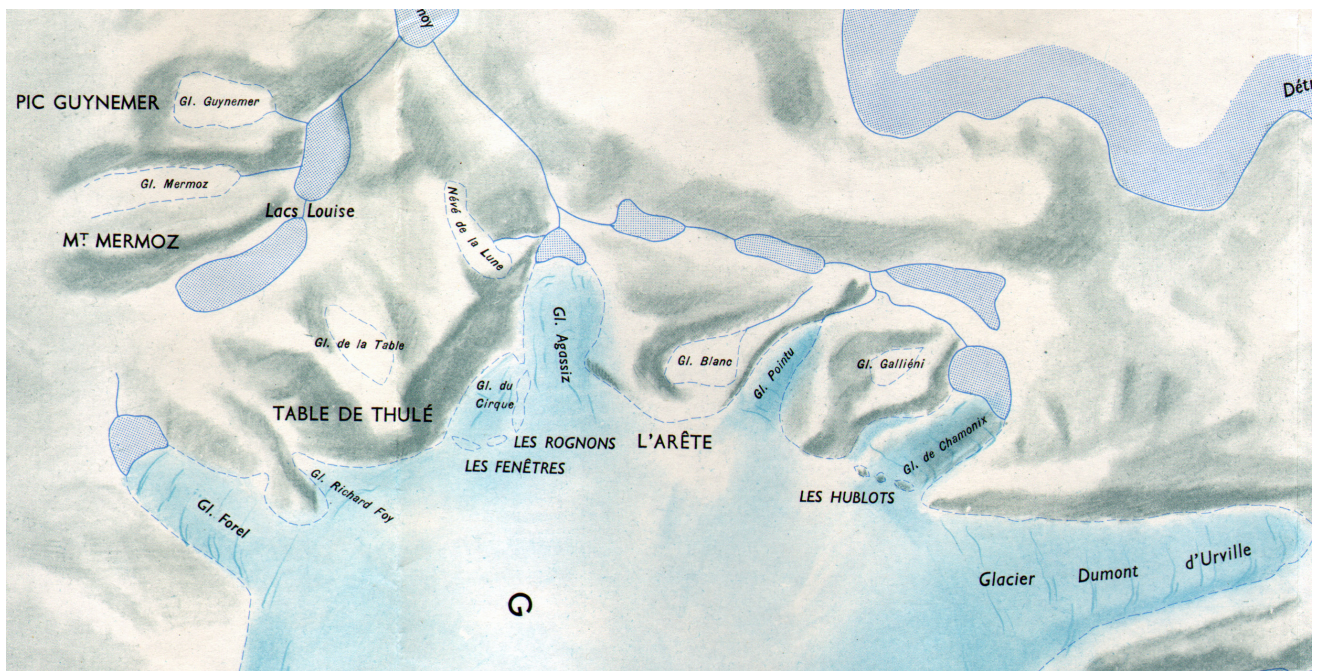


## Supplemental Data

P. Deline, H. Linge, L. Ravel, T. Tuestad, R. Lafite, F. Arnaud, J. Bakke  
Mapping of morainic complexes and reconstruction of glacier dynamics  
northeast of Cook Ice Cap, Kerguelen Archipelago (49°S)



