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An elevated turbulent mixing event caused by a near-inertial wave in the mixed layer

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Between 2005 and 2016, an extensive shipboard and autonomous microstructure measurement program was carried out in the proximity of PIRATA sites in the central and northeastern tropical Atlantic. The data reveal regional variability of upper ocean mixing processes from diurnal to seasonal time scales. Here, we discuss an elevated turbulent mixing event below the mixed layer caused by surface near-inertial waves (NIWs) and address the impact of these mixing events on the mixed layer heat balance at the PIRATA site at 11.5°N, 23°W. Altogether, microstructure data at this site was collected during 8 different cruises. During one incident, sampling was conducted during the presence of an elevated NIW. Velocities associated with the NIW were above 0.6ms^{-1} in the mixed layer and decreased to near zero below the stratification maximum at 30m depth. Mixing during the presence of the NIW was strongly elevated and dissipation rates of turbulent kinetic energy exceeded 1x10^{-5}m^{2}s^{-3} in the stratified region below the mixed layer in some profiles. Associated cooling of the sea surface temperature was also elevated. Diapycnal heat flux was above 140Wm^{-2} 10m below the mixed layer and more than 300Wm^{-2} in the region 5m below the mixed layer. Near-inertial wind stress magnitude (NIWSM) during the period war particularly high. Wind energy flux to NIWs from a slab ocean model is used to estimate the frequency of the occurrence of the elevated NIW ocean velocity.