
Supplementary Information

Expansion of supraglacial lake area, volume and extent on the Greenland Ice

Sheet from 1985 to 2023

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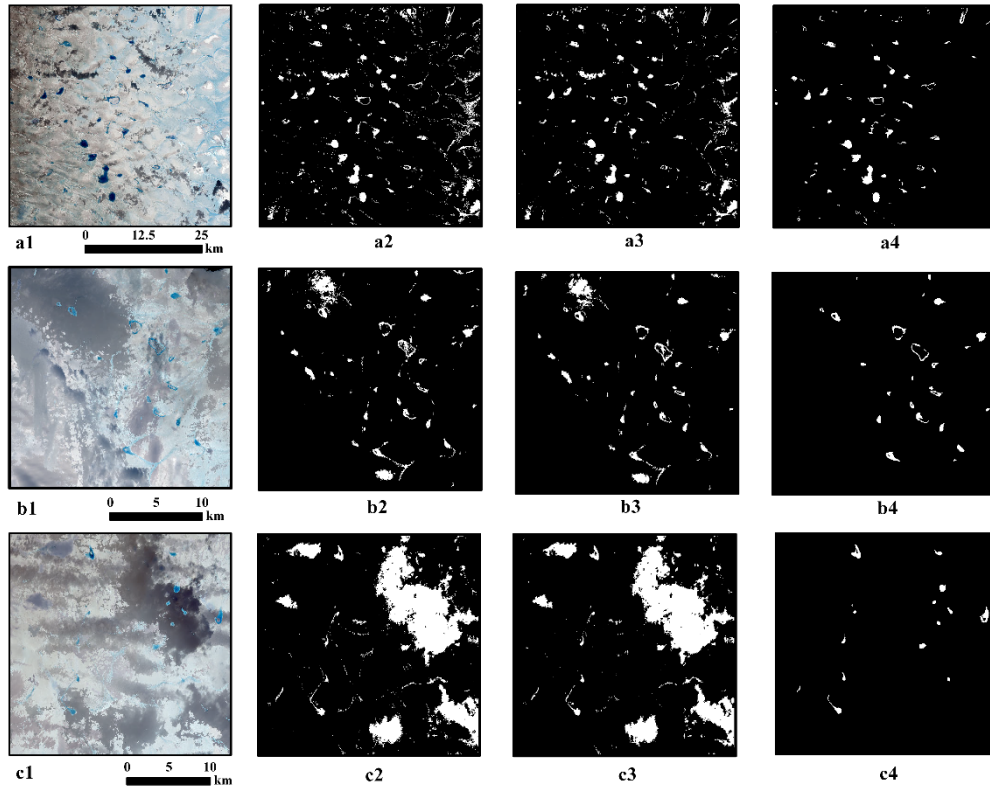


Fig. S1. Process of extracting supraglacial lakes, using 2016 as an example (where white color represents supraglacial lakes). The rows correspond to the SW, NE, and NO basins, respectively. The first column shows the Landsat 8 composite image, the second column displays the NDWI threshold classification result, the third column represents the result after removing slush and rivers, and the fourth column shows the manually corrected result.

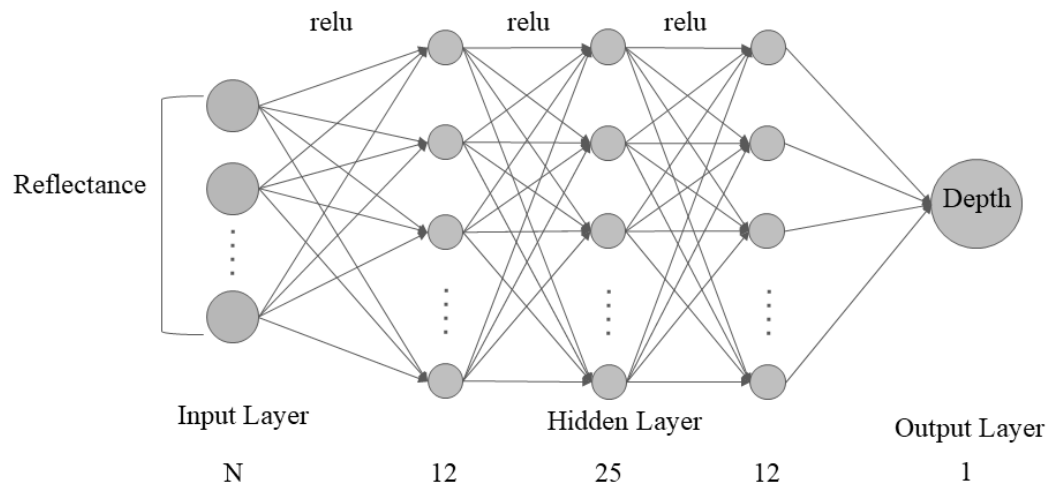


Fig. S2. Neural network for supraglacial lake depth inversion based on Landsat 8 band reflectance.

