

It's all about Timing: Exploring the Relationship between Snowmelt and Caribou (*Rangifer tarandus*) Migration in the Northwest Territories of Canada

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ABSTRACT

Recent studies suggest that snow characteristics may be primary drivers of migration, largely due to caribou's high level of mobility and their dependence on landscape conditions for locomotion. To investigate whether and how snow characteristics such as melt/refreeze status and the presence of ice are related to caribou movement, we used GPS (Global Positioning System) tracking collar data provided by the Government of the Northwest Territories' Department of Environment and Natural Resources to identify individual animal location and migration patterns, with a focus on female animals in the Bathurst herd. We analyzed 117 individual female caribou with more than 30,000 observations between 2007 and 2016 from the Bathurst herd in the Northwest Territories of Canada. We used a hierarchical model to estimate the beginning, duration, and end of spring migration and compared these statistics against snowpack characteristics (i.e., the timing of melt onset and melt/refreeze cycles) which we derived from 37 GHz vertically polarized (37V GHz) Calibrated, Enhanced Resolution Brightness Temperatures (CETB) at 3.125 km resolution. We found that the start and end of the female herd's spring migration closely followed melt onset and migration duration was longer when melt onset occurred earlier, suggesting that melt onset events provide triggers for migration or favorable conditions that increase mobility. However, we did not find any significant relationships when we tested them at the individual level. A causal relationship between snowmelt timing and caribou migration would allow for anticipation of the herd's migratory behavior and potential shifts in herd ranges.

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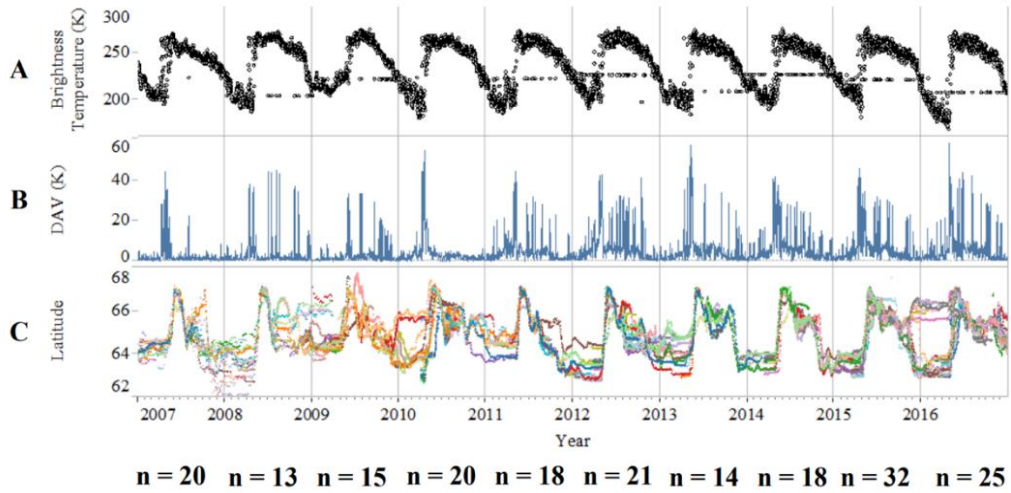


Figure 1. Time series of 3.125 km EASE-Grid pixels and female caribou latitudinal movement (northward migration) caribou departure locations between 2007 and 2016. The top two graphs are of brightness temperature (A) and diurnal amplitude variation (DAV) (B). The graph includes individual tracks of female caribou latitudinal movement through time (C). Individual female caribou are colored by unique collar ID. Collar ID legend has been omitted, as there are >100 unique IDs within this time span. Number of individuals per year is noted below each year's panel, where n = number of individuals.