

Mass balance monitoring of Kaffiøyra glaciers

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The studies of the structure of mass balance of Kaffiøyra glaciers refer to the Waldemarbreen, Irenebreen and Elisebreen. The data on the structure of the mass balance of Waldemarbreen were based on the direct field measurements conducted from 1996 to 2006 (Sobota, 1999, 2000, 2004, 2005a, Sobota and Grześ, 2006). The studies of the mass balance of Irenebreen were taken between 2001 and 2006. In 2005 the studies of the mass balance of Elisebreen began. This research is continued. At the same time geodetic and cartographic measurements were carried out (Lankauf, 2002, Bartkowiak et al., 2004).

Glaciers are located in the northern part of the Oscar II Land, Kaffiøyra, north-western Spitsbergen. Waldemarbreen is about 3.5 km long and has an area of 2.6 km². The ice originates in one cirque and flows from an elevation of more than 500 m to the present terminus at 130 m a.s.l. Irenebreen, a valley glacier located to the south of Waldemarbreen, flows down towards the Kaffiøyra plain. The area of Irenebreen amounts to 4.2 km². Elisebreen area is 11.9 km². Its length is about 7 km, while its width is up to 1.8 km. To the north the glacier borders Agnorbreen which is often treated as part of Elisebreen.

In order to estimate the mass balance of Kaffiøyra glaciers the method of direct measurements was used. It was based on a set of ablation poles completed with the studies of the snow cover in

the snow profiles. Twenty-two poles were placed on Waldemarbreen; Irenebreen and Elisebreen had ten poles installed each.

Spatial diversity of mass balance of Waldemarbreen, Irenebreen and Elisebreen is mainly influenced by the weather conditions in a specific part of glacier and by local morphological conditions. The areas of the glaciers may be generally divided into the part of the negative mass balance and the part of the positive mass balance. In the case of Waldemarbreen the year 1998 was exceptional, as the entire glacier showed negative mass balance. Irenebreen shows more positive mass balance in its both accumulation parts. The accumulation part of Elisebreen also shows positive mass balance. This results from the fact that they both are located at higher altitude than Waldemarbreen.

Thanks to the direct measurements, the average location of the equilibrium line (ELA) on Waldemarbreen was estimated at the altitude of 397 m in 1996–2006. From 2002 to 2006 the annual equilibrium line altitude was 421 m a.s.l. for Irenebreen, while for Elisebreen it was 365 m a.s.l.

The average mass balance of Waldemarbreen amounted to –57 cm w.e. in 1996–2006. Between 2002 and 2006 the mean annual mass balance of Irenebreen was –71 cm w.e. In 2006 the mass balance of Elisebreen was –73 cm w.e. These values are close to other Svalbard glaciers of similar size.

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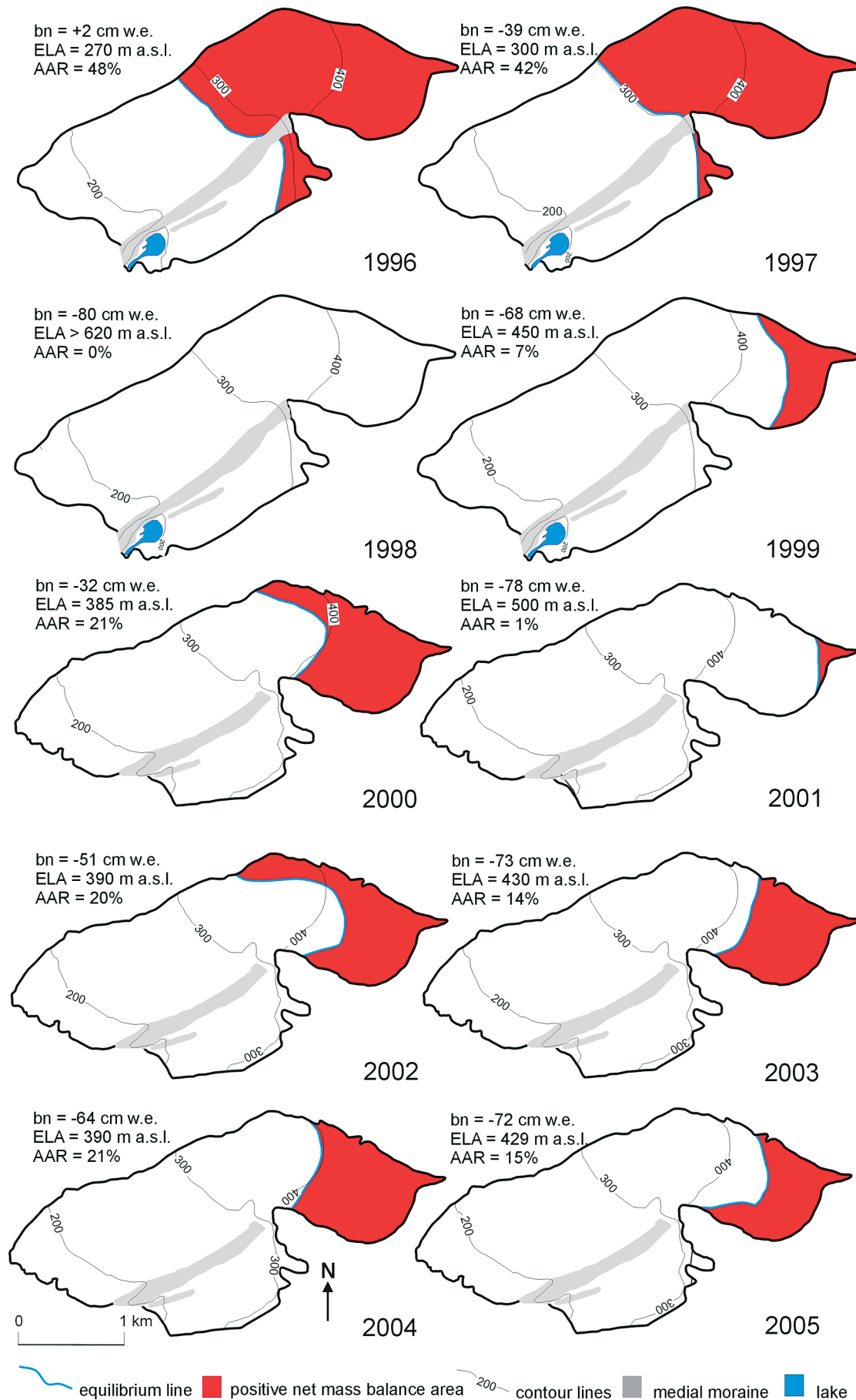


