

## THE GLACIERS OF GOLDBERGGRUPPE, HOHE TAUERN, AUSTRIA: 1850 – 1931 – 1969 – 1998 – 2009 (1:50,000)

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The map illustrates the glacier area change in 32 glaciers of Goldberggruppe in Austria's Hohe Tauern. The analysis covers the period from the maximum glacial extension of the Little Ice Age (LIA, ~1850) until 2009.

The Goldberggruppe is situated on the Alpine main ridge, which separates 18 north-facing glaciers from 14 south-facing glaciers (1850). By 2009 these numbers decreased to 12 glaciers on the northern and 5 on the southern side.

Figure 1 (see corresponding map) gives a short glimpse of the impressive glacier area loss of Goldberggruppe. Compared to 1850, almost 77 % of the total glacier area was lost by 2009. In absolute numbers, the overall glacier area decreased from 34.19 km<sup>2</sup> (1850) to 7.91 km<sup>2</sup> (2009). South of the Alpine main ridge, 19% of the 1850 glacier extent was still left in 2009 and 25% of the glacierized terrain north of the main ridge (see Table 5.1).

In order to compare the rate of glacier retreat between the two main aspects of Goldberggruppe, mean annual area changes were calculated. In this way, mean relative annual changes (in %) were determined with respect to the earlier extent of the specific period (i.e. for changes between 1969 and 1998, 100% equals the area in 1969).

From 1998 to 2009 annual rates of area change were the highest for all periods (about -1.7% per year). That was also the only period for which the rate of the north-facing glaciers exceeded the rate of the south-facing ones. In all other periods the south-facing glaciers diminished faster, particularly from 1850 to 1931 and 1969 to 1998. The smallest rate of area loss was found for both the north-facing and the south-facing glaciers during the earliest period 1850–1931 (-0.29% y<sup>-1</sup> and -0.64% y<sup>-1</sup>). The mean annual area change for all glaciers during the entire period 1850–2009 was -0.48% y<sup>-1</sup>.

Plots of the data are illustrated in the appended map.

Table 5.1 Characteristic numbers for glacier area changes of Goldberggruppe

Code	Location	Glacier Name	Area [10 <sup>3</sup> m <sup>2</sup> ]					Area change (rel. to 1850) [%]			
			1850	1931	1969	1998	2009	1931	1969	1998	2009
N1	N	No name	512	120	121	67	38	-77	-76	-87	-93
N2	N	Weißbachkees	3142	1989	1243	866	523	-37	-60	-72	-83
N3	N	No name	590	252	220	207	156	-57	-63	-65	-74
N4	N	Krummlkees	2031	1321	1143	898	622	-35	-44	-56	-69
N5	N	No name	148	0	0	0	0	-100	-100	-100	-100
N6	N	No name	1016	334	146	114	75	-67	-86	-89	-93

Table 5.1 continued

Code	Location	Glacier Name	Area [10 <sup>3</sup> m <sup>2</sup> ]					Area change (rel. to 1850) [%]			
			1850	1931	1969	1998	2009	1931	1969	1998	2009
N7	N	No name	216	131	0	0	0	-39	-100	-100	-100
N8	N	Hocharnkees + Pilatuskees	3141	2187	1600	1546	1363	-30	-49	-51	-57
N9	N	No name	52	27	0	0	0	-48	-100	-100	-100
N10	N	Goldbergkees + dead ice, Kleines Sonnblückees	4104	2827	1929	1656	1474	-31	-53	-60	-64
N11	N	No name	289	0	0	0	0	-100	-100	-100	-100
N12	N	Schareckkees	1851	1003	1020	600	491	-46	-45	-68	-73
N13	N	No name	247	0	0	0	0	-100	-100	-100	-100
N14	N	No name	546	101	53	35	41	-82	-90	-94	-92
N15	N	Schlapperebenkees	1628	1230	917	759	619	-24	-44	-53	-62
N16	N	Sparangerkees	1362	360	250	167	143	-74	-82	-88	-90
N17	N	No name	1232	0	0	0	0	-100	-100	-100	-100
N18	N	No name	303	207	182	99	115	-32	-40	-67	-62
S1	S	No name	360	49	0	0	0	-86	-100	-100	-100
S2	S	Großes Fleißkees	1633	392	397	347	273	-76	-76	-79	-83
S3	S	Goldzechkees	907	267	155	113	102	-71	-83	-88	-89
S4	S	Kleinfließkees	2080	1600	1266	958	831	-23	-39	-54	-60
S5	S	No name	204	0	0	0	0	-100	-100	-100	-100
S6	S	No name	119	0	0	0	0	-100	-100	-100	-100
S7	S	Zirknitzkees	865	48	103	108	89	-94	-88	-88	-90
S8	S	Wurtenkees + dead ice	3587	322	2129	1174	917	-91	-41	-67	-74
S9	S	Kleines Zirknitzkees	355	29	0	0	0	-92	-100	-100	-100
S10	S	No name	266	28	0	0	0	-89	-100	-100	-100
S11	S	No name	52	0	0	0	0	-100	-100	-100	-100
S12	S	No name	407	0	0	0	0	-100	-100	-100	-100
S13	S	No name	314	0	0	0	0	-100	-100	-100	-100
S14	S	No name	631	0	0	0	0	-100	-100	-100	-100
<b>All glaciers [km<sup>2</sup>]</b>			<b>34.2</b>	<b>17.7</b>	<b>12.9</b>	<b>9.7</b>	<b>7.9</b>	<b>-48.2</b>	<b>-62.3</b>	<b>-71.6</b>	<b>-76.9</b>