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Dynamic evolution of debris flow grain composition

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Debris flow is composed of solid grains of different sizes. the characteristics of grain size distribution reflect the movement mode and dynamic conditions of the fluid, and have different effects on the movement of debris flow. Due to the high variability of debris flow materials, the granular interaction is bound to affect the fluid properties. The grain size distribution (GSD) of debris flow satisfies the formula: $P(D)=CD^{-\mu}\exp(-D/D_c)$, where, GSD parameters μ and D_c can comprehensively reflect the change of grain composition. with μ reflecting the structure and variation characteristics of fine grains, and D_c reflecting the range of grain size. Field surveys in various regions indicate that the GSD parameters are distinct in materials of flow, source, and deposition. The GSD parameters of source soil and deposition soil are random and discrete, while the GSD parameters of fluid samples show obvious negative power function form: $D_c= a\mu^b$ (Figure 1). This shows that the grain composition of debris flow contains some dynamic information. In this paper, we use natural soil materials in a typical debris flow valley to conduct a series dynamically mixing and rotating experiments to simulate the flow evolution, and explore the change of grains under the action of dynamics and the effect of grain adjustment on the mobility of debris flow. The results show that the GSD shows a significant regularity after dynamic rotation. The specific performance is that μ and D_c change from the initial random discrete state to negative power correlation (Figure 2), and the appearance of this correlation corresponds to the best mobility of debris flow. At the same time, the Malvern laser grain size analyzer was used to analyze the specific surface area of fine grains (<0.20 mm) in the dynamic rotation experiment. The results show that with the increase of dynamic time, the specific surface area increases according to power law, and when the time reaches about 100 minutes, the growth slows down, and the specific surface area changes little. The experimental results are helpful for a deep understanding of the dynamics of debris flow.