This PDF file includes:

Figures S1 to S37

Supplementary Figures

Figures S1–S37 show the observations and analysis for individual subglacial lakes. Each figure contains the following panels:

- (a) Regional map showing the location of the lake in the Canadian Arctic.

- (b) Sentinel-2 true-color image in August 2020 showing the surface conditions of the lake. The green star indicates the sampling location of the elevation and ice velocity data in panels (e) and (f). RGI 7.0 glacier outlines are illustrated as black lines.

- (c) ArcticDEM surface elevation around the lake. ICESat-2 measurement locations for DEM alignment are plotted as orange dots. RGI 7.0 glacier outlines are illustrated as black lines.

- (d) Elevation change of lake; the zoom-out version of the corresponding lake panel from Figure 2. The panel is color-coded by the ice elevation change (dH) during the selected short-term event (specified in panel (e) as a dashed line and Table 1) between 2011 and 2022. Lakes 5, 7, 25, 31, and 32 do not have any short-term events and are visualized by the linear elevation change rate (dH/dt) between 2011 and 2022 instead.

- (e) Ice surface elevation over time at the lake location, derived from the ArcticDEM strip data. Purple squares are observations used for the regression model (green curve), and yellow circles are the flagged outliers excluded from the regression model. Vertical bars indicate the 2-σ error of the observations. The vertical dashed line indicates the selected short-term event to be plotted in panel (d).

- (f) Surface ice velocity over time at the lake location, derived from the ITS_LIVE data set. The vertical dashed line indicates the selected short-term event to be plotted in panel (d).
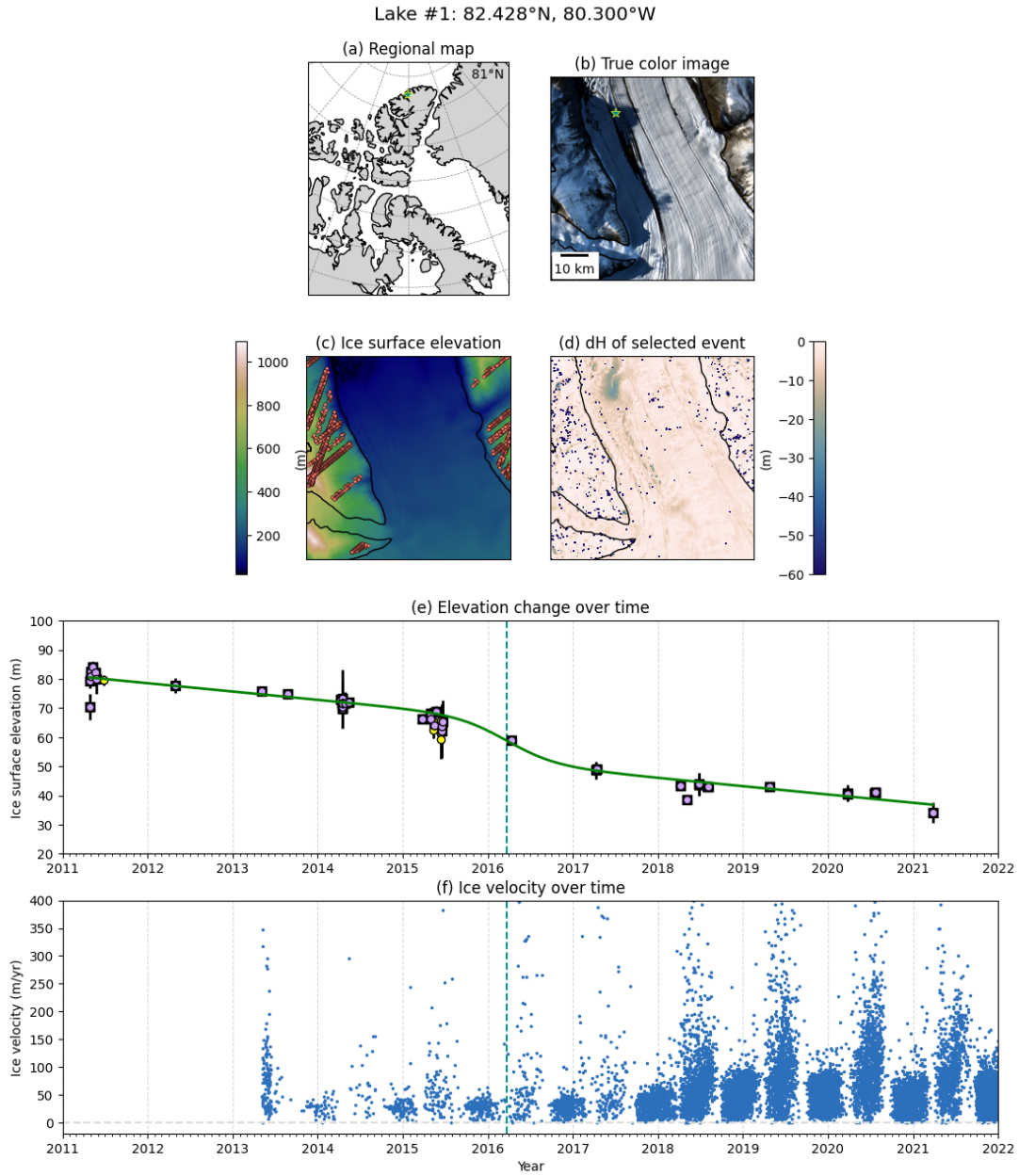
Figure S1: **Analysis of Lake 1.** See supplementary text for detailed description.
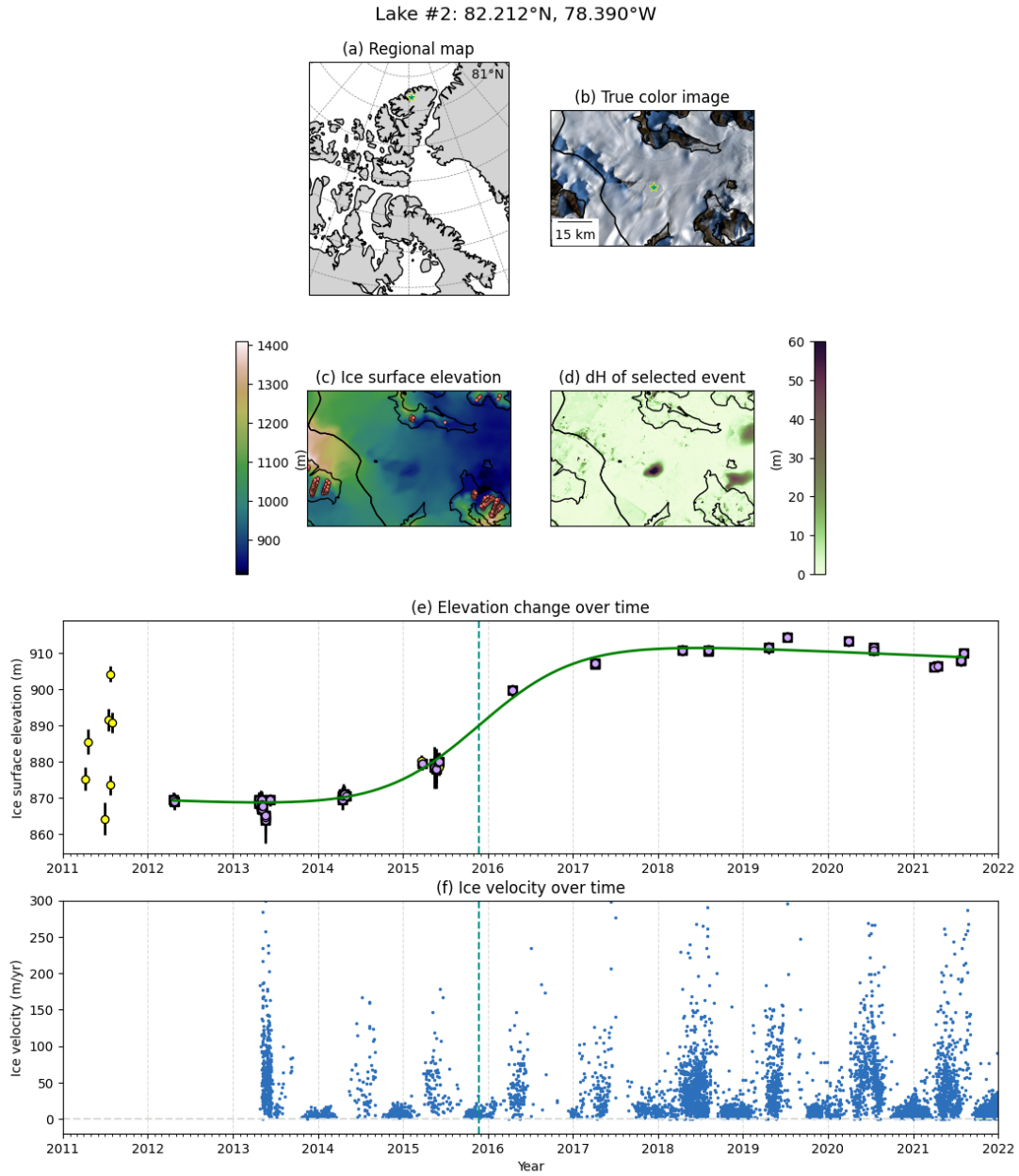
Figure S2: **Analysis of Lake 2.** See supplementary text for detailed description.
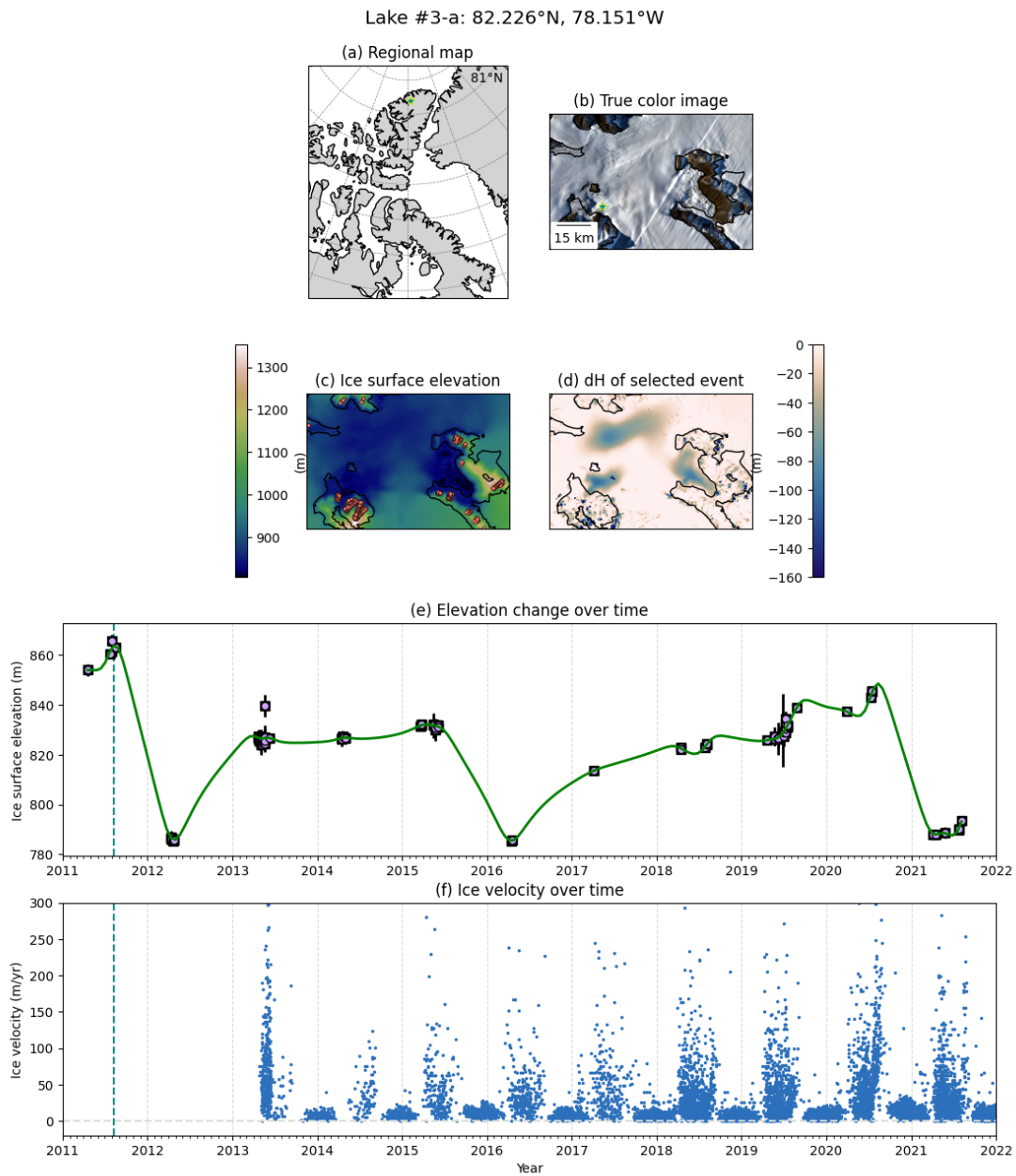
Figure S3: **Analysis of Lake 3-a.** See supplementary text for detailed description.
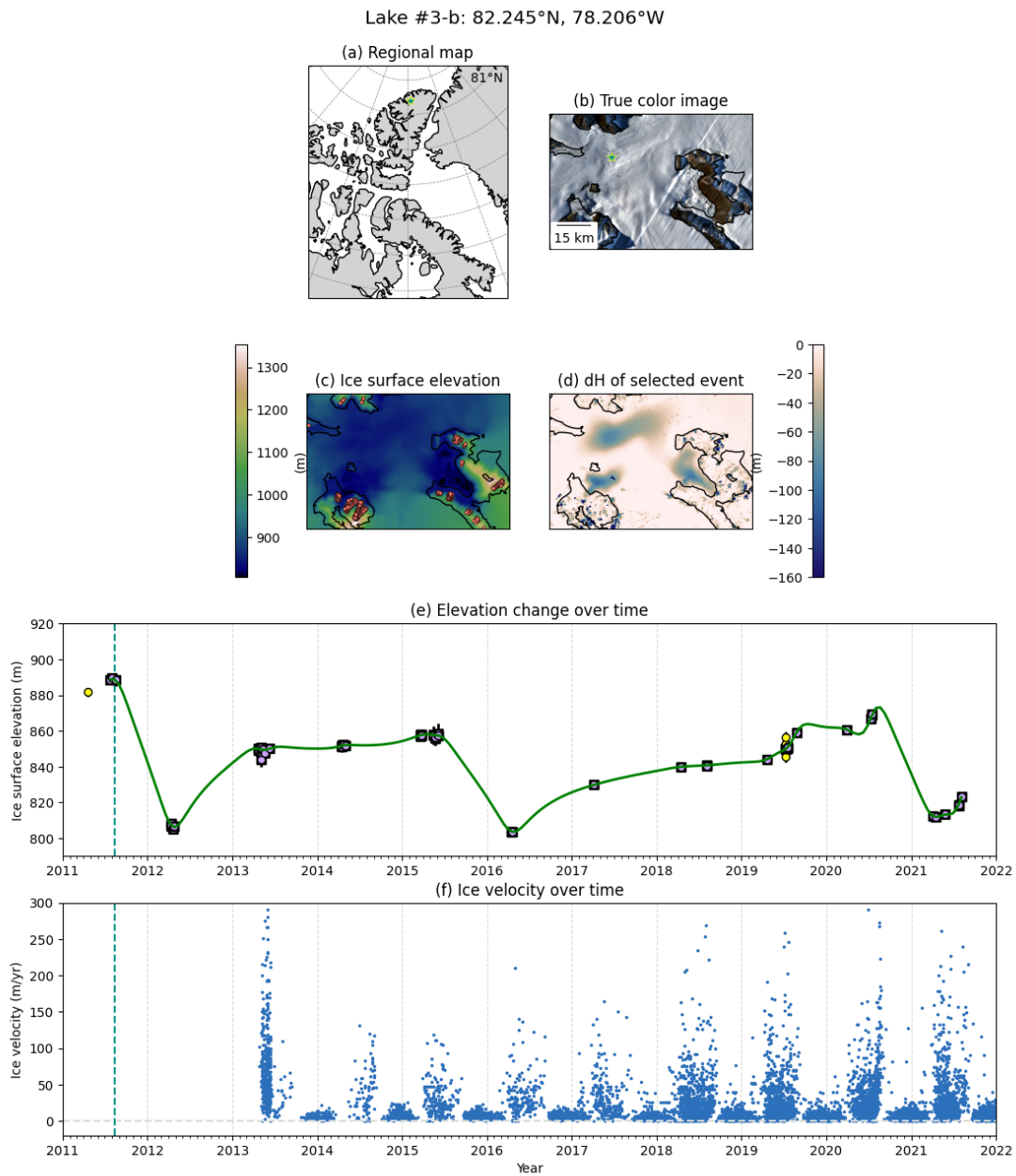
Figure S4: **Analysis of Lake 3-b.** See supplementary text for detailed description.
