Experimental and Weakly Non-linear Investigation into the Long-term Spatial and Temporal Development of Triadic Resonance Instability

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With an aim of understanding the role of internal waves to oceanic mixing, various mechanisms have been cited as a possible explanation for how they transfer energy across the wavenumber and frequency spectra and eventually contribute to small-scale turbulence. Triadic Resonance Instability (TRI) has become increasingly recognised as potentially one of these mechanisms. This talk will summarise both experimental work and theoretical modelling (using numerical solutions of a weakly non-linear system) that examines the long-term temporal and spatial evolution of this instability for a finite-width internal wave beam. Experiments have been conducted using a new generation of wave maker, featuring a flexible horizontal boundary driven by an array of independently controlled actuators. We present experimental results exploring the role that a finite width wave beam has on the evolution of TRI. Experimentally, we find that the approach to a saturated equilibrium state for the three triadic waves is not monotonic, rather their amplitudes continue to oscillate without reaching a steady equilibrium. Further theoretical modelling then suggests that part of this variability is due to multiple resonant frequencies interacting with each other, as opposed to a simple triad system. We show how a spectrum of these resonant frequencies in the flow ‘beat’ to cause interference patterns which manifest throughout the instability as slow amplitude modulations.