Langmuir circulation inhibits near-surface water turbulence

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In the surface ocean, breaking waves are a major source of air bubbles and turbulent kinetic energy. During the presence of a consistent surface wind, these wave-generated bubbles, along with other surface material like seaweed or foam, can be drawn into long rows along the surface.

Driving this organization is Langmuir circulation, a phenomenon in which the wind and waves cause surface waters to rotate helically, moving like a wire wrapped around a pole in the windward direction. These spiral currents oscillate between left-handed and right- handed rotations, such that in some places the surface waters are pushed together and in others they are pulled apart. Researchers have previously found that at sites of convergence the bubbles produced by breaking waves are pushed to depths of 15 meters (49 feet) or more, with important implications for air-sea gas mixing and other processes.

Of interest to Gemmrich, however, is whether Langmuir circulation-induced convergence also affects near-surface turbulent kinetic energy, the other product of breaking waves. Using measurements taken from aboard the R/P Floating Instrument Platform, a unique ship designed to deliberately flood itself to turn into a stable floating research station, the author finds that Langmuir circulation convergence zones suppressed turbulence in the near-surface ocean.

The author suggests that in convergence zones the wave-generated bubbles that had been forced to depth would rise at varying rates, with large bubbles rising faster than small bubbles. This would cause the ocean waters to become stratified by air fraction. This stable stratification would, in turn, inhibit turbulence close to the surface.

The results suggest that in a convergence zone, buoyant particles originating from a surface source-such as oil from a tanker spill-would get trapped in the near-surface waters rather than be mixed to depth, the opposite of what would have been previously assumed.

More information: Bubble-induced turbulence suppression in Langmuir circulation, *Geophysical Research Letters*, doi:10.1029/2012GL051691 , 2012.

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