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ABSTRACT

Sensitivity of microwave scattering to snow electro-thermo-physical properties of snow-covered first-year sea ice: A multi-frequency approach

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Monitoring Arctic sea ice and its snow cover variability is of prime importance in cryospheric research. Snow cover thickness measurements are required to understand the present condition and future behavior of first-year ice (FYI) in the Arctic. Microwave remote sensing provides the most effective means to acquire near-real time thermodynamic information about snow cover on smooth FYI. Microwave interaction with snow-covered sea ice is a function of both snow/ ice electro-thermo-physical properties such as shape, size and orientation of scatterers, surface roughness, complex dielectric constant as a function of brine volume, and brine volume as a function of temperature, salinity and density, microwave parameters such as incidence angle, polarization and wavelength. Fluctuations in snow thermodynamic and geophysical properties such as density, salinity, temperature and snow grain size throughout the snow layers can change brine volume, dielectric and thermal properties of snow cover, resulting in complex microwave scattering behavior and reduced penetration and thereby masking subtle thermodynamic effects which is essential for snow thickness estimation on FYI. Previous studies exhibit reduced penetration depth and inaccurate snow thickness estimates, at C-band microwaves, from snow cover of variable thickness. We present a case study based on the theoretical approach to understand the influence of microwave scattering mechanisms and penetration to the thermodynamic and geophysical properties of snow-covered FYI, at Ku-, X- and C-band frequencies. The study will focus on *in-situ* snow property measurements sampled during early-melt season of 2012, over moderately thick (~18cm) and thinner (~10cm) snow covers over smooth landfast FYI, near Resolute Bay, Nunavut, Canada. The primary research objective is to determine salient snow properties which are sensitive to microwave bands at these three frequencies which will ultimately influence our ability to remotely infer snow thickness on FYI.