Proposal for Method of Forecasting Sediment Disasters by Long-period Continuous Rainfall using Sediment Transport Hydrological Observation

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1. Background and purpose

Warning and evacuation information concerning sediment disasters is prepared and issued based on rainfall but is hard to transmit urgency and does not necessarily lead to evacuation. Further, in the 2011 Kii Peninsula Flood Disaster, etc., it was observed that an abnormal sediment run-off that is not usually observed around the stricken area occurred before the occurrence of sediment disaster. Accordingly, we have conducted this study considering that if such abnormal sediment run-off can be observed, it would be possible to detect rise in the risk of sediment disaster and to issue information that communicates the urgency of sediment disaster more clearly. Specifically, we checked to what extent the event of abnormal sediment run-off was perceived in the recent disasters and confirmed whether such abnormal sediment run-off can be detected by the real-time sediment transport hydrological observation of mountain rivers, which has been conducted by river basin sabo offices in the country.

3. Study outline and results

For ten recent disasters caused by heavy rainfall, we organized data on the number of events of abnormal sediment run-off perceived, such as water turbidity and sound of sediment transport before the disaster, as well as time lag until occurrence of the disaster (Figs. 1)[2]. In organization of data, disasters were classified into those caused by intensive rainfall in a short period (Nagiso Disaster etc.) and those caused by continuous rainfall in a long period (Kii Peninsula Flood Disaster, 2012 Aso Disaster, etc.). First, the event of abnormal sediment run-off was perceived before occurrence of the disaster in 8 out of 10 disasters. In the long-period continuous rainfall, the number of events of sediment run-off perceived and time lag until occurrence of the disaster were both greater than those in the short-period intensive rainfall. This shows that abnormal sediment run-off is often seen before occurrence of the disaster in disasters caused by long-period continuous rainfall.

We also organized the relationship between sediment discharge and water depth in a flood where debris flow occurred in the upstream and a flood where no debris flow occurred using the data obtained from observation of the Yotagiri River in the Tenryu River system (Fig. 2).[2] The envelope was experientially determined based on the observation results of past floods where debris flow did not occur. It shows that plots are located in the upper left of the envelope when debris flow occurred. Accordingly, it was found that the possibility of detecting occurrence of abnormal sediment run-off due to occurrence of debris flow etc. in the upstream is high when focusing on the magnitude relationship of observation data and envelope.

3. Future perspective

In the future, we continue the verification of flexibility of the method above and study a method applicable even to basins on which data accumulation is insufficient.

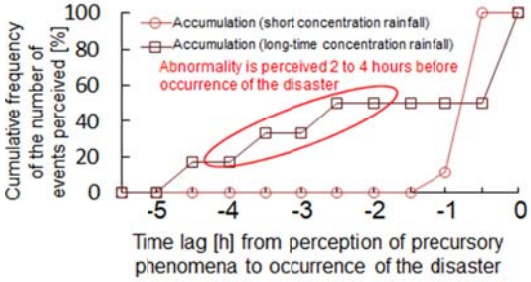

Fig. 1. Time of occurrence of precursory phenomena related to sediment run-off

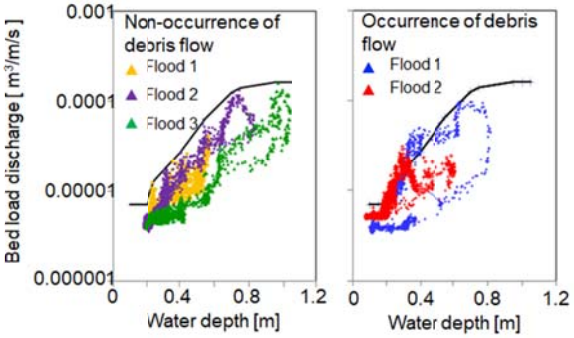

Fig. 2. Relationship between sediment discharge and water depth (Yodagiri River)

☞**See the following for details.**

1) Collection of Summaries on the 2018 Japan Society of Erosion Control Engineering Research Presentation Meeting, pp. 679-680

2) Geomorphology, Vol.306, pp.198-209