Fig. 1. Positive net mass balance area and equilibrium line (ELA) location maps of Waldemarbreen in 1996–2006

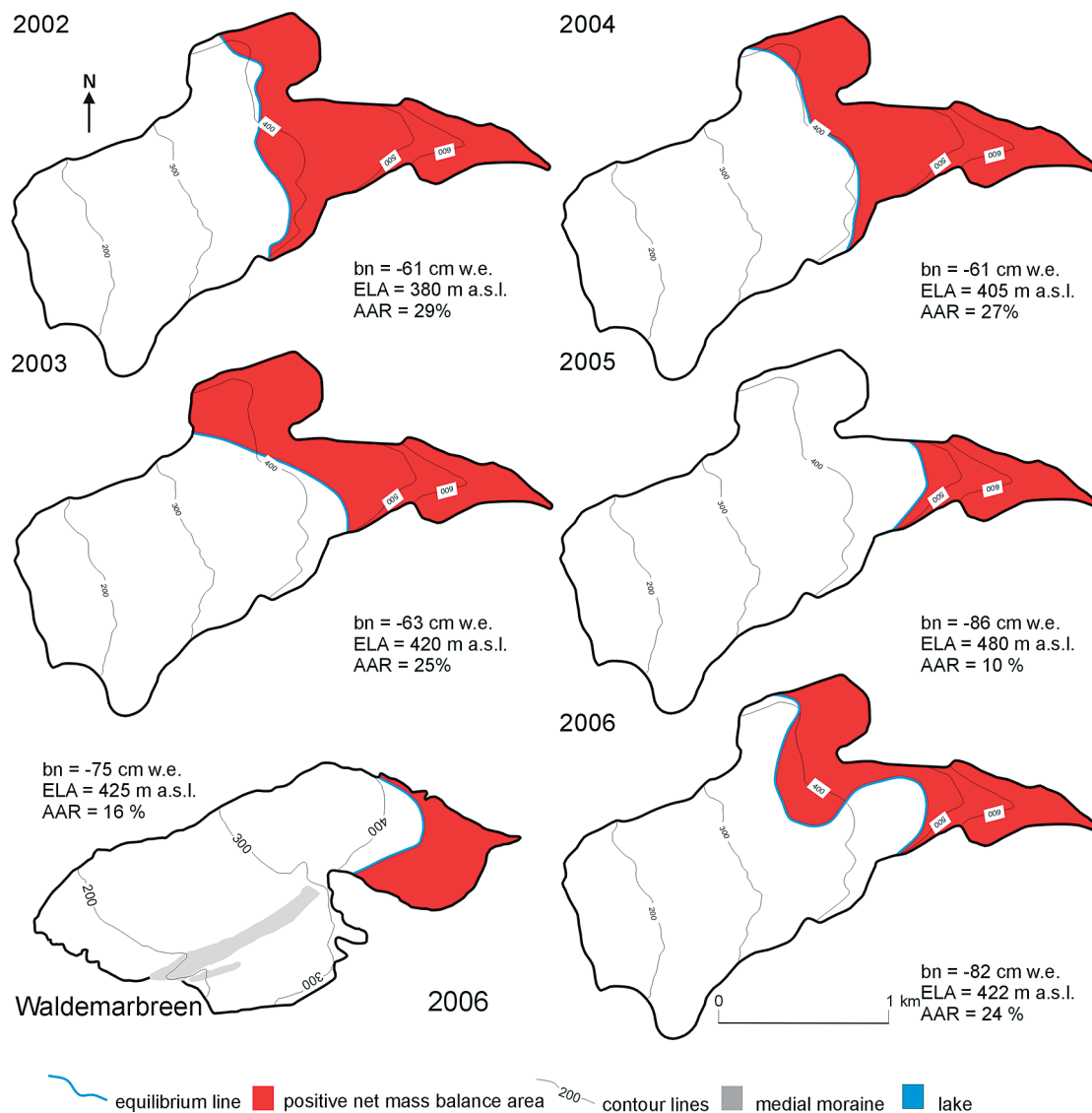


Fig. 2. Positive net mass balance area and equilibrium line (ELA) location maps of Irenebreen in 2002–2006