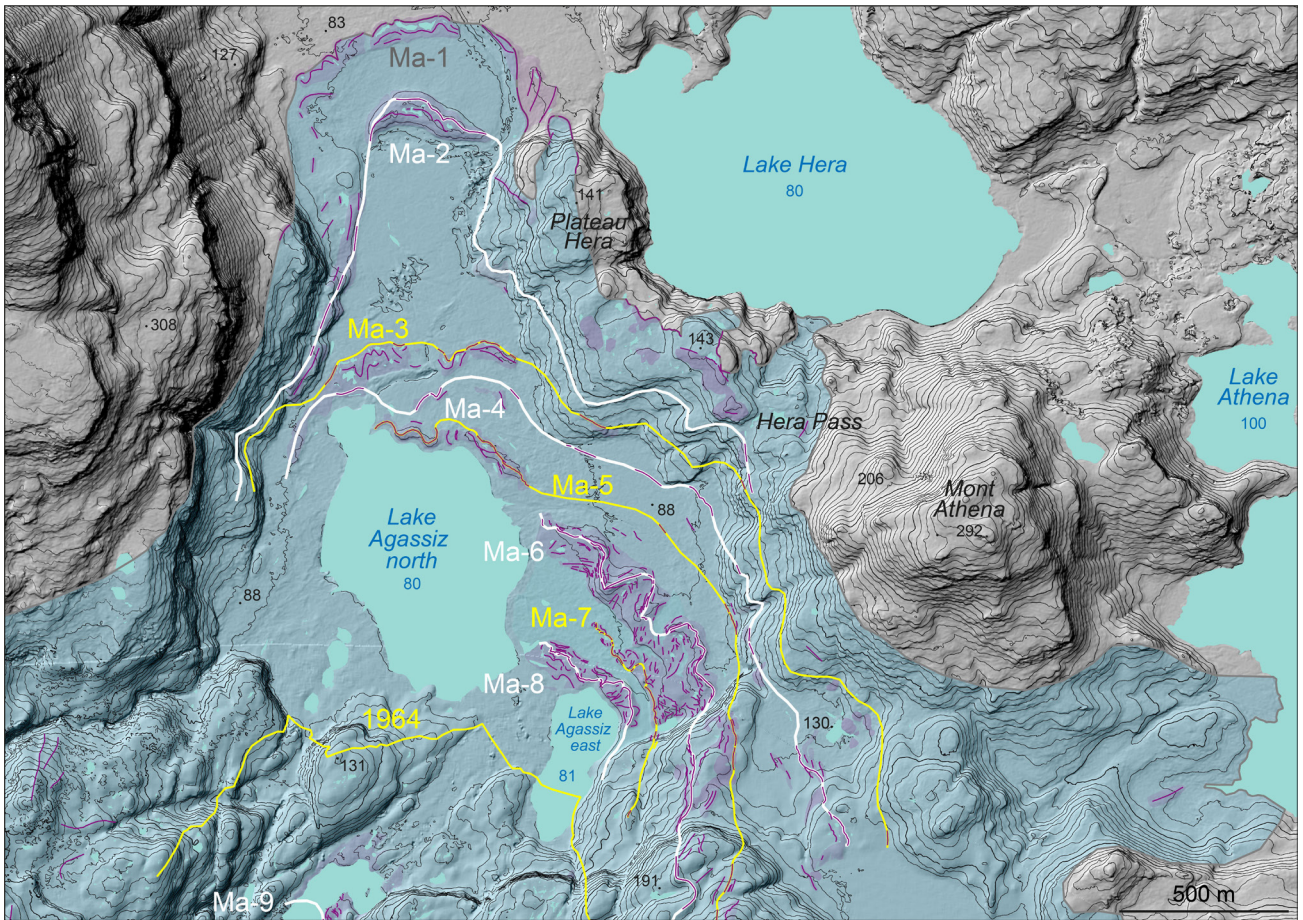
**Fig. S1** Northern part of the reconnaissance sketch "Sheet n°5 - Glacier Cook" at scale c.1: 100 000 produced from oblique aerial photographs taken during Summer 1961-62 (Bauer, 1963). Besides the approximate extent of the glaciers, several of them here mapped (Richard Frey, Blanc, Galliéni) were not maintained on the IGN topographic map at 1: 100 000 that was later released.



