Winter 2018-19 Observations with Wideband Autocorrelation Radiometry

ROGER DE ROO[1] AND MOHAMMAD MOUSAVI[2]

ABSTRACT

Wideband Autocorrelation Radiometry (WiBAR) is a technique for passively measuring the microwave propagation time of low loss layers. Radiobrightness from below the layer propagates upward toward the sensor through the layer after transiting first the lower and then the upper interfaces. At the same time, some of the radiation reflects from the upper interface, then the lower interface, before transiting the upper interface towards the sensor. This delayed ray is an attenuated and delayed copy of the direct ray, leading to a local maximum in the autocorrelation function of the received waveform. The time lag at which this maximum occurs is the round-trip propagation time of the layer. To resolve short time lags, on the order of nanoseconds, large bandwidths, on the order of gigahertz, are needed.

This technique has application for measuring the low loss layers of snow pack and lake ice. In the winter of 2018-19, we deployed two independent WiBAR instruments specifically to observe the passive lag signature of snow on the ground, one operating roughly in L-band and one in S-band. In early March 2019, a snowpack up to 64 cm had developed, which is deep enough for the WiBAR observable to be detected by each instrument. We have recently downloaded the data, and see some first hints of the signal, albeit contaminated with considerable radio frequency interference. We will report on our findings.

[1] Climate and Space Science and Engineering, University of Michigan, Ann Arbor, MI, USA
[2] Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, USA