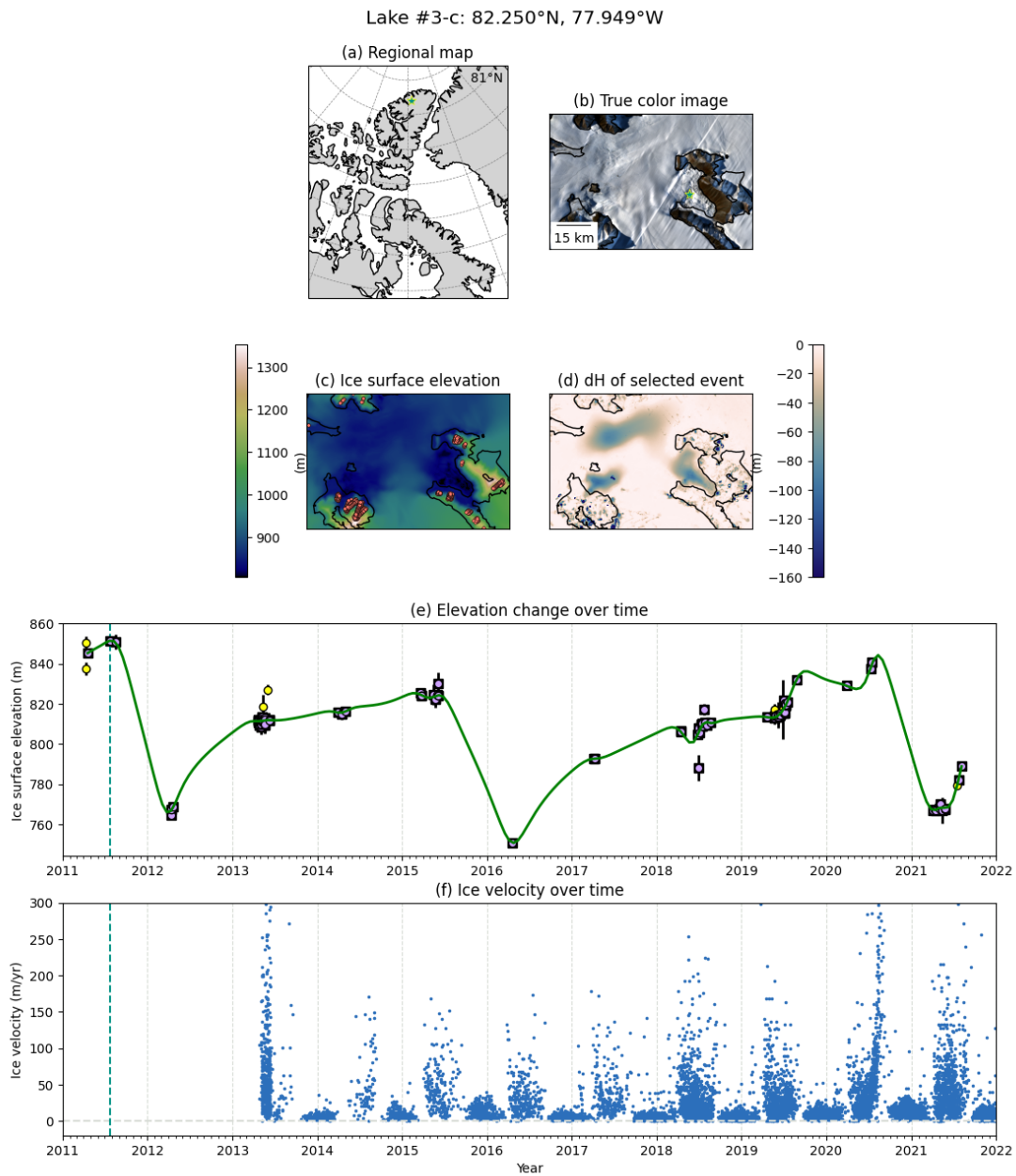
Figure S5: **Analysis of Lake 3-c.** See supplementary text for detailed description.
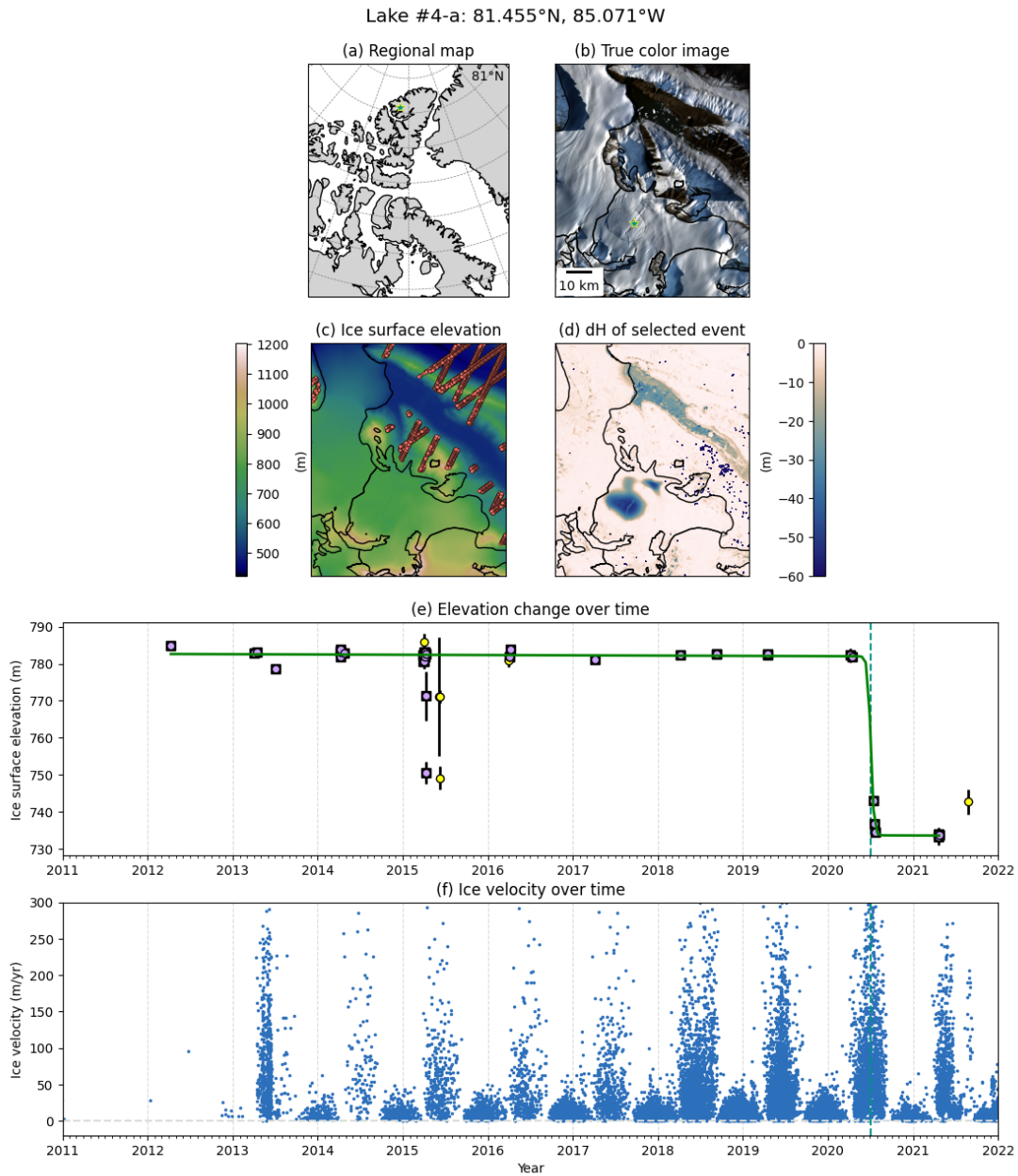
Figure S6: **Analysis of Lake 4-a.** See supplementary text for detailed description.
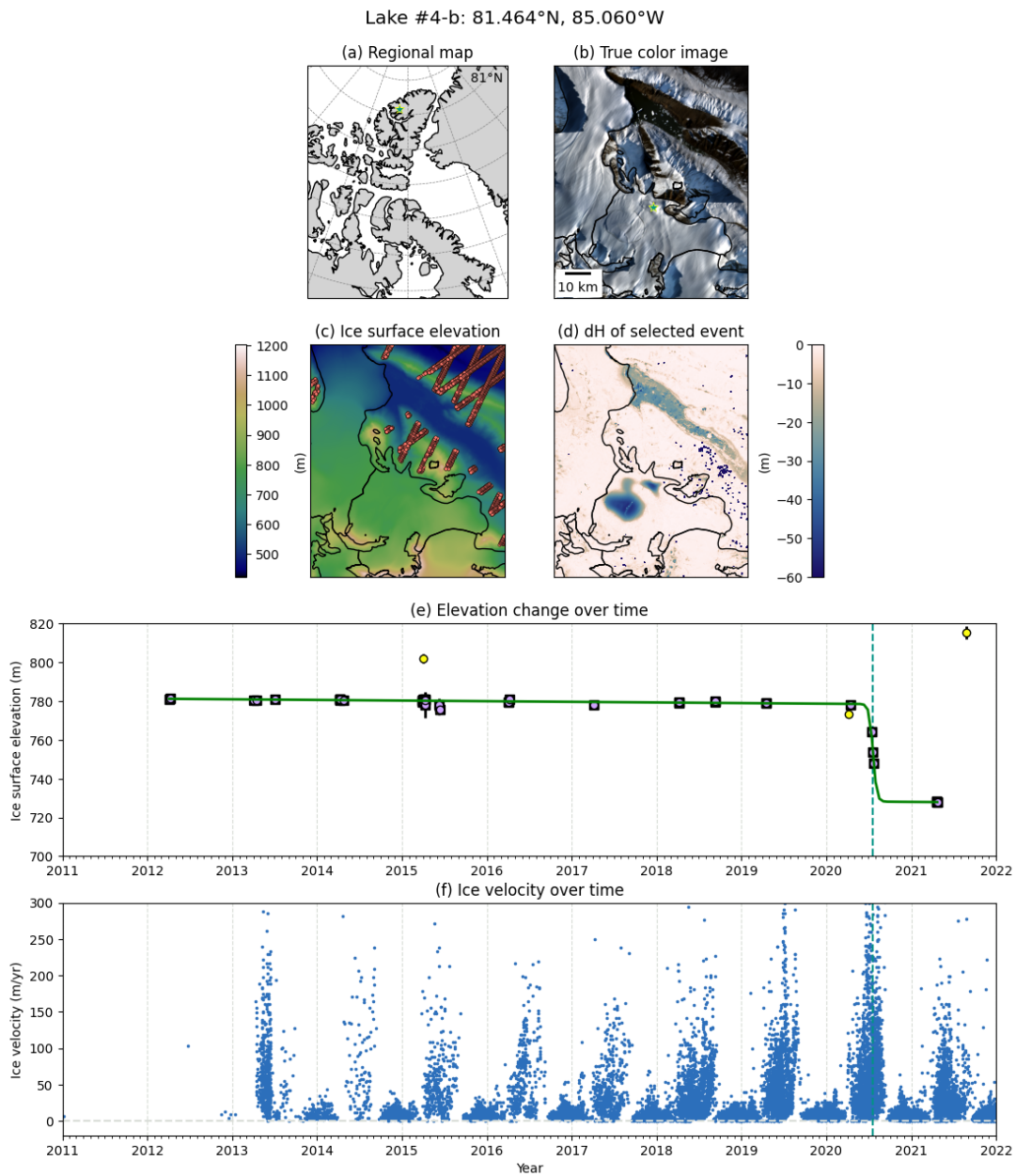
Figure S7: **Analysis of Lake 4-b.** See supplementary text for detailed description.
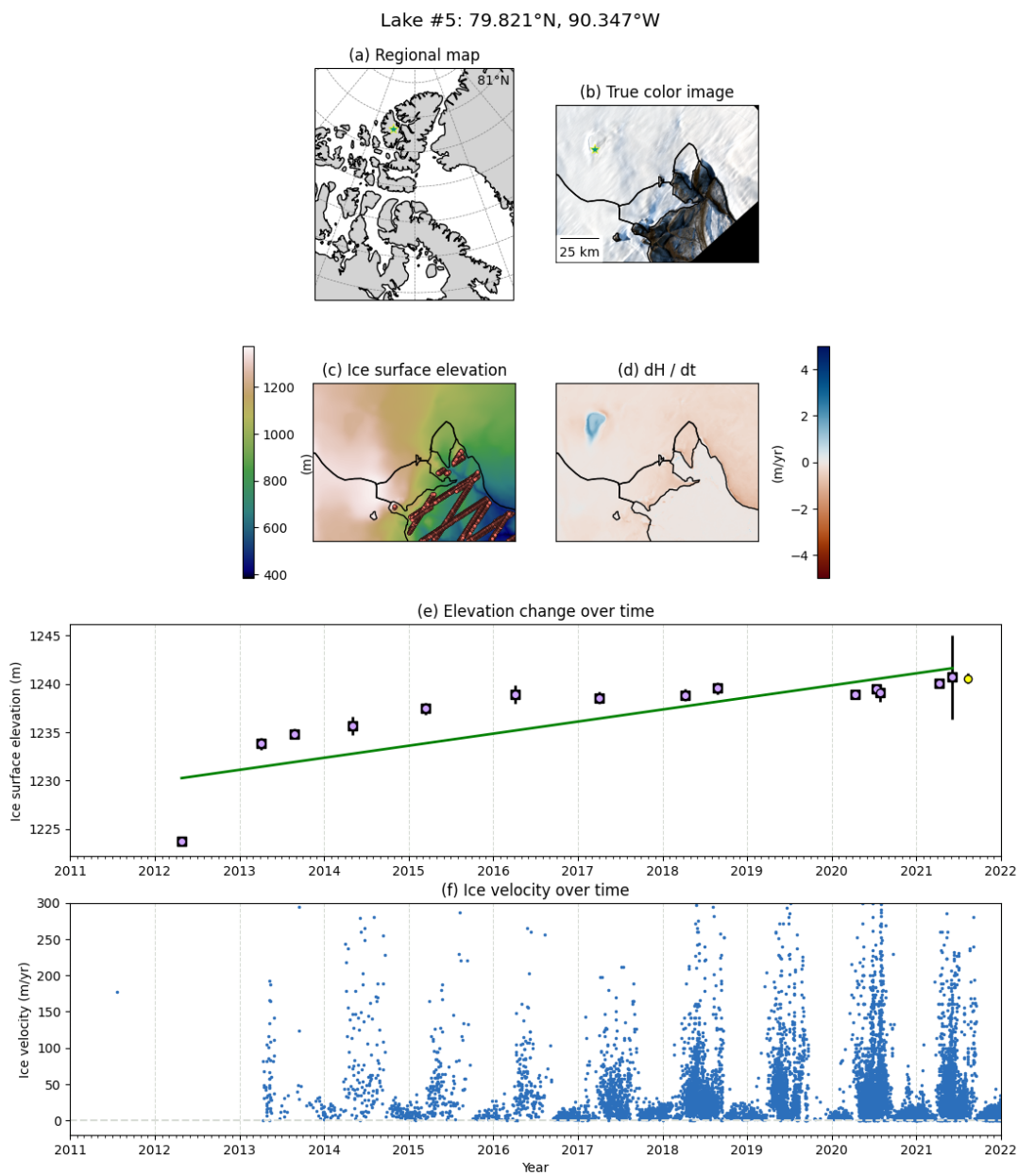
Figure S8: **Analysis of Lake 5.** See supplementary text for detailed description.
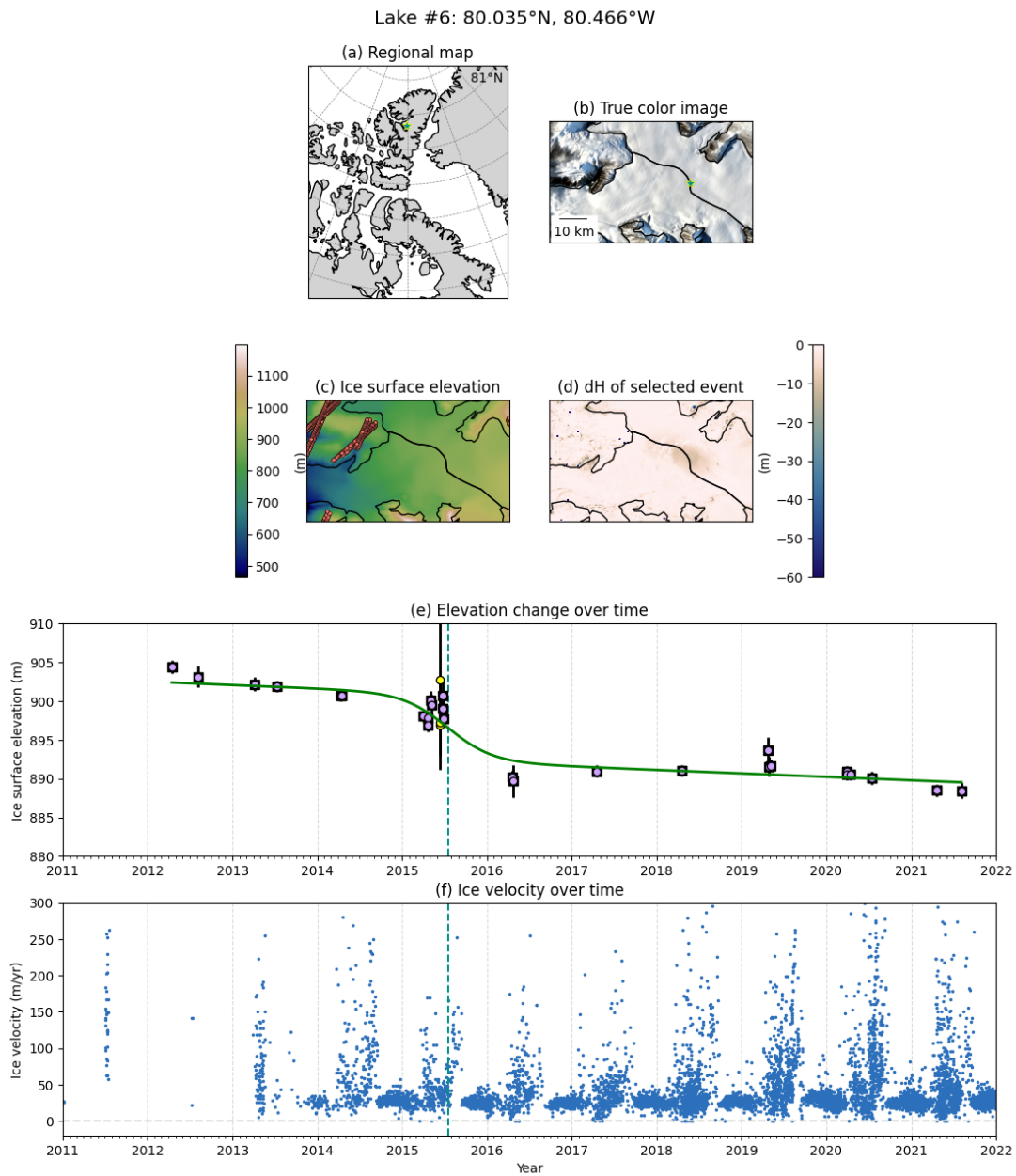
Figure S9: **Analysis of Lake 6.** See supplementary text for detailed description.
