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Full-Water Column Turbulence Parameterization of Stratified Waters in Southern Lake Michigan

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ABSTRACT

Full water column mean flow and turbulence structure was characterized at two stratified locations in Lake Michigan (a. Muskegon, MI; b. Michigan City, IN) in order to better understand the filtration potential of invasive quagga mussels. Invasive quagga mussels in Lake Michigan are filter feeders and can dramatically alter clarity as well as the biological/chemical characteristics of the water column. This filtering capacity is highly contingent on turbulence characteristics throughout the water column, which is poorly understood in the Great Lakes. Using velocity, temperature, and turbulence data collected from these locations, the structure of the water column turbulence was modeled for site (a) using data from 2011 and measured for site (b) in 2017. The data from 2017 was collected as a test run of a new acoustic Doppler current profiler, the Nortek Signature500, that will be utilized in future experiments on Lake Michigan. This data was analyzed to better characterize the turbulence structure of Lake Michigan and how it is affected by wind events and wave trends. Using power spectra and turbulence structure function, the turbulent kinetic energy dissipation of the full water column was analyzed from these two locations. This analysis provides insight into the turbulence structure of the full-water column in a stratified lake and will be utilized to prepare for the execution of future sampling events in Lake Michigan.

KEYWORDS

Turbulence, boundary layers, stratified, lakes, vertical mixing