Ondes et instabilités de fronts en milieu tournant et stratifié

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Fronts occur in the Earth oceans and atmosphere and separate masses of air of fluid of different temperature and different velocities. Their instabilities are relevant to the transport of heat and energy in the oceans and atmosphere, and are therefore very relevant for climate modeling. In this study, a front is generated in the laboratory in a density stratified and differentially rotating fluid, and the corresponding flow is investigated numerically using DNS. In former studies of fronts, mainly the frontal instability has been discusses and baroclinic instability and newly found Rossby Kelvin instability were reported (Flor et al 2011, Scolan 2011, and Scolan et al 2013). The exact state of the interface is very relevant for the type of instability and waves we may expect. We therefore focus on the interfacial dynamics, and consider the diffusion of vorticity and density at an interface as a function of Rossby and Schmidt number. We note the existence of interfacial Ekman layers, observe Kelvin Helmholtz instability and discuss Hölmböe instability as well as other wave types near the interface.

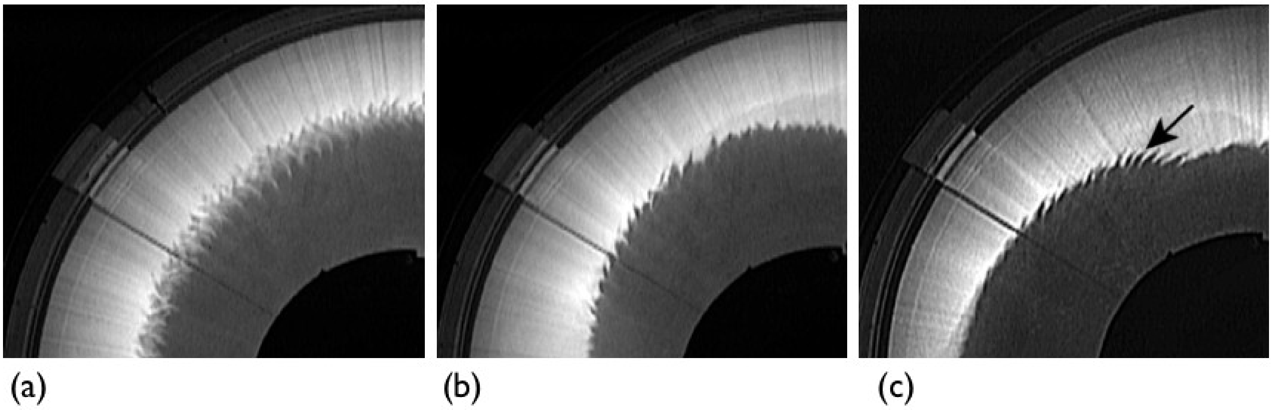

Figure 1: Typical observations of mall scale waves at the frontal region with (a) Holmboe waves, and (b) Kelvin Helmholtz waves. In (c) necessary conditions for Kelvin Helmholtz and Holmboe waves are not satisfied. The waves are observed in (a) the stable regime (b), the Rossby Kelvin regime, and (c) the baroclinic unstable regime.

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