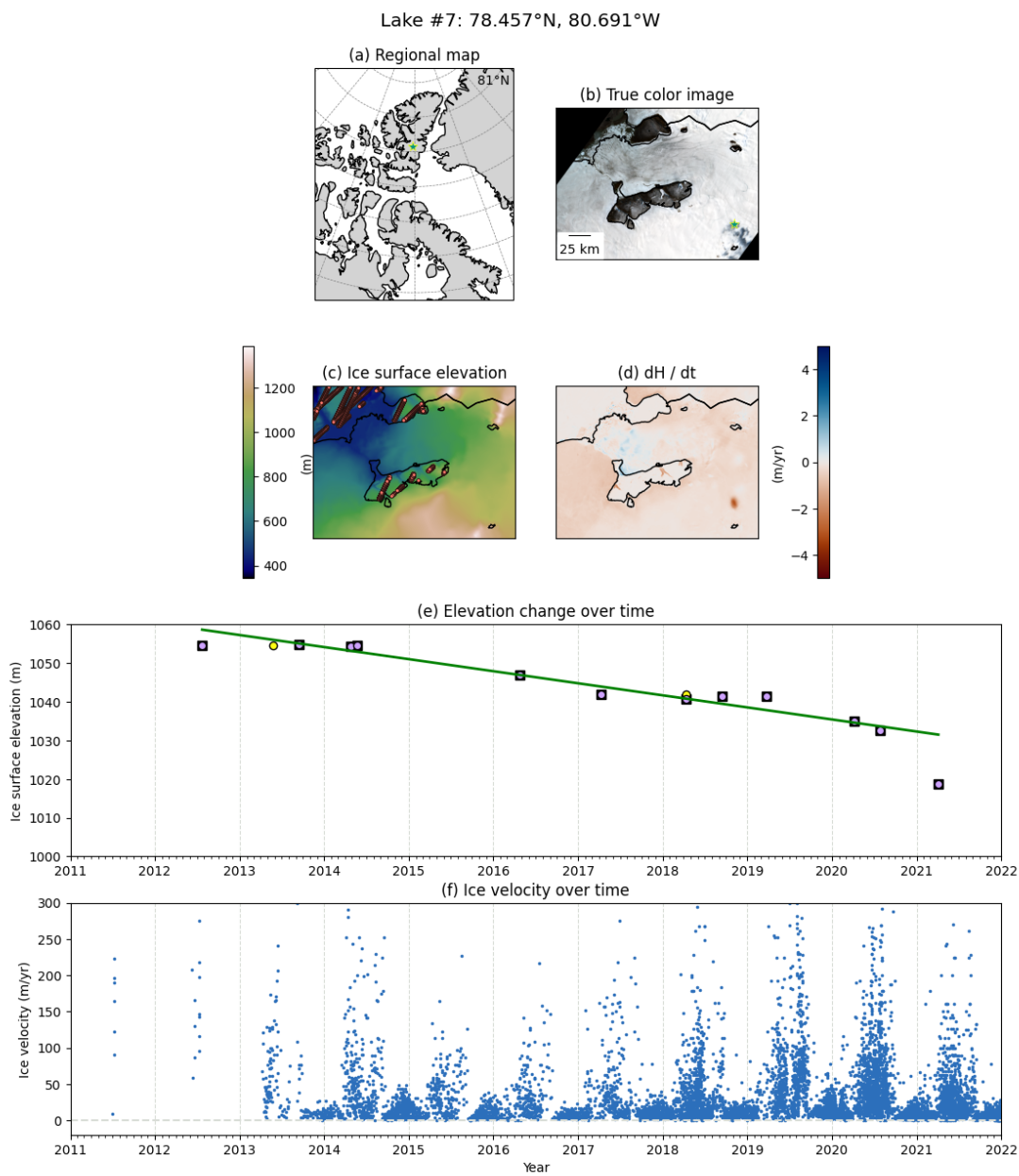
Figure S10: **Analysis of Lake 7.** See supplementary text for detailed description.
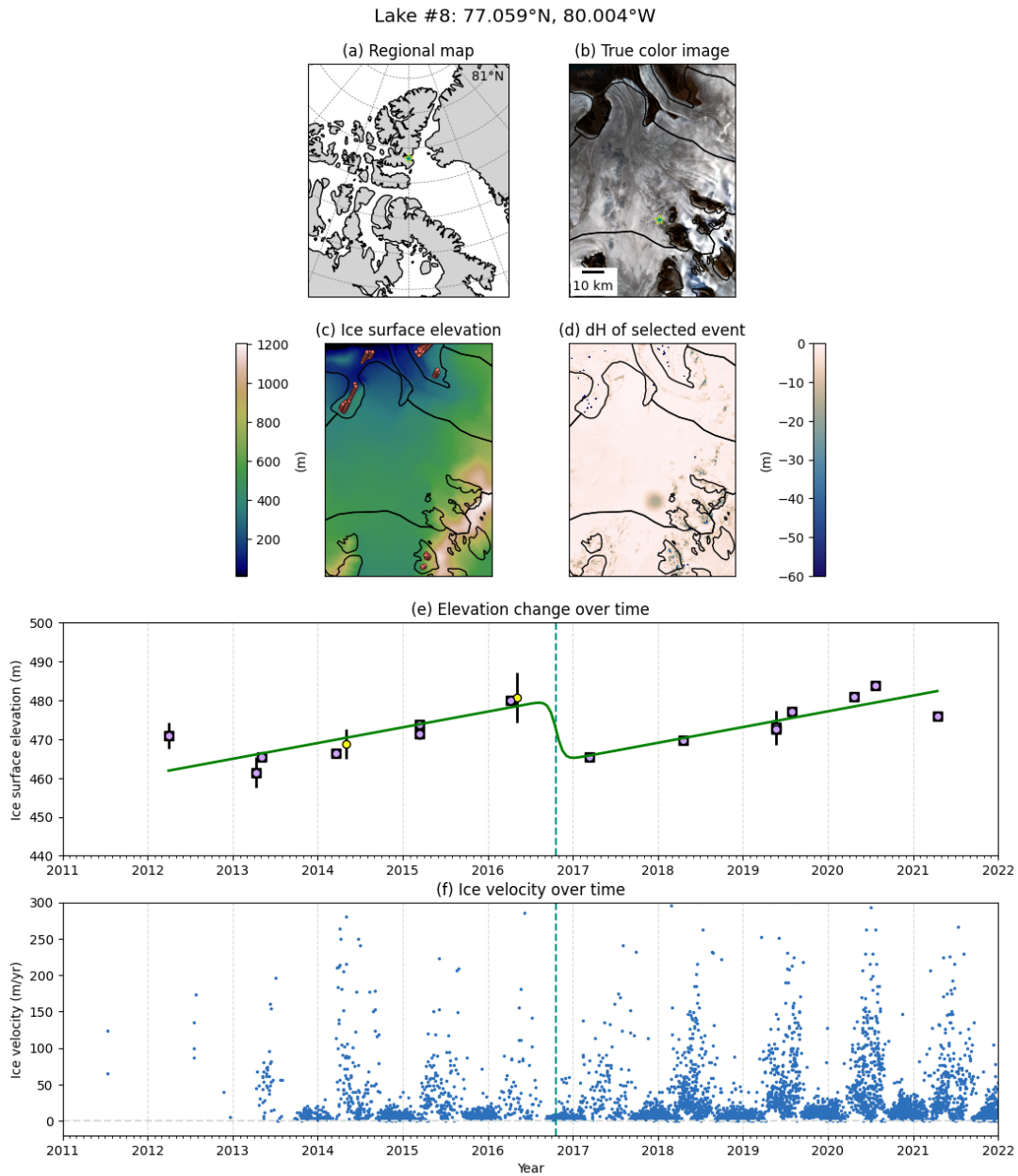
Figure S11: **Analysis of Lake 8.** See supplementary text for detailed description.
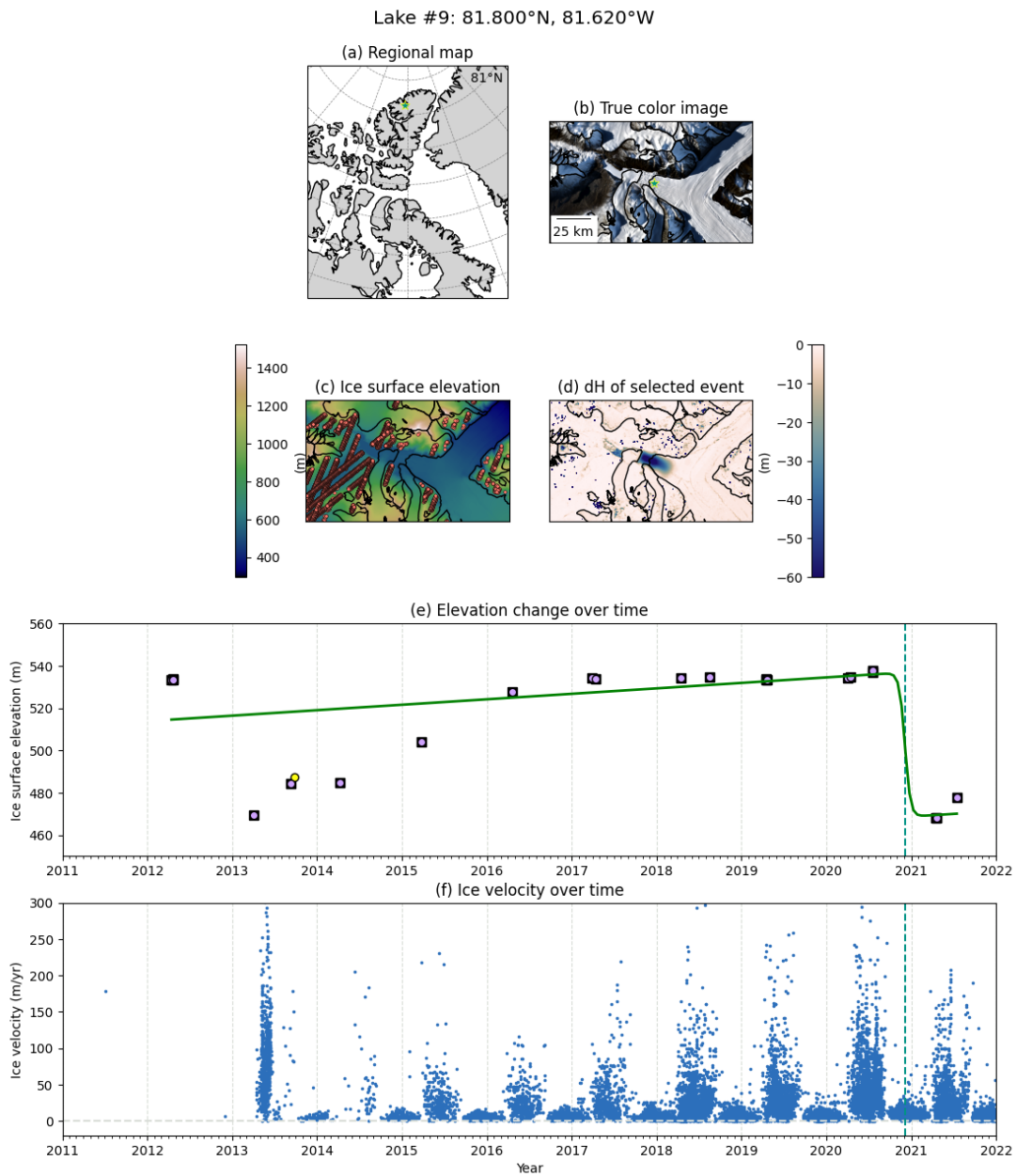
Figure S12: **Analysis of Lake 9.** See supplementary text for detailed description.
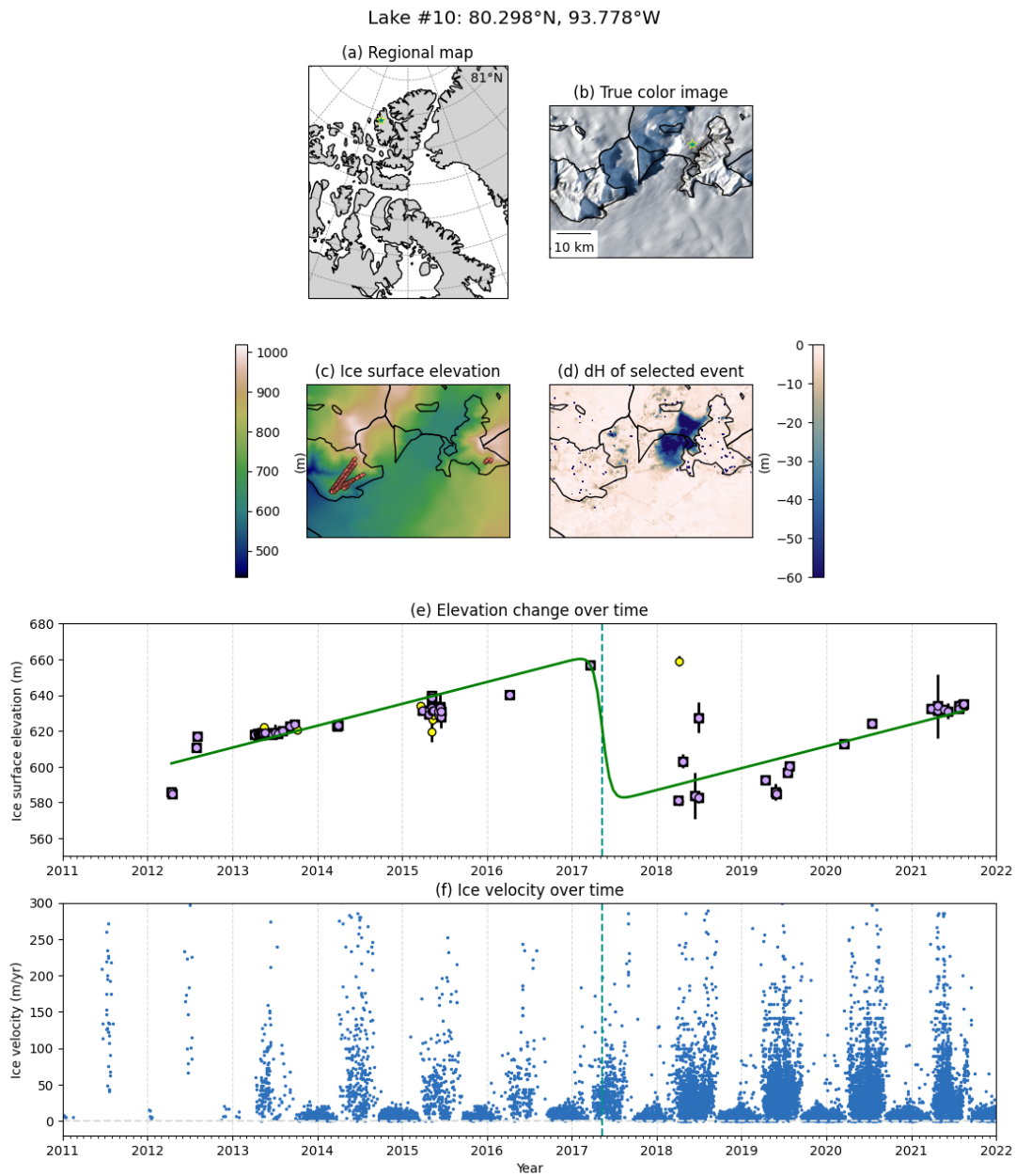
Figure S13: **Analysis of Lake 10.** See supplementary text for detailed description.
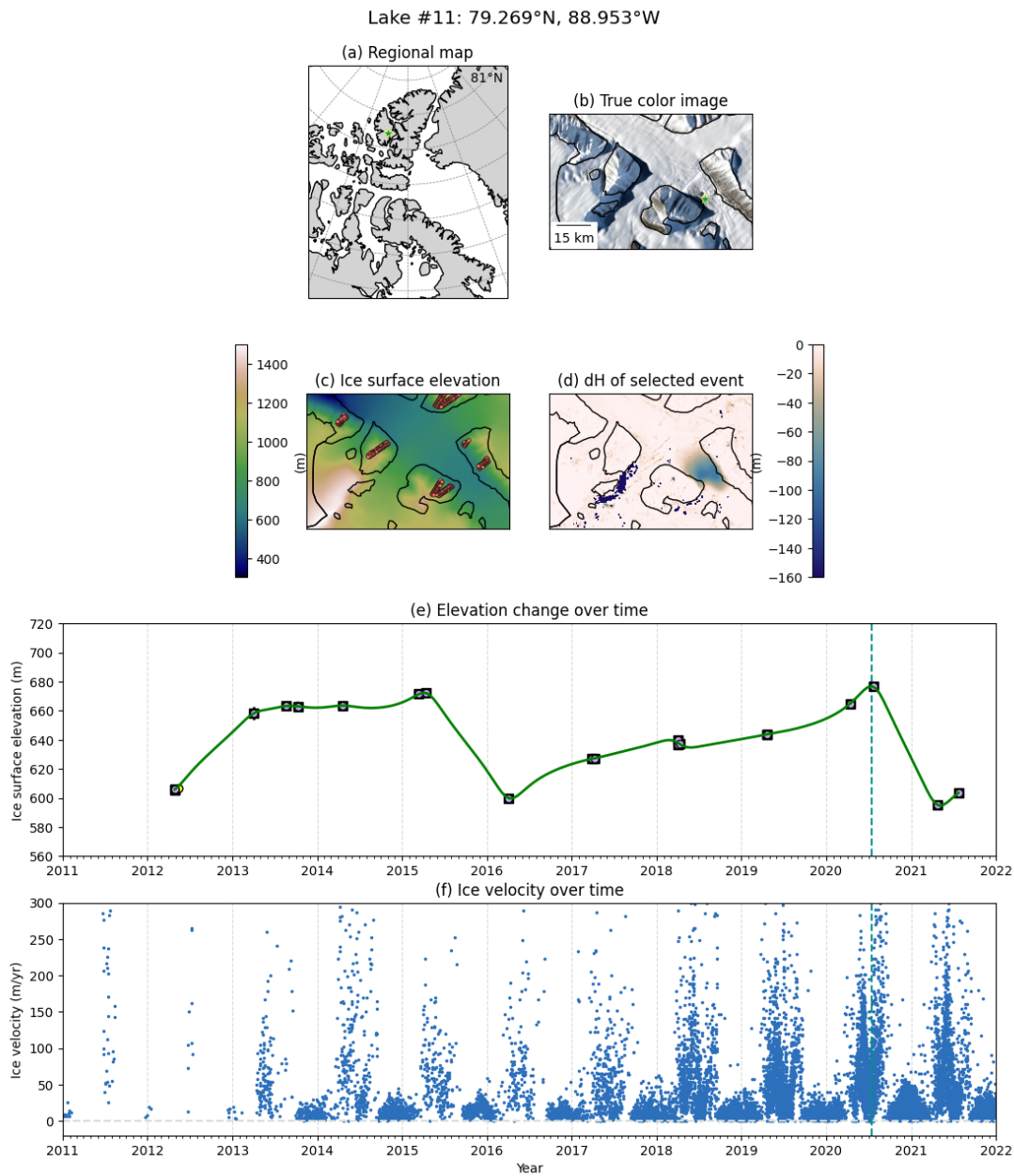
Figure S14: **Analysis of Lake 11.** See supplementary text for detailed description.
