

Table S 1. Calculations of the flow velocities of the eight rock glaciers studied. The values were calculated taking into account all measurements (All), above the LoD of the respective epoch and rock glacier (LoD) and above the maximum LoD of all epochs of the respective rock glaciers (maxLoD). Furthermore, a comparative value of the study by Groh & Blöthe (2019) is given for the movement rates in the period between 2001 resp. 2003 and 2015 (G&B). All values are given in the unit m/yr.

Name	Epoch*	LoD	Mean				Median				Max	
			All	LoD	G&B	maxLoD	All	LoD	G&B	maxLoD	All	G&B
RG01	1	0.03	0.39	0.42		0.49	0.37	0.41		0.45	1.41	
RG01	2	0.04	0.31	0.32		0.38	0.27	0.29		0.33	1.19	
RG01	3	0.05	0.34	0.37		0.39	0.30	0.34		0.35	1.11	
RG01	4	0.08	0.43	0.52		0.52	0.34	0.45		0.45	1.69	
RG01	5	0.02	0.38	0.41	0.51	0.47	0.34	0.37	0.43	0.41	1.45	1.77
RG01	6	0.01	0.49	0.50		0.60	0.45	0.47		0.55	1.72	
RG02	1	0.03	0.04	0.08		0.10	0.03	0.08		0.08	0.16	
RG02	2	0.03	0.04	0.06		0.08	0.04	0.05		0.08	0.16	
RG02	3	0.05	0.06	0.10		0.11	0.05	0.09		0.10	0.24	
RG02	4	0.06	0.14	0.21		0.21	0.07	0.17		0.17	0.69	
RG02	5	0.02	0.14	0.19	0.22	0.26	0.06	0.12	0.14	0.24	0.67	0.82
RG02	6	0.01	0.19	0.23		0.34	0.07	0.10		0.30	0.79	
RG03	1	0.03	0.07	0.13		0.14	0.04	0.12		0.12	0.39	
RG03	2	0.05	0.09	0.15		0.15	0.06	0.14		0.14	0.43	
RG03	3	0.03	0.11	0.16		0.20	0.07	0.17		0.19	0.49	
RG03	4	0.06	0.17	0.28		0.28	0.08	0.29		0.29	0.57	
RG03	5	0.02	0.14	0.17	0.23	0.24	0.08	0.22	0.28	0.25	0.40	0.46
RG03	6	0.02	0.19	0.26		0.34	0.08	0.29		0.36	0.55	
RG04	1	0.03	0.06	0.10		0.14	0.04	0.09		0.13	0.41	
RG04	2	0.06	0.06	0.12		0.13	0.04	0.12		0.12	0.25	
RG04	3	0.03	0.07	0.10		0.14	0.05	0.08		0.13	0.33	
RG04	4	0.07	0.08	0.14		0.14	0.06	0.12		0.12	0.35	
RG04	5	0.02	0.06	0.08	0.07	0.12	0.04	0.06	0.05	0.12	0.22	0.27
RG04	6	0.03	0.06	0.08		0.12	0.04	0.07		0.12	0.22	
RG05	1	0.02	0.08	0.09		0.16	0.06	0.06		0.16	0.29	
RG05	2	0.05	0.09	0.10		0.11	0.08	0.09		0.10	0.27	
RG05	3	0.05	0.13	0.19		0.24	0.06	0.12		0.18	0.67	
RG05	4	0.07	0.12	0.19	0.31	0.19	0.08	0.14	0.28	0.14	0.83	0.81