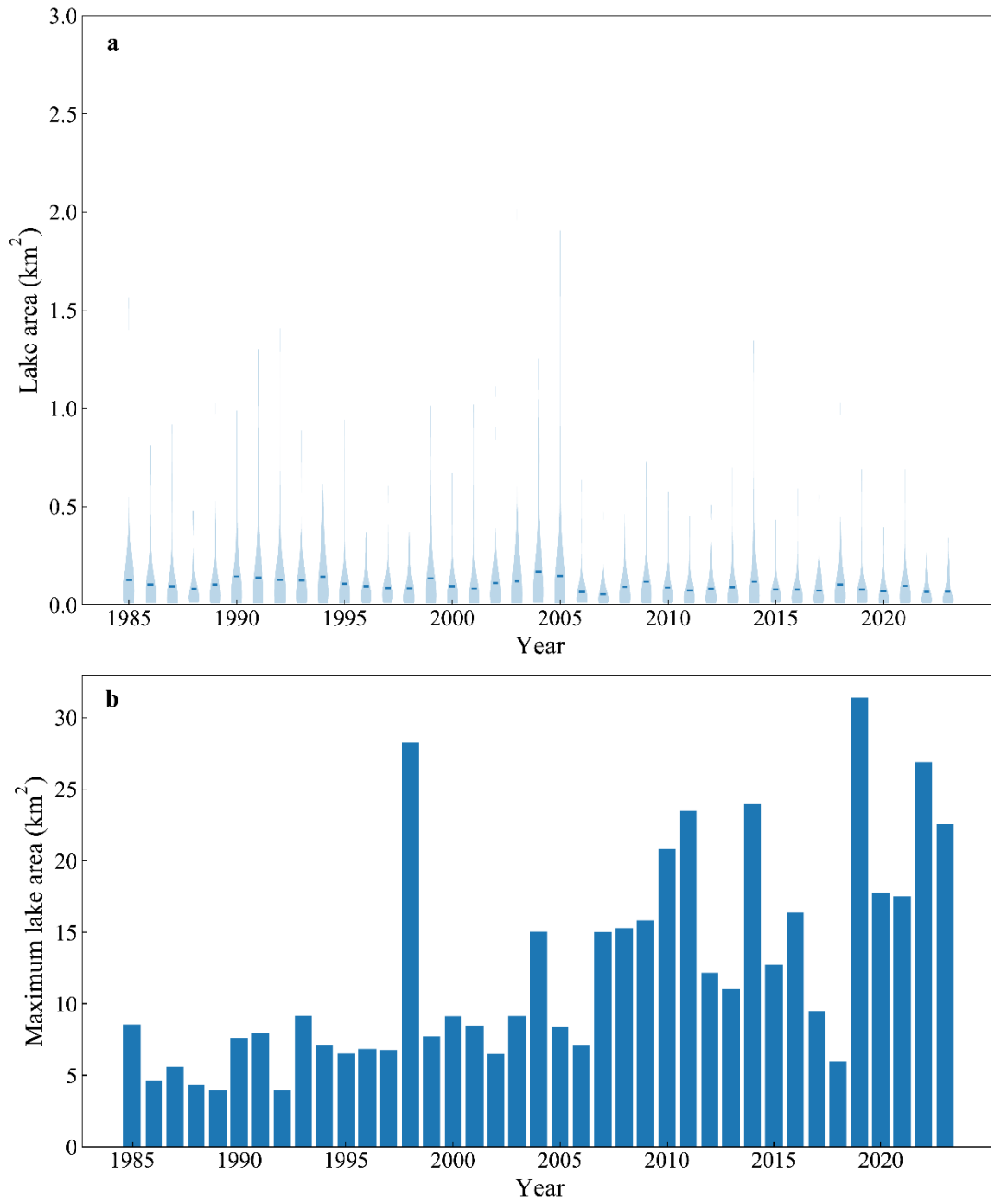


Fig. S3. (a) Violin plot of supraglacial lake area and (b) Maximum lake area in Greenland Ice Sheet from 1985 to 2023.

