Real-time observation of suspended sediment from ADCP and Turbidimeter mounted on a Metocean Data Buoy

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Introduction

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, and these sensors has been deployed, manipulated, and recovered, while the sea is calm or smooth condition.

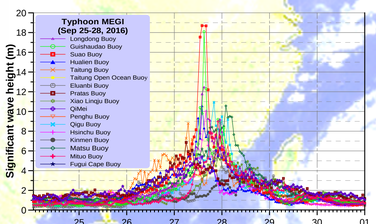
However, the majority of suspended sediment transport is concentrated on high rainfall intensity period, because the sediments will be conveyed by flood waters to the river estuary or coastal area.

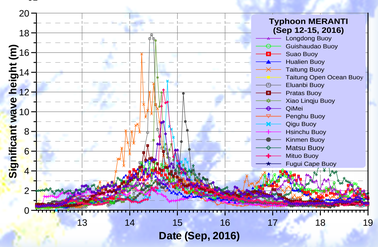
As a result, a real-time and robust technology developed by the Coastal Ocean Monitoring Center (COMC) has been used to monitor and estimate suspended sediment concentration (SSC).

Opaertional Coastal Ocean Monitoring Network

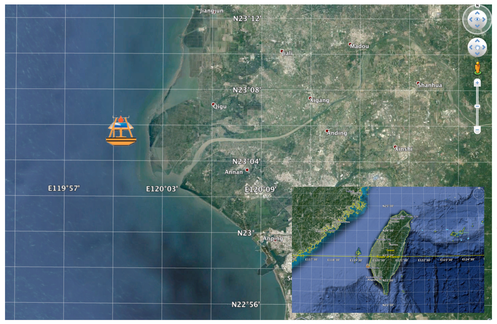
Under the auspices of the Central Weather Bureau, the Tourism Bureau and the Water Resources Agency of the Republic of China, COMC coordinates the Operational Coastal Ocean Monitoring Networks to ensure marine safety and mitigate coastal hazards. Since 1998, 41 offshore and coastal stations have been constructed and are operational. COMC is the unique institute in Taiwan operating offshore buoy stations.

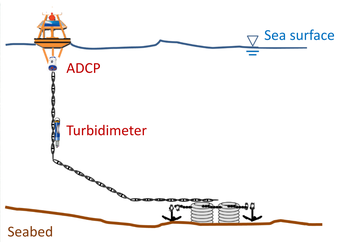
To ensure high quality data, COMC has developed a data QC system according to NOAA's standards. The system includes daily data QC, monthly data check and annual data comparisons. The system is embedded in all operating stations.





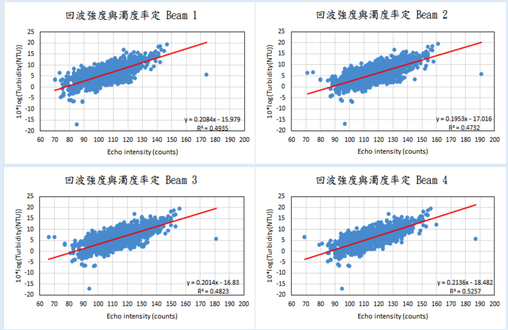
Wave heights observed during typhoon MEGI and MERANTI , Sep. 2016.

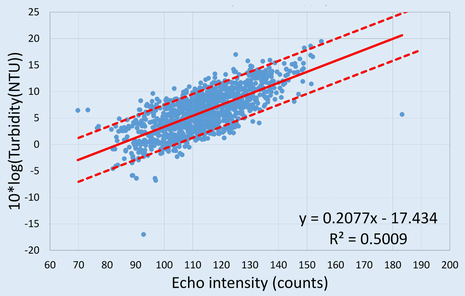




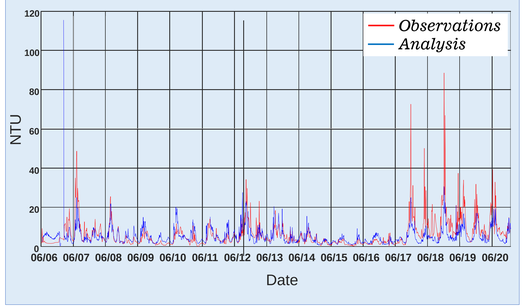
Field test

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 0.70. Using the relation between turbidity and echo intensity, the ADCP could be calibrated to yield depth profiles of turbidity, and then converted to SSC.



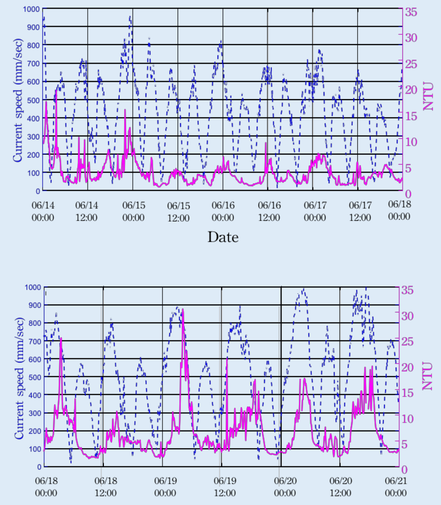


$$Turbidity = 10^{\left(\frac{-17.434+0.2077-E}{10}\right)}$$



Factor of causes high turbidity

The temporal variation of turbidity was compared with those of waves and tides. The comparisons reveal that in the Qigu area the strong tidal current often lead to high turbidity.



Summary and Outlook

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.

The ADCP was integrated with a metocean data buoy, so Tthe 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.