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Poster
The Prediction and Research Moored Array in the Tropical Atlantic (PIRATA) is a network of 18 long-term buoys spanning the tropical Atlantic Ocean. In this study, a unique collection of measurements from the 4˚N, 23˚W PIRATA mooring is used to explore upper-ocean shear, buoyancy, and internal tides on semi-diurnal to seasonal time scales using point measurements that include two deployments (March 2017-March 2018 and May 2019-May 2020) of enhanced upper-ocean velocity measurements from 11 current meters of the Tropical Atlantic Current Observations Study (TACOS). During spring, high diurnal amplitudes of sea surface temperatures are a common occurrence due to light winds and strong insolation. The associated diurnal changes in stratification and mixed layer depth are superimposed on a shallow seasonal thermocline centered at a depth of approximately 45 meters. Frequency spectra of shear and stratification show peaks at the semidiurnal period, indicating forcing from internal tides. Coherence analyses also show a close relationship between the magnitude of shear above the thermocline and vertical undulations of the thermocline at semi-diurnal periods. The internal tides increase mixing at the base of the mixed layer at night, when the diurnal mixed layer is thickest, based on a marginal stability analysis. However, at a given depth, the shear variance is nearly uniform throughout the diurnal cycle, meaning that the increase in shear variance and mixing at the base of the mixed layer at night results from the descent of the mixed layer into the region with stronger mean shear variance. Velocity data from Saildrones deployed during the Atlantic Tradewind Ocean-Atmosphere Mesoscale Interaction Campaign (ATOMIC; January – February 2020) are used for comparisons with the TACOS results. There is a strong diurnally-varying shear-squared signal that is similar to that found from TACOS, furthering the notion that internal waves play a role in nighttime mixing at the base of the mixed layer. Previous studies along the equator in the Pacific and Atlantic show comparable results, with nighttime enhancement of the vertical shear variance, an indication of deep-cycle turbulence. However, a main difference is that in close proximity to the equator the Equatorial Undercurrent provides a strong subsurface source of mean vertical shear that is not present at 4˚N. The lack of mean shear from the EUC at 4˚N may be the reason for the diurnally uniform shear variance

above the thermocline, while internal waves are found to be the main drivers of nighttime mixing at the base of the mixed layer.

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