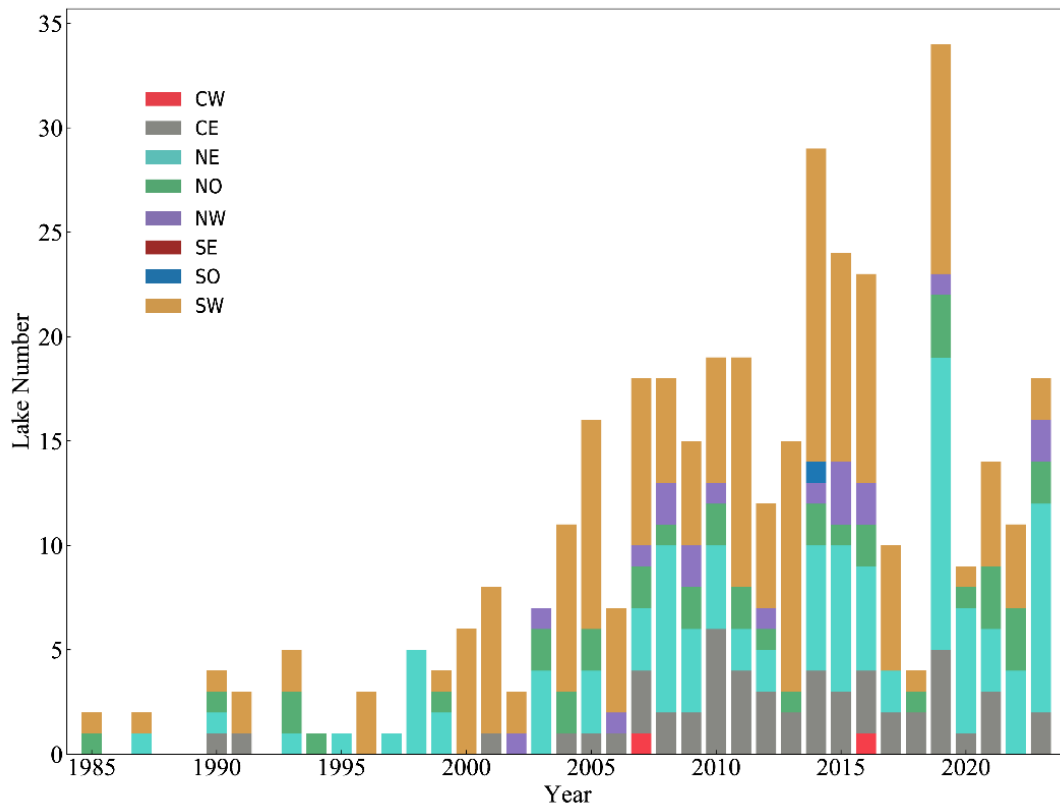


Fig. S4. Number of supraglacial lakes with an area larger than 5 km² in different basins from 1985 to 2023.

