Ⅱ－1 Study on the Behavior of Shiribetsu River mouth Morphology and Water Level Fluctuation

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Introduction

Precise prediction of water level in the river mouth is important for flood inundation modeling in the vicinity of river mouth. However, the wave heights of water level rise in a river mouth at different locations are quite different from each other. These differences are due to the occurrence of wave set-up with distinct dependence on the geomorphology of river entrance (Tanaka et al., 2000).

In this study, instead of measured shoreline data of river mouth, the oblique photographs are introduced to investigate the quantitative relationship between water level rise and the area of sand spit.

Study Area and Data Collection

Shiribetsu River, which flows into Japan Sea from western Hokkaido, is used for this research (Figure 1). The catchments area and the length of the river are 1636 km^2 and 111.2 km respectively

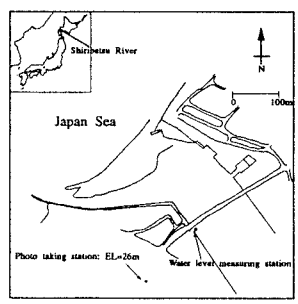


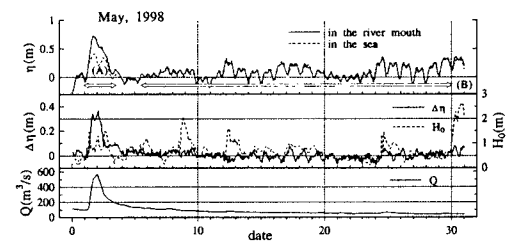
Figure 1: Location map of the Shiribetsu River mouth

Hourly water levels at the river mouth were collected and analyzed. The water level measuring station is close to the bridge (see Figure 1) and it is 300 m far from the river mouth. Fresh water discharge of Shiribetsu River was measured at Nakoma discharge measuring station 14.20km far from river mouth. Setana Port where tidal level and significant wave height were measured is about 60 km far from the river mouth towards southwestern direction.

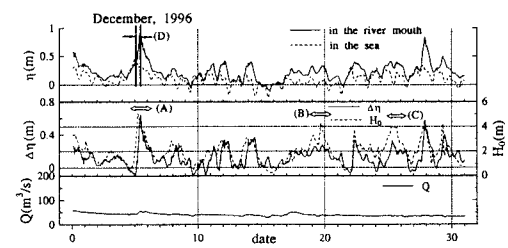
The oblique photographs are taken once in every two weeks for last 30 years from the top of a small mountain near the river mouth. The elevation of Photo taking station (see Figure 1) is about 26m.

Data analysis

Two periods of typical examples of water level variations at the Shiribetsu River mouth are depicted in Figure 2, along with tidal level at the Setana Port, wave height H_0, and discharge of the Shiribetsu River, Q. η and $\Delta\eta$ in Figure 2 indicate water level and difference of water level between in the river mouth and in the sea.



(a)



(b)

Figure 2: Time-variation of water level and discharge

In Figure 2(a), it is noted that the difference between these two becomes more considerable with the increase of the fresh water discharge ((A) in Figure 2(a)). At the end of this period, however, the difference becomes smaller again in accordance with the reduction of discharge ((B) in Figure 2 (a)). In contrast to this, the water level in the river

mouth shown in Figure 2(b) is distinctly different from tidal variation, being always higher than the tide. During the period shown in Figure 2 (b), the superelevation of water level in the river mouth shows very close correlation with the wave height, but no relationship with the fresh water discharge in the river. The time lag is depicted in (D) in Figure 2(b).

Wave set-up height data from January 1991 to December 1998 is used in this study. The wave set-up height data was selected when the significant wave height was higher than 2 m. (A) in Figure 2(b), (B) in Figure 2(b) and (C) in Figure 2(c) is the selected data on December 1996.

Results and Discussions

Oblique photographs (Photo1) can explain the approximate area of sand spit at Shiribestu River mouth. Photo 1(a) shows the fully developed sand spit at the right side of river mouth. Photo 1(b) shows that the sand spit flushing due to increase in discharge. These images can be used to detect the shape of the sand spit.

(a)

(b)

Photo 1: The oblique photographs of Shiribetsu River

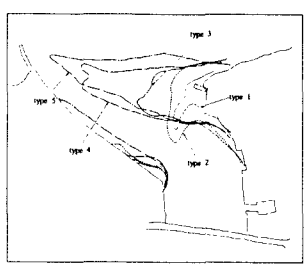


Figure 3: Schematic explanation for types

Using these images the geography of the river mouth was classified into five types (Figure 3). In general these five types represent the every state of the sand spit during the study period.The relationship between dimensionless wave set-up height and the sand spit type can be seen in Figure 4. $\Delta\eta/H_0$ is dimensionless wave set-up height (in Figure 4). From April to September, the wave set-up is not occurred ((A) in figure 4). However, from October to March, a lot of cases of wave set-up are observed at Shiribetsu River ((B) in Figure 4). It is noted that the sand spit changes ((C) in Figure 4) relates to the dimensionless wave set-up height ((D) in Figure 4). The dimensionless wave set-up heights of Shiribestu River distribute from 0 to 0.17.

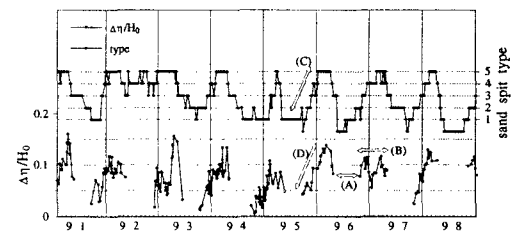


Figure 4: Relationship between dimensionless wave set-up height and sand spit type

Conclusions

Investigation of the water level, the fresh water discharge and sand spit at the Shiribetsu River entrance shows following results.

1) It is found that the quantitative relationship between dimensionless wave set-up height and the area of sand spit is strong
2) From the results, the prediction of sand spit in the river mouth is expected.

Acknowledgement

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Reference

Tanaka, H., Nagabayashi, H. and Yamauchi, K. (2000),"Observation of wave set-up height in a river mouth", *Proceedings of 27th International Conference on Coastal Engineering*, (in printing).