Observations of Langmuir Circulation From FLIP: A progression to multi-dimensional sampling

J. A. Smith and R. Pinkel, Scripps Institution of Oceanography, La Jolla, CA 92039, USA
Email: jasmith@ucsd.edu, web: http://jerry.ucsd.edu/

Abstract

Langmuir circulation has significance across the marine disciplines. Enhanced mixing and related to stratification processes, it can involve energy transfer, nutrient supply, ocean chemistry, and biota. The factors that drive Langmuir circulation are wind direction and speed variability and effects, surface flow patterns, surface wave generation and dissipation, and changes in the pycnocline. Direct measurements of surface expression of Langmuir circulation are rare. The observations made include measurements of crosswind velocity (e.g., from underwater Doppler sonars), and the use of surface-borne instruments to measure near -surface velocities. The observations were conducted from the FLIP-II, a 300 ton research vessel that travels on the surface-line up into “windrows,” and how regular those rows were. The correspondence between this former was made with the concept of Langmuir circulation: there is little crosswind velocity at mid -depth in a Langmuir “cell.”

Introduction

In the 1980’s, attempts were made to obtain significant data regarding Langmuir circulation. Those efforts came from a number of sources, often linked by what was then an emerging technique called the Doppler sonar. The first of these experiments took place in 1982, and the second in 1985. Both efforts were undertaken on the same research vessel, the FLIP-II, which was then in the process of becoming a multi-purpose research vessel. The second experiment also utilized a new technique, the use of high -frequency (500 kHz) Doppler sonars, which had been developed by Roger Pinkel and his colleagues in the early 1980’s. The first of these experiments was conducted in 1982, and the second in 1985. Both efforts were undertaken on the same research vessel, the FLIP-II, which was then in the process of becoming a multi-purpose research vessel.

The Air Sea Interface: Radio and Acoustic Experiments

Radio and acoustic experiments were conducted on the FLIP-II in 1983, 1985, and 1992. These experiments were designed to study the interaction of wind and waves with the ocean surface. The results of these experiments have been used to improve our understanding of the physical processes that govern the air-sea interface. The experiments have also been used to study the effects of climate change on the ocean.

Data similar to above (40 second smoothing), but for a calm period near the peak tidal flows. High-frequency internal waves are seen to propagate across the field from left (South) to right (North). The signal is seen in both intensity and velocity.

The air-sea interface is a complex system that is influenced by a variety of factors, including wind, waves, and the ocean’s temperature and salinity. The interaction of these factors can result in a variety of phenomena, such as the formation of waves, the generation of sound, and the transfer of heat and matter across the air-sea interface. Understanding the air-sea interface is important for a variety of reasons, including the prediction of weather and climate, the monitoring of ocean health, and the management of marine resources.