Sustained Lagrangian Observations of Upper-Ocean Currents, Stratification, and Turbulence

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Time-dependent coupling of upper-ocean shear, turbulence, waves, and stratification is known to control the response of surface currents to wind forcing. However, long-term observations of these surface boundary layer dynamics in the open ocean remain rare.

During the NASA SPURS-2 experiment, an autonomous Lagrangian Float equipped with a high-resolution Acoustic Doppler Current Profiler observed the evolution of near-surface shear and stratification in the Eastern Pacific Fresh Pool for over 100 days. Stratification cycling induced by solar heating and episodic strong rainfall was associated with pronounced variability of boundary layer turbulence and vertical shear of wind-driven (Ekman) currents. Decoupled from the bulk of the mixed layer by strong stratification, warm and fresh near surface waters were rapidly accelerated by wind causing a strong downwind near-surface distortion of the Ekman spiral. Quantitative interpretation of the results remains a challenge, which can be addressed with the high-resolution numerical modeling given sufficiently accurate air-sea fluxes of heat and momentum.