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# Energy dissipating effect of forests on the flowing avalanches -Numerical simulation over the terrain of Makunosawa-

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Energy dissipating effect of forests on the flowing avalanches is considered to depend on such as type and scale of the snow-avalanches, kinds, ages, stem diameters, and stand density of trees consisting of the forests, and topographies. But, the relationships among them have not been investigated. Then, the forest effects on the disaster reduction for avalanches have been known empirically but are not known quantitatively. The large-scale dry slab avalanche occurred in the Makunosawa valley in Myoko in February, 2008 and damaged many trees. It was found that the avalanche seemed to stop in the forest and not pass through the forest. Then we could obtain a dataset of an avalanche with forest damage.

In this study, avalanche flow was simulated over the terrain of the Makunosawa valley using the numerical model TITAN2D, in order to verify the effect of forests on reducing velocity and stopping the avalanche of the Makunosawa valley. In the simulations, forest was distinguished from open area without forest by giving the larger bed friction angle. The bed friction angle were regarded as 25 degrees in the forest and 13 - 14 degrees without forest through trial and error according to the actual position of the farthest reach of avalanche, avalanche paths and avalanche velocity estimated from the bending stress of the broken trees. In result of the simulation, if the forest had not existed, the avalanche might have reach 200 m farther than the actual reach in the forest. The distinct effect of forest was shown.

Keywords: snow-avalanche, forest, numerical simulation, Makunosawa-valley