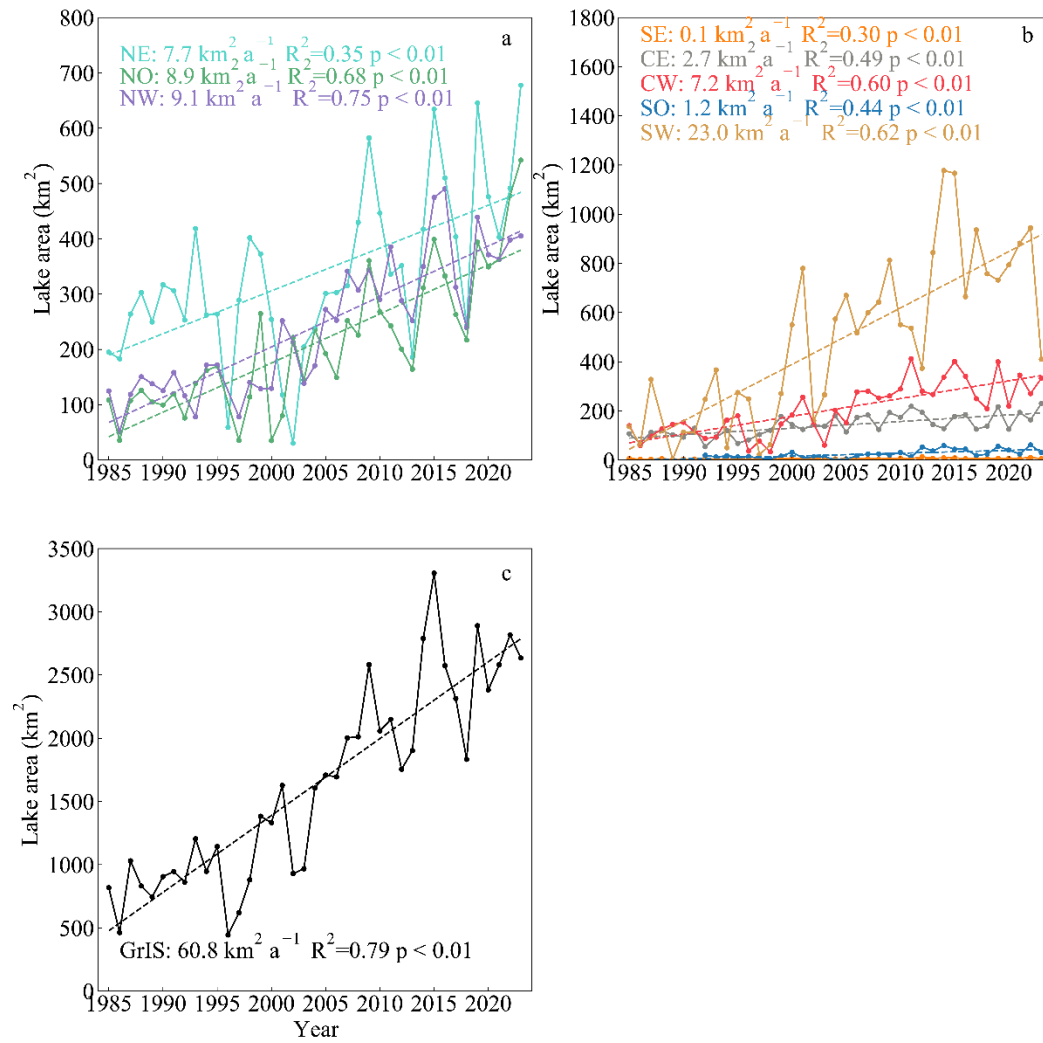


Fig. S5. Interannual variability in total supraglacial lake area using the mapped lake area of the Greenland Ice Sheet from 1985 to 2023. The upper left panel shows the northern region, while the upper right panel displays the central and southern regions. All fitted trends have p-values less than 0.01.

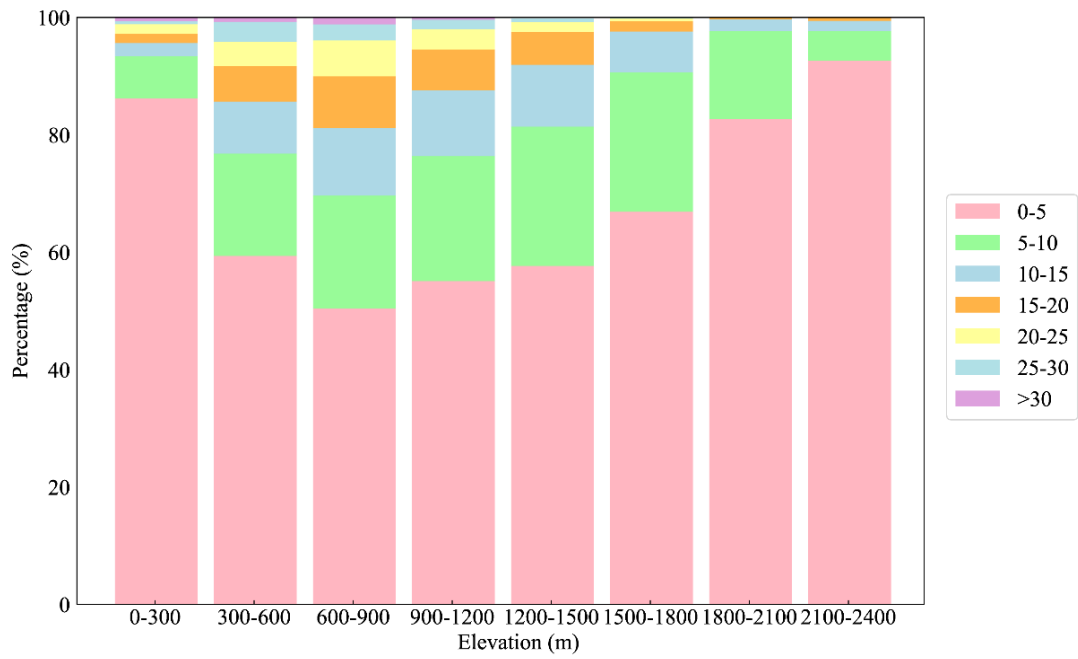


Fig. S6. Relationships between lake elevation and lake reoccurrence. The bars indicate the percentage of different reoccurrences for 300 m elevation bins.