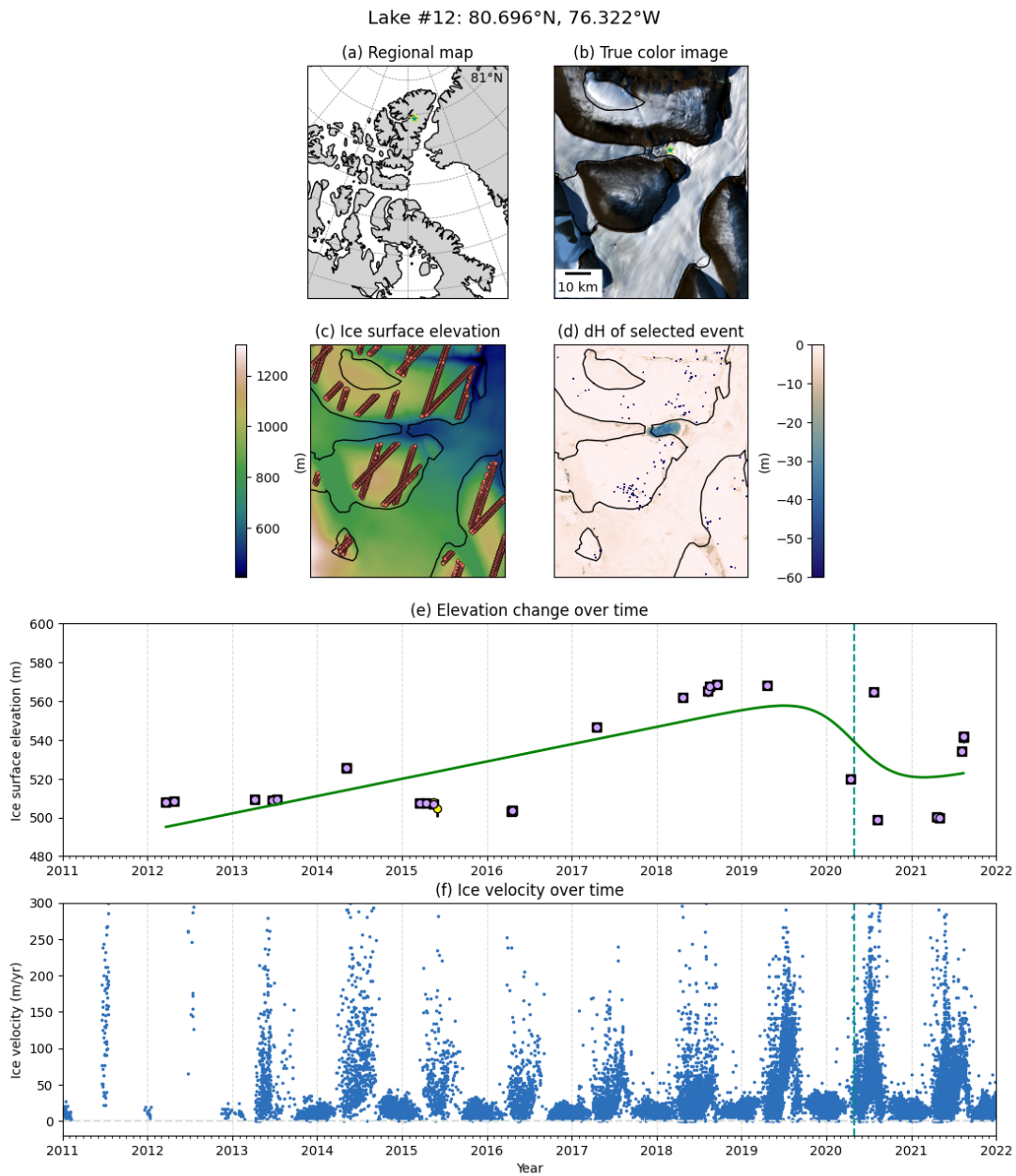
Figure S15: **Analysis of Lake 12.** See supplementary text for detailed description.
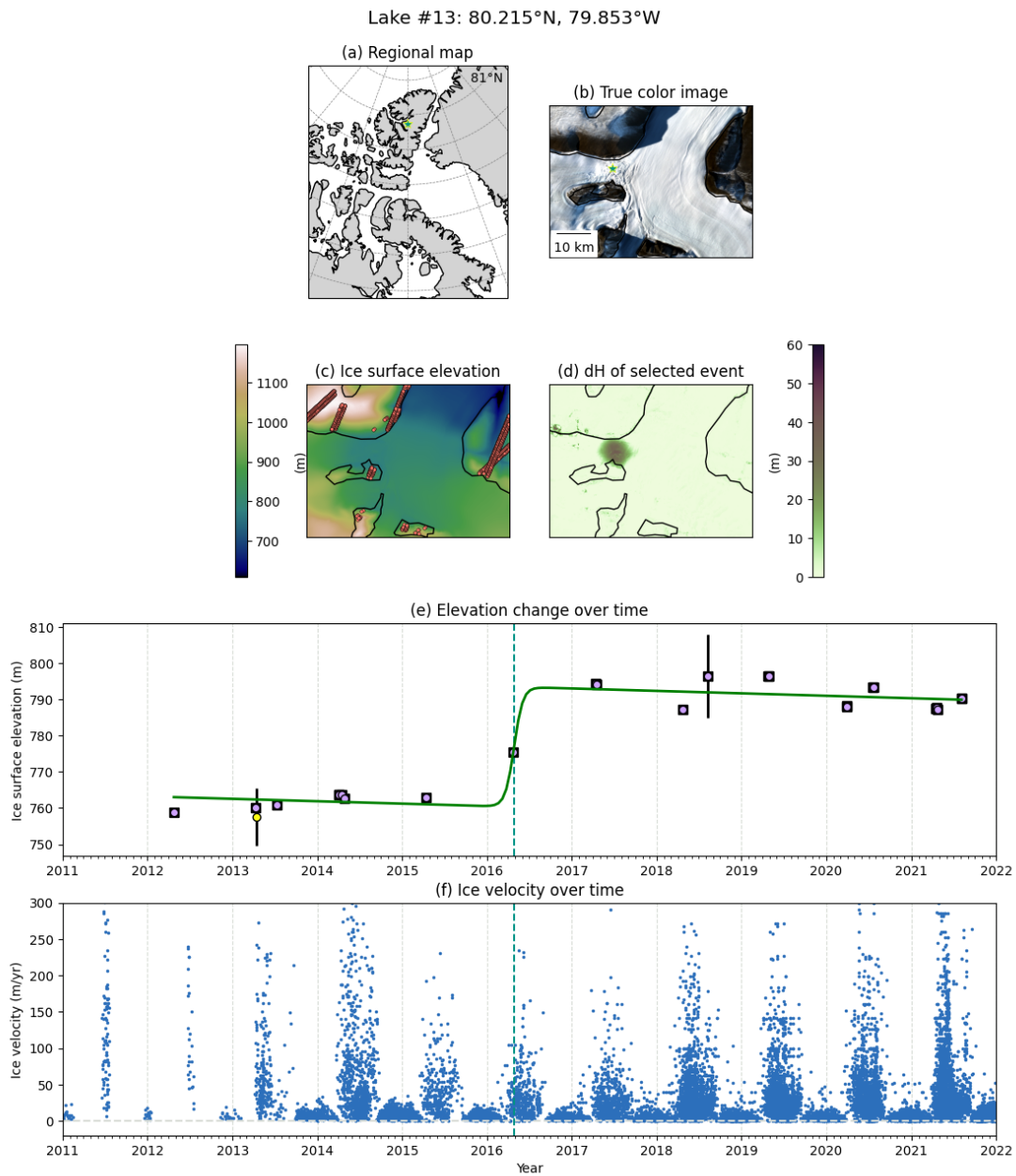
Figure S16: **Analysis of Lake 13.** See supplementary text for detailed description.
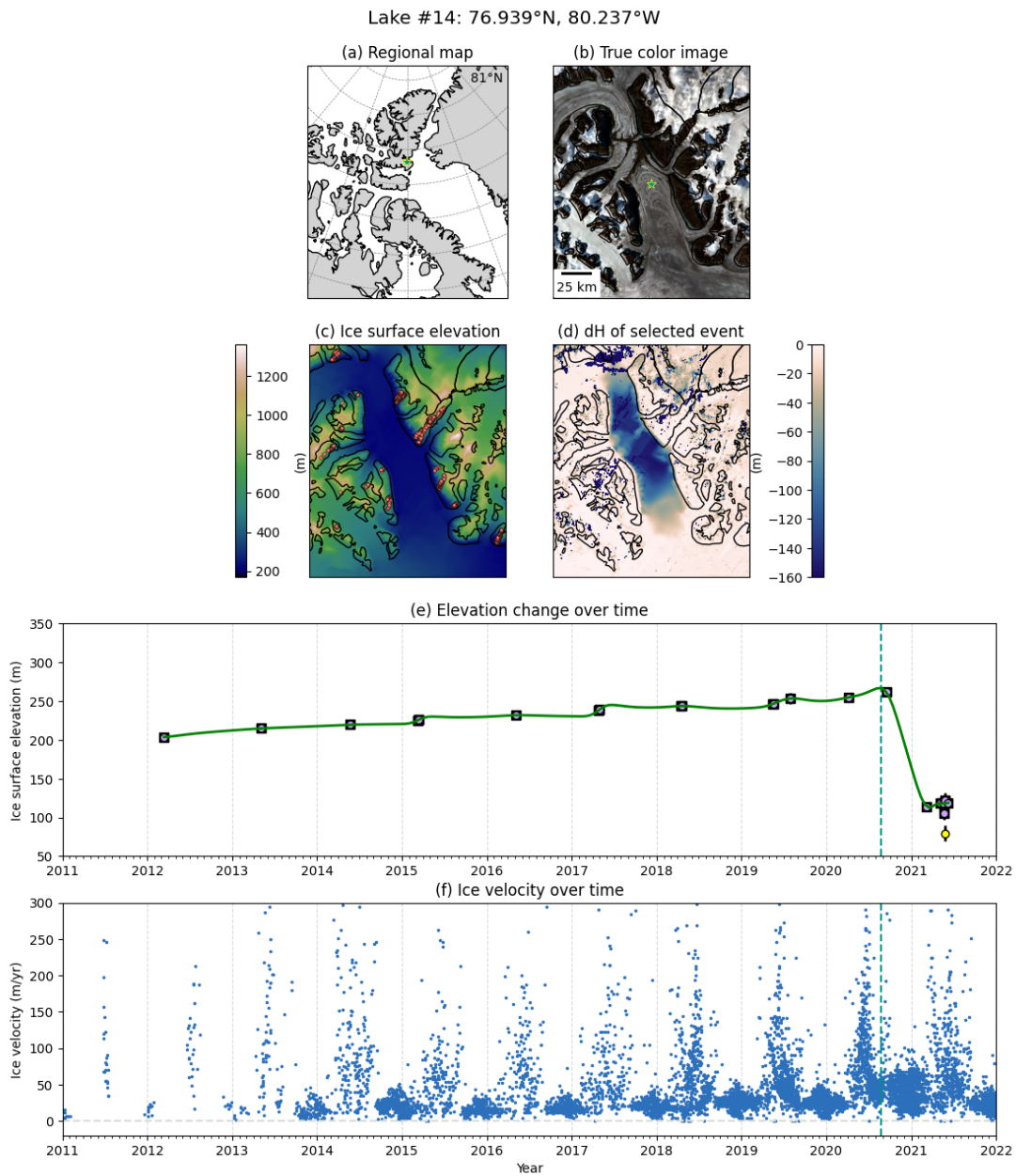
Figure S17: **Analysis of Lake 14.** See supplementary text for detailed description.
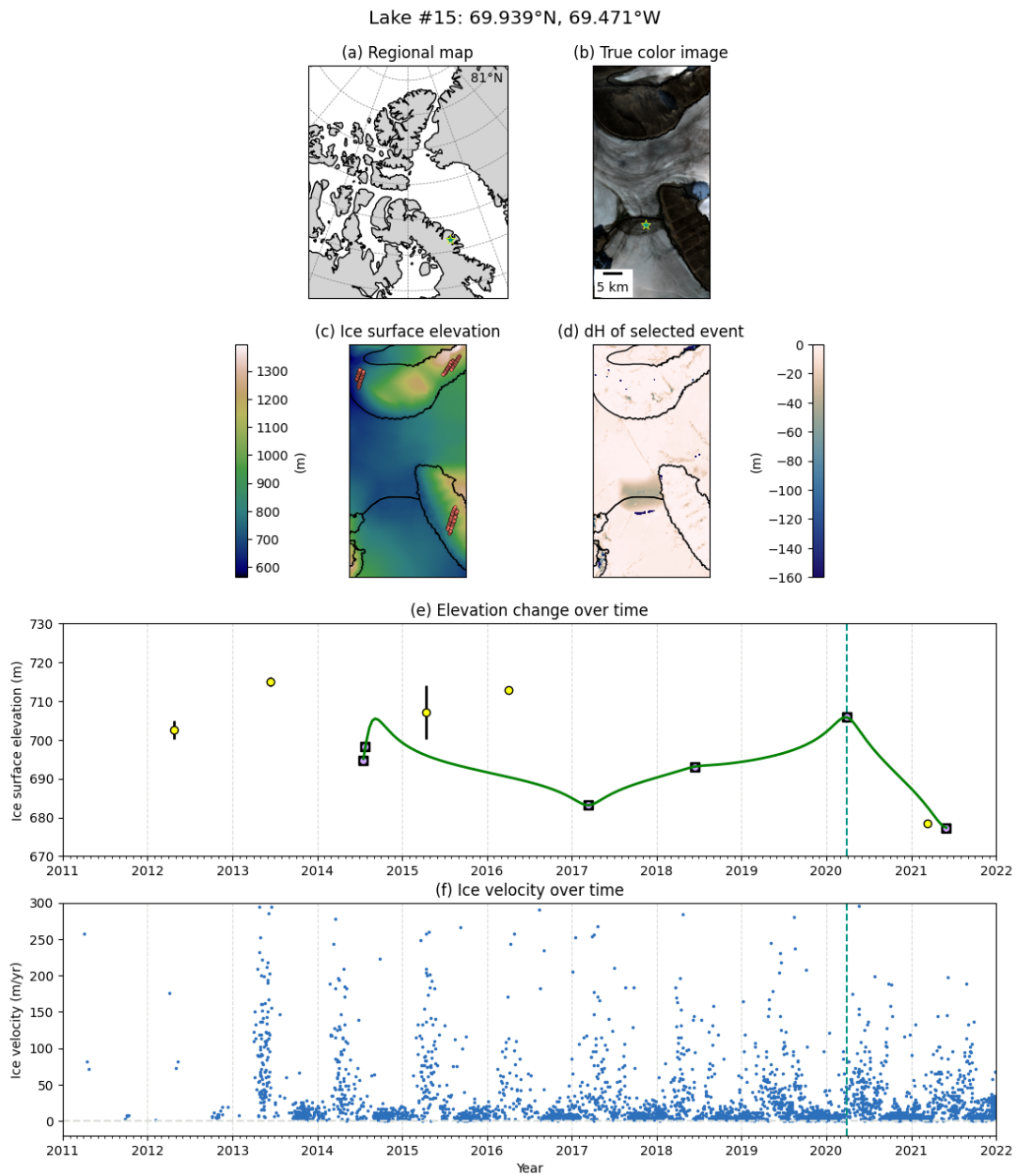
Figure S18: **Analysis of Lake 15.** See supplementary text for detailed description.
