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# Modulation of Equatorial Turbulence by Tropical Instability Waves

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Strong modulation of turbulent mixing by a westward propagating Tropical Instability Wave (TIW) was observed during October and November 2008 on the equator at 140$^o$W in the stratified shear layer between the equatorial undercurrent (EUC) and the surface mixed layer. At these depths, the unique deep diurnal-cycle mixing in the stratified layer under the equatorial cold tongue was observed with nighttime turbulent mixing a factor of 10 greater than during daytime. The turbulent kinetic energy dissipation rate, $\epsilon$, was O($10^{-6}$)Wkg$^{-1}$, and the turbulent heat flux was ˜500 Wm$^{-2}$, at least 5-10 times greater than previously observed at the central equatorial Pacific. Turbulence mixing varied significantly during the four distinct phases of the meridional flow associated with the TIW: steady northward (˜0.6 ms$^{-1}$), northward-to-southward transition, steady southward (˜-0.6 ms$^{-1}$), and southward-to-northward transition. During the northward-to-southward transition, we observed the largest values of reduced shear squared (Sh$^2$?4N$^2$), where Sh$^2$ is the total shear squared and N$^2$ the buoyancy frequency squared, the thickest nighttime surface mixed layer, the deepest penetration of the deep-cycle turbulence, and the largest turbulent heat flux and largest integrated $\epsilon$ in the deep-cycle layer. During steady southward flow, the depth of the bases of the nighttime surface mixed layer and of the deep-cycle layer were shallowest. For the first time, a 50-m-thick layer of strong turbulence was observed immediately above the EUC core during the northward-to-southward and steady southward phases. The average $\epsilon$ exceeded 10-$^6$ Wkg$^{-1}$, the eddy diffusivity was ˜10$^{-3}$ m$^2$s$^{-1}$, and the turbulent heat flux was ˜500 Wm$^{-2}$. It is likely that to accurately parameterize mixing in the central equatorial Pacific, numerical models must properly simulate not only the enhancement of mixing associated with TIWs but also the variability of mixing within individual TIWs. In this talk, some results from the extensive (from November 2008 to February 2009) mooring data set, comparisons with a general circulation model, and details of mixing events will also be shown.