Sand Bar Formation at a River Mouth after a Typhoon Attack

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ABSTRACT

A field investigation was carried out at Tenjin River mouth in Tottori Prefecture, Japan, in order to understand the formation of the sand bar change mechanisms after typhoon attack. A numerical model for predicting the sand bar formation is utilized. From field investigations and numerical model, the sand bar reformed rapidly due to large waves in the winter season. The position of the reformed sand bar was related to the direction of the wave energy flux and the scale of the terrace in front of the river mouth.

KEY WORDS: Numerical model, Field investigation, River-mouth bar, Sediment transport.

INTRODUCTION

Decrease of sand supply from a river-mouth causes shoreline retreat and coastal erosion. Some of the causes for the decrease of sand supply are the block due to river-mouth bar formation, and river improvement for flood control and river management. River mouth bar is formed mainly due to the interaction of wave action and river flow characteristics. The river mouth will be closed by bars when the river discharge is small. The closing of the river mouth affects the flooding due to rising water level and the coastal erosion due to decreasing sand supply from river. According to Sawaragi (1995), the topographic features around river mouths are roughly classified into four types. In a river-flow-dominating type, deltas and terraces are formed in front of the river mouth. In a wave-dominated type, a river-mouth bar and asymmetric bars are formed under normal wave conditions, and a longshore bar is formed under an extreme wave condition. The flow field characteristics around river mouths are extremely complex phenomena, as they are affected by an interplay of factors, such as river discharge, wave action, wave-induced currents, and tidal currents.

The Tenjin River mouth, located at the middle part of Tottori Prefecture and faces the Sea of Japan. It has a sand bar as shown in Fig 1.

The Tenjin River mouth is 14km long. The width of shoreline of the Hojyo Coast retreated 30-40 m from 1969 to 2003. In order to maintain to shoreline and preserve the coastal area, the morphodynamic mechanisms was river-mouth and source of the sand supply to the Hojyo Coast should be clarified. Kuroiwa et al. (2018) and Katayama et al. (2019) carried out a field investigation from July, 2015, to Dec, 2017. From the survey results, the mechanism for the short-term changes in river mouth topography under stormy and flooding conditions were examined. During the field investigation, the river-mouth bar was flushed away by attacking two typhoons in 2017. The sand bar was reformed due to wave actions in the winter season.