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Sub-seasonal pressure, geometry and sediment transport changes observed in subglacial channels from the analysis of seismic ground motion

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Water from ice melt and precipitation that flows to and pressurizes the base of glaciers contributes to glacier and ice sheet acceleration. Predicting acceleration and its impact on ice mass loss and sea-level rise under global climate warming therefore requires knowledge of subglacial channel evolution and water pressurization, which remains limited by a lack of observations. Here we show that ground motion caused by subglacial channel flow at Mendenhall Glacier (Alaska) can be used to recover simultaneously basal water pressure, channel geometry and sediment transport throughout the melt season. We provide observations of the interplay between these physical quantities and discuss the implications for glacier sliding and erosion. By constraining the physics of subglacial hydrology, our framework and its application to outlet glaciers of the Greenland and Antarctic ice sheets may lead to more reliable predictions of ice flow, sea level rise and subglacial erosion rates.