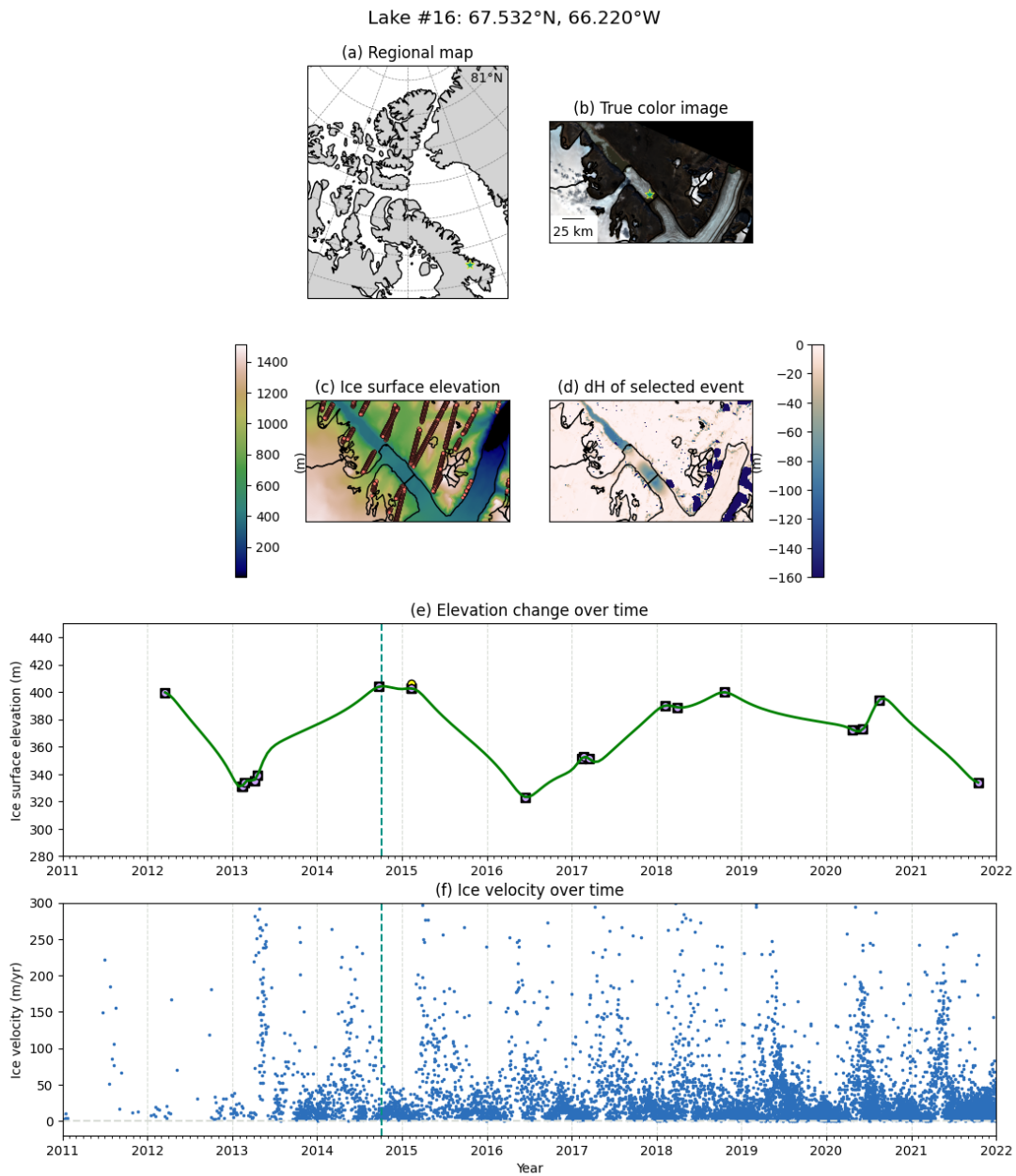
Figure S19: **Analysis of Lake 16.** See supplementary text for detailed description.
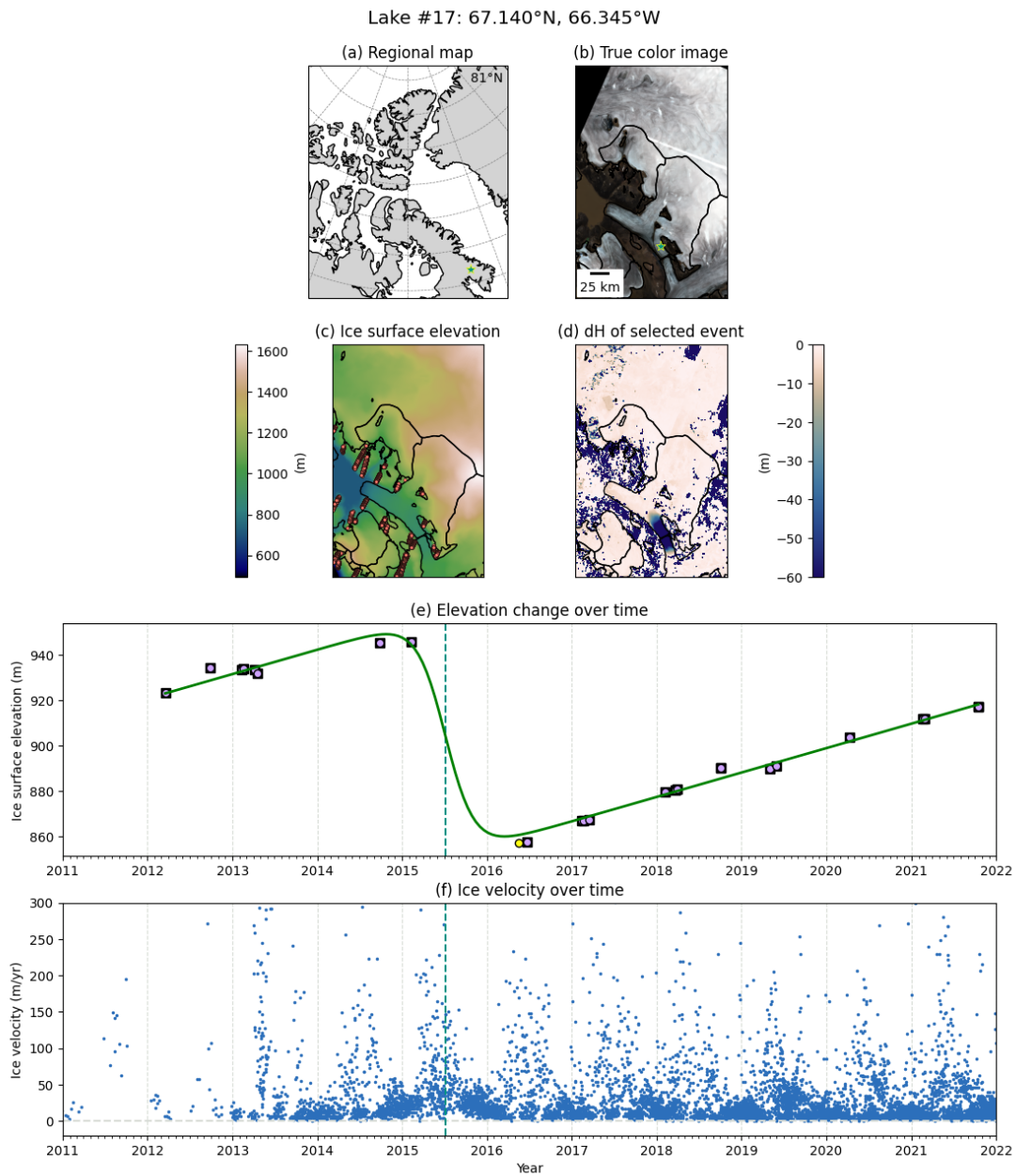
Figure S20: **Analysis of Lake 17.** See supplementary text for detailed description.
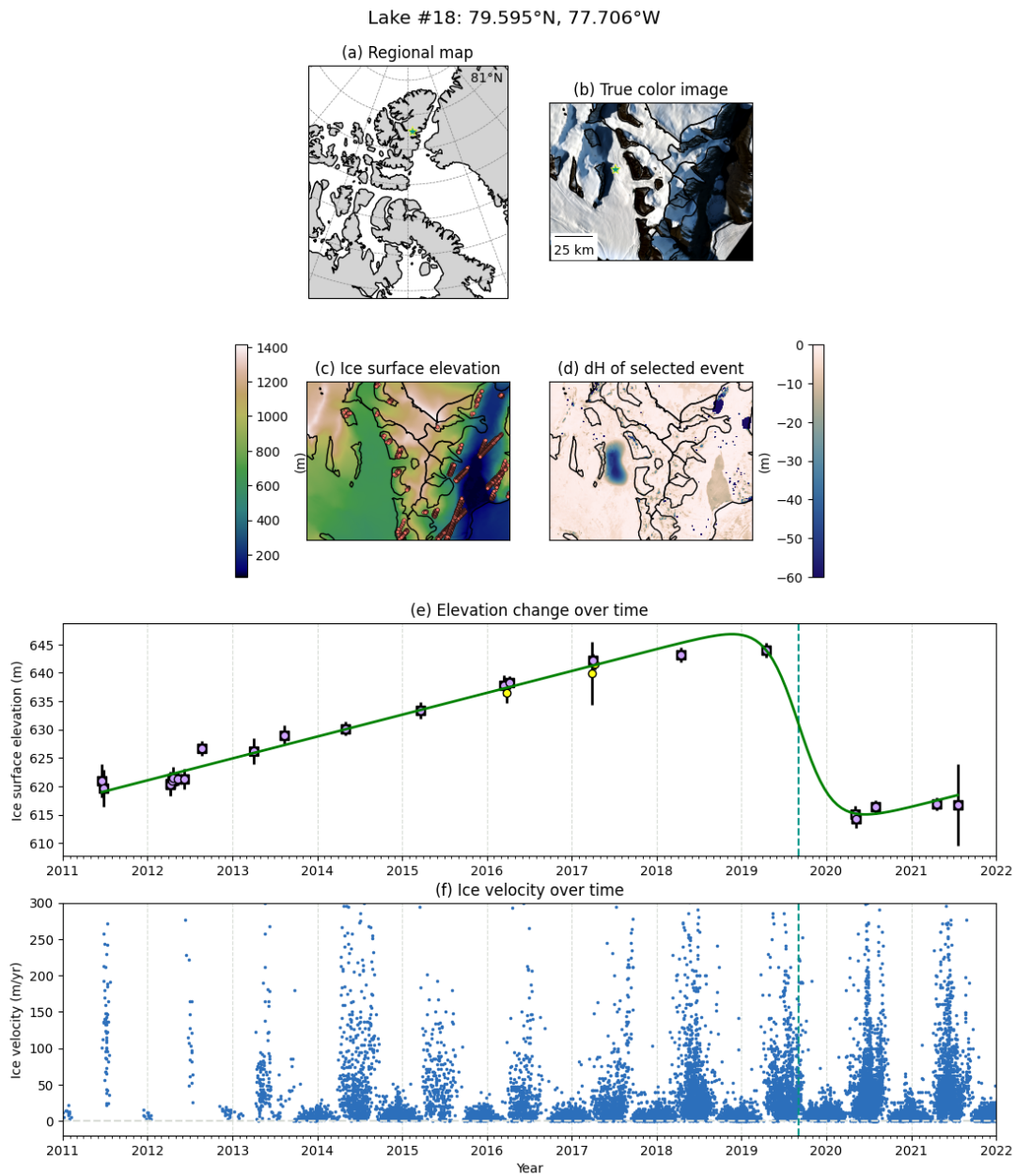
Figure S21: **Analysis of Lake 18.** See supplementary text for detailed description.
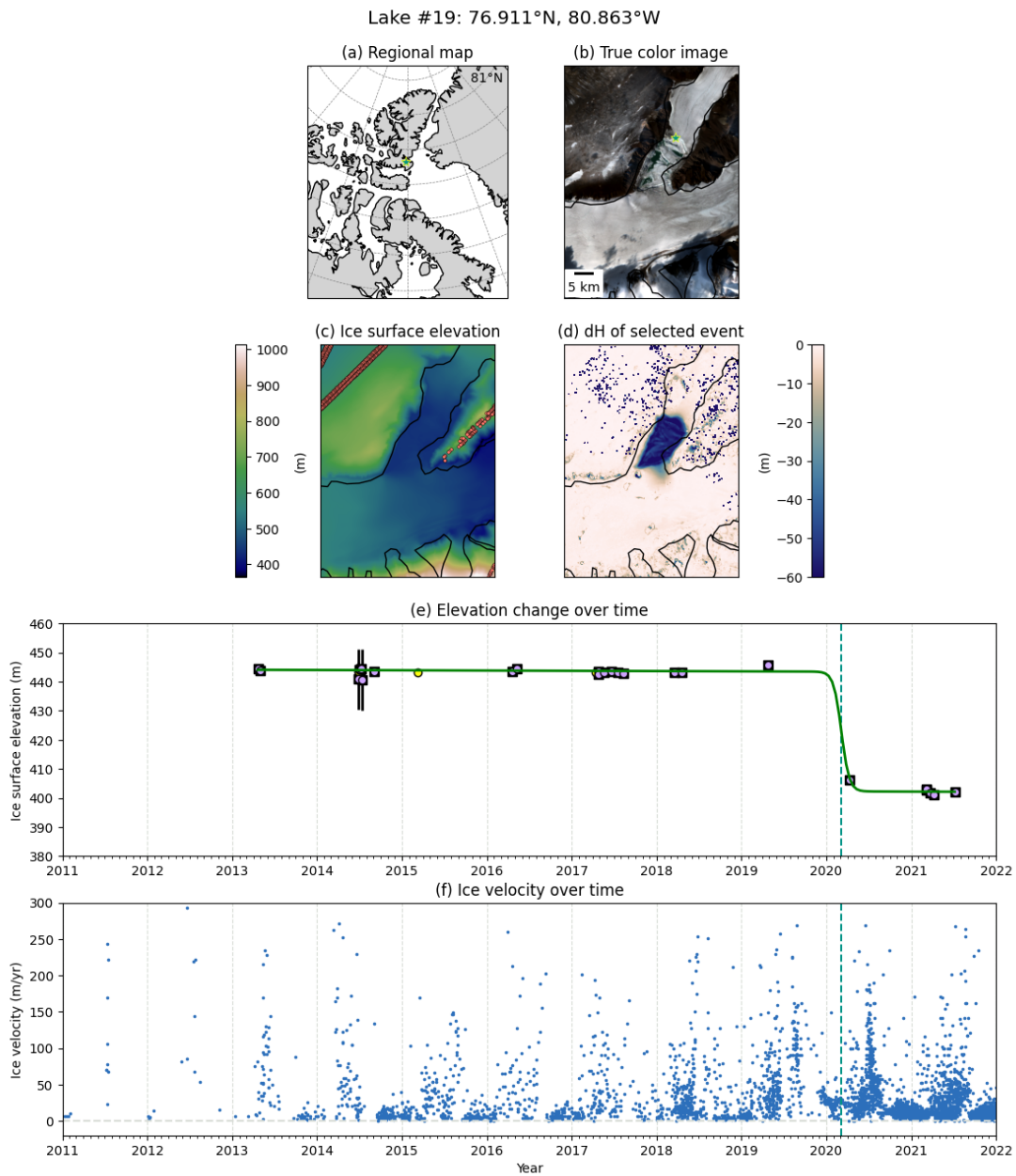
Figure S22: **Analysis of Lake 19.** See supplementary text for detailed description.
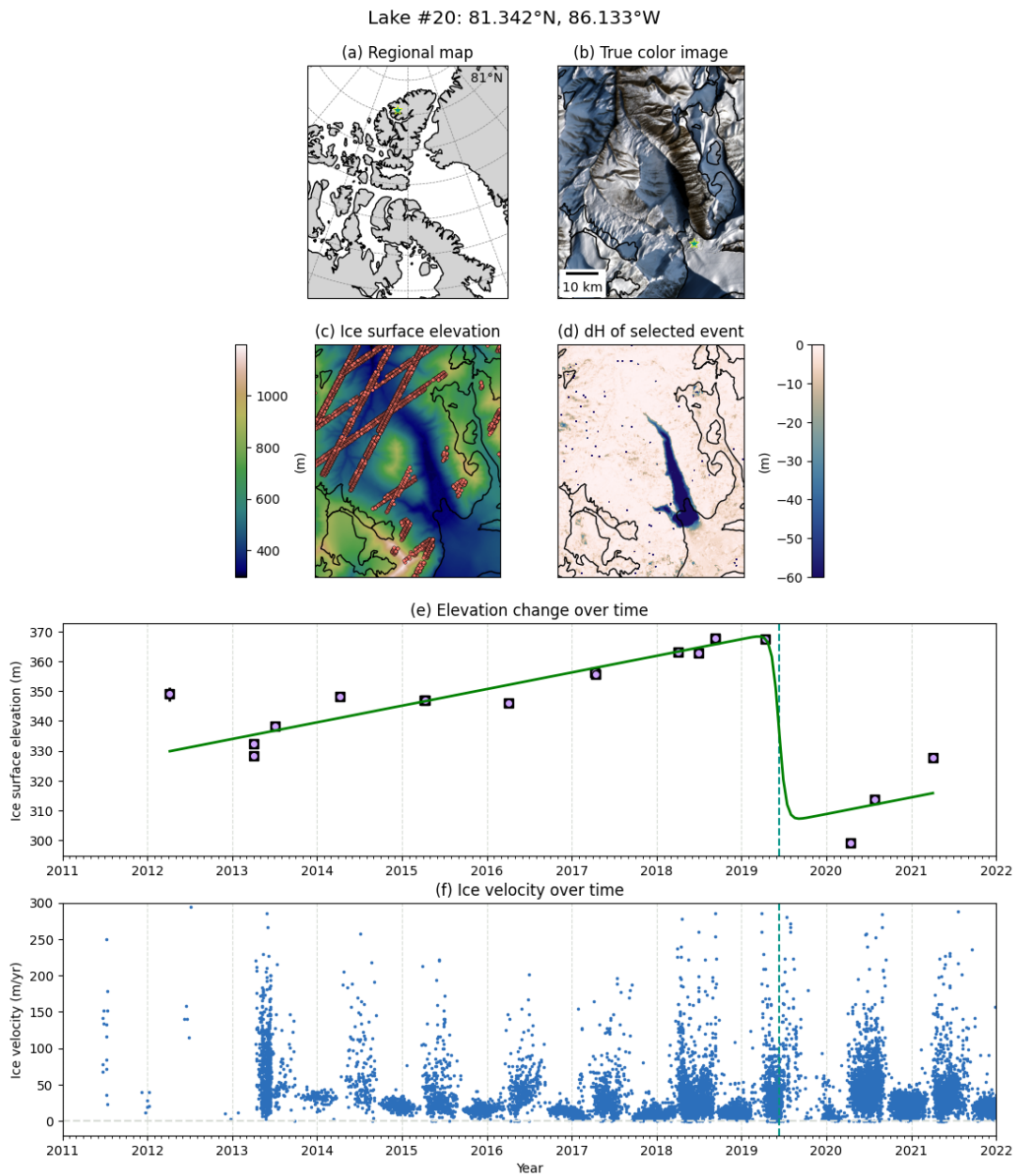
Figure S23: **Analysis of Lake 20.** See supplementary text for detailed description.
