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Spaceborne Observations of Ice Regimes Changes of Lakes in the Canadian Arctic Archipelago

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A 15-year time series (1997-2011) of RADARSAT-1/2 ScanSAR Wide Swath, ENVISAT ASAR Wide Swath and Landsat acquisitions was analyzed to document the response of ice cover on lakes in the Canadian High Arctic to climate conditions of recent years. Results indicate that some lakes may be transitioning from a perennial to a seasonal ice regime. Earlier melt onset was observed for all lakes, by 14-39 days for polar oasis lakes and by 2.7-22.5 days for polar desert lakes. A greater change in the timing of ice-off dates was observed for polar-oasis lakes – 9-23.6 days earlier vs. 1.6-20 days earlier for polar desert lakes. The greatest change in timing of melt onset (39 days early, α = 0.05) and summer ice minimum (30 days early, α = 0.10) was observed for lake L6 on Devon Island (76°33' N, 92°31' W) while ice-off for Buchanan Lake (79°27' N, 87°37' W) occurred earlier by a total of 23.6 days (α = 0.01). The only lake that gained ice days (12.5 days later, α = 0.10) as a result of later break-up was Lower Murray Lake (81°20' N, 69°32' W). The residual summer ice generally disappeared earlier on all lakes, by 9-30 days in polar oasis environments and by 1.5-18.8 days in polar desert environments. Ice cover changes of the lakes examined in this study display high correlation with changes in air temperatures. Generally, earlier melt onset and ice-off dates were observed during years with positive anomalies of the 0°C spring isotherm date and later melt onset and ice-off dates were noticed during years with negative anomalies of the 0°C spring isotherm date.