Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Oceanic Double-Diffusive Layer Thicknesses in the Presence of Turbulence NICOLE SHIBLEY, MARY-LOUISE TIMMERMANS, Yale University — Double-diffusive stratification in the ocean is characterized by staircase structures consisting of mixed layers separated by high-gradient interfaces in temperature and salinity. Several past studies have examined mechanisms that govern the observed thicknesses of staircase mixed layers. In one formalism, the mixed-layer thickness is set by layer formation that arises when a heat source is applied at the base of water that is stably-stratified in salinity; in another, the equilibrium thickness of mixed layers has been explained as the product of "merging," where thin layers continue to grow until they reach a thickness determined by a criterion relating the ratio of heat flux to salt flux and the density ratio. We extend the above two theories to consider the influence of turbulence on mixed-layer thicknesses. The study has implications for the Arctic Ocean where double-diffusive staircases are widely present, and mixed-layer thicknesses are well-resolved by ocean measurements. Our theoretical framework provides a means to determine turbulent diffusivities (in regions where microstructure measurements are not available) by considering only observations of density ratio, stratification, and layer thicknesses.

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Date submitted: 28 Jul 2016 Electronic form version 1.4