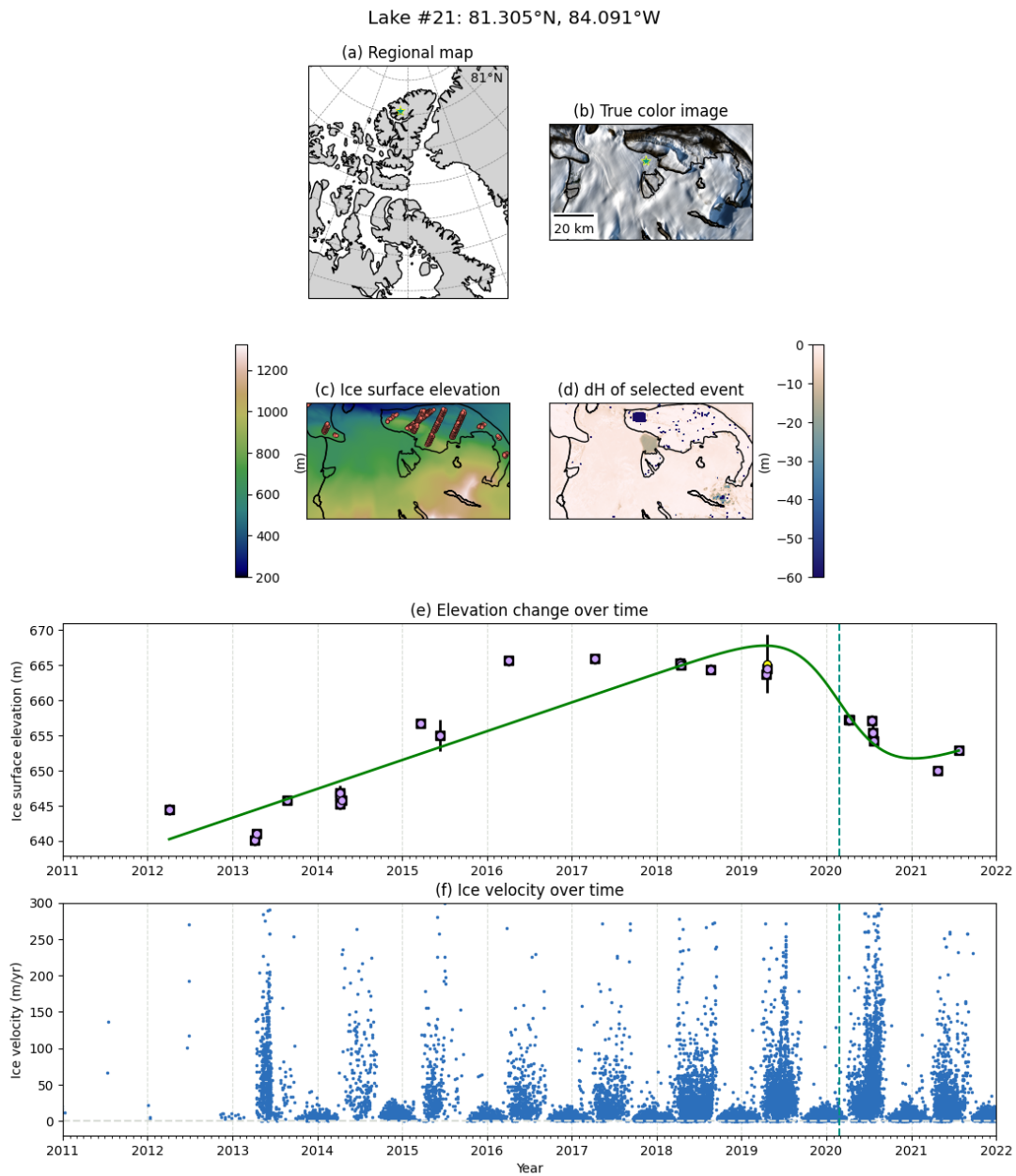
Figure S24: **Analysis of Lake 21.** See supplementary text for detailed description.
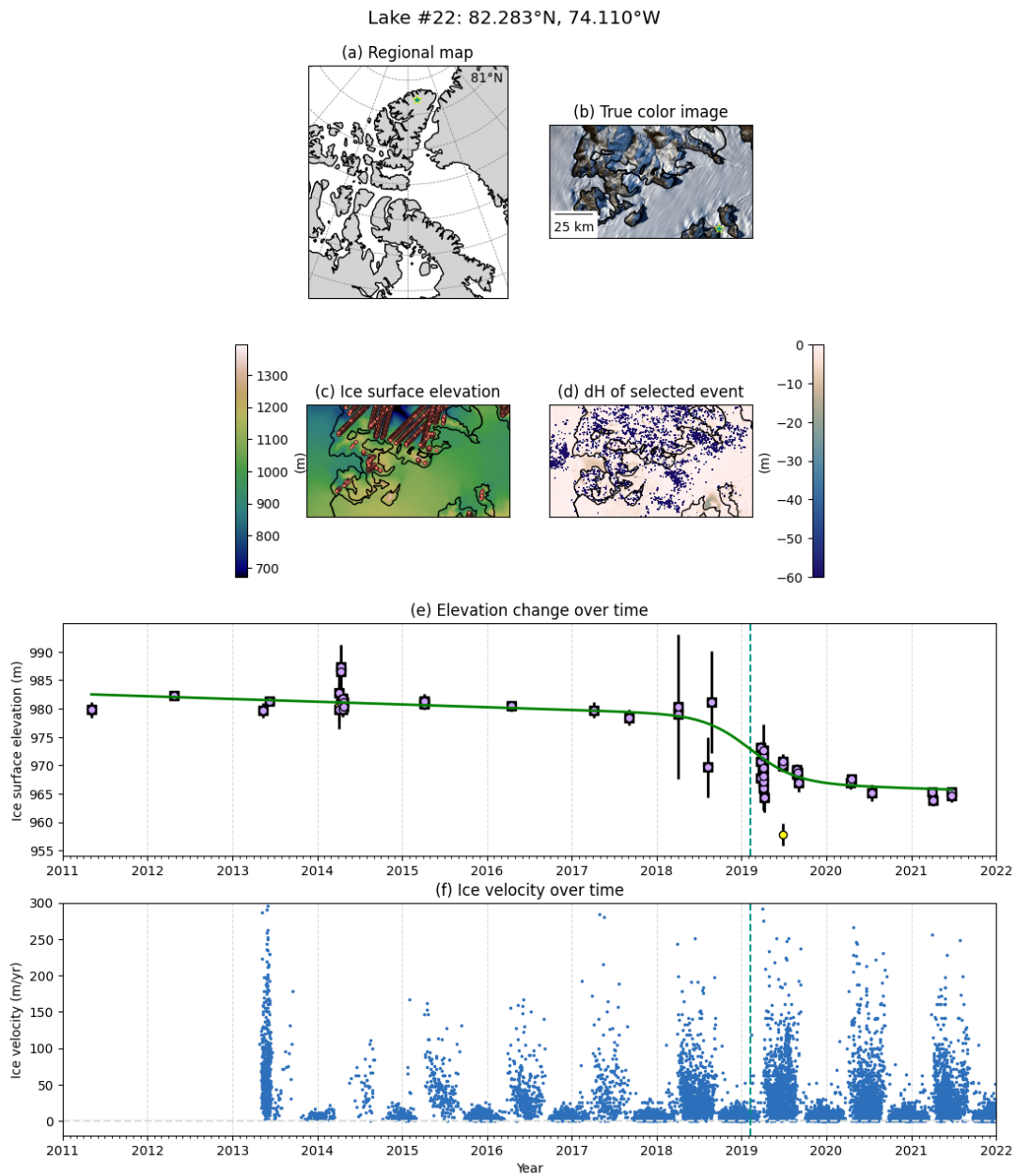
Figure S25: **Analysis of Lake 22.** See supplementary text for detailed description.
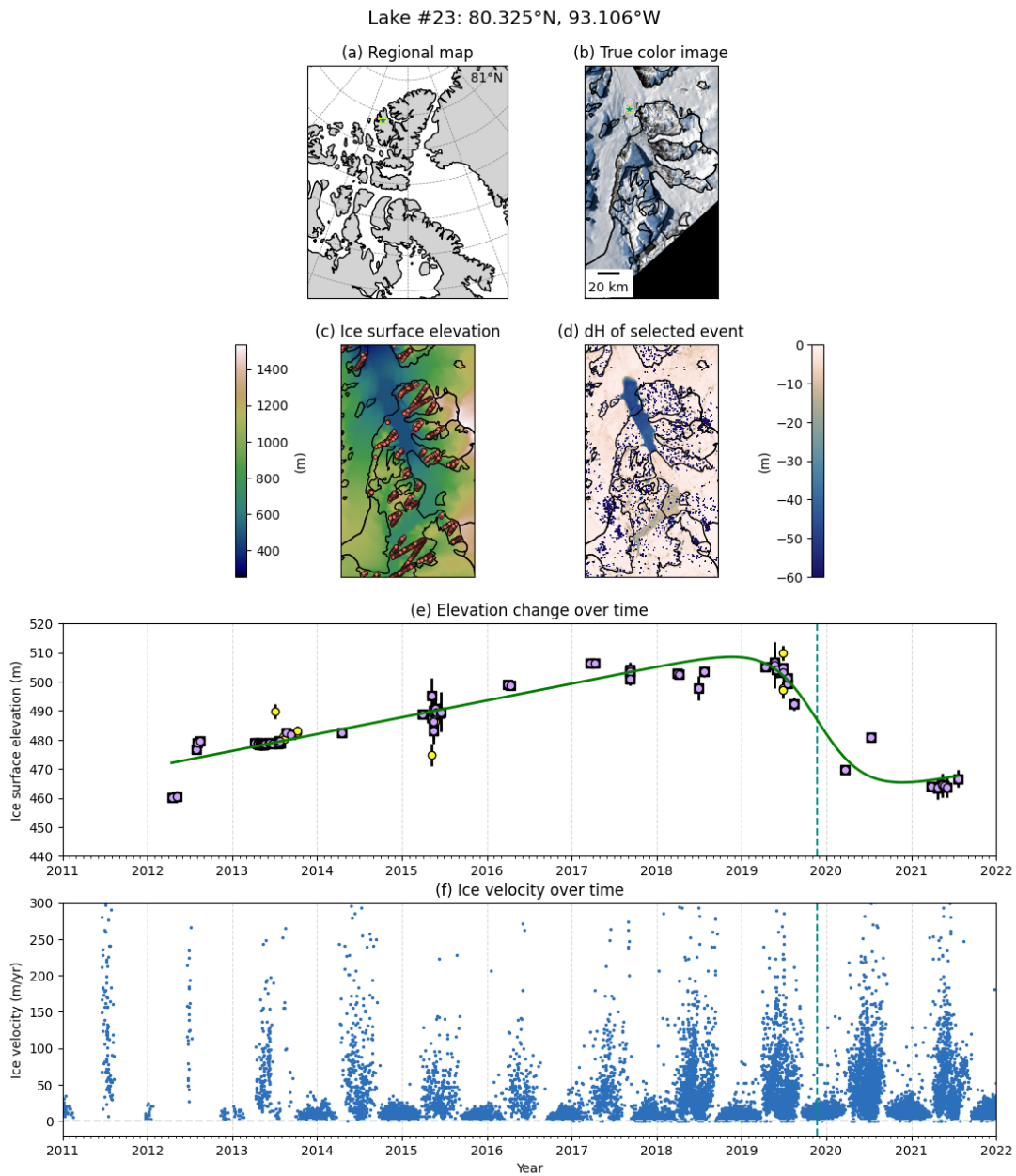
Figure S26: **Analysis of Lake 23.** See supplementary text for detailed description.
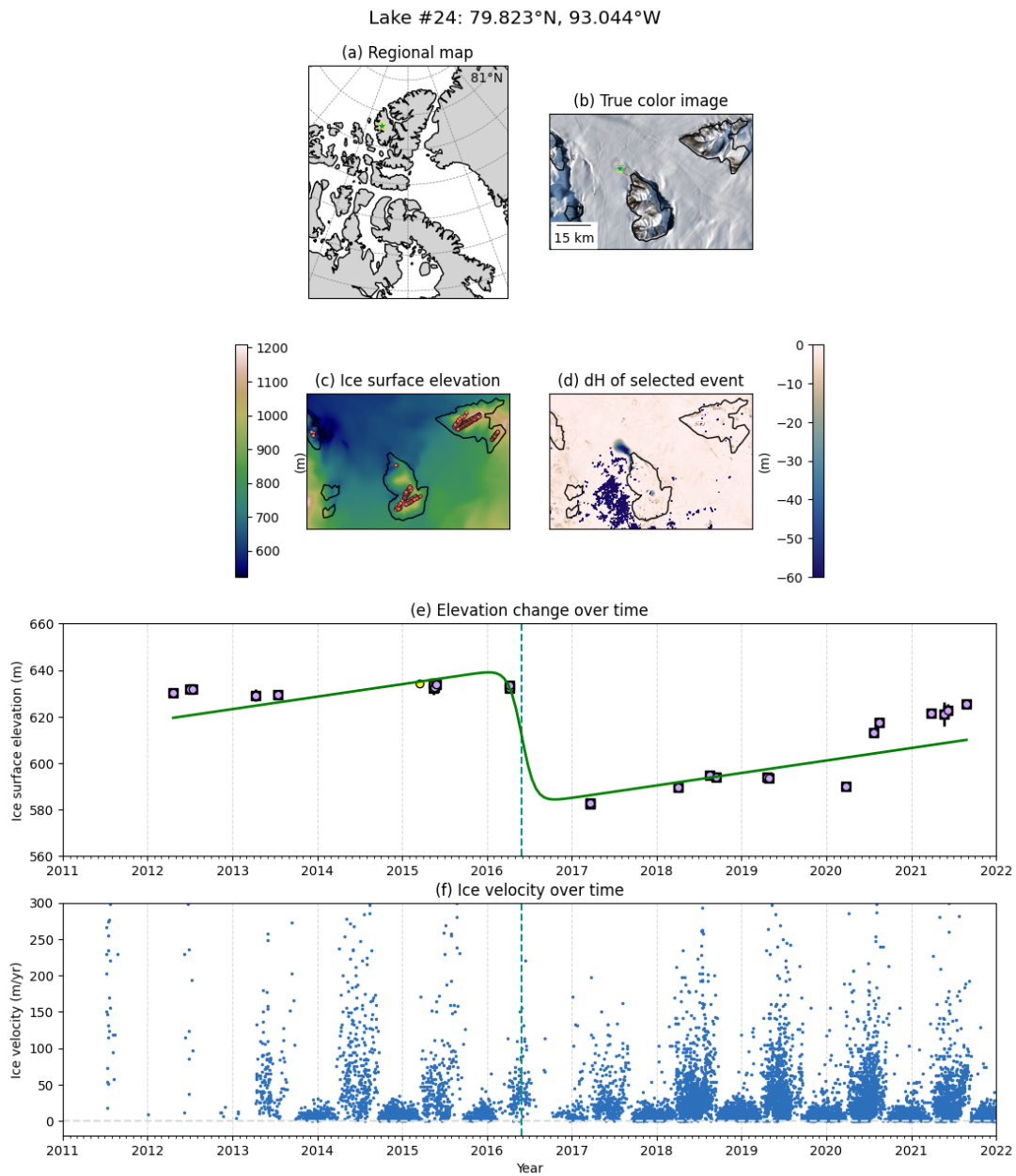
Figure S27: **Analysis of Lake 24.** See supplementary text for detailed description.
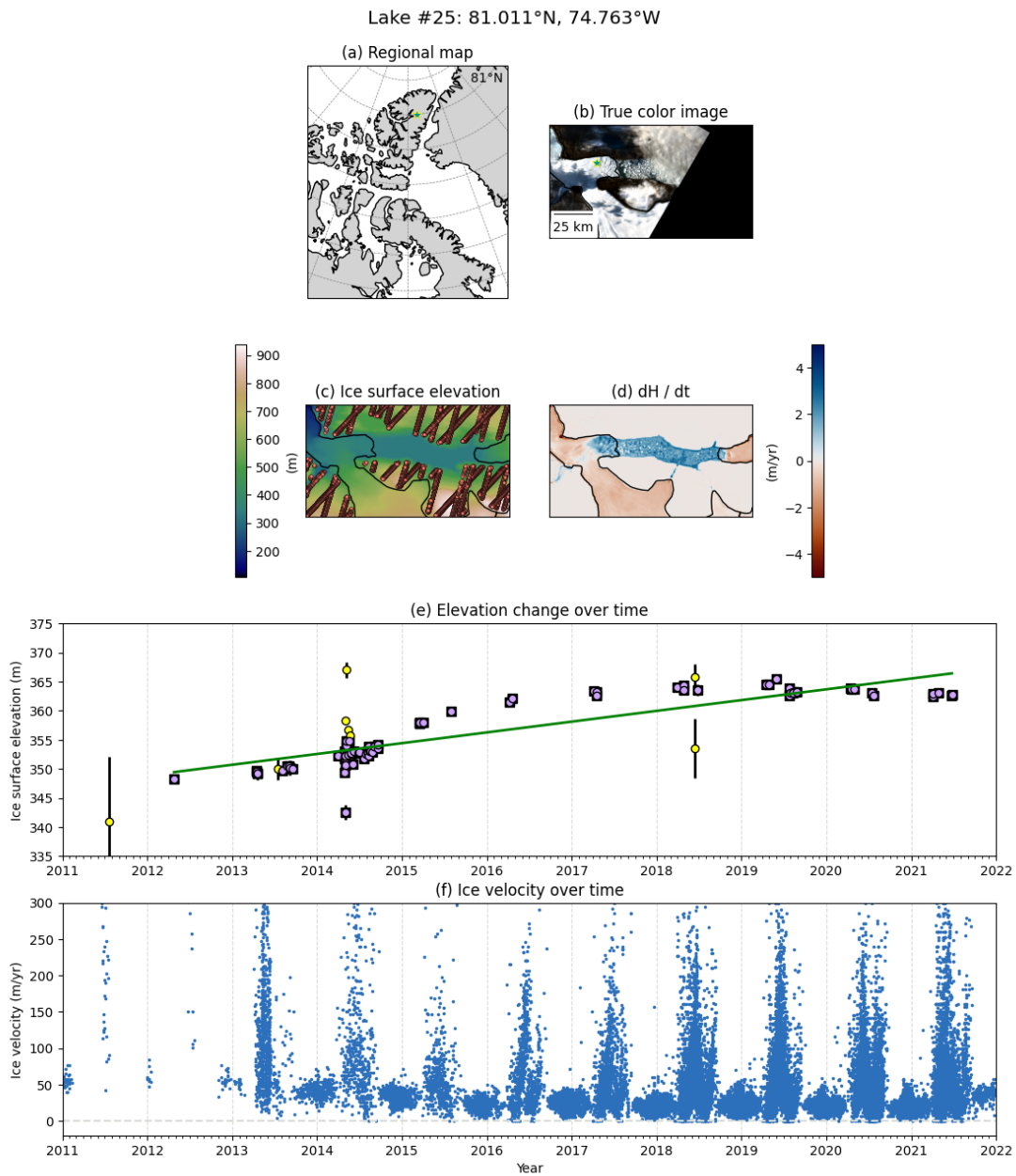
Figure S28: **Analysis of Lake 25.** See supplementary text for detailed description.