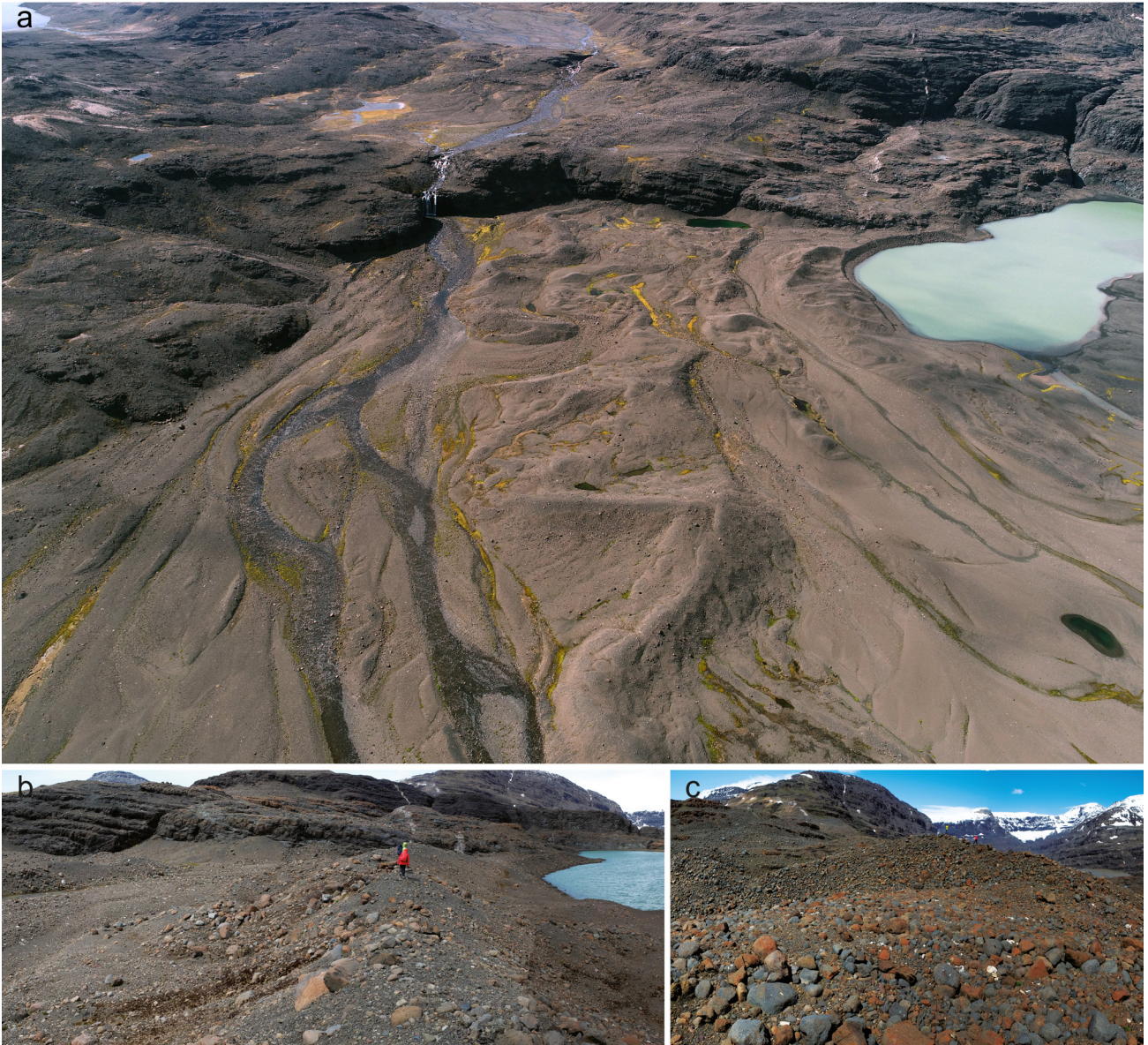
**Fig. S2** a: 30-m-high, Mg-7 matrix-supported lateral moraine; crest elevation is 240 m asl.

b: small Mg-7 matrix-supported latero-frontal moraines.

c: matrix-supported lateral moraine Mg-1 of a metric size (185 m asl), east of Lake Guynemer; boulder height is c.5.50 m.



**Fig. S3** Agassiz Glacier morainic complex (downstream area), with Ma-1 to Ma-8 moraine sets and the 1964 front position. Moraines and their crest lines are in light and dark purple, respectively; reconstructed glacier extent corresponding to Ma-1: grey (fronts of east lobe and Hera Pass lobe arbitrarily correspond to the current shore of the lakes); later extents: white and yellow lines. Topographic map from Pléiades-derived DEM; contour interval: 5 m; elevation: m asl.



