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Bubble induced destratification in unconfined fluids[1] MAATHANGI GANESH, SADEGH DABIRI, Purdue University — Rising motion of bubbles in density stratified fluids leads to destratification effects. In order to study this, DNS of hundreds of bubbles in unbounded stratified fluids is carried out using the finite volume/front-tracking method. Bubble dynamics, including the bubble rise velocities, bubble velocity fluctuations, temporal correlations and bubble dispersion is studied. Importance of bubble Reynolds number and deformability is presented. Bubble motion is seen to cause bubble-induced turbulence (BIT) in the liquid, which is the driving mechanism for mixing and subsequent destratification. BIT is quantified by examining the liquid fluctuations and turbulent kinetic energy. The dependence of mixing efficiency on the void-fraction, stratification strength, Eotvos and Reynolds numbers is also presented. Highly deformable, high Reynolds number bubbles undergo path instabilities and give rise to higher levels of mixing. An increase in buoyancy flux across pycnoclines is observed as void fraction increases. A similar increase in vertical mass flux is observed for a decrease in stratification strength. Flow pattern around the bubbles and the bubble microstructure are studied. It is shown that the extent of mixing is heavily dependent on the bubble dynamics.

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