RESEARCH ON CHANGES OF TOPOGRAPHICAL FEATURES AND VEGETATION ON A SAND BAR DUE TO FLOODS

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The vegetation in a river channel plays an important role in the world's ecosystems; however, it also affects flood flow and the transportation of riverbed material. Growth of such vegetation is therefore important in river management. Recently, many researches on changes of topographical features and vegetation of river channels have been conducted and much understanding of them has been brought.

The Kita River in the northern part of Miyazaki Prefecture, Japan, is one of Japan's first class rivers. The heavy rainfall that occurred in 1997 caused severe flooding, resulting in severe damage to areas within the Kita River basin. A special emergency project to protect from further severe flood disasters was consequently executed. In this project, it was requested that the natural river environment be conserved, and also a fixed degree of safety against flooding be secured.

In Honmura district, the river bends at an angle of about 90° and a point bar has formed near the inner bank. The bar has been developing for a long time and has become a floodplain due to the deposition of gravel sediments transported from the upstream reach. The vegetation on the sand bar also has changed in response of floods. In this paper, past developing process of the sand bar and past changing process of vegetation on the bar were examined.

We clarified the developing process of the Honmura sand bar through past topographical changes and grain size distribution in depth of the sand bar. At the central part of the bar, it was found that two thin layers of fine sand with clay at 1.0 m and 2.0 m in depth were sandwiched between gravel layers. By considering the changes of the extent and the surface elevation of the bar, and the existence of new bar crest lines too, it was concluded that new sand bars had been formed on the old sand bar in response of the past major floods.

During major floods, the bar changes topographically and its vegetation is destroyed. At low flows and during minor floods, the vegetation grows naturally. Consequently, the vegetation on this bar follows a repeated cycle of destruction and restoration in response to the flow scale. We previously clarified the process of vegetation change due to flooding scale through monitoring research (Sugio et al. (2004), Sugio et al. (2004)); however, it is difficult to quantitatively analyze this process, because the degree of vegetation abundance is somewhat qualitative.

In this paper, to quantitatively reproduce the past cycle of destruction and restoration of vegetation on the bar in response to variation in flow discharge, we analyzed the relationship between the vegetation and scale of flooding by introducing a vegetation

index, VF. The vegetation index, which expresses a degree of vegetation coverage and abundance, was assumed to be a function of annual maximum river discharge. The values of vegetation index were determined from aerial photographs.

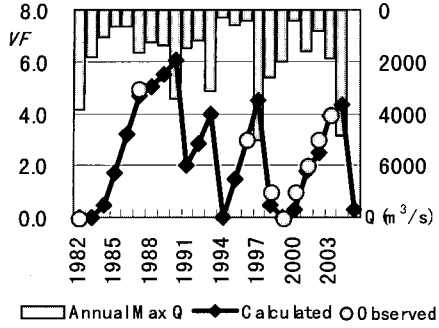

Fig. 1 Comparison of the annual vegetation index.

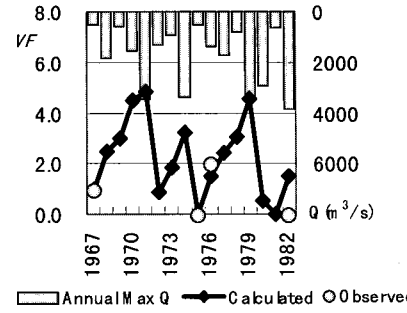

Fig. 2 Comparison of the annual vegetation index.

Parameter values of the equation were identified by trial and error using the observed vegetation index after 1982. The calculated vegetation index is shown in Fig. 1. The validity of equation was verified with the index between 1967 and 1982 as shown in Fig. 2. The difference between calculated and observed value in 1982 in Fig.2 is thought to indicate an artificial decrease as a result of construction.

Through changes in the vegetation index, changes in vegetation since 1967 were clarified, and it was revealed that a cycle of vegetation destruction and restoration lasted for almost six years in the Honmura sand bar as shown in Figs. 1 and 2. Moreover, though the vegetation between 1982 and 1996 could not be understood from aerial photographs, a presumption of the situation is possible from this calculation.

REFERENCES

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