RG05	5	0.02	0.17	0.18		0.21	0.14	0.15		0.17	0.65
RG05	6	0.02	0.31	0.32		0.37	0.29	0.30		0.34	1.28
RG06	1	0.03	0.05	0.07		0.12	0.03	0.06		0.11	0.41
RG06	2	0.04	0.06	0.08		0.12	0.06	0.07		0.11	0.34
RG06	3	0.05	0.07	0.11		0.14	0.05	0.09		0.13	0.57
RG06	4	0.09	0.18	0.21		0.21	0.16	0.19		0.19	0.57
RG06	5	0.02	0.11	0.12	0.15	0.19	0.08	0.09	0.11	0.16	0.51 0.56
RG06	6	0.02	0.15	0.17		0.22	0.13	0.14		0.18	0.66
RG07	1	0.03	0.04	0.05		0.08	0.03	0.05		0.08	0.09
RG07	2	0.03	0.04	0.05		0.08	0.03	0.05		0.08	0.09
RG07	3	0.08	0.05	0.09		0.09	0.05	0.09		0.09	0.13
RG07	4	0.07	0.19	0.30		0.31	0.10	0.38		0.39	0.53
RG07	5	0.03	0.18	0.24	0.22	0.35	0.07	0.15	0.09	0.43	0.49 0.74
RG07	6	0.03	0.25	0.38		0.49	0.07	0.57		0.63	0.80
RG08	2	0.04	0.12	0.15		0.27	0.07	0.08		0.09	1.15
RG08	3	0.04	0.11	0.14		0.19	0.07	0.10		0.12	0.77
RG08	4	0.08	0.25	0.29		0.29	0.23	0.26		0.26	0.89
RG08	5	0.02	0.18	0.20	0.20	0.24	0.16	0.17	0.18	0.20	0.71 0.80
RG08	6	0.01	0.19	0.21		0.25	0.18	0.19		0.22	0.71

5 * 1: 1953 – 1970/71; 2: 1970/71 – 1982; 3 1982 – 1997; 4: 1997 – 2006; 5: 2006 – 2012; 6: 2012 – 2017

10 **Table S 2. Volumetric and surface height change of the individual block glaciers and time slices and the associated error values, which were determined in stable areas. The errors are subdivided into uncorrelated random error (Uncor.), correlated random error (Cor.) and systematic error (Sys.). Combined, these result in the total uncertainty (Total). The equations for the calculation can be found in Anderson (2019).**

Name	Epoch*	Volumetric [m ³ /yr]					Mean surface elevation [m/yr]				
		Error					Error				
		Change	Uncor.	Cor.	Sys.	Total	Change	Uncor.	Cor.	Sys.	Total
RG01	1	-2930.83	11.234	18.261	-434.248	434.78	-0.013	0.000	0.000	-0.002	0.002
RG01	2	-5465.71	2.685	1.303	93.356	93.40	-0.025	0.000	0.000	0.000	0.000
RG01	3	-9217.84	8.735	0.000	-290.581	290.71	-0.042	0.000	0.000	-0.001	0.001
RG01	4	-9930.79	5.409	0.000	56.419	56.68	-0.045	0.000	0.000	0.000	0.000
RG02	1	-83.28	2.972	2.243	-213.013	213.05	-0.002	0.000	0.000	-0.004	0.004
RG02	2	34.84	1.325	0.918	58.375	58.40	0.001	0.000	0.000	0.001	0.001
RG02	3	5.48	3.539	0.000	-31.042	31.24	0.000	0.000	0.000	-0.001	0.001
RG02	4	-234.22	3.747	0.000	-38.373	38.56	-0.005	0.000	0.000	-0.001	0.001

