

A Simple In Situ Sensor for Snow Grain Size Measurement

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ABSTRACT

Grain size is an important standard parameter required for models that simulate the evolution of the microphysical state of a snowpack, energy and mass balance, or radiative transfer for remote sensing. Determining the size of a grain of snow is subjective and complex requiring practice. A typical method is to measure the dimensions of sample snow grains on a grid under magnification. However, removal of grain clusters frequently breaks their structure apart, causing underestimation. Subjectivity of measurement is introduced through the selection of which grains to measure; this introduces bias in the measured grain dimension statistics. To attempt to overcome these challenges, a simple instrument was constructed as an open-ended box (density cutter), with two parallel prongs containing an optical transmitter (green LED) and receiver (photoresistor). The intensity of received light decreases when an object is inserted between the prongs. The instrument's open end is inserted into the snow, so an undisturbed sample can be removed. A shield is then placed over the open end, and a resistance reading is taken. This resistance change is a function of the grain size and the snow grain packing (or density). Measured attenuation values were paired with traditional grain size measurements. Linear regression of mean grain diameter to observed resistance produced an R^2 value of 0.67. The instrument and empirical regression model represent a simple and cost-effective method of sampling grain size with reduced observer bias.

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