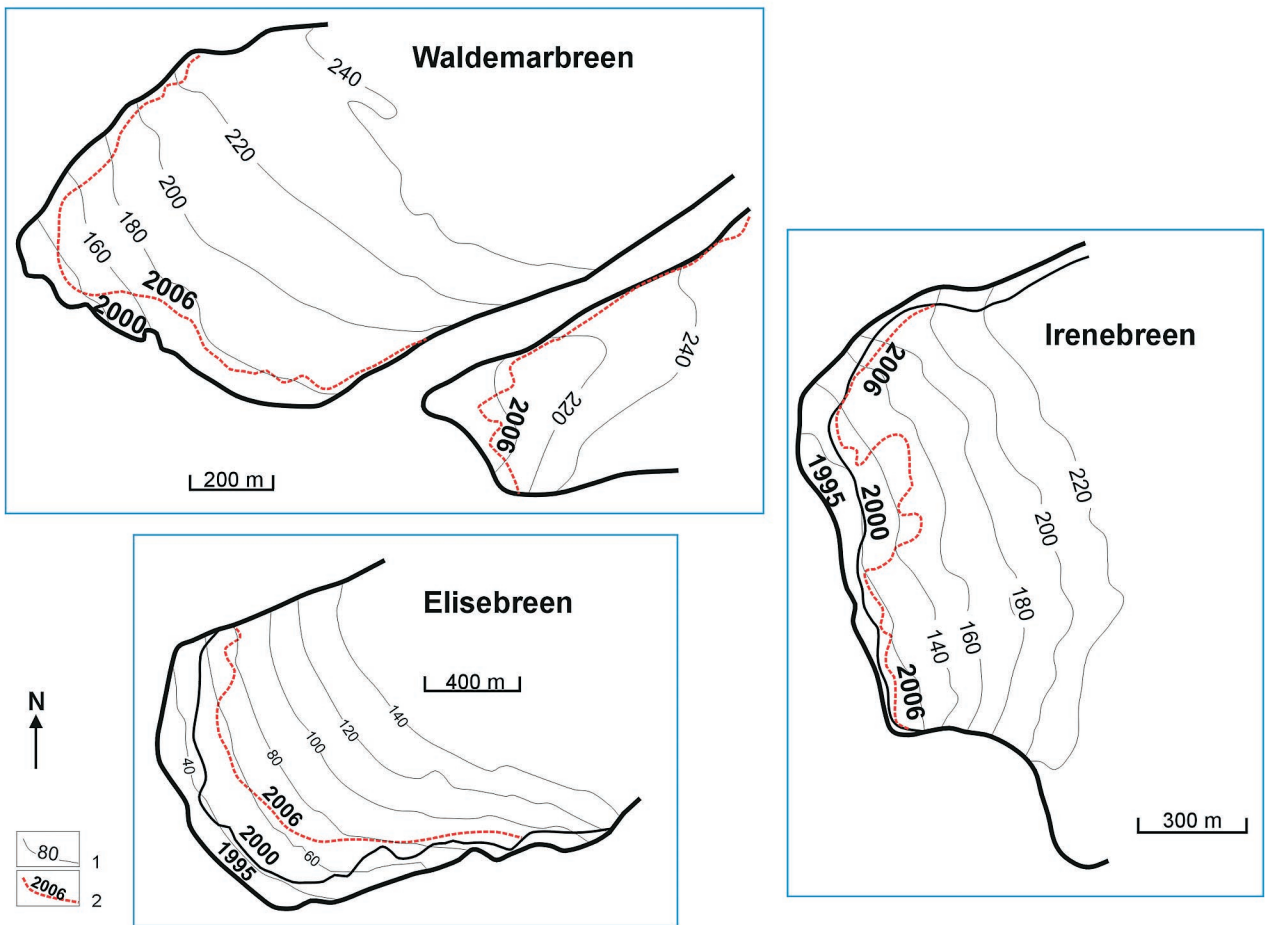


Fig. 3. The retreat of Kaffiøyra glaciers in the period from 2000 to 2006. Based on Lankauf's topographical map from 1995 (2002) and GPS measurements
1 – contour lines, 2 – location of glacier front in 2006