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Continuous monitoring of acoustic emissions in an avalanche start zone

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The deformation of most solids is associated with the rapid release of elastic energy in the form of acoustic waves. In snow, the breaking of bonds between snow crystals and the formation of cracks results in the release of such acoustic signals. Previous research has shown that there are low frequency acoustic signals emanating from a natural snowpack. However, the relation between these signals and the stability of the snowpack or meteorological conditions has remained elusive. For this study a geophone was placed in an avalanche start zone to continuously monitor acoustic emissions. For good acoustic coupling between the sensor and the snow, the sensor is placed in a foam housing in order to match the acoustic impedance of snow. The housing also acts as a waveguide and preliminary testing showed that it improved the sensitivity of the sensor by a factor of two. Furthermore, in order to minimize signal degradation, the sensor output is digitized at the sensor using a digitizing board with a low noise amplifier and 24 bit A/D converter sampling at 500 Hz. These data are then sent to a single board computer for storage. In order to relate the recorded signals to local meteorological and snowpack data, the sensor was placed in close vicinity to a weather station measuring temperature, humidity, snow depth, wind direction and speed, and snowpack stability data were collected regularly in the area.