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Transient Growth in Internal Solitary Waves KARL HELFRICH, Department of Physical Oceanography, Woods Hole Oceanographic Institution, Woods Hole, MA, USA, PIERRE-YVES PASSAGGIA, BRIAN WHITE, Department of Marine Sciences, University of North Carolina, Chapel Hill, NC 27599, USA — Internal solitary waves of large amplitude are common in the atmosphere and ocean and play an important role in mixing and transport. While these waves can propagate over long distances, observations suggest they are susceptible to a range of instabilities, which promote breakdown, overturning, and mixing. To gain insight into these instabilities, we consider the optimal transient growth of a family of solitary waves, which are solutions to the Dubreil-Jacotin-Long (DJL) equation for increasing phase speed and varying background stratification. Optimal initial disturbances are computed by means of direct-adjoint iterations of the Navier-Stokes system in the Boussinesq approximation. The most amplified disturbances resemble Kelvin-Helmholtz instabilities and are localized near the bottom of the wave, where the Richardson number is minimum, and are maximized for short time horizons. The optimal transient growth of these perturbations is shown to increase with the phase speed. Implications for breakdown and mixing will be discussed.

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