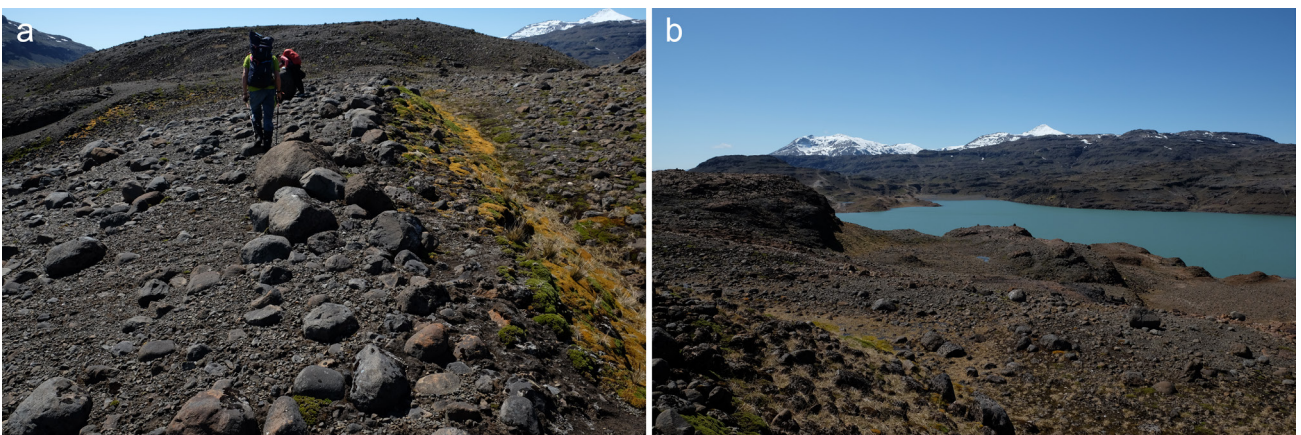
**Fig. S4** a: southeastward view of right-lateral moraines of Ma-5 on the left, sinuous Ma-6 in the middle, Ma-7, and Ma-8 along the north shore of Lake Agassiz east. Upstream section of Ma-6 is visible in the background between the two rock scarps on the right.

b: c.5-m-high Ma-8 frontal moraines (85 m asl). Southern end of Ma-7 moraine on the left, Lake Agassiz east on the right. Melt-water channel from the lake between Ma-8 and 7 moraines.

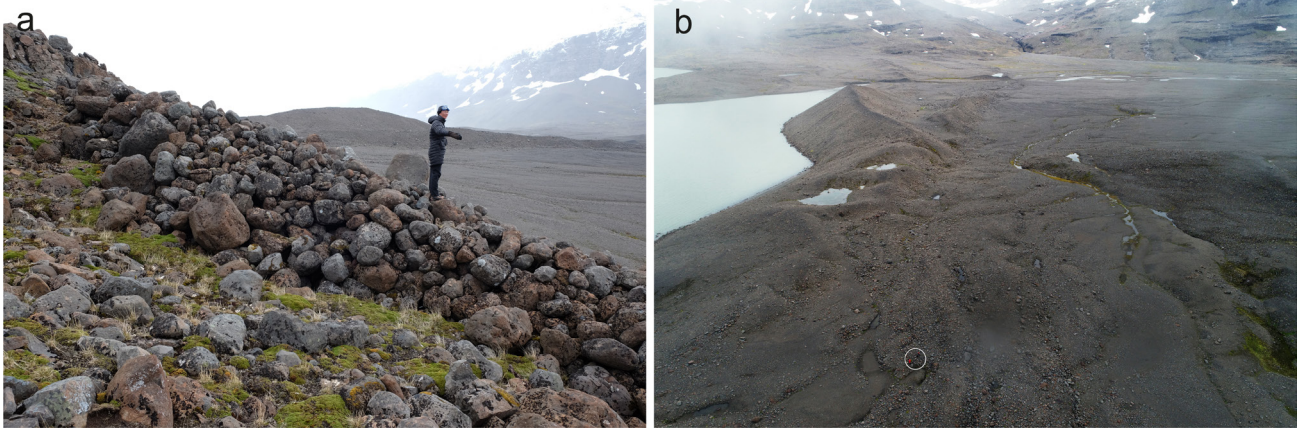
c: westward view of a Ma-6 right-lateral moraine in the upstream area (up to c.10-m-high, 185 m asl). Note the abundance of rounded boulders of a pluridecimetric size. Cook Ice Cap in the back ground.



