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*A catastrophic break-up of the front of Jakobshavn Isbræ,
West Greenland, 2002/03*

Jakobshavn Isbræ (also called Ilulissat Isbræ or Sermeq Kujalleq) is situated on the west coast of Greenland at 69°10' N, 49°45' W, and is known for its size, high rate of movement and large calving rate into the 50 km long Jakobshavn Isfjord (also called Ilulissat Isfjord or Kangia). This 1000 m deep fjord is separated from Disko Bay and Davis Strait by a threshold at its mouth, the "Iceberg Bank" with depths of 200–300 m, where the larger icebergs run aground.

Changes of the glacier front are known from several descriptions since 1850 (e.g. Weidick and others, 1990; Echelmeyer and others, 1991; Sohn and others, 1998). Between 1850 and about 1950 the front gradually retreated from a Neoglacial maximum position at –24 km from the mouth of the fjord to –50 km from this locality, and since 1950 it has maintained a rather stable position with annual fluctuations of the front, the winter position being about 2–4 km in front of the summer position. This half-century of stability now seems to be ending after a recent major disintegration event.

In early spring 2003, the glacier front retreated approximately 11 km, and it is now located close to the estimated grounding line. A series of satellite images covering the

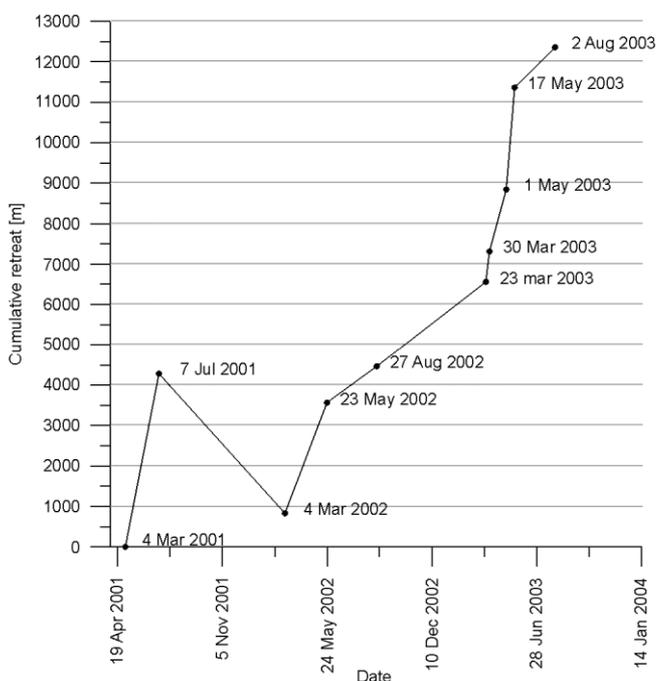


Fig. 1. Cumulative retreat pattern of Jakobshavn Isbræ.

years 2001–03 were used to document the retreat of the glacier tongue. The results of this image analysis are shown as dates in Figure 1. The images were retrieved from the Landsat 7 satellite and geo-referenced (projection: Universal Transverse Mercator; datum: World Geodetic System 1984 ellipsoidal elevation (WGS84); zone: 22 North). The pixel resolution of each image is relatively poor, with a pixel size of only 150 m by 150 m. Although the estimated error for each determination of the glacier terminus position is therefore ± 220 m, this is adequate for our purposes (i.e. the initiation of the recent recession).

The difference between the winter and summer positions of the glacier front for 2001/02 was determined to –4 km (Fig. 1). This fluctuation between summer retreat and winter advance of the glacier front is somewhat larger than observations during the past half-century have indicated (e.g. Sohn and others, 1998). In Figure 1 the advanced winter position for 4 May 2001 is taken as a reference line; the winter position for 4 March 2002 is almost identical. However, the winter position for 2003 (23 and 30 March) was not reached and is located approximately 2 km behind the normal summer position; the floating glacier front is clearly disintegrating. The break-up of the front continued during spring and early summer 2003, and on 17 May 2003 the front was 11 km behind the reference position, close to the grounding zone. The retreat of the glacier front is significant and it seems unlikely that the previous winter positions of the Jakobshavn Isbræ front will be reached during winter 2003/04.

To the above can be added some observations made during a visit to the glacier and the "Iceberg Bank" on 2 and 5 August 2003. On the "Iceberg Bank" an unusually large number of detached parts of the glacier front were observed, which are easily distinguishable by their pinnaled, dark surface comparable to the glacier front surface. In August 2003 the fjord was densely packed with ice, and the retracted position of the glacier front to a position near the grounding zone was evident. The glacier front itself was not clearly defined, but appears as a gradation between the ice stream proper and densely packed fragments of the front in the fjord. It appears that the recession shown by the Landsat scene of 17 May 2003 has continued. In August 2003 the northern part of the glacier front was located at the easternmost tip of the wedge of land known as Nunatar-suaq, which suggests a further recession of 1–2 km since May 2003. A recession of the same magnitude seems to have occurred at the southern part of the front (cf. Fig. 2) in this period.

