Internal waves patterns in the wake of a 3D body towed in a two-layer fluid.

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Abstract

Stratified flows over obstacles are important features in meteorology and oceanography. The characterization of these flows is crucial in order to propose models of geophysical processes such as mixing and ocean circulation or orographic drag in the atmosphere.
For some specific stratification profiles, the energy of internal waves generated by the obstacle can be trapped at a given depth, at the base of the oceanic mixing layer or at the top of the atmospheric boundary layer for instance. This scenario can be modelled by a two-layer stratified fluid for which gravity waves spread at the interface between the two layers.

The work presented here focuses on a two-layer flow over a 3D obstacle, or equivalently, an obstacle towed in a fluid at rest. Experiments performed both in the large-scale flume of CNRM-GAME Toulouse (METEO-FRANCE & CNRS) and in a smaller tank apparatus (IMFT), are presented with a specific attention on the measurement of the 3D wave patterns generated by several 3D objects.
A non-hydrostatic linear analysis is used to describe the observed wave patterns. The experiments highlight the strong influence of the Froude number on the generated waves. More specifically, we investigate the nature of the wake angle obtained from the wave pattern, and discuss a transition from Kelvin to Mach angle.

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