Describing Arctic Snow and Ice with a Small Ka-Band Radar

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ABSTRACT

A 24 GHz Frequency Modulated Continuous Wave (FMCW) radar is used to characterize Arctic snow and ice. This radar type has been used in mid-latitudes to describe lake ice profiles and the snowpack in mountainous regions for avalanche forecasting. As the Arctic snow is mostly wind packed, the algorithm is developed further to distinguish between the major arctic snow types, wind slabs and depth hoar. Additional development will focus on ice lens detection, as these occur more and more often due to increased rain-on-snow (ROS) events. Experiments have been conducted in Finland and Canada (Quebec, Northwest Territories, and Nunavut). A first analysis shows good results, but the radar seems very sensitive to humidity in the snow pack and has major problems if liquid water or brine are present. The accuracy is with the cm-range, but the maximum depth in ice is limited to ca. 100 cm (more in snow). The size of the radar is small enough to mount it on a remotely piloted aircraft system (RPAS), which is planned for the next campaign.

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