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The effects of Prandtl number on the nonlinear dynamics of Kelvin-Helmholtz instability in two dimensions JEREMY PARKER, C. P. CAULFIELD, RICH KERSWELL, Univ of Cambridge — It is known that the pitchfork bifurcation of Kelvin-Helmholtz instability occurring at minimum gradient Richardson number $Ri_m \simeq 1/4$ in viscous stratified shear flows can be subcritical or supercritical depending on the value of the Prandtl number, Pr. Here we study stratified shear flow restricted to two dimensions at finite Reynolds number, continuously forced to have a constant background density gradient and a hyperbolic tangent shear profile, corresponding to the 'Drazin model' base flow. Bifurcation diagrams are produced for fluids with $Pr = 0.7$ (typical for air), 3 and 7 (typical for water). For $Pr = 3$ and 7, steady billow-like solutions are found to exist for strongly stable stratification of Ri_m up to $1/2$ and beyond. Interestingly, these solutions are not a direct product of a Kelvin-Helmholtz instability having too short a wavelength but can give rise to Kelvin-Helmholtz states of twice the wavelength through subharmonic bifurcations. These short-wavelength states can be tracked down to at least $Pr \approx 2.3$ and act as instigators of complex dynamics even in strongly stratified flows when the flow is unforced.

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