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Flow behaviour of snow in a rotating drum

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Snow, rapidly moving in an avalanche, transforms along the avalanche path, and consequently changes the flow behaviour over time. Recent studies showed that this expected change is particularly pronounced at temperatures above -2°C. Since investigations in the field are connected to considerable challenges, we aim to investigate the flow behaviour and the dynamic transformation of snow continuously at (relatively) controlled boundary conditions at a scale as large as possible. We therefore create a continuous movement of snow in a vertically rotating drum with a diameter 2.5 m and a rectangular cross section of 0.45 m. Experiments in our outdoor facility were carried out at temperatures below freezing and at tangential velocities between 0.1 and 1 m/s. To avoid basal slip semi-circular roughness elements with a height of 1 cm were installed. We present results of measurements of snow temperature, the liquid water content of snow, as well as flow geometry, basal normal stress distribution, and bulk shear stress over time. Furthermore we link the thermal energy increase to the equivalent vertical travel distance of the flow. The outcomes of this study shall increase our understanding of the material snow and consequently contribute to an improved model building for avalanche simulations.