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Multi-decadal frontal change rates of tidewater glaciers in the Canadian Arctic Archipelago

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Recent studies of post-2000 observational data have shown variability in the dynamic ice discharge of tidewater glaciers throughout the Canadian Arctic Archipelago (CAA). Expanding this to all tidewater glaciers in the region on a decadal time scale using earlier records can help identify when glacier retreat began, and determine longer-term temporal trends in mass balance.

Our study shows that over 94% of 300 tidewater glaciers in the CAA (from southern Baffin Island to Ellesmere Island, excluding those on the northern coast) have retreated since the earliest observational records (aerial photographs acquired in 1958-1960). Mean overall length change rate of the 211 glaciers in the Queen Elizabeth Islands (QEI) is -9.3 ma-1 ($\pm$ 1.38 SE), and of the 89 glaciers on Baffin and Bylot Islands (BBI) is -7.1 ma-1 ($\pm$ 0.72 SE). Mean frontal widths of tidewater glaciers in the QEI are greater than those on islands to the south, resulting in greater mean area loss from this region. Each glacier has $\sim$6 frontal positions digitised from a range of image sources at approximately decadal intervals. Length change rates have been calculated across each time interval for each glacier, based on area changes divided by glacier frontal width. Results indicate a similar temporal pattern throughout the region, whereby glaciers show minimal change in early years with retreat rates slowly increasing, followed by acceleration in retreat rates since the late 1990s. Mean change rates in the QEI and BBI in the 1960s were -6.92 ma-1 and -0.51 ma-1 respectively, increasing to -28.96 ma-1 and -24.84 ma-1 since 2010. The same trend (at differing magnitudes) has been observed within each latitudinal degree band, and for glaciers of differing frontal widths. Further observations of glacier changes and links to climate change are revealed on the poster.