



4-D observations of a restratifying surface mixed layer with lateral density gradients

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The nature of surface fluxes at the air-sea interface are intimately dependent on the extent of restratification, especially that due to insolation, that occurs following vertical mixing due to nighttime convection and storm-forcing. Here we present four-dimensional observations from within the Subtropical Front (STF) of a restratifying surface mixed layer (SML) containing a sub-mesoscale lateral density gradient. During a 33 hour period that followed a storm, 16 small-scale surveys were conducted around a drogued float. Insolation accounted for only 60% of observed restratification during daytime at 50 m vertical scale following nighttime convection that extended throughout the entire SML. This proportion dropped to 25% at 10 m scales in the lower half of the SML. The excess restratification was caused by the vertically-sheared horizontal advection of the lateral density gradient due to a near-inertial wave of 100 m vertical wavelength. The phase and period of the wave ensured constructive interference with the isopycnal displacement achieved by insolation during the diurnal cycle. The restratification by the sheared advection matched that predicted for vertically-sheared inertial oscillations generated by the geostrophic adjustment of a density front, ubiquitous in the STF. By further including the effects of uncompensated thermohaline inhomogeneity we can account for 100% of observed daytime restratification.