

Structures of Longitudinal Mass Flux in Tidal Basins

Hideichi YASUDA

Chugoku National Industrial Research Institute, JAPAN

In the Seto Inland Sea which is a typical enclosed sea in Japan, tidal currents are dominant all the year round compared with density and wind-induced currents. Although longitudinal dispersion of matter due to the tidally oscillatory current could be ignored in the tidal basin such as an estuary by the usual analysis of longitudinal dispersion because of the large characteristic mixing time in the vertical or lateral scale, it has been recognized from plenty of field-observational data that the oscillatory components of tidal current play an effective role in dispersion and transport of both dissolved and suspended matter in tidal basins.

This study has analyzed longitudinal dispersion due to oscillatory and steady currents with the boundary layers from the viewpoint that dispersion should be a kind of mixing phenomena similar to turbulent diffusion. The vertical structure of longitudinal dispersion can clarify the distribution of the matter concentration in the longitudinal vertical section at each time. The velocity profiles given and the matter concentration solved can yield the vertical structure of the mass flux, and it has revealed the detailed process of matter dispersion in shear flows. These analyses elucidate that the negative flux is induced just above the bottom boundary layer and it is related to the dispersion coefficient of suspended particles drifting around the sea floor, the values of which is much larger than the estimation given by usual analysis. And further it is suggested that the periodically averaged flux obtained from the field-observational data might depend on the averaging procedure. These imply that we have to pay much attention to the estimation of "the exchange rate of the sea water", which is being regarded as an important parameter expressing the characteristics of the enclosed sea.

On the basis of the above theoretical results, we have developed a current meter of a new type to get the vertical profile of the flux of suspended particles which can measure simultaneously currents and turbidity of sea water at four levels near the basin floor. The observational results obtained from the Seto Inland Sea and Lake Biwawill be presented in the conference.