

Experimental study on turbulent characteristics of tidal flow

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Abstract: Study on turbulent characteristics of tidal flow is essential to understand the mechanism of contaminant and sediment transport, as well as ecological and environmental protection in tide water. A systematic overall analysis was performed for the variation of turbulence in a tidal flow with sinusoidal water level. Three-dimensional instantaneous velocity of a point in the mainstream region was sampled continuously with high sampling frequency of 100 Hz. The evolution of turbulent intensity and Reynolds shear stress, the difference between measured probability density distribution and normal distribution at typical moments, as well as turbulent energyspectrum of fluctuating velocity were analyzed, based on the mean velocity calculated by a moving average method and principle of least squares. Results show that the longitudinal velocity changes approximately in accordance with sinusoidal curve, the peak values of relative turbulent intensity in the longitudinal, lateral, and vertical directions occur at the transitional stage of tides. Results also show that for flood tide and ebb tide, Reynolds shear stress associated with longitudinal turbulent velocity enhances and the probability distribution of longitudinal and vertical fluctuating velocity deviates from the normal distribution. It is also found that the density of turbulent energy spectra decreases with the increase of frequency, and the main frequency is below 10 Hz for energy of water flow.

Key words: tidal flow; turbulent intensity; Reynolds stress; probability density distribution; energy spectra