

**PASTERZE 2004/05, HOHE TAUERN,  
AUSTRIA (1:25000)**

(Mass Balance Map)

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The mass balance of Pasterze was monitored during 1980–1997 by the Austrian Electricity Provider Tauernkraft (now VERBUND-AHP). After a break of seven years, measurements of Pasterze mass balance were restarted in 2004 by the Central Institute for Meteorology and Geodynamics (ZAMG). Hence the annexed map of mass balance 2004/2005, obtained by the glaciological method and a fixed date system, is the first complete mass balance after the interruption.

In September 2004, 31 ablation stakes were drilled in the ablation zone of Pasterze. During summer 2005 the stake network was extended by 6 further stakes in the ablation zone, (4 stakes on the debris-covered area) and by 11 stakes on the Oberer Pasterzenboden near the supposed equilibrium line. In sum the ablation data of 48 different stake sites were used to calculate the mass balance of the 2004/05 observation period.

Accumulation was measured by snow depth probing on 88 different points at the end of September 2005. Because of current weather conditions, snow pits could not be dug in 2005. For the calculation of the snow-water equivalent, the snow density values of September 2005 measured on the nearby Goldbergkees and Kleinfleißkees glaciers were used instead (firn: 530 kg/m<sup>3</sup>, new snow: 400 kg/m<sup>3</sup>). Accumulation measurements in the following years with higher accuracy and spatial resolution (ground penetrating radar, in addition to snow pits and probing, was used to detect horizons from previous years) and led to the estimation that the accumulation in 2005 was obtained with an accuracy of about +/-5%.

Surveying of snow depletion, which was almost the only information of mass balance in the hardly accessible areas in the south-eastern parts of the glacier and the large crevasse zones of Hufeisenbruch, was done at various times during summer 2005; maximum snow depletion was reached in early September 2005. Due to the use of a fixed date system (1.10.2004–30.9.2005) the line of maximum snow depletion (blue line with blue dots for snow in the annexed map) is not identical to the equilibrium line (red-blue border).

Total mass balance 2004/05 was calculated for the glacier area of 2003, which was derived from an ortho-photo taken on the 4<sup>th</sup> of September 2003 (source: Land Kärnten). The main results of the mass balance measurements are summarised in Table 1. In order to calculate the mass balance for different altitudinal zones (cf. Table 2), a digital elevation model (DEM) from 1998 (Kuhn, 1998) was used. The equilibrium line altitude (ELA) was obtained graphically from the diagram of mass balance versus altitude.

Table 1 Mass balance results for 2004/05 at Pasterze

S (area 2003)	17.7	km <sup>2</sup>	B (total net mass balance)	-15925 · 10 <sup>6</sup>	kg
Sc (accumulation area)	10.6	km <sup>2</sup>	Bc (total net accumulation)	5466 · 10 <sup>6</sup>	kg
Sa (ablation area)	7.1	km <sup>2</sup>	Ba (total net ablation)	-21391 · 10 <sup>6</sup>	kg
Sc/S (AAR)	0.6		b (mean specific mass balance)	-899	mm w.e.
Sc/Sa	1.5		bc (mean specific accumulation)	309	mm w.e.
ELA	2920	m a.s.l.	ba (mean specific ablation)	-1208	mm w.e.

Table 2 Mass balance for 2004/05 at Pasterze versus altitude for the debris-free and the debris-covered areas. Altitudinal zones were calculated from the DEM of 1998 (Kuhn, 1998). Glacier area was derived from the ortho-photo 2003 (source: State of Kärnten).

Altitude	Area S (2003)			Specific Mass Balance b			Mass Balance B		
	DEM 98	total	debris-free	debris-covered	total	debris-free	debris-covered	total	debris-free
m a.s.l.	km <sup>2</sup>	km <sup>2</sup>	km <sup>2</sup>	m w.e.	m w.e.	m w.e.	10 <sup>6</sup> kg	10 <sup>6</sup> kg	10 <sup>6</sup> kg
2000 - 2100	0.007		0.007	-1.801		-1.801	-13		-13
2100 - 2200	0.620	0.323	0.298	-4.513	-6.976	-1.846	-2800	-2250	-550
2200 - 2300	1.242	0.678	0.564	-4.413	-6.027	-2.474	-5481	-4085	-1396
2300 - 2400	1.138	0.823	0.316	-4.921	-5.260	-4.040	-5602	-4326	-1276
2400 - 2500	0.543	0.505	0.038	-4.491	-4.474	-4.711	-2440	-2259	-181
2500 - 2600	0.434	0.420	0.015	-3.081	-3.041	-4.223	-1338	-1276	-62
2600 - 2700	0.583	0.582	0.002	-2.000	-1.995	-3.659	-1167	-1161	-6
2700 - 2800	0.853	0.853		-1.536	-1.536		-1310	-1310	
2800 - 2900	1.372	1.372		-0.661	-0.661		-907	-907	
2900 - 3000	2.383	2.383		0.259	0.259		617	617	
3000 - 3100	3.089	3.089		0.634	0.634		1959	1959	
3100 - 3200	2.868	2.868		0.544	0.544		1559	1559	
3200 - 3300	1.679	1.679		0.416	0.416		699	699	
3300 - 3400	0.704	0.704		0.358	0.358		252	252	
3400 - 3500	0.191	0.191		0.242	0.242		46	46	
3500 - 3600	0.003	0.003		0.160	0.160		0	0	
2000 - 3600	17.711	16.471	1.240	-0.899	-0.755	-2.810	-15925	-12442	-3484