Periodic outburst floods from an ice-dammed lake in East Greenland.

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We report evidence of four cycles of outburst floods from Catalina Lake, an ice-dammed lake in East Greenland, identified in satellite imagery between 1966-2016. The lake measures 20-25 km2, and lake level drops 130-150 m in each event, corresponding to a water volume of 2.6-3.4 Gt, and a release of potential energy of 10^{16} J, among the largest outburst floods reported in historical times. The drainage cycle has shortened systematically, and the lake filling rate has increased over each cycle, suggesting that the drainage pattern is changing due to climate warming with possible implications for environmental conditions in Scoresbysund fjord.

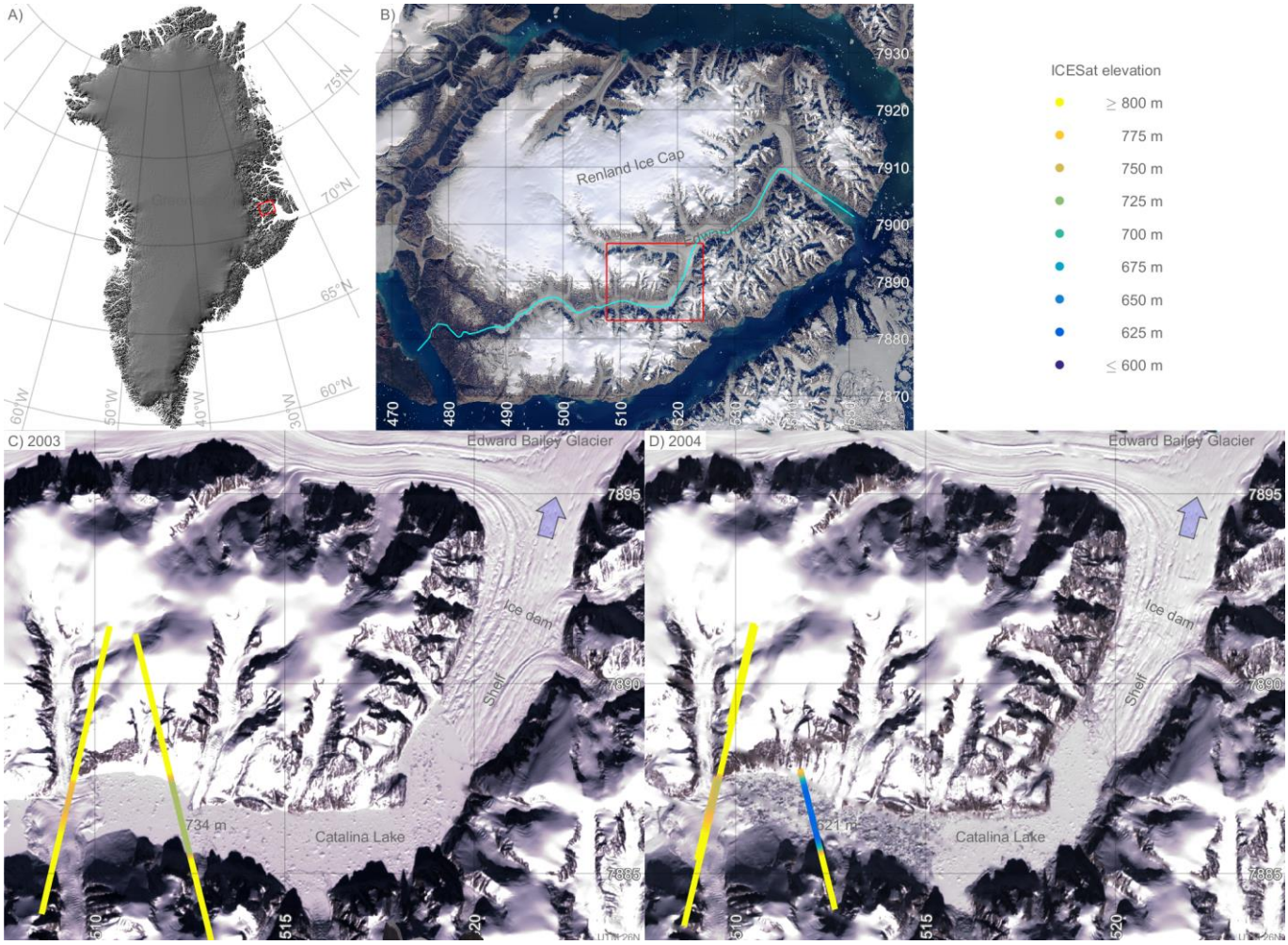

Figure 1. Satellite images showing the lake before and after an outburst flood. A) Map of Greenland. B) Map of Renland.. C,D) Landsat-7 scenes showing Catalinadal valley before and after a glacial outburst flood, and elevation observations from ICESat. Light blue arrow indicate direction of drainage.

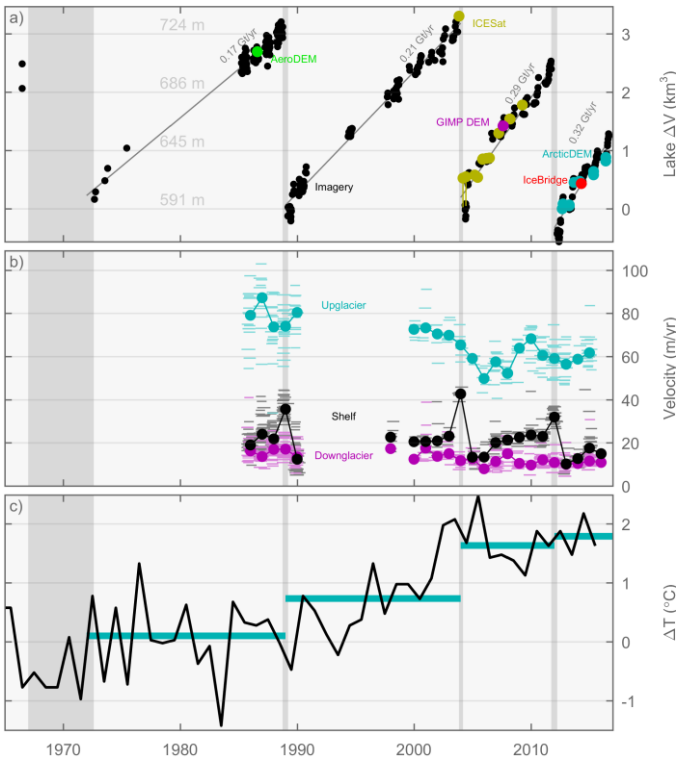

Figure 2. Satellite observed evolution of outburst floods and climate. a) Catalina Lake volume and level estimated from shorelines (black), ICESat (yellow), AeroDEM (green), GIMP DEM (magenta), ArcticDEM (cyan), IceBridge (red). b) Velocities at three locations on the glacier damming the lake estimated from optical feature tracking. Velocities for individual image pairs are shown as horizontal lines, and annual averages are shown as circles. c) Regional temperatures relative to 1961-1990 (average of records from Danmarkshavn and Tassilaq). Cyan lines show longer term averages.

References

Grinsted, Hvidberg, Campos, Dahl-Jensen (2017), Periodic outburst floods from an ice-dammed lake in East Greenland, Scientific Reports, 7, doi:10.1038/s41598-017-07960-9