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Disintegration (or not) of the nonlinear internal tide KARL HELFRICH, Woods Hole Oceanographic Institution — The disintegration of a low-mode internal tide into high-frequency solitary-like waves is re-examined in the fully-nonlinear regime. As with weakly nonlinear models, the disintegration is inhibited by rotation. Using a two-layer fully-nonlinear long-wave model with rotation, it is shown that underlying periodic fully-nonlinear hydrostatic waves act as attractors that prevent the complete disintegration of a general (e.g. sinusoidal) initial tide. In the hydrostatic limit the initial tide will steepen to breaking, dissipate energy and eventually settle onto a nonlinear periodic solution. When weak nonhydrostatic dispersion is included, excess energy in the initial tide is shed as a packet of high-frequency waves; however, the underlying long tidal wave is the same. While qualitatively similar to results from weakly nonlinear theory, there are substantial quantitative differences related to the properties of both the underlying low and high-frequency waves. The periodic nonlinear tide solutions are extended to continuously stratified systems and it is shown via numerical solutions of the Euler equations that these tidal solutions are generally robust to weak nonhydrostatic effects.

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