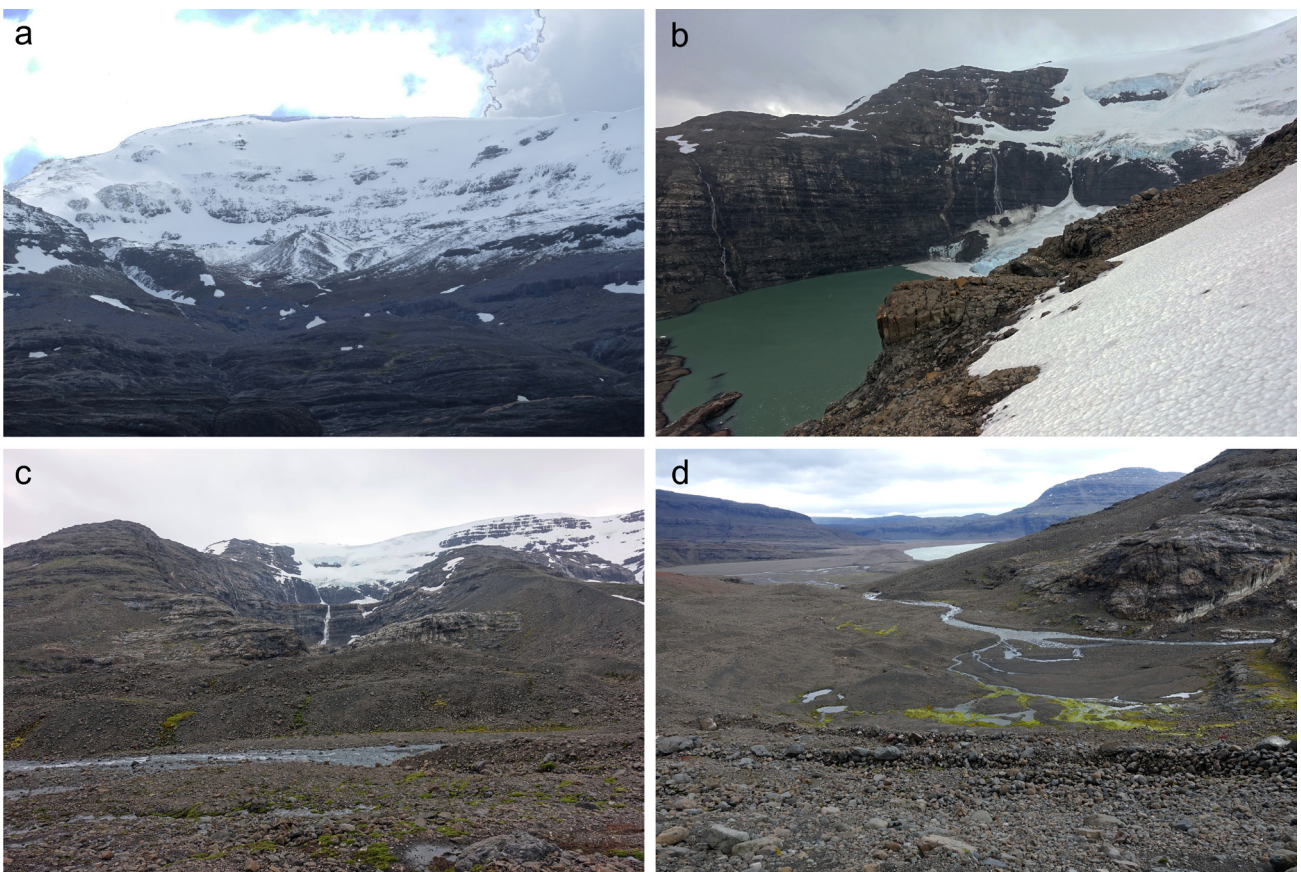
**Fig. S5** a: eastward view of 5-m-high Ma-3 frontal moraines (85 m asl), downstream Lake Agassiz north.  
 b: westward view of matrix-supported Ma-3; boulder height with person is c.3.5 m.  
 c: westward view of 10-m-high Ma-2 matrix-supported frontal moraines (80 m asl). East end of frontal moraines Ma-1 in the background on the right.



