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Mixing efficiency in horizontal convection

Remi Tailleux
University of Reading, Meteorology, Reading, United Kingdom (r.g.j.tailleux@reading.ac.uk, +44-(0)118-3788316)

The mixing efficiency Γ is a central quantity in the study of turbulent stratified fluids, which is often used to convert estimates of turbulent viscous dissipations rates of kinetic energy in estimates of turbulent diapycnal mixing. It is therefore a central quantity in turbulent parameterizations of mixing using turbulent closures based on the use of a turbulent kinetic energy equation. An important problem, however, is that most observational or parameterization studies generally use the 'canonical' value $\Gamma = 0.2$, regardless of the physical processes physically controlling turbulent mixing. The danger in using a fixed value of Γ are illustrated in this work by showing that the mixing efficiency in the particular context of horizontal convection, i.e., the buoyancy-driven circulation driven by surface buoyancy fluxes, usually increase with the Rayleigh number, and can reach values significantly larger than unity.