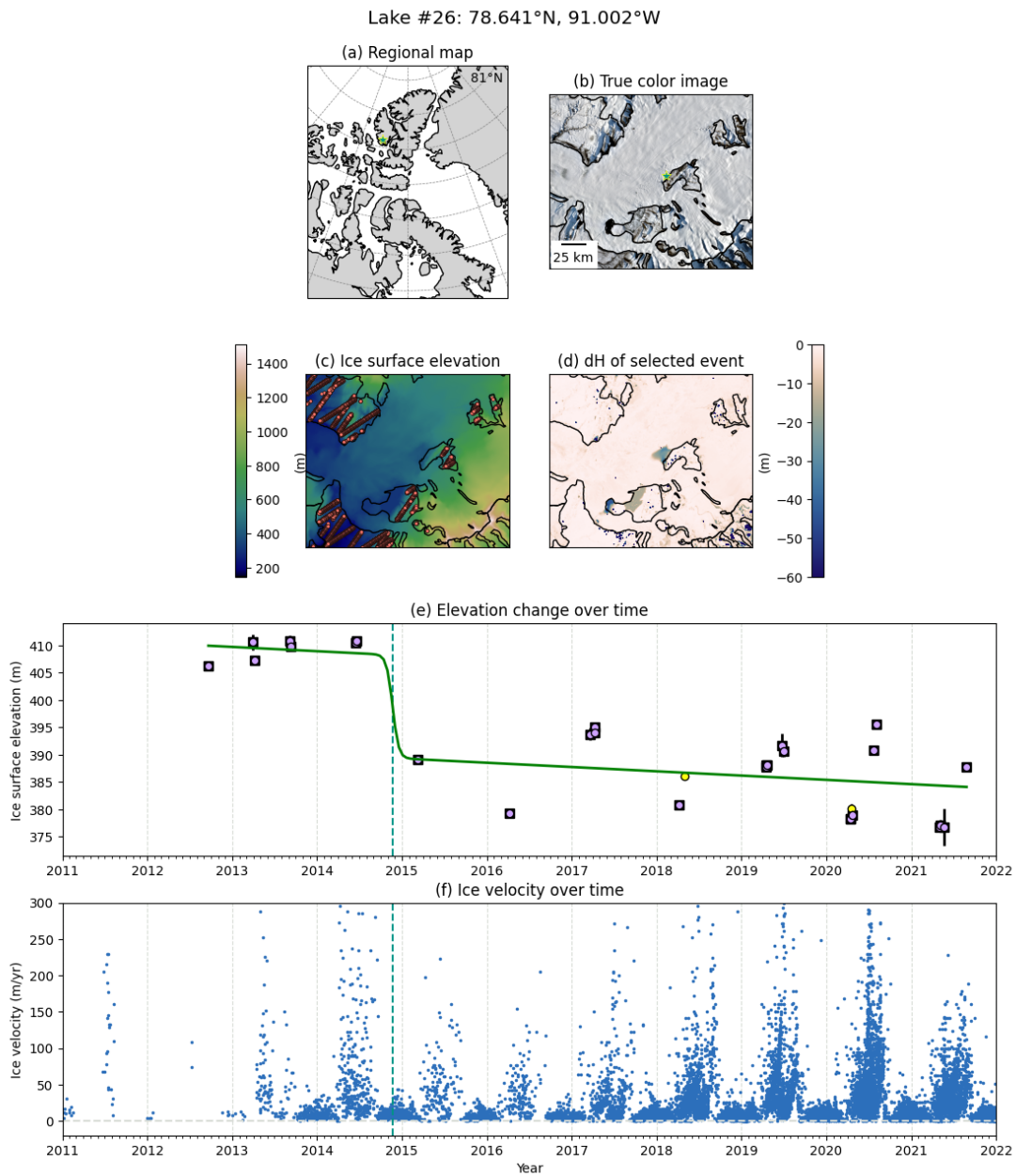
Figure S29: **Analysis of Lake 26.** See supplementary text for detailed description.
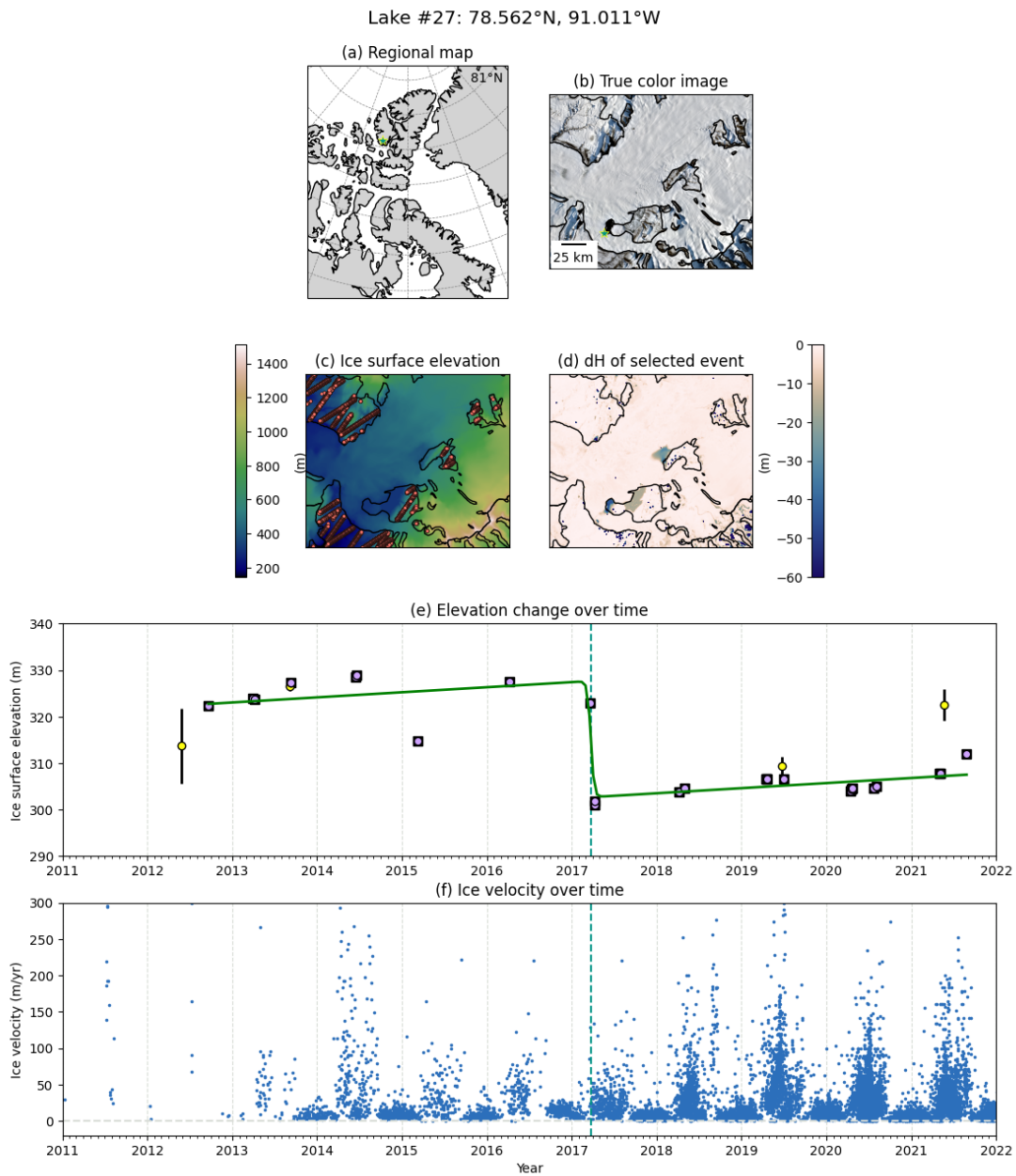
Figure S30: **Analysis of Lake 27.** See supplementary text for detailed description.
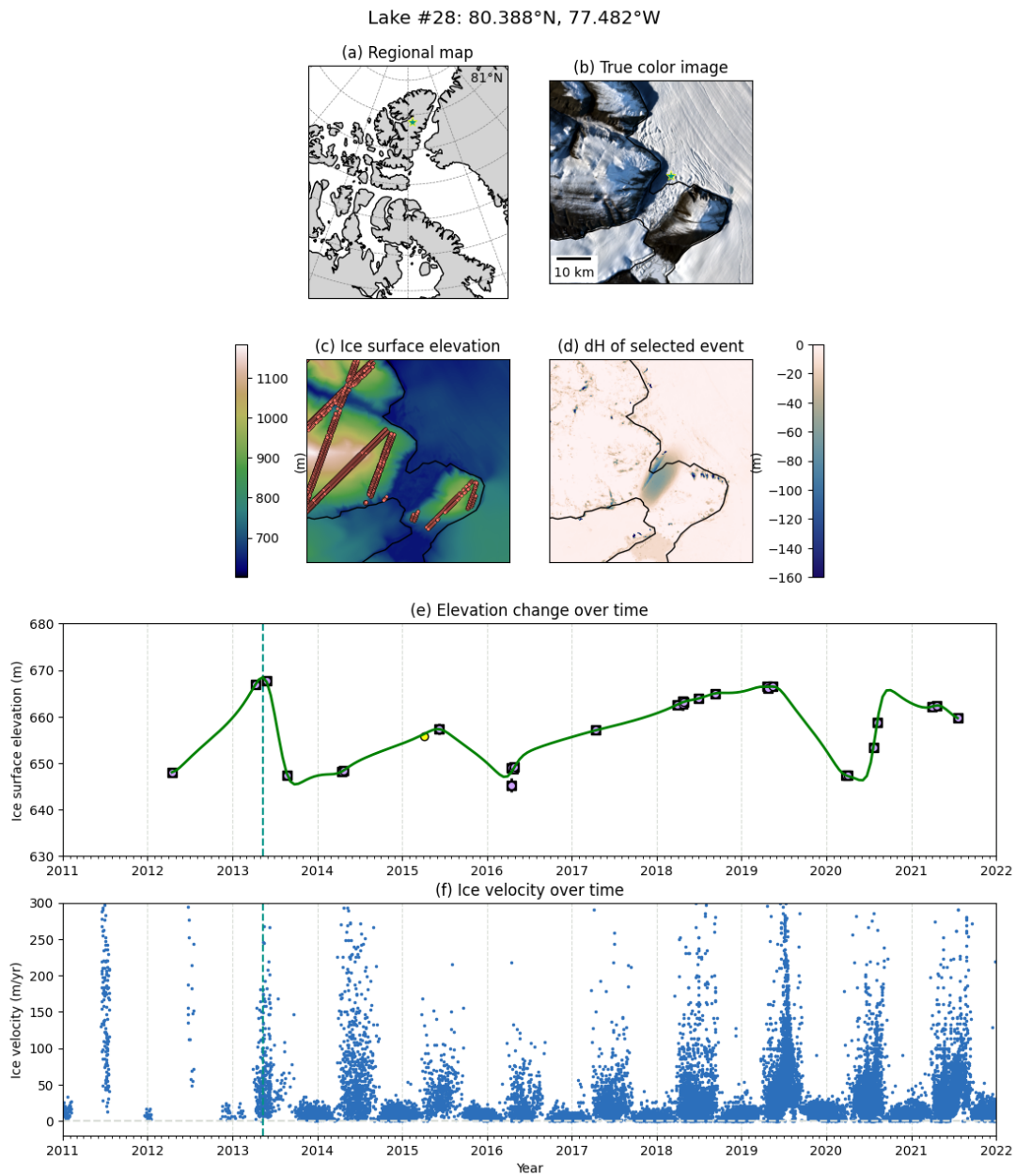
Figure S31: **Analysis of Lake 28.** See supplementary text for detailed description.
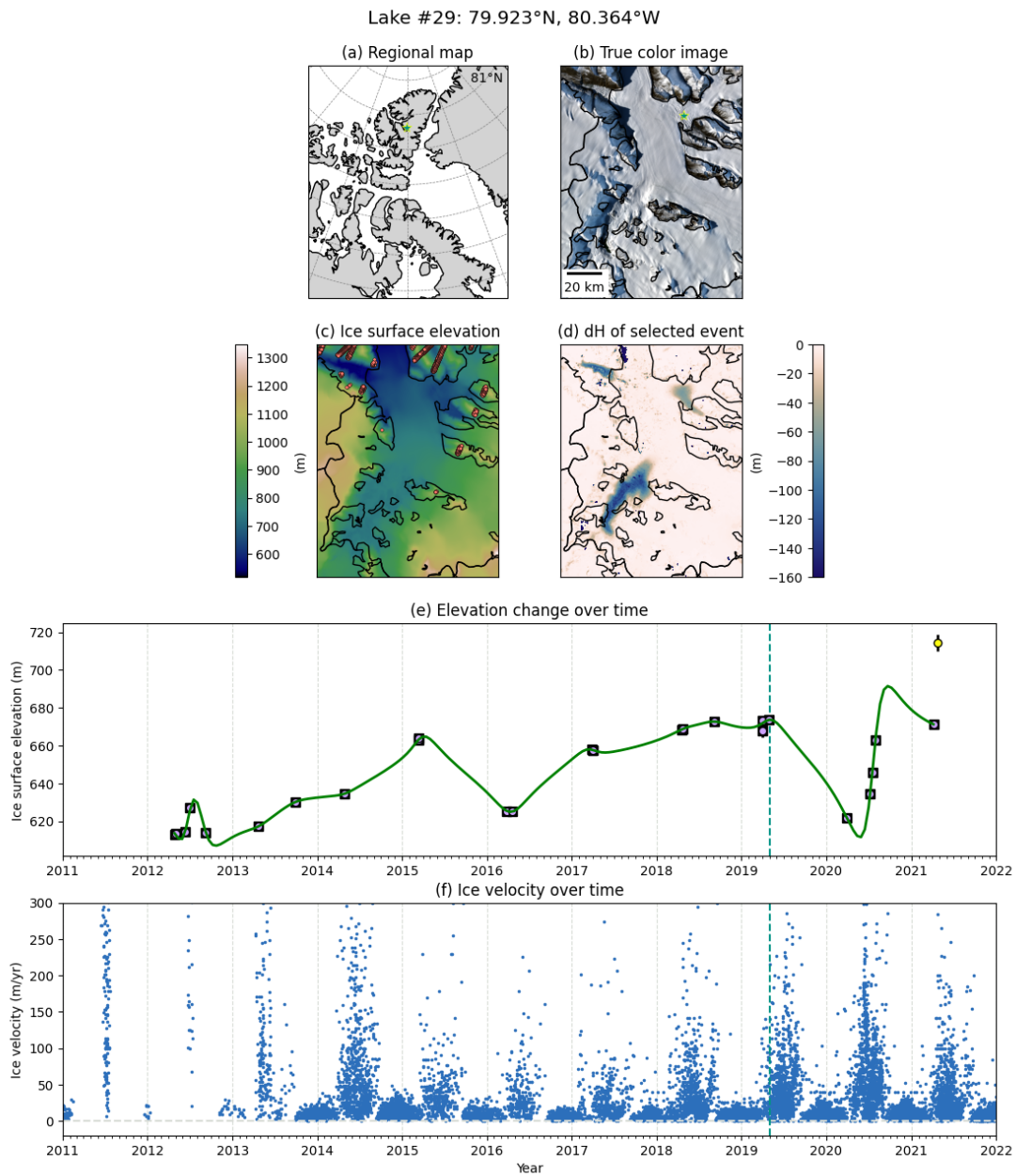
Figure S32: **Analysis of Lake 29.** See supplementary text for detailed description.