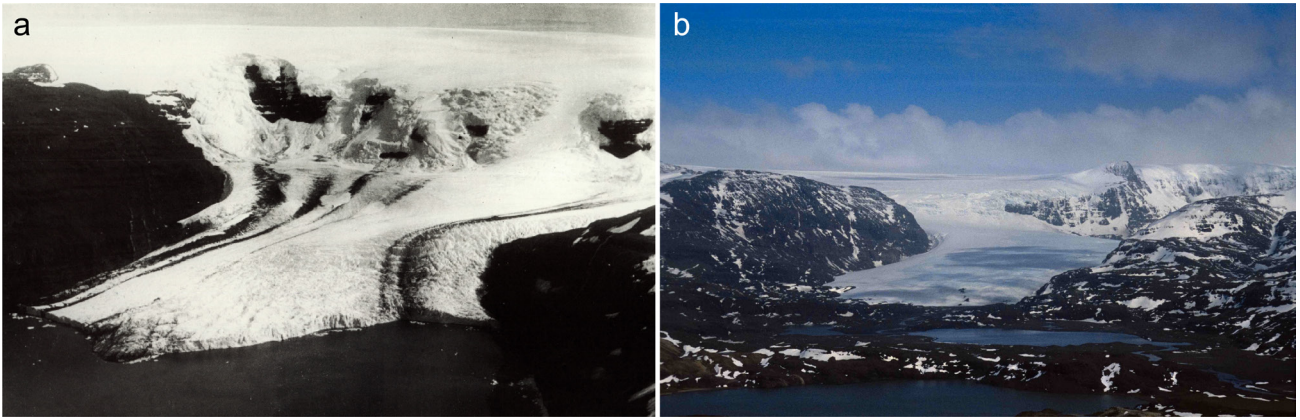
**Fig. S6** a: northward view of Ma-2 lateral moraines on the south side of Hera Pass (125 m asl).  
 b: northward view of Ma-1 moraines deposited by the glacier when it overflowed the Hera Pass on its north side, above Lake Hera. Snowy summits of Presqu'île de la Société de Géographie in the background, with Mont Richards (1081 m asl) on the right.



