Point 5c – Waldemarbreen *78° 40' 30" N 11° 59' 28" E*

Snow accumulation on Kaffiøyra glaciers

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Studies of winter mass balance mainly referred to the estimation of the size of the snow accumulation on glaciers, as well as its selected physico-chemical properties. Soundings of the snow depth on Waldemarbreen, Irenebreen and Elisebreen were carried out in about 150 measurement points. They gave a very detailed picture of the spatial diversity of the winter snow accumulation at about 50 measurement points per 1 km^2. Measurement points were located relatively close to one another as the differences in the snow depth is often significant, which mainly results from topography and anemometric conditions. Location of the measurement points was based on both geodesic and the GPS measurements. The measurements were made in the selected snow profiles in accordance with the International Commission on Snow and Ice (ICSI) standards. Additionally, according to the above standards, the selected physical and chemical properties of the snow cover were measured. This mainly referred to the snow structure, graining, hardness and density.

Spatial distribution of winter snow accumulation on Waldemarbreen shows some regularity. The largest accumulation is found in the accumulation part and at the foot of the mountain slopes. The smallest accumulation, however, is observed in the front part of glacier up to the altitude of 220 m and at the foot of the medial moraine. Such a distribution is conditioned by anemometric situation and a larger inclination of this part of glacier. Some asymmetry in the snow cover depth was recorded. In the accumulation part of glacier the main factor influencing the depth of the snow cover was precipitation, while in the lower parts of glacier – local conditions (aspect) as well as wind directions and velocity (snow redeposition). The depth of the snow cover lowers from north east towards south west, i.e. in the direction of the medial moraine. Next in grows again towards the Gråfjellet Range. In the case of Irenebreen snow accumulation increases significantly from the front