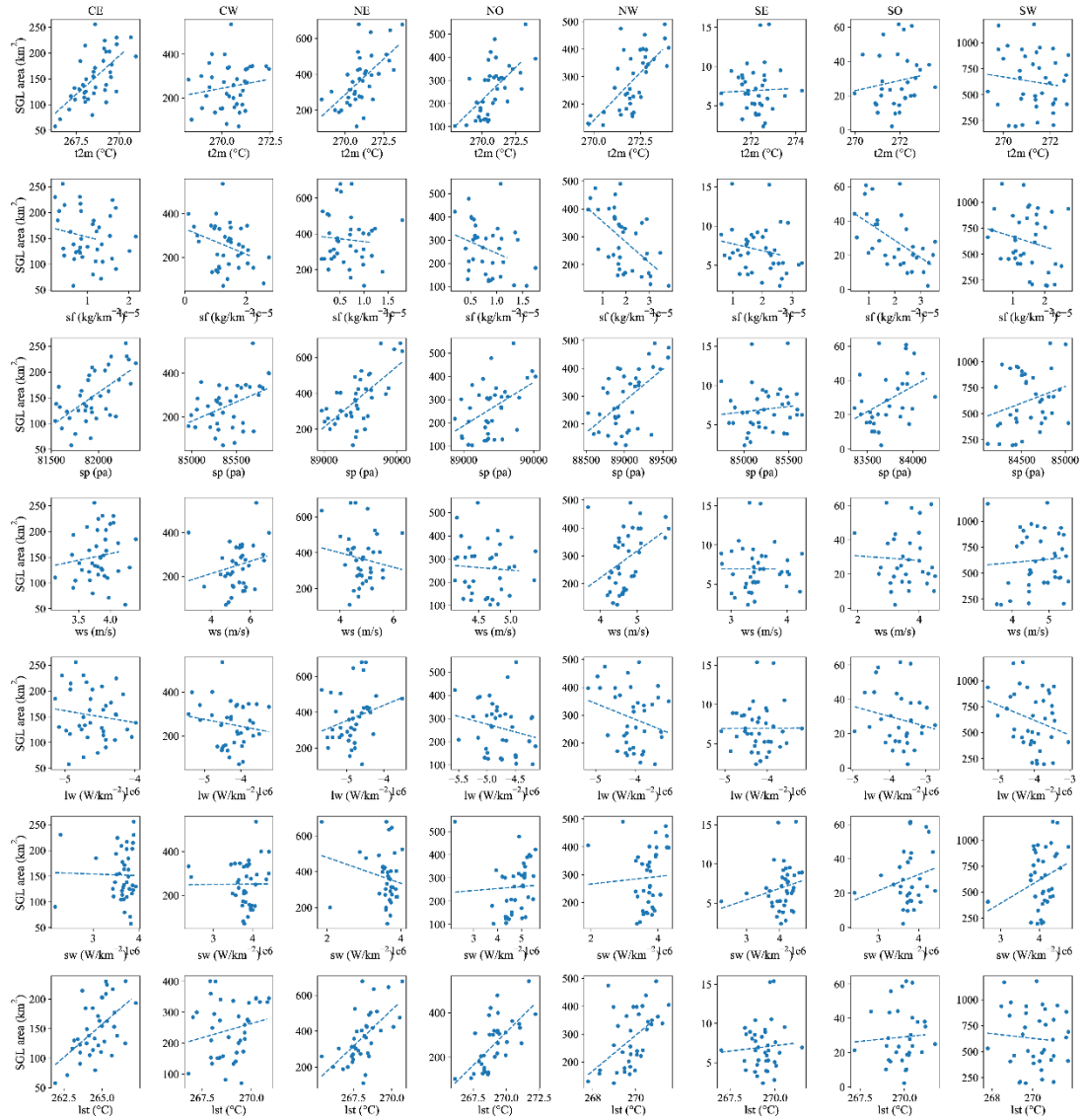


Fig. S7. Relationships between supraglacial lake area and 2-m air temperature (t2m), snowfall (sf), surface pressure (sp), wind speed (ws), surface net thermal radiation (lw), surface net solar radiation (sw), and land surface temperature (lst) from the ERA5 reanalysis dataset on the Greenland Ice Sheet.

Table. S1. Relationships between supraglacial lake area and volume for different basins.

Basin	CE	CW	NE	NO	NW	SE	SO	SW
Slope	3.75	5.13	3.52	4.18	4.80	4.38	2.12	4.19