Study on Method for Prediction of Sediment Yield during Torrential Rain by Physical Model

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Sabo Department, Sabo Planning Division

Head (Ph.D. in Agricultural Science) YAMAKOSHI Takao, Senior Researcher TANAKA Yasutaka, Guest Research Engineer YOSHIDA Takumi

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1. Introduction

MLIT has promoted research on prediction of areas at risk of surface collapse by physical models. It is considered possible to predict the amount of sediment yield necessary in sabo projects by using a technology for identifying slopes at risk of surface collapse called H-SLIDER ("Hillslope scale shallow landslide-induced debris flow risk evaluation method"). Therefore, the amount of sediment yield predicted by the physical model and the sediment yield actually produced by ground surface collapses during the Heavy Rain Event of July 2018 were compared, and the usefulness of prediction of sediment yield by the physical model was examined.

2. Method

The object of this study was four river basin areas (Fuchuokawa, Misoogawa, Hatakakagawa and Yaguchigawa Rivers) in the eastern part of Hiroshima City where collapses occurred as a result of the torrential rain in July 2018. Slopes at risk of surface collapse were identified by using H-SLIDER, and the existing results of soil tests and cone penetration tests were used as parameters of the calculations. For the amount of rainfall, the X-band radar rainfall amount was given as the input condition. Rainfall was also given by probability scale, and the reproducibility of sediment yield in small river basin units and the characteristics of increased sediment yield by rainfall scale were arranged.

3. Results and Discussion

In the case of secondary watersheds, when the physical model and actual data were compared, sediment yields of approximately the same order were estimated by the model. However, it cannot be said that compatibility in calculation mesh units was satisfactory.

When rainfall was given by probability scale, the results of the sediment yield generated by surface failure changed corresponding to the scale of rainfall. Because this was an estimate by a physical model, and not an empirical formula, the technique used in this study is considered to be effective for analyzing the impacts of climate change in the future. In addition, these results showed a tendency to reach a peak. In case a physical model is used, it is suggested that the upper limit value of sediment yield is decided by the distribution of site conditions such as the thickness of the soil layer, etc., even if the amount of rainfall increases. This indicates that is also necessary to take site conditions into account when considering the increase in sediment yield due to climate change.

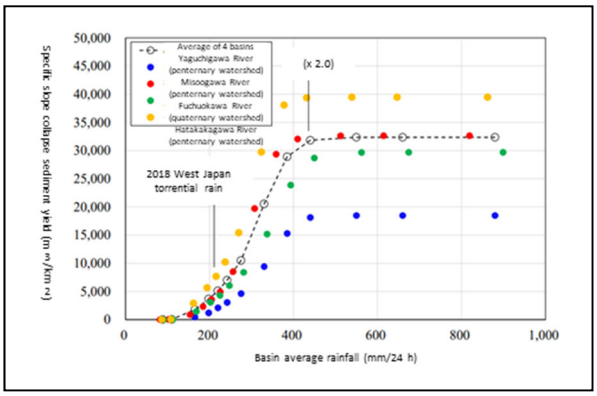

Fig. Relationship of cumulative rainfall and specific slope collapse sediment yield

4. Conclusion

Although the possibility of predicting sediment yield by the physical model also depends on the accuracy of estimations of the distribution of site conditions in the target river basin, this research confirmed the possibility of such predictions. Issues for the future include improvement of accuracy in setting site conditions and the possibility of application when drafting sabo plans.

☞For more information:

1) TECHNICAL NOTE of the National Institute for Land and Infrastructure Management No. 1048
https://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn1048.htm