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# Establishment and Application of Early Warning System for Flood and Debris Flow Triggered by Rapid Erosion of Natural Barrier

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A large amount of mass of land from a mountain slides into a gorge and a river, depositing on the bed. The formation of such natural barrier provides a dam called “a natural dam”, allowing water to accumulate in the upstream. People living in the downstream of basin are at risk of flood triggered by the dam break. Recently, many people have been at such risk emerged by earthquakes and heavy rainfall therefore they have been requesting to establish an early warning system for such flood risk.

By analyzing the past case of the formations and the natural dam breaks in Japan, it was found that the surface flow on the natural dam eroded the deposition rapidly and the accumulated water and the deposition started to flow downstream in many cases. So that an alert should be issued by forecasting when the accumulated water in the upstream starts to flow on the deposition. In order to forecast the timing, we have to take into consideration of the difference between the water volume of flowing to the lake from the upstream basin and that of seeping into the deposition. Our final target is to develop a method for estimating the two previous quantities. In the first step, we report the result of analysis of the past cases in Japan.

We focused on the two natural dams in the Yuhama village in Miyagi prefecture and in the Nagatono village in Nara prefecture. The natural dam in Yuhama village was formed by a deep-seated landslide triggered by the earthquake in 2008, and the natural dam in Nagatono was formed by a deep-seated landslide triggered by heavy rainfall in 2011. In the Yuhama case, the water level of the accumulated water had been rising until it reached to the top of the natural dam. In the Nagatono case, the water level had been rising during rainfall, however the water level had been dropping after the rainfall. The difference between the water volume of flowing in and that of flowing out from the natural dam caused the tendencies. We are going to analyze the soil features of the two natural dams and to clarify the process of the seepage in the natural dam in order to establish a sophisticated method for the early warning system.