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Critical Richardson Numbers in Breaking Internal Waves CARY TROY, Purdue University, ERIN HULT, JEFFREY KOSEFF, Stanford University — The breaking of internal waves is known to be responsible for much of the vertical mixing observed in the ocean, large lakes, and the atmosphere. In order to both correctly model and correctly infer the mixing associated with breaking internal waves, a thorough understanding of the instability mechanism driving these turbulent events is crucial. In this study, a primary indicator of turbulence in stratified flows, the gradient Richardson number (Ri), is examined for internal waves on the verge of instability. We use simultaneous high-resolution scalar (Planar Laser-Induced Fluorescence, PLIF) and velocity (Digital Particle Image Velocimetry, DPIV) measurement techniques to infer the gradient Richardson number of breaking and near-breaking progressive internal waves in a laboratory channel. The results show important deviations from the oft-assumed canonical stability limit of Ri=1/4, which we attribute to the unsteadiness of the internal wave-generated shear driving the instability. Results are compared to inviscid theory based on the normal modes equation. These results have important implications for the diagnosis of turbulent mixing in stratified environments.

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