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Flume investigation of cylindrical baffles for dissipation of debris flow energy

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A debris flow with a high speed along valleys has been reported to cause serious damages to urban area or infrastructure. To prevent debris flow disaster, countermeasures for flow-impeding structures are installed on the flow path of debris flows. Recently, an installation of cylindrical baffles which are open-type countermeasures has increased because of a low construction cost, filtering out rocks, and an increased hydraulic continuity. However, a comprehensive design guideline for specification and arrangement on cylindrical baffles has not yet been suggested. Moreover, the design of baffle installation is mainly based on empirical approaches as the influence of baffle array on debris mobility is not well understood. In this study, to investigate the effect of cylindrical baffles on the flow characteristics of debris flow, a series of small-scale flume tests were performed according to the varying baffle height and row numbers of installed baffles. High-speed cameras and digital camera to record the flow interaction with baffles were installed at the top and side of the channel. To reproduce the viscosity of debris flows caused by fine-grained soil in the flume, glycerin was mixed with debris materials (sand and gravel). After the test, the velocity and energy dissipation according to various baffle arrays were estimated. Test results showed that the installation of baffles reduced the frontal velocity of debris flows. Furthermore, taller baffles also increased the effect of the energy dissipation in debris flows, but additional rows of the baffle did not have a major effect on the energy dissipation. Thus, increasing the height of baffle led to an increased efficiency of energy dissipation of debris flows.