



## **Progressive increase in number and volume of ice-marginal lakes on the western margin of the Greenland Ice Sheet**

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The evolution in number, area and volume of ice-marginal lakes in western Greenland is very poorly documented or understood. It is important to understand ice-marginal lake evolution because they provide an element of meltwater retention, affect ice-margin character and behaviour, and potentially glacier dynamics. This study uses repeat satellite imagery acquired between 1987 and 2010 to reveal a net 44 % ( $\pm 6.5$  %) increase in the number of lakes, a net 20 % ( $\pm 6.5$  %) expansion in total lake surface area and an increase of 12% ( $\pm 3.3$  %) in the estimated volume of meltwater retained along a 1300 km length of the ice margin in western Greenland. Whilst  $\sim 12$  % ( $\pm 1.6$  %) of the ice margin holds lakes at any one time there is considerable complexity in lake evolution; many lakes have coalesced, drained partially or fully, or become detached from the ice margin. The total lake volume equates to 144 % of the annual runoff combined from Gothab and Jakobshavn hydrological catchments. The rate of increase in meltwater retention between 1987 and 2010 was similar to the rate of increase in ice sheet surface runoff over the same time period. If the study region is representative of the whole Greenland ice sheet margin then as a first-order estimate  $\sim 5$  % of the increased runoff over the last 25 years has been intercepted enroute to the oceans by the increased ice-marginal lake capacity. Interactions between these ice-marginal lakes, the western Greenland ice sheet and climate should be determined to provide insight into future land-terminating ice-marginal conditions, runoff retention and meltwater and sediment fluxes to the oceans.