Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

A general criterion for the release of background potential energy through double diffusion LEO MIDDLETON, JOHN R. TAYLOR, University of Cambridge — Double diffusion occurs when the fluid density depends on two components that diffuse at different rates (e.g. heat and salt in the ocean). Double-diffusive fluids display forms of convection not present in single-component fluids as well as modifying the effects of canonical environmental flows (gravity currents, jets etc.). Energetically, double diffusion can lead to an up-gradient buoyancy flux which may drive motion at the expense of potential energy. Here, we follow the work of Lorenz 1955 and Winters et al. 1995, for a single-component fluid and define the background potential energy (BPE) as the energy associated with an adiabatically sorted density field and derive its budget for a double-diffusive fluid. We find that double diffusion can convert BPE into available potential energy (APE), unlike in a single-component fluid, where the transfer of APE to BPE is irreversible. We also derive an evolution equation for the sorted buoyancy in a double-diffusive fluid, extending the work of Winters DAsaro 1996, and Nakamura 1996. The criterion we develop for a release of BPE can be used to analyse the energetics of mixing and double diffusion in the ocean and other multiple-component fluids. We illustrate its application using two-dimensional simulations of salt fingering.

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Date submitted: 06 Aug 2020 Electronic form version 1.4