Characters of Sediments Distribution near Estuary of Cho-Shui River in Taiwan

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ABSTRACT

The characteristics of sediment transport occurring in the nearshore region are mainly produced by the interaction of the coastal morphological evolution and nearshore hydrodynamics from waves, wave-driven-currents and tidal currents. In this study, we discussed how various seasonal marine conditions can influence the characteristics of sediment transport in spatial and temporal with filed observations near the estuary of Cho-Shui River. The spatial distribution of grain size is decreasing alongshore from the estuary during summer, and is decreasing offshore from shoreline but no significant changing alongshore during winter. Comparing with the numerical simulation with DHI MIKE-21, it shows that sands banked up at estuary caused by an excess of river sediments transport with smaller grain size in summer, and that estuarine erosion results from the interplay of less river sediment transport supplied and hydrodynamic forcing scoured with larger grain size by waves in winter. In this paper, the different characteristic associated from seasonal marine conditions, river sediment transports, and estuarine morphologies have been discussed, and the influence of typhoon also analyzed.

KEY WORDS: Cho-Shui River, Sediments Distribution, MIKE-21

INTRODUCTION

Coastal and estuarine morphological evolution results from the interplay of nearshore hydrodynamic forcing, geological settings and river sediment transports. The relative importance of these three depends on how strong the nearshore forcing is. Where the nearshore dynamics is significantly strong, as on the estuary of Cho-Shui River Located at the narrowest channel of Taiwan Strait, it is easily found large tidal range, strong tidal current, strong wind wave, strong wind-driven-circulation and high river sediments transport as consequences of the forcing. For the requirement of coastal managements and appropriate developments in the feature, the establishment of the background environment database is very important. Field observations are an indispensable tool to quantify actual physical processes occurring in the nearshore region, such as wave transformation, tidal and nearshore current, sediment transport, and beach change. The major purpose of this study is to analyze this field surveys and associate with the others, and to gain sufficient understanding of the local morphodynamics process in this area.

Therefore, field data collection of Lin et al. (1997) based on sediments analysis, morphological investigations, and the studies of local coastal processes, shows that the littoral sediment transport at western Taiwan coast is highly dominated by nearshore hydrodynamics. Kostaschuk et al. (2005) used the acoustic Doppler current profiler (ADCP) shift principle, whilst the bottom tracking function and acoustic backscatter can be used to measure bed load velocity and estimate suspended sediment concentration. Lin et al. (2008) used Acoustic Current Profiler, Electromagnetic Current Meters and Turbidity Meters. Instantaneous bed shear stress and the vertical distribution of suspended sediment concentration in the surf zone are measured and analyzed. Those are vital resources to get information.

On the other hand, examples of combing the field data with numerical simulation are like, Chang et al. (1998) took development area into consideration with detail and prudence before building coast structure. Make use of numerical simulation in this study to discuss shoreline changing and sediment transport under condition that are the action of different meteorology and water characteristic in summer and winter. By very few past researches, [Chiang et al. (2008)] considered the effect of partial harbor constructions on topography change in a short-term period which maybe important information to harbor builder, and to establish a numerical model to predict the impact of the built harbor structure on topography changes during the construction period. Yang et al. (2009) used Nearshore Spectral Wind Wave model simulates wave refraction, shoaling and flow field change due to wave breaking. The results of Nearshore Spectral Wind Wave and Hydrodynamic models carry on the simulation together to obtain the flow field data and to confirm. Tsai et al. (2010) collected data of metrological, geophysical, and topographical factors around Taichung Harbor to build a data base for analyzing statistics of the wave, the tide, and topographical variations, etc. It can not only fulfill the lack of time and samples but establish prediction models and provide data for related projects.

Therefore, this study will use these field survey data, such as sediment transport, current, and wave transformation, to simulate the sediments distribution around the estuary of Cho-Shui River by DHI MIKE-21. Results can provide information to future development plans and coastal ecosystem protections.

FIELD OBSERVATION