Seasonal Ku-Band Radar Measurements across a Snow-Covered Tundra Basin

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ABSTRACT

Current satellite observation systems are unable to estimate terrestrial snow water equivalent (SWE) at the spatial or temporal scales necessary to advance operational climate services or numerical weather prediction. Insensitivity to basin-scale changes in snow mass, limited spatial coverage and poor temporal revisit are amongst the reasons a novel space borne observation concept has become a priority. To address this gap, Environment and Climate Change Canada (ECCC), the Canadian Space Agency (CSA), and international partners, are developing a dual-frequency (17.2 and 13.5 GHz) moderate resolution (250 m) radar mission concept for global monitoring of terrestrial snow mass. As part of the mission's science activities, a coordinated airborne, satellite and *in situ* campaign to evaluate multi-frequency radar interactions with snow, vegetation and soils in the tundra was completed during the winter of 2019. An airborne 13.5 GHz interferometric synthetic aperture radar (InSAR) deployed within the Trail Valley Creek (TVC) research basin (Northwest Territories, Canada) on three occasions (December 2018, January 2019, March 2019) to characterize these interactions. Distributed snow property measurements including SWE and microstructure were completed during each flight campaign to evaluate spatiotemporal influence. Bi-monthly RadarSAT-2 and TerraSAR-X imagery was acquired to quantify variations in vegetation and soil background contributions. The acquired snow property measurements and satellite-derived background fields were used to parametrize the Snow Microwave Radiative Transfer (SMRT) model. Output of the forward model parametrizations allows decomposition of observed backscatter diversity within the TVC domain.

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