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An inversion method to extract basal friction law of granular flows and snow avalanches

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The aim of this work is to develop an inversion method allowing to extract basal friction parameters from snow avalanches. To develop this method, granular flows on an incline covered by sand paper (typical roughness size is 500μm) are used. The granular material is composed of glass beads of 1.1 mm diameter. A controlled volume of granular material is released by retracting a gate of 35 mm height. On the upper and steepest part of the incline, the front velocity of the flow is measured by image capture (30 frames/s). At three locations, the flow height and the Lagrangian velocity are measured with infrared distance sensors and the Particle Image Velocimetry technics, respectively. On the lower and less steep part of the rough incline where granular flow decelerates and stops, the front velocity is also measured by image capture. The shape and the thickness of the deposit is determined with an accurate four fringe shifted Moiré method. A Saint-Venant code is used as a direct model to simulate the granular experiments. From the measurements and an optimization/inversion method, best estimates of basal friction parameters are extracted. In order to discuss and validate this inverse approach, an external determination of the rheology of the granular material is performed using Hstart and Hstop curves constructed under the same basal surface roughness.