FIELD STUDY ON SEDIMENT TRANSPORT AROUND RIVER MOUTH OPENING AT THE TENRYU RIVER IN JAPAN

Yuya Sasaki, Osaka University, sasaki@civil.eng.osaka-u.ac.jp
Shinji Sato, Tokyo University, sato@coastal.t.u-tokyo.ac.jp

INTRODUCTION AND OBJECTIVE

The Tenryu River mouth and its surrounding coast, located on the Pacific Ocean side in the central Japan, have been suffered from severe coastal erosion. Although increasing sediment supply from river to coast is planned by sand-bypassing through the upstream dams in near future, a better understanding on morphology change around river mouth is needed to facilitate optimal management of the river mouth. Especially, understanding on sediment transport around the river mouth opening is essential to prevent river mouth closure which leads to many problems. The purpose of this study is to reveal the mechanism of sediment transport around river mouth opening.

METHODS

We have conducted frequent field surveys from July 2013 to October 2016. Shoreline and cross sectional profiles were measured during the field surveys. In addition to the field surveys, we have monitored the Tenryu River mouth with field cameras installed at around 25m elevation. The field camera recorded images at every 1.2 seconds or every 2 minutes. Combined with hydrodynamic data (Figure 1), following analyses were performed.

1) Analysis of the morphology change every few week or every few months based on measured topography
2) Analysis of the daily morphology change based on time averaged ortho-images generated from the recorded images at mean tide level.
3) Analysis of water behavior under various hydrodynamic conditions based on successive ortho-images and time-stack images of representative cross sections (Figure 2).

RESULTS AND CONCLUSIONS

Three kinds of major sediment transports and resulting morphology changes were observed around the river mouth opening. The first is gradual extension of the sand spit due to alongshore sediment transport, resulting in reduction of the opening (Figure 3). The second is erosion around the opening and accumulation at seaward side of the opening due to floods, resulting in enlargement of the opening. The third is onshore migration of the shoals due to overwash at high waves or high tide, resulting in reduction of the opening (Figure 4, negative impact) and recovery of adjacent shores (positive impact). These shoals emerged several weeks after floods.

Although both alongshore sediment transport and onshore migration of shoals led to reduction of the opening, the morphology change caused by the onshore migration of shoals was more sudden process and need to be paid more attention.

On the other hand, when waves were extremely high and mean water level was comparable to the height of shoals, the overwash significantly lowered the height of shoals partially, where became a new opening (Figure 5).

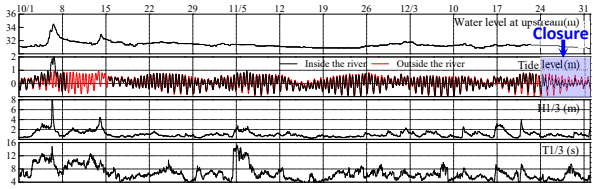

Figure 1 - An example of a time-series of hydrodynamics.

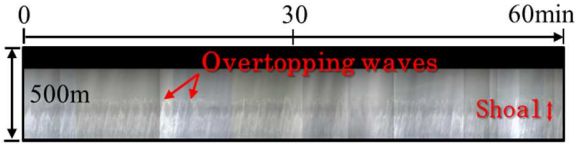

Figure 2 - An example of a time-stack image.

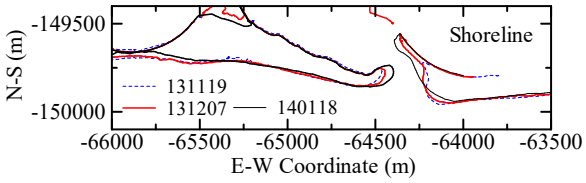

Figure 3 - Gradual extension of the sand spit.

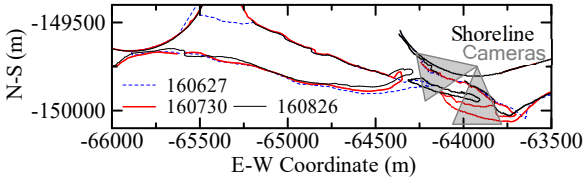

Figure 4 - Emergence of a shoal (from blue to red) and onshore migration of it (from red to black).

Figure 5 - Onshore migration of a shoal due to overwash and development of a new opening after high waves. Each of the three images is an ortho-image.