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"3S Sonic Snow Sensor" - A prototype acoustic snow penetrometer

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High-resolution snow penetrometry has resulted in an improved understanding of the mechanical and stratigraphic properties in a snowpack. However, the necessaryly very sensitive force sensor is not suitable for mass production, and the application of these instruments is limited to research. Here, we present a prototype of an acoustic penetrometer, which measures the sound produced at the tip of the penetrating rod - an indirect method of measuring the bonding of the snow structures. We observed that snow produces a characteristic sound when a probe is inserted. The amplitude and spectrum seems to be characteristic for different snow types. We developed different prototypes using a microphone encapsulated in the tip of the probe, and tested different drive mechanisms. We also compared the signal to traditional high-resolution penetrometry and snow profiles. The first results show a very good correspondence between sound and force. We are currently trying to replace the drive system with a hand-pushed system, where distance is measured using accelerometers and the resulting acoustic amplitude profile is visualized with depth on a small handheld-screen . Such a probe could ease the rapid and precise measurement of snow properties for practitioners in avalanche warning.