FINE STRUCTURE AND MIXING IN THE WESTERN EQUATORIAL PACIFIC

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ABSTRACT

Recent studies from the Western Equatorial Pacific suggest that small-scale velocity structures (SVSs) play an important role in mixing in the near-equatorial thermocline. During the MIXET experiment in 2012, moored profilers of velocity, salinity and temperature were deployed along the 156°E meridian in order to observe the behaviour of the fine structure field on longer time scales. In addition to high-frequency sampling in the thermocline, the profilers cycled to 1500 m every three days. In this study, we compare and contrast the simultaneous $\sim$2.5 months long time series from the moorings at 4.5°N and 0.5°S. We find substantial differences in density and velocity fine structure between the extra-equatorial and equatorial regimes, both in the thermocline region and below.

At 4.5°N, thermocline shear is almost entirely associated with motion near the local inertial frequency, dominated by vertical wavelengths near the SVS scale of 30 m. In contrast, no particular frequency or vertical wavelength stands out at 0.5°S. Instead, the greatest shear amplitudes occur when the background shear of the Equatorial Undercurrent is reinforced by the shear of superimposed, small-scale flow features. These features persist for a month or more, and show signs of wavelike behavior, but their dynamical origins are unknown.

We also observe differences in fine structure below the thermocline. At 4.5°N, the fine structure is qualitatively similar to that typically observed in the mid-latitude open ocean. At 0.5°S, both shear and strain are elevated, and their wavenumber and frequency spectra differ in shape and level from the generic mid-latitude spectra. Strain and shear close to the Equator are organized in a slowly varying, layered structure, with the largest density steps in the 300-600 m depth range. Microstructure measurements from the mooring recovery cruise suggest that turbulent kinetic energy dissipation is elevated within individual steps.