Hydrogeological properties of fault zones in a karstified carbonate aquifer (Northern Calcareous Alps, Austria)

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Fig S1 Overview of P_{32} values measured from the faults. These data are used for the fault zone profiles presented in section '*Lithological and hydrogeological characterization of carbonate protolith, fractured rock and fault rock'* of the main article. Individual fracture sets with their average orientation and spacing are listed and are the basis for P_{32} calculation and the classification of fracture classes (Frac Class).

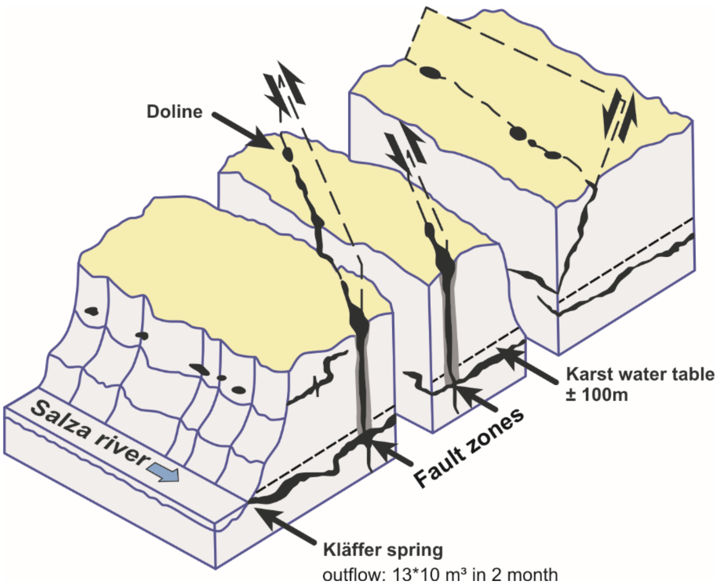
Fig S1

Fault	Distance MF (m)	Set Nr.	Average Orientation	Spacing (cm)	P_{32}	(m²/m³)	Frac Class
Fault A1 (Dolostone)	4m NW	1	310/76 //MF	23	4,3		
		2	288/64	16	6,3		
		3	217/54	12	8,3		
		4	051/62	15	6,7	25,6	FC 2
	2m NW	1	320/80 // MF	5	20,0		
		2	290/70	8	12,5		
		3	020/68	10	10,0		
		4	220/60	7	14,3		
		5	040/65	7	14,3	71,1	FC 3
	0,2m NW	1	320/80 //MF,R	2	50,0		
		2	287/15	2	50,0		
		3	290/70	3	33,3		
		4	020/68	4	25,0		
		5	222/58	4	25,0		
		6	038/ 62	5	20,0	203,3	FC 4
Fault A2 (Dolostone)	Limestone	1	190/78	10	10,0		
		2	315/74 // MF	13	7,7		
		3	095/62	9	11,1	28,8	FC 2
	Dolostone	1	188/ 78	3	33,3		
		2	320/81	2	50,0		
		3	100/59	7	14,3		
		4	210/67	5	20,0		
		5	025/63	7	14,3	131,9	FC 3
		1	188/ 76 // MF	2	50		
		2	312/80 // MF	2	50		
		3	088/63	4	25		
		4	220/65	7	14,29		
		5	038/70	5	20	159,3	FC 3
		1	184/83	11	9,1		
		2	327/81 // MF	6	16,7		
		3	077/65	13	7,7		
		4	074/68	18	5,6	39,0	FC 2
Fault A6 (Limestone)	20m S	1	358/89 //MF	10	10		
		2	248/58	21	4,8		
		3	010/15	18	5,6	20,3	FC 2
	8m S	1	178/79 //MF	3	33,3		
		2	308/25	7	14,3		
		3	240/ 88	7	14,3		
		4	286/89	5	20	81,9	FC 3
	3m S	1	080/70	6	16,7		
		2	182/88 //MF	3	33,3		
		3	130/85	2	50,0		
		4	301/26	9	11,1	111,1	FC 3
	1,5m S	1	208/80	2,7	36,7		
		2	130/80	5,6	18,0		
		3	180/85 //MF	6,0	16,7		
		4	163/85 //R	3,6	28,0		
		5	300/85	1,8	56,0		
		6	090/80	2	50,0	205,3	FC 4
	10 m N	1	330/40	6	16,7		
		2	120/80	6	16,7		
		3	340/83 // R	5,7	17,5		
		4	010/70 // MF	3	33,3		
		5	080/65	5	20,0	104,2	FC 3
	20m N	1	344/75 //R	16	6,3		
		2	033/23	35	2,9		
		3	245/12	25	4	13,1	FC 2

