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# Laboratory rainfall simulation for surface runoff generation on tephra-covered slopes with different fine particle content

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After pyroclastic materials are deposited in a watershed following a volcanic eruption, the risk of debris flow initiation may increase during subsequent rainfall events. Clarifying the rainfall-runoff process on tephra-covered slopes is essential to understand the mechanism of debris flow initiation after an eruption. Because the quality and quantity of pyroclastic materials vary from volcano to volcano, and from eruption to eruption of the same volcano, each rainfall-runoff process is expected to differ accordingly. Laboratory rainfall simulation is useful to highlight parameters (rainfall and sample conditions) that may affect the surface runoff process on slopes during and after a volcanic eruption. In this study, a laboratory experiment was conducted using a calibrated rainfall simulator to investigate how the occurrence of surface runoff during the first rainfall after an eruption depends on the fine particle content. Pyroclastic material was volcanic ash collected on Mount Sakurajima, Japan and the fine particle content $F_c$ was adjusted using artificial silt: Sample A ($F_c$ = 20%, control) and Sample B ($F_c$ = 30%, adjusted). The experimental plots (1723.4 $cm^2$ of the projection area) were prepared by filling each sample with a 5 cm thickness at a constant pressure on highly permeable silica sand, and placed at an inclination of 10°. The initial moisture condition of both samples was assumed to be dry (≈ 5% of water content ratio). The rainfall simulation was performed for 3 hours on each sample at an intensity of 30 mm $h^{-1}$. Runoff water including sediment from the experimental plot during the simulation was captured at the lower end of the plot and the weight was recorded. Two soil moisture sensors were buried 2.5 cm below the surface of each sample to measure the change in volumetric water content (VWC) over time. Runoff water including sediment occurred and increased with time on Sample B though hardly occurred on Sample A. In both samples, the VWC increased with time and eventually approached a constant value. However, the maximum value of the VWC, and the time to reach the maximum value, were different; lower and slower in Sample B. The saturated hydraulic conductivity of Sample B was one order of magnitude lower than that of Sample A. These comparative results suggested that surface runoff may be greater during the first rainfall after an eruption because the infiltration is lower when the fine particle content, that is particle size distribution, in pyroclastic materials is high.