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Nonlinear destabilization of stably stratified shear flow[1] NADIA MKHININI, THOMAS DUBOS, PHILIPPE DROBINSKI, Laboratoire de meteorologie dynamique, Ecole polytechnique/IPSL — The supercritical or subcritical nature of the bifurcation occurring at a critical bulk Richardson Ric in stratified shear flows is investigated. This investigation is motivated by the recent observation that, in the stratified Ekman boundary layer, both supercritical and subcritical bifurcations occur for low and high values of the Prandtl number Pr, respectively. Linear stability of stratified shear flows is well-described by the Miles-Howard criterion, but the nature of bifurcation is determined by stabilizing or destabilizing nonlinear feedback mechanisms. To identify such mechanisms, an amplitude equation is derived near Ric. The variations of the first Landau coefficient mu as a function of Reynolds number, Prandtl number and wave vector of the shear instability are studied. Pr is the leading factor determining the sign of mu and the nature of bifurcation. The underlying mechanism is that vertical mixing induced by shear instability reduces background gradients of both velocity and buoyancy. The shear-induced feedback is stabilizing while the stratification-induced feedback is destabilizing and stronger when diffusion is low and Pr is high. The weakly nonlinear analysis is repeated on the continuously stratified Kelvin-Helmholtz flow with identical conclusions.

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Nadia Mkhinini
Laboratoire de meteorologie dynamique, Ecole polytechnique/IPSL

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