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深層崩壊に起因する土石流の流下過程に関する数値計算
Numerical Simulation for Run-out Process of Debris Flow Triggered by Deep Catastrophic Landslides

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Deep catastrophic landsides have triggered large-scale debris flows that have had serious impacts on humans. Therefore, it is important to predict the run-out process of debris flows and to identify debris flow hazard areas. However, previous studies have shown that the commonly used debris flow numerical simulation models may not be applicable for debris flow triggered by deep catastrophic landslide.

Most models used to describe run-out process of stony debris flows assume that they consist of solid and fluid phases. Some researchers have suggested that the motion of fine sediment in large-scale debris flows is similar to that of the interstitial water, which means the fine sediment in large-scale debris flows might be considered to fluid phase rather than solid phase.

In this study, we tested the hypothesis for behaviors of fine sediment and developed a technique for simulation of deep catastrophic landslide-triggered debris flows. We developed new methods to evaluate key parameters to simulate deep catastrophic landslide-triggered debris flows, such as sediment concentration, fluid density, and representative particle diameter and modified the continuity equation for sediment.

To test our model, we conducted detailed field surveys of the past debris flows triggered by deep catastrophic landslides by using topographic data from LiDAR imagery, porosity measurements of soil and weathered bedrock and the grain size distributions of the debris flow sediments.

Using these new data and methods, we conducted numerical simulations of five recent debris flows occurred in Japan in the unified method which we developed. Although the volume of these landslides and travel distances of these debris flows were various, their simulated results reproduced well the observed erosional and depositional patterns if when the concept of fine sediment behaving like fluids was included in the numerical simulation. It showed that the proposed method for debris flow numerical simulation in this study could be applied to predict run-out process of deep catastrophic landslide-triggered debris flow.

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