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Instability of Corotating Vertical Vortices in a Stratifield Fluid: Why Strongly Stratifield Turbulence is not Similar to 2D Turbulence

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We show numerically the existence of a new instability of two corotating vertical vortices in a vertically stratified fluid. This three dimensional instability induces the formation of thin horizontal layers with a thickness inversely proportional to the Brünt-Väisälä frequency. This instability is due to the coupling of vortex displacement modes and the strain field induced by the companion vortex. Experimental observations have confirmed the existence of this instability. It speeds up the merging in some layers and delays it in other layers. Since this instability occurs during the pairing of vortices, it may play a major role in energy transfer in stratified turbulence and question the classical Lilly's theory of a two dimensional dynamics in the mesoscale atmospheric turbulence.

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