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A method to find locations where debris flow can exceed ridges in volcanic areas in Japan

Fumiaki Akazawa¹, Naoki Fujimura¹, Hiroaki Izumiyama², Yuya Takahashi¹, Hideaki Mizuno¹

¹Volcano and Debris Flow Research Team, Erosion and Sediment Control Research Group, Public Works Research Institute, Japan

²Sabo Planning Division, Sabo Department, National Institute for Land and Infrastructure Management, Japan

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In October 2013, debris flows that occurred in Izu-Oshima Island, Japan, exceeded a small undulation ridge, spread and caused large damage. In the river basins in volcanic areas (e.g., Izu-Oshima), there are small undulation ridges that have not been dissected. There is a risk of future debris flows exceeding these ridges, creating potential hazard areas. Therefore, conducting surveys to determine if mountain streams have such ridges is necessary. In this study, we proposed a simple method of detecting such ridges and applied it in Izu-Oshima. We assumed that debris flow exceeds a ridge when the debris flow flows straightly, collides with a ridge where the flow path is curved, and has the energy to exceed ridge. Under this assumption, we devised a method of locating the point where the flow path meets a large curve and determining whether the debris flow has the energy to exceed the ridge. To locate the point where the flow path meets the large curve, we determined whether the angle of the flow path was larger than a threshold angle. To determine whether the debris flow exceed we compared the total head before collision with elevation of the ridge. The total head before collision was expressed as the sum of the velocity head, pressure head and elevation head. If the sum of the velocity head, pressure head and elevation head in before collision is higher than elevation of the ridge, it can be interpreted that the debris flow exceeded. As a result, the method proposed in this study determined that the debris flow exceeded the ridge at points where the debris flow actually did exceed. Therefore, the proposed method is considered to be an effective tool for locating points where debris flow has exceeded the ridge.