RG03	1	-267.11	1.901	1.265	8.431	8.73	-0.011	0.000	0.000	0.000	0.000
RG03	2	-118.72	1.214	0.448	149.954	149.96	-0.005	0.000	0.000	0.006	0.006
RG03	3	-369.35	2.430	0.000	42.720	42.79	-0.015	0.000	0.000	0.002	0.002
RG03	4	-527.63	3.122	0.000	30.569	30.73	-0.021	0.000	0.000	0.001	0.001
RG04	1	-719.31	4.824	8.008	-177.180	177.43	-0.022	0.000	0.000	-0.005	0.005
RG04	2	-855.47	1.151	0.936	34.682	34.71	-0.026	0.000	0.000	0.001	0.001
RG04	3	-1552.80	3.642	0.000	-23.882	24.16	-0.047	0.000	0.000	-0.001	0.001
RG04	4	-1527.13	3.986	0.000	-28.992	29.26	-0.046	0.000	0.000	-0.001	0.001
RG05	1	235.27	4.744	6.054	-120.494	120.74	0.005	0.000	0.000	-0.003	0.003
RG05	2	-0.04	1.445	1.340	-64.039	64.07	0.000	0.000	0.000	-0.001	0.001
RG05	3	-145.94	4.895	0.000	248.577	248.63	-0.003	0.000	0.000	0.005	0.005
RG05	4	-694.28	3.661	0.000	-47.944	48.08	-0.015	0.000	0.000	-0.001	0.001
RG06	1	-466.64	8.603	10.804	393.485	393.73	-0.004	0.000	0.000	0.003	0.003
RG06	2	-968.07	3.132	2.769	257.536	257.57	-0.009	0.000	0.000	0.002	0.002
RG06	3	-2544.06	7.035	0.000	527.778	527.83	-0.022	0.000	0.000	0.005	0.005
RG06	4	-3579.38	6.286	0.000	-85.272	85.50	-0.032	0.000	0.000	-0.001	0.001
RG07	1	-36.03	2.651	3.114	-13.360	13.97	-0.002	0.000	0.000	-0.001	0.001
RG07	2	-49.54	1.146	0.568	60.188	60.20	-0.003	0.000	0.000	0.003	0.003
RG07	3	-3.25	3.200	0.000	-47.960	48.07	0.000	0.000	0.000	-0.003	0.003
RG07	4	-50.40	2.678	0.000	9.542	9.91	-0.003	0.000	0.000	0.001	0.001
RG08	1	-180.03	5.043	5.023	-602.753	602.80	-0.002	0.000	0.000	-0.007	0.007
RG08	2	-363.60	2.205	1.491	-20.248	20.42	-0.004	0.000	0.000	0.000	0.000
RG08	3	-1071.66	6.037	0.000	105.870	106.04	-0.013	0.000	0.000	0.001	0.001
RG08	4	-1392.12	4.324	0.000	105.057	105.15	-0.017	0.000	0.000	0.001	0.001
RG09	1	-714.35	4.722	4.813	-188.050	188.17	-0.008	0.000	0.000	-0.002	0.002
RG09	2	-1596.79	1.886	1.065	14.987	15.14	-0.018	0.000	0.000	0.000	0.000
RG09	3	-1807.09	6.001	0.000	70.760	71.01	-0.021	0.000	0.000	0.001	0.001
RG09	4	-2027.95	4.263	0.000	-93.052	93.15	-0.023	0.000	0.000	-0.001	0.001

