Supplement of

Hydrogeology of an alpine rockfall aquifer system and its role in flood attenuation and maintaining baseflow

U. Lauber et al.

Correspondence to: U. Lauber (ute.lauber@kit.edu) and N. Goldscheider (goldscheider@kit.edu)

Supplementary Material:

Table with discharge characteristics of selected precipitation events during 2002–2011. Hydrographs from 2006 and 2011 are presented in Figs. 8 and 9. All events with a peak discharge $Q_P > 2.3 \pm 0.2 \text{ m}^3/\text{s}$ are high-flow events, and marked with a grey background. [Q_i : initial discharge, Q_P : peak discharge, discharge coefficient: ratio between direct discharge ($Q_P - Q_i$) and ($P_{\text{peak}} \cdot A$), discharge ratio: quotient between Q_P and Q_i , lag time: time difference between discharge peak upstream (GS-RU) and downstream (GS-RD) from the rockfall aquifers].

Event	Gauging station	P_{SUM}^a	Peak rainfall in 6h ^b	Rainfall duration	Q_i	Q_P	Discharge response ($(Q_P - Q_i) / (P_{\text{peak}} \cdot A)$)	Discharge ratio Q_P / Q_i	Lag time
-	-	mm	mm	h	$\text{m}^3 \text{s}^{-1}$	$\text{m}^3 \text{s}^{-1}$	-	-	h
1.8.2002	GS-RU	176	90	12	2.01	5.28	0.069	2.63	4.5
	GS-RD				2.82	5.92	0.065	2.10	
4.8.2002	GS-RU	180	180	6	1.97	3.39	0.015	1.72	5.4
	GS-RD				3.40	3.90	0.005	1.15	
6.8.2002	GS-RU	205	130	12	1.98	4.12	0.031	2.08	5.0
	GS-RD				3.54	5.43	0.028	1.53	
11.8.2002	GS-RU	662	220	30	1.78	7.76	0.052	4.36	4.5
	GS-RD				3.10	12.17	0.078	3.93	
20.8.2002	GS-RU	290	160	12	1.46	2.34	0.010	1.60	14
	GS-RD				2.55	3.04	0.006	1.19	
1.9.2002	GS-RU	260	160	12	0.94	2.20	0.015	2.34	85 ^c
	GS-RD				1.90	2.24	0.004	1.18	
29.8.2003	GS-RU	120	120	6	0.81	2.10	0.020	2.59	105 ^c
	GS-RD				1.08	1.58	0.008	1.46	
10.9.2003	GS-RU	351	190	12	0.65	1.83	0.012	2.82	187 ^c
	GS-RD				1.08	1.86	0.008	1.72	
4.10.2003	GS-RU	357	210	12	0.66	1.21	0.005	1.83	186
	GS-RD				1.08	2.57	0.013	2.38	
20.8.2004	GS-RU	89	70	12	1.69	2.92	0.033	1.73	40
	GS-RD				2.47	3.07	0.016	1.24	
26.8.2004	GS-RU	688	270	18	1.52	2.89	0.010	1.90	29
	GS-RD				2.57	3.46	0.006	1.35	
22.9.2004	GS-RU	679	250	30	0.71	2.88	0.016	4.06	125 ^c
	GS-RD				1.59	2.47	0.007	1.55	

Continuation of Supplementary Material A.

