Documenting Winter Snow Accumulation and Ablation of a Shrub-Tundra Catchment using Unmanned Aerial Systems and *in situ* Observations

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ABSTRACT

Arctic tundra environments are characterized by a spatially heterogenous end-of-winter snow distribution resulting from wind transport and deposition. Large spatial variations in snow depth, density and snowpack microstructure result in localized concentrations of water storage across the landscape influenced by topography and vegetation cover. Understanding the distribution of snow across tundra environments is important as the snow accumulation typically accounts for over half of the annual precipitation and is the dominant driver of the hydrological system. Currently, our ability to accurately measure snow has proven difficult and traditional methods often fail to accurately represent small-scale variations in snow cover at catchment scales. Furthermore, the accumulation patterns at landscape scales are poorly documented resulting from technical and environmental limitations. In this study we document spatial variations in snow depth accumulation and ablation across a shrub-tundra catchment as part of the TVCSnow campaign from Trail Valley Creek, NWT. We applied Structure-from-Motion photogrammetry using a fixed-wing Unmanned Aerial System (UAS) resulting in high-resolution snow depth mapping (1 meter) at five key periods of snow accumulation and throughout the snowmelt period. In combination with aerial surveys, snow depth and water equivalent measurements were recorded across the winter accumulation period resulting in a detailed documentation of snow accumulation and ablation for various key landcover types. The ability to capture high-resolution spatio-temporal changes to tundra snow cover furthers our understanding of the relative importance of various land cover types on winter snow accumulation and ablation which has strong implications on the hydrological system during the spring freshet.

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