



Evolution of supra-glacial lakes across the Greenland Ice Sheet

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We have used 268 cloud-free Moderate-resolution Imaging Spectroradiometer (MODIS) images spanning the 2003 and 2005-2007 melt seasons to study the seasonal evolution of supra-glacial lakes in three different regions of the Greenland Ice Sheet. Lake area estimates were obtained by developing an automated classification method for their identification based on 250 m resolution MODIS surface reflectance observations. Widespread supra-glacial lake formation and drainage is observed across the ice sheet, with a 2-3 weeks delay in the evolution of total supra-glacial lake area in the northern areas compared to the south-west. The onset of lake growth varies by up to one month inter-annually, and lakes form and drain at progressively higher altitudes during the melt season. A correlation was found between the annual peak in total lake area and modelled annual runoff across all study areas. Our results indicate that, in a future warmer climate (Meehl et al., 2007), Greenland supra-glacial lakes can be expected to form at higher altitudes and over a longer time period than is presently the case, expanding the area and time period over which connections between the ice sheet surface and base may be established (Das et al., 2008) with potential consequences for ice sheet discharge (Zwally et al., 2002).

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