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Real-time Observation of Suspended Sediment from ADCP and Turbidimeter Mounted on a Metocean Data Buoy

Ching-Jer Huang (1), Yang-Ming Fan (1), Ping-Chang Hsueh (1), Mon-Shen Shi (1), and Jia-Wei Bian (2)

(1) Coastal Ocean Monitoring Center, National Cheng Kung University, Tainan City, Taiwan (R.O.C.), (2) Department of Hydraulic and Ocean Engineering, National Cheng Kung University, Tainan City, Taiwan (R.O.C.)

The measurement of suspended sediment is one of the most important issues for coastal erosion and protection. The traditional measurement methods for suspended sediment are self-recorder instrument, such as optical turbidimeter, optical backscatter sensor, laser diffraction sensor, and time domain reflectometry. Typically, these sensors has been deployed, manipulated, and recovered, while the sea is calm or smooth condition. However, the majority of suspended sediment transport is concentrated on high rainfall intensity period, because the sediments will be conveyed by flood waters to the river estuary or coastal area. As a result, a real-time and robust technology developed by the Coastal Ocean Monitoring Center (COMC) has been used to monitor and estimate suspended sediment concentration (SSC).

The ability of a 600 kHz Acoustic Doppler Current Profiler (ADCP) to measure suspended sediment concentration in the mouth of a lagoon area has been investigated and validated with an optical turbidimeter. A series of calibration experiments were conducted in the mouth of Qigu lagoon and the Zengwun River, Tainan, Taiwan, where clays and silts in the range of 3-120 μm are prevalent. The turbidimeter was mounted with the mooring chain of a metocean data buoy below the sea level 13 m, where is the range of the eleventh bin of this ADCP. Over the time span of 15 days calibration experiments, the logarithmic scale data of turbidity was found to be proportional to the echo intensity of this ADCP with high correlation to 0.73. Using the relation between turbidity and echo intensity, the ADCP could be calibrated to yield depth profiles of turbidity, and then converted to SSC. In addition, the ADCP was integrated with a metocean data buoy, so that the echo intensity data could be transmitted to the land-base station. After finishing the echo intensity data transmission, suspended sediment concentration can be estimated in real-time for the clients to prevent data unavailable or instrument lose, even though the weather is in harsh condition. The diurnal dynamic behavior of the suspended sediment, such as erosion and subsequent deposition can be calculated by the ADCP backscatter measurement. The evidence suggests that the SSC data highly depend both on the acoustic frequency of ADCP and the average grain size.