
KEISUKE NAKAYAMA, Kobe University

Mass transport velocity in a three-layer system

In lakes and the ocean, organic matter and nutrients tend to remain within the pycnocline due to the suppressed diapycnal mixing by the strong density gradient. Stokes velocity within the pycnocline can cause significant isopycnal mass transport. Therefore, isopycnal mass transport due to Stokes velocity within the pycnocline can be important for long-term processes in the ecology and biogeochemistry. Under the vertically symmetric stratification conditions, mass transport velocity has been investigated in the previous studies. However, studies on mass transport velocity under internal solitary waves are scarce. In this study, Fully nonlinear and strongly Dispersive Internal wave (FDI) equation based on a variational principle in a three-layer system was proposed, and the FDI equation was applied to investigate mass transport velocity due to both sinusoidal and solitary internal waves. The validity of the FDI equations was done by using an analytical solution for mass transport velocity due to sinusoidal waves under vertically symmetric stratification. Mass transport velocity in the middle layer under internal solitary waves is revealed to be more positive than that under sinusoidal internal waves. In addition, the applicability of the FDI equations was confirmed from the analysis of “breathers”.