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An investigation of two-phase grain-fluid model on the development process of debris flow fan

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The movement of a debris flow is channelized by the mountain topography. It slows down and begins to deposit, forming the so-called debris-flow fan, when the slope is gentle. Since the flow body is composed of solid grains with interstitial fluid, the solid fraction may vary and plays a crucial role in the deposition process. In the present study, an entrainment-deposit law together with the two-phase model for grain-fluid flows (Tai et al., 2019) is proposed for describing the development of a debris flow fan. The model equations are derived in a terrain-following coordinate system, in which the coordinates are in coincidence with the topographic surface and the deposition/erosion is treated as the sub-topography. Numerical validation is performed against flume experiments (Tsunetaka et al., 2019), where the sediment-water mixture is released from a channel and merging into a gentle inclined flat plain via a steady water inflow. In this study, we shall illustrate the impacts of the sediment concentration on the evolution of the debris-flow fan, such as the location, distribution, geometry of debris-flow fan as well as the flow paths.