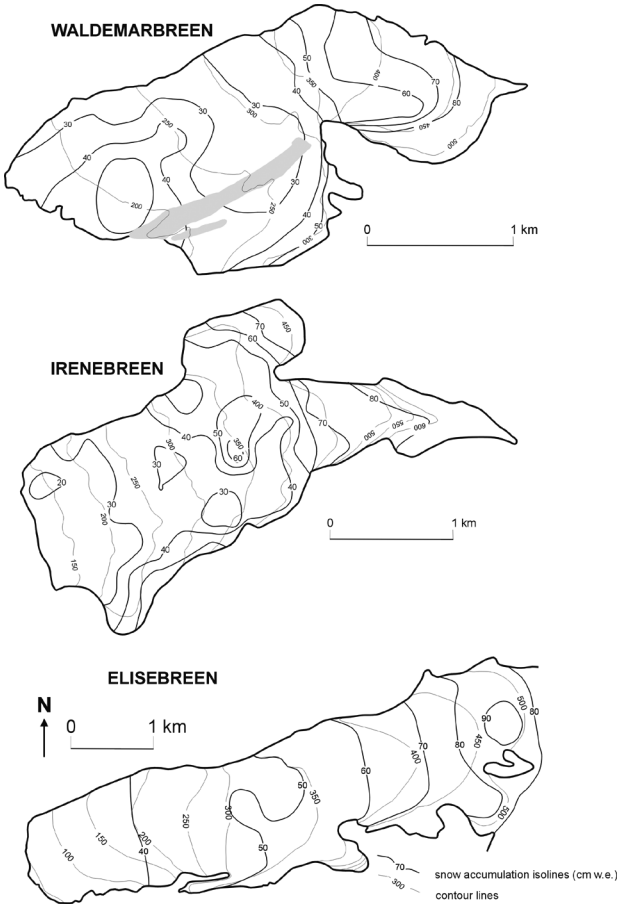

Fig. 1. Snow accumulations maps of Kaffiøyra glaciers in 2005

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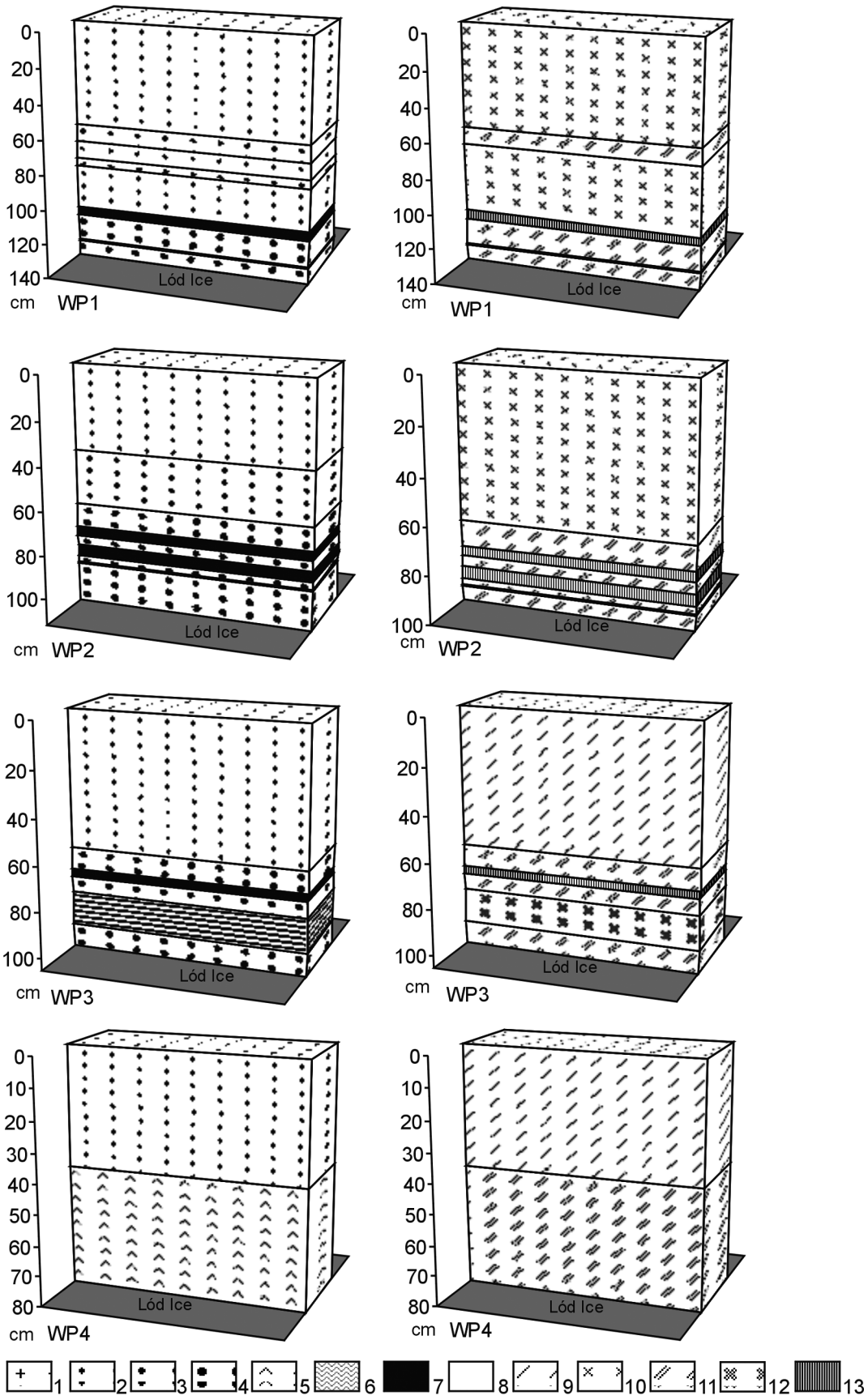

Fig. 2. Snow profiles at selected parts of the Waldemarbreen according to ICSI in May of 2005
Snow grain sizes and types: 1 – fresh snow, 2 – fine grained snow, 3 – medium grained snow, 4 – coarse grained snow, 5 – coarse grained snow, intesively matamorphosed (hoar snow), 6 – frozen snow with ice layers, 7 – ice layer. Hardness of deposited snow: 8 – very low (R1), 9 – low (R2), 10 – medium (R3), 11 – high (R4), 12 – very high (R5), 13 – ice (R6)

Fig. 3. Mesurements in snow pit (photo M. Grześ)

part of glacier towards the accumulation fields. On Elisebreen snow accumulation increases considerably with altitude until the ice-shed, i.e. from 40 cm w.e. to 150 cm w.e.

