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CGD Seminar Series

Off-equatorial deep cycle turbulence forced by Tropical Instability Waves in the equatorial Pacific

Deepak Cherian

NCAR

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Time: 11am – 12pm MT

For Zoom information, please contact Tracy Baker tbaker@ucar.edu

For live stream information, visit the CGD Seminar Webpage

ABSTRACT

The equatorial Pacific cold tongue is a site of large heat absorption by the ocean. This heat uptake is enabled by a daily cycle of turbulence beneath the mixed layer (deep-cycle turbulence) that removes heat from the sea surface and deposits it in the upper flank of the Equatorial Undercurrent. Deep-cycle turbulence results when turbulence is triggered daily in sheared and stratified flow that is marginally stable (gradient Richardson number Ri ≈ 0.25). Deep-cycle turbulence has been observed on numerous occasions in the cold tongue at 0°N, 140°W, and may be modulated by Tropical Instability Waves (TIWs).

Here we use a primitive equation regional simulation of the cold tongue to show that deep-cycle turbulence can also occur off the equator within the cold cusps of TIWs where the flow is marginally stable. In the cold cusp, pre-existing equatorial zonal shear u_z is enhanced by horizontal vortex stretching near the equator, and subsequently modified by horizontal tilting terms to generate meridional shear v_z off the equator. Turbulence in the sheared flow of the cold cusp is triggered daily by the descent of the surface mixing layer associated with the weakening of the stabilizing surface buoyancy flux in the afternoon. Observational evidence for off-equatorial deep-cycle turbulence is restricted to a few CTD casts, which when combined with shear from shipboard ADCP data suggest the presence of marginally stable flow in TIW cold cusps. This study motivated further observational campaigns to characterize the modulation of deep-cycle turbulence by TIWs both on and off the equator