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Satellite investigations of the seasonal evolution of supra-glacial lakes at the margins of the Greenland Ice Sheet

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A survey of supra-glacial lakes on the western margin of the Greenland Ice Sheet reveals a seasonally-driven hydrological system, culminating in rapid lake drainage through englacial pathways in late summer. We used satellite imagery to study the evolution of 292 lakes across a 22,000 km^2 region and, during 2001, their combined area increased to $\sim$75 km^2 by the end of July. Over the following month, drainage occurred from 216 lakes - potentially supplying water to the ice sheet base. Using meteorological data and a positive degree day model, we calculated the volume of water generated through melting in the lake catchment areas. Based on this estimate, the average depth of filling lakes rose from 2.0 meters in July to 8.7 meters in August, and the mean flux of water passing through each lake that drained completely was 3.1 m^3 s^{-1}. If these volumes of meltwater are directly accessing the ice-bed interface, they could affect ice-dynamics at the margins of the ice sheet through changes in basal traction.