Characteristics of Debris Flows that Occurred in the Osawa-gawa River of Mount Fuji

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INTRODUCTION

In estimating the range of debris flows in volcanic area, it is necessary to study estimation methods considering characteristics of sediment flow including pyroclastic materials by eruption. Therefore, we examined the characteristics of debris flow by recalculating the debris flow occurred in November 21, the largest scale in observation history of Oosawa-gawa River of Mt. Fuij.

Overview of debris flow that occurred on November 21, 2000

At around three o'clock on November 21, 2000, the sediment stream from Osawa Failure, the source head of the Osawa-gawa River, became a debris flow due to snowmelt and rainfall (a continuous rainfall of 260 mm at Otaki observatory at 1,700 m above sea level). And that sediment reached the Osawa alluvial fan in the downstream area while muddy water reached the Urui-gawa River downstream. According to VTR image analysis, the peak flow rate reached 1,424 m3/s at the Iwadoi (at around 900 m above sea level). Longitudinal and lateral measurements show that about 280,000 m3 of sediment accumulated on the Osawa sandpocket in the Osawa alluvial fan , and about 50,000 m3 of the sediment flowed downstream. *1In order to manage standardized appearance and structure of the abstract for the symposium proceedings, the editorial board strictly demands authors to follow the instructions below:

Overview of simulation method

Multiple methods are recommended as simulation of debris flows. In this examination, we used New-SASS (developed by the Sabo & Landslide Technical Center), in which debris flows are handled as dilatant fluid, and simultaneous equations are created according to the resistance rule and continuity. We set hydrographs and parameters such as representative grain size from actual results. In this model, as a resistance rule of debris flows, shearing stress caused by particle collision and disturbance of interparticle hydrodynamic force are handled as an internal frictional angle with respect to the particle collision. As a result of analyzing the mechanism of massive debris flows, Matsumura and Mizuyama*2 show that when the sediment concentration is about 0.3, Reynolds stress due to the disturbance of interparticle hydrodynamic force stands out and the apparent internal frictional angle becomes small. So that, we used five internal frictional angles: 35° of static internal frictional angle, 18° obtained from Bagnold's test result, 12° obtained from debris flows reproduction calculation at Mt.Unzen-fugendake, 6° and 24° as comparison.

Result of reproduction calculation

Tab. 1 Comparison of sediment volume passing through each point (including void) (m^3)

Point	Actual result	Internal frictional angles				
		6°	**12°**	18°	24°	35°
Iwadoi	**222,893**	224,000	**224,000**	224,000	224,000	224,000
No.9 goroundsill	**392,427**	237,634	**229,754**	120,813	30,952	9,603
No.8	**324,298**	251,244	**231,943**	76,028	23,991	8,488
No.7	**242,790**	266,535	**200,563**	31,651	14,344	6,795
No.6	**221,583**	284,300	**154,873**	33,321	19,330	8,299
No.5	**193,333**	297,485	**97,359**	21,473	10,720	3,953
No.4	**80,898**	253,477	**16,257**	1,411	1,496	815
No.3	**85,967**	256,646	**16,759**	6,909	6,059	2,801

The sediment volume passing through each point of Osawa sandpocket is shown according to the actual results and the value simulation of five cases.

In the cases with an internal frictional angle of 24° and 35°, sediment accumulated immediately below Iwadoi which is the calculation starting point, and the result of sediment accumulation are not reproduced within the Osawa sandpocket. In the case of an internal frictional angle of 12°, the passage sediment volume was reproduced best, and the results of sediment accumulation upstream from No.5 point are well reproduced.

Consideration about characteristics of debris flows in the Osawa-gawa River of Mt. Fuji

The characteristics of the debris flows that occurred on November 21, 2000 was (1) the debris flow had a sediment volume of 300,000 m^3 or more and a peak flow rate of 1,424 m^3/s, which are comparatively massive, and (2) it contained a lot of fine-grained pyroclastic materials. As a result there was remarkable disturbance from interparticle hydrodynamic force compared with particle collision in the shearing stress and it had a high flowability. And the sediment flowed into the Osawa sandpocket(average river bed gradient of 1/14 to 1/20) and accumulated. This suggests that the internal frictional angle must be set to about 12° to reflect these factors in the simulation.

CONCLUSION

Debris flows that occur in a volcanic area have a high flowability and reach a mild slope. We confirmed from reproduction calculation of debris flows that occurred in the Osawa-gawa River that it is effective to set the apparent internal frictional angle not to a static frictional angle of 35° but to about 12° in order to reflect the characteristics in the simulation.

REFERENCE

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