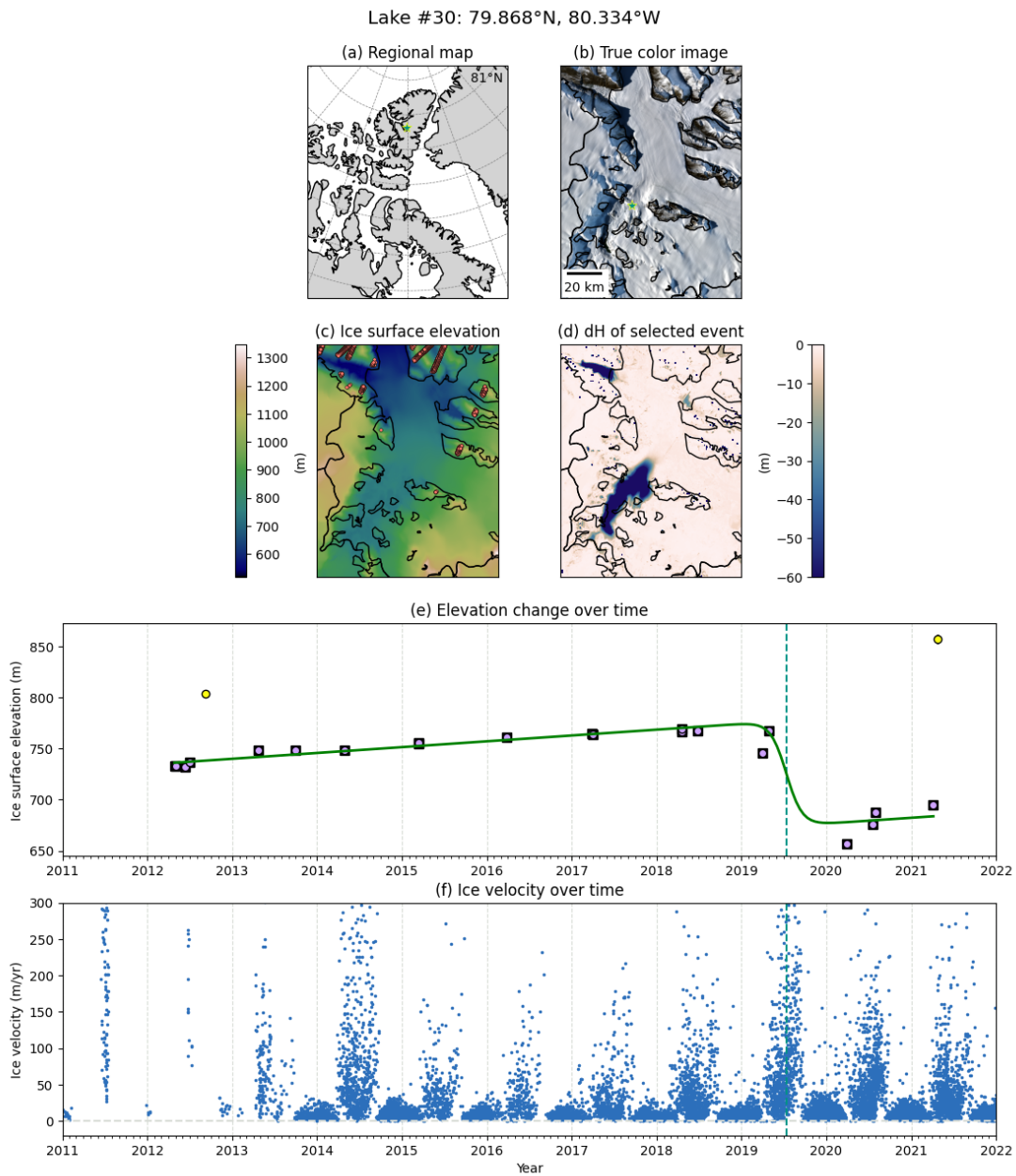
Figure S33: **Analysis of Lake 30.** See supplementary text for detailed description.
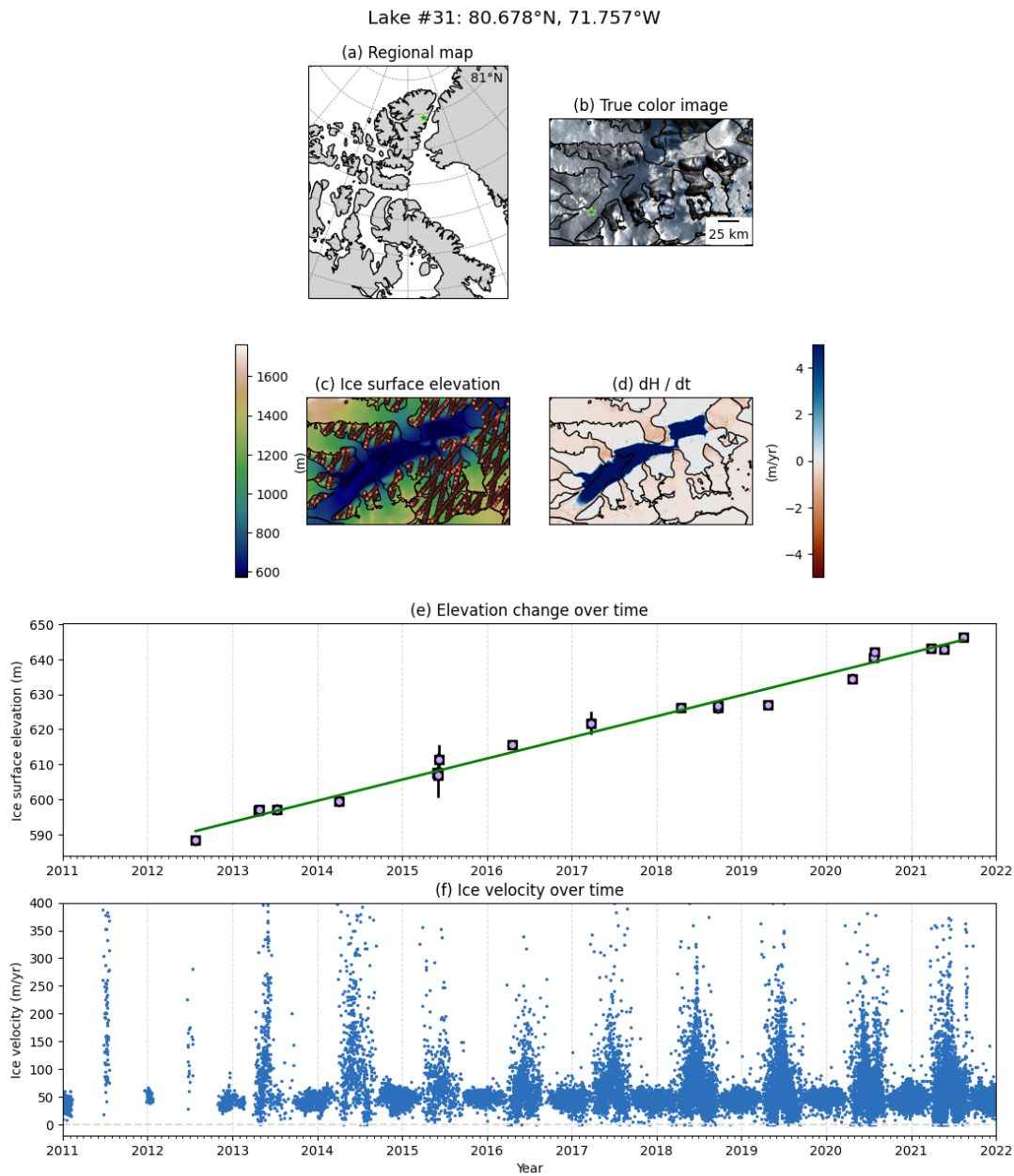
Figure S34: **Analysis of Lake 31.** See supplementary text for detailed description.
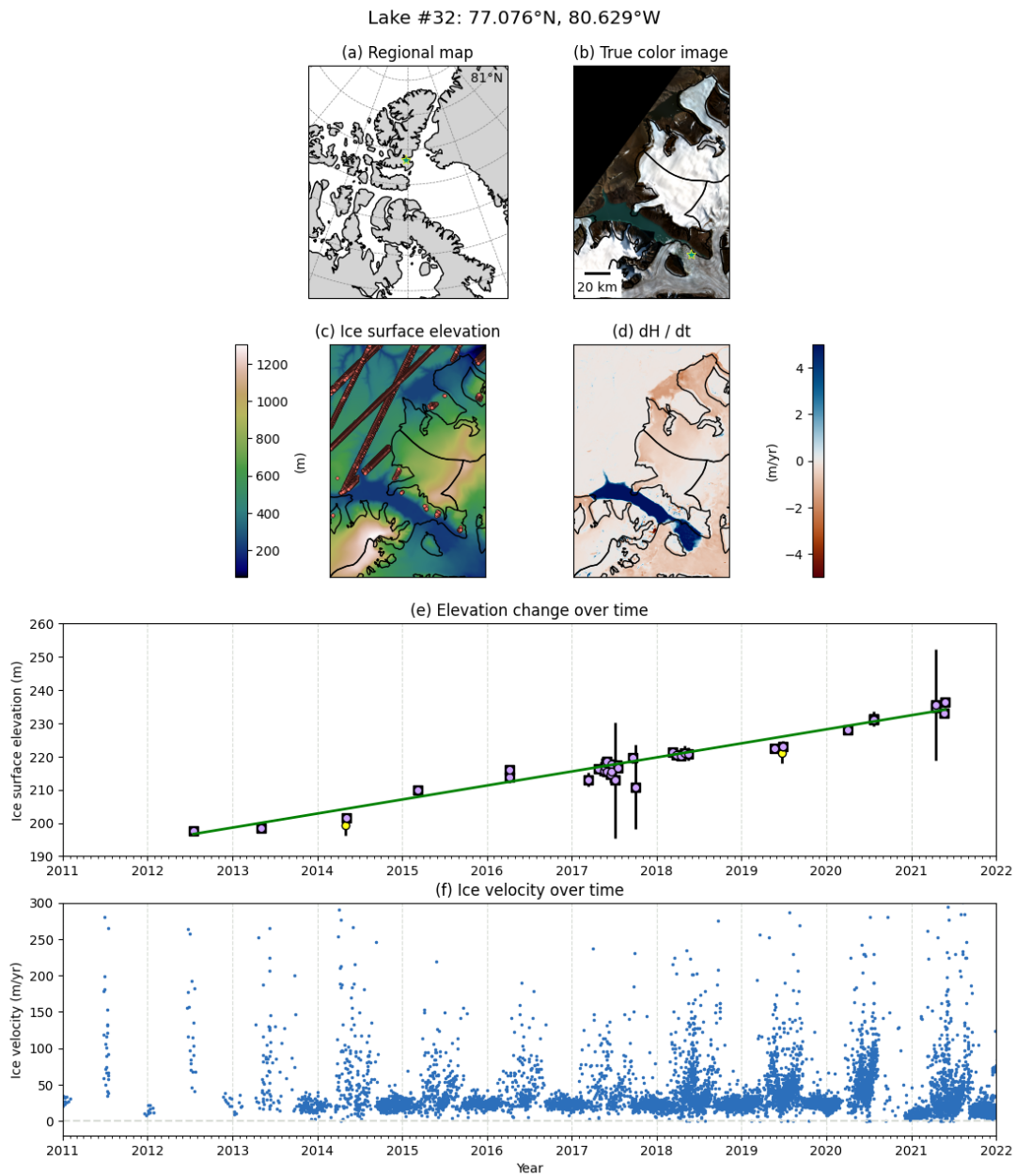
Figure S35: **Analysis of Lake 32.** See supplementary text for detailed description.
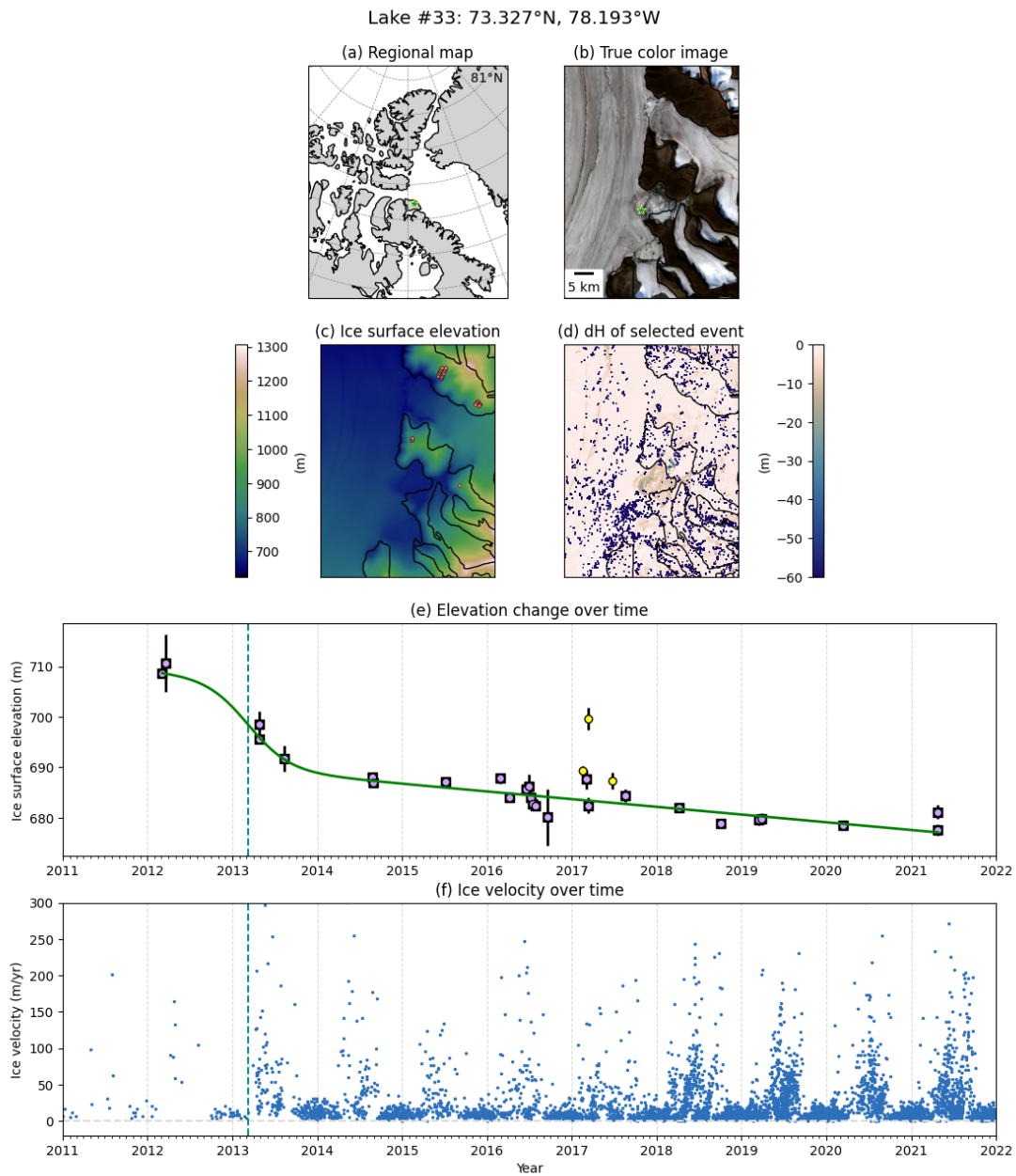
Figure S36: **Analysis of Lake 33.** See supplementary text for detailed description.
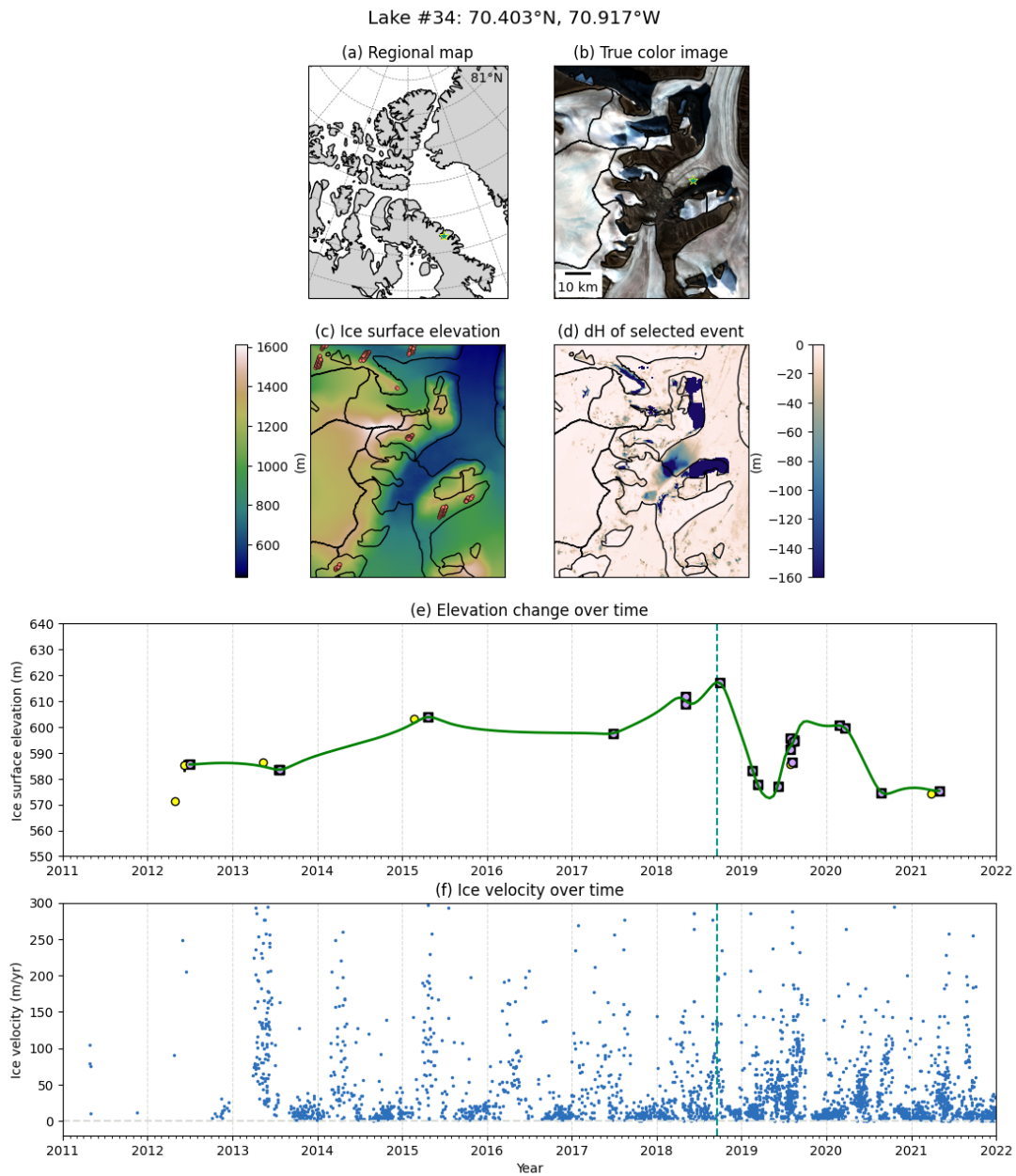
Figure S37: **Analysis of Lake 34.** See supplementary text for detailed description.