The measurements of structure and graining of the snow cover were not undertaken during all of the analysed periods. When undertaken, the studies included making a few snow profiles in the selected parts of both Waldemarbreen and Irenebreen. Snow cover shows some specific physico-chemical properties. Its vertical profile shows a variety of snow types of diverse level of metamorphosis, hardness and wetting. Snow structure reflects prevailing weather conditions at the time when the snow cover formed.

Snow density on Waldemarbreen ranged from 310 kg m^{-3} to 520 kg m^{-3} maximum. The mean snow density on both Waldemarbreen, Irenebreen and Elisebreen is similar and it amounts to about 400 kg m^{-3} on average. In the individual years the snow cover of the studied glaciers was dominated by fine-grained and medium-grained snow, while the layer above ice contained coarse-grained snow. Numerous ice layers were also found.

From 1996 to 2006 the mean snow accumulation on Waldemarbreen was 47 cm w.e. Cumulated value of accumulation for the entire glacier was 521 cm w.e. Between 2002 and 2006 the mean snow accumulation value for Irenebreen was 52 cm w.e., while the cumulated value of the winter balance for this period for the entire Irenebreen was 262 cm w.e. In 2005 the snow accumulation for Elisebreen was 59 cm w.e., while in 2006 it was 63 cm w.e. These values are similar to those estimated for other studied Svalbard glaciers.

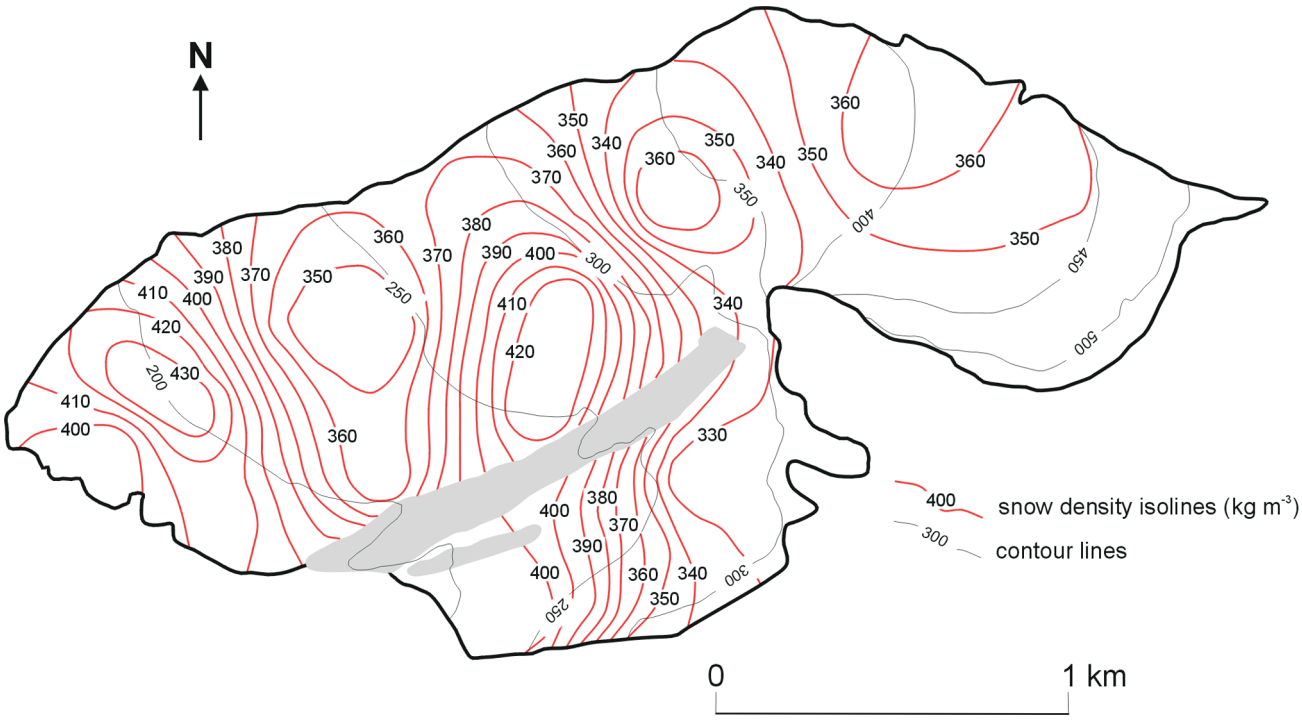

Fig. 4. Surface snow density map of Waldemarbreen, April 2007