

PROJECT SUMMARY REPORT

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Project Title	Wavefields in near-critical rotating flow past orography
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1. Project objectives (no more than 10 lines)

From the earliest space flights observations of cloud patterns near islands have shown patterns of waves likened always to the bow wave generated by a ship advancing into calm water. In theoretical analyses (Johnson & Vilenski, 2004; Vilenski & Johnson, 2004) we had shown that these waves are strongest in two-layer flows for obstacles advancing at speeds near to the critical unforced speed of interfacial waves. The objective of the experiments on the Coriolis table was to determine whether the theoretical results were in fact relevant to a real flow. In particular the reasonably large obstacle speeds meant that a rotat tank of large horizontal extent was vital.

2. Main achievements and difficulties encountered (no more than 20 lines)

A towing mechanism and set of closely spaced density probes were set up and monitored by computer so that entire runs of the experiment could be performed with no intervention after setting the parameters of the experiment. The processing of the data was so organised that maps of the interfacial height could be produced within minutes of the end of a run. This meant that we were able to zero in rapidly on the towing speeds of greatest interest. This was important as, in agreement with the theoretical predictions, we found that strong nonlinear behaviour was confined closely to speeds near critical. The short time between runs meant that we were able to examine many different obstacle shapes, layer depths and rotation rates. The large horizontal extent of the tank meant that our results for both rotating and non-rotating flows are perhaps unique in their illumination of the cross-flow behaviour of the wavefields. Previous reported experiments and theory, confined mainly to channels, were generally dominated by sidewall effects. We demonstrated that bow waves appear only in flows close to critical and that their horizontal extent decreases exactly inversely with increasing rotation in line with the theoretical predictions. A paper is in preparations demonstrating the narrow band of nonlinearity near critical speeds, the form of the nonlinear patterns and the effect of rotation on these patterns and correlating these observations against theory. The results allow a far more detailed understanding of the observed cloud fields than that given by the correct, but oversimplified, analogy with ship bow waves.