THE ULTRA-WIDEBAND SOFTWARE-DEFINED RADIOMETER (UWBRAD) FOR ICE SHEET INTERNAL TEMPERATURE SENSING: RESULTS FROM THE SEPTEMBER 2017 CAMPAIGN

Mark Andrews[(1)], Alexandra Bringer[(1)], Joel Johnson [(1)], Kenneth C. Jezek[(2)], Domenic Belgiovane[(1)], Julie Miller[(2)], Michael Durand[(2)], Yuan Duan[(2)], Caglar Yardim[(1)], Chi-Chih Chen[(1)], Leung Tsang[(3)], Shurun Tan[(3)], Mohammadreza Sanamzadeh[(3)], Vladimir Leuski[(4)], Giovanni Macelloni[(5)], and Marco Brogioni[(5)]

(1) ElectroScience Laboratory, The Ohio State University, Columbus, OH
(2) Byrd Polar Research Center, The Ohio State University, Columbus, OH
(3) University of Michigan, Ann Arbor, MI
(4) Microwave Radiometers and Antennas, Inc.
(5) Institute of Applied Physics, Florence, Italy

The ultra-wideband software-defined radiometer (UWBRAD) provides measurements of ice sheet thermal emission over the frequency range 0.5-2 GHz for the purpose of remotely sensing internal ice sheet temperature information. Previous studies have demonstrated the potential of using multiple frequency observations of the ice sheet to obtain the internal ice sheet temperature profile. Because electromagnetic waves can penetrate deeper in the ice depending on their frequency, multiple frequency observations of the ice sheet can provide information coming from different depths inside the ice sheet.

UWBRAD was designed and built at The Ohio State University to provide brightness temperature measurements over 0.5-2 GHz frequency range using 12 frequency channels and full-bandwidth sampling of each channel. Because the instrument operates in unprotected portions of the spectrum, RFI detection and mitigation algorithms are included to filter the data in real time.

UWBRAD was deployed in a September 2017 campaign in Greenland, and observed brightness temperatures of the ice sheet as well as firn aquifers, sea ice, the ocean surface, and land regions during the transit to and from Calgary, Canada (the aircraft base of operations). The presentation will review the campaign and datasets collected, as well as the methods used for calibration and RFI processing. Spectral features of thermal emissions from the ice sheet and other geophysical regions will then be reviewed and compared with the predictions of available forward models. The use of the results to retrieve internal ice sheet temperature information will then be presented, along with comparisons of the retrieved temperature profiles to in-situ measurements at the Camp Century, NEEM, and NGRIP core site locations. The use of multi-frequency brightness temperatures for remotely sensing sea ice properties as well as sea salinity will also be reviewed and discussed.