SHORT TIME-SCALE AND SEASONAL VARIABILITY OF POREWATER CONSTITUENTS IN A PERMEABLE NEARSHORE SEDIMENT

A THESIS SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAI‘I IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

IN

OCEANOGRAPHY

DECEMBER 2010

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Abstract

Porewater samples were collected from a nearshore permeable sediment at the Kilo Nalu Nearshore Observatory, O‘ahu, Hawai‘i over a variety of surface gravity wave conditions to evaluate the effect of ocean swells and their corresponding bottom currents on dissolved oxygen and nutrient dynamics in porewater. Our results indicate that swell events, resulting in nearbed velocities greater than 0.30 m/s, affect porewater constituents to a depth of ~7.5 cm by causing enhanced flushing between the porewater in the uppermost sediment and the overlying water column. This process is associated with a fluorescence response in the bottom water, suggesting that the flushing and subsequent nutrient input to the water column may be important to nutrient budgets in nearshore oligotrophic waters. Increased nearbed velocities were correlated with greater depth-integrated dissolved oxygen concentrations, suggesting that a larger amount of dissolved oxygen is injected in the sediment with larger significant wave heights and their correspondingly larger nearbed velocities. Seasonal variability in the physical environment appears to be linked to available amounts of total nitrate + nitrite in the sediment, with greater amounts available during the summer months, when the sediments are more aerated due to more intense austral winter wave action on the south shore of O‘ahu. Ratios of regenerated nutrients suggest that the majority of the organic matter undergoing remineralization is planktonic in origin. However, a shift in source matter undergoing remineralization coincided with a late-summer swell event, suggesting that swell events and/or seasonality may be important factors in controlling the organic matter supplied to the sediments at Kilo Nalu Nearshore Observatory.

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