interest in this study, the scattering of ITs by balanced flow. Mesoscale wave-vortex interactions are characterized by low Rossby numbers. With the aid of satellite altimetry, the effects of mesoscale eddies on ITs has been used successfully to map low mode IT propagation. In the submesoscale, these interactions become more complex, due to strong non-linearities, a partial breakdown of geostrophic balance, and intermediate scales for both balanced flows and ITs, which are hard to observe with current methods. However, the next generation of satellite altimetry, the Surface Water and Ocean Topography mission, will have fine enough resolution to begin to capture the submesoscale, which makes it an exciting time to explore wave-vortex interactions in this regime. We use the one-layer shallow water model to run idealized numerical simulations of a single wave mode propagating through a (cyclo)geostrophic vortex. By varying the Rossby number, which controls the strength of the vortex, and varying the relative scale of the vortex size to IT wavelength, we observe the IT energy redistribution at the lee side of a submesoscale vortex. We find that high Rossby numbers and relatively small waves will induce sharper deflections in wave propagation, which we quantify with energy flux calculations. By applying complex demodulation, we can filter the incoming plane wave to reveal the characteristic pattern of an isolated vortex scatter, which consists of three beams, two slightly skewed beams from the edge of the vortex, and one strongly skewed beam from the middle.