論 文 要 旨

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論文題目	Responses of the fluvial geomorphic system to man-induced and natural impacts in Mid-Arakawa, central Japan

Various geomorphic changes have occurred in rivers which have been continuingly and/or increasingly influenced by human action, e.g., gravel mining, embankment, channel transfer, and dam and sluice construction. This study, consisting of 6 chapters, intends to interpret the processes involved in these man-induced geomorphic changes in the same way as natural fluvial processes. Examples were taken from geomorphic events which occurred during the recent 300 years in the alluvial-fan section of the Arakawa in the Kanto Plain.

Chapter 1 presented the background and purpose of this study.

Chapter 2 showed the outline of the studied watershed, which includes geomorphic characteristics and brief history of flood, gravel mining, and various river works. Available records on the river management prepared by administrative sectors were also reviewed.

Chapter 3 discussed the methods and the basic concepts used in this study. Important previous discussions on the concepts of equilibrium in river morphology and the systems approach to geomorphic processes were reviewed. Based on the review work, time and spatial scales in the fluvial geomorphic system were investigated in order to apply to this study.

In Chapter 4 it introduces (historical records) material to be used in the present study, said the results of the organized transition of flow and geomorphic change Mid-Arakawa section, flood history, for man-induced history.

Chapter 5, the geomorphic changes occurred in the alluvial fan in several large flood events were interpreted in the framework prepared in Chapters 3 and 4. In this interpretation, the cross-sectional area of flood in the canyon situated immediately upstream of the alluvial-fan reach was used as an indicator of flood magnitude. The cross-sectional area of each flood can be estimated from the trace of water level which is recorded in a monument in some old floods and restored from documents and interview to residents in relatively recent floods. At the same time, an uppermost overflow point in alluvial-fan reach in each flood was used as an indicator of geomorphic change, particularly the extent of deposition and erosion after the preceding flood, in the fan reach. Using these indicators, it was revealed that geomorphic changes in the alluvial-fan reach depend on not only the magnitude of the flood concerned but also the condition of debris accumulation continued from the preceding flood. For example, the uppermost overflow point in the 1859 flood, which was indicated as smaller than the 1742 one by the cross-sectional area, was situated near the apex of the fan instead of the mid-fan where the uppermost overflow occurred in the 1742 flood. It was understandable by considering the effect of continuing deposition of debris which was produced in the 1742 flood. The upstream migration of the uppermost overflow point was considered a response of the fluvial geomorphic system of the fan reach in which continuing deposition had been continued since the 1742 flood. The continued deposition was also an output of the system to the 1742 flood as a natural input.

Chapter 6 dealt with several artificial construction and destruction in and along the river channel from the viewpoint of human intervention to the fluvial geomorphic system. Combined analysis of the records of direct observation and measurement, records prepared by administrative sectors, and airphoto interpretation enabled the explanation of processes that human action affected both the tractive force and the amount of debris. River-bed degradation was induced by gravel mining which was continued until mid-1970s. The upstream extension of degradation induced the exposure of a concrete-made irrigation siphon which had been buried below the riverbed near the apex of the fan. The exposed siphon formed a kind of waterfall which induced localized over-deepening immediately below the

siphon. On the other hand the exposed siphon provided a local base level of erosion in the reach upper than the siphon. Degradation in the upper reach was resulted in the destruction of a sluice for irrigation in several flood events. The combined effects of over-deepening immediately below the siphon and the destruction of the sluice produced debris, which was transported downstream and developed a gravel bar several kilometers below. The processes of gravel-bar development were reconstructed by sratigraphic observation. A series of geomorphic changes as above was interpreted as both contemporaneous and delayed responses of the fluvial geomorphic system to a combined human action over a few decades.

In Chapter 7 it was summarized that several geomorphic changes which occurred in mid-Arakawa since 1742 were interpreted as outputs of responses of the fluvial geomorphic system to natural and man-induced inputs. The outputs were in many cases responded to not a single input but compound inputs. A systems approach is suitable to the analysis of processes particularly in compound cases which sometimes contain delayed responses. The results will contribute to more comprehensive management of riverine environment.

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