

Department of Ocean and Resources Engineering

Seminar

Langmuir circulation and convective mixing on the continental shelf: A comparison of forcing conditions

By

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Wednesday, February 21, 2007, Holmes Hall 243

3:00-3:30 pm Coffee Hour

3:30-4:30 pm Seminar

Please join us for the coffee hour near the seminar venue a half hour before the seminar, 3:00 – 3:30 pm

Abstract

A bottom-mounted 5-beam acoustic Doppler current profiler recorded measurements of backscatter amplitude and velocity during a 6 month deployment at the LEO-15 New Jersey shelf observatory. An on-site thermistor chain and profiling CTD and an onshore meteorological station provided a coterminous measure of water properties and atmospheric conditions. The observations presented here are from September and October 2003, a time of strong weather systems and intermittent surface cooling. The ADCP data from this period contain striking examples of Langmuir cells filling the entire water column as well as instances of full-depth thermal convection. Both phenomena are characterized by strong alternating vertical velocities with velocity maxima at middepth and downward velocities exceeding upward velocities. However, Langmuir circulations are distinguished by intensified alongstream flows near the bottom boundary with downstream jets occurring under downwelling regions. The Langmuir cells occurred during periods of relatively high winds and waves and the convective overturns during periods of destabilizing surface buoyancy fluxes.

I will discuss the identification of velocity structures and backscatter signals in the ADCP record and also examine the conditions under which the two circulations develop. Aspects of both sets of conditions can be described by nondimensional numbers which gauge the magnitude of vortex forcing due to wave/current interaction relative to forcing due to surface wind stress (the turbulent Langmuir number, La_t) and surface buoyancy flux (the Hoenikker number, Ho). These two numbers define regimes within which Langmuir cells or convection may occur. However, the La_t/Ho regimes do not, by themselves, guarantee either circulation. Additional criteria include the degree of stratification, the magnitude of surface buoyancy flux and the duration of forcing.