Abstract Submitted
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Instability onset of the boundary layer on a rotating cylinder in a stratified fluid[1] JAN-BERT FLOR, LEGI, LIONEL HIRSCHBERG, BART OOSTENRIJK, GERTJAN VAN HEIJST, TUE Eindhoven, MEIGE TEAM — We consider the instability of the laminar shear layer on a circular cylinder that is impulsively set into rotation about its vertical axis with angular speed Ω. The outer wall of this large gap Taylor-Couette flow is at a radial distance of about 10 times the inner cylinder radius, and the gap is either filled with a homogeneous or linearly stratified fluid. In a homogeneous fluid, the thickness of the boundary layer on the cylinder, d, grows until it becomes centrifugally unstable with a wavelength that is determined by the boundary layer thickness d. In a linearly stratified fluid with stratification N, the flow instability is set by the Froude number $F = \Omega/N$. For $F>1$ the onset of the centrifugal instability is well predicted by the Taylor-Görtler number and theory for homogenous fluids. When $F\leq 1$, the onset of the instability is for a relatively higher Reynolds number, and bifurcates from a vortex regime to a wave regime with a pure inertial wave in the boundary layer. The mechanism of instability is determined by parametric resonance and the generation of waves with subharmonic frequencies typical for Parametric Subharmonic Instability. The results are discussed in view of former results on stratified TC flow.

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