

Canadian Arctic glaciers a major contributor to sea level rise from glaciers and ice caps: Lessons from >50 years of monitoring activities

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Four glaciers and ice caps in the Canadian Arctic Archipelago located on Meighen, Axel Heiberg, Melville, and Devon islands host continuous/near-continuous surface mass balance records that span >50 years in length. These official reference glaciers, as designated by the World Glacier Monitoring Service under the auspices of the United Nations Environment Program, provide in situ measurements critical to validating and cross-calibrating satellite-based mass change estimates and informing our understanding of the key processes driving glacier response. Together, these records indicate a trend of increasing mass loss over the past two decades alongside rising equilibrium line altitudes and shrinking accumulation area ratios. We present a synthesis of the long-term mass balance records in the Canadian Arctic alongside two recent studies demonstrating the value, and challenges, of using such records to estimate regional mass balances and sea level rise contributions from Canada's northern glaciers. The first of these studies uses the combined strengths of the high-temporal resolution of surface mass balance observations alongside high-accuracy of multi-year geodetic mass balances to infer regional mass balances between 1960-2016. The second uses a semi-empirical approach that scales point mass balances across regions to align with gravimetry (GRACE)-derived mass balance averages over the same region. Both studies demonstrate that the Canadian Arctic continues to be a major contributor to global sea level rise from glaciers and ice caps.