The glacier front is presently poorly defined, a marked change from the situation during the stable period 1950–2000 when the glacier front was usually clearly discernible from the fjord and its icebergs, but comparable to descriptions from the recessional period 1850–1950, when there were difficulties in pinpointing the exact position of the front (cf. Engell, 1904).

The recession of the front has detached a large ice-filled

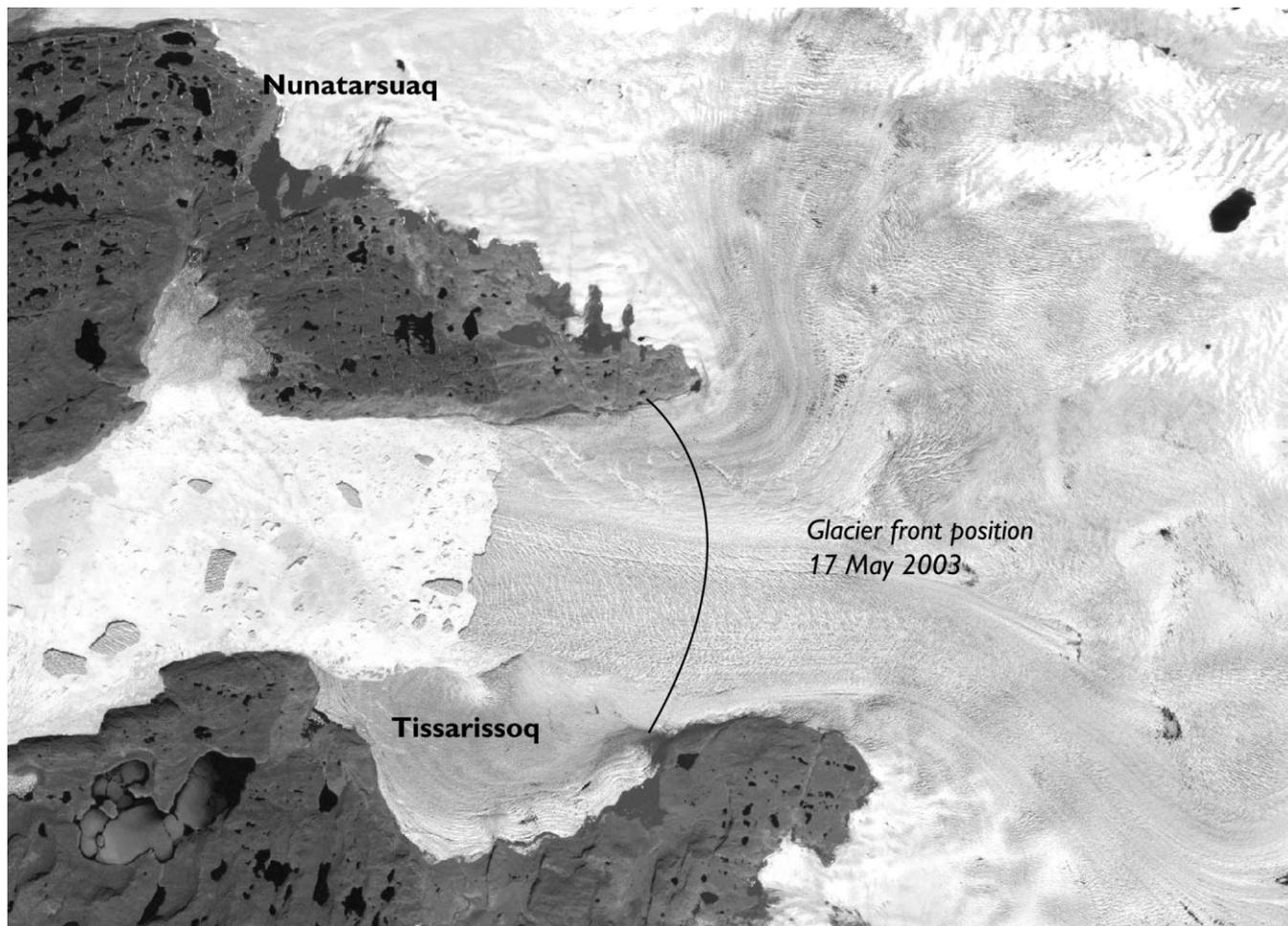


Fig. 2. Satellite image of 7 July 2001. Inset is the approximate position of the glacier front at 17 May 2003. The recession between the two positions is 8 km.

inlet (Tissarissog; Fig. 2) from the glacier tongue. This former part of the glacier, which was 100–200 m thick (Weidick and others, 1990), can now be seen to be melting and thinning and, close to the former connection with the ice stream, disintegrating. This area may once have been ice-free, since there are historical accounts of seal-hunting in the bay (Hammer, 1883) during the initial phase of the Little Ice Age. Perhaps present-day conditions are a return to those of medieval times!

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