*1: 1953 – 1970/71; 2: 1970/71 – 2006; 3: 2006 – 2012; 4: 2012 – 2017

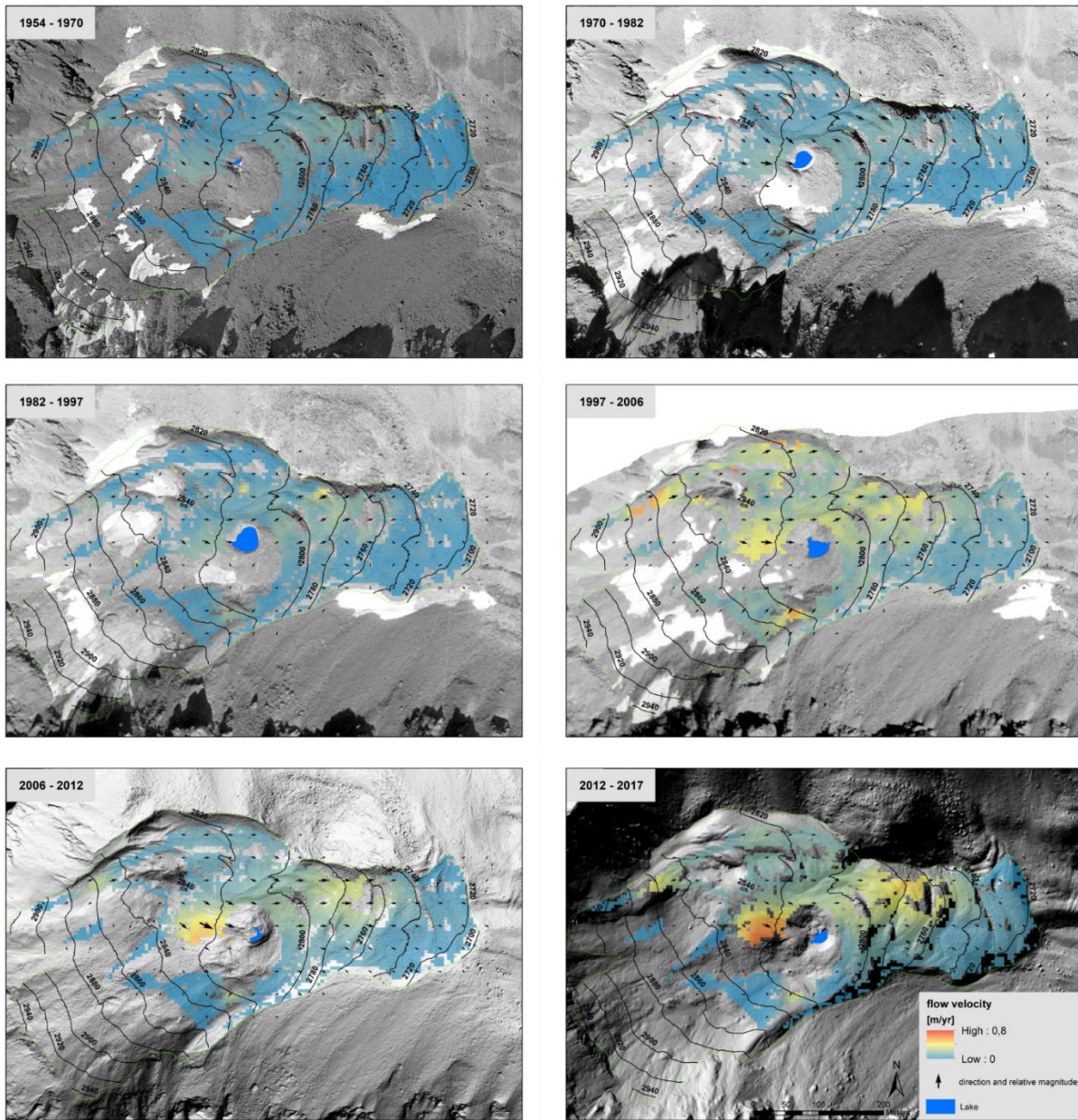


Figure S 1. Development of the thermokast lake on RG 06. The lake changed its extent and position, with a distinct trend regarding its size.

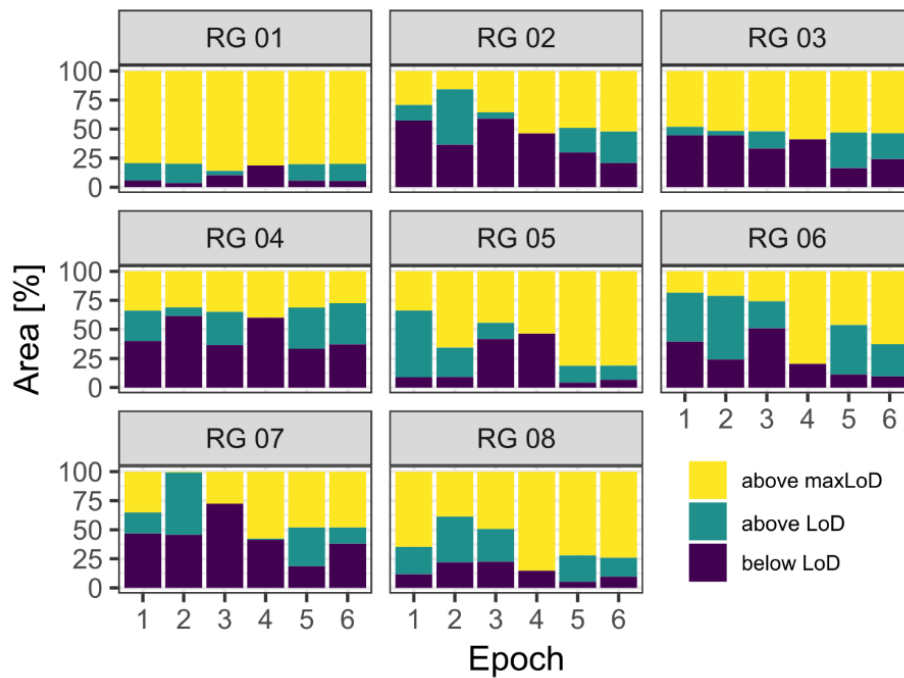


Figure S 2. Proportional area of the studied rock glaciers below LoD, above LoD and above maxLoD.

20

References

Anderson, S. W.: Uncertainty in quantitative analyses of topographic change: error propagation and the role of thresholding, *Earth Surf. Process. Landforms*, 44, 1015–1033, <https://doi.org/10.1002/esp.4551>, 2019.

Groh, T. and Blöthe, J. H.: Rock Glacier Kinematics in the Kaunertal, Ötztal Alps, Austria, *Geosciences*, 9, 373, <https://doi.org/10.3390/geosciences9090373>, 2019.

25