Event	Gauging station	P_{SUM}^a	Peak rainfall in 6h ^b	Rainfall duration	Q_i	Q_p	Discharge response $(Q_p - Q_i) / (P_{\text{PEAK}} \cdot A)$	Discharge ratio Q_p / Q_i	Lag time
-	-	mm	mm	h	$\text{m}^3 \text{s}^{-1}$	$\text{m}^3 \text{s}^{-1}$	-	-	h
30.9.2004	GS-RU	120	70	12	1.47	1.82	0.009	1.24	103 ^c
	GS-RD				2.21	2.61	0.011	1.18	
16.8.2005	GS-RU	414	280	12	1.30	2.99	0.011	2.30	43
	GS-RD				1.98	3.45	0.010	1.74	
2.10.2005	GS-RU	140	140	6	0.98	2.48	0.020	2.53	102 ^c
	GS-RD				1.55	1.99	0.006	1.28	
20.5.2006	GS-RU	37	8	6	0.97	3.52	0.604	3.63	38
	GS-RD				0.53	3.11	0.611	5.87	
28.5.2006	GS-RU	148	80	18	1.14	6.03	0.116	5.29	33
	GS-RD				0.51	2.63	0.050	5.16	
7.8.2006	GS-RU	487	100	12	0.96	8.09	0.135	8.43	3.8
	GS-RD				0.64	14.40	0.261	22.50	
18.9.2006	GS-RU	171	80	18	0.65	1.25	0.014	1.92	101 ^c
	GS-RD				0.74	1.06	0.008	1.43	
27.9.2006	GS-RU	264	90	30	0.65	1.22	0.012	1.88	93 ^c
	GS-RD				0.67	0.93	0.005	1.39	
4.10.2006	GS-RU	292	150	18	0.67	2.84	0.027	4.24	106 ^c
	GS-RD				0.77	1.80	0.013	2.34	
26.6.2007	GS-RU	320	180	18	1.05	2.1	0.011	2.00	22
	GS-RD				2.77	2.85	0.001	1.03	
2.7.2007	GS-RU	668	210	24	0.79	1.97	0.011	2.49	35
	GS-RD				2.32	4.67	0.021	2.01	
9.7.2007	GS-RU	360	280	12	0.85	2.99	0.014	3.52	23
	GS-RD				2.94	5.24	0.016	1.78	
24.7.2007	GS-RU	93	70	12	0.78	1.47	0.019	1.88	56
	GS-RD				1.69	2.47	0.021	1.46	
9.8.2007	GS-RU	294	100	30	0.67	1.15	0.009	1.72	34
	GS-RD				1.1	2.20	0.021	2.00	
16.8.2008	GS-RU	1180	380	36	0.84	2.93	0.010	3.49	3.5
	GS-RD				2.01	7.73	0.029	3.85	

Continuation of Supplementary Material A.

Event	Gauging station	P _{SUM} ^a	Peak rainfall in 6h ^b	Rainfall duration	Q _i	Q _p	Discharge response (Q _p -Q _i) / (P _{PEAK} ·A)	Discharge ratio Q _p / Q _i	Lag time
-	-	mm	mm	h	m ³ s ⁻¹	m ³ s ⁻¹	-	-	h
11.9.2008	GS-RU	100	100	6	0.61	0.92	0.006	1.51	161 ^c
	GS-RD				1.54	2.02	0.009	1.31	
17.7.2010	GS-RU	454	180	18	1.41	3.06	0.017	2.17	3.2
	GS-RD				2.35	3.9	0.016	1.66	
23.7.2010	GS-RU	371	250	18	1.14	2.45	0.010	2.15	4.3
	GS-RD				2.03	2.83	0.006	1.39	
25.9.2010	GS-RU	451	240	18	0.56	0.64	0.001	1.14	83 ^c
	GS-RD				1.16	1.27	0.001	1.09	
13.11.2010	GS-RU	118	60	18	0.31	0.55	0.008	1.77	122 ^c
	GS-RD				0.89	1.01	0.004	1.13	
18.6.2011	GS-RU	391	200	18	1.65	3.77	0.020	2.28	9.5
	GS-RD				2.58	4.96	0.023	1.92	
30.6.2011	GS-RU	300	160	12	1.34	4.02	0.032	3.00	29
	GS-RD				2.04	3.08	0.012	1.51	
7.8.2011	GS-RU	550	310	12	0.88	2.65	0.011	3.01	36
	GS-RD				2.00	3.45	0.009	1.73	
5.9.2011	GS-RU	525	210	18	0.52	1.96	0.013	3.77	86 ^c
	GS-RD				1.04	1.71	0.006	1.64	
18.9.2011	GS-RU	190	150	12	0.46	1.2	0.009	2.61	105
	GS-RD				1.00	1.6	0.008	1.60	
10.10.2011	GS-RU	307	120	18	0.45	3.16	0.043	7.02	34
	GS-RD				0.9	2.87	0.031	3.19	
mean values (excluding extreme event in 2006)				GS-RU	1.04	2.65	0.036	2.65	
				GS-RD	1.80	3.22	0.032	1.93	

^a Sum of precipitation until peak discharge at GS-RU^b Note that maximum resolution of sum of precipitation is 6 h^c Obtained by impulse-response-analysis