Fault	Distance MF (m)	Set Nr.	Average Orientation	Spacing (cm)	P_{32}	(m²/m³)	Frac Class
Fault A3 (Limestone)	5m S	1	330/80 //MF, R	33	3,0		
		2	082/70// R´	27	3,7		
		3	045/40	19	5,3		
		4	048/17	52	1,9	12,0	FC 2
	1m S	1	326/84 //MF,R	25	4		
		2	082/70// R´	30	3,3		
		3	045/40	20	5		
		4	048/17	38	2,63	15,0	FC 2
	1m N	1	331/80 //MF,R	5	20		
		2	081/70// R´	15	6,7		
		3	042/43	35	2,9		
		4	050/10	10	10,0	39,5	FC 2
	10m N	1	328/75//MF,R	31	3,2		
		2	075/72	42	2,4		
		3	046/45	40	2,5		
		4	048/15	28	3,6	11,7	FC 2
	20m N	1	334/88 //MF,R	30	3,3		
		2	068/60	16	6,3		
		3	046/45	15	6,7		
		4	045/14	35	2,9	19,1	FC 2
Fault A4 (Limestone)	17m S	1	352/80	15	6,7		
		2	077/82	30	3,3		
		3	046/45	10	10,0		
		4	214/40	7	14,3	34,3	FC 2
	2,5m S	1	200/76	3	33,3		
		2	216/58	9	9,1		
		3	242/36	6	16,7		
		4	340/78 //R	14	7,1		
		5	050/55	10	10	76,2	FC 3
	2,5m N	1	160/21	16	6,3		
		2	180/87//MF	14	7,1		
		3	350/50 //R	11	9,1		
		4	045/52	12	8,3		
		5	240/42	7	14,3	45,1	FC 2
	9m N	1	100/45	4	25		
		2	350/80 //MF	3	33,3		
		3	090/20	13	7,7	66,0	FC 3
	17m N	1	335/49	16	6,3		
		2	110/60	10	10,0		
		3	350/76 //R	14	7,1		
		4	205/70	9	11,1	34,5	FC 2
	25m N	1	316/50	13	7,7		
		2	020/80	12	8,3		
		3	165/80 //R	5	20	36,0	FC 2
Fault A5 (Limestone)	6m S	1	172/84 //MF	3	33,3		
		2	010/35	3,0	33,3		
		3	234/55	3,6	28		
		4	330/50	10,0	10		
		5	022/81	1,7	60		
		6	258/64	1,7	60	224,7	FC 4
	2m N	1	324/83//R	5,0	20		
		2	278/39	6,3	16		
		3	041/51	1,5	66,7		
		4	300/86	6,0	16,7		
		5	148/68	5,0	20		
		6	019/62	2,5	40	179,3	FC 4
	10m N	1	060/54	10	10		
		2	340/74	6,0	16,67		
		3	250/62	8	12,5	39,2	FC 2

Monte_Carlo simulation was used to testify whether a significant part of the storage capacity of the Hochschwab limestone karst aquifer resides within pores, fractures and karst features of an interconnected fault-zone network.

The underlying assumption is a fault-zone network between base and top spring of the Kläffer spring system at maximum fill (~ 100 m) just before the onset of the winter months with no additional recharge during the following cold months since precipitation mostly falls as snow. In order to verify whether a fault-zone network with the parameters resulting from this study on one hand could be assumed representative for the entire watershed, and on the other hand may be able to supply the winter base flow to the above springs or whether significant additional storage volume has to be taken into account. A range of percentages of fault rock and corresponding average porosities was chosen as input. The range of gross-rock volume reflects the uncertainty in the exact size of the watershed.



Kläffer spring outflow ~ 10 x 10^6 m^3 in 2 months

Fig S2 Block diagram of conceptual karst aquifer system used in Monte Carlo simulation

Table S1 Input for Monte-Carlo simulation of pore volume of conceptual limestone fault network:

	min	mode	max
Area of watershed (10^6 m^2)	54	64	80
Height (m)	80	100	120
GRV (10^6 m^3)	4320	6400	9600
Net/Gross (decimal)	0.01		0.1
Porosity (decimal)	0.01	0.03	0.05
	P90	**P50**	**P10**
Resulting pore volume of fault network (10^6 m^3)	3.3	11	20

Area: extent of catchment; *Height*: height of water table above base spring; *GRV*: total rock volume of phreatic zone; *Net/Gross*: percentage of fault rock; *Porosity*: average porosity of fault rock.
P90, *P50* and *P10* are exceedance probabilities