Granular flow in a varying width rotating drum

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A landslide is a form of mass move abruptly, and that is prone to be triggered by an earthquake or high intense rainfall. Rapid flows of granular materials on inclined surfaces are often encountered in engineering applications, and also found in geophysical situations.
In this study, we focused on the variation of three-dimensional fluid velocity and the volumetric solid fraction in varying width channel. We have conducted experiments with a 40-cm-diameter grainflow-generating rotating drum designed to simulate simplified landslide. The rotating drum was half filled with 2 mm-diameter grains, which formed a thin grain-avalanching layer. The channel width was varied along the flow direction from 4 cm to 8 cm. The motion of moving particles was recorded by a high-speed camera with 1920x1080 resolution. A parallel laser system was used to reconstruct the position of particles, and particle tracking velocimetry (PTV) method was applied to construct three-dimensional velocity field. Also, by using the same laser system, the volumetric solid fraction was measured. (fig.1). In the end, we verified our results with granular flow theory prediction.

Keywords: granular flow, rotating drum, three dimensional velocity field, volumetric solid fraction