Development of method of predicting sediment-related disasters using real-time observations

(Research period: FY 2015 – 2017)

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1. Background and Objective

In Japan, information regarding early warnings for sediment-related disasters is produced using the relationship between rainfall and a preliminarily determined rainfall index. However, it is difficult to directly evaluate the severity of a sediment-related disaster because the amount of deposited sediments and the sediment dynamics in a watershed are not addressed in the information.

On the other hand, real-time observations of sediment transport has been conducted since FY 2009[1,2] by branch offices of the Sabo Department, MLIT, located all over Japan. We have analyzed the accumulated observations to understand the irregular changes in the trend in sediment dynamics and to develop a method for detecting trends since FY 2015. The purpose of this study is to develop a method of producing information about the potential for a sediment-related disaster using sediment transport observations.

2. Outline of research

Our previous research[3] indicated qualitatively that changing trends in bed-load and suspended-load in a sediment-related disaster were different from normal events. In addition, antecedent small sediment runoff occurred in the vicinity of deep-seated rapid landslides on the Kii peninsula in 2011.

Therefore, if we can quantitatively detect small runoff before sediment dynamics with the potential for causing sediment-related disasters, then there is the possibility of developing an early warning system that could prevent severe disasters. In FY 2016, we analyzed the relationship between observation parameters, such as bed-load transport rate – water discharge and increasing rate of bed-load – water level relationships, and separated these relationships into normal and abnormal events to understand the conditions for the detection of antecedent phenomena (Fig. 1).
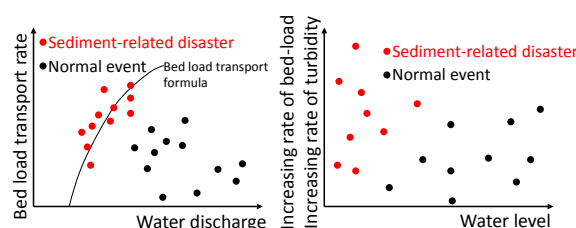

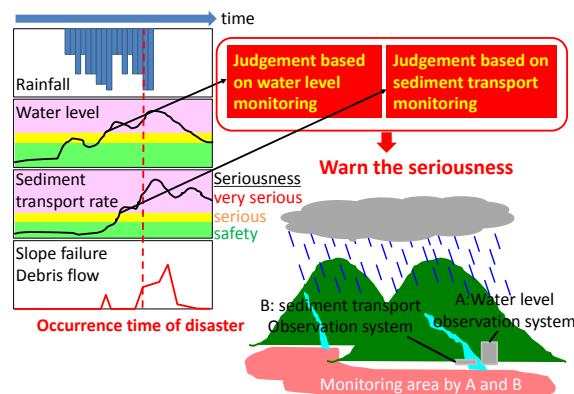Fig .1 Schematic diagram of the relationship between observation parameters

Fig. 2 Schematic of new early warning system for sediment-related disaster

3. Future perspectives

Using the results obtained in this research, reference values to judge the antecedent phenomena of sediment-related disasters will be determined for each watershed and its effectiveness will be tested. Finally, a high precision, new early warning system for sediment-related disasters will be proposed (Fig. 2).

[Reference]
1) Technical note of NILIM No. 886 (In Japanese and English abstract)
2) Technical note of NILIM No. 887 (In Japanese and English abstract)
3) Doboku Seko (In Japanese) Vol. 57, No. 6, pp. 14 – 17