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# Dissipation rate of turbulent kinetic energy in stably stratified flows

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Until present, the dissipation rate of turbulent kinetic energy as reliant on static stability and non-steady energy budget remained poorly understood, which caused principal difficulties in turbulence-closure theory and intolerable uncertainties in modelling stably-stratified turbulent flows. We respond to this challenge and consider the two key problems: dependence of dissipation on static stability over the whole range of stratifications from neutral to extremely stable, and adjustment of dissipation to non-steady changes in the energy budget. For the steady-state, we employ the turbulent-kinetic-energy budget equation to retrieve the dissipation rate versus static stability from massive data on wind profiles in the atmospheric surface layer; supplement this yet unused information with our own topical direct numerical simulation; and derive universal stability dependence of the equilibrium dissipation rate. For non-steady regimes, we define the adjustment of actual dissipation rates to its equilibrium value by the relaxation equation taking proportional the relaxation and dissipation time-scales, and determine the proportionality constant empirically. We provide experimental confirmation to our vision of dissipation and to novel algorithm for its calculation. The latter can be used in the contest of any turbulence closure model, and provides the research community with physically and empirically grounded instrument for modelling dissipation in any stably-stratified geophysical, astrophysical or engineering turbulent flows.