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Energetics of stratified turbulent mixing at geophysical scales[1]
ALBERTO SCOTTI, PIERRE-YVES PASSAGGIA, BRIAN WHITE, Dept. of Marine Sciences, University of North Carolina at Chapel Hill — Energy-based arguments provide a fundamental diagnostic tool in turbulent flows. In stratified incompressible flows, there are two reservoirs of energy, the kinetic and potential energy. However, the standard expression $E_\mathrm{p} = \rho g Z$ for the latter is not convex, and thus, within an energetic framework based on this definition, turbulent fluctuations have zero potential energy, a rather unsatisfactorily state of affairs. The solution is to modify the definition of potential energy to include only the portion that is effectively available. This introduces the concept of Available Potential Energy (APE). In this talk, we approach the problem of APE using a general framework which recovers the standard buoyancy-only dependent formulation in non-rotating systems. Unlike the standard formulation, rotation can be included in a natural way, in which case the Available Energy depends both on the buoyancy and potential vorticity distribution. We will show results from experiments of stratified mixing at oceanic values of the Gibson number conducted in our large flume. The goal of this experiments is to shed some light on the controversy surrounding the relationship between the mixing efficiency and the Gibson number.

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