

Development of an Open-Ended Coaxial Probe (OECF) for Snow Liquid Water Content Measurement

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ABSTRACT

Liquid water content (LWC) in snow is an important metric for the evaluation of various snowpack physical processes. The percolation of water from rain and snowmelt can lead to instability through the additional weight of wet snow and the creation of ice layers/crusts. The understanding of those instabilities through percolation schemes as well as their detection is critical in avalanche risk assessment. In addition, rain on snow events occurrence is increasing in Arctic regions and snow LWC greatly affects the microwave signal used to retrieve snow and ground information over vast and remote regions. Precise LWC measurements are required to take into account those particular snow conditions in radiative transfer models in order to improve passive microwave satellite products.

Our team at the University of Sherbrooke has developed a probe to measure the LWC of snow. The approach is based on the strong relationship between snow microwave permittivity (at 1.4 GHz) and LWC knowing that water permittivity is much higher than air and ice permittivity. The performance of the probe is similar to the performance of other instruments currently available but is slightly more accurate. This new instrument is able to quantify the water content of thin layers of percolation accumulation due to its smaller probed volume, which other instruments cannot. The characterization of those thin percolation layers is critical for the validation of percolation models and avalanche risk assessment.

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