Influence of grain-size distribution on formation of debris-flow fan

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Accurate prediction of debris-flow fan formation is critical to sediment disaster mitigation because most damage from debris flow occurs in the inundation area. Although actual debris flows include a diversity of grain sizes, assessment is generally based on numerical simulation results for monogranular debris flows. This study conducted flume tests of debris flows using 0.08 m^3 of sediment particles that were either monogranular (2.65 mm) or a mixture of seven diameters (0.7 to 6 mm; average size of 2.65 mm) and compared formation processes of debris-flow fans to examine the influence of grain-size distribution. Channels (15˚, 10 cm wide) with a deposition area (12˚ to 6˚) were used for the experiments. We captured the development of the debris-flow fans using photographs and videos made by digital cameras and used the techniques of Structure from Motion (SfM) and Particle Image Velocimetry (PIV) to monitor debris-flow fan formation and flow regimes. As a result, monogranular debris flows produced an approximately symmetric debris-flow fan. In contrast, multigranular debris flows produced an asymmetric debris-flow fan, and the topography and range differed in each case. These results suggest that grain-size distributions of debris flows affect the process of debris-flow fan formation.

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