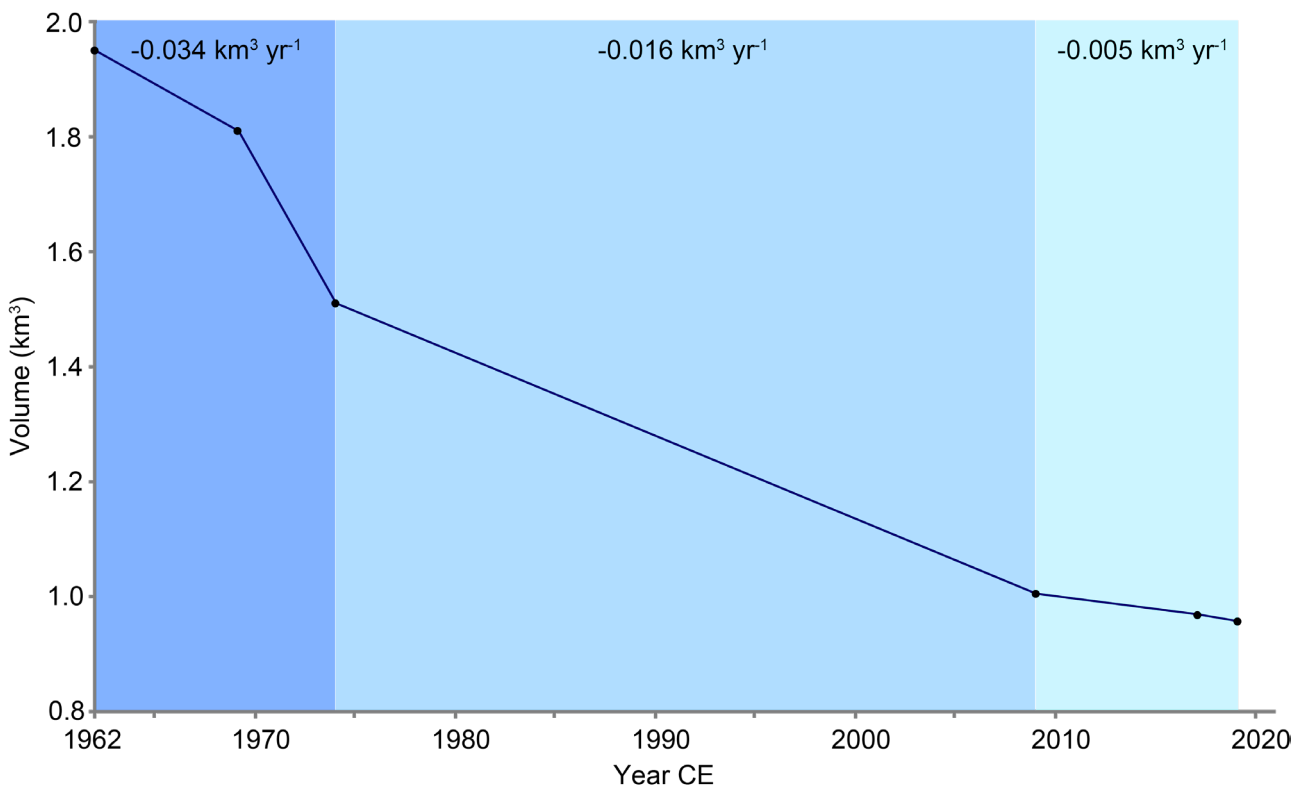
**Fig. S7** a: clast-supported moraine Mc-1 with rounded boulders of a pluridecimetric size.  
 b: westward view of frontal moraines Mc-1 and Mc-2 on the right, Mc-3 in the middle, and Mc-4 on the left, along the north shore of Lake Chamonix. Two persons in the circle for scale.



**Fig. S8** a: westward view of Lune Cirque, with the upper set of moraines dusted with fresh snow.  
 b: Hanging and calving fronts of Pointu Glacier, flowing from the Arête (>900 m asl) to Lake Pointu (375 m).  
 c: upward view to the Pointu glacial trough with its c.150-m-high rock step, and the morainic complex.  
 d: downward view to the Pointu morainic complex. Lake Chamonix in the background.



**Fig. S9** a: southward oblique aerial view of Chamonix Glacier in 1969, with rock windows “les Hublots” and supraglacial medial moraines. The front was mainly lake-terminating but remained grounded to the island until 1971 (Ph: Bertrand Frölich).  
 b: eastward view of Agassiz Glacier on 21 March 1994, with small nunataks pointing out of the front surface; the then tiny Lake Agassiz north not visible here. Lakes Hera in the foreground, and Agassiz north (center) and east (left) beyond; Cook Ice Cap in the background, with Les Rognons (752 m asl) culminating on the right (Ph: Bertrand Moine).



**Fig. S10** Decrease of the volume of Chamonix Glacier from 1962 to 2019. Annual rate of volume decrease for the three periods 1962-74, 1974-2009, and 2009-19.



**Fig. S11** Lake-level changes at Lakes Agassiz north and east. While the snowpack outside of the glaciers was similar for both years in the study area, the highest discharge coming from Lake Agassiz south in 2021 likely resulted from a stronger